2015–17 MBTA Systemwide Passenger Survey

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Massachusetts Bay Transportation Authority
Rapid Transit/Key Bus Routes Map
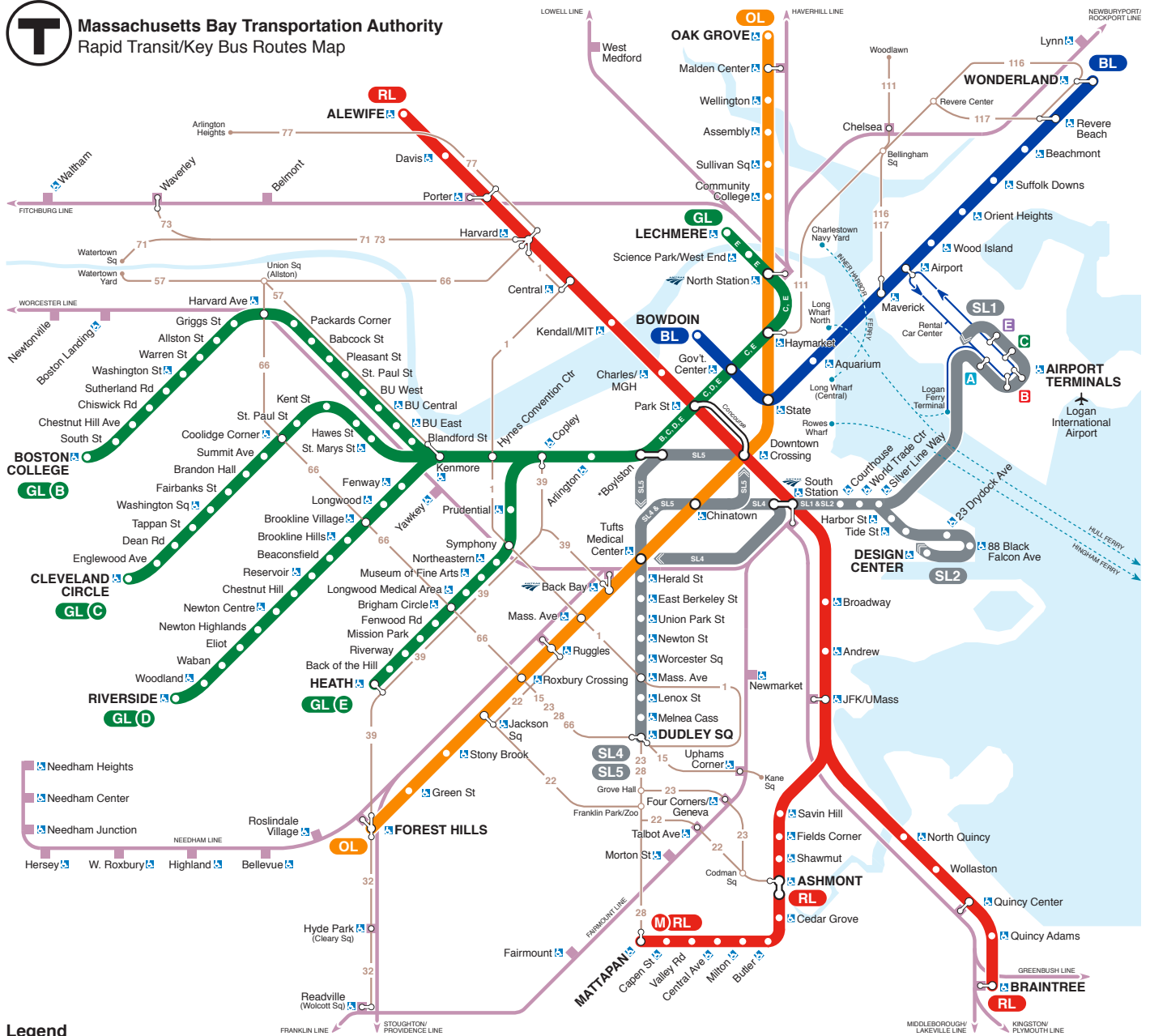
Legend

- **RL** RED LINE
- **M** MATTAPAN LINE
- **OL** ORANGE LINE
- **BL** BLUE LINE

SL SILVER LINE and branches — SL1 SL4 SL2 SL5

GL GREEN LINE and branches
- **B** Terminates at Park St
- **C** Terminates at N. Station
- **D** Terminates at Gov't Center
- **E** Terminates at Lechmere

— 000 — KEY BUS ROUTE Frequent service

COMMUTER RAIL

Accessible station
All MBTA and Massport bus and ferry services are accessible

Rapid Transit transfer station

Commuter Rail transfer station

FERRY

Free Logan Airport shuttle bus

Amtrak service
Back Bay, North & South stations

*Boylston: Accessible for Silver Line only

Customer Communications & Travel Info
617-222-3200, 800-392-6100,
TTY 617-222-5146, www.mbta.com

MBTA Transit Police: 911
TTY 617-222-1200

Elevator/escalator/lift updates: 800-392-6100

Not to scale

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Abstract

The Federal Transit Administration (FTA) Title VI Circular (C 4702.1B) requires large transit providers to collect demographic, travel, and fare payment data about their riders using passenger surveys at least every five years. The 2015–17 Massachusetts Bay Transportation Authority (MBTA) Systemwide Passenger Survey was conducted by the Central Transportation Planning Staff (CTPS) of the Boston Region Metropolitan Planning Organization (MPO) to meet this requirement and to obtain additional information useful for planning purposes.

This report describes the methodology used by CTPS to conduct the survey and process the results. Major findings of the survey are summarized. Results at a more detailed level are available online at www.ctps.org/apps/mbtasurvey2018/.

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Executive Summary

ES.1   BACKGROUND

This report summarizes the methodology used by the Central Transportation Planning Staff (CTPS) of the Boston Region Metropolitan Planning Organization (MPO) in conducting a systemwide passenger survey for the Massachusetts Bay Transportation Authority (MBTA), and discusses some of the main findings of the survey. More detailed results are available online at www.ctps.org/apps/mbtasurvey2018/. The survey was conducted to meet the requirements of Federal Transit Administration (FTA) Title VI Circular (C 4702.1B) and to obtain other information essential for transportation planning purposes.

ES.2   SAMPLING PLAN

The survey was conducted through a combination of an online form that was available from October 2015 through May 2017 and paper survey forms with mail-back option, distributed at MBTA stations and on MBTA vehicles between March 2016 and March 2017.

The sampling plan was designed to obtain the highest levels of statistical reliability feasible within the constraints of the available resources. In consultation with the MBTA, CTPS established criteria that for each unit of service for which data were to be presented separately, the number of completed surveys should meet the statistical requirements for a 90 percent confidence level with a 10 percent confidence interval.

Bus (including trackless trolley) and MBTA boat passengers were to be surveyed at the route level, and rail rapid transit (heavy and light rail), bus rapid transit (Silver Line), and commuter rail passengers at the station level. The survey forms called for each respondent to provide information pertaining to the most recent one-way trip taken on the MBTA at the time the survey was completed and to include the date when that trip was made.

Respondents were instructed to include information about each link in the MBTA trip being described. Consequently, each completed form provided a sample of ridership on one or more MBTA services. On services for which results were to be presented at the station level, each response contributed to the samples of riders at both the boarding station and the alighting station.

ES.3   SURVEY WEIGHTING

To account for differences among routes and stations in survey response rates, it was necessary to apply weight factors to the records. At the end of the distribution phase there were insufficient responses for Saturday or Sunday trips to be used separately from weekday trips, so results from all days of the week were combined. In some cases, it was necessary to combine results from two or more routes or stations serving the same general area to compile enough responses to meet the statistical standards.

For each route or route group and for each station or station group for which results were to be presented, the weight factor was calculated as the quotient of the most recent available average total weekday boardings on the route or routes or at the station or stations divided by the number of survey responses from the corresponding service. At rail rapid transit stations, control totals were calculated as the average of weekday boardings and alightings.

ES.4   KEY FINDINGS

The results of the 2015–17 survey are available online and can be viewed and downloaded at www.ctps.org/apps/mbtasurvey2018/. The findings from some of the most commonly requested results are summarized in this report.

ES.4.1 Trip Purpose

Trip purpose was calculated as a cross-tabulation of the responses to the statements "My trip started at…" and "My trip ended at…," which provided check-off choices for the kind of activity at the beginning and end of the reported trip. Trips with either end at home were classified as home based; these included the vast majority of trips on every mode surveyed. Overall, 72.9 percent of reported trips were from home to work or work to home.

ES.4.2 Alternative Means of Travel

Slightly more than one-half of all survey respondents (55.1 percent) reported that they sometimes made the same trip described on the survey by another means of travel. The most common alternatives were using a different MBTA service (46.4 percent) and driving alone (23.2 percent).

ES.4.3 Access and Egress Modes

The majority of survey respondents would be expected to have made the reverse of the trip described on the survey earlier or later on the same day, but to have filled out a survey only for one direction of the trip. Therefore, for each reported access trip to a station there was an implied egress trip by the same means, and

vice-versa. In the survey summaries, access and egress modes for each station or bus route are shown as a combined total.

With results summarized separately for each link in each reported trip, 57.0 percent of all access or egress trips were at the beginning or end of an entire MBTA trip and 43.0 percent were transfers from or to another MBTA service.

Many MBTA stations or stops have no parking facilities, with the exception of the commuter rail system. Overall, 85.6 percent of access trips to the initial link or egress trips from the final link in an MBTA trip were reported as being made by walking or bicycling. This percentage ranged from 53.1 percent on commuter rail lines (including the downtown Boston terminals) to 96.1 percent on bus lines.

Of the access or egress trips that consisted of transfers to or from another MBTA service, more than one-half overall (57.5 percent) were to or from a rail rapid transit line.

ES.4.4 Access and Egress Times

Similarly to the treatment of access and egress modes, access times to the first MBTA services used on trips were combined with egress times from the last services used. The reported times were consolidated into ranges and summarized separately for walking or bicycling, park and ride (driving alone or carpooling), drop-off by personal vehicle, and drop-off by other type of vehicle for each route or station.

Average access/egress times were shortest for walking or bicycling, with 56.3 percent of such trips reported at five minutes or less, 85.9 percent at 10 minutes or less, and 95.1 percent at 15 minutes or less.

Average walking or bicycling access/egress times were shortest for the bus network, with 89.9 percent at 10 minutes or less and longest for the commuter rail network, with only 65.9 percent at 10 minutes or less.
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ES.4.5 Trip Frequency

Overall, the most common frequency reported for making the MBTA trip reported on the survey was five days per week, at 56.9 percent. Frequency of use varied little from this average among core services (bus, Silver Line, and rail rapid transit), but 69.4 percent of commuter rail riders and 69.0 percent of boat riders reported making their trips five days per week.

ES.4.6 Fare Types

The most common method of fare payment reported was some form of monthly pass, at 72.8 percent overall. There was relatively little difference among modes in this share. Use of passes by pass type is not directly comparable among modes, because not all pass forms are valid on all services. Pay-per-ride fare options also vary among services.

ES.4.7 Demographics

Demographics of MBTA users determined from questions in the survey were age, gender, annual household income, low-income classification, self-identified race, ethnicity, minority classification, possession of a driver's license, vehicles per household, and vehicles per capita.

The most common age range was 22 to 34, at 39.3 percent. The age range of 22 to 34 also had the largest share of responses from bus, rail rapid transit, and Silver Line riders. The age range from 45 to 64 had the largest share of responses from boat riders (53.9 percent) and commuter rail riders (45.1 percent).

The check-off choices for gender were Man, Woman, a space for write-ins, and prefer not to say. Of the respondents who checked any of these choices, 59.0 percent checked woman, 38.7 percent checked man, 0.2 percent wrote in something else, and 2.1 percent preferred not to say. Some of the disparity may reflect a greater reluctance of men to participate in surveys.

The survey form offered a choice of eight ranges of household incomes plus a choice of "Prefer not to say." The three lowest income ranges, covering incomes of less than $43,500, are classified as low-income and the rest as non-low-income. For the system overall, 28.8 percent of respondents that specified their income were from the low-income ranges. This percentage was largest among bus riders (41.6 percent) and lowest among boat riders (3.7 percent) and commuter rail riders (6.8 percent).

FTA regulations require that transit operators determine the proportions of minority and nonminority riders on their services. In the summarized survey results, respondents who self-identified as any race other than white and/or checked yes for Hispanic were classified as minority. Those who checked white and no other race and checked no for Hispanic were classified as nonminority. All other respondents could not be classified.

Excluding survey responses with insufficient information to determine minority status, 34.3 percent of respondents were classified as minority. At the modal

level, the minority percentage was largest on buses (48.1 percent) and smallest on commuter rail (14.6) and ferries (1.7 percent).

Overall, the majority (79.4 percent) of survey respondents had valid driver's licenses, ranging from 68.5 percent among bus riders to 95.6 percent among boat riders.

Overall, the most common number of vehicles reported per household was one, at 39.7 percent, but 30.0 percent of respondents were from zero-vehicle households. The percentage of zero-vehicle households was largest among bus passengers, at 39.2 percent.

Vehicles per capita were calculated by dividing the number of vehicles per household by the number of people per household for each survey response with answers to those two questions. Potential vehicle availability depends not only on the number of vehicles per household but on the number of people who have to share these vehicles. Values of 1.0 or more vehicles per capita should indicate that a vehicle is available, but overall 22.3 percent of responses were in this category. At the modal level, only 15.4 percent of bus passengers had 1.0 or more vehicles per capita.

ES.4.8 Language

Survey forms were available in eight languages in addition to English, but 99.3 percent of respondents used the English version. Given the option of specifying English or any other language as the preferred one for receiving information about the MBTA, 98.6 percent of respondents specified English. However, these results do not include riders who were not proficient enough in English or in one of the other languages in which the survey form was available to participate in the survey.

ES.4   COMPARISONS WITH PRIOR SURVEYS

Prior to the 2015–17 survey, the most recent MBTA systemwide survey with comparable level of detail was conducted by CTPS in 2008–09. However, the Silver Line routes were not included in the 2008–09 survey because they had been covered in special surveys approximately two to three years prior. The special surveys did not include all of the same questions, and the Silver Line services were relatively new when surveyed. Given these limitations, Silver Line survey results are excluded from the comparisons.

Attributes that could be compared directly between the 2015–17 survey and the 2008–09 survey included minority classification, low-income classification, possession of a driver's license, and vehicles per household. For these

attributes, changes between the two surveys in the characteristics reported by respondents were not statistically significant.

A comparison of alternate means would be of interest because the 2008–09 survey predated the establishment of rideshare companies in the MBTA service area. However, the wording of the question differed among surveys conducted in different years. In the 2008–09 survey, respondents were asked to report alternatives used for the trip segment on which the survey form was received. In the 2015–17 survey, respondents were asked to report alternatives used to make an overall trip. Consequently, no meaningful comparisons can be made.

Chapter 1—Background

1.1   REASONS FOR CONDUCTING THE 2015-17 SURVEY

The Federal Transit Administration (FTA) Title VI Circular (C 4702.1B) requires large transit providers to collect demographic, travel, and fare payment data about their riders using passenger surveys at least every five years. In addition, results of past MBTA passenger surveys have provided essential data to many different users, including the MBTA, CTPS, consultants, other transportation agencies, academic researchers, and members of the public. Previous surveys with content comparable to that of the 2015–17 systemwide survey had been most recently conducted on the MBTA rail rapid transit, bus, commuter rail, and boat systems in 2008 and 2009. The Silver Line Washington Street bus rapid transit line had last been surveyed in 2005, and the Silver Line Waterfront bus rapid transit lines had last been surveyed in 2006.

1.2   OBJECTIVE

The objective of the survey project was to obtain responses from sufficiently large samples of riders on each MBTA service to provide statistically valid results at the levels of aggregations at which the findings will be used. Contingent on the number of responses, the results are being made available at both mode level and route level for buses (including trackless trolleys) and ferries and at line and stop level for rail rapid transit (light and heavy rail), Silver Line (bus rapid transit), and commuter rail. In some cases, small sample sizes have necessitated combining results for two or more routes or for two or more stops serving the same general geographical area.

1.3   SURVEY CONTENT

The survey forms distributed on all modes included the same set of questions pertaining to a respondent's demographic information and most recent trip on the MBTA. The survey was designed to obtain the following kinds of information:
- Demographic characteristics, including minority status, English proficiency, gender, age, and household income
- Preferred language for receiving MBTA information
- Possession of a valid driver's license, number of usable vehicles in household, and vehicles per capita in household
- Trip purpose
- Origin/destination locations
- Modes of access and egress
- Fare and fare payment method
- Frequency of making the reported trip using the MBTA
- Other characteristics, as required for federal reporting

Survey forms could be completed online or on paper with a postage-paid mail-in option. In addition to English, survey forms were available in Spanish, Portuguese, Cape Verdean Creole, traditional Chinese, simplified Chinese, French, and Vietnamese. The online survey was also available in Haitian Creole. However, of the forms completed by either method, 99.3 percent were completed in the English version. The English version of the survey form can be viewed at www.ctps.org/apps/mbtasurvey2018/mbta_survey_English.pdf.

Chapter 2—Sampling Plan

2.1   RESPONSE TARGETS

In designing the sampling plan for the 2015–17 MBTA systemwide passenger survey, a guiding principle was to strive to attain the highest levels of statistical reliability feasible within the constraints of the available resources.

As in past MBTA systemwide surveys, motor bus, trackless trolley, and MBTA boat passengers were to be surveyed at the route level, and heavy rail rapid transit, light rail, and commuter rail service passengers at the station level. Most individual bus stops have much lower total ridership than most individual stops on the other modes, making stop-level bus surveys impractical. On two of the three boat routes ridership is heavily concentrated toward Boston for the first half of the service day and away from Boston for the second half, making survey distribution at the Boston terminals the most efficient strategy.

Ideally a survey project would have aimed for a confidence level of 95 percent and a confidence interval of 5 percent (referred to below as 95/5 standards) for the samples from each bus and boat route and for each station or stop on the other modes. For the given ridership levels, 95/5 standards would require samples of 200 to 375 per route or station. The response rates from previous MBTA surveys indicated that it would be infeasible to obtain enough responses from most routes or stations to meet these standards without incurring expense far greater than the available funding for survey distribution and processing.

After examining the costs for various levels of survey distribution, CTPS, in consultation with the MBTA, set goals of obtaining enough valid survey responses from each bus or boat route or from each station or stop on other modes to provide a confidence level of 90 percent with a confidence interval of 10 percent (referred to below as 90/10 standards). This typically called for approximately 65 responses per route or station. The number of responses for some routes and stations exceeded this target, resulting in confidence levels larger than 90 percent and confidence intervals smaller than 10 percent.

2.2   SURVEY DISTRIBUTION STRATEGIES

In the most recent previous MBTA systemwide passenger survey, conducted by CTPS in 2008–09, passengers were given the options of completing a paper survey form or filling out an equivalent form online. However, to obtain the link to the online version, a passenger first had to have received a paper copy that included a unique serial number.

In the 2015–17 survey project, paper survey distribution was preceded by an interval from late October through December 2015 during which an online version was available to anyone, with the MBTA and CTPS engaging in extensive efforts to publicize the availability of this option. The online form continued to be available from the time paper survey distribution commenced in March 2016 until the end of paper survey distribution in March 2017. Overall, paper surveys accounted for almost half (49 percent) of the returns completed sufficiently to be usable.

In the 2008–09 and previous systemwide surveys, respondents were asked to provide information about each link in the one-way trips on which they received their survey forms. The results were entered in separate databases, depending on the route or station where the passengers received their forms, regardless of which link in a trip that was. The summarized results for each mode included only those for passengers who received survey forms while riding on a vehicle or entering a station on that mode.

In contrast, in the 2015–17 survey, respondents were asked to provide information about each link in their most recent MBTA trip. The information for each route or station used on the trip was included in the summarized results for that mode. For example, a passenger starting a trip on a bus, transferring from the bus to a rapid transit train, and transferring from the rapid transit train to a commuter rail train, was counted in the results for the bus route, for the rapid transit boarding and alighting stations, and for the commuter rail boarding and alighting stations. A passenger transferring between rapid transit lines, for example from the Red Line to the Orange Line at Downtown Crossing, was counted as a Red Line alighting passenger and as an Orange Line boarding passenger at that station. This made it possible to obtain much larger samples for each mode relative to the number of surveys distributed and returned than prior survey methods provided.

To optimize use of resources during paper survey distribution, at the conclusion of the phase when surveys were only available online, the results were tabulated and compared with the response targets for 90/10 standards. If the targets were already met, no paper survey distribution was conducted. If the targets were not already met, strategies were devised for obtaining the additional number of surveys needed, disregarding potential additional online responses, or responses for a line or station obtained through distribution on another line or at another station.

It is not usually possible to distribute survey forms to all passengers entering a station or boarding a vehicle on a route during a given time span. Not all passengers offered survey forms accept them, and not all those accepting forms

complete and return them. For each bus route or station, it was necessary to estimate the number of boarding or entering passengers that would form a large enough pool from which to obtain the desired number of completed paper survey forms. These estimates were based on the ratios by mode in the 2008–09 survey of paper forms distributed to total ridership and the percentages of distributed forms returned completed.

For each line or station, the most recent available ridership figures by hour for a typical weekday were reviewed, and a span of hours was identified during which the number of boarding or entering passengers would at least equal the number estimated as described above. Assignments for survey distributors covering these spans of hours were then prepared.

Based on experience from previous survey projects, it was concluded that one survey distributor assignment would be sufficient to cover most stations or stops where forms were to be distributed to boarding passengers. For bus routes, distributor assignments were based on the driver assignments covering all trips scheduled during the selected span of hours.

Limited availability of personnel to distribute surveys, and the need to suspend distribution during times of low ridership such as school vacations, resulted in the total survey distribution phase extending through the spring of 2017.

2.3   RESPONSE TARGET REFINEMENT

Passenger minority and low-income status are of particular concern in the systemwide survey because they are needed to perform service equity analyses. There was some delay between when paper surveys were returned and when they were entered in the database, but progress was monitored during the survey distribution phase to determine whether 90/10 targets for minority and low-income status were being met. For routes or stations for which these targets were not being met, if it appeared unlikely that they would be met under the original distribution strategy, revised strategies were developed.

The formulas for confidence levels and confidence intervals are based on binary choices of answers. For questions with multiple possible answers, the number of responses for each answer can be compared with the totals for all others.

The initial 90/10 targets for each line or station were based on the assumption of a split at or near 50 percent for each choice in a question with two possible responses. However, the farther the actual split is from 50 percent/50 percent, the smaller the sample size that is needed to provide a given confidence level and confidence interval. For routes or stations for which the initial targets were

not being met, the minority/nonminority and low-income/non-low-income splits for the responses already received and the splits for the same routes and stations in the 2008–09 surveys were examined. If these splits differed significantly from 50/50, revised targets were calculated.

If the revised targets were being met, no further changes in distribution strategy were required. For cases in which even the revised targets were not being met, additional survey distribution beyond that already completed or planned was considered. However, this was determined not to be cost effective given the low response rates from the stations or routes in this category. Instead, plans were devised for clustering routes or stations serving the same general areas and having similar ridership characteristics. Results would be published for these routes or stations only as part of clusters rather than individually.

When most of the survey returns had been entered in the database, several routes or stops that had been candidates for inclusion in clusters had enough responses to stand alone. Only a small number of bus routes and commuter rail stations and one boat route for which targets were not met were also too dissimilar to others to be included in clusters. Stand-alone results for these are not being published because of low statistical validity.

Chapter 3—Survey Weighting

3.1   GENERAL CONSIDERATIONS

To account for differences among routes and stations in survey response rates, it was necessary to apply weight factors to the records. The survey forms called for passengers to specify the date on which the trip being described took place. This was intended to allow the responses to be separated between weekdays, Saturdays, and Sundays, in case passenger characteristics differed between weekdays and weekend days. However, not all responses included a trip date.

In general, average ridership on a given service is much lower on a typical Saturday or Sunday than on a typical weekday. In a week with no special holiday service there are five weekdays for each Saturday or Sunday. Consistent with these patterns, and because paper surveys were distributed only on weekdays, the vast majority of responses that included dates were from weekdays. Many services did not have enough weekend responses to meet 90/10 standards if used separately. In some cases weekday responses alone did not meet 90/10 standards but combined weekday and weekend responses did.

For consistency, in the final data processing, weekday and weekend responses for each route or station were combined and weighted equally. The methods used to calculate weight factors for each mode are detailed below.

3.2   CALCULATION OF BUS WEIGHT FACTORS

As anticipated, most bus stops generated too few survey responses to be meaningful if examined individually. Therefore, responses were combined at the route level. In some cases, responses from two or more routes serving the same general area were combined to meet the 90/10 standards.

The control total used for each route or cluster was average weekday boardings in both directions combined for that route or cluster. These totals were based on counts taken in MBTA fiscal year 2016 on several days on each trip by vehicles with automatic passenger counters (APC). Totals for trackless trolley routes, which do not have APC-equipped vehicles, were based on 2016 manual CTPS counts. The weight factor was the weekday control total divided by the number of responses from the line or lines including weekday and weekend responses.

3.3   CALCULATION OF RAIL RAPID TRANSIT WEIGHT FACTORS

The majority of rail rapid transit system passengers make round trips, so a passenger alighting at a given station will usually also board at that station earlier or later the same day. However, because the survey instructions called for

describing a one-way trip, a passenger could appear in the results either as entering or as exiting a given station but not both. To capture as complete a picture as possible of station users, entering and exiting passengers were all included in the results for that station.

Six of the gated stations (North Station, Haymarket, Government Center, Park Street, State Street, and Downtown Crossing) are transfer points between two heavy rail rapid transit lines or between one of these lines and Green Line light rail lines. Each of these stations has separate levels for the two lines, so for purposes of analysis it was treated as two stations, one on each line.

Three other stations (Arlington and Kenmore on the Green Line and JFK/UMass on the Red Line) have significant reverse-transfer activity by passengers alighting inbound on one branch and boarding outbound on another branch. At all three stations this requires changing platforms, and except at JFK/UMass, all such transfers are made via the fare-collection lobby, although within the paid area.

In terms of equity, the quality of a station affects transferring passengers as well as entering and exiting passengers, so it is reasonable to include transferring passengers in calculating the overall characteristics of passengers who use the station. Furthermore, they can be counted both as alighting passengers on the arriving platform and as boarding passengers on the departing platform.

The Green Line Central Subway has 13 gated stations, but only four of these are currently served by trains of all four branches (B, C, D, and E Lines). Consequently, some trips require same-direction transfers between Green Line branches. However, insufficient information is available to determine how these transfers are divided among stations, so for purposes of the survey they were not included in the activity at any station. Similarly, Red Line passengers starting out on a southbound Ashmont train but transferring to a Braintree train or vice versa to complete their trips were not counted as transfers.

Control totals for boardings from entries to gated stations were based on the average of entry totals from the MBTA's automated fare collection (AFC) system, from two Wednesdays and one Thursday in April 2017. Control totals for alightings to exits were calculated through a computer model that infers station-to-station trip pairs from the sequential uses of farecards on selected days. Transfer control totals were calculated from trips having entries and inferred exits on different lines, with transfer locations based on past manual counts if more than one transfer location was reasonable for the same line combination

To obtain averages of the results for entering and exiting passengers while accounting for differences in their survey response rates, separate weight factors were calculated for entries and exits. This was done by dividing the entry control totals by entry responses and the exit control totals by exit responses and multiplying each of these values by 0.5. Similarly, at stations where transfer activity was to be included, separate weight factors were calculated for transfer boardings and transfer alightings.

For surface Green Line branches, control totals at the branch level were also based on AFC records, with factors applied to account for passengers who display monthly or weekly passes but do not register them at fareboxes when boarding. These totals were subdivided by stop or stop cluster based on past CTPS manual passenger counts.

3.4   CALCULATION OF SILVER LINE WEIGHT FACTORS

For the MBTA's bus rapid transit system (Silver Line Washington Street routes SL4 and SL5 and Silver Line Waterfront routes SL1 and SL2), some stops had enough total responses that it was desirable to consider results at the stop or stop-cluster level rather than at the route level. However, most stops did not have enough responses to allow boarding and alighting activity to be weighted separately. For each stop or cluster, a combined weight factor to be used for boardings and alightings was calculated by dividing a control total of boardings in both directions from fiscal year (FY) 2016 APC counts by total boarding and alighting survey responses at the stop or cluster.

For South Station on the Silver Line Waterfront routes, weight factors were calculated separately for passengers entering or exiting the station and for passengers transferring to or from the Red Line. The split between transfers and external entries and exits was based on past CTPS manual counts.

3.5   CALCULATION OF COMMUTER RAIL WEIGHT FACTORS

For the MBTA commuter rail system, control totals by line were based on figures provided by Keolis Commuter Services (KCS), the contract operator of the system. KCS conducted counts in May 2016 at the Boston terminal stations and other Fare Zone 1A stations with rail rapid transit connections, and added factors for ridership not going to or from these stations based on manual counts conducted by CTPS in 2012.

In the calculations of weight factors by station or cluster for most lines, CTPS combined the responses for weekday and weekend boardings and alightings, treating them equally. The control total for each station or cluster was the average of the weekday boardings and alightings in both directions in the 2012

counts multiplied by the ratio of the KCS line total to the 2012 line total. The weight factor was the control total divided by the survey combined boardings and alightings at the station or cluster.

An exception to this method of obtaining control totals was that for the Fairmount Line, which had three new stations open after the 2012 counts were conducted, KCS counts by station conducted in May 2017 prior to a free fare promotion were used as control totals.

On the Providence Line, boardings and alightings at the three stations in Rhode Island (Wickford Junction, T.F. Green Airport, and Providence) were not included in the 2015–17 survey results, because the Rhode Island Department of Transportation conducts its own passenger surveys for those stations. However, alightings at stations in Massachusetts by passengers boarding at the Rhode Island stations and passengers boarding at Massachusetts stations to go to the Rhode Island stations were included in the results for the Massachusetts stations.

On the Fitchburg Line, Wachusett Station was open for only the last few months of the survey project, and the number of survey responses was insufficient to represent ridership there. Boardings and alightings at Wachusett were not included in the survey calculations, but alightings at other stations by passengers boarding at Wachusett and boardings at other stations by passengers going to Wachusett were included in the calculations for those stations.

In most cases, when it was necessary to cluster survey results for two or more commuter rail stations, all stations in a cluster were on the same route, but there were a few exceptions. Results for North Wilmington on the Haverhill Line and Wilmington on the Lowell Line were combined. Results for Dedham Corporate Center on the Franklin Line were combined with those for Route 128 on the Providence/Stoughton Line. Results for Weymouth Landing/East Braintree on the Greenbush Line, East Weymouth on the Greenbush Line, and South Weymouth on the Kingston Line were all combined. Results for Hyde Park on the Franklin and Providence/Stoughton Lines were combined with those for Fairmount Station on the Fairmount Line. At Braintree Station, results from the Middleborough/ Lakeville and Kingston/Plymouth Lines were combined. At Quincy Center Station, results for the Middleborough/Lakeville and Greenbush Lines were combined. (There were no Quincy Center responses from Kingston/Plymouth Line passengers.) At JFK/UMass Station results from the Middleborough/ Lakeville, Kingston/Plymouth, and Greenbush Lines were all combined. At Readville Station, results from the Franklin and Fairmount Lines were combined.

3.6   CALCULATION OF BOAT WEIGHT FACTORS

The MBTA boat network currently has only three routes. Target response totals were met for the routes from Hingham to Rowes Wharf and from Hingham to Long Wharf via Hull and Logan Airport, but were not met for the route from Charlestown to Long Wharf.

Weight factors for each route were calculated only at the route level, and were applied to boardings in both directions. The control totals used were weekday average boardings by route in FY 2015, reported by the contract operator of the service, Boston Harbor Cruises.

Chapter 4—Key Findings

4.1   OVERVIEW

The MBTA 2015–17 systemwide passenger survey generated approximately 35,000 forms completed sufficiently to be usable. Each form provided details of the most recent MBTA trip made by the respondent. When subdivided into all the MBTA services used to complete each trip, these forms provided details for approximately 56,000 trip links.

The survey results have been summarized in a series of tables comparable to those used in past MBTA systemwide surveys. The results from some of the tables are presented as charts in this chapter, and corresponding tables appear in Appendix A, but all of the tables can be viewed and downloaded at www.ctps.org/apps/mbtasurvey2018/.

4.2   TRIP PURPOSE

Trip Purpose was calculated as a cross-tabulation of the responses to the statements "My trip started at…" and "My trip ended at…," which provided check-off choices for the kind of activity at the beginning and end of the reported trip. Figure 1 illustrates how the question on activity at trip beginning appeared on the survey form. The same range of options was provided for trip-ending activity.

Figure 1
Trip Beginning Activity Question

Figure 2 shows the percentage distributions of trip purposes reported by users of each MBTA service mode in the 2015–17 survey. As in past survey summaries, trips with either end at home were classified as home based, and this included the vast majority of trips on every mode surveyed. On the MBTA system overall, 93.1 percent of trips were home based. This percentage ranged from 91.1 on the Silver Line network to 97.0 percent on the boats.

The most common trip purpose reported was travel from home to work or work to home. Overall 72.9 percent of trips were for this purpose. The share of trips accounted for by travel between home and work was largest on ferries (93.4 percent) and commuter rail (90.3 percent) and smallest on buses (69.6 percent), the Silver line (67.0 percent), and Green Line surface branches (64.0 percent). Travel between home and school was the second most common trip purpose overall (5.9 percent) followed by travel between home and social, recreational, or entertainment activity (4.7 percent).

Figure 2
Trip Purpose by Service Mode
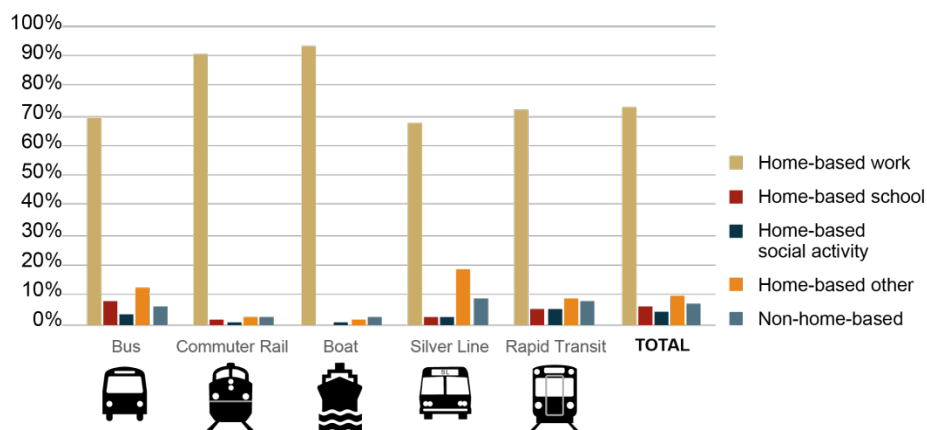
Most of the other individual cross tabulations of the check-off choices for activity at the beginning or end of trips accounted for less than 3.0 percent of overall trip purposes, and none accounted for more than 5.0 percent. Therefore, they were further combined into two groups: all other home-based trips and all non-home-based trips. Overall, all other home-based trips accounted for 9.6 percent of the total, ranging from 2.3 percent on boats to 18.6 percent on the Silver Line. Approximately half of the latter consisted of trips to and from Logan Airport or South Station.

Non-home-based trips constituted the difference between total trips and home-based trips. They accounted for 6.9 percent of all trips, ranging from 3.0 percent

on boats to 8.9 percent on the Silver Line, with much of the latter consisting of trips between work locations and the airport.

4.3   ALTERNATIVE MEANS OF TRAVEL

Slightly more than one-half of all survey respondents (55.1 percent) reported that they sometimes used alternative means to make the trip described on the survey form. Those who used alternative means were provided the check-off choices shown in Figure 3. However, the form did not provide a way to indicate the frequency of use of the alternative means relative to that of the described trip. Multiple alternatives could be checked, so the total number of alternatives reported was more than the number of respondents reporting use of any alternative.

Figure 3
Alternative Means of Travel Question

Figure 4 shows the percentage distributions of alternative means of travel reported by passengers on each MBTA service mode reporting use of at least one alternative. Overall, the most common alternative to the service used on the reported trip was another MBTA service, reported by 46.4 percent of those who used any alternative. Driving alone was the second most common alternative, at 23.2 percent. However, for commuter rail riders, driving alone was slightly more common than using a different MBTA service (48.9 percent versus 42.4 percent).

Three other check-off choices for alternative means were nearly tied overall: taxi or rideshare company (18.7 percent), walking (17.8 percent), and carpooling (17.7 percent). However, use of these alternatives varied within individual modes. Not surprisingly given the longer average distances of their trips, only 0.1 percent of commuter rail riders reported walking as an alternative and only 4.0 percent reported using taxis or rideshare services instead, but 48.9 percent reported sometimes driving alone.

Figure 4
Alternative Means of Travel by Service Mode
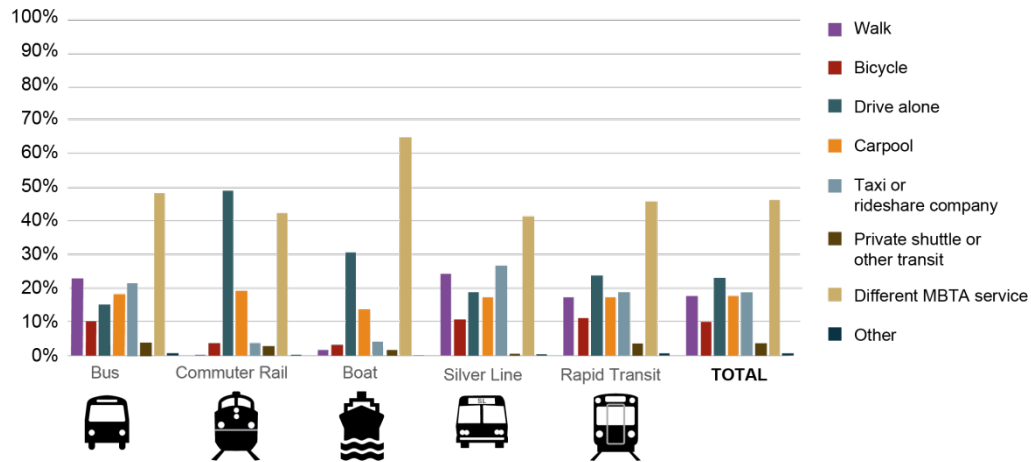
4.4   ACCESS AND EGRESS MODES

An underlying assumption in compiling the survey results was that the majority of respondents would make the reverse of the trip described on the survey form earlier or later on the same day but would fill out a form only for one direction of the trip. Under this assumption, for each access trip reported to a given station or bus route, there was an implied egress trip by the same means, and for each reported egress trip, there was an implied access trip by the same means. In the database, access and egress modes for each station or bus route are shown as a combined total.

Figure 5 shows the check-off choices on the survey form for means of access to the first MBTA service used on the trip. The same choices were provided for means of egress from the final MBTA service used, except that "Dropped off" was changed to "Picked up."

With results summarized separately for each link in each reported trip, 57.0 percent of all access or egress trips were at the beginning or end of an entire MBTA trip and 43.0 percent were transfers from or to another MBTA service. Many individual MBTA rail rapid transit and commuter rail stations do not have direct connections with other MBTA services, and parking capacity varies greatly among stations. Consequently, generalizations about access and egress modes are of limited usefulness.

A private vehicle is usually available only at one end of a trip. At the other end, connection between the MBTA service used and the actual endpoint most often involves some amount of walking.

Figure 5
Means of Access to MBTA Question

Figure 6 shows the percentage distributions of modes used for initial access to or final egress from an entire MBTA trip for each MBTA mode when used as the first or last link in the MBTA portion of a trip. Overall, walking or bicycling accounted for 85.6 percent of the initial access trips to or final egress trips from an entire MBTA trip. This percentage ranged from maximums of 96.1 percent for bus routes and 95.8 percent for the Silver Line to minimums of 52.8 percent for boats and 53.1 percent for commuter rail.

Figure 6
Initial Access Mode to or Final Egress Mode from MBTA by Service Mode
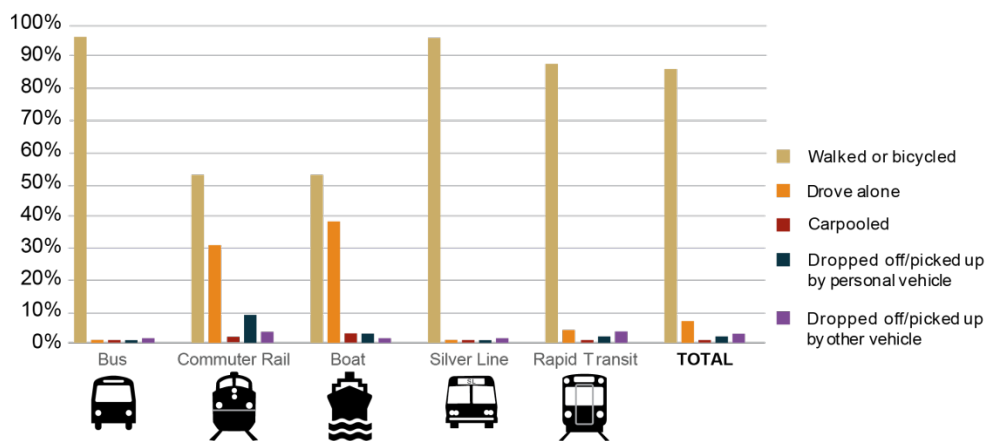
Driving alone to or from an MBTA service was the second most common means of initial access or final egress at 7.3 percent overall. This percentage ranged from minimums of 1.1 percent for bus routes and 1.3 percent for the Silver Line to maximums of 38.9 percent for boats and 31.1 percent for commuter rail.

For commuter rail and boats, park-and-ride access and egress take place almost entirely at suburban trip ends. For stations outside downtown Boston, the park-and-ride shares for boat and commuter rail are approximately twice as great as the shares for these modes overall.

Overall, 2.9 percent of initial access or final egress trips to or from an MBTA service were made by being dropped off or picked up by a personal vehicle. This means ranged from minimums of 0.7 percent for the Silver Line and 1.0 percent for buses to a maximum of 9.7 percent for commuter rail.

Pick up or drop-off by a taxi or rideshare company, by a private shuttle or non-MBTA transit route, or by THE RIDE accounted for 3.4 percent of initial access or final egress trips. These modes were least frequent for buses (1.6 percent) and most frequent for rapid transit (4.4 percent) and commuter rail (3.9 percent).

Carpooling to or from an MBTA trip was uncommon, accounting for only 0.8 percent of initial access or final egress trips. The only modes with carpooling percentages greater than 1.0 percent were commuter rail (2.3 percent) and boat (3.3 percent). This means, like driving alone, is used mostly at suburban trip ends.

The survey form provided check-off choices for trips with one, two, or three links of MBTA service. Respondents making trips with more than three links were supposed to write in the service and exit station or stop on the final link. Figure 7 shows the check-off choices provided for the first link. The choices for the second and third links were the same as these.

In the summarized survey results, for trips with more than one link, the second service was the transfer egress mode for the first link, the first service was the transfer access mode for the second link, etc.

Figure 8 shows the percentage distributions of use of MBTA modes for access to or egress from other MBTA services. Of the access or egress trips that consisted of transfers to or from another MBTA service, more than one-half overall (57.5 percent) were to or from a rail rapid transit line. This percentage varied greatly among services, depending on the number of such connections available and the locations served by the connecting lines.

For commuter rail trips that included a transfer to or from another MBTA service, transfers to or from a rail rapid transit line accounted for the largest share, at 79.2 percent. Very few commuter rail stations serve more than one commuter rail line or have connecting bus routes with coordinated schedules.

For comparison, 73.5 percent of transfers by Green Line passengers were to or from rail rapid transit lines. This included trips on which the Green Line link was entirely in the Central Subway, trips on links with one end at a Green Line surface stop and the other end in the subway, and trips on links between two surface stops. Four Green Line Central Subway stations are shared with heavy rail rapid transit stations, and the Green Line is used as an intermediate link for trips between the Blue and Red Lines, but only a few Green Line stops or stations have bus or commuter rail connections.

The majority of transfers to or from MBTA services other than rail rapid transit were to or from buses, at 35.3 percent of access or egress transfers. However, this percentage varied greatly, from a maximum of 38.2 percent for rail rapid transit links to a minimum of 9.7 percent for boats. Among rail rapid transit lines, the Orange Line had the largest percentage of transfer access and egress trips accounted for by buses (47.2 percent), followed by the Red Line (44.9 percent), the Blue Line (32.3 percent), and the Green Line (19.7 percent). Differences among modes and lines in bus shares of transfers were more a reflection of the availability of bus connections rather than of preferences between types of connecting modes.

Figure 7
First MBTA Service Questions

Only 7.2 percent of all access or egress transfers were to or from commuter rail or boats. The largest difference from this average was on links on boats, for which 36.6 percent of access or egress transfers were with other boats. The present boat routes have no direct commuter rail connections and few direct bus connections, but two of the three routes connect at Long Wharf. The third route serves Rowes Wharf, which is within reasonable walking distance of Long Wharf.

Figure 8
Transfer Modes to or from Other MBTA Services by Service Mode
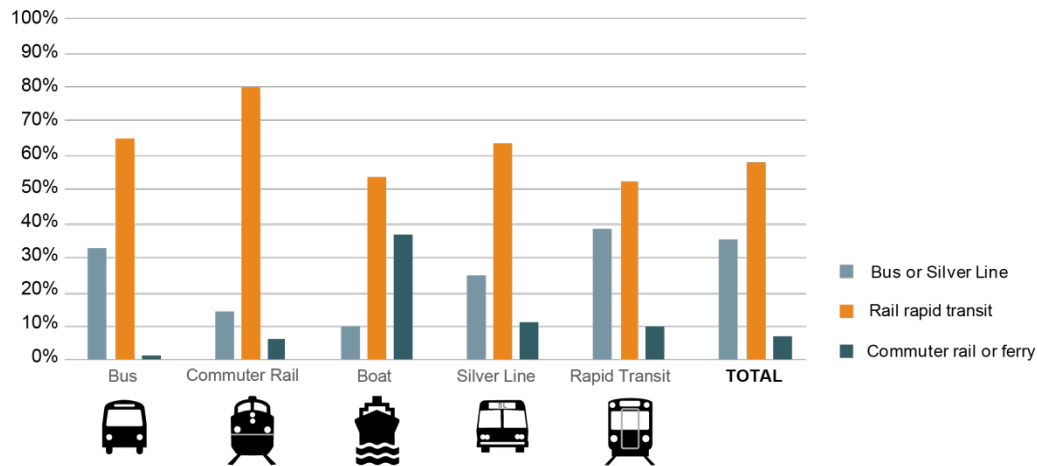
4.5   ACCESS AND EGRESS TIMES

The survey called for reporting of access time to the first MBTA service used and egress time from the last service used as write-in values. For purposes of analysis and for comparability with previous surveys, the reported times were consolidated into ranges. The results were separated into access/egress times for walking or bicycling, park-and-ride (drive alone or carpool), drop-off/pick up by a personal vehicle, and drop-off/pick up by a private shuttle, taxi, or rideshare company.

Average access/egress times were shortest systemwide for walking or bicycling with 56.3 percent of such trips reported at five minutes or less, 85.9 percent at 10 minutes or less, and 95.1 percent at 15 minutes or less.

The bus system had the shortest average walking or bicycling access/egress times, with 67.6 percent reported at five minutes or less, 89.9 percent at 10 minutes or less, and 96.2 percent at 15 minutes or less. The walking or bicycling access/egress time distribution for light rail surface stops differed only slightly from those for bus stops.

Heavy rail rapid transit and Green Line Central Subway stations had longer average walking or bicycling access/egress times than bus lines, with 51.6 percent reported at five minutes or less, 85.8 percent at 10 minutes or less, and 95.7 percent at 15 minutes or less.

The commuter rail and boat systems had the longest average walking or bicycling access/egress times. For the commuter rail network, 26.3 percent were

reported at five minutes or less, 65.9 percent at 10 minutes or less, and 86.4 percent at 15 minutes or less. Walking or bicycling access/egress time percentages for the boat routes differed only slightly from these.

Reported average access/egress times were longest for respondents reporting park and ride, either in single-occupant vehicle or in carpools. The survey form did not include access distance, but the distance covered in a given amount of time would be greater for park and ride than for other alternatives except drop-off or pick up. Therefore, park and ride also had the longest implied average access/egress trip distances.

For the system overall, 18.8 percent of park-and-ride access/egress times were reported at five minutes or less, 50.1 percent at 10 minutes or less, and 70.2 percent at 15 minutes or less. Among the relatively few bus passengers with park-and-ride access or egress, 34.2 percent had times reported at five minutes or less, 64.6 percent at 10 minutes or less, and 78.9 percent at 15 minutes or less. Too few Silver Line passengers reported park-and-ride access to allow accurate breakdowns of times by range.

Rail rapid transit stations and stops had the longest average park-and-ride access/egress times, with 13.6 percent reported at five minutes or less, 36.0 percent at 10 minutes or less, and 54.1 percent at 15 minutes or less. In contrast, on the commuter rail system, 21.2 percent of park-and-ride access/egress trips were reported at five minutes or less, 58.0 percent at 10 minutes or less, and 79.4 percent at 15 minutes or less. However, these times varied widely among lines.

Some differences among park-and-ride access/egress times for subway and commuter rail lines would be more a reflection of the types of roads used in the access/egress trips and the amount of congestion on them than of differences in access/egress distances. However, because most of the commuter rail lines extend much farther from downtown Boston than the outer endpoints of subway lines, residents of most suburbs who use rail rapid transit as the initial MBTA link on a trip must travel farther to reach a station than those who use commuter rail as the first MBTA link.

4.6   TRIP FREQUENCY

Figure 9 shows the check-off choices provided on the survey form for frequency of making the reported trip on the MBTA.

Figure 9
Trip Frequency Question

Figure 10 shows the percentage distributions of frequency of making the reported trips using the MBTA for survey respondents on each MBTA mode. Overall, the most common frequency for making the MBTA trip reported on the survey was five days a week, at 56.9 percent. The form did not provide for reporting whether or not the trip would be made in both directions or would be made more than once in either direction on a day when it was made at all. Frequency of use varied little from this average among core services (bus, Silver Line, and subway or light rail), but 69.4 percent of commuter rail riders and 69.0 percent of boat riders reported making their trips five days a week. Travel on three to four days a week was the second most common frequency reported, at 14.4 percent overall, but 18.0 percent on commuter rail and 19.0 percent on ferries.

Travel less than once a month was reported for 7.6 percent of all trips, but for 15.4 percent of Silver Line trips. The latter result was influenced heavily by travel to or from stops at Logan Airport, of which 61.3 percent were reported as being made less than once a month. For comparison, at Airport Station on the Blue Line, which also serves East Boston origins and destinations other than at the airport, only 28.6 percent of trips were made less than once a month. (In the trip-purpose question, 71.6 percent of Silver Line airport stop users reported connecting to or from intercity transportation, compared with 25.9 percent of Blue Line Airport Station users.)

Figure 10
Frequency of Making Reported Trip Using the MBTA by Service Mode
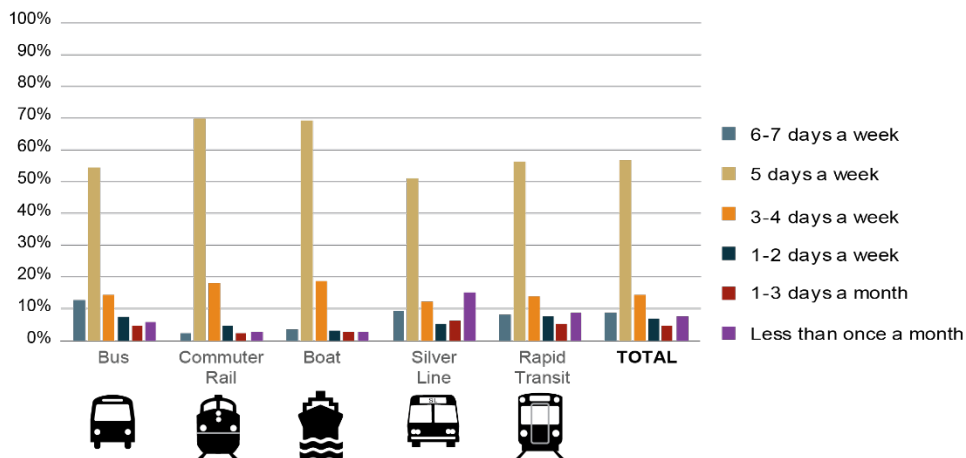
4.7   FARE TYPES

There are many possible ways for MBTA passengers to pay their fares. Figure 11 shows the check-off choices for fare payment methods provided on the survey form.

Figure 11
Fare Payment Method Question

Figure 12 shows the distribution of fare payment methods by MBTA service mode. Overall, the most common method of fare payment reported was some form of monthly pass, at 72.8 percent overall. There was relatively little difference among modes in this share, with a range from 67.2 percent on the Silver Line and 67.5 percent on ferries to 76.7 percent on the commuter rail system. Pay-per-ride was the second most common form of fare payment, at 21.5 percent overall. The largest difference from this was on the boat system, at 31.4 percent. The 1-day and 7-day LinkPasses accounted for most of the rest of fares, at 4.6 percent.

Figure 12
Fare Payment Method by Service Mode
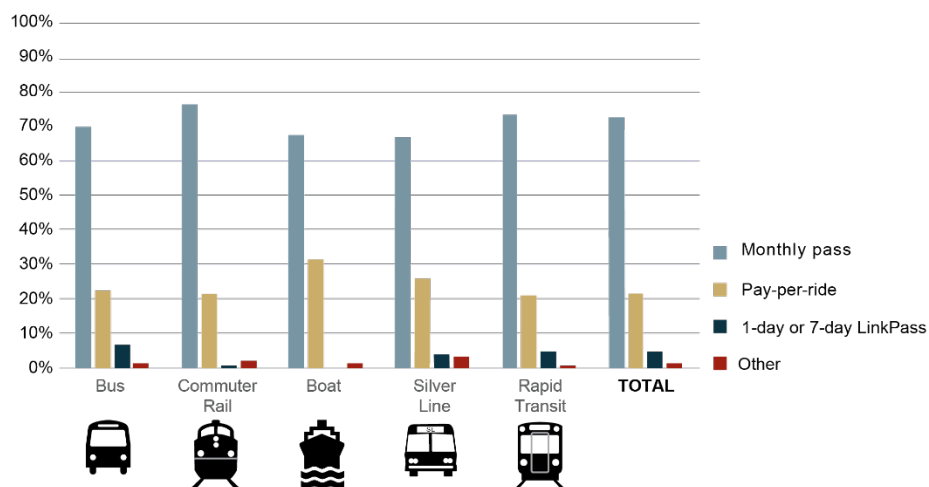
Figure 13 shows the distribution of monthly pass types used by service mode. Among monthly pass options, the ones most commonly reported were the LinkPass, Inner Express Bus pass, and Outer Express Bus pass, at 66.1 percent of all passes. However, most of this use was on the bus, subway, or light rail lines. On the commuter rail system these three pass forms are valid only for Zone 1A trips, and on the boat system they are valid only on the Charlestown route.

Commuter rail zone passes and Hingham and Hull boat passes, which are also valid on the core system, accounted for 19.3 percent of all reported monthly passes. On most of the individual commuter rail lines, such passes accounted for 92 to 97 percent of all monthly passes. The only exception was the Fairmount Line, at 88.2 percent. Most stations on the Fairmount Line are in Zone 1A, for which a monthly LinkPass is valid. These accounted for 8.7 percent of monthly passes reported on the Fairmount Line.

Reduced-fare monthly passes for seniors, students, and people with disabilities are available for the rail rapid transit, bus, and Silver Line networks, but are not available for commuter rail or boat lines.

Figure 13
Monthly Pass Type by Service Mode
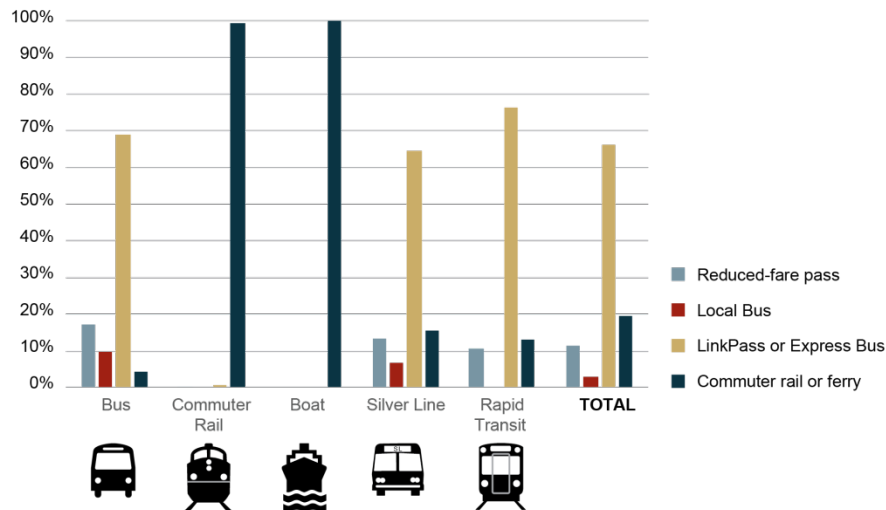
Figure 14 shows the distribution of pay-per-ride fare payment methods used by service mode. Among passengers reporting some form of pay-per-ride fare, the most common form overall was the CharlieCard at 73.3 percent. The only other form accounting for more than five percent of overall pay-per-ride fares were reduced fares for seniors, students or Transportation Access Pass (TAP) cardholders (12.8 percent), and paper CharlieTickets (8.4 percent). On the commuter rail system, 40.1 percent of pay-per-ride fares were by CharlieTickets, including 10-ride and single-ride tickets. After July 1, 2016, while the survey was still in progress, 10-ride tickets except via mTicket, were eliminated. In the survey responses, 37.2 percent of commuter rail pay-per-ride fares were by mTicket.

On boat routes, 57.0 percent of pay-per-ride fares were reported as being by CharlieTicket (either 10-ride or single-ride), and 19.1 percent as mTicket. Except for reduced-fare passengers, 10-ride boat tickets were eliminated effective July 1, 2016.

Figure 14
Pay-per-ride Fare Type by Service Mode
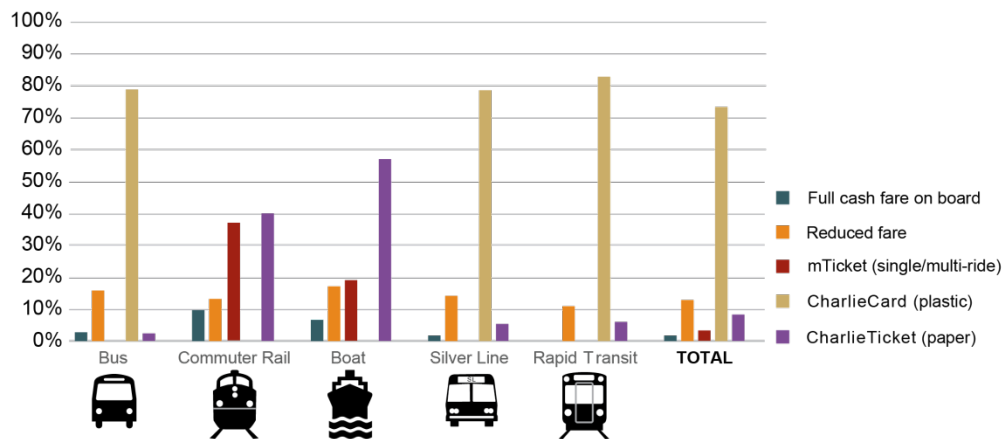
4.8   DEMOGRAPHICS

The preceding sections of this chapter summarize the findings from questions pertaining to the trips made by survey respondents. The remainder of this chapter summarizes the findings from a series of questions about the survey respondents themselves. Figure 15 shows these questions and the response choices provided on the survey form.

In general, passengers are less inclined to answer questions about themselves than about their trips, but it was not possible to determine the extent to which this may have affected the distributions of responses within each demographic category.

4.8.1 Age

The survey form provided check-off choices for six age ranges, but they were not of uniform spans. As shown in Figure 16, the range with the largest percentage of responses overall was ages 22 to 34, at 39.3 percent. This range also had the largest percentage of responses on each of the MBTA's directly operated service modes (bus, rail rapid transit, and Silver Line). However, the age range from 45 to 64 had the largest share of responses from boat riders (53.9 percent) and commuter rail riders, (45.1 percent). This range also had the largest share of reported ages on every individual commuter rail line.

It should be noted that the age range from 45 to 64 had the longest span of years, with 20. If it had been subdivided into two 10-year ranges there would have been less contrast with the responses from commuter rail riders ages 22 to 34 and 35 to 44.

Figure 15
Demographics Questions

ABOUT ME

What is your age?
❏ Under 18   ❏ 18 to 21   ❏ 22 to 34
❏ 35 to 44   ❏ 45 to 64   ❏ 65 or over

Do you currently have a valid driver's license?
❏ Yes   ❏ No

How many usable vehicles are in your household?
❏ 0   ❏ 1   ❏ 2   ❏ 3 or more

What is your gender?
❏ Man   ❏ _____ (specify)
❏ Woman   ❏ Prefer not to say

How do you self-identify by race?
(Check all that apply.)
❏ American Indian or Alaska Native
❏ Asian
❏ Black or African American
❏ Native Hawaiian or other Pacific Islander
❏ White
❏ Other (specify) _____
❏ Prefer not to say

Are you Hispanic or Latino/Latina?
❏ Yes   ❏ No   ❏ Prefer not to say

How many people are in your household?
_____ (include yourself)

What is your current household income?
❏ Less than $14,500   ❏ $76,000 to $108,499
❏ $14,500 to $28,999   ❏ $108,500 to $151,999
❏ $29,000 to $43,499   ❏ $152,000 or more
❏ $43,500 to $57,999   ❏ Prefer not to say
❏ $58,000 to $75,999

Are you generally able to understand basic
directions spoken or written in English?
❏ Always   ❏ Often   ❏ Sometimes   ❏ Never
❏ Prefer not to say

In what language do you prefer to receive
information about riding the MBTA?
❏ English   ❏ Other (specify) _____

Passengers in the age range "under 18" accounted for the smallest number of age responses, at 1.9 percent. Responses by mode in this range varied little from the average except for 0.0 percent on ferries and 3.5 percent on buses. These responses understate ridership of passengers age 18 or younger, as young children cannot be expected to answer surveys, and students who could fill out forms typically have lower response rates than older passengers. The age range from 18 to 21 would also be expected to have a high proportion of students, many of whom would be transit-dependent. With only 5.1 percent of age responses, overall, it appears to be under-represented, even after adjusting for the smaller number of years in the range.

Passengers ages 65 or older accounted for 7.4 percent of age responses. The largest differences by mode from this average were on ferries (12.1 percent) and the Silver Line (10.4 percent.) The reasons for these differences were not apparent.

Figure 16
Age by Service Mode
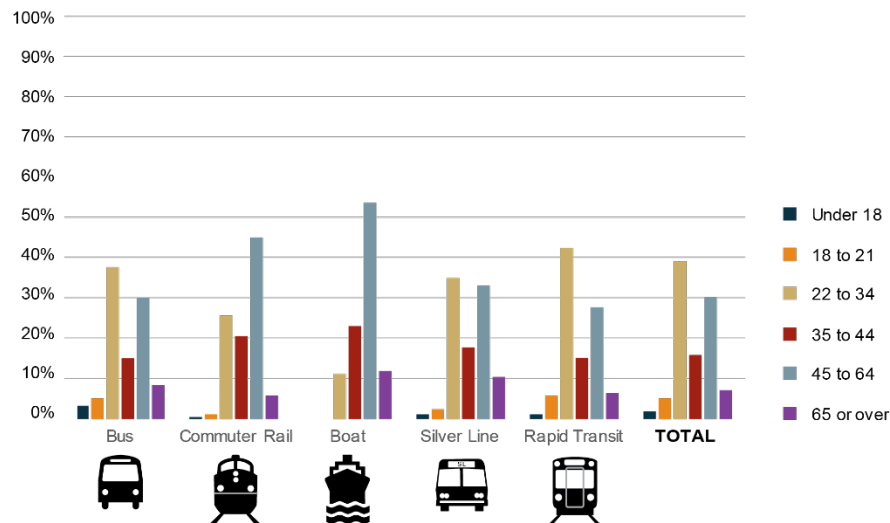
4.8.2 Gender

The check-off choices provided for this question were Man, Woman, a space for write-ins, and "Prefer not to say." Overall, 97 percent of the returned surveys had some response to the gender question. Of these, as shown in Figure 17, 59.0 percent checked woman, 38.7 percent checked man, and 0.2 percent wrote in something else. Another 2.0 percent checked "Prefer not to say." These results suggest a disparity in the response rates between female and male passengers rather than such a large difference in the actual ridership population.

Summarized by mode, buses showed the largest difference in response by gender, at 62.9 percent woman and 35.0 percent man. Ferries showed the smallest difference, at 50.4 percent woman and 48.2 percent man. At the sub-modal level, only eight bus routes, two commuter rail lines, and the Silver Line Waterfront routes had more responses from men than from women.

Figure 17
Gender by Service Mode
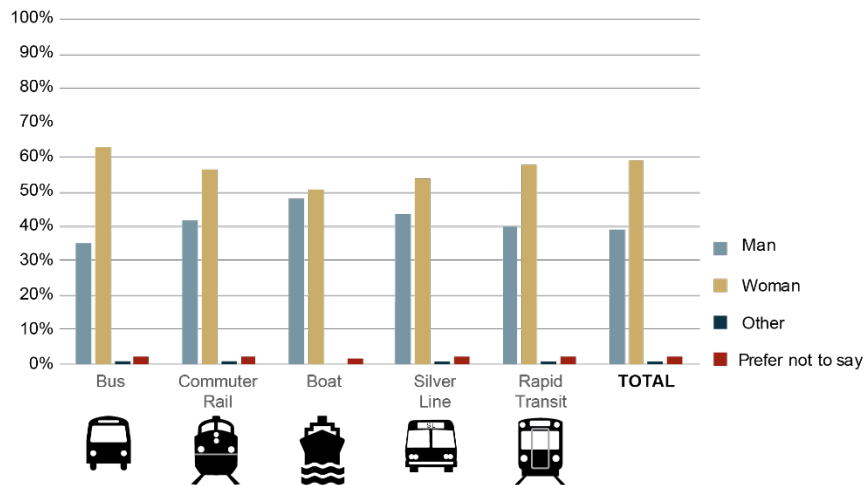
4.8.3   Annual Household Income and Income Classification

The survey form provided eight checkbox choices for household income ranges plus a choice of "Prefer not to say." This was the least-answered question on the survey, with 4 percent leaving it blank and 17 percent checking "Prefer not to say."

The threshold for low income was set at 60 percent of the median household income in the MBTA service area, as determined from the 2013 American Community Survey (ACS). The three lowest income ranges on the survey form, covering incomes of less than $43,500, were classified as low-income and the rest as non-low-income.

Overall, as shown in Figure 18, of the responses that specified income, 28.8 percent were from the low-income ranges and 71.2 percent from the non-low-income ranges. At the modal level, the proportion of low-income riders was largest on the bus system at 41.6 percent, and smallest on ferries (3.7 percent) and commuter rail (6.8 percent).

Figure 18
Income Classification by Service Mode
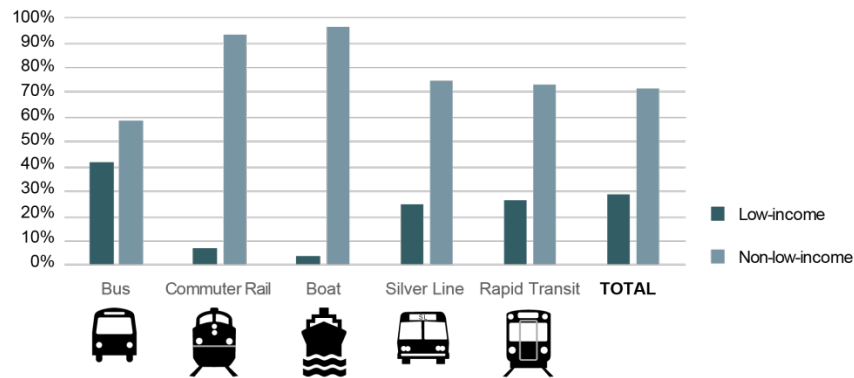
4.8.4   Race, Ethnicity, and Minority Classification

Two questions in the survey asked about race and ethnicity. For "How do you self-identify by race?" there were checkboxes for five specific choices, plus a line for write-ins of other races and a box for "Prefer not to say." Respondents could check all boxes that applied. For the question "Are you Hispanic or Latino/Latina?" there were checkboxes for Yes, No, and "Prefer not to say."

Overall 93.2 percent of returns checked a choice for the Hispanic Latino/Latina question. Of these, 10.2 percent checked Yes, 84.3 percent checked No, and 5.6 percent checked "Prefer not to say." At the modal level, the Yes percentage was largest on buses (13.3 percent) and smallest on ferries (0.2 percent) and commuter rail (3.7 percent).

Respondents who checked any race other than White or checked Yes for Hispanic Latino/Latina were classified as minority. Those who checked only White for race and checked No for Hispanic Latino/Latina were classified as nonminority. All other respondents provided insufficient information to be classified as minority or nonminority. Overall, 91.6 percent of survey forms had enough information to be classified as minority or nonminority. Of these, as shown in Figure 19, 34.3 percent overall were classified as minority and 65.7 percent as nonminority. At the modal level, the minority percentage was largest on buses (48.1 percent) and smallest on commuter rail (14.6 percent) and ferries (1.7 percent).

Figure 19
Minority Classification by Service Mode
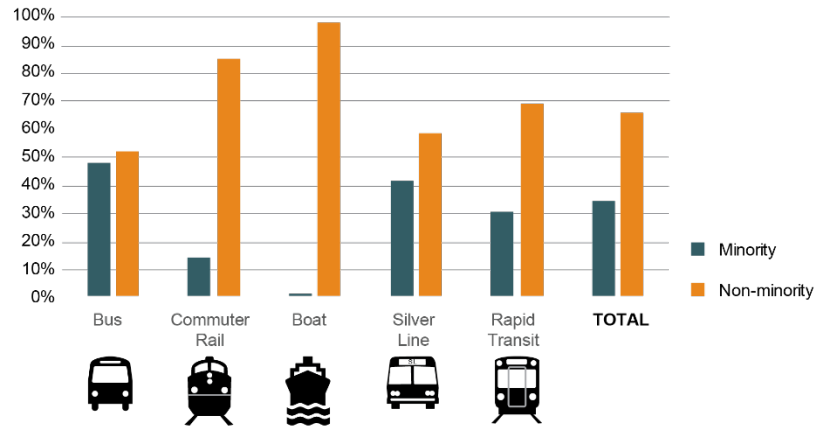
4.8.5 License

Overall, as shown in Figure 20, of respondents who answered whether or not they had valid driver's licenses, 79.4 percent responded Yes and 20.6 percent responded No. At the modal level, the percent of respondents with licenses was smallest on buses (68.5 percent) and largest on ferries (95.6 percent) and commuter rail (94.7 percent).

Figure 20
Possession of Valid Driver's License by Service Mode
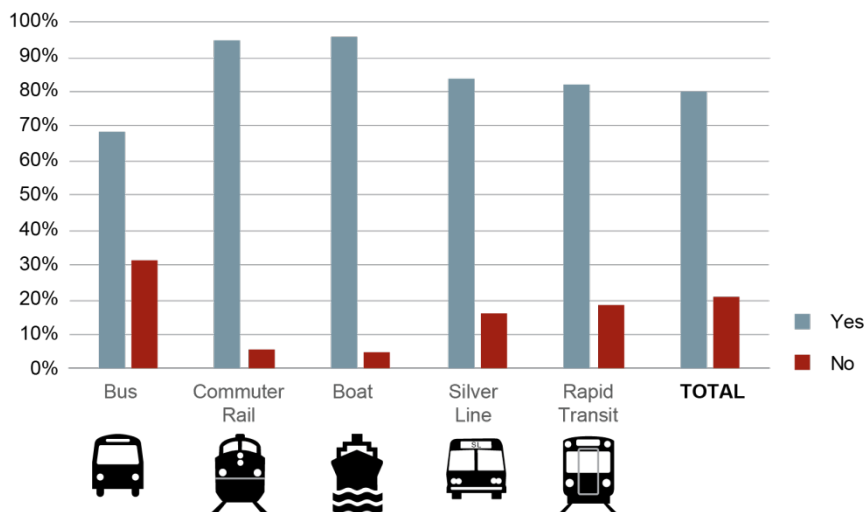
4.8.6 Vehicles per Household

Overall, as shown in Figure 21, the most common number of vehicles per household was one (39.7 percent), followed by zero (30.0 percent), two (23.3 percent), and three or more (7.0 percent).

At the modal level, the proportion of zero-vehicle households was largest on buses (39.2 percent) and smallest on ferries (4.6 percent) and commuter rail (5.2 percent). The percentage of households with three or more vehicles was greatest among commuter rail passengers (17.5 percent) and boat passengers (16.0 percent) and smallest on bus (4.4 percent).

Figure 21
Vehicles per Household by Service Mode
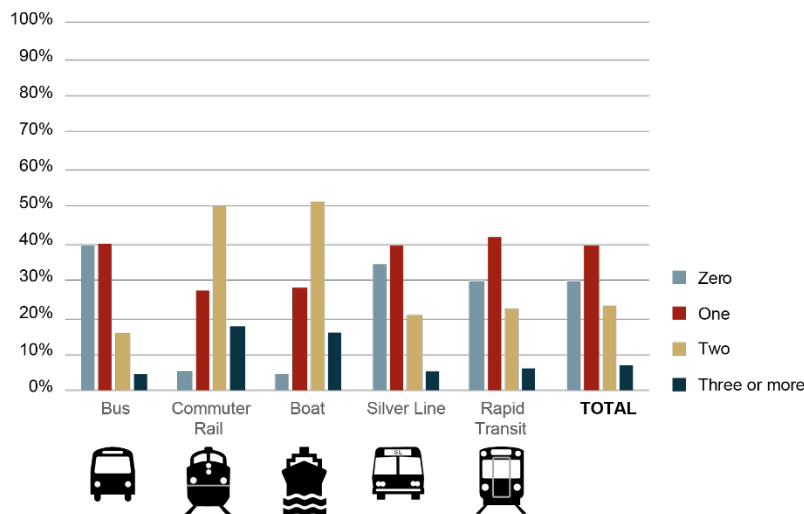
4.8.7 Vehicles per Capita

Potential vehicle availability depends not only on the number of vehicles per household but on the number of people who have to share these vehicles. A calculation of the number of vehicles per household divided by the number of people per household provides some measure of this, but understates availability to the extent that not all household members are licensed drivers with travel needs that require use of the household vehicles. For purposes of this calculation "three or more" was assumed to be three, so the per capita number of vehicles for respondents checking this choice may be understated.

For consistency with past surveys, the results for vehicles per capita were summarized in ranges, with increments of 0.5 from zero to two and then greater than two, as shown in Figure 22. Overall, the most common number of vehicles per capita was 0.5 to 0.99, at 30.8 percent. Values of 1.0 or more vehicles per capita should indicate that a vehicle was likely to be available, but overall only

22.3 percent of responses were in these ranges. At the modal level, only 15.4 percent of bus passengers had 1.0 or more vehicles per capita, compared with 39.1 percent of commuter rail passengers and 49.6 percent of boat passengers.

Figure 22
Vehicles per Capita by Service Mode
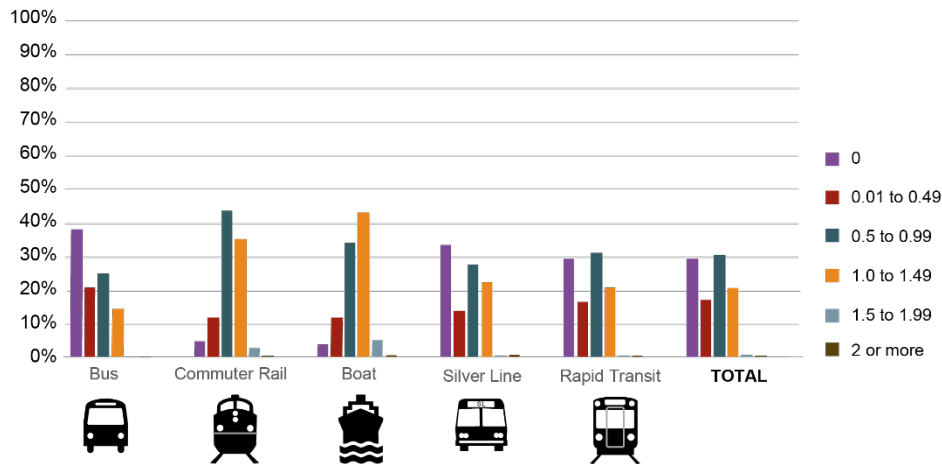
4.9   LANGUAGE

Information about language usage of survey respondents was determined through the languages in which the survey was completed and a question that asked respondents in which language they would prefer to receive information about the MBTA.

4.9.1 Survey Responses by Language

In addition to English, the online and paper survey forms were available in Spanish, Portuguese, Cape Verdean Creole, traditional Chinese, simplified Chinese, French, and Vietnamese. The online version was also available in Haitian Creole. These options were based on census data on the languages other than English most commonly used in the MBTA service area.

Despite efforts to publicize the availability of survey forms in multiple languages, the vast majority of returned forms (99.3 percent) used the English language version. Of the forms available in other languages, the one most commonly used was Spanish (0.37 percent), followed by simplified Chinese (0.12 percent), traditional Chinese (0.09 percent), and French (0.06 percent). Each of the other forms was used by less than 0.05 percent of all respondents.

4.9.2 Language Preference for MBTA Information

To help measure the need for providing information throughout the system in other languages, the final question on the survey form asked respondents to select a preferred language for receiving information about riding the MBTA. The choices were English or a write-in of another language.

Consistent with the predominance of the use of the English version of the survey form, 98.6 percent of the respondents who specified a language preference checked English. Respondents who checked English but also wrote in another language were counted as sufficiently proficient in English as not to require information in another language. The other languages written in by these respondents are not included in the following totals.

The responses indicating a preference only for a language other than English included write-ins for 39 different languages. Of these, the one most often written in was Spanish, on 0.74 percent of the forms with a specified preference, followed by Chinese (0.24 percent), French (0.08 percent), Portuguese (0.07 percent), Haitian Creole (0.04 percent), and Russian (0.04 percent). Of these, only Russian was not among the languages in which the survey form was available.

In absolute numbers, requests for the languages above ranged from 249 for Spanish to 13 for Russian. Each other language preference was specified by fewer than 10 respondents, including 18 languages specified by only one respondent each.

These results do not indicate how many passengers who were not proficient in English or in one of the other languages in which the survey form was available would have participated in the survey if the form had been available in their preferred languages. However, the low numbers of responses to forms in most of the languages offered other than English illustrates the difficulty of including non-English speakers in survey efforts.

Chapter 5—Comparisons with Prior Surveys

5.1   SURVEYS USED IN COMPARISONS

In this chapter, the results for selected questions on the 2015–17 survey are compared with those of the most recent previous surveys that included the same questions. For bus, commuter rail, boat, and rail rapid transit, the most recent past surveys were conducted in 2008–09.

The Silver Line bus rapid transit routes were not surveyed in 2008–09 because they had been covered in special surveys approximately two to three years prior. The Silver Line Washington Street had been surveyed in 2005 and the Silver Line Waterfront in 2006. However, some questions for which the responses to the 2015–17 survey and the 2008–09 survey can be compared were not included in the Silver Line surveys. All the Silver Line services were relatively new when surveyed, and ridership patterns may still have been stabilizing. In 2005, the Silver Line Washington Street included only what is now Route SL5.Given these limitations, Silver Line survey results are excluded from the comparisons below.

5.2   MINORITY STATUS

The 2015–17 survey results showed little change from 2008–09 in the percentage of minority passengers on any MBTA service mode. For all rail rapid transit lines combined, the percent of minority riders increased 2.2 percent. Only the Blue Line showed an increase much different from this average, at 9.6 percent. Other minority increases within this mode ranged from 1.2 percent on the Red Line to 2.5 percent on the Green Line.

For the commuter rail system overall, the minority percent decreased 0.2 percent. At the line level, changes ranged from a 2.9 percent decrease on the Lowell Line to a 3.2 percent increase on the Fitchburg Line, except for a 7.6 percent increase on the Fairmount Line. The latter increase was likely related to the opening of three new stations on this line in Boston neighborhoods and a fare change from Zone 1 to Zone 1A at Fairmount Station.

The Charlestown boat had an insufficient number of survey responses in 2015–17 for comparison with 2008–09. The Hingham-Rowes Wharf route showed a 4.9 percent decrease in minority passengers. The Hingham-Hull-Long Wharf route has been run as such only since 2013, when it replaced a Quincy-Hull-Long Wharf route. The present configuration showed a 2.2 percent increase in minority passengers compared with the former one.

The bus system overall showed a 0.7 percent increase from 2008–09 in minority passengers, but changes varied widely among routes. As noted previously, in some cases it was necessary to combine results from two or three routes serving the same general area to obtain enough responses to meet the criteria for a 10 percent confidence interval at a 90 percent confidence level.

The MBTA classifies 15 of the most heavily patronized bus routes in the system as key bus routes. These are Routes 1, 15, 22, 23, 28, 32, 39, 57, 66, 71, 73, 77, 111, 116, and 117. Each of these routes, except for 116 and 117, had enough responses in the 2008–09 and 2015–17 surveys to allow for comparisons of changes in their percentages of minority riders at a 95 percent confidence level. Most of the travel paths of Routes 116 and 117 overlap, so their combined survey responses along with those of Route 114, which is a short-turn variation, are also sufficient for comparisons at the 95 percent confidence level.

For each key bus route, an increase or decrease in the percentage of minority riders was considered to be statistically insignificant if the 2008–09 percentage fell within the confidence interval around the 2015–17 percentage. Under this standard, routes with significant changes in minority percentages were Routes 15 (-14.5 percent), 32 (+7.3 percent), and 114/116/117 (+10.1 percent).

Table 16 in Appendix A shows the percentages of minority riders on each of the key bus routes or groups in the 2008–09 and 2015–17 surveys, the confidence intervals for the 2015–17 surveys, and whether the changes were statistically significant.

5.3   LOW-INCOME STATUS

The 2015–17 survey results showed little change from 2008–09 in the percentage of low-income passengers on any MBTA service mode. For all rail rapid transit lines combined, the percent of low-income riders increased 2.4 percent. The Green Line, including all subway and surface segments, showed a decrease of 0.2 percent in low-income riders. Other lines showed increases in low-income riders as follows: Red Line, 2.8 percent; Orange Line, 3.1 percent; Blue Line, 6.3 percent; and Mattapan Trolley, 9.9 percent.

For the commuter rail system overall, the low-income ridership percent decreased 0.6 percent. At the line level, changes ranged from a 3.9 percent decrease on the Newburyport/ Rockport Line to a 3.1 percent increase on the Kingston/Plymouth Line, except for a 7.9 percent increase on the Fairmount Line. The latter increase was likely related to the same changes that impacted the minority ridership status—the opening of three new stations on the line and the change of fare zone for Fairmount Station.

Of the two boat routes that had enough survey responses for comparisons, the Hingham-Rowes Wharf route had a 0.2 percent increase in low-income riders and the Hingham-Hull-Long Wharf route had a 6.2 percent decrease. However, as noted above, the configuration of the latter route changed significantly starting in 2013.

The bus system overall showed a 0.2 percent increase in low-income riders, but changes varied widely among routes. Changes in the percentages of low-income riders on the key bus routes were examined using the same standards described above for changes in minority ridership. Routes with significant changes in low-income ridership were Routes 57 (+11.3 percent), 77 (+7.8 percent), and 111 (+24.7 percent).

The apparent significant change in low-income ridership for Route 111 appears to be an anomaly in the data. The census data for this route's service area does not show a similar increase in low-income population. Route 111 and Routes 114/116/117 all serve neighborhoods in the city of Chelsea, so the results for Route 111 were compared to the results for Routes 114/116/117 in both surveys. In the 2015–17 results, Route 111 had 59.5 percent low-income respondents, compared with 53.9 percent on Routes 114/116/117. In the 2008–09 survey results, Route 111 had 34.8 percent low-income respondents compared with 50.0 percent on Routes 114/116/117. The 2015–17 results are more likely indicative of the low-income population on Route 111 than the 2008–09 results given the results for Routes 114/116/117.

Table 17 in Appendix A shows the percentages of low-income riders on each of the key bus routes or groups in the 2008–09 and 2015–17 surveys, the confidence intervals for the 2015–17 surveys, and whether the changes were statistically significant.

5.4   LICENSED DRIVERS AND VEHICLES PER HOUSEHOLD

The MBTA bus, commuter rail, and boat networks had changes of less than 2.0 percent in the percentages of survey respondents with valid driver's licenses in 2015–17 compared with 2008–09. However, on the rail rapid transit network, the portion of respondents with licenses decreased 5.2 percent.

Among bus and commuter rail survey respondents, the percentage distributions of vehicle ownership were almost unchanged in 2015–17 compared with 2008–09. Among subway and light rail riders, the percentage of respondents who reported living in zero-vehicle households increased 2.5 percent, while the percentage of those living in two-vehicle households decreased 1.4 percent. The

largest changes in vehicle ownership occurred among boat riders, with a 6.5 percent increase in those living in one-vehicle households, and a 1.9 percent increase in those living in zero-vehicle households.

5.5 ALTERNATE MEANS OF TRANSPORTATION

A comparison of alternate means of transportation used by MBTA customers in 2008–09 and 2015–17 would be of interest because the 2008–09 survey predated the establishment of rideshare companies in the MBTA service area. However, the usefulness of comparing responses to this question is limited because survey respondents were allowed to check as many means of transportation as they used without specifying how frequently they used each one or whether they were used singly or in combination.

Additionally, the wording of the question differed among surveys conducted in different years. In the 2008–09 survey, respondents were asked to report alternatives used for the trip segment on which they received the survey form. In the 2015–17 survey, respondents were asked to report alternatives they used to make an overall trip, and when the results were shown at the unlinked trip level, the alternatives were included in the record for each link. Consequently, summaries of the use of alternatives at the mode level are misleading. For example, an alternate bus service shown in a record for a rapid transit link is more likely to refer to an alternate bus route used to access that link than to a bus service used instead of the rapid transit link.

Given the many factors limiting the comparability of the 2015–17 survey responses for alternate means of transportation with the responses from the most recent prior surveys, no meaningful comparisons can be made.

Appendix A—Tables of Key Findings

Key findings of the 2015–17 survey are presented in Chapter 4 of this report in narrative and bar-chart form. This appendix shows the results underlying the bar charts in table form. Where applicable, table titles include the figure number for the corresponding chart.

Table 1
Data for Figure 2–Trip Purpose by Service Mode

Trip Purpose	Bus	Commuter Rail	Boat	Silver Line	Rail Rapid Transit	Total
Home-based work	69.6	90.3	93.4	67.0	71.6	**72.9**
Home-based school	8.2	2.3	0.0	2.9	5.7	**5.9**
Home-based social/recreational	4.1	1.4	1.3	2.7	5.7	**4.7**
Home-based other	12.2	2.8	2.3	18.6	9.2	**9.6**
Non-home-based	5.9	3.2	3.0	8.9	7.9	**6.9**

Table 2
Data for Figure 4–Alternative Means of Travel by Service Mode

Alternative Means of Travel	Bus	Commuter Rail	Boat	Silver Line	Rail Rapid Transit	Total
Walk	22.8	0.1	1.9	24.6	17.4	**17.8**
Bicycle	10.2	4.1	3.4	11.0	11.1	**10.2**
Drive alone	15.3	48.9	31.0	18.7	24.0	**23.2**
Carpool	18.1	19.4	13.7	17.3	17.1	**17.6**
Taxi or rideshare company	21.5	4.0	4.2	26.7	19.0	**18.7**
Private shuttle or other transit	4.0	2.9	1.9	5.2	3.7	**3.7**
Other MBTA service	48.4	42.4	65.1	41.4	46.0	**46.4**
All other	0.7	0.3	0.0	0.5	0.6	**0.6**

Table 3
Data for Figure 6–Initial Access Mode to or Final Egress Mode from MBTA by Service Mode

Initial Access or Final Egress	Bus	Commuter Rail	Boat	Silver Line	Rail Rapid Transit	Total
Walk or bicycle	96.1	53.1	52.8	95.8	87.9	**85.6**
Drive alone	1.1	31.1	38.9	1.3	4.5	**7.3**
Carpool	0.1	2.3	3.3	0.4	0.8	**0.8**
Drop-off or pick up (personal vehicle)	1.0	9.7	3.4	0.7	2.4	**2.9**
Drop-off or pick up (other)	1.6	3.9	1.7	1.9	4.4	**3.4**

Table 4
Data for Figure 8–Transfer Modes to or from Other MBTA Services by Service Mode

Transfer from or Egress to	Bus	Commuter Rail	Boat	Silver Line	Rail Rapid Transit	Total
Bus or Silver Line	33.1	14.6	9.7	25.0	38.2	**35.3**
Rail Rapid Transit	65.2	79.2	53.8	63.9	52.5	**57.5**
Commuter Rail or Boat	1.7	6.2	36.6	11.1	9.3	**7.2**

Table 5
Data for Figure 10–Frequency of Making Reported Trip Using the MBTA by Service Mode

Frequency of Use	Bus	Commuter Rail	Boat	Silver Line	Rail Rapid Transit	Total
6 or 7 days per week	12.9	2.5	3.4	9.6	8.2	**9.0**
5 days per week	54.4	69.4	69.0	51.2	56.1	**56.9**
3 or 4 days per week	14.4	18.0	19.0	12.4	13.8	**14.4**
1 or 2 days per week	7.7	4.5	2.9	5.1	7.5	**7.2**
1 to 3 days per month	4.8	2.4	2.9	6.4	5.5	**5.0**
Less than once per month	5.8	3.2	2.8	15.4	8.9	**7.6**

Table 6
Data for Figure 12–Fare Payment Method by Service Mode

Fare Type	Bus	Commuter Rail	Boat	Silver Line	Rail Rapid Transit	Total
Monthly pass	69.9	76.7	67.5	67.2	73.8	**72.8**
Pay-per-ride fare	22.3	21.1	31.4	25.9	20.9	**21.5**
1-day or 7-day LinkPass	6.6	0.1	0.0	3.7	4.4	**4.6**
Other	1.2	2.1	1.1	3.3	0.8	**1.1**

Table 7
Data for Figure 13–Monthly Pass Type by Service Mode

Monthly Pass Type	Bus	Commuter Rail	Boat	Silver Line	Rail Rapid Transit	Total
Reduced fare	17.1	0.2	0.0	13.4	10.5	**11.3**
Local Bus	9.8	0.0	0.0	6.7	0.0	**2.9**
LinkPass or Express Bus	68.9	0.4	0.0	64.4	76.4	**66.1**
Commuter Rail or Boat	4.2	99.4	100.0	15.5	13.1	**19.7**

Table 8
Data for Figure 14–Pay-per-ride Fare Type by Service Mode

Pay-Per-Ride Fare Type	Bus	Commuter Rail	Boat	Silver Line	Rail Rapid Transit	Total
Full cash fare on board	2.9	9.5	6.8	1.8	0.1	**1.9**
Reduced fare	15.8	13.2	17.2	14.4	11.1	**12.8**
mTicket (single or multi-ride)	0.0	37.2	19.1	0.0	0.0	**3.6**
CharlieCard (plastic)	78.9	0.0	0.0	78.5	82.9	**73.3**
CharlieTicket (paper)	2.3	40.1	57.0	5.3	6.0	**8.4**

Table 9
Data for Figure 16–Age by Service Mode

Age range	Bus	Commuter Rail	Boat	Silver Line	Rail Rapid Transit	Total
Younger than 18	3.5	0.8	0.0	1.1	1.5	**1.9**
18 to 21	5.3	1.6	0.0	2.7	5.7	**5.1**
22 to 34	37.5	26.1	10.9	35.0	42.7	**39.3**
35 to 44	15.4	20.4	23.1	17.8	15.5	**16.0**
45 to 64	29.9	45.1	53.9	33.0	27.8	**30.3**
65 or older	8.5	6.0	12.1	10.4	6.9	**7.4**

Table 10
Data for Figure 17–Gender by Service Mode

Gender	Bus	Commuter Rail	Boat	Silver Line	Rail Rapid Transit	Total
Man	35.0	41.3	48.2	43.7	39.8	**38.7**
Woman	62.9	56.3	50.4	53.8	57.9	**59.0**
Other	0.2	0.1	0.0	0.1	0.2	**0.2**
Prefer not to say	2.0	2.3	1.4	2.3	2.0	**2.0**

Table 11
Data for Figure 18–Income Classification by Service Mode

Household Income	Bus	Commuter Rail	Boat	Silver Line	Rail Rapid Transit	Total
Low income	41.6	6.8	3.7	24.9	26.5	**28.8**
Non-low income	58.4	93.2	96.3	75.1	73.5	**71.2**

Table 12
Data for Figure 19–Minority Classification by Service Mode

Minority Status	Bus	Commuter Rail	Boat	Silver Line	Rail Rapid Transit	Total
Minority	48.1	14.6	1.7	41.7	30.8	**34.3**
Nonminority	51.9	85.4	98.3	58.3	69.2	**65.7**

Table 13
Data for Figure 20–Possession of Valid Driver's License by Service Mode

Driver's License	Bus	Commuter Rail	Boat	Silver Line	Rail Rapid Transit	Total
Yes	68.5	94.7	95.6	83.6	81.9	**79.4**
No	31.5	5.3	4.4	16.4	18.1	**20.6**

Table 14
Data for Figure 21–Vehicles per Household by Service Mode

Household Vehicles	Bus	Commuter Rail	Boat	Silver Line	Rail Rapid Transit	Total
Zero	39.2	5.2	4.6	34.1	29.8	**30.0**
One	40.3	27.2	27.8	39.7	41.7	**39.7**
Two	16.1	50.1	51.6	20.5	22.1	**23.3**
Three or more	4.4	17.5	16.0	5.7	6.5	**7.0**

Table 15
Data for Figure 22–Vehicles per Capita by Service Mode

Vehicles per capita	Bus	Commuter Rail	Boat	Silver Line	Rail Rapid Transit	Total
0	38.4	5.1	4.2	33.7	29.5	**29.5**
0.01 to 0.49	21.0	12.0	12.1	14.2	16.7	**17.4**
0.5 to 0.99	25.2	43.9	34.0	27.8	31.4	**30.8**
1.0 to 1.49	14.6	35.3	43.1	22.5	21.1	**20.8**
1.5 to 1.99	0.4	2.9	5.4	0.8	0.8	**0.9**
2.0 or more	0.4	0.8	1.1	1.1	0.5	**0.5**

Table 16
Changes in Percent of Minority Riders on Key Bus Routes
in 2008–09 and 2015–17 Surveys

Route	2008-09 Percent Minority	2015-17 Percent Minority	2015-17 Confidence Interval	Change in Percent Minority	Change exceeds Confidence Interval
1	40.3	36.5	4.7	-3.8	No
15	89.9	75.3	9.8	-14.5	Yes
22	88.4	89.6	5.3	1.2	No
23	90.7	84.9	6.5	-5.8	No
28	94.2	92.2	4.8	-2.0	No
32	68.2	75.5	4.9	7.3	Yes
39	36.6	36.0	5.0	-0.6	No
57	32.3	28.5	5.5	-3.9	No
66	38.0	39.9	5.0	2.0	No
71	22.2	24.1	5.9	1.9	No
73	22.9	19.5	5.5	-3.4	No
77	24.8	24.0	5.7	-0.8	No
111	56.6	62.2	6.1	5.7	No
114/116/117	49.8	59.9	7.1	10.1	Yes

Table 17
Changes in Percent of Low-Income Riders on Key Bus Routes
in 2008–09 and 2015–17 Surveys

Route	2008-09 Percent Low-Income	2015-17 Percent Low-Income	2015-17 Confidence Interval	Change in Percent Low-Income	Change exceeds Confidence Interval
1	31.6	33.7	4.7	2.1	No
15	61.7	67.2	11.7	5.5	No
22	66.2	70.0	8.5	3.8	No
23	57.9	59.0	8.2	1.0	No
28	73.5	65.0	9.3	-8.5	No
32	40.7	42.7	6.3	1.9	No
39	31.7	27.4	5.0	-4.3	No
57	31.5	42.7	6.3	11.3	Yes
66	43.4	40.1	5.1	-3.4	No
71	21.6	21.1	5.9	-0.5	No
73	17.4	20.6	5.7	3.1	No
77	27.2	35.1	6.6	7.8	Yes
111	34.8	59.5	6.5	24.7	Yes
114/116/117	50.0	53.9	7.5	3.9	No