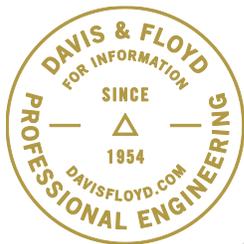# Appendix 1-B: CARTA I-26 Alternatives Analysis - Passenger Ridecheck Survey Report

Draft Report – February 2016

CARTA I-26 ALTERNATIVES ANALYSIS: PASSENGER RIDECHECK SURVEY TECHNICAL MEMORANDUM

RSG
the science of insight | **5.19.2015**

PREPARED FOR:
BERKELEY-CHARLESTON-DORCHESTER COUNCIL OF GOVERNMENTS

SUBMITTED BY:
RSG

IN COOPERATION WITH:
ETC INSTITUTE

CARTA I-26 ALTERNATIVES ANALYSIS: PASSENGER RIDECHECK SURVEY TECHNICAL MEMORANDUM

PREPARED FOR:
BERKELEY-CHARLESTON-DORCHESTER COUNCIL OF GOVERNMENTS

CONTENTS

1.0   STUDY PURPOSE AND DESCRIPTION

The Berkeley-Charleston-Dorchester Council of Governments (BCDCOG) is presently conducting an analysis of potential alternative transportation options along I-26 between Charleston and Summerville. As part of this effort, formally known as the I-26 Regional Fixed Guideway Transit Alternatives Analysis (I-26ALT), BCDCOG has commissioned an origin-destination (OD) study of the travel patterns of riders on existing bus routes. Bus service in the region is provided by the Charleston Area Regional Transportation Authority (CARTA). CARTA serves approximately 15,000 riders each weekday (according to the results of this study).

Data collection for this study was done in three parts:

Boarding and alighting counts. Project staff recorded boardings and alightings at each stop on each bus route, providing estimates for daily ridership and activity at each stop.

On-to-off Survey. This low-burden survey provides an understanding of boarding and alighting patterns on certain high-ridership routes. In other words, in addition to providing boarding and alighting *counts* at each stop, on-to-off counts provide the additional information of the boarding and alighting *pair* for each surveyed rider. On-to-off surveying was conducting on four CARTA routes: 1, 10, 11, and 12.

Full OD Survey. This survey provides a comprehensive overview of transit riders, including: (a) travel patterns, (b) fare payment, (c) travel purpose, (d) means of access and egress to/from the system, (e) time of travel, and (f) socio-demographics. The data collected from this effort were expanded and weighted using the data collected from the on-to-off survey and boarding and alighting counts.

2.0   SAMPLING

The study team developed a sampling plan for weekday travel between 6:00am and 9:00pm. Counting and surveying were conducted only on weekdays. All three efforts (boarding and alighting counts, the on-to-off survey, and the OD survey) were based on sampling plans constructed around the following four time periods:

- AM Peak (6:00 a.m. – 9:29 a.m.)
- Midday (9:30 a.m. – 3:29 p.m.)
- PM Peak (3:30 p.m. – 6:29 p.m.)
- Evening (6:30 p.m. – 8:59 p.m.)

BOARDING AND ALIGHTING COUNTS

Using tablet computers, staff noted the number of riders boarding and alighting at each stop along every CARTA route. Counts were recorded for a minimum of 30% of bus trips by route, time of day, and direction.

ON-TO-OFF SURVEY SAMPLING

The four routes along the I-26 corridor with the highest ridership were selected for on-to-off sampling. The sampling plan for the On-to-off survey was designed to obtain completed surveys from a minimum of 20% of the trips on each sampled route. This ensured that the on-to-off survey database could adequately support data expansion requirements for the full survey.

FULL OD SURVEY SAMPLING

The RSG team prepared sampling plans for each of the CARTA weekday fixed routes. The sampling plans target a number of complete surveys on each route equal to 7-10% of the estimated daily ridership. Ridership estimates were based on the boarding and alighting counts and the on-to-off survey data where available.

3.0 SURVEY INSTRUMENT

The on-to-off survey involved the use of cards with unique barcodes, which allowed survey staff to record the time and location of each rider's boarding and alighting (Figure 1). By design, the on-to-off survey puts a very low burden on the respondent; this encourages a high response rate and an accurate boarding/alighting matrix.

FIGURE 1: EXAMPLE OF ON-TO-OFF SURVEY CARD

The data collected for the on-to-off survey were as follows:

- Route;
- Boarding location;
- Boarding time;
- Alighting location;
- Alighting time

The full OD survey was administered by an interviewer with a tablet computer. The full questionnaire can be seen in the appendix.

The data collected for the full OD survey including the following:

- Route
- Any other transit routes used and number of transfers
- Time of trip
- Origin
- Boarding location
- Alighting location
- Destination
- Origin and destination type (e.g. home, work)
- Access and egress modes
- Fare type
- Home address of respondent
- Gender, race, and income, and age of respondent

4.0   SURVEY ADMINISTRATION

Boarding and alighting counts took place November 12th through December 1st, 2014. On-to-off surveys were conducted throughout all times of day and took place November 13th through December 1st, 2014. OD surveys were conducted throughout all times of day and took place January 20th through February 12th, 2015. Survey Staff were trained by ETC supervisors with detailed instructions for all three data collection efforts.

The ETC Supervisory staff focused their efforts on several bus routes per week. The staff supervised a group of approximately 16-20 interviewers per day.

Counting and the two surveys were administered on weekdays (Monday-Thursday) from roughly 6:00am to 9:00pm.

4.1 | BOARDING AND ALIGHTING COUNT ADMINISTRATION

The boarding and alighting counts are conducted using a tablet computer with special software allowing a staff member to capture the number of riders who board and alight at each stop. As the bus comes to a stop, the staff member first indicates that a stop is being made. At that point, the tablet records both a time stamp and location. Once this indication has been made, the surveyor tallies the number of riders getting off and on the bus.

If the surveyor begins a trip and there are already riders on the bus from the previous trip, the number of riders is recorded. Likewise, when the bus reaches the end of a trip, the number of riders aboard is captured. These counts are necessary to balance the boarding and alighting activity for the trip.

4.2 | ON-TO-OFF SURVEY ADMINISTRATION

The on-to-off survey collects passenger boarding and alighting pairs for all fixed bus routes by utilizing plastic cards equipped with barcodes. Staff distribute the cards to all riders as they board, passing each card through a scanner as it is distributed. Riders are asked to return the card to staff when they alight, at which time the barcode is scanned again. Each time the card is scanned, the location and time are recorded.

4.3 | OD SURVEY ADMINISTRATION

Interviewers select riders at random to participate in the survey based on the sampling goals established for each route. Once an interviewer selects a rider for the survey, the interviewer does the following:

- The interviewer approaches the person selected and asks them to participate in the survey.
- If the person refuses, the interviewer ends the survey, but the refusal is recorded to help assess the overall response rate to the survey.
- If the rider agrees to participate, the interviewer asks if he/she has at least five minutes to complete the survey.

- If the rider does NOT have at least five minutes, the surveyor asks the rider to provide his/her boarding location, alighting location, name, and phone number. ETC Institute's call center the contacts the respondent within 48 hours and asks him/her to complete the survey by phone. If a respondent cannot or will not provide a phone number, then a printed copy of the survey with prepaid return postage is provided. This ensures that short trips are well represented.
- If the respondent has at least five minutes, the surveyor administers the full survey to the respondent as a face-to-face interview using a tablet computer.

4.4 | SURVEY TOTALS

Final counts for both the on-to-off and full OD surveys, along with estimated daily ridership based on the boarding and alighting counts (and on-to-off survey data where available) are presented in Table 1 for all routes.

TABLE 1: SURVEY COUNTS AND RIDERSHIP

ROUTE	OD	ON-TO-OFF	EST. RIDERSHIP
1 James Island-North Charleston Express	89	231	788
2 Mt. Pleasant - West Ashley Express	111		584
3 Dorchester Road Express	32		249
4 NASH Express	9		106
10 Rivers Avenue	383	773	3,713
11 Dorchester/Airport	185	308	1,436
12 Upper Dorchester AFB	127	243	1,142
13 Remount Road	28		302
20 King Street/Citadel	59		588
21 Rutledge Grove	5		82
30 Savannah Highway	42		522
31 Folly Road	20		238
32 North Bridge	42		599
40 Mt. Pleasant	71		649*
41 Coleman Boulevard	18		84
102 North Neck	31		205
103 Leeds Avenue	21		192
104 Montague Avenue	32		294
105 North Area Shuttle NASH	7		39
201 North Beltline	4		86
203 Medical University Shuttle	46		560
210 Aquarium/ CofC DASH	86		1,212
211 Meeting/King DASH	133		1,840
213 Lockwood/Calhoun DASH	40		541
301 St. Andrews	41		580
Total	**1662**	**1555**	**16,632**

*Updated ridership

5.0   DATA PROCESSING

5.1 | DATA CLEANING

COMPLETENESS OF DATA

Incomplete surveys were not counted toward the survey returns. For the on-to-off survey, a complete survey simply required the return of the plastic card containing a barcode at the respondent's alight stop or station. Barcodes which were distributed but not returned were considered to be incomplete surveys.

For the Full OD study, the tablet survey tool did not allow the interviewer to continue through the survey if a question was left unanswered. The only exceptions were certain demographic questions, which some respondents might have been uncomfortable answering (e.g., household income). Therefore, a completed survey was one which had every question answered except those few demographic questions. If, while interviewing a respondent, it was found the respondent could not finish the survey, that survey was marked incomplete and was not counted toward the quota goal.

REAL-TIME DATA REVIEW

To ensure that accurate and quality data were collected, completed surveys were reviewed by field supervisors upon receipt. Field supervisors then provided feedback and additional training to interviewers. Real-time review had the added benefit of calculating the number of surveys completed by time period. Additionally, it provided overall daily progress, the progress of each route, and the progress of the surveyors. This information was also used in the creation of the weekly progress reports.

REAL-TIME GEOCODING

Because a web-based tablet survey was used to conduct and administer intercept interviews, addresses and intersections collected during field interviews were instantaneously geocoded with nearly 100% accuracy because the tablets were equipped with 4G/3G service and interface with Google Maps in real-time. In addition, after addresses and intersections were geocoded, the survey software plots the locations on a map, which served as a visual aid that interviewers used to confirm accurate information was gathered.

INTERVIEWER TRACKING AND MONITORING

ETC tracked the location of their equipment and surveyors using GPS technology. Each surveyor was assigned a surveyor number and a route. Because the equipment used to administer the survey was GPS-enabled, supervisors know where each of their surveyors was located at any given time.

Field Supervisors also rode along with each surveyor periodically throughout the day to check on their accuracy and productivity.

VERIFICATION OF DATA COLLECTION

The following data cleaning steps were taken after data collection:

- Checking for valid home, origin, and destination street names, city names, and zip codes;
- Ensuring the number of household occupants was greater than or equal to the number of employed members of the household and the number of adults in the household;
- Ensuring the respondents who indicated that they were employed also reported that at least one member of their household was employed;
- Ensuring that transit route/line names and stops/stations were consistently spelled/coded
- Ensuring that transfers to/from other transit routes/lines were possible, with some leeway provided for riders who walk several blocks to reach their next route;
- Ensuring the time of day a survey was completed was reasonable given the published operating schedule for the route;
- Ensuring the origin and destination addresses are not the same;
- Ensuring that the boarding and alighting addresses are not the same;
- Ensuring the boarding and alighting addresses make sense for the route;
- Ensuring that the respondent did not list the same route twice;
- Checking to be sure the access/egress mode is appropriate given the distance of travel from the trip origin/destination to place where the respondent boarded/alighted transit; and
- Reviewing the total distance on transit compared to the total trip distance.

VISUAL INSPECTION

This step involved a visual inspection of the trip record. The key tasks that were conducted as part of this visual inspection include the following:

- Visually inspecting and examining key variables of survey trips with very short distances;
- Visually inspecting the sensibility of trips with zero transfers or three or more transfers;
- Visually inspecting the sensibility of drive access/egress trips given the distance traveled by car relative to the distance traveled by transit;
- Visually inspecting the sensibility of drive access/egress trips with more than one transfer;
- Visually inspecting sensibility of the origin-to-destination path with respect to the survey route that was used for the trip; and
- Visually inspecting the routes reported being used for the trip.

If a record passed all of the visual checks and verifications listed above, the record was classified as "useable" and tagged for inclusion in the final survey database.

5.2 | DATA WEIGHTING/EXPANSION

The RSG/ETC team recognized the importance of weighting data to the most disaggregate level possible and followed a multi-step process similar to one used on FTA-driven OD studies.

First, bus stops were assigned to segments based on geography. Survey, on-to-off, and APC records were assigned to one of two time periods: an early period (9:00am to 3:30pm) and a late period (3:30pm to 9:00pm).

ROUTES WITH ON-TO-OFF

For routes on which the team conducted an on-to-off survey, the weighting process included three main steps:

- Create a boarding/alighting matrix using the on-to-off survey dataset
- Weight surveys to proportionally reflect the on-to-off matrix by boarding and alighting segments, route, and time of day.
- Expand Full OD survey dataset to average daily ridership by route, time of day, and direction.

ROUTES WITHOUT ON-TO-OFF

For routes with no on-to-off survey, weighting was slightly simpler. Data were weighted and expanded to match average ridership for each boarding segment (not boarding-alighting pair) by route, time of day, and direction.

6.0 RIDER PROFILE

The survey collected detailed information on CARTA's diverse riding population. The demographic data presented below reflect the entire weighted sample.

6.1 | DEMOGRAPHICS

Women outnumber men in the sample 54% to 46% (Figure 2). Well over half of the respondents (65%) identified as Black/African-American with another 32% identifying as White (Figure 3). Just under 20% reported an annual household income of under $10,000, and median annual household income was in the $20,00-$30,000 range (Figure 4). Just under half (48%) of the respondents were under 35 years of age (Figure 5).
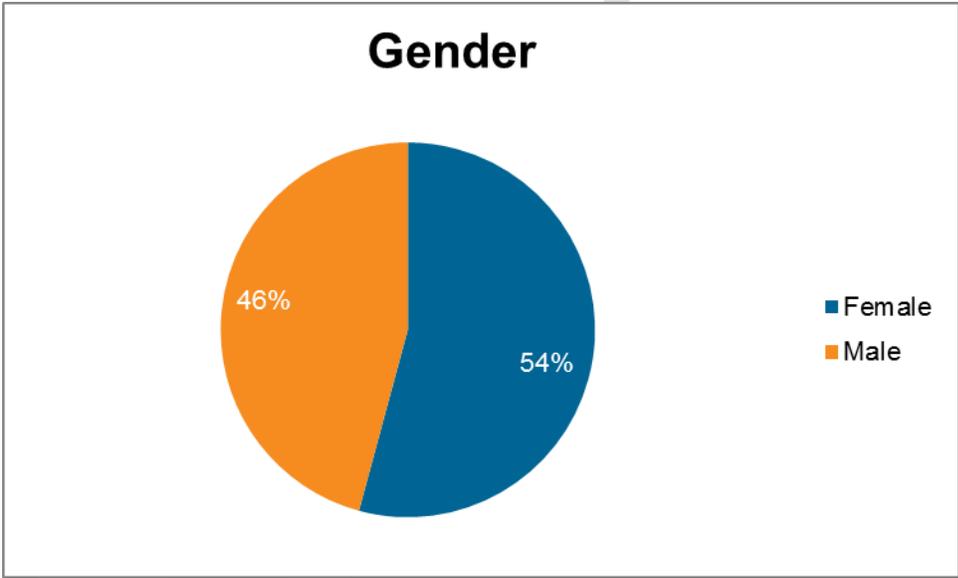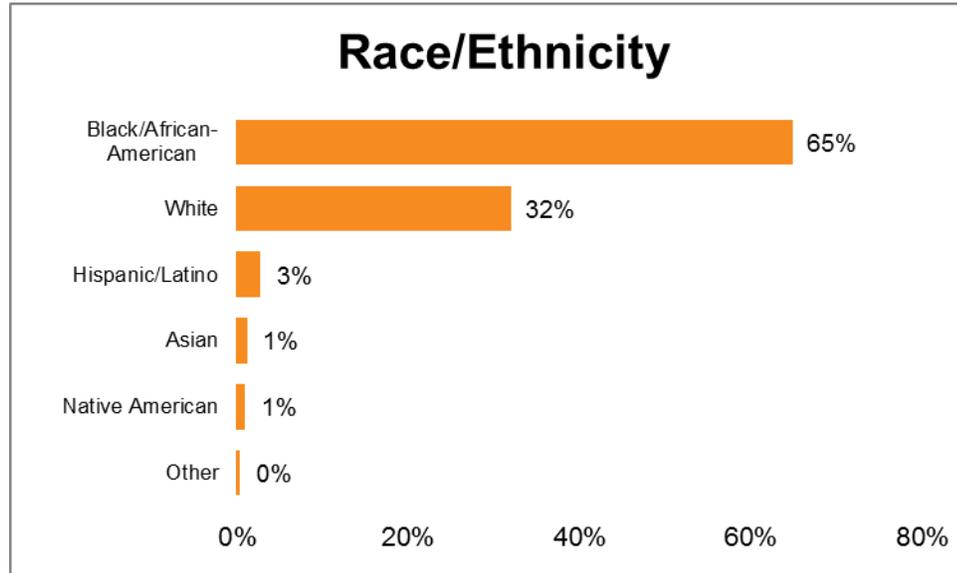
FIGURE 2: GENDER

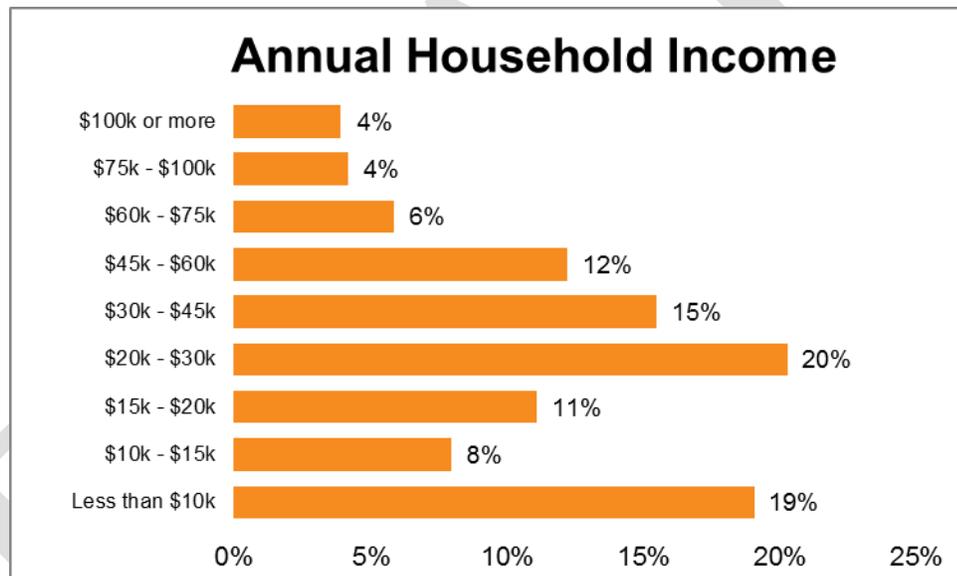**FIGURE 3: RACE**

FIGURE 4: INCOME

Age

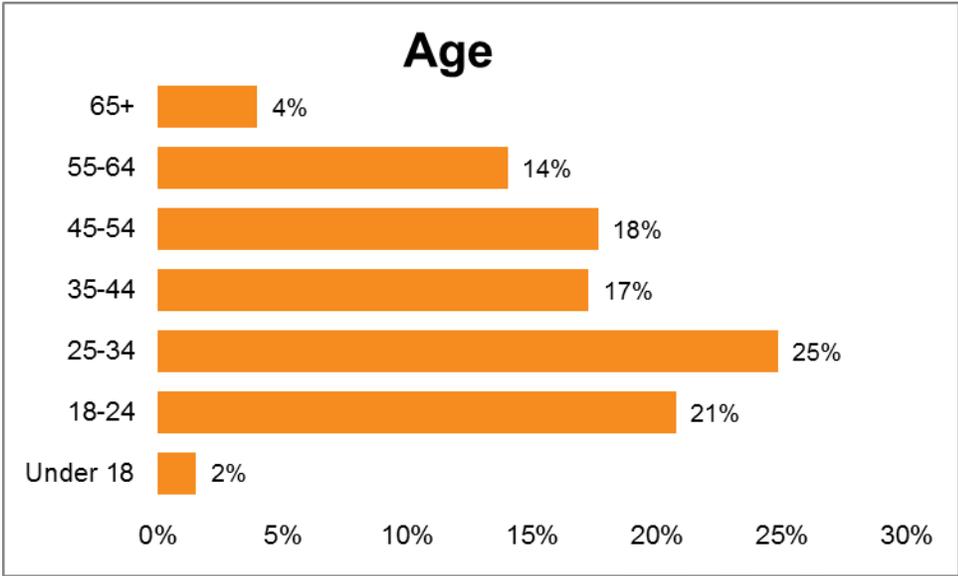| Age	Percent
65+	4%
55-64	14%
45-54	18%
35-44	17%
25-34	25%
18-24	21%
Under 18	2%

6.2 | CHOICE RIDERSHIP

Respondents were asked whether they had the option to use a car for their trip. Those who have such an option are commonly referred to as "choice" riders, while those without an automobile alternative are referred to as "captive" riders. Three quarters of the sample is composed of captive riders (Figure 6).

FIGURE 6: CHOICE RIDERSHIP

Choice Ridership
(Respondent could have used a car for their trip)

- No: 75%
- Yes: 25%

Berkeley-Charleston-Dorchester Council Of Governments
CARTA I-26 Alternatives Analysis: Passenger Ridecheck Survey Technical Memorandum
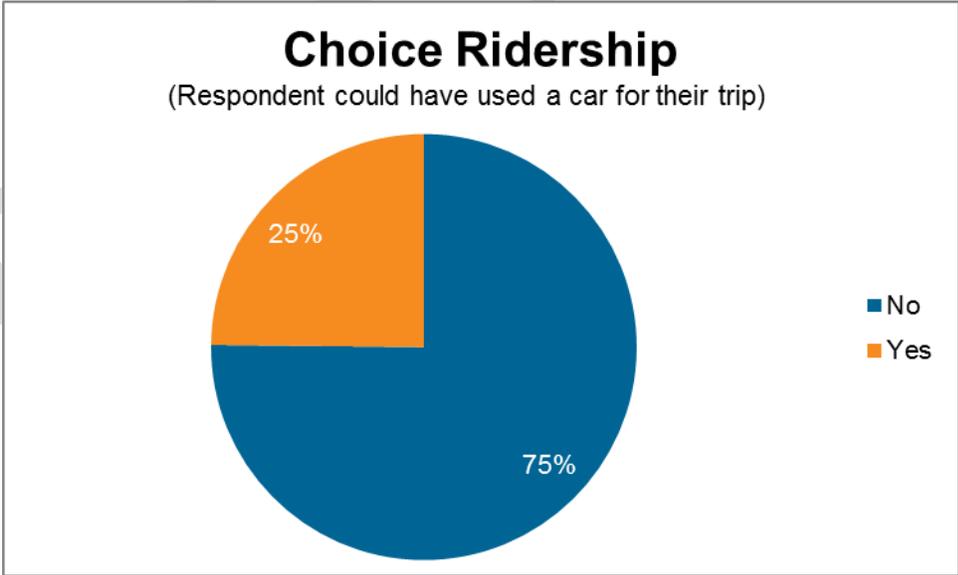
7.0   TRIP PROFILE

In addition to characteristics of the riders themselves, the survey collected data on the nature of each trip. Here, we present trip data segmented by in-corridor vs. non-corridor routes, which may be useful in anticipating ridership and farebox revenue on a future light rail system.

7.1 | TRIP PURPOSE

The most common trip type in the sample was home-based work (i.e. commute) trips. Home-based school trips (which include both K-12 and college) comprised 11% of all trips. An atypically high percentage of trips, 13%, neither originated nor terminated at the respondent's home.

FIGURE 7: TRIP PURPOSE
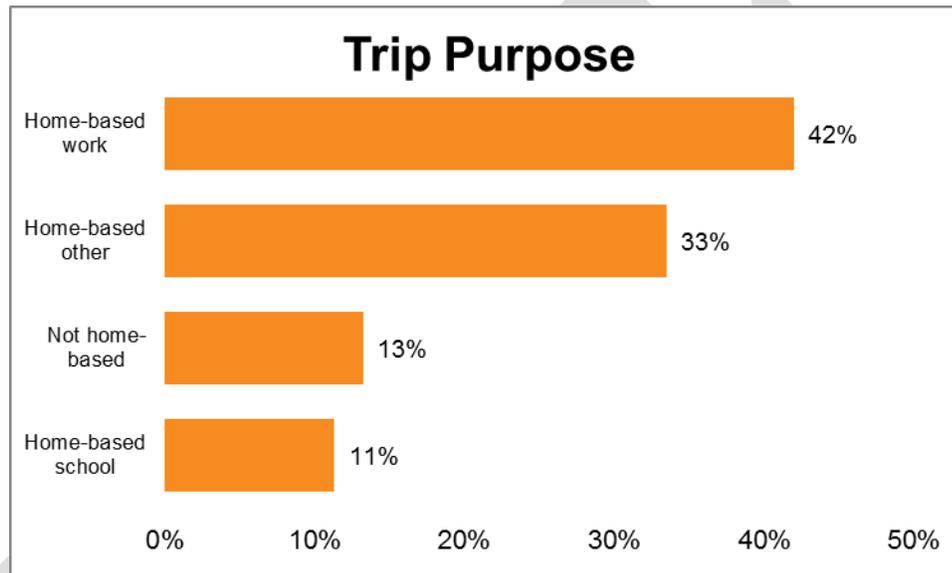
7.2 | FARE PAYMENT

Most riders pay a single full fare (50%), ride with a Student ID or Employee ID (23%), or pay a discounted fare (12%) (Figure 8). Among the 12% paying a discounted half, about half pay the Low Income fare (Figure 9).
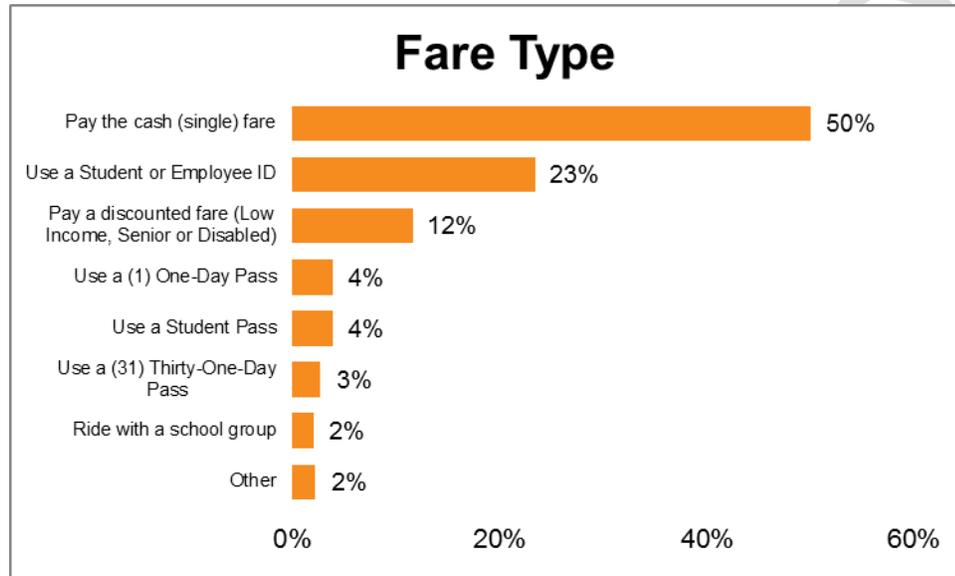
FIGURE 8: FARE TYPE

Fare Type

Fare Type	Percentage
Pay the cash (single) fare	50%
Use a Student or Employee ID	23%
Pay a discounted fare (Low Income, Senior or Disabled)	12%
Use a (1) One-Day Pass	4%
Use a Student Pass	4%
Use a (31) Thirty-One-Day Pass	3%
Ride with a school group	2%
Other	2%

FIGURE 9: FARE DISCOUNT

Fare Discount Type

| Fare Discount Type	Percentage
Low Income fare	49%
Senior fare	30%
Disabled Patrons/Regular Fixed Route fare	19%
Disabled Patrons/Tel-A-Ride Service fare	2%

7.3 | ACCESS AND EGRESS MODE

Respondents were asked how they traversed the "first and last mile" of their transit trip. Both their access and egress modes are combined in Figure 10. Walking is by far the most

common way to get to and from the bus stop, with a significant number also driving. Relatively few riders bike or carpool.
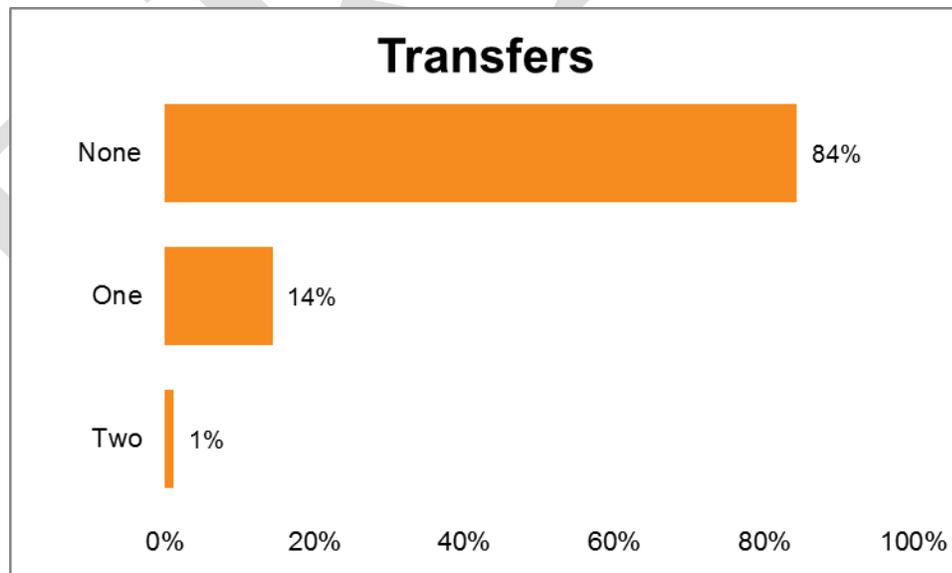
FIGURE 10: ACCESS AND EGRESS
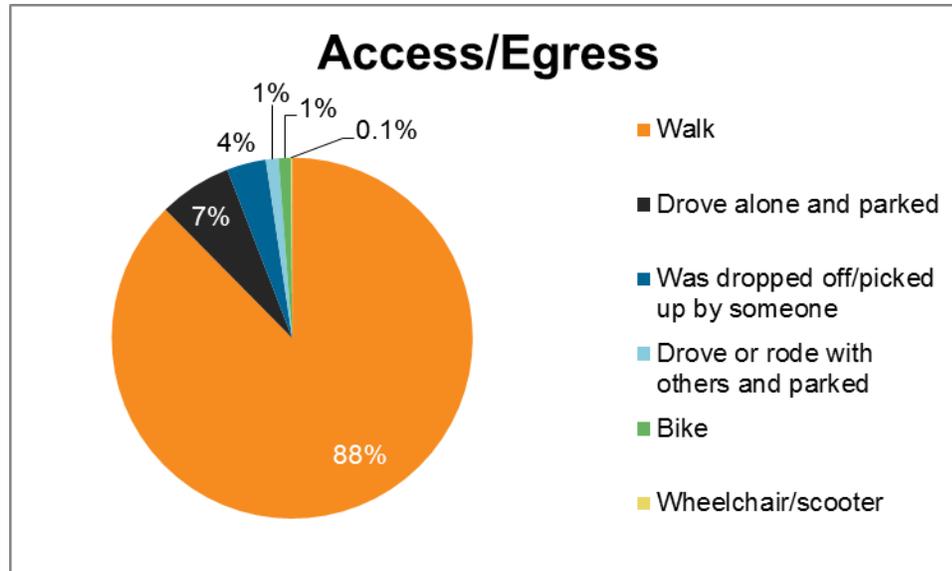
7.4 | TRANSFERS

Survey respondents provided their entire transit path, which included any transfers. Most riders (84%) ride just a single bus, with a combined 16% making one or two transfers (Figure 11).

FIGURE 11: TRANSFERS

8.0 TRIP ANALYSIS

Figure 12 is map showing estimated daily origins (trip production) for several regions of the Charleston area. Downtown is by far the busiest district, with North Charleston, West Charleston, Mount Pleasant, Goose Creek, and Summerville also contributing large numbers of trips.

FIGURE 12: DAILY TRIP PRODUCTION

Legend

districts

- Downtown - 7012
- North Charleston - 4463
- West Charleston - 1350
- Mount Pleasant - 759
- Goose Creek - 458
- Summerville - 277
- Ravenel - 39
- Johns Island - 29
- Eastern Charleston - 27
- Berkeley - 24
- Daniel Island South - 22
- Dorchester - 9
- 0 trips