

Honolulu 2012 On-Board Transit Survey Honolulu Rail Transit Project

Final Draft

April 2014

Prepared for:
Honolulu Authority for Rapid Transportation



Table of Contents

| | | |
|-------|--|----|
| 1 | Survey Overview | 1 |
| 1.1 | Survey Purpose and Objectives | 1 |
| 1.2 | Survey Development Process | 1 |
| 1.3 | Types of Data Collected | 3 |
| 1.3.1 | Required Data | 3 |
| 1.3.2 | Desired Data..... | 3 |
| 1.3.3 | Follow-up Data Analysis | 4 |
| 1.4 | Survey Instrument | 5 |
| 2 | Sampling Procedures | 6 |
| 2.1 | Sampling Goals | 6 |
| 2.1.1 | On-to-Off Survey Sampling Goals | 6 |
| 2.1.2 | Main Survey— Route-Specific Sampling Goals..... | 7 |
| 2.1.3 | Main Survey: Sampling of Ridership between Stops/Segments and Time of Day | 10 |
| 2.2 | Other Techniques Used to Manage the Sampling Process | 11 |
| 3 | On-to-Off Administration Methodology | 14 |
| 3.1 | Recruiting and Training Surveyors | 14 |
| 3.2 | ETC Institute On-to-Off Program Procedure..... | 20 |
| 3.3 | Organization of the Survey Team | 21 |
| 3.4 | Timing of the On-to-Off Survey | 22 |
| 4 | Main Survey Administration Methodology | 23 |
| 4.1 | Recruiting and Training Interviewers | 23 |
| 4.2 | Main Survey Administration Procedure | 24 |
| 4.2.1 | Direction for Main Survey | 24 |
| 4.2.2 | Survey of Local Routes | 24 |
| 4.2.3 | Express Service Routes | 25 |
| 4.2.4 | Monitoring of Survey Activities..... | 26 |
| 4.3 | Organization of the Main Survey Team | 27 |
| 4.4 | Timing of the Main Survey Administration | 27 |
| 5 | Data Review Process | 28 |
| 5.1 | Process for Identifying “Complete and Useable” Surveys | 28 |
| 5.1.1 | Pre-processing Tests..... | 28 |
| 5.1.2 | Post-processing Tests | 29 |
| 5.1.3 | Visual Inspection | 31 |
| 5.2 | Summary of the Data Review QA/QC Process..... | 31 |
| 6 | Data Expansion Process | 33 |
| 6.1 | Methodology for Calculating Expansion Factors..... | 34 |
| 6.1.1 | Boarding and Alighting Information from On-to-Off Survey | 34 |
| 6.1.2 | Refinement of Data Expansion Results | 36 |

| | | |
|--------|---|----|
| 7 | High Level Findings from the Survey | 40 |
| 7.1 | Demographic Characteristics | 40 |
| 7.1.1 | Vehicle Availability | 40 |
| 7.1.2 | Adults in the Household | 41 |
| 7.1.3 | Student Status | 41 |
| 7.1.4 | Employed Status of Transit Rider | 42 |
| 7.1.5 | Driver's License | 42 |
| 7.1.6 | Age | 43 |
| 7.1.7 | Income | 44 |
| 7.1.8 | Gender | 44 |
| 7.1.9 | Race/Ethnicity | 45 |
| 7.1.10 | Necessity of Transit Service | 45 |
| 7.2 | Travel Characteristics | 46 |
| 7.2.1 | Trip Purpose | 46 |
| 7.2.2 | Trip Origins | 47 |
| 7.2.3 | Types of Destinations Visited by Transit Users..... | 47 |
| 7.2.4 | Ridership Characteristics at Ala Moana Center | 48 |
| 7.2.5 | How Passengers Access Public Transit..... | 48 |
| 7.2.6 | How Passengers Traveled from Transit to Their Final Destination..... | 49 |
| 7.2.7 | Transfers..... | 49 |
| 7.2.8 | Where Transit Users Live | 50 |
| 7.2.9 | Where Transit Trips Began | 51 |
| 7.2.10 | Where Transit Trips Ended | 52 |
| 7.3 | Visual Presentation of On-to-Off Survey Results | 52 |
| 7.4 | Passenger Characteristics—Relation to Project Corridor | 54 |
| 7.5 | Additional Analysis of Survey Results..... | 57 |

Figures

| | | |
|-------------|---|----|
| Figure 2-1. | Number of On-to-Off Surveys Collected by Time Period | 13 |
| Figure 2-2. | Number of Main Surveys Collected by Time Period..... | 13 |
| Figure 3-1. | On-to-Off Survey Scan Card Screenshot..... | 21 |
| Figure 7-1. | Types of Places Riders are Coming From | 47 |
| Figure 7-2. | Geocoded Map of Where Transit Users Live | 50 |
| Figure 7-3. | Geocoded Map Where Most Transit Trips Originated..... | 51 |
| Figure 7-4. | Geocoded Map of Where Most Transit Trips Ended | 52 |
| Figure 7-5. | Visual Representation of On-to-Off Data for Route 17 | 53 |
| Figure 7-6. | Visual Representation of On-to-Off Data for a Portion of Route 1..... | 54 |

Tables

| | |
|--|----|
| Table 2-1. Sampling Goals and Main Surveys Completed..... | 7 |
| Table 3-1. Route Operating Characteristics..... | 15 |
| Table 5-1. Data Review QA/QC Summary..... | 32 |
| Table 5-2. Problematic Survey Records Disqualified by QA/QC Test..... | 32 |
| Table 6-1. Data Expansion Table Results of On-to-Off Survey (Eastbound AM Peak Period)..... | 35 |
| Table 6-2. Distribution of On-to-Off Survey (Eastbound AM Peak Period)..... | 35 |
| Table 6-3. Data Expansion Results—Initial Estimate of Total Ridership Flows between Segments (Eastbound AM Peak Period)..... | 36 |
| Table 6-4. Data Expansion- Comparison of Actual Boardings and Alightings by Segment (Eastbound AM Peak Period)..... | 36 |
| Table 6-5. Iterative Balance Process | 37 |
| Table 6-6. Final Estimate of Ridership Flows between Segments | 38 |
| Table 6-7. Number of Completed Surveys..... | 38 |
| Table 7-1. Number of Working Vehicles in Household (by percentage of transit riders surveyed)..... | 40 |
| Table 7-2. Number of Adults in Household (by percentage of transit riders surveyed)..... | 41 |
| Table 7-3. Student Status | 41 |
| Table 7-4. Employment Status of Respondent..... | 42 |
| Table 7-5. Valid Driver's License | 42 |
| Table 7-6. Age of Transit Riders | 43 |
| Table 7-7. Total Annual Household Income..... | 44 |
| Table 7-8. Gender of Transit Riders..... | 44 |
| Table 7-9. Race/Ethnicity (by percentage of transit riders surveyed)..... | 45 |
| Table 7-10. Without Transit Service (by percentage of transit riders surveyed)..... | 46 |
| Table 7-11. Trip Purpose | 46 |
| Table 7-12. Types of Destinations Visited by Transit Users..... | 48 |
| Table 7-13. Mode to Access Public Transit..... | 49 |
| Table 7-14. Egress Mode to Destination..... | 49 |
| Table 7-15. Total Number of Transfers | 50 |
| Table 7-16. Location of Bus Routes: Project Corridor..... | 55 |

- Appendix A—Survey Instrument
- Appendix B—I Pad Survey Tablet PC Screenshots
- Appendix C—Data Summary Spreadsheets
- Appendix D—Signs Posted in Buses
- Appendix E—List of Unique Unlinked Weighting Factors by Route, Time Period, Direction, Boarding Segment and Alighting Segment.
- Appendix F—Results of Data Expansion Process for Sample Route
- Appendix G—Results by Location of Routes: Within Project Corridor, Connecting to Project Corridor and Outside Project Corridor
- Appendix H—Expansion Factor Matrices for each route (published in an electronic format only)

Acronyms and Abbreviations

| | |
|---------|---|
| AMC | Ala Moana Center |
| APC | automatic passenger count |
| DTS | Department of Transportation Services for the City and County of Honolulu |
| FTA | Federal Transit Administration |
| GEC | General Engineering Consultant |
| HART | Honolulu Authority for Rapid Transportation |
| HBA | home-based airport |
| HBC | home-based college |
| HBO | home-based office |
| HBSC | home-based school |
| HBSH | home-based shopping |
| HBW | home-based work |
| NHB | non-home-based |
| NHBO | non-home-based other |
| NHBW | non-home-based work |
| OTS | O'ahu Transit Services |
| Project | Honolulu Rail Transit Project |
| QA/QC | quality assurance/quality control |
| SRRT | Survey Records Review Team |
| TAZ | Traffic Analysis Zone |
| VSEP | Visual Survey Editor Program |

The Honolulu Rail Transit Project (Project) involves a 20-mile rail line connecting East Kapolei with Ala Moana Center. The 2012 onboard survey of bus riders in Honolulu was carried out in part to support the analysis of transit demand patterns prior to opening of the Project. After the Project is completed, similar surveys will be conducted to identify transit demand patterns in Honolulu involving both bus and rail transit services.

The onboard survey was carried out by the ETC Institute working under the direction of Parsons Brinckerhoff, the General Engineering Consultant (GEC) for the Project. The survey consisted of two major elements: (1) the On-to-Off element identified boarding and alighting patterns of bus riders while also providing a basis for expanding the results of the Main Survey and (2) the Main Survey element consisted of detailed surveys of riders that were conducted on all Honolulu bus routes.

The following sections further describe the survey process.

1.1 Survey Purpose and Objectives

The purpose of the 2012 onboard bus survey was to gather accurate, updated travel behavior data from transit users in the Honolulu area. The data is being used to gain a better understanding of how bus services are being utilized as well identifying accurate characteristics of public transit being operated in Honolulu. The collected data serves as a base of knowledge prior to the upcoming rail system implementation. This *before* phase of the survey will provide a frame of reference for a post-implementation analysis of transit ridership characteristics in Honolulu. Since full implementation of the rail service is expected in 2019, the follow-up *after* survey will be conducted by 2021.

1.2 Survey Development Process

The 2012 onboard survey development process began by having representatives from the Honolulu Authority for Rapid Transportation (HART), the GEC, and the City and County of Honolulu Department of Transportation Services (DTS) review the data requirements for the transit on-board survey. Since the primary objective for the 2012 survey was to provide a baseline for assessing the impacts that the introduction of rail service will have on O'ahu, most questions focused on collecting data that will support current and future transportation forecasting efforts.

After six iterations of input and review, the survey instrument was shared with representatives of the Federal Transit Administration (FTA) to ensure all federal requirements and expectations for the design of the survey were met.

All of the suggestions from the FTA staff were incorporated into the final version of the survey.

Before and during the onboard survey, coordination took place between ETC Institute, the Public Transportation Division of DTS, O'ahu Transportation Services (OTS), and the GEC. A key part of this coordination was the development and installation of information cards on buses. This coordination also included the submittal to ETC Institute staff of operations information by route as well as provision of logistical support, including uses of facilities by ETC Institute staff. For example, training of surveyors took place at the Kalihi Transit Center.

In order to be responsive to guidance from the FTA, HART elected to conduct a robust data collection and expansion process that differed from more traditional on-board survey efforts. Major differences included the following:

- The use of personal interviewers via tablet PCs as the primary data collection method instead of paper surveys. The use of tablet PCs and personal interviews enabled real-time geocoding of passenger address data, which greatly increased the percentage of surveys that contained useable address information.
- More detailed attention to the development of the sampling plan and the management of data collection activities to ensure that the survey results were representative of transit ridership by time of day and direction for specific segments/stops along each bus route. Unlike more traditional transit surveys, which typically have aggregate sampling goals for each route, the 2012 Honolulu bus survey had specific targets by route segment, time of day, and direction of travel. This level of detail regarding ridership patterns ensured that the sample for each route accurately reflected the transit patterns bus route in its entirety and for its segments by various time periods.
- Data expansion that was substantially more robust than more traditional transit surveys. In addition to expanding the sample by direction and time of day, which is typically expected by the FTA, this sample was expanded based on the *path* where riders boarded and alighted buses to more accurately represent the specific types of trips that are being completed by transit users. Since information is being obtained at the segment or stop level for each route, the path represents a more precise indication of transit ridership patterns. The number of stops per segment varies by route and is dependent on factors such as adjacent land use and the extent of ridership at stops within a segment. In some cases there is sufficient ridership at an individual bus stop to the point that it was not included in a segment.

1.3 Types of Data Collected

To ensure that the length of the survey did not negatively affect the response rate, the survey questions were divided into two categories—“required” and “desired” data. These categories are further described in the following sections.

1.3.1 *Required Data*

Required data involved questions for which a response from a respondent was required in order for the survey to be considered complete. The data required to fulfill the objectives of the project are listed below:

- Type of place where the trip began
- Address where the trip began
- Mode of access to the transit system
- Boarding location
- Alighting location
- Transfers used to get to and from the route/segment where the survey was administered
- Mode of egress from the transit system
- Destination address
- Type of place where the trip ended
- Home address
- Employment status
- Student status
- Driver’s license status
- Age
- Annual household income
- Number of operational vehicles available in the household
- Number of occupants in the respondent’s household
- Time of day the survey was completed

1.3.2 *Desired Data*

Desired data involved questions for which a response from a respondent was preferred but was not required in order for the survey to be considered complete. Desired questions were asked of all respondents who had time to complete the full survey. The additional time to obtain the desired items took

between two and three minutes. Although these questions could be skipped if a respondent did not have time to complete the full survey, more than 95 percent of the respondents completed all of the desired questions. The data considered desired are as follows:

- Park-and-ride location (if applicable) on either end of the trip
- How long the respondent had been using public transportation
- Fare payment method
- How the respondent would make the trip if public transit was not available
- Respondent's race/ethnicity
- Respondent's gender
- Name of the school respondent attends (if applicable)

1.3.3 Follow-up Data Analysis

Using survey results, other types of data analysis were identified. This follow-up analysis included the total number of transfers (addition of transfers prior to respondent's current route and transfers following respondent's current route). However, the most important type of follow-up analysis involved the purpose of the respondent's trip. The purpose of the trip was determined by the types of destinations that were visited by the respondent and classified as one of eight possible trip purposes that are also used by the region's travel demand forecasting model:

- **Home-Based Work (HBW)**—Trips that began at home and ended at work *or* began at work and ended at home.
- **Home-Based Shopping (HBSH)**—Trips that began at home and ended at a shopping area *or* began at a shopping area and ended at home. If the respondent worked at a shopping area, the trip was classified as an HBW trip.
- **Home-Based College (HBC)**—Trips that began at home and ended at a college/university *or* began at a college/university and ended at home. If the respondent worked at a college/university, the trip was classified as an HBW trip.
- **Home-Based School (HBSC)**—Trips that began at home and ended at a K-12 school *or* began at a K-12 school and ended at home. If the respondent worked at a K-12 school, the trip was classified as an HBW trip.
- **Home-Based Airport (HBA)**—Trips that began at home and ended at an airport *or* began at an airport and ended at home. If the respondent worked at an airport, the trip was classified as an HBW trip.

- **Home-Based Other (HBO)**—Trips that began at home and ended at any other location not previously listed **or** began at any location not previously listed and ended at home.
- **Non-Home-Based Work (NHBW)**—Trips that did not begin **or** end at home but ended **or** began at the respondent's place of employment.
- **Non-Home-Based (NHB)**—Trips that did not begin **or** end at home or at the respondent's place of employment.

1.4 Survey Instrument

The survey instrument was designed to be administered as a face-to-face interview using tablet PCs (Apple iPad) or printed surveys. Survey instruments were printed on heavy card stock for easy distribution and completion. Tablet PCs were the preferred method while paper surveys were only used on some express route buses. Bilingual interviewers were also hired to administer the surveys on tablet PCs in more than six different languages (English, Spanish, Tagalog, Japanese, Ilocano, Chinese, and Samoan).

For express routes, the respondent generally has a longer ride time that would allow completion of the survey; also, Express routes often serve employed travelers with higher education levels. The combination of higher education levels, longer ride time, and the ease of distributing the paper surveys to a higher number of passengers often leads to a much higher percentage of rider surveys being captured than would have been possible by using tablet PCs alone while still maintaining a high level of accuracy.

While most respondents completed the survey during their trips, postage-paid return envelopes were available for riders who did not have time to complete the survey. Riders could return the survey by mail or complete the survey on the Internet by going to a website address printed on the envelope. Each survey contained a serial number that was used by ETC Institute to track the route and sequence in which surveys were completed. Only 72 surveys were received in the mail by ETC out of a total of approximately 26,200 completed and useable surveys.

Respondents who did not have time to complete the survey during their bus trip were also given the option of providing their phone numbers. Those who provided their phone numbers were then contacted by ETC Institute's call center within three days of the original attempt to survey the rider.

Copies of the printed survey materials are provided in Appendix A of this report. Screen shots that show how the survey questions appeared on the tablet PCs are provided in Appendix B of this report.

This chapter describes the procedures used for carrying out the sampling of Honolulu bus riders. Three major areas are addressed by these procedures: (1) sampling goals, (2) methods for selecting survey participants, and (3) techniques used to manage the sampling process.

2.1 Sampling Goals

In order to ensure that the distribution of completed surveys mirrored the actual distribution of riders who use the Honolulu bus system, ETC Institute developed a sampling plan that would ensure the completion of the Main Survey by at least 10 percent of the system's riders. In addition to being complete, the surveys also had to be useable. A survey was considered *complete* if all of the statistically required information was collected. A survey was considered *useable* if it met 100 percent of the quality assurance and quality control tests that were applied to each record. Overall, the total number of "complete and useable surveys" exceeded the contractual requirements by more than 3,000 surveys.

The following sections further describe the sampling procedures for the On-to-Off and Main Surveys.

2.1.1 On-to-Off Survey Sampling Goals

The results of the On-to-Off Survey, conducted in February and March of 2012, were used to guide the development of the sampling plan for the Main Survey. Based on the results of the pilot test for the On-to-Off survey, ETC Institute estimated that a minimum of 90 percent of riders would agree to participate and that useable survey data could be obtained from at least 90 percent of those who participated. Using these estimates, ETC Institute selected at least 30 percent of total bus trips operating on each route to be included in the sample. Achieving this goal ensured that useable surveys would be obtained from at least 44,700 passengers, which was 20 percent of the average weekday ridership.

The On-to-Off survey was conducted on all routes between the hours of 6 am and 7 pm (or during all hours of operation if service was offered for a shorter duration). On routes with high ridership after 7 pm, such as Routes 1 and 2, the survey was conducted until 9 pm.

The sampling goals for the On-to-Off Survey were greatly exceeded. The actual number of completed On-to-Off Surveys records was 57,957 which was 13,257 more than the original goal. The goals were exceeded for two main reasons: (1) the participation rate by riders was higher than expected (96 percent participated vs. the initial estimate of 90 percent) and (2) the

percentage of surveys that were useable was slightly higher than planned (91 percent were useable as compared to the 90 percent goal).

2.1.2 Main Survey— Route-Specific Sampling Goals

Table 2-1 shows the estimated average weekday ridership for each bus route as well as sampling goals. The table also shows the actual number of completed records for the Main Survey that were obtained from each route and the route-specific margin of error at the 90 percent confidence level. The estimated weekday ridership was provided by OTS. The sampling goals were updated later based on new ridership numbers provided by OTS.

Table 2-1. Sampling Goals and Main Surveys Completed

| Route | Estimated Average Weekday Ridership Prior to Survey | Goal for Completed Surveys—Main Survey (10%) | Completed Surveys | Within 10% or 10 of the Goal | Margin of Error at the 90% Level of Confidence |
|-------|---|--|-------------------|------------------------------|--|
| 1 | 17,826 | 1,783 | 2,033 | YES | +/- 1.7% |
| 2 | 16,212 | 1,621 | 1,952 | YES | +/- 1.8% |
| 3 | 13,115 | 1,311 | 1,511 | YES | +/- 2.0% |
| 4 | 8,747 | 875 | 1,116 | YES | +/- 2.3% |
| 5 | 1,408 | 141 | 192 | YES | +/- 5.5% |
| 6 | 5,899 | 590 | 643 | YES | +/- 3.1% |
| 7 | 3,453 | 345 | 397 | YES | +/- 3.9% |
| 8 | 4,709 | 471 | 485 | YES | +/- 3.5% |
| 9 | 7,462 | 746 | 670 | YES | +/- 3% |
| 10 | 575 | 58 | 103 | YES | +/- 7.4% |
| 11 | 1,216 | 122 | 180 | YES | +/- 5.7% |
| 13 | 12,000 | 1,200 | 1,152 | YES | +/- 2.3% |
| 14 | 1,249 | 125 | 132 | YES | +/- 6.8% |
| 15 | 625 | 63 | 88 | YES | +/- 8.2% |
| 16 | 73 | 7 | 16 | YES | +/- 18.4% |
| 17 | 1,406 | 141 | 228 | YES | +/- 5.0% |
| 18 | 862 | 86 | 93 | YES | +/- 8.1% |
| 19 | 4,497 | 450 | 476 | YES | +/- 3.6% |
| 20 | 3,248 | 325 | 409 | YES | +/- 3.8% |
| 22 | 1,155 | 115 | 65 | YES | +/- 9.9% |
| 23 | 3,169 | 317 | 347 | YES | +/- 4.2% |
| 24 | 715 | 72 | 81 | YES | +/- 8.6% |
| 31 | 744 | 74 | 141 | YES | +/- 6.3% |

Table 2-1. Sampling Goals and Main Surveys Completed (continued)

| Route | Estimated Average Weekday Ridership Prior to Survey | Goal for Completed Surveys—Main Survey (10%) | Completed Surveys | Within 10% or 10 of the Goal | Margin of Error at the 90% Level of Confidence |
|-------|---|--|-------------------|------------------------------|--|
| 32 | 1,458 | 146 | 158 | YES | +/- 6.2% |
| 40 | 11,051 | 1,105 | 1,157 | YES | +/- 2.3% |
| 41 | 1,614 | 161 | 236 | YES | +/- 5.0% |
| 42 | 9,492 | 949 | 970 | YES | +/- 2.5% |
| 43 | 2,571 | 257 | 355 | YES | +/- 4.1% |
| 44 | 733 | 73 | 111 | YES | +/- 7.2% |
| 52 | 4,342 | 434 | 558 | YES | +/- 3.3% |
| 53 | 2,735 | 273 | 344 | YES | +/- 4.2% |
| 54 | 3,119 | 312 | 396 | YES | +/- 3.9% |
| 55 | 4,021 | 402 | 392 | YES | +/- 4.0% |
| 56 | 3,016 | 302 | 314 | YES | +/- 4.4% |
| 57 | 3,209 | 321 | 331 | YES | +/- 4.3% |
| 62 | 6,027 | 603 | 568 | YES | +/- 3.3% |
| 65 | 1,789 | 179 | 184 | YES | +/- 5.8% |
| 70 | 240 | 24 | 49 | YES | +/- 10.5% |
| 71 | 81 | 8 | 10 | YES | +/- 24.6% |
| 72 | 552 | 55 | 58 | YES | +/- 10.3% |
| 73 | 483 | 48 | 37 | YES | +/- 13.0% |
| 74 | 60 | 6 | 16 | YES | +/- 17.8% |
| 76 | 377 | 38 | 43 | YES | +/- 11.9% |
| 77 | 410 | 41 | 71 | YES | +/- 8.9% |
| 80 | 345 | 35 | 76 | YES | +/- 8.4% |
| 81 | 1,260 | 126 | 164 | YES | +/- 6.0% |
| 82 | 257 | 26 | 58 | YES | +/- 9.6% |
| 83 | 631 | 63 | 102 | YES | +/- 7.5% |
| 84 | 278 | 28 | 94 | YES | +/- 6.9% |
| 85 | 630 | 63 | 65 | YES | +/- 9.7% |
| 88 | 208 | 21 | 43 | YES | +/- 11.2% |
| 89 | 138 | 14 | 41 | YES | +/- 10.8% |
| 90 | 158 | 16 | 88 | YES | +/- 5.9% |
| 91 | 1,020 | 102 | 110 | YES | +/- 7.4% |
| 92 | 223 | 22 | 84 | YES | +/- 7.1% |
| 93 | 1,247 | 125 | 168 | YES | +/- 5.9% |
| 94 | 167 | 17 | 136 | YES | +/- 3.1% |
| 96 | 155 | 16 | 94 | YES | +/- 5.4% |
| 97 | 342 | 34 | 127 | YES | +/- 5.8% |

Table 2-1. Sampling Goals and Main Surveys Completed (continued)

| Route | Estimated Average Weekday Ridership Prior to Survey | Goal for Completed Surveys—Main Survey (10%) | Completed Surveys | Within 10% or 10 of the Goal | Margin of Error at the 90% Level of Confidence |
|---------|---|--|-------------------|------------------------------|--|
| 98 | 215 | 21 | 92 | YES | +/- 6.5% |
| 101 | 488 | 49 | 111 | YES | +/- 6.9% |
| 102 | 212 | 21 | 75 | YES | +/- 7.7% |
| 103 | 126 | 13 | 80 | YES | +/- 5.6% |
| 201 | 544 | 54 | 77 | YES | +/- 8.7% |
| 202 | 256 | 26 | 31 | YES | +/- 13.9% |
| 203 | 190 | 19 | 60 | YES | +/- 8.8% |
| 231 | 167 | 17 | 20 | YES | +/- 17.4% |
| 234/235 | 53 | 5 | 17 | YES | +/- 16.6% |
| 401 | 424 | 42 | 36 | YES | +/- 13.2% |
| 402 | 366 | 37 | 33 | YES | +/- 13.7% |
| 403 | 554 | 55 | 62 | YES | +/- 9.9% |
| 411 | 520 | 52 | 62 | YES | +/- 9.8% |
| 412 | 429 | 43 | 58 | YES | +/- 10.1% |
| 413 | 212 | 21 | 24 | YES | +/- 15.9% |
| 414 | 232 | 23 | 33 | YES | +/- 13.3% |
| 415 | 89 | 9 | 16 | YES | +/- 18.8% |
| 432 | 1,503 | 150 | 145 | YES | +/- 6.5% |
| 433 | 1,468 | 147 | 134 | YES | +/- 6.8% |
| 434 | 1,200 | 120 | 124 | YES | +/- 7.0% |
| 1L | 3,063 | 306 | 283 | YES | +/- 4.7% |
| 57A | 1,096 | 110 | 171 | YES | +/- 5.8% |
| 80A | 151 | 15 | 43 | YES | +/- 10.7% |
| 80B | 19 | 2 | 9 | YES | +/- 20.5% |
| 84A | 362 | 36 | 78 | YES | +/- 8.3% |
| 85A | 200 | 20 | 36 | YES | +/- 12.5% |
| 88A | 180 | 18 | 35 | YES | +/- 12.6% |
| 98A | 213 | 21 | 66 | YES | +/- 8.5% |
| A | 14,275 | 1,427 | 1,562 | YES | +/- 2.0% |
| B | 7,409 | 741 | 777 | YES | +/- 2.8% |
| C | 6,847 | 685 | 745 | YES | +/- 2.9% |
| E | 5,044 | 504 | 523 | YES | +/- 3.4% |
| PH1 | 84 | 8 | 58 | YES | +/- 6.1% |
| PH2 | 57 | 6 | 27 | YES | +/- 11.6% |
| PH3 | 76 | 8 | 29 | YES | +/- 12.1% |
| PH4 | 31 | 3 | 28 | YES | +/- 4.9% |

Table 2-1. Sampling Goals and Main Surveys Completed (continued)

| Route | Estimated Average Weekday Ridership Prior to Survey | Goal for Completed Surveys—Main Survey (10%) | Completed Surveys | Within 10% or 10 of the Goal | Margin of Error at the 90% Level of Confidence |
|--------------|---|--|-------------------|------------------------------|--|
| PH5 | 60 | 6 | 36 | YES | +/- 8.8% |
| PH6 | 138 | 14 | 54 | YES | +/- 8.8% |
| 501/504 | 259 | 26 | 38 | YES | +/- 12.4% |
| 503 | 237 | 24 | 45 | YES | +/- 11.1% |
| TOTAL | 223,858 | 22,386 | 26,251 | YES | +/- 0.5% |

The sampling target for each route involved completed and useable surveys that were within 10 percent of the goal or, in the case of sample goals that are less than 100, within 10 surveys of the goal. For example, 10 percent of Route 433's daily ridership is 147 surveys. To be within 10 percent of this goal, a minimum of 132 surveys had to be completed. With 134 completed surveys for Route 433 during the 2012 onboard survey, the sample target was achieved. In the case of Route 401, the goal (42) is less than 100 survey records. Since the number of completed surveys (36) for this route was within 10 of the goal, the target was achieved. In sum, the number of complete and useable surveys was within 10 percent of the goal (or 10 completed and usable surveys if the sampling goal was less than 100) on all routes that were included in the survey.

Table 2-1 shows the margin of error for each of the surveyed bus route and for the total number of surveys. Based on the approximately 26,300 completed surveys, the overall results for the estimated daily ridership of approximately 223,000 riders is at a 90 percent confidence level. The precision of this confidence level is +/- 0.5 percent.

2.1.3 Main Survey: Sampling of Ridership between Stops/Segments and Time of Day

To develop an estimated distribution of trips between stops or segments along each route, ETC Institute applied the distribution of the On-to-Off survey results to the stop or segment level data identified through APCs. Stops along each route were aggregated into segments based on surrounding land use and the ridership distribution on the route. This was also done by direction and for each of the four time periods to ensure that reasonable data expansion factors could be developed based on the path taken by riders.

A total of 576 *sub-route* sampling goals were identified to ensure that the survey sample accurately represented the more detailed ridership characteristics for each route throughout the day. Sub-route goals were set for specific times of day, directions, and/or location along a route to ensure that the overall

sample for the route would be representative of the more detailed ridership characteristics of each route in the Honolulu system.

The number of completed surveys was within 10 or 20 percent of the sub-route goal for 554 of the 576 (96.2 percent) goal areas. Most (15 of 22) of the sub-route goals that were not met were for evening routes. These shortfalls were expected because the survey was not conducted after 9 pm even though service on many routes is offered after 9 pm. Although there were some shortages, all sub-route goals were met within 50 percent of the goal, which means that resulting impact of the sampling deficiency on the expansion factors that were developed was minimal. Tables showing how the data was summarized are available for review in Appendix C. Methods for Selecting Survey Participants

In addition to setting specific goals for the number of surveys that were completed on each route/segment, ETC, in coordination with HART, DTS, and the GEC developed specific guidelines for selecting survey participants. The process ensured that the participants would be randomly selected.

A random number generator was used to determine which passengers were asked to participate in the survey after boarding a bus. For example, if four people boarded a bus, the tablet PC randomly generated a number from 1 to 4. If the answer was 2, the second person who boarded the bus was asked to participate in the survey. If the answer was 1, the first person was asked to participate in the survey, and so forth. The selection was limited to the first four people who boarded a bus at any given stop to ensure the interviewer could keep track of the passengers as they boarded. For example, if 20 people boarded a bus, the tablet PC program would randomly pick one of the first four people for the survey.

2.2 Other Techniques Used to Manage the Sampling Process

Some of the other techniques that were used to manage the sampling of bus riders are described below:

- **Daily Reviews of Interviewer Performance**—At the end of each day, the research team evaluated the performance of each interviewer. This review included characteristics of passengers with regard to age, gender, race, the number of reported transfers, the number of required data fields that were completed, the number of desired data fields that were completed, and the average length of each interview. These daily reviews allowed the research team to provide immediate feedback to interviewers to improve their overall performance as necessary. It also allowed the research team to quickly identify and remove interviewers who were not conducting the survey properly.

- **Oversampling of High Volume Bus Stops**—ETC Institute identified high volume boarding locations along each route (such as schools and major employment centers) prior to conducting the survey. To ensure that these locations were not under-represented during the on-board survey, ETC Institute conducted surveys at these stops while passengers were waiting to board the bus. Examples of these high volume bus stops are listed below:
 - Kona Street and Ke‘eaumoku Street
 - S Hotel Street and Bishop Street
 - S Beretania Street and Pali Highway B
 - S King Street and Punchbowl Street
 - Ala Moana Boulevard and Ala Moana Center
 - S Beretania Street and Punchbowl
 - Kalihi Transit Center
 - Kūhiō Avenue and Seaside Avenue
 - Alapai Transit Center
 - S Hotel Street and Bethel Street
 - Kapi‘olani Boulevard and Ke‘eaumoku Street
 - Kūhiō Avenue and Liliuokalani Avenue
 - Kūhiō Avenue and Paoakalani Avenue
 - Alapai Street and S Hotel Street
 - S Hotel Street and Alakea Street
 - Waipahu Transit Center
 - Kūhiō Avenue and Walina Street
 - Alakea Street and S Hotel Street
 - N Hotel Street and Smith Street
 - N Hotel Street and River Street
 - Sinclair Circle
 - Kūhiō Avenue and Lewers Street
 - School Street and Likelike Highway
- **Management of the Sample by Time of Day**—In addition to monitoring the total number of surveys that were completed for each route/segment, ETC Institute also reviewed the number of surveys that were completed during each of the following four time periods: AM peak (6 am to 10 am), midday (10 am to 2 pm), PM peak (2 pm to 6 pm), and all other hours (before 6 am and after 6 pm). These four time periods correspond to those used for regional travel demand forecasting. This was done to ensure that the number of completed surveys for each time period would adequately support data expansion requirements for travel demand forecasting. The data expansion process is further described in Chapter 6 of this report. Figure 2-1 shows the number of On-to-Off surveys that were collected by time period and Figure 2-2 shows the number of Main surveys that were collected by time period.

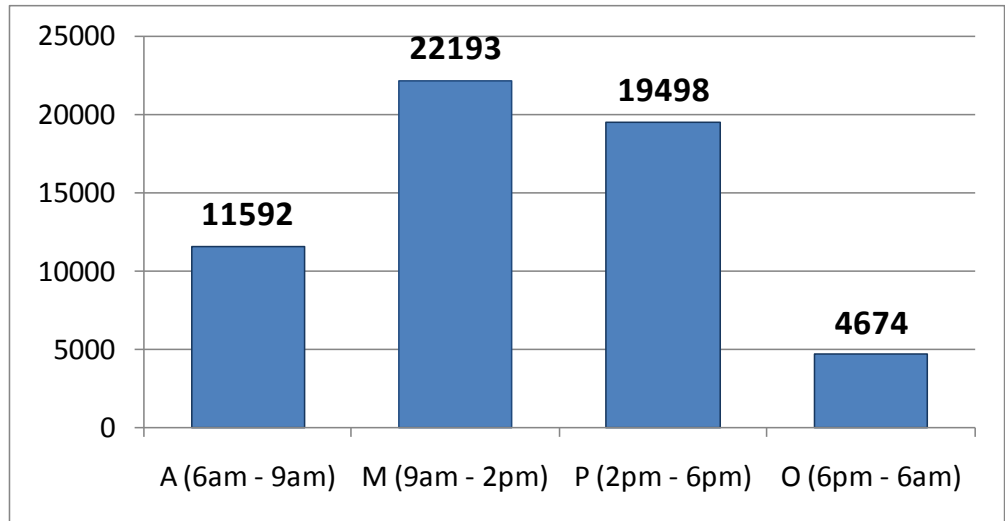


Figure 2-1. Number of On-to-Off Surveys Collected by Time Period

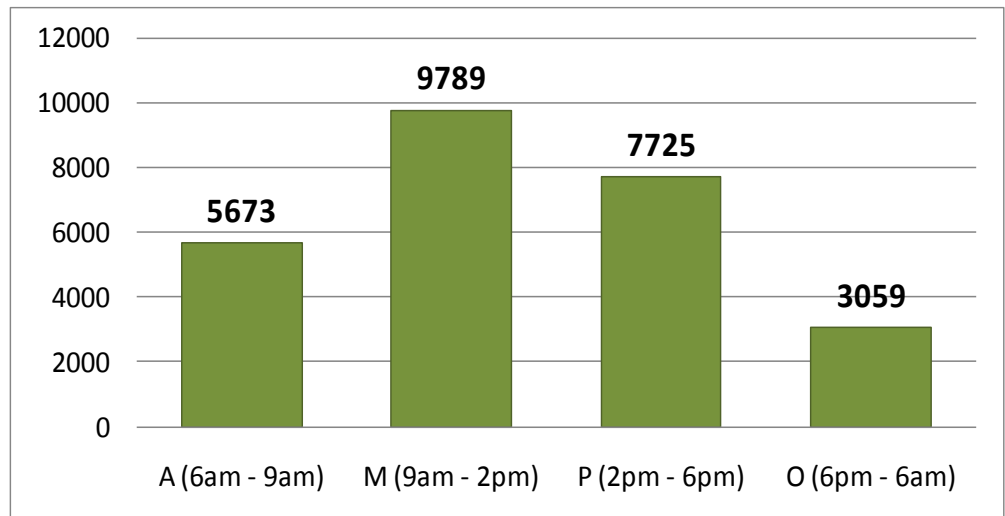


Figure 2-2. Number of Main Surveys Collected by Time Period

Before administering the Main Survey using an interviewer and a tablet PC, an On-to-Off Survey was conducted on the routes. An On-to-Off Survey is meant to identify the ridership flow of each bus route. In other words, the On-to-Off Survey captures where the individual rider boarded the bus and the corresponding location where the rider alighted. Time of day can also be included as part of the ridership patterns. This information allows for a more comprehensive understanding of the true ridership profiles of each route while also allowing the Main Survey data to be more accurately expanded.

The On-to-Off and Main surveys were conducted on TheBus routes in service as of spring 2012. Table 3-1 provides the complete list of routes as well as their operating characteristics. Also, during June and August of 2012, DTS implemented changes to service on several bus routes. Since April 2012 was selected as the baseline for this survey, the administration of the survey was completed prior to these changes.

3.1 Recruiting and Training Surveyors

Assembling a team of high-quality surveyors was one of the most important steps in the On-to-Off administration process. For this project, ETC Institute complemented its team of supervisors with temporary surveyors who were recruited by a local staffing agency in Honolulu. Surveyors recruited by the agency were required to have a familiarity with the service areas, a solid work history, ability to work with the public, a professional attitude and appearance, an ability to operate a tablet PC and proficiency with ETC Institute's On-to-Off software program.

Each surveyor was required to attend ETC Institute's training session. During this training session, surveyors were taught how to operate the tablet PCs and the On-to-Off software, execute the On-to-Off surveying procedures, and deal with various situations that could be encountered during their surveying period.

The surveyor training was conducted in a classroom style setting at the Kalihi Transit Center training room. The classroom provided ETC Institute a quiet and convenient location to train its team efficiently. The training elements provided to all personnel who participated in the administration of the On-to-Off Survey ensured are described below:

- Overview of the on-board survey objectives
- On-to-Off equipment/software overview and training
- On-to-Off barcode administering procedures
- One-on-one tutoring/mock interview with an ETC Institute supervisor

Table 3-1. Route Operating Characteristics

| TheBus Routes | | Weekday Revenue Hours | Weekday Revenue Miles | Average Miles per Hour | Weekday Span of Service | Average Weekday Headways | |
|---------------------|-----------------------------|-----------------------------|-----------------------------|------------------------------|-------------------------|-----------------------------|------|
| | | | | | | AM Peak | Base |
| Rapid Bus Routes | | | | | | | |
| A | City Express! A | 190.8 | 2,395.1 | 12.6 | 4:18 AM–10:49 PM | 15 | 15 |
| B | City Express! B | 104.0 | 823.6 | 7.9 | 4:47 AM–10:04 PM | 15 | 20 |
| C | Country Express! C | 144.5 | 2,850.8 | 19.7 | 3:52 AM–10:48 PM | 30 | 30 |
| E | Country Express! E | 116.3 | 1,930.2 | 16.6 | 4:10 AM–11:25 PM | 30 | 30 |
| Urban Trunk Routes | | | | | | | |
| 1 | Kaimukī-Kalihi | 208.4 | 1,863.3 | 8.9 | 4:03 AM–1:17 AM | 10 | 10 |
| 1L | Downtown-Hawaii Kai Limited | 65.6 | 749.4 | 11.4 | 6:19 AM–7:18 PM | 30 | 30 |
| 2 | Waikiki-School-Middle | 181.8 | 1,333.1 | 7.3 | 4:37 AM–12:44 AM | 12 | 15 |
| 3 | Kaimukī-Salt Lake | 188.4 | 1,850.5 | 9.8 | 4:15 AM–1:26 AM | 12 | 20 |
| 4 | Nu‘uanu-Punahou | 135.5 | 1,128.1 | 8.3 | 4:59 AM–12:20 AM | 12 | 20 |
| 6 | Pauoa-Woodlawn | 98.2 | 827.6 | 8.4 | 5:03 AM–12:00 AM | 20 | 20 |
| 8 | Waikiki-Ala Moana | 81.2 | 528.7 | 6.5 | 7:24 AM–10:44 PM | 20 | 10 |
| 9 | Pālolo Valley-Pearl Harbor | 114.2 | 1,168.2 | 10.2 | 5:10 AM–11:26 PM | 19 | 45 |
| 13 | Waikiki-Liliha | 154.1 | 1,108.6 | 7.2 | 4:10 AM–1:41 AM | 15 | 15 |
| 19 | Waikiki-Airport-Hickam | 110.7 | 1,162.1 | 10.5 | 4:04 AM–1:45 AM | 25 | 40 |
| 20 | Waikiki-Pearlridge | 68.5 | 670.9 | 9.8 | 5:14 AM–7:35 PM | 40 | 40 |
| Urban Feeder Routes | | | | | | | |
| 5 | Ala Moana-Mānoa | 23.2 | 203.4 | 8.8 | 5:36 AM–10:02 PM | 30 | 50 |
| 7 | Kalihi Valley | 48.1 | 444.9 | 9.3 | 4:39 AM–11:07 PM | 15 | 45 |
| 10 | Kalihi-‘Ālewa Heights | 27.7 | 285.4 | 10.3 | 4:53 AM–10:46 PM | 40 | 70 |
| 14 | St. Louis-Kāhala-Maunalani | 44.9 | 624.9 | 13.9 | 5:23 AM–10:10 PM | 30 | 60 |
| 15 | Makiki-Pacific Heights | 22.8 | 291.0 | 12.8 | 5:30 AM–10:23 PM | 30 | 60 |

Table 3-1. Route Operating Characteristics (continued)

| TheBus Routes | | Weekday Revenue Hours | Weekday Revenue Miles | Average Miles per Hour | Weekday Span of Service | Average Weekday Headways | |
|------------------------------|--------------------------------|-----------------------------|-----------------------------|------------------------------|-----------------------------------|-----------------------------|------|
| | | | | | | AM Peak | Base |
| 16 | Moanalua Valley | 3.7 | 60.0 | 16.4 | 5:47 AM–7:24 AM ♦ 4:12 PM–6:12 PM | 3 trips | — |
| 17 | Makiki-Ala Moana | 18.4 | 108.6 | 5.9 | 6:00 AM–9:47 PM | 30 | 40 |
| 18 | University-Ala Moana | 15.0 | 121.8 | 8.1 | 6:50 AM–9:46 PM | 70 | 65 |
| 24 | ‘Āina Haina-Ala Moana | 18.1 | 203.3 | 11.3 | 5:46 AM–8:21 PM | 60 | 65 |
| 31 | Tripler-Māpunapuna | 23.2 | 286.8 | 12.4 | 4:40 AM–10:31 PM | 37 | 50 |
| 32 | Kalihi-Pearlridge | 44.3 | 558.5 | 12.6 | 5:05 AM–9:52 PM | 30 | 60 |
| Suburban Trunk Routes | | | | | | | |
| 11 | Makalapa-Hālawa-Aiea Heights | 36.1 | 516.1 | 14.3 | 5:38 AM–10:21 PM | 30 | 60 |
| 22 | Beach Bus | 21.0 | 326.7 | 15.6 | 8:00 AM–6:15 PM | 60 | 60 |
| 23 | Hawaii Kai-Sea Life Park | 47.3 | 726.4 | 15.4 | 6:00 AM–8:25 PM | 32 | 40 |
| 40 | Honolulu-Māhaha | 225.7 | 3,465.9 | 15.4 | 24 hours | 30 | 30 |
| 41 | Kapolei-Ewa Beach | 40.2 | 492.6 | 12.3 | 4:45 AM–10:33 PM | 30 | 40 |
| 42 | Ewa Beach-Waikiki | 172.1 | 1,940.0 | 11.3 | 4:07 AM–2:48 AM | 30 | 30 |
| 43 | Waipahu-Honolulu-Alapai | 51.5 | 796.7 | 15.5 | 7:09 AM–6:07 PM | 30 | 30 |
| 52 | Wahiawa-Circle Island | 122.2 | 2,515.1 | 20.6 | 4:30 AM–1:22 AM | 30 | 40 |
| 53 | Honolulu-Pacific Palisades | 68.5 | 971.4 | 14.2 | 4:48 AM–11:27 PM | 20 | 35 |
| 54 | Honolulu-Pearl City | 80.2 | 1,050.0 | 13.1 | 4:57 AM–11:10 PM | 30 | 30 |
| 55 | Kaneohe-Circle Island | 115.0 | 2,423.0 | 21.1 | 4:05 AM–12:20 AM | 35 | 40 |
| 56 | Honolulu-Kailua-Kaneohe | 75.0 | 1,255.6 | 16.7 | 4:46 AM–10:39 PM | 30 | 45 |
| 57 | Kailua-Waimanalo-Sea Life Park | 79.9 | 1,468.1 | 18.4 | 5:03 AM–11:27 PM | 30 | 40 |
| 57A | Kailua-Enchanted Lake | 30.1 | 497.0 | 16.5 | 5:01 AM–6:33 PM | 45 | 60 |
| 62 | Honolulu-Wahiawa Heights | 123.7 | 1,713.0 | 13.9 | 4:27 AM–1:19 AM | 20 | 35 |
| 65 | Honolulu-Kahalu ‘u | 50.4 | 850.1 | 16.9 | 4:58 AM–10:53 PM | 23 | 70 |

Table 3-1. Route Operating Characteristics (continued)

| TheBus Routes | | Weekday Revenue Hours | Weekday Revenue Miles | Average Miles per Hour | Weekday Span of Service | Average Weekday Headways | |
|-----------------------------|---------------------------------|-----------------------|-----------------------|------------------------|-----------------------------------|--------------------------|------|
| | | | | | | AM Peak | Base |
| Suburban Feeder Routes | | | | | | | |
| 70 | Lanikai-Maunawili | 13.7 | 197.7 | 14.4 | 6:09 AM–7:45 PM | 60 | 90 |
| 71 | Pearlridge-Newtown | 5.6 | 89.9 | 16.2 | 5:41 AM–8:16 AM ♦ 3:12 PM–6:09 PM | 4 trips | — |
| 72 | Schofield-Wahiawa-Whitmore | 14.1 | 172.0 | 12.2 | 5:22 AM–9:34 PM | 60 | 65 |
| 73 | Leeward Community College | 11.8 | 154.7 | 13.2 | 6:12 AM–5:47 PM | 22 | 35 |
| 74 | Aiea-Hālawa Heights | 4.9 | 60.5 | 12.3 | 5:32 AM–7:56 AM ♦ 3:56 PM–6:23 PM | 3 trips | — |
| 76 | Waialua-Haleiwa | 13.0 | 233.2 | 18.0 | 6:00 AM–7:15 PM | 40 | 40 |
| 77 | Waimanalo-Kaneohe | 12.7 | 223.2 | 17.6 | 5:32 AM–6:21 PM | 90 | 90 |
| Community Circulator Routes | | | | | | | |
| 44 | Waipahu-Ewa Beach | 35.9 | 508.6 | 14.2 | 4:24 AM–12:15 AM | 60 | 60 |
| 231 | Hawaii Kai-Hahaione Valley | 15.3 | 139.0 | 9.1 | 6:03 AM–9:12 PM | 30 | 30 |
| 234 | Kāhala Mall-Waiʻalaе Nui | 3.4 | 44.0 | 13.1 | 6:08 AM–7:19 AM ♦ 2:48 PM–6:44 PM | 2 trips | — |
| 235 | Kāhala Mall-Waiʻalaе Iki | 2.0 | 29.8 | 14.9 | 6:35 AM–6:53 AM ♦ 3:20 PM–6:22 PM | 1 trip | — |
| 401 | Waianae Valley | 10.6 | 157.9 | 15.0 | 3:43 AM–9:37 PM | 60 | 70 |
| 402 | Lualualei Homestead | 8.8 | 121.3 | 13.9 | 4:07 AM–10:00 PM | 60 | 65 |
| 403 | Nānākuli-Maili-Waianae | 17.8 | 278.7 | 15.7 | 4:14 AM–10:22 PM | 60 | 65 |
| 411 | Makakilo Heights | 18.7 | 258.9 | 13.9 | 4:30 AM–12:49 AM | 30 | 40 |
| 412 | Panana-Kapolei | 14.7 | 134.5 | 9.1 | 4:30 AM–7:14 PM | 45 | 45 |
| 413 | Campbell Industrial Park | 5.5 | 99.5 | 18.3 | 5:30 AM–8:28 AM ♦ 3:00 PM–5:55 PM | 6 trips | — |
| 415 | Kapolei Transit Center-Kalaeloa | 2.7 | 37.3 | 13.8 | 5:05 AM–6:25 AM ♦ 5:15 PM–6:41 PM | 3 trips | — |
| 432 | East-West Waipahu | 36.9 | 414.9 | 11.3 | 4:36 AM–1:38 AM | 30 | 15 |
| 433 | Waipahu-Waikele Shopping Center | 27.3 | 327.7 | 12.0 | 4:55 AM–11:31 PM | 40 | 30 |
| 434 | Waipahu-Village Park | 17.8 | 210.3 | 11.8 | 4:36 AM–12:47 AM | 45 | 45 |

Table 3-1. Route Operating Characteristics (continued)

| TheBus Routes | | Weekday Revenue Hours | Weekday Revenue Miles | Average Miles per Hour | Weekday Span of Service | Average Weekday Headways | |
|----------------------------|---------------------------------------|-----------------------------|-----------------------------|------------------------------|-----------------------------------|-----------------------------|------|
| | | | | | | AM Peak | Base |
| Community Access Routes | | | | | | | |
| 414 | Palahi'a-Makakilo-Kapolei | 14.2 | 109.5 | 7.7 | 4:30 AM–6:43 PM | 60 | 60 |
| 501 | Mililani Mauka | 8.2 | 106.9 | 13.1 | 5:45 AM–9:12 PM | 62 | 65 |
| 503 | Mililani-Launani Valley | 15.3 | 158.7 | 10.4 | 4:33 AM–7:52 PM | 60 | 60 |
| 504 | Mililani South | 8.7 | 128.4 | 14.8 | 5:06 AM–9:38 PM | 62 | 65 |
| Peak Period Express Routes | | | | | | | |
| PH1 | Waianae Coast-Pearl Harbor Express | 2.7 | 72.0 | 26.7 | 4:50 AM–6:10 AM ♦ 3:10 PM–4:32 PM | 1 trip | — |
| PH2 | Mililani Town-Pearl Harbor Express | 2.3 | 50.3 | 21.9 | 5:10 AM–6:18 AM ♦ 3:10 PM–4:18 PM | 1 trip | — |
| PH3 | Wahiawa Heights-Pearl Harbor Express | 2.3 | 38.1 | 16.6 | 5:10 AM–6:18 AM ♦ 3:10 PM–4:20 PM | 1 trip | — |
| PH4 | Kaneohe-Kahalu'u-Pearl Harbor Express | 2.4 | 57.6 | 24.5 | 5:07 AM–7:17 AM ♦ 3:10 PM–4:21 PM | 1 trip | — |
| PH5 | Windward-Pearl Harbor Express | 2.0 | 50.6 | 25.3 | 5:16 AM–6:17 AM ♦ 3:10 PM–4:11 PM | 1 trip | — |
| PH6 | Hawaii Kai-Pearl Harbor Express | 2.8 | 60.2 | 21.9 | 5:01 AM–6:16 AM ♦ 3:10 PM–4:40 PM | 1 trip | — |
| 80 | Hawaii Kai Park & Ride Express | 11.8 | 205.3 | 17.5 | 5:37 AM–8:21 AM ♦ 4:10 PM–6:43 PM | 6 trips | — |
| 80A | Hawaii Kai Park & Ride Express-UH | 6.1 | 110.7 | 18.1 | 6:00 AM–8:44 AM ♦ 3:20 PM–6:00 PM | 3 trips | — |
| 80B | Upper 'Āina Haina Express | 0.8 | 11.6 | 14.5 | 6:23 AM–7:10 AM | 1 trip | — |
| 81 | Waipahu Express | 22.6 | 437.1 | 19.4 | 4:28 AM–8:39 AM ♦ 3:00 PM–7:18 PM | 12 trips | — |
| 82 | Hawaii Kai Park & Ride Express | 5.9 | 111.6 | 19.1 | 5:28 AM–8:03 AM ♦ 3:50 PM–6:09 PM | 4 trips | — |
| 83 | Wahiawa Town Express | 18.5 | 430.0 | 23.3 | 4:58 AM–7:44 AM ♦ 3:40 PM–6:54 PM | 7 trips | — |
| 84 | Mililani Express-North | 9.5 | 214.6 | 22.6 | 4:55 AM–7:29 AM ♦ 3:45 PM–6:37 PM | 4 trips | — |
| 84A | Mililani Express-South | 9.3 | 209.5 | 22.5 | 5:10 AM–7:56 AM ♦ 4:05 PM–6:49 PM | 4 trips | — |
| 85 | Windward Express-Kailua | 17.4 | 349.4 | 20.1 | 5:40 PM–7:39 AM ♦ 2:41 PM–7:01 PM | 6 trips | — |
| 85A | Windward Express-Haiku | 5.9 | 98.5 | 16.8 | 6:05 AM–7:54 AM ♦ 4:08 PM–5:50 PM | 3 trips | — |
| 88 | Kahalu'u-'Āhuimanu Express | 4.8 | 79.5 | 16.7 | 6:05 AM–7:30 AM ♦ 4:09 PM–6:22 PM | 2 trips | — |
| 88A | North Shore Express | 11.9 | 297.1 | 25.1 | 3:49 AM–6:44 AM ♦ 4:20 PM–8:18 PM | 2 trips | — |

Table 3-1. Route Operating Characteristics (continued)

| TheBus Routes | | Weekday Revenue Hours | Weekday Revenue Miles | Average Miles per Hour | Weekday Span of Service | Average Weekday Headways | |
|--------------------------|------------------------------------|-----------------------------|-----------------------------|------------------------------|-----------------------------------|-----------------------------|------|
| | | | | | | AM Peak | Base |
| 89 | Waimanalo-Kailua Express | 3.6 | 72.2 | 20.3 | 5:42 AM–7:22 AM ♦ 4:05 PM–5:37 PM | 2 trips | — |
| 90 | Pearl City Express | 3.8 | 67.3 | 17.7 | 5:57 AM–7:35 AM ♦ 4:10 PM–5:36 PM | 2 trips | — |
| 91 | Ewa Beach Express | 21.6 | 419.4 | 19.5 | 4:30 AM–8:19 AM ♦ 3:25 PM–7:20 PM | 9 trips | — |
| 92 | Makakilo City Express | 7.2 | 164.3 | 22.8 | 5:10 AM–7:02 AM ♦ 4:07 PM–6:28 PM | 3 trips | — |
| 93 | Waianae Coast Express-CBD | 32.0 | 859.7 | 26.9 | 4:16 AM–8:13 AM ♦ 3:00 PM–7:29 PM | 10 trips | — |
| 94 | Villages of Kapolei-Kaupea Express | 4.7 | 117.8 | 25.3 | 5:40 AM–6:59 AM ♦ 4:15 PM–6:27 PM | 2 trips | — |
| 96 | Waipi 'Gentry Express | 3.2 | 70.9 | 22.2 | 5:45 AM–6:59 AM ♦ 4:30 PM–6:02 PM | 2 trips | — |
| 97 | Village Park Express | 7.1 | 163.6 | 23.0 | 5:15 AM–7:07 AM ♦ 3:35 PM–5:59 PM | 4 trips | — |
| 98 | Wahiawa-Mililani Park & Ride | 6.3 | 153.6 | 24.4 | 5:12 AM–7:13 AM ♦ 4:15 PM–6:28 PM | 3 trips | — |
| 98A | Kunia-Wahiawa-Mililani | 6.5 | 131.7 | 20.3 | 4:55 AM–6:52 AM ♦ 4:00 PM–6:29 PM | 2 trips | — |
| 101 | Ewa Gentry Express | 10.2 | 237.0 | 23.3 | 4:57 AM–7:14 AM ♦ 4:00 PM–6:25 PM | 5 trips | — |
| 102 | Villages of Kapolei Express | 6.4 | 156.4 | 24.6 | 5:30 AM–7:10 AM ♦ 4:00 PM–6:18 PM | 3 trips | — |
| 103 | Paiwa-Waikele Express | 3.5 | 69.8 | 20.2 | 5:45 AM–6:52 AM ♦ 4:20 PM–5:44 PM | 2 trips | — |
| 201 | Waipahu via Farrington Express | 15.1 | 251.7 | 16.7 | 4:45 AM–7:26 AM ♦ 4:00 PM–6:23 PM | 6 trips | — |
| 202 | Waipahu via Paiwa Express | 6.7 | 133.2 | 20.0 | 5:00 AM–7:02 AM ♦ 4:10 PM–5:55 PM | 4 trips | — |
| 203 | Kalihi via School Street Express | 3.5 | 39.7 | 11.4 | 5:44 AM–7:02 AM ♦ 3:37 PM–5:05 PM | 2 trips | — |
| Totals All Routes | | 4,207.6 | 54,975.3 | 13.1 | | | |

Source: DTS/OTS Scheduled Information for 3/4/2012 and Public Timetables.

Notes: AM Peak is defined as 6:00 AM to 8:59 AM; base period is 9:00 AM to 2:59 PM.

Once the training was completed, and an ETC Institute supervisor approved of each surveyor's abilities in the classroom, the surveyors then spent several days in the field. This field work was done under the management of an ETC supervisor who assessed each surveyor's ability to properly conduct the On-to-Off procedures. Surveyors who did not demonstrate proficiency in all of the required tasks were released.

3.2 ETC Institute On-to-Off Program Procedure

The purpose of the On-to-Off software program is to identify ridership patterns based on an individual's boarding and alighting locations by time period. The resulting information provided the key basis for developing the sampling plan for the Main Survey. This was accomplished by using ETC Institute's custom On-to-Off software which records the latitude and longitude of boarding and alighting locations using a barcode system. These barcodes eliminated language barriers and increased ridership participation thereby providing more accurate boarding and alighting locations.

The survey team used the On-to-Off software with a GPS-equipped tablet PC to record the rider's boarding latitude/longitude, alighting latitude/longitude, time of usage, route used, and inbound/outbound direction. The key steps in the barcode scanning system method are described below:

- Riders were asked to participate in the On-to-Off ridership pattern survey as they entered the bus.
- Riders who agreed to participate were handed a barcode card which was scanned by a surveyor.
- Riders were told to keep the barcode card during the duration of their trips.
- Riders were reminded to hand their cards back to the surveyor as they exited the bus.
- When riders' bus stops were approached, the surveyor took their barcode cards before they exited. The surveyor scanned riders' barcode cards as they departed the bus.
- The software then paired the boarding and the alighting location of each rider based on the unique barcode card each was handed.

A screen shot of the interface of the On-to-Off boarding/alighting software that was used to record the information and a picture of a barcode card are shown in Figure 3-1.

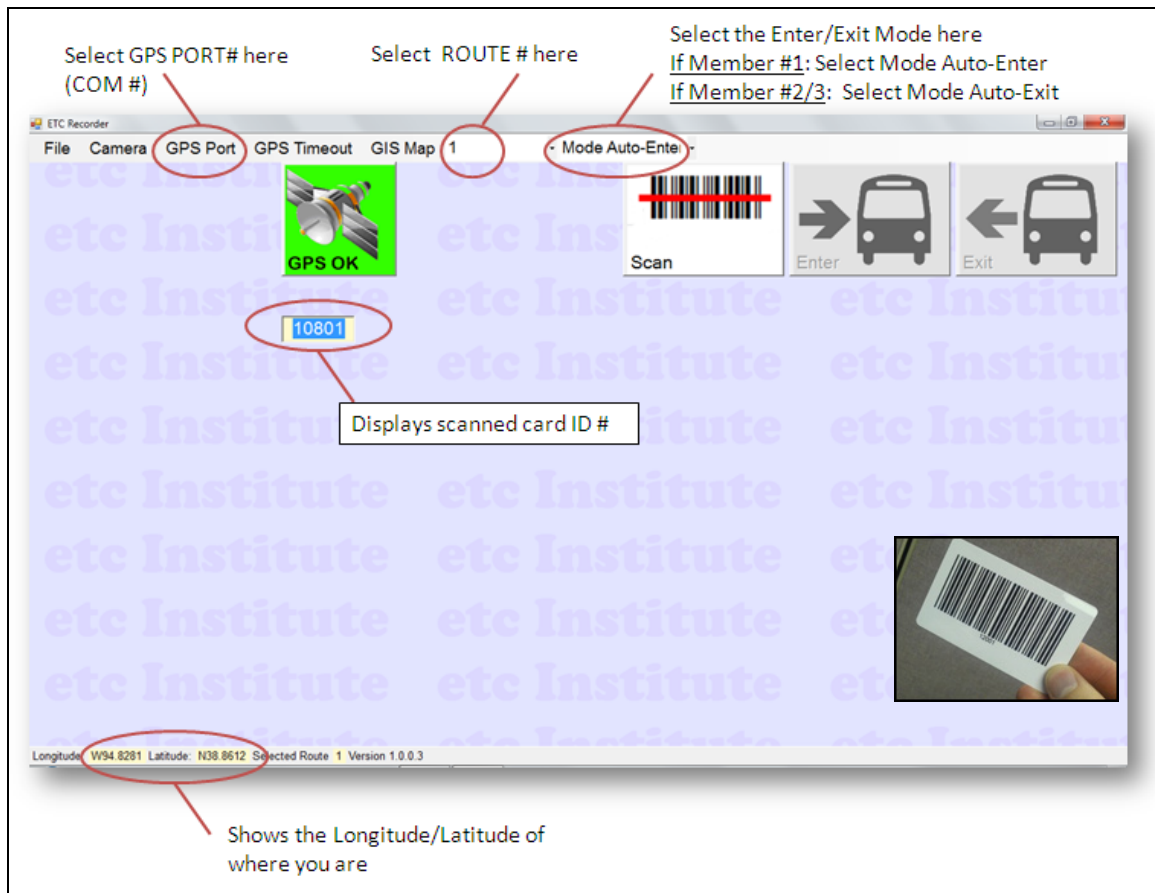


Figure 3-1. On-to-Off Survey Scan Card Screenshot

3.3 Organization of the Survey Team

The On-to-Off Survey was administered by teams that were directly supervised by an ETC Institute supervisor. The supervisors were responsible for reviewing the performance of each team and ensuring that all parts of the On-to-Off procedure were being followed and the sampling goals for each route were met. The supervisors operated from centralized locations, such as transit centers, so that the performance of all teams could be evaluated.

The On-to-Off Survey Team sizes were determined by route ridership levels and bus size (articulated [3+ doors] or standard [1-2 doors]). A typical team consisted of two members, based on a medium- to high-ridership level for a route and a standard size bus. On-to-Off teams were typically deployed on at least two buses running in opposite directions. For high-volume routes, teams may have been deployed on up to four buses on a route. On low-volume routes, teams may have been deployed on just one bus serving the route.

The responsibilities of each of the positions on the On-to-Off teams are described below:

- The **team leader** was responsible for route and direction selection for On-to-Off software, offering riders an opportunity to participate in the survey, scanning barcode cards for boarding riders, answering rider questions, and overseeing On-to-Off operations of his/her bus.
- The **support surveyor** was responsible for collecting and scanning barcode cards for alighting riders, reminding riders to keep their cards ready to hand in to a surveyor when they exited at their bus stop, and answering rider questions.

3.4 Timing of the On-to-Off Survey

The bulk of the On-to-Off survey was administered during weekdays (Monday through Thursday) from February 2012 through March 2012 with the exceptions of holidays and breaks for colleges/schools. The On-to-Off Survey was administered at the time of day that coincided with the hours that each route was operational. This was to ensure that the On-to-Off data would provide the Main Survey with an accurate sampling plan for administration and for the data expansion. Although the administration of the On-to-Off Survey began as early as 5 am and continued as late as 9 pm on some routes, most were conducted between the 6 am and 7 pm.

4 *Main Survey Administration Methodology*

The following sections describe the methodology used for the 2012 onboard Main Survey in Honolulu. This methodology includes recruiting and training of interviewers, procedures used for the survey, and organization of the survey teams. Prior to the survey administration, ETC met with management of OTS and DTS in order to finalize the scheduling and coordination of the survey effort. It should be noted that, prior to initiation of the survey elements, the survey methodology was reviewed by HART and the GEC.

4.1 Recruiting and Training Interviewers

Assembling a team of high quality interviewers was one of the most important steps in the Main Survey administration process. As was the case for the On-to-Off Survey, ETC Institute used temporary interviewers who were recruited by a local staffing agency to complement experienced supervisors.

Interviewers recruited by the staffing agency were required to have a familiarity with the bus service areas. They were also required to document a solid work history, show a professional attitude and appearance, prove to supervisors the ability to interact with the public, display an ability to work a tablet PC, and show proficiency with ETC Institute's surveying program.

Each interviewer was required to attend ETC Institute's training session. During this training session, interviewers were presented with the following:

- An overview of the on-board survey objectives
- How to operate the tablet PC and surveying software
- How to approach riders and sampling procedures
- Survey etiquette
- How to deal with various situations that could be encountered during a survey
- Role-playing and one-on-one tutoring with an ETC Institute supervisor

Once the training was completed, interviewers spent several days under the supervision of an ETC Institute staff person who assessed each interviewer's ability to properly conduct surveys. Those who did not demonstrate proficiency in all of the required tasks for the Main Survey were released.

4.2 Main Survey Administration Procedure

In order to encourage participation in the survey, OTS posted signs (one copy is provided in Appendix D) on buses that explained the importance of the survey. The sign also pictured an interviewer for recognition. The signs were posted on buses during the On-to-Off phase of the survey and throughout the duration of the Main Survey. The following sections further describe procedures used for the Main Survey, including those applied to Local and Express routes.

4.2.1 *Direction for Main Survey*

Prior to administration of the Main Survey, the results of the On-to-Off Survey were reviewed to ensure the survey team fully understood the trip patterns along each route. Information from this review was used to direct the Main Survey. Some of the specific aspects of the On-to-Off survey data that were reviewed included:

- Whether any pairs of stops along a route account for at least 10 percent of the one-way trips that were completed on the route during a particular time period. If a high percentage of trips along a given route involved the same set of boarding and alighting pairs, ETC Institute placed additional interviewers on buses to be sure these trips were captured. Without the On-to-Off data, these trips may have been underrepresented using traditional sampling techniques.
- The percentage of boarding/alighting pairs along each bus route that were “short trips”, which means the distance between the boarding and alighting locations was less than one mile. If more than 10 percent of the records from the On-to-Off survey for a given route involved boarding/alighting pairs were less than one mile apart, additional interviewers were staffed on the route and were told to conduct the full interview. These interviews occurred even if the rider said that he/she did not have enough time to complete the survey. The interviewer would then get off the bus with the rider to complete the survey.

4.2.2 *Survey of Local Routes*

Local routes, which provide regular/continuous service throughout the day, were surveyed using tablet PCs. Since local routes have more frequent stops than express routes and shorter ride times for the passenger, interviews using tablet PCs were deemed necessary. Interviewers selected people for the survey in accordance with the sampling procedures described in Chapter 2 of this report. Once an interviewer had selected a person for the survey, he/she carried out the following steps:

- Approached the person who was selected and asked him or her to participate in the survey.

- If the person refused, the interviewer ended the survey.
- If the person agreed to participate, the interviewer asked the respondent if he/she had at least five minutes to complete the survey.
- If the person did not have at least five minutes on the bus, the interviewer asked the person to provide his/her home address, boarding location, alighting location, name, and phone number. A phone interviewer from ETC Institute's call center contacted the respondent and asked him/her to provide the information by phone. This methodology ensured that people who completed "short-trips" on public transit were properly represented.
- If the person had at least five minutes on the bus, the interviewer began administering the survey to the respondent as a face-to-face interview using a tablet PC. After all of the required questions had been answered, the interviewer asked the respondent if he or she had two to three more minutes to complete the desired questions. If the respondent agreed, the interviewer then asked the remaining questions on the survey.

Interviewers working in ETC Institute's call center contacted respondents who did not have the two to three minutes to complete the desired questions at a later date. Of those that did not have the necessary two to three minutes to complete the survey, ETC's call center was able to retrieve answers to those remaining questions from 92 percent of those individuals. Overall, 78 percent of all respondents to the survey provided their phone numbers.

4.2.3 *Express Service Routes*

Express routes were surveyed by interviewers using the printed forms. Interviewers distributed the printed surveys and pencils to boarding riders. Paper surveys were used on some express route buses because this type of bus service generally have longer ride times and the routes often serve employed travelers with higher education levels. The combination of higher education levels, longer ride time, and the ease of distributing the paper surveys to a higher number of passengers often leads to a much higher percentage of rider surveys being captured (than would have been possible with using a tablet PC alone) while still maintaining a high level of accuracy.

Once a rider finished a survey, an interviewer conducted a short-version interview to ensure that all questions were answered properly. The interviewer then made corrections/additions to the survey as necessary. After corrections/additions were made, the interviewer initialed the printed survey for submittal.

4.2.4 *Monitoring of Survey Activities*

Surveys on Local bus routes submitted with tablet PCs were reviewed by an ETC Supervisor in real-time using ETC Institute's survey program's on-line database. This real-time review ensured that the following information had been provided:

- Type of place where the trip began
- Complete address where the trip began
- Mode of access to the transit system
- Boarding location
- Alighting location
- Mode of egress from the transit system
- Complete destination address
- Type of place where the trip ended
- Respondent's home address
- Respondent's employment status
- Respondent's student status
- Respondent's driver's license status
- Respondent's age
- Number of operating vehicles available in the household
- Number of occupants in the household
- Number of adults in the household
- Number of workers (employed persons) in the household
- Annual household income
- Time of day the survey was completed

If any item listed above was missing or incomplete, the supervisor flagged the record for reviewing. ETC Institute's Project Manager then forwarded all flagged survey records and the corresponding name and phone number to ETC Institute's call center. Interviewers working in this call center then contacted respondents who had provided their names and phone numbers to retrieve the missing information by phone.

Once survey records for Local bus routes were classified as *complete*, meaning all of the required information had been collected, the records were forwarded to ETC Institute's geocoding manager. This manager then recorded the home, origin, boarding, alighting, and destination locations. Express route surveys were physically reviewed by an ETC Supervisor to ensure that the information described above for Local routes had been provided. The printed surveys were then sent to ETC Institute's Data Entry department to be

entered. Those surveyed on Express routes were sometimes contacted by ETC Institute's Call Center to retrieve any missing information.

4.3 Organization of the Main Survey Team

The Main Survey was administered by teams who were directly supervised by an ETC Institute staff person. The supervisors were responsible for reviewing the performance of each interviewer to ensure that all parts of the surveying procedure were being followed and the sampling goals for each route were being met. The supervisors operated from centralized locations, such as transit centers (e.g., Kalihi Transit Center and Ala Moana Center), so that the performance of all interviewers could be evaluated.

The responsibilities for the two positions on the Main Survey team are described below.

- The supervisor was responsible for ensuring that interviewers were properly trained, equipping interviewers to conduct surveys, scheduling interviewers, inspecting work, and reviewing the data collected.
- The interviewer was responsible for administering surveys while following surveying procedures.

4.4 Timing of the Main Survey Administration

The Main Survey was administered at the time of day that coincided with the hours that each route was in service. This was to ensure that the administration of the survey began prior to peak ridership levels in the morning and continued after peak ridership levels in the evening. Although the administration of the Main Survey began as early as 5 am and continued to as late as 9 pm on some routes, most of it was administered between 6 am and 7 pm.

The bulk of the Main Survey was administered during weekdays (Monday through Thursday) from April 2012 through May 2012 with the exceptions of holidays and breaks for colleges/schools. Upon completion of this Main Survey, the analysis of results indicated some gaps regarding the targeted number of response per bus routes. To fill in the gaps, follow-up Main Surveys were carried out in September and October 2012.

The items described in the first four sections of this report were essential elements of the overall quality assurance/quality control (QA/QC) process that was implemented throughout the survey administration process. The establishment of specific sampling goals and procedures for managing them ensured that a representative sample was obtained from each bus route as well as for route segments by time of day.

The following sections describe the QA/QC processes that were implemented after the data was collected. The processes used in the onboard survey resulted in a database with approximately 26,200 complete and useable surveys. This total met the contractual requirements established by HART.

5.1 Process for Identifying “Complete and Useable” Surveys

Once a survey had been classified as being *complete*, meaning all of the required data were provided, the next phase of the QA/QC process was to determine the usability of each survey record. The term *useable* was applicable to those records that passed all QA/QC tests after they were classified as being complete. (A list of *required* data that were needed to meet the contractual requirements for completeness is provided in Section 1.3.1)

5.1.1 Pre-processing Tests

The first step in this process involved the application of a series of QA/QC tests that were conducted before the address fields were processed for geocoding. Some of the specific checks that were conducted during the pre-processing phase included:

- Valid *home* street names, city names, and zip codes
- Valid *origin* street names, city names, and zip codes
- Valid *destination* street names, city names, and zip codes
- *Origin* place names that could be matched to a pre-existing list of major origins that had been previously geocoded
- *Destination* place names that could be matched to a pre-existing list of major destinations that had been previously geocoded
- The number of household occupants was greater than or equal to the number of employed members of the household
- The number of household occupants was greater than or equal to number of adults in the household

- The number of respondents who indicated that they were employed also reported that at least one member of their household was employed
- Bus route names were consistently spelled and coded correctly
- The report dates on which the survey was administered were on a Monday, Tuesday, Wednesday, or Thursday
- Transfers to a bus route were possible
- Transfers from a bus route were possible
- The number of vehicles available to a respondent's household was consistent with the respondent's reported annual household income. Low income families who reported owning many vehicles and high income families that reported no vehicles were flagged
- The time of day a survey was completed was reasonable given the published operating schedule for the route
- The origin type of place code matched the type of place reported by the respondent
- The destination type of place code matched the type of place reported by the respondent

Records that passed all the QA/QC tests described above were forwarded to ETC Institute's geocoding team. Records that did not pass all of the tests were sent to ETC Institute's Survey Records Review Team (SRRT) for further review. The SRRT members then took one of the following actions:

- They corrected the deficiency in record.
- They directed ETC Institute's Call Center to contact the respondent by phone (if a phone number were available) to retrieve additional information or to confirm whether or not their responses were correct.
- They reclassified the record as *incomplete* by assigning a value of "3" for the record's Quality Control Flag. This assignment removed the record from further consideration for the final survey database.

5.1.2 Post-processing Tests

The next step in this process involved the application of a series of QA/QC tests that were conducted after all five addresses were successfully geocoded. Once all five addresses had been geocoded, the following QA/QC checks were performed to assess the logic and other attributes of the reported trip.

- Ensuring the origin and destination addresses were not the same
- Ensuring the boarding and alighting addresses were not the same
- Ensuring that the respondent did not list the same route as both a "transfer from" and a "transfer to" during their one-way trip

- Checking to be sure the access mode was appropriate given the distance of travel from the trip origin to the place where the respondent initially accessed transit. For example, if a rider reported that he/she accessed transit by car but the distance from his/her origin to the entry point for transit was less than 0.25 mile, the record would have been flagged for further review. Similarly, if a respondent reported that he/she walked to transit but the distance from the origin to transit was more than two miles, the record would have been flagged to check for a missing transfer. Two miles or more is well beyond typical walk distance.
- Checking to ensure that the egress mode was appropriate given the distance of travel from the place where the respondent exited the transit system to his/her destination
- Reviewing the total distance the respondent traveled on transit compared to the distance the respondent traveled from the origin to the destination for his/her trip. For example, if a respondent reported traveling 6 miles on transit in order to travel 0.5 mile from the origin to the destination for his/her trip, the record would have been flagged for further review. Similarly, if a respondent reported traveling just 1 mile on transit to complete a 10-mile trip, the records would have been flagged to check for a missing transfer.

Records that passed all the QA/QC tests described above were forwarded to ETC Institute's SRRT for a final visual review of the trip using the Visual Survey Editor Program (VSEP), which is described in the Section 5.1.3. Any records that were flagged for further review were forwarded to the appropriate section based on the nature of the flag. Issues that involved address geocoding assignments were referred to ETC Institute's geocoding team. Any issues that needed clarification of data were directed to ETC Institute's Call Center (if a phone number was available). The Call Center then contacted the respondent to retrieve additional information as needed. All other issues were directed to ETC Institute's SRRT.

Records that were corrected were then forwarded to the SRRT for a final visual inspection using the VSEP. Any records that were complete but could still have problems with the trip logic or other attributes of the trip were reclassified as *problematic* by assigning a value of "2" as the record's Quality Control Flag. This assignment removed the record from further consideration for the final survey database.

5.1.3 Visual Inspection

The final step of the QA/QC data review process involved a visual inspection of the trip record using the VSEP. The key tasks that were conducted as part of this visual inspection included the sensibility of results for the following areas:

- Key variables of survey trips with very short distances (less than one mile for local bus trips and less than four miles for express trips)
- Trips with zero transfers given location of boarding and alighting locations relative to the origin and destination
- Trips that reported three or more transfers
- Drive access/egress trips given the distance traveled by car relative to the distance traveled by bus
- Drive access/egress trips with more than one transfer
- Looking at the origin-to-destination to ensure that it was appropriate for the survey route that was used for the trip

If a record passed all the visual checks listed above, the record was classified as *useable* and tagged for inclusion in the final survey database by assigning a value of “1” as the record’s Quality Control Flag. If a record did not pass all the visual checks, it was sent back to the SRRT for further review. If the SRRT was not able to resolve the problem that was identified, the record was reclassified as *problematic* by assigning a value of “2” as the record’s Quality Control Flag. This assignment removed the record from further consideration for the final survey database.

5.2 Summary of the Data Review QA/QC Process

Among the 27,844 surveys that were originally administered, 27,456 met the requirements for completeness. Of those that were classified as *complete*, 26,246 passed all the QA/QC tests and were subsequently classified as *useable* records. Only the *useable* records (those with a Quality Control Flag of “1”) were included in the final survey database that was expanded and used for the analysis in this report. The results of the QA/QC review are shown in Table 5-1.

Table 5-1. Data Review QA/QC Summary

| Classification | Quality Control Flag Value | Description | # of Surveys | % of All Surveys Administered |
|----------------|----------------------------|---|---------------|-------------------------------|
| Not complete | 3 | Missing one or more pieces of required data | 488 | 2% |
| Problematic | 2 | All required data was provided but there was a problem with the trip logic or other attribute of the trip | 1,110 | 4% |
| Useable | 1 | Record passed all QA/QC tests | 26,246 | 94% |
| Total | | | 27,844 | 100% |

Table 5-2 describes the breakdown of the *problematic* survey records. Of the five types of categories that make up the problematic records, approximately one-third involve transfer issues. This type of issue could include lack of consistency between what was identified as a transfer routes and the actual opportunities available to the rider. For example, a rider on Route A may have indicated that a transfer occurred to or from Route 41. Since, there were no transfer opportunities between Routes A and 41, the survey record would be classified as problematic.

Table 5-2. Problematic Survey Records Disqualified by QA/QC Test

| Problematic Category | Number of Disqualified Records |
|-----------------------------------|--------------------------------|
| Boarding and/or Alighting Address | 132 |
| Origin and/or Destination Address | 211 |
| Access-Related Logic | 165 |
| Egress-Related Logic | 209 |
| Transfer-Related | 393 |
| Total Problematic Record | 1,110 |

This section describes the process used to expand the data generated by the 2012 onboard survey. The total number of complete and useable surveys from the 2012 onboard survey represents a sample of daily bus ridership in Honolulu. Expanding the information generated by the survey so that it represents total daily ridership resulted in a comprehensive database that can be used to analyze ridership patterns. The database will also provide a basis for the follow-up onboard survey that will be carried out after implementation of the Project.

The Honolulu on-board transit survey was expanded by route, direction, time of day, and the boarding and corresponding alighting locations of the rider. In order to complete this complex expansion process, 100 Excel files (one per route) were prepared. Most of the Excel files contained 8 worksheets, so nearly 800 worksheets were prepared. Each worksheet was used to develop a set of unlinked expansion factors to translate the survey database to actual boardings using farebox and automatic passenger count (APC) data.

6.1 Ridership Data for Data Expansion

To validate the ridership levels on each route, as estimated through the data expansion process, two sets of ridership information were reviewed: (1) farebox data and (2) APC data. The validation was done by comparing farebox data for each route to APC data. The assumption was that if the total ridership from both sources were within 5 percent of each other, the ridership counts for the route could be accepted.

If there was a difference of more than 5 percent¹ between the farebox totals and the APC totals, additional APC runs were reviewed until a comparable set of data was obtained. APC data collected by OTS for April 2012 was within 5 percent of the fare box ridership data for all routes with the following exceptions: C, 41, 53, 411, 415, 432, 501, and 504. For these eight routes, APC data collected during the month of May 2012 was used instead of the April 2012 data. This was done since the May 2012 farebox data was within 5 percent of the APC data.

Since the sample size of the farebox was larger than the sample for the APC data, the farebox data was used as the source for the aggregate totals by direction and time of day on each route. Use of the farebox data also helped address lack of APC data on some routes. The distribution of the APC data was applied to the farebox totals to estimate the number of boardings and alightings at each stop along each route.

¹ Part of this difference may result from gaps that existed in the APC data.

6.2 Methodology for Calculating Expansion Factors

Although OTS collects daily boarding and alighting data by stop, data on the number of trips between stops and segments along routes was not available. A major goal of the onboard survey analysis was to obtain have expanded data that addressed ridership patterns between stops/segments, direction, and time of day for each routes. To attain this goal, over 3,000 unique unlinked expansion factors were developed for the survey. To view a list of all of the unique unlinked weighting factors by route, time of day, direction, boarding segment and alighting segment, refer to Appendix E. Most of the Excel worksheets that were prepared contained eight tables with each table documenting a different step in the data expansion process.

The following sections describe the methodology that was used to develop the unlinked expansion factors.

6.2.1 Boarding and Alighting Information from On-to-Off Survey

While the number of passengers that board and alight at each stop is important, determining where a passenger boards and then correspondingly where that same passenger alights provides a more robust picture of transit ridership patterns. In order to determine a sample of ridership between stops and segments along each route, the On-to-Off Survey was administered to approximately 20 percent of the passengers on each route. This sampling step was followed up by expanding the results from the On-to-Off survey so that total demand between bus stops and segments by time of day and direction could be determined.

Table 6-1 shows a portion of the results for the On-to-Off Survey that was administered on Route 1, Eastbound, during the AM peak. Each row in the table identifies the major stops/segments where passengers boarded the bus. The columns in the table identify the major stops or segments where people got off the bus. For illustration purposes, 7 of the 16 segments for this route (segments A through G) are shown. The segment locations along Route 1 are as follows:

- A—Kalihi Transit Center (includes 1 stop)
- B—from Kalihi Transit Center to the North King Street and 'Umi Street stop (includes 2 stops)
- C—from North King Street and Gulick Avenue to the North King Street and Mokauea Street stop (includes 2 stops)
- D—from North King Street and Kalihi Street to the North King Street and Waiakamilo Road stop (includes 3 stops)

- E—from North King Street and Kohou Street to the North King Street and Hikina Lane stop (includes 3 stops)
- F—from North King Street opposite of Palama Street to the North King Street and Dillingham Boulevard stop (includes 2 stops)
- G—Stops from North King Street and North Beretania Street to the North Hotel Street and Smith Street stop (includes 3 stops)

Table 6-1. Data Expansion Table Results of On-to-Off Survey (Eastbound AM Peak Period)

| Segment | Total Ons | Actual Ridership Counts (Alightings) from the On-to-Off Survey | | | | | | |
|---------|-----------|--|---|---|---|---|---|----|
| | | A | B | C | D | E | F | G |
| A | 18 | 0 | 6 | 1 | 0 | 2 | 1 | 0 |
| B | 20 | 0 | 1 | 0 | 1 | 1 | 1 | 2 |
| C | 69 | 0 | 0 | 0 | 1 | 6 | 4 | 19 |
| D | 39 | 0 | 0 | 0 | 0 | 0 | 4 | 8 |
| E | 41 | 0 | 0 | 0 | 0 | 0 | 2 | 5 |
| F | 27 | 0 | 0 | 0 | 0 | 0 | 1 | 2 |
| G | 48 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Table 6-2 shows the distribution of the data in Table 6-1 as a percentage of all boardings for Route 1. For example, 1 percent of all eastbound trips during the AM peak on Route 1 board at Major Stop/Segment A and end at Major Stop/Segment B.

Table 6-2. Distribution of On-to-Off Survey (Eastbound AM Peak Period)

| Segment | Total (%) | Distribution of Ridership Counts (Alightings) from the On-to-Off Survey (percent) | | | | | | |
|---------|-----------|---|-----|-----|-----|-----|-----|-----|
| | | A | B | C | D | E | F | G |
| A | 3.0 | 0.0 | 1.0 | 0.2 | 0.0 | 0.3 | 0.2 | 0.0 |
| B | 3.4 | 0.0 | 0.2 | 0.0 | 0.2 | 0.2 | 0.2 | 0.3 |
| C | 11.6 | 0.0 | 0.0 | 0.0 | 0.2 | 1.0 | 0.7 | 3.2 |
| D | 6.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.7 | 1.3 |
| E | 6.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.3 | 0.8 |
| F | 4.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 0.3 |
| G | 8.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

To develop an initial estimate of total ridership flow on each route based on the Stop/Segment On to the Stop/Segment Off, the total ridership for the route for this time period and direction was applied to the distribution shown in Table 6-2. Table 6-3 shows the initial estimate of total ridership from Stop/Segment On to Stop/Segment Off. Based on this estimate, 22 of the total

eastbound trips during the AM peak on Route 1 begin at Major Stop/Segment A and end at Major Stop/Segment B.

Table 6-3. Data Expansion Results—Initial Estimate of Total Ridership Flows between Segments (Eastbound AM Peak Period)

| Segment | Total | Projected Ridership (Alightings) Based on the On-to-Off Survey | | | | | | |
|---------|-------|--|----|---|---|----|----|----|
| | | A | B | C | D | E | F | G |
| A | 65 | 0 | 22 | 4 | 0 | 7 | 4 | 0 |
| B | 72 | 0 | 4 | 0 | 4 | 4 | 4 | 7 |
| C | 249 | 0 | 0 | 0 | 4 | 22 | 14 | 69 |
| D | 141 | 0 | 0 | 0 | 0 | 0 | 14 | 29 |
| E | 148 | 0 | 0 | 0 | 0 | 0 | 7 | 18 |
| F | 98 | 0 | 0 | 0 | 0 | 0 | 4 | 7 |
| G | 173 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

The distribution in Table 6-3 was compared to the actual boarding and alighting data collected for each major stop/segment by APCs. The top portion of Table 6-4 shows the APC boardings and alightings for each major stop/segment on the route. The bottom portion of the table shows the difference between the projected boardings and alightings at each major stop/segment (from Table 6-3) and actual APC counts. The process shown for selected segments of eastbound Route 1 ridership in the am peak period was repeated for all route segments by time of day and direction.

Table 6-4. Data Expansion- Comparison of Actual Boardings and Alightings by Segment (Eastbound AM Peak Period)

| | Total | Average Weekday Ridership (Alightings) Provided by OTS | | | | | | |
|--|-------|--|-----|-----|-----|-----|-----|-----|
| | | A | B | C | D | E | F | G |
| Actual boardings | 2147 | 137 | 53 | 245 | 156 | 131 | 177 | 192 |
| Actual alightings | 2147 | 0 | 6 | 20 | 36 | 31 | 55 | 193 |
| Difference of Actual from Projected | | | | | | | | |
| Boardings | 1 | 72 | -19 | -4 | 15 | -17 | 80 | 18 |
| Alightings | 1 | 0 | -19 | 17 | 29 | -2 | 8 | 62 |

6.2.2 Refinement of Data Expansion Results

In order to develop a more accurate estimate of the ridership flows between major stops/segments on each route, ETC Institute developed an Iterative Proportional Fitting Algorithm. This algorithm balanced the differences between the ridership projected from the On-to-Off Survey (shown in

Table 6-3) and the actual ridership observed by APCs at each stop (shown in Table 6-4).

The key steps to the iterative process are described below:

Step 1: Correction for the Boardings—The estimated ridership from the On-to-Off data for each route (such as the data shown in Table 6-3) was obtained by multiplying the ratio of the actual boardings from APCs for each stop by the estimated boardings for each stop. For example, if the actual boardings for Stop A were 120 and the estimated boardings were 100, each cell associated with Stop A would have been multiplied by 1.2 ($120 / 100$) to adjust the estimated boardings to actual boardings.

Step 2: Correction for the Alightings—Once the correction in Step 1 (described above) was applied, the estimated boardings would have equaled the actual boardings. However, the adjustment to the boardings total may have changed the alighting estimates. In order to correct the alighting estimate, the new values calculated in Step 1 were adjusted by multiplying the ratio of the actual alightings from APCs for each stop by the estimated alightings for each stop from Step 1. For example, if the actual alightings for Stop B were 220 and the estimated alightings from Step 1 were 200, each cell associated with Stop B would have been multiplied by 1.1 ($220 / 200$) to adjust the estimated alightings from Step 1 to actual alightings.

The processes described in Steps 1 and Steps 2 were repeated sequentially until the difference between the actual and estimated boardings and alightings was zero. Table 6-5 shows that after eight balancing iterations in this algorithm, there were no differences between the projected distribution and the actual boardings and alightings.

Table 6-5. Iterative Balance Process

| Segment | Total | Difference from Actual Boardings | 8th Step of Iterative Balancing to Correct Distribution of Ridership | | | | | | |
|---------|-------|----------------------------------|--|---|----|----|----|----|-----|
| | | | A | B | C | D | E | F | G |
| A | 137 | 0 | 0 | 6 | 20 | 0 | 17 | 13 | 0 |
| B | 53 | 0 | 0 | 0 | 0 | 16 | 2 | 2 | 8 |
| C | 245 | 0 | 0 | 0 | 0 | 20 | 12 | 12 | 91 |
| D | 157 | 0 | 0 | 0 | 0 | 0 | 0 | 15 | 47 |
| E | 131 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 25 |
| F | 177 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 22 |
| G | 192 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total | 2,147 | 0 | 0 | 6 | 20 | 36 | 31 | 55 | 193 |

Step 3: Final Estimate of Ridership between Segments—The final estimate of ridership flows between segments as shown in Table 6-6. To calculate the expansion factors, the final estimate of ridership between major stops/segments shown in Table 6-6 was divided by the actual number of surveys that were completed for trips between major stops/segments shown in Table 6-7. When factors were high or survey data did not exist for a given cell, stops/segments were combined with adjacent stops/segments.

Table 6-6. Final Estimate of Ridership Flows between Segments

| Segment | Total | Difference from Actual Boardings | 1st Step of Iterative Balancing to Correct Distribution of Ridership by Alighting Location | | | | | | |
|-----------------------------------|-------|----------------------------------|--|---|----|----|----|----|-----|
| | | | A | B | C | D | E | F | G |
| A | 137 | 0 | 0 | 6 | 20 | 0 | 17 | 13 | 0 |
| B | 53 | 0 | 0 | 0 | 0 | 16 | 2 | 2 | 8 |
| C | 245 | 0 | 0 | 0 | 0 | 20 | 12 | 12 | 91 |
| D | 156 | 0 | 0 | 0 | 0 | 0 | 0 | 15 | 47 |
| E | 131 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 25 |
| F | 177 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 22 |
| G | 192 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total | 2,147 | 0 | 0 | 6 | 20 | 36 | 31 | 55 | 193 |
| Difference from Actual Alightings | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Table 6-7. Number of Completed Surveys

| Segment | Total | A | B | C | D | E | F | G |
|---------|-------|---|---|---|---|---|---|---|
| A | 39 | 0 | 0 | 0 | 0 | 1 | 1 | 4 |
| B | 15 | 0 | 0 | 0 | 1 | 0 | 1 | 1 |
| C | 35 | 0 | 0 | 0 | 1 | 1 | 1 | 2 |
| D | 14 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| E | 13 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| F | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| G | 18 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |

The next step after creating the weighting factors was to give each record in the Main Survey database a weight factor name based on route, direction, time period, boarding segment, and alighting segment. For example, the weight factor name of “1_E_A_B_H” indicates that the record is from ROUTE 1 (1), going EASTBOUND (E), during the AM PEAK (A), the rider boarded at Major Stop/Segment B (B), the rider alighted at Major Stop/Segment H (H).

Step 4: Validating the Expansion—After all the expansion factors were added into the Main Survey database, the weighting factors were summed by route, direction, and time period. Appendix F contains the tables which include results of the data expansion effort for a representative bus route: Route 1.

The system-wide daily ridership that was projected by the survey database after the weighting factors were applied was 223,871 riders per day, which was just 14 short of the actual daily ridership of 223,885. This means that the difference between the expanded daily ridership from the survey and the actual daily ridership is just 0.006 percent. The tables show the actual ridership for an average weekday in April 2012 using fare box data as well as the difference in the expanded projections actual ridership.

Among the 780 ridership figures reported, the difference between the expanded ridership projection and actual ridership was within +/-1 percent at the 95% level of confidence of the actual value; this would occur 779 out of the 780 times. The difference was just 3 in 1 of the 780 cells in the matrix.

In addition, when the expanded daily ridership was compared to the actual daily ridership on each route by direction and time of day (for four time periods), the expanded ridership was within +/- 1 of the actual daily ridership for 779 of the 780 ridership values that were reviewed. The only exception involved the projected ridership for Route 57 in the eastbound direction during the evening. In this case, the expanded ridership for Route 57a was 3 short of the actual ridership for the evening time period.

Step 5: Assessing Expansion Factor Values—The average value of all unlinked expansion factors in the database is 8.53. Of the 26,246 records in the database, 19,153 (73 percent of the sample) have an expansion factor of 10 or less and 24,538 (93.5 percent of the sample) have a value less than 20. Only 107 records in the database have an expansion factor greater than 30. The highest value is 35.17.

The vast majority of the weight factors with values above 20 were for trips completed during “Other Hours” (before 6 am and after 6 pm). Surveys were typically only conducted until 8 pm in the evening, which is the reason the expansion factors for the “Other Hour” period are slightly higher.

7 *High Level Findings from the Survey*

This section highlights selected demographic and travel pattern information from the 2012 survey. The results for all questions on the survey based on the type of service (local and express) are provided in Appendix A. Three major categories are presented regarding the survey findings: (1) demographic characteristics, (2) travel characteristics, and (3) rider characteristics by bus route location. Information is also provided for responses within the Project corridor, connecting to the corridor and outside the corridor.

7.1 Demographic Characteristics

7.1.1 Vehicle Availability

Of all transit passengers, 37 percent indicated that they do not have a working vehicle available to their household. Express route passengers were significantly more likely to have at least one working vehicle available to their household than local route passengers (86 percent express vs. 61 percent local) (Table 7-1).

Table 7-1. Number of Working Vehicles in Household (by percentage of transit riders surveyed)

| Working Vehicles | Peak Period Express | Local/Limited Stop Express | Overall |
|-------------------------|----------------------------|-----------------------------------|----------------|
| None | 14% | 39% | 37% |
| One | 31% | 31% | 31% |
| Two | 33% | 18% | 20% |
| Three | 13% | 7% | 8% |
| Four or more | 8% | 5% | 5% |

7.1.2 Adults in the Household

Of all transit passengers, 24 percent indicated that they live in a household that has just one adult. Local route passengers were more likely to live in a household with just one adult than were express route passengers (17 percent express vs. 25 percent local) (Table 7-2).

Table 7-2. Number of Adults in Household (by percentage of transit riders surveyed)

| Adults in Household | Peak Period Express | Local/Limited Stop Express | Overall |
|---------------------|---------------------|----------------------------|---------|
| One | 17% | 25% | 24% |
| Two | 36% | 33% | 33% |
| Three | 20% | 19% | 19% |
| Four | 15% | 12% | 12% |
| Five | 6% | 5% | 5% |
| Six | 3% | 3% | 3% |
| Seven | 1% | 1% | 1% |
| Eight | 1% | 1% | 1% |
| Nine | 0 | 0 | 0 |
| Ten or more | 1% | 1% | 1% |

7.1.3 Student Status

Of all transit passengers, 27 percent indicated that they were students. Local route passengers were more likely to be enrolled in a college or university than express route passengers (9 percent express versus 19 percent local) (Table 7-3).

Table 7-3. Student Status

| Student Status | Peak Period Express | Local/Limited Stop Express | Overall |
|------------------------------|---------------------|----------------------------|---------|
| Not a student | 86% | 72% | 73% |
| Full-time college/university | 7% | 16% | 15% |
| Student through 12th grade | 5% | 8% | 7% |
| Part-time college/university | 2% | 3% | 3% |
| Other | 1% | 2% | 2% |

7.1.4 *Employed Status of Transit Rider*

Two-thirds of all transit passengers (67 percent) reported that they are employed on at least a part-time basis, 6 percent indicated they were not currently employed but seeking work, 16 percent were not employed and not seeking work, 9 percent were retired, and 1 percent indicated they were a homemaker (*does not equal 100 percent due to rounding*).

Express route passengers were significantly more likely to be employed full-time as compared to local route riders (81 percent express vs. 42 percent local). In addition, express bus routes provide travel times that are more competitive with private auto travel and, therefore, attract a greater share of *choice* riders that are likely to be employed full-time (Table 7-4).

Table 7-4. Employment Status of Respondent

| Employment Status | Peak Period Express | Local/Limited Stop Express | Overall |
|--|---------------------|----------------------------|---------|
| Employed full-time (at least 35 hours per week) | 81% | 42% | 46% |
| Employed part-time (less than 35 hours per week) | 8% | 22% | 21% |
| Not currently employed but seeking work | 4% | 7% | 6% |
| Not currently employed and not seeking work | 5% | 18% | 16% |
| Retired | 2% | 10% | 9% |

7.1.5 *Driver's License*

More than half (53 percent) of all transit passengers indicated that they have a valid driver's license. Express route passengers were significantly more likely to have a driver's license than local route passengers (70 percent express vs. 51 percent local) as shown in Table 7-5.

Table 7-5. Valid Driver's License

| Driver's License | Peak Period Express | Local/Limited Stop Express | Overall |
|------------------|---------------------|----------------------------|---------|
| Yes | 70% | 51% | 53% |
| No | 30% | 49% | 47% |

7.1.6 Age

A majority (54 percent) of all transit riders indicated that they were between the ages of 18 and 44, 8 percent were under age 18 and 38 percent were age 45 or older. Express route passengers were more likely to be over age 44 than local route passengers (55 percent express vs. 36 percent local). Part of this disparity could be due to the fact that students, who tend to be under 45, usually do not work full-time and are less likely to use express routes (Table 7-6). Express services are focused on a 9-to-5 weekday work schedule with jobs located in the Primary Urban Center of O'ahu.

Table 7-6. Age of Transit Riders

| Age | Peak Period Express | Local/Limited Stop Express | Overall |
|------------|----------------------------|-----------------------------------|----------------|
| Under 18 | 5% | 8% | 8% |
| 18-24 | 9% | 24% | 23% |
| 25-34 | 13% | 18% | 18% |
| 35-44 | 18% | 14% | 14% |
| 45-54 | 25% | 15% | 16% |
| 55-64 | 24% | 11% | 12% |
| 65+ | 7% | 10% | 10% |

7.1.7 Income

Of all transit passengers, 22 percent reported annual household incomes below \$15,000. Only 5 percent reported an annual household income of \$115,000 or more. Express passengers were more likely to report annual household incomes above \$60,000 than local route passengers (41 percent express versus 24 percent local) as shown in Table 7-7.

Table 7-7. Total Annual Household Income

| Annual Household Income | Peak Period Express | Local/Limited Stop Express | Overall |
|--------------------------------|----------------------------|-----------------------------------|----------------|
| Below \$12,000 | 7% | 16% | 15% |
| \$12,000–\$14,999 | 3% | 7% | 7% |
| \$15,000–\$29,999 | 11% | 15% | 14% |
| \$30,000–\$39,999 | 14% | 13% | 13% |
| \$40,000–\$49,999 | 11% | 11% | 11% |
| \$50,000–\$59,999 | 10% | 10% | 10% |
| \$60,000–\$74,999 | 11% | 8% | 9% |
| \$75,000–\$89,999 | 10% | 7% | 7% |
| \$90,000–\$114,999 | 12% | 5% | 6% |
| \$115,000+ | 8% | 4% | 5% |
| Did not know | 1% | 2% | 2% |
| Not asked because | 3% | 3% | 3% |

7.1.8 Gender

Of all transit passengers, 47 percent were male and 53 percent were female. Express route passengers were more likely to be female as shown in Table 7-8.

Table 7-8. Gender of Transit Riders

| Gender | Peak Period Express | Local/Limited Stop Express | Overall |
|---------------|----------------------------|-----------------------------------|----------------|
| Male | 37% | 48% | 47% |
| Female | 63% | 52% | 53% |

7.1.9 Race/Ethnicity

Of all transit riders, 24 percent identified themselves as Pacific Islander or Native Hawaiian, 23 percent identified themselves as White, and 45 percent identified themselves as Asian (Japanese, Filipino, Chinese, Korean, or other Asian). There was no significant difference for Race/Ethnicity when compared between express and local route passengers as shown in Table 7-9.

Table 7-9. Race/Ethnicity (by percentage of transit riders surveyed)

| Race/Ethnicity | Peak Period Express | Local/Limited Stop Express | Overall |
|-------------------------------------|---------------------|----------------------------|---------|
| Asian Japanese | 9% | 11% | 11% |
| Asian Filipino | 20% | 20% | 20% |
| Asian Chinese | 3% | 5% | 5% |
| Asian Korean | 1% | 2% | 2% |
| Asian Other | 27% | 5% | 7% |
| Pacific Islander or Native Hawaiian | 19% | 25% | 24% |
| Black or African American | 2% | 4% | 3% |
| American Indian or Alaska Native | 1% | 1% | 1% |
| Hispanic or Latino | 3% | 4% | 4% |
| White | 16% | 24% | 23% |

7.1.10 Necessity of Transit Service

More than one-fourth (27 percent) of all transit passengers reported that they would not have been able to make their trip if public transit were not available. Two-thirds of express route passengers reported that they would either be able to drive themselves or drive with someone else (67 percent) if transit service was not available compared to 44 percent of local route passengers. Express route passengers were three times as likely as local route passengers to report that they would have driven themselves if public transit had not been available (42 percent express vs. 14 percent local) (Table 7-10).

Table 7-10. Without Transit Service (by percentage of transit riders surveyed)

| Options if No Available Transit | Peak Period Express | Local/Limited Stop Express | Overall |
|---------------------------------|---------------------|----------------------------|---------|
| I could not make this trip | 26% | 27% | 27% |
| Taxi | 1% | 7% | 6% |
| Drive myself | 42% | 14% | 17% |
| Drive with someone else | 25% | 30% | 29% |
| Walk/bike | 5% | 21% | 20% |
| Other | 1% | 1% | 1% |

7.2 Travel Characteristics

7.2.1 Trip Purpose

Home-based work accounted for over one-third (38 percent) of all trips completed on public transit. Of all trips, 14 percent were home-based shopping trips and 9 percent were home based-college trips. Express route passengers were significantly more likely to complete home-based work trips than local route passengers (82 percent express vs. 33 percent local). Local route passengers were significantly more likely to use public transit to complete home-based shopping trips (2 percent express vs. 16 percent local) (Table 7-11).

Table 7-11. Trip Purpose

| Trip Purpose | Peak Period Express | Local/Limited Stop Express | Overall |
|-----------------------------|---------------------|----------------------------|---------|
| Home-based other (HBO) | 4% | 22% | 20% |
| Home-based work (HBW) | 82% | 33% | 38% |
| Home-based shopping (HBSH) | 2% | 16% | 14% |
| Home-based school (HBSC) | 4% | 5% | 5% |
| Non-home-based other (NHBO) | 0% | 8% | 8% |
| Home-based college (HBC) | 5% | 10% | 9% |
| Non-home-based work (NHBW) | 2% | 5% | 5% |
| Home-based airport (HBA) | 0% | 1% | 1% |

7.2.2 Trip Origins

Figure 7-1 shows the distribution of survey responses relating to trip origins. At approximately 98,900 daily trips, the dominant origin is Home followed by Workplace with approximately 46,200 trips. There is an estimated number of nearly 21,000 boardings per day that begin at a College/University or School.

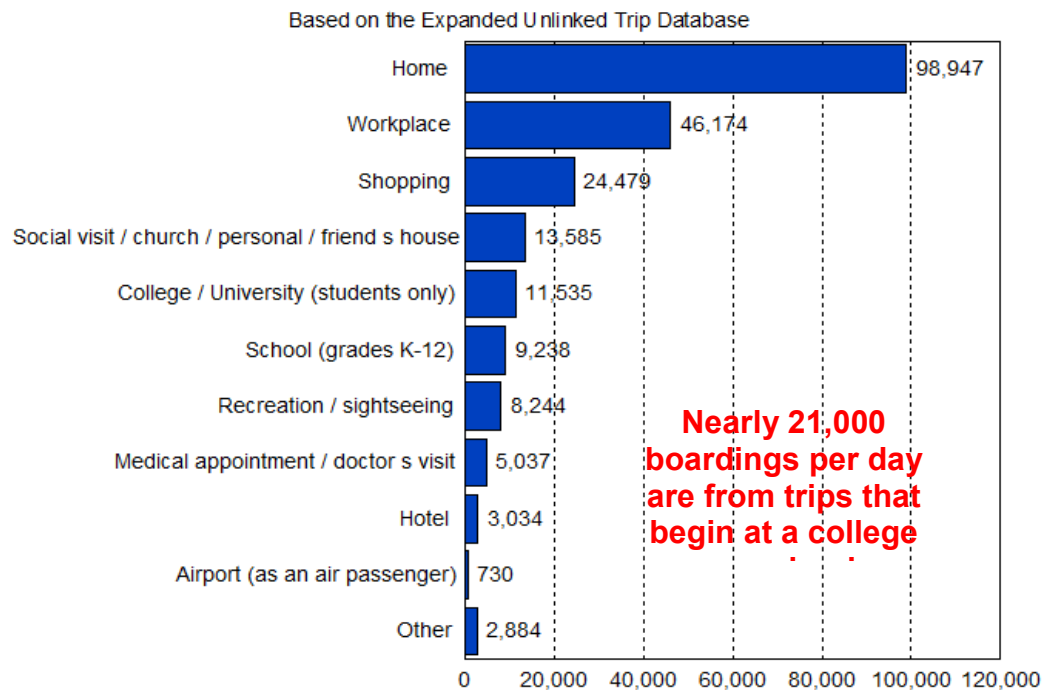


Figure 7-1. Types of Places Riders are Coming From

7.2.3 Types of Destinations Visited by Transit Users

Of all transit trips, 37 percent ended at the respondent's home. Nearly one in four trips (24 percent) ended at the respondent's workplace and 11 percent ended at a shopping location. Express route passengers were more than twice as likely as local route passengers to end their trip at their workplace (46 percent express vs. 21 percent local). Local route passengers were significantly more likely than express route passengers to end their trips at either a shopping location or at a social visit location (3 percent express vs. 22 percent local) (Table 7-12).

Table 7-12. Types of Destinations Visited by Transit Users

| Major Destinations | Peak Period Express | Local/Limited Stop Express | Overall |
|---|---------------------|----------------------------|---------|
| Respondent's workplace | 46% | 21% | 24% |
| Shopping | 2% | 12% | 11% |
| School (grades K-12) | 3% | 3% | 3% |
| Hotel | 0% | 2% | 1% |
| Airport (as an air passenger) | 0% | 0% | 0% |
| Recreation/sightseeing | 1% | 5% | 5% |
| Medical appointment/doctor's visit | 1% | 3% | 3% |
| Social visit/church/personal/friend's house | 1% | 10% | 9% |
| College/university (students only) | 3% | 7% | 6% |
| Respondent's home | 1% | 1% | 1% |
| Other | 1% | 1% | 1% |

7.2.4 Ridership Characteristics at Ala Moana Center

Of all transit passengers, 7 percent indicated that they boarded a bus at Ala Moana Center during their one-way trip. Local route passengers were more likely to report boarding a bus at Ala Moana Center during their one-way trip than were express route passengers (2 percent express vs. 8 percent local).

Of the passengers who indicated they boarded a bus at Ala Moana Center during their one-way trip, 55 percent indicated the main reason they were at Ala Moana Center was to board a bus or transfer to another bus. The remaining share of bus riders (45 percent) indicated that were involved with some other activity at AMC with 35 percent indicating that the main reason they were at AMC was to work/shop/dine/do something other than just board a bus or transfer to another bus. Another 10 percent indicated that the main reason they were at Ala Moana Center was to board a bus or transfer to another bus but they also did other things. These activities were convenient to do before they boarded a bus; for example, shopping, eating, or using the ATM.

7.2.5 How Passengers Access Public Transit

A large majority of transit passengers (96 percent) indicated that they accessed public transit by walking. Compared to local route riders, Express route passengers were more likely to report accessing public transit by first riding in a vehicle, whether it was driving themselves, being dropped off, or riding with others and parking (9 percent express vs. 2 percent local) (Table 7-13).

Table 7-13. Mode to Access Public Transit

| Access Mode | Peak Period Express | Local/Limited Stop Express | Overall |
|---|---------------------|----------------------------|---------|
| Walk | 90% | 97% | 96% |
| Bike | 1% | 1% | 1% |
| Was dropped off by someone going someplace else | 5% | 2% | 2% |
| Drove alone and parked | 3% | 0% | 1% |
| Drove or rode with others and parked | 1% | 0% | 0% |
| Wheelchair/scooter | 0% | 0% | 0% |
| Other | 0% | 0% | 0% |

7.2.6 How Passengers Traveled from Transit to Their Final Destination

A large majority of transit passengers (98 percent) indicated that they walk to their final destination after using public transit. As compared to those using Local routes, Express route passengers were more likely to report reaching their final destination by being picked up by someone, getting in a parked vehicle and driving alone, or getting in a parked vehicle and traveling with others to their final destination (5 percent express vs. 1 percent local) (Table 7-14).

Table 7-14. Egress Mode to Destination

| Access Mode | Peak Period Express | Local/Limited Stop Express | Overall |
|--|---------------------|----------------------------|---------|
| Walk | 94% | 98% | 98% |
| Bike | 1% | 1% | 1% |
| Be picked up by someone | 2% | 1% | 1% |
| Get in a parked vehicle and drive alone | 2% | 0% | 0% |
| Get in a parked vehicle and drive/ride with others | 1% | 0% | 0% |
| Wheelchair/scooter | 0% | 0% | 0% |
| Other | 0% | 0% | 0% |

7.2.7 Transfers

Of all transit passengers, 28 percent made at least one transfer during their trip and 3 percent made two or more transfers. There was almost no difference between express route passengers and local route passengers with respect to transfer totals (Table 7-15).

Table 7-15. Total Number of Transfers

| Transfers | Peak Period Express | Local/Limited Stop Express | Overall |
|-----------|---------------------|----------------------------|---------|
| None | 69% | 69% | 69% |
| One | 28% | 28% | 28% |
| Two | 3% | 3% | 3% |
| Three | 1% | 0% | 0% |

7.2.8 Where Transit Users Live

Figure 7-2 shows a visual representation of locations in Honolulu (zip codes) where surveyed transit users live; information is from the Main Survey. This is displayed with varying shades of green as indicated in the top right corner of the figure. Each shade of green represents the number of transit riders who indicated they lived in the corresponding zip code. The red circled numbers on the figures are indications of major roads in O'ahu.

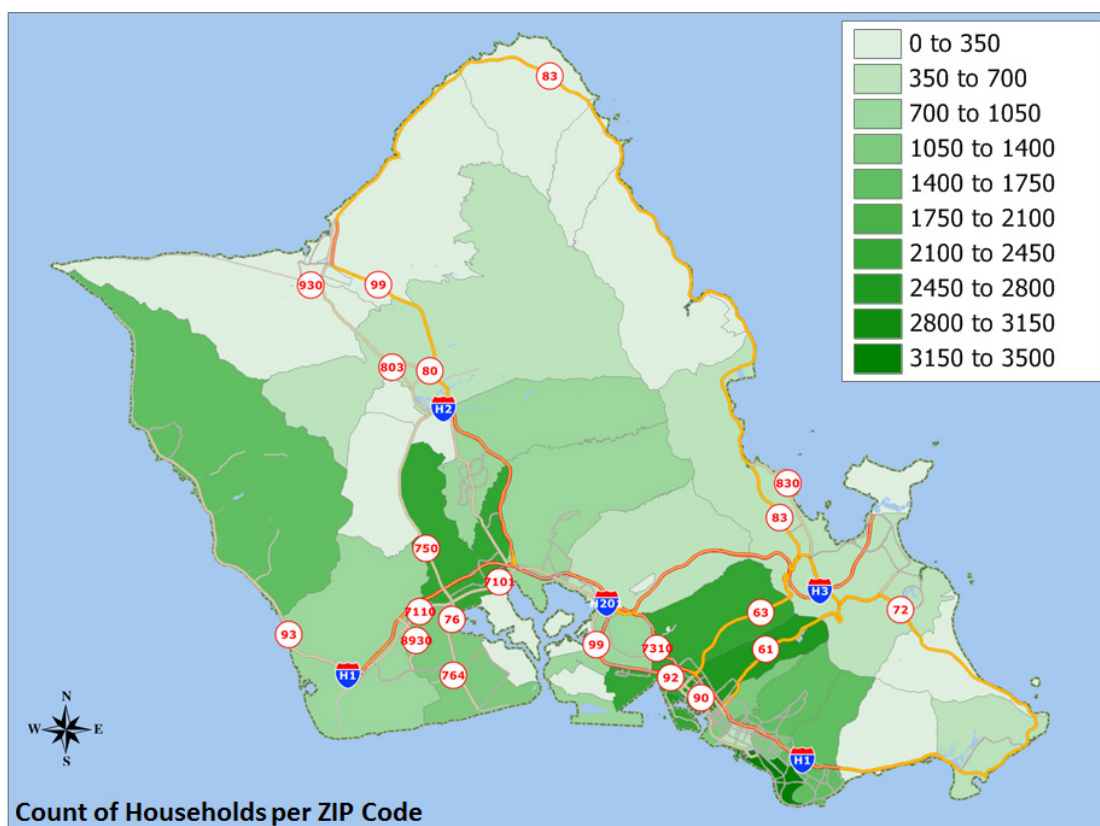


Figure 7-2. Geocoded Map of Where Transit Users Live

7.2.9 Where Transit Trips Began

Figure 7-3 shows the visual representation of areas in Honolulu where transit trips began; information is from the Main Survey. This is displayed with varying shades of brown as indicated in the top right corner of the figure. Each shade of brown represents the number of transit riders who indicated their trips began in the corresponding zip code. The red circled numbers on the figures are indications of major roads in O'ahu.

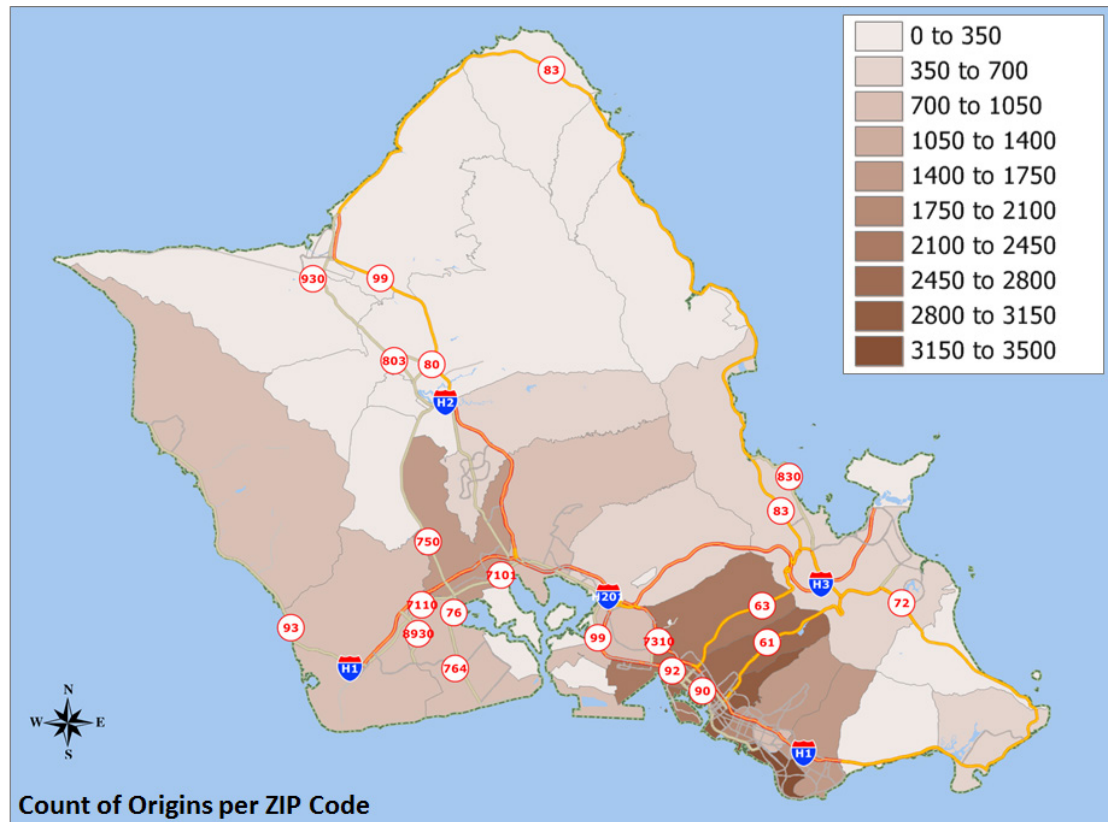


Figure 7-3. Geocoded Map Where Most Transit Trips Originated

7.2.10 Where Transit Trips Ended

Figure 7-4 shows the visual representation of the zip codes where transit trips ended. This is displayed with varying shades of blue as indicated in the top right corner of the figure. Each shade of blue represents the number of transit riders who indicated their trips ended in the corresponding zip code. The red circled numbers on the figures are indications of major roads in O'ahu.

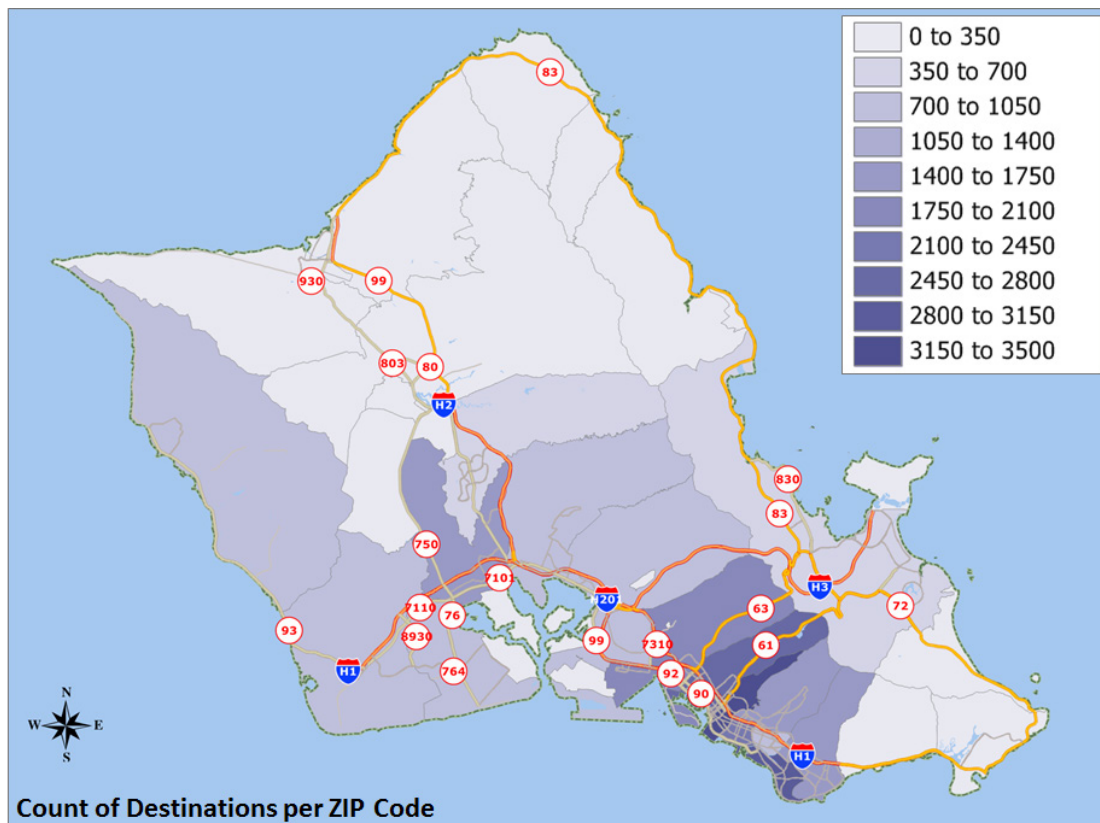


Figure 7-4. Geocoded Map of Where Most Transit Trips Ended

7.3 Visual Presentation of On-to-Off Survey Results

The on-to-off survey results provide an opportunity to see how boardings and alightings are connected. In other words, to see not just how many people board and alight at various stops, but to also determine where passengers board and then correspondingly where those same passengers alight.

This data is available for review for each route by looking under the On-to-Off portion of the tables in Appendix H; provided separately on CDs. In addition to data included in tables, visual representations of on-to-off ridership patterns can provide the reader with an effective presentation of results. Figure 7-5 below shows an example of a visual presentation of on-to-off data that was collected for Route 17 which provides Local service between Ala Moana Center and Makiki. The thicker the line in the figure below the more volume of bus ridership there is between various stops.

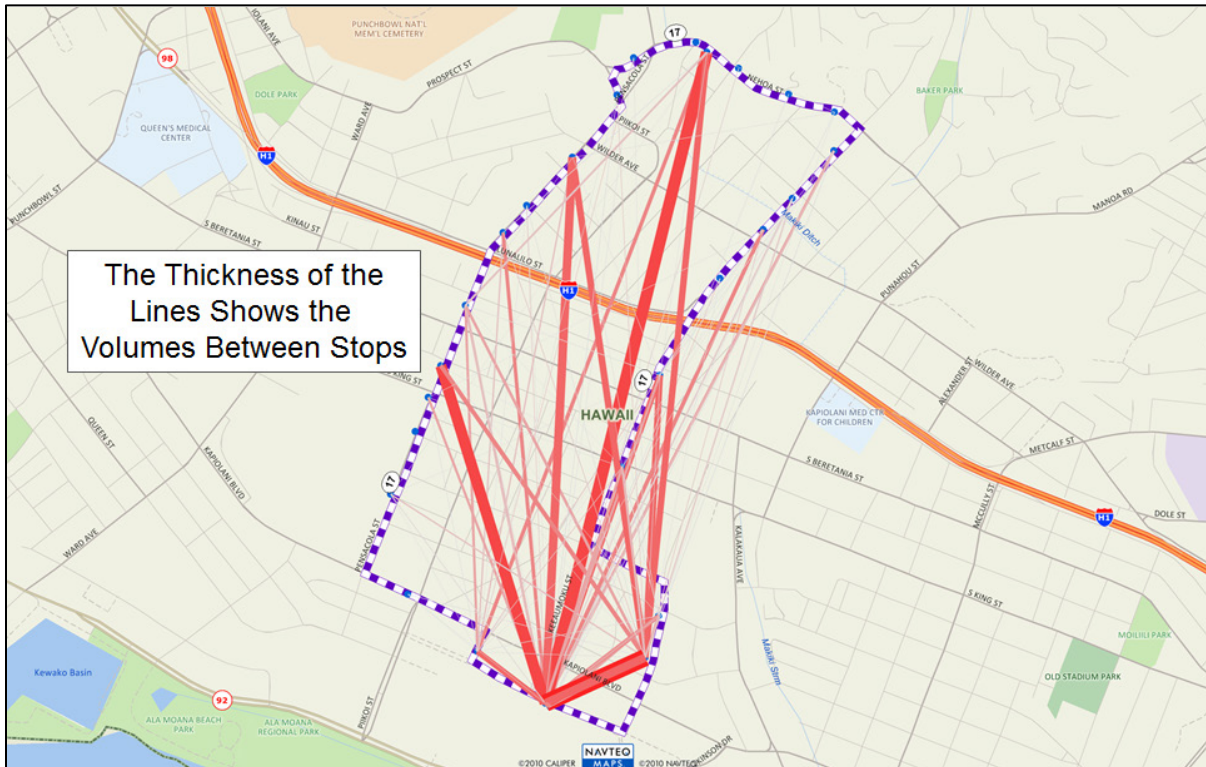


Figure 7-5. Visual Representation of On-to-Off Data for Route 17

Another visual representation from the On-to-Off data from Route 1 is provided in Figure 7-6. The thickness of the lines in Figure 7-6 corresponds to the number of passengers traveling between stops. The total boardings at each stop is represented by the size of the dots.

The visual information items presented in Figure 7-5 and Figure 7-6 are examples of how survey results can be graphically portrayed. For other potential data analyses, including those that can be presented in a visual manner, ETC has developed a tool to allow users to access results. Section 7.5 provides further information relating to this tool.

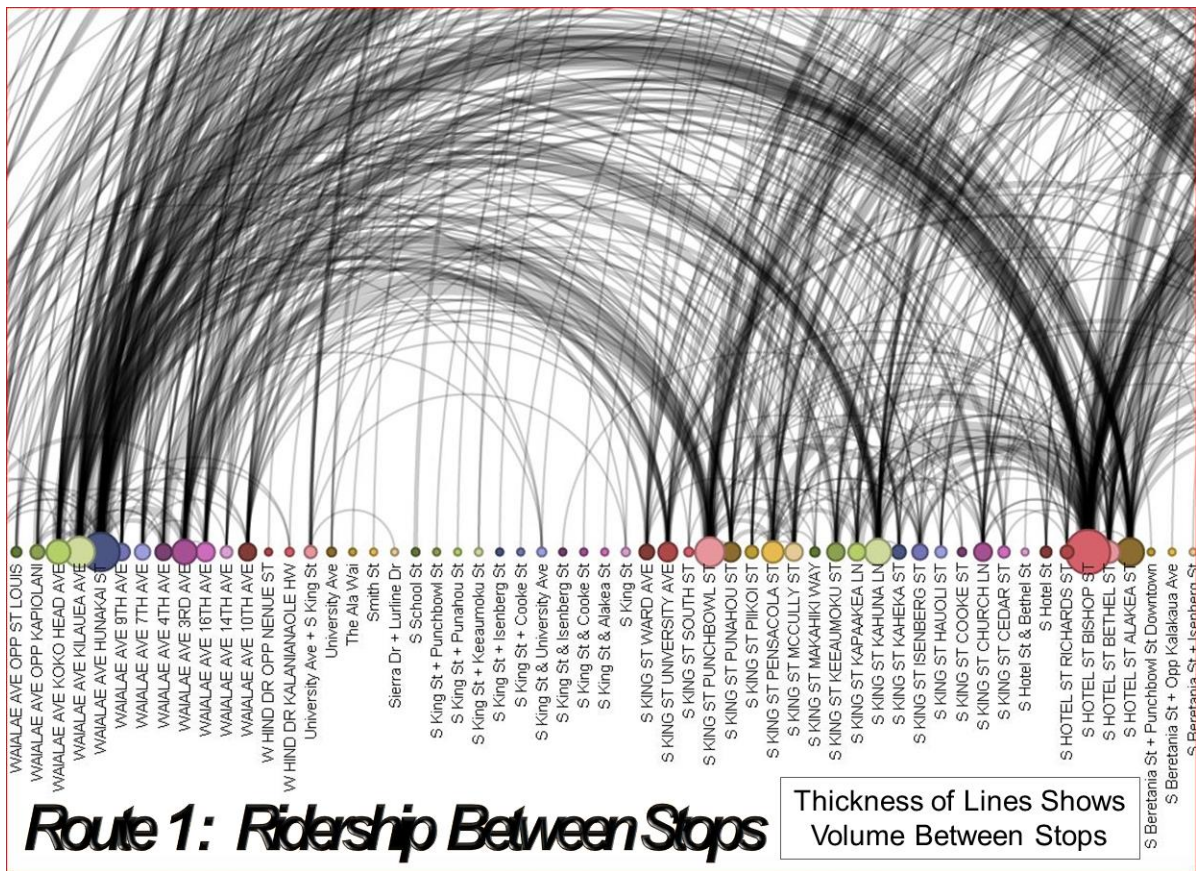


Figure 7-6. Visual Representation of On-to-Off Data for a Portion of Route 1

7.4 Passenger Characteristics—Relation to Project Corridor

The analysis of survey results includes transit rider characteristics with respect to location along the Project corridor. These characteristics were identified for passengers on bus routes operating within the Project corridor, connected to the corridor, or not operating in the corridor. Table 7-16 describes the bus routes that are associated with these major categories.

Table 7-16. Location of Bus Routes: Project Corridor

| ROUTE | | | ROUTE | | |
|--------|---------------------------------|-------------------------|--------|--|-------------------------|
| Number | Description | WITHIN PROJECT CORRIDOR | Number | Description | WITHIN PROJECT CORRIDOR |
| A | CityExpress! Waipahu-UH Manoa | y | PH2 | Pearl Harbor Express-Mililani | c |
| C | CountryExpress! Makaha-Downtown | y | PH3 | Pearl Harbor Express-Wahiawa Heights | c |
| E | CountryExpress! Ewa-Waikiki | y | PH4 | Pearl Harbor Express-Kaneohe-Kahaluu | n |
| 1 | Kaimuki-Kalihi | y | PH5 | Pearl Harbor Express-Windward | n |
| 1L | Hawaii Kai-Downtown | y | PH6 | Pearl Harbor Express-Hawaii Kai | n |
| 2/2L | Waikiki-School-Middle | y | 80 | Hawaii Kai Park & Ride Express | n |
| 3 | Kaimuki-Salt Lake | y | 80A | Hawaii Kai Park & Ride Express-UH | n |
| 4 | Nuuanu-Punahou | y | 80B | Upper Aina Haina Express | n |
| 5 | Ala Moana-Manoa | y | 81 | Waipahu Express | y |
| 6 | Pauoa-Woodlawn | y | 82 | Hawaii Kai Park & Ride Express | n |
| 7 | Kalihi Valley | y | 83 | Wahiawa Town Express | c |
| 8 | Waikiki-Ala Moana | y | 84 | Mililani Express-North | c |
| 9 | Kaimuki-Pearl Harbor | y | 84A | Mililani Express-South | c |
| 9S | Palolo Valley | n | 85 | Windward Express-Kailua | n |
| 10 | Kalihi-Alewa Heights | y | 85A | Windward Express-Haiku | n |
| 11 | Makalapa-Halawa-Aiea Heights | y | 88 | Kahaluu-Ahuimanu Express | n |
| 13 | Waikiki-Liliha | y | 88A | North Shore Express | c |
| 14 | St. Louis-Kahala-Maunalani | n | 89 | Waimanalo-Kailua Express | n |
| 15 | Makiki-Pacific Heights | y | 90 | Pearl City Express | y |
| 16 | Moanalua Valley | y | 91 | Ewa Beach Express | y |
| 17 | Makiki-Ala Moana | y | 92 | Makakilo City Express | y |
| 18 | University-Ala Moana | y | 93 | Waianae Coast Express-CBD | y |
| 19 | Waikiki-Airport-Hickam | y | 94 | Kapolei-Downtown | y |
| 20 | Waikiki-Pearlridge | y | 96 | Waipio Gentry Express | y |
| 22 | Beach Bus | n | 97 | Village Park Express | y |
| 23 | Hawaii Kai-Sea Life Park | n | 98 | Wahiawa-Mililani Park & Ride | c |
| 24 | Aina Haina-Kahala Mall | n | 98A | Kunia Village-Mililani-Waikiki | c |
| 31 | Tripler-Mapunapuna | y | 101 | Ewa Gentry Express | y |
| 32 | Kalihi-Pearlridge | y | 102 | Villages of Kapolei Express | y |
| 40 | Honolulu-Makaha | y | 103 | Paiwa-Waikele Express | y |
| 41 | Kapolei-Ewa Beach | y | W1 | Waipahu via Farrington Express (201) | y |
| 42 | Ewa Beach-Waikiki | y | W2 | Waipahu via Paiwa Express (202) | y |
| 43 | Waipahu-Honolulu-Ala Moana | y | W3 | Kalihi via School Street Express (203) | y |
| 44 | Ewa Beach - Waipahu | y | 234 | Kahala Mall-Waiaiae Nui | n |
| 52 | Wahiawa-Circle Island | c | 235 | Kahala Mall-Waialae Iki | n |
| 53 | Honolulu-Pacific Palisades | y | 401 | Waianae Valley | n |
| 54 | Honolulu-Pearl City | y | 402 | Lualualei Homestead | n |
| 55 | Kaneohe-Circle Island | c | 403 | Nanakuli-Mailii-Waianae | n |
| 56 | Honolulu-Kailua-Kaneohe | c | 411 | Makakilo Heights | y |
| 57/57A | Kailua-Waimanalo-Sea Life Park | c | 412 | Panana-Kapolei | y |
| 62 | Honolulu-Wahiawa Heights | y | 413 | Campbell Industrial Park | y |
| 65 | Honolulu-Kahaluu | c | 414 | Palahia-Makakilo-Kapolei | y |
| 70 | Lanikai-Maunawili | n | 415 | Kapolei Transit Center-Kalaeloa | y |
| 71 | Pearlridge-Newtown | y | 432 | East-West Waipahu | y |
| 72 | Schofield-Wahiawa-Whitmore | n | 433 | Waikele/Waipio | y |
| 73 | Leeward Community College | y | 434 | Village Park | y |
| 74 | Aiea-Halawa Heights | y | 501 | Mililani Mauka-Mililani Transit Center | n |
| 76 | Waialua-Haleiwa | n | 503 | Mililani-Launani Valley | n |
| 77 | Waimanalo-Kaneohe | n | 504 | Mililani South-Mililani Transit Center | n |
| PH1 | Pearl Harbor Express-Makaha | y | | | |

Notes: Y = operates in project corridor; C = connects to corridor; N = does not connect to corridor

Discontinued routes: B, 231

Renamed routes: 201 = W1, 202 = W2, 203 = W3

Cross tabular data from the onboard survey was processed for bus routes by their location in relation to the Project corridor (Appendix B has complete results). These three classifications were bus routes located inside the Project corridor, routes connecting to the corridor, and routes outside the corridor. Of the 26,246 surveys that were collected, 22,192 surveys were on routes inside the Project corridor, 2,302 were on routes connecting to the corridor, and 1,752 were on routes outside the corridor. Below are some of the findings from that cross tabular data.

- Surveys conducted on routes outside the Project corridor were more likely to involve visitors to Hawai'i than were surveys conducted on routes inside or connecting to the corridor (12 percent outside corridor, 6 percent connecting to corridor, and 5 percent inside corridor).
- Surveys conducted on routes connecting to the corridor were more likely to involve boarding a bus at Ala Moana Center than were surveys conducted on routes either inside or outside of the corridor (8 percent outside corridor, 15 percent connecting to corridor, and 6 percent inside corridor).
- Of the 15 percent of those surveyed who were riding a route that connects to the project corridor that boarded a bus at Ala Moana Center at some point during the passenger's one-way trip, 71 percent reported the main reason they were at Ala Moana Center was to board a bus or transfer to another bus.
- If transit service was not available, 21 percent of those surveyed on routes inside the corridor indicated they could walk or bike to make their trip, compared to 18 percent of those on routes outside the corridor and 8 percent of those on routes connecting to the corridor.
- Those surveyed on routes outside the project corridor or routes connecting to the corridor were more likely to have a valid driver's license than those riding routes inside the corridor (61 percent outside corridor, 60 percent connecting to corridor, and 52 percent inside corridor).
- Of those surveyed on routes inside the corridor, 35 percent indicated that they spoke a language other than English at home compared to 26 percent of those surveyed on routes connecting to the corridor and 25 percent of those surveyed on routes outside the corridor.
- Of those surveyed on routes outside the corridor, 26 percent indicated their annual household income was below \$30,000 compared to 36 percent for both those surveyed on routes inside the project corridor and connecting to the corridor.
- Of those surveyed on routes outside the corridor, 32 percent identified themselves as "White" compared to 22 percent for those surveyed on routes inside the corridor and 28 percent for those surveyed on routes connecting to the corridor. Of those surveyed on routes outside the corridor, 39 percent identified themselves as Asian (Japanese, Filipino, Chinese, Korean, or other Asian decent) compared to 46 percent for those

surveyed on routes inside the corridor and 37 percent for those surveyed on routes connecting to the corridor.

7.5 Additional Analysis of Survey Results

While Section 7 of the report provides a selection of analysis results, the database generated by the 2012 onboard survey in Honolulu can generate additional results. To facilitate follow-up analysis of survey results, ETC Institute has developed a web-based tool that can access various information items. With a user ID and password, analysts will be able to focus on database elements of the survey results and perform analysis of trip patterns and ridership characteristics as follows:

- by time of day
- by route
- by type of route
- by trip purpose
- by income and other socio-economic variables
- by location (Traffic Analysis Zone)

This tool should be available for use by January 2014.

