HAMPTON ROADS TRANSIT

Regional Origin and Destination Study 2016

PREPARED BY ETC INSTITUTE & HAMPTON ROADS TRANSIT
APRIL 2017

gohrt.com

Contents

EXECUTIVE SUMMARY

INTRODUCTION

Hampton Roads Transit provides regional transit service to six cities in the Hampton Roads region of Virginia – Chesapeake, Hampton, Newport News, Norfolk, Portsmouth, and Virginia Beach. In FY2016, HRT carried 15.2 million passengers; inclusive of bus, rail, and ferry transit riders. The HRT fixed-route bus system consists of approximately 70 fixed-routes, with local service (53 routes), Express Service (ten routes), Peninsula Commuter Service (five routes), and seasonal service in Virginia Beach (three routes). HRT also operates The Tide light rail service and the Elizabeth River Ferry. The 2016 Regional Origin & Destination Study provides data, information, maps, and graphical representations of the regional transit system. The system is comprised of six independent cities whose travel patterns, based on the results of this survey, are truly regional in nature. The details of the Study and the updated origin and destination data provides HRT staff, leadership, the TDCHR (HRT's governing board), the six-member cities, stakeholders and the public, information highlighting who are riders are, where they are going, and how they get there. This information is critical in HRT's decision-making processes, short and long-term regional strategies related to transit, growth in the region, and the regional economy that transit supports. The data shows that our riders do not recognize city boundaries or lines in their travel patterns. Therefore, we must continue to create, expand, and foster a transit system that supports the regional travel behaviors and patterns that are exhibited in the findings of this Study.

Survey Summary and Key Findings

The full report, as provided in Chapters 1 - 5, will offer details of the findings of the 2016 Origin and Destination Study. As a preview to these chapters, and based on the expanded weekday survey data (unlinked weighted passenger trips), there are several key findings to be highlighted. The first is that the majority of HRT's riders ride the system regularly and frequently; 71% of all HRT riders use the HRT transit system 4-7 days per week. Riders are utilizing the system primarily to travel to and from home and work. Seventy-six (76%) percent of riders identified that they are employed full or part-time, making HRT's transit service critical for employment and access to opportunity. To get to one of HRT's approximately 2,800 transit stops, 92% of customers' access and egress mode to the stop is by walking. This figure underscores the need for complete streets within the service area allowing for safe and accessible service to those who walk, bike, and use other modes to access HRT transit service. The Study also finds that HRT's riders are highly transit dependent, with 89% of riders not having a car available to use for their trip. Therefore, regular, frequent, and on-time service is critical to allow our customers to get home, to work, go shopping, and "do-life" with Hampton Roads Transit providing the means for them to travel from their origin and to their destination.

Other key findings include:

- Approximately ¾ of trips consist of riders traveling home, to work, or shopping
- Transportation Network Companies (TNC's), like Uber and Lyft, accounted for only 0.10% of the mode by which HRT riders accessed transit.
- Most customers pay their fare with cash (91%)
- The HRT rider demographics are skewing younger. In 2016, 56% of riders identified as being between the ages of 18 – 34, as compared to 53% in 2014
- Twenty-one percent (21%) of riders were over the age of 45
- System-wide and across all modes, the majority of HRT riders are women (55%)
- Nearly ninety percent (88.9%) of all HRT riders have a smartphone
- Fifteen percent (15%) of riders identified themselves as students; including, approximately 12% as full/part-time college/university students and 3% are students in grades K-12
- Approximately 50% of riders live in households with incomes of less than $25,000 per year
- Ninety-nine percent (98.76%) of riders use two or fewer routes to complete their one-way trip

REPORT OVERVIEW

This report provides an overview and detailed description of the 2016-2017 HRT on-board study process. The report covers the Study's Purpose/Background, the Survey Design, Sampling, and Administration Methodology. The report will also cover the Quality Control process before, during, and after the study.

The 2016 Hampton Roads Transit (HRT) regional on-board origin and destination survey was conducted by ETC Institute, with collection occurring between August 2016 and early December 2016. Minimal data collection occurred during January and February 2017 to improve the overall distribution by targeting specific route, direction, and time of day data to improve the overall distribution and segments. The magnitude of the survey will allow regional planners to better understand the needs and travel patterns of many specialized populations. The on-board survey was completed for bus, rail, and ferry riders in HRT's six-city service area; including, Chesapeake, Hampton, Newport News, Norfolk, Portsmouth and Virginia Beach.

HRT staff has utilized the data and information provided through ETC's data collection efforts to develop the 2016 Origin & Destination Study report. The data has been thoroughly analyzed to provide graphics, tables, and summary information to help users of this report understand the travel patterns and related information of HRT riders throughout the system. This report includes how the region utilizes the transit system (Chapter 2), demographic information of HRT riders (Chapter 3), a new section featuring maps of the tripmaking behaviors of HRT customers across modes and routes (Chapter 4), and concludes with the survey methodology (Chapter 5).

Acronyms and Abbreviations

ACRONYM	DEFINITION
BA	Boarding & Alighting/Boarding & Alighting Counts
ETC	ETC Institute (or identified as the Survey Administrator)
FTA	Federal Transit Administration
GIS	Geographic Information System
GPS	Global Positioning System
HRT	Hampton Roads Transit
IPF	Iterative Proportional Fitting
MAX	Metro Area Express
O&D	Origin and Destination/Origin and Destination Survey
O2O	On-to-Off/ On-to-Off Survey
PnR	Park and Ride
Project	Hampton Roads Transit (HRT) regional on-board origin and destination survey
QA/QC	Quality Assurance/Quality Control
RFP	Request for Proposal
Study	Hampton Roads Transit (HRT) regional on-board origin and destination survey
Title VI	Title VI of the Civil Rights Act of 1964
VDOT	Virginia Department of Transportation

Chapter 1

Study Overview, Survey, Design & Administration

HAMPTON ROADS TRANSIT

CHAPTER 1: STUDY OVERVIEW, SURVEY DESIGN, & ADMINISTRATION

OVERVIEW

Purpose of the Survey

The purpose of this project was to gather updated travel information and behavior data from Hampton Roads Transit (HRT) riders. The information gathered will serve several objectives, including:

- Improving transit forecasts by updating the Virginia Department of Transportation's (VDOT) regional travel demand model,
- Gathering updated travel behavior data from transit users in the regional service area to gain a better understanding of today's transit riders,
- Supporting transit planning and operations activities based on observed ridership patterns and preferences,
- Allow for updated Environmental Justice and Title VI analysis and reporting.

The data and information collected, and as presented in this report, demonstrate that HRT is truly a regional transit system with a customer base who live, work, and engage in activities not only within their city of origin, but throughout the region. The 2016 Origin & Destination Study also shows the diverse ways in which our customers travel and interact within HRT's regional transit system network through their travel patterns and mode choices.

Date/Time Period of the 2016 O&D Study

The majority of the 2016 Hampton Roads Transit (HRT) regional on-board origin and destination survey collection was administered from August 2016 through early December 2016 and avoided all school breaks and holidays. Minimal data collection also occurred during January and February 2017 to improve the overall distribution by targeting specific routes, direction and time of day data.

Survey Administrator and Survey Elements

ETC Institute, the firm who administered the survey, is a nationwide leader in performing O&D surveys for the Federal Transit Administration (FTA). ETC has worked directly with the FTA modeling and planning staff to help establish guidelines for O&D methodologies. The methodology used for this survey was similar to those employed in more than 30 intercept interview based collections conducted by ETC Institute since 2009; including, the HRT 2013-2014 O&D Survey. The procedures used for this and the previous survey, continue to be developed with extensive input from the FTA and following national reviews of best practices in on-board survey research methods.

The survey consisted of four major elements as listed below:

- The On-to-Off (O2O) Counts are intended to identify boarding to alighting paths on a given route trip.
- The Boarding and Alighting (BA) Counts are intended to capture the volume of activity for the boardings and alightings on a given route trip.
- The Park and Ride (PnR) Counts are intended to assess the number of vehicles and passengers utilizing these facilities. These counts, along with the O2O and BA counts, are utilized to create the expansion template for the interview.
- The Origin & Destination (O&D) Survey is the core of the effort. The Survey consists of a detailed interview of riders conducted on-board rail, bus, and ferry routes. This data is expanded to the template created using the first three elements of the survey.

SURVEY DESIGN AND ADMINISTRATION

Pilot Survey Summary

A pilot test was conducted from August 16 - 17, 2016. The purpose of the pilot test was to assess all aspects of the survey including survey design, sampling methodology, implementation, and data processing tasks. The overall goal was to complete 100 Origin & Destination (O&D) Intercept Surveys. The actual number of O&D Intercept Surveys that were completed in the field was 201, of these 164 were classified as useable (82% recovery rate). Based on the results of the pilot test, the Survey Administrator recommended that the O&D survey proceed as scheduled with limited superficial changes.

Sampling Plan Summary

To ensure that the distribution of completed surveys mirrored the actual distribution of riders, the survey administrator developed a sampling plan that ensured: the completion of Boarding-Alighting counts on over 700 system trips, On-to-Off counts with at least 8,500 of the system's riders, park and ride counts for designated locations, and a full Origin & Destination Survey with at least 5,300 of the system's riders during the weekdays - representing 10% of HRT's average daily ridership (Tuesday – Thursday). Monday and Friday have more variations in trips than Tuesday through Thursday; therefore, were not included as part of the weekday. A sampling plan was developed that ensured the completion of 800 of the system's riders on the weekend (Saturday). The table below shows the overall sampling plan rates, goals, records completed, and percentage obtained of the goal.

PROJECT TASK	SAMPLING RATE	GOAL	COMPLETED	% COLLECTED
Boarding & Alighting Counts	50% Daily Trip (Ridership Above 500)	716	787	110%
On-To-Off Survey	20% of Daily Ridership (Ridership Above 500)	7,575	14,123	186%
Park and Ride Counts	Assigned Park and Ride Lots	13	13	100%
Weekday O&D Survey	10% of Daily Ridership/10% Rail Station	5,312	6,959	131%
Weekend O&D Survey	800 Weekend Rider Records	800	803	100%

Survey Weighting and Expansion Summary

Expanding and weighting is used to make the sample collected representative of system-wide and route specific HRT ridership. Survey records are "expanded" to represent the total average weekday ridership of each route by time-period and direction (see Chapter 5: Survey Expansion Overview for detailed information on survey data expansion). O&D surveys for Rail were expanded by direction/time of day and by the boarding and corresponding alighting rail station of the rider. For the HRT Bus and Ferry services, the surveys were expanded by route, direction, time of day, and the boarding and corresponding alighting segment of the rider. Overall, there are over 1,300 different weight factors in the final database. The average weight factor is 9.168 which means, on average, each survey record represents approximately nine (9) HRT riders. The average weight factor reflects and is representative of the appropriate ridership for a route, time-period and direction.

Data Quality Assurance and Processing Summary

The quality assurance/quality control (QA/QC) process was implemented throughout the survey's administration and after its completion, with proven post-processing quality check techniques. The establishment of specific sampling goals and procedures for managing the goals ensured that a representative sample was obtained from each route. Training of surveyors/interviewers, with high levels of oversight by team leaders, ensured that the survey was administered properly. Also, the use of the latest geocoding/survey review tools used by the survey administrator's Transit Review Team contributed to the high-quality results that were achieved.

Chapter 2

How the Hampton Roads Region Utilizes the HRT System

HAMPTON ROADS TRANSIT

CHAPTER 2: HOW THE HAMPTON ROADS REGION UTILIZES THE HRT SYSTEM

Hampton Roads Transit – Rider Travel Characteristics

Hampton Roads Transit (HRT) is the regional transit system for Hampton Roads. The integration of the transit system, through the connection of bus routes across cities, ferry connection between cities, and riders accessing light rail in all six jurisdictions makes it truly a regional transit system.

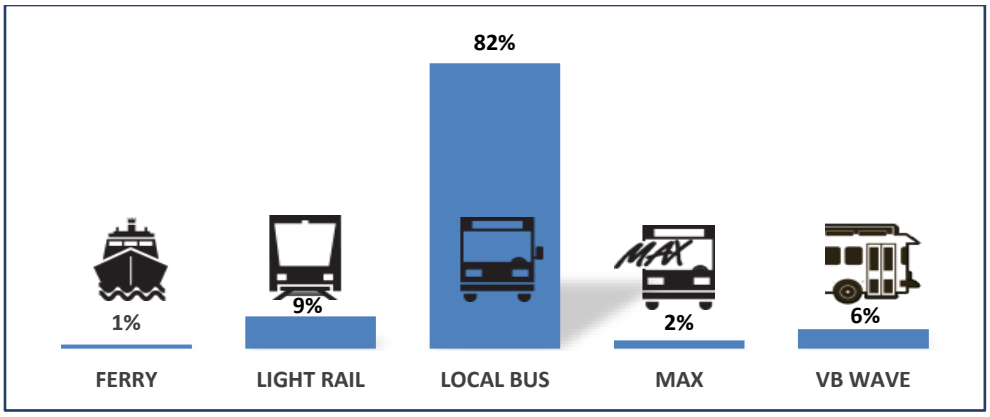
Chapter Two (2) focuses on how the Hampton Roads Region utilizes the transit system. This Chapter highlights and identifies key characteristics and aspects of customer travel within the regional system. The highlights of the chapter include selected demographic and trip-related findings from the survey based on the type of service; bus, rail, MAX routes, and the ferry. The survey provides insight to how HRT customers access transit, how often, the origin of their trip, and how they pay their fare among other data elements. The results of this information identify how the system is utilized, and may be used in the future to enhance the transit system and understand patterns that can positively impact the agency, cities, and region's approach to high quality transit service.

Note: All information provided throughout this report is based on expanded weekday ridership data unless otherwise stated.

Mode

The majority of HRT's transit riders utilize fixed-route bus service to get to and from their origin and destination. This mode of transit accounts for 82% of weekday trips. Other modes of service include; The Tide, HRT's light rail service providing 9% of passenger trips, followed by the VB Wave (seasonal service) at 6%, MAX service at 2%, and the Elizabeth River Ferry providing 1% of trips.

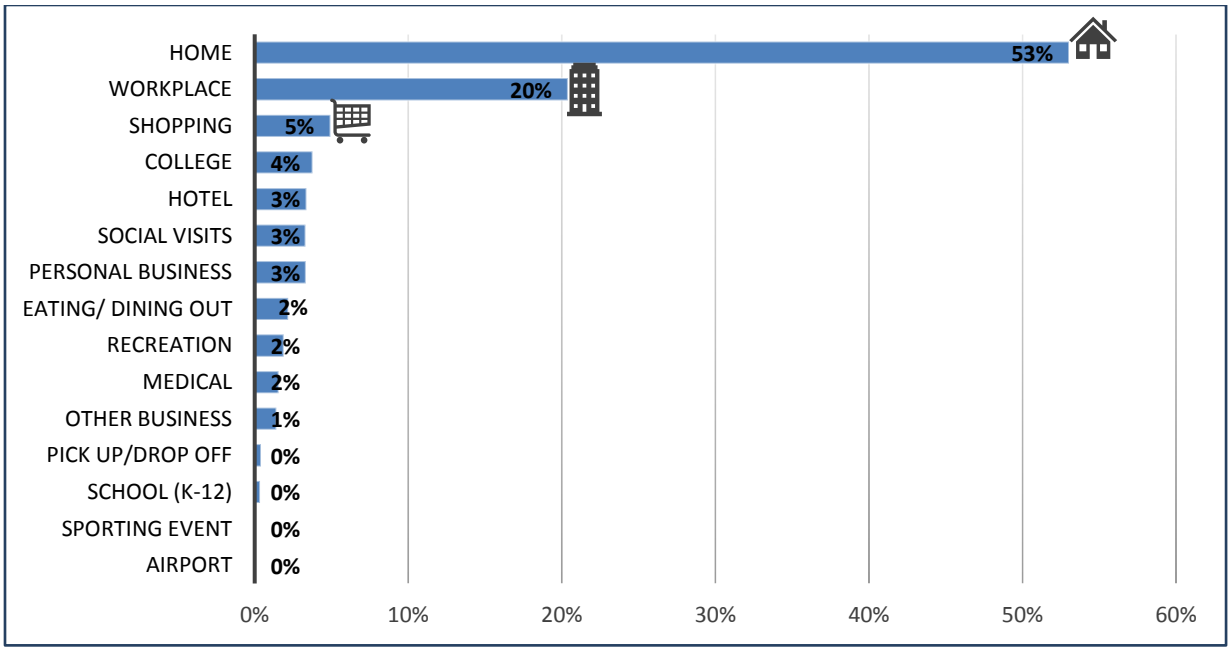
Figure 2-1: Ridership by Mode - Weekday



Most Common Trip Origins

Over half of riders named their home as the most common trip origin at fifty-three (53%) percent, followed by travel originating from their workplace (20%). Transit riders are demonstrating the highest trip patterns that allow them to travel from home and from work. There are several other destinations that make up the genesis of the passenger trip; these trips account for approximately 27% of the travel origins. Other key origins include shopping, social visits, college, personal business, hotel, and recreation.

Figure 2-2: Most Common Trip Origins



Most Common Trip Origins by Service Type

Table 2-1: Most Common Trip Origins by Service Type

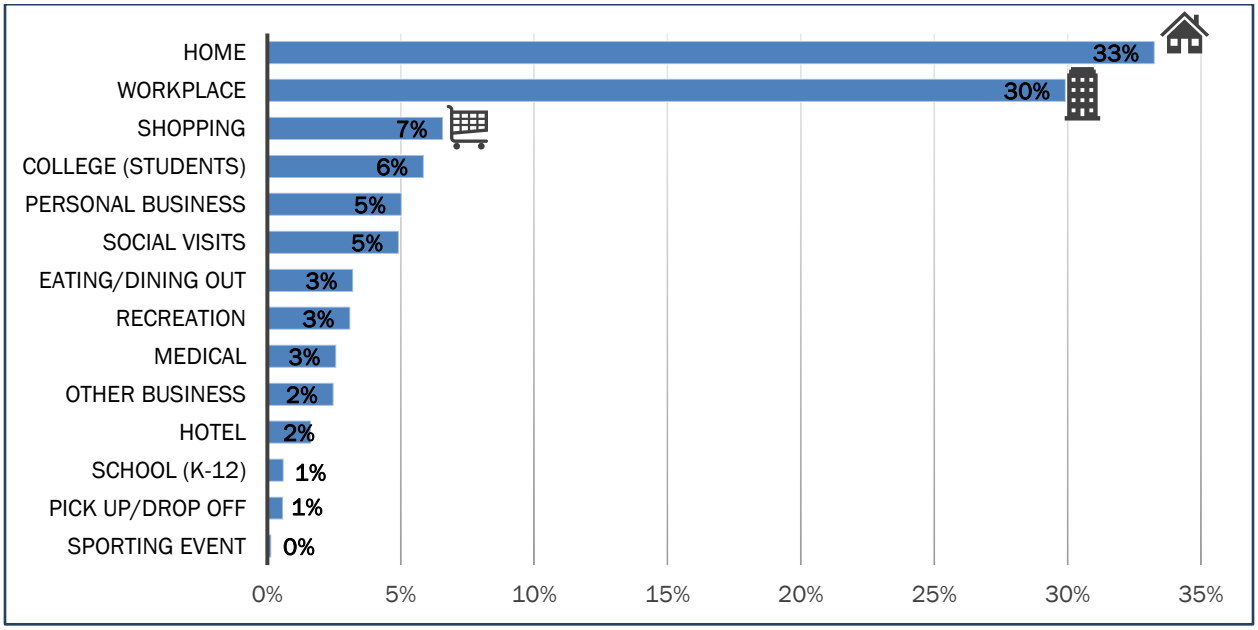
	AIRPORT	COLLEGE	EATING/ DINING OUT	HOME	HOTEL	MEDICAL	OTHER BUSINESS	PERSONAL BUSINESS
System Total	**0%**	**4%**	**2%**	**53%**	**3 %**	**2%**	**1%**	**3%**
Ferry	0%	0%	0%	1%	0%	0%	0%	0%
Light Rail	0%	1%	0%	4%	0%	0%	0%	0%
Local Bus	0%	3%	1%	47%	1%	1%	1%	3%
MAX	0%	0%	0%	2%	0%	0%	0%	0%
VB Wave	0%	0%	1%	0%	3%	0%	0%	0%

	PICK UP/ DROP OFF	RECREATION	SCHOOL (K-12)	SHOPPING	SOCIAL VISITS	SPORTING EVENT	WORKPLACE
System Total	**0.4%**	**2%**	**0.3%**	**5%**	**3%**	**0.0%**	**20%**
Ferry	0%	0%	0%	0%	0%	0%	1%
Light Rail	0%	0%	0%	0%	0%	0%	1%
Local Bus	0%	1%	0%	4%	3%	0%	18%
MAX	0%	0%	0%	0%	0%	0%	1%
VB Wave	0%	1%	0%	0%	0%	0%	0%

Most Common Trip Destinations

The most common trip destination for riders is their home (33%), followed by travel to their workplace (30%). Transit riders are demonstrating the highest trip patterns that allow them to travel to home and to work. There are several other destinations that make up the terminus of the passenger trip; these trips account for approximately 38% of the travel destinations. Other key destinations included shopping, social visits, recreation, and college.

Figure 2-3: Most Common Trip Origins by Service Type



Most Common Trip Destinations By Service Type

Table 2-2: Most Common Trip Origins by Service Type

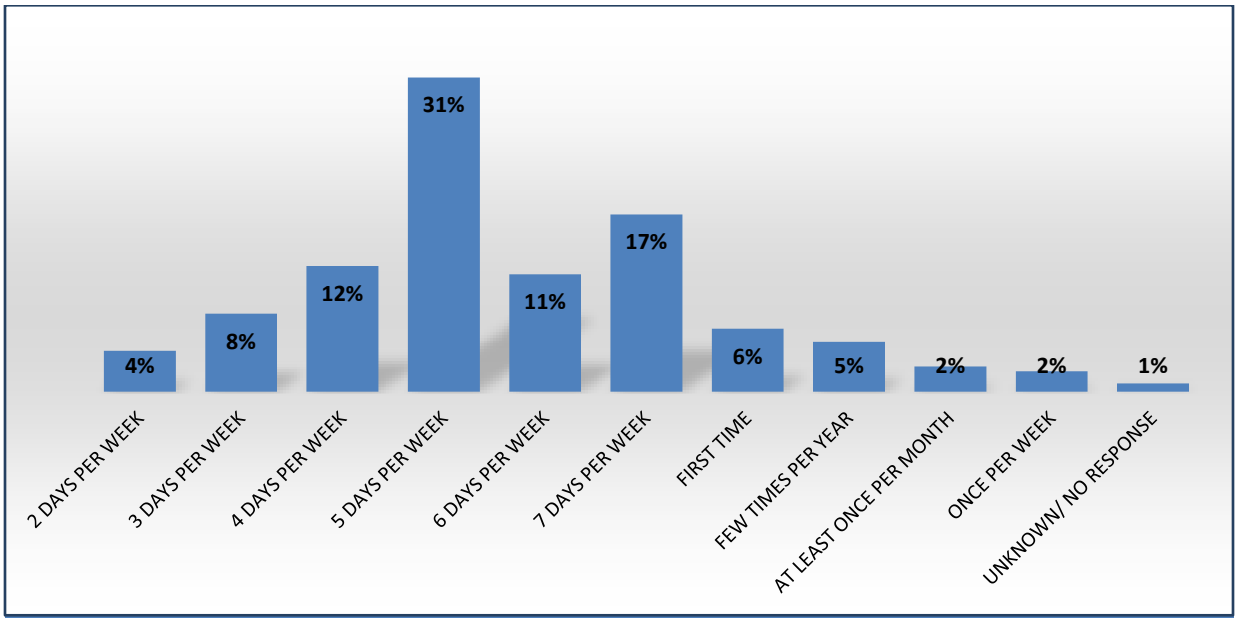
	COLLEGE (STUDENTS)	EATING/ DINING OUT	HOME	HOTEL	MEDICAL	OTHER BUSINESS	PERSONAL BUSINESS
System Total	**6%**	**3%**	**33%**	**2%**	**3%**	**2%**	**5%**
Ferry	0%	0%	1%	0%	0%	0%	0%
Light Rail	1%	0%	2%	0%	0%	0%	0%
Local Bus	5%	2%	29%	0%	2%	2%	4%
MAX	0%	0%	1%	0%	0%	0%	0%
VB Wave	0%	2%	0%	1%	0%	0%	0%

	PICK UP/DROP OFF	RECREATION	SCHOOL (K-12)	SHOPPING	SOCIAL VISITS	SPORTING EVENT	WORKPLACE
System Total	**1%**	**3%**	**1%**	**7%**	**5%**	**0%**	**30%**
Ferry	0%	0%	0%	0%	0%	0%	1%
Light Rail	0%	0%	0%	0%	0%	0%	2%
Local Bus	0%	1%	1%	6%	5%	0%	26%
MAX	0%	0%	0%	0%	0%	0%	1%
VB Wave	0%	2%	0%	0%	0%	0%	0%

Transit System Utilization – Frequency

Most transit riders utilize the system five or more days a week. The purpose of those trips are described the previous section. Thirty-one percent (31%) of riders ride the system five (5) days per week. Approximately sixty percent (59%) utilize the system five (5) to seven (7) days a week.

Figure 2-4: Frequency of Transit System Utilization



Note: Data includes weekday and weekend expanded data

Transit System Utilization – Frequency by Service Type

Customer utilization, or the frequency of how often HRT customers utilize a particular mode of transit, is an important factor that assists in the understanding of the trip purpose. The data below examines the five modes; bus, MAX, light rail, the VB Wave, and ferry and shows how many days of the week riders utilize each mode.

Table 2-3: Transit System Utilization – Frequency by Service Type

MODE	2 DAYS PER WEEK	3 DAYS PER WEEK	4 DAYS PER WEEK	5 DAYS PER WEEK	6 DAYS PER WEEK	7 DAYS PER WEEK	FIRST TIME	FEW TIMES PER YEAR	AT LEAST ONCE PER MONTH	ONCE PER WEEK	UNKNOWN/ NO RESPONSE
System Total	**4%**	**8%**	**12%**	**31%**	**11%**	**17%**	**6%**	**5%**	**2%**	**2%**	**1%**
Ferry	4%	6%	2%	49%	5%	11%	9%	4%	7%	3%	0%
Light Rail	3%	7%	9%	44%	11%	15%	2%	5%	2%	0%	1%
Local Bus	4%	8%	14%	31%	12%	18%	3%	4%	2%	2%	1%
MAX	4%	2%	5%	40%	8%	30%	1%	5%	4%	1%	0%
VB Wave	4%	1%	1%	2%	2%	3%	62%	19%	2%	0%	2%

Passenger Transfers

Customers utilizing transit in the HRT system are primarily able to reach their destination without making a transfer, thereby having a one-seat ride. Sixty-one (61%) percent of customers did not make a transfer to another route to get their destination. Over 91% are able to travel to their destination by having to make only one transfer to another route. The method by which transfer data is calculated has been modified from the 2014 Study, and is explained in Chapter Five.

Table 2-4: Passenger Transfers

	0 TRANSFERS	1 TRANSFER	2 TRANSFERS	3 TRANSFERS	4 TRANSFERS
System Total	**61%**	**30%**	**8%**	**1%**	**0.1%**
Ferry	64%	29%	7%	1%	0%
Light Rail	59%	29%	10%	2%	0%
Local Bus	60%	31%	8%	1%	0.1%
MAX	48%	29%	20%	3%	0.4%
VB Wave	73%	24%	1%	1%	0.2%

Reverse Trip Pattern

The survey instrument asked passengers if they took the exact trip to arrive to their destination on the way back to their point of origin (ex. exact return trip by route). Most riders (60%) took the exact same trip back to their destination; however, a notable portion of riders (40%) did not return to their point of origin with the same trip pattern. Therefore; those passengers may have traveled by a different route, mode, or means of access to get back to their point of origin and/or new destination.

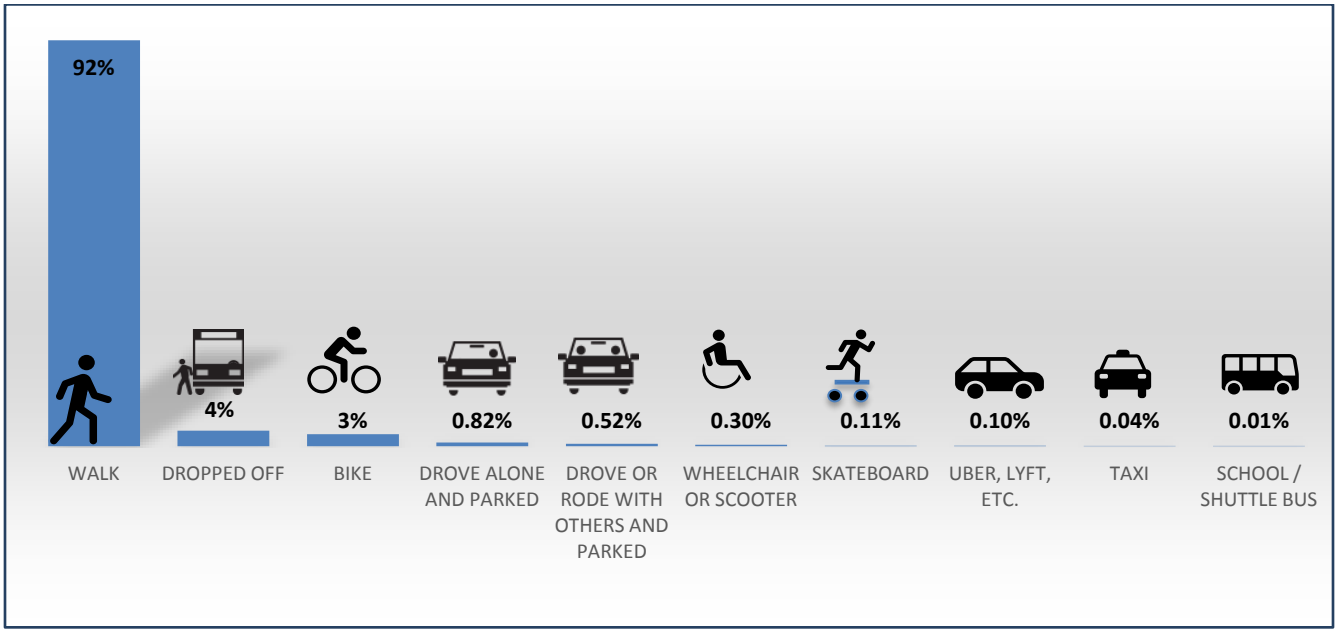
Table 2-5: Reverse Trip Pattern

	NO – ROUND TRIP (SAME TRIP NOT TAKEN IN REVERSE)	YES – ROUND TRIP (SAME TRIP TAKEN IN REVERSE)
System Total	**40%**	**60%**
Ferry	64%	29%
Light Rail	59%	29%
Local Bus	60%	31%
MAX	48%	29%
VB Wave	73%	24%

Transit Access

Ninety-two percent (92%) of riders access the HRT system by walking to their stop location. The lowest utilized methods of access to transit include Transportation Network Companies (TNCs) like Uber and Lyft at 0.10% and Taxis at 0.04%. Access modes to transit included walking, biking, carpooling, being dropped off, driving alone, TNCs, and taxis. The total percentage of all other modes in comparison to walking is significantly lower as shown in Figure 2-5.

Figure 2-5: Transit System Access



Access Mode by Service Type

Table 2-6 provides details on transit service type and how customers access (ex. walking, biking) the service type.

Table 2-6: Access Mode by Service Type.

	WALK	DROPPED OFF	BIKE	DROVE ALONG & PARKED	DROVE OR RODE W/ OTHERS & PARKED	WHEELCHAIR OR SCOOTER	SKATEBOARD	TNCs - UBER, LYFT,	TAXI	SCHOOL/ SHUTTLE BUS
System Total	**92%**	**4%**	**3%**	**0.82%**	**0.52%**	**0.30%**	**0.11%**	**0.10%**	**0.04%**	**0.01%**
Ferry	68%	2%	9%	3%	17%	0%	2%	0.0%	0%	0%
Light Rail	81%	5%	5%	7%	1%	0%	0%	0.5%	0%	0%
Local Bus	93%	3%	3%	0.2%	0.1%	0.4%	0.1%	0.1%	0.1%	0%
MAX	80%	11%	3%	5%	0.9%	0%	0%	0%	0%	0%
VB Wave	99%	0.6%	0%	0.4%	0.2%	0.1%	0%	0%	0%	0%

Fare Payment

HRT riders overwhelmingly utilize cash to pay their fare. Cash was identified as the payment method for 92% of transactions, on and off-board the vehicle. A smaller percentage of customers pay their fare by credit or debit card - six-percent (6%), and two-percent (2%) of customers utilize other means of fare payment. This includes employees who ride via their employee ID and the Student Freedom Pass. As a note, at the time of the study HRT had a limited number (approximately 36) of Ticket Vending Machines (TVMs) throughout its service area. TVMs and the locations where tickets are distributed (ex. transit centers and resellers) throughout the service area may have an impact on the data and the availability of fare payment options for customers.

Figure 2-6: Fare Payment

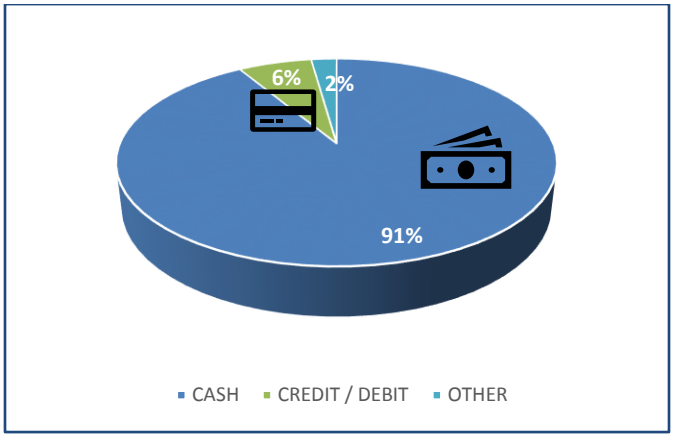


Figure 2-7: Fare Payment

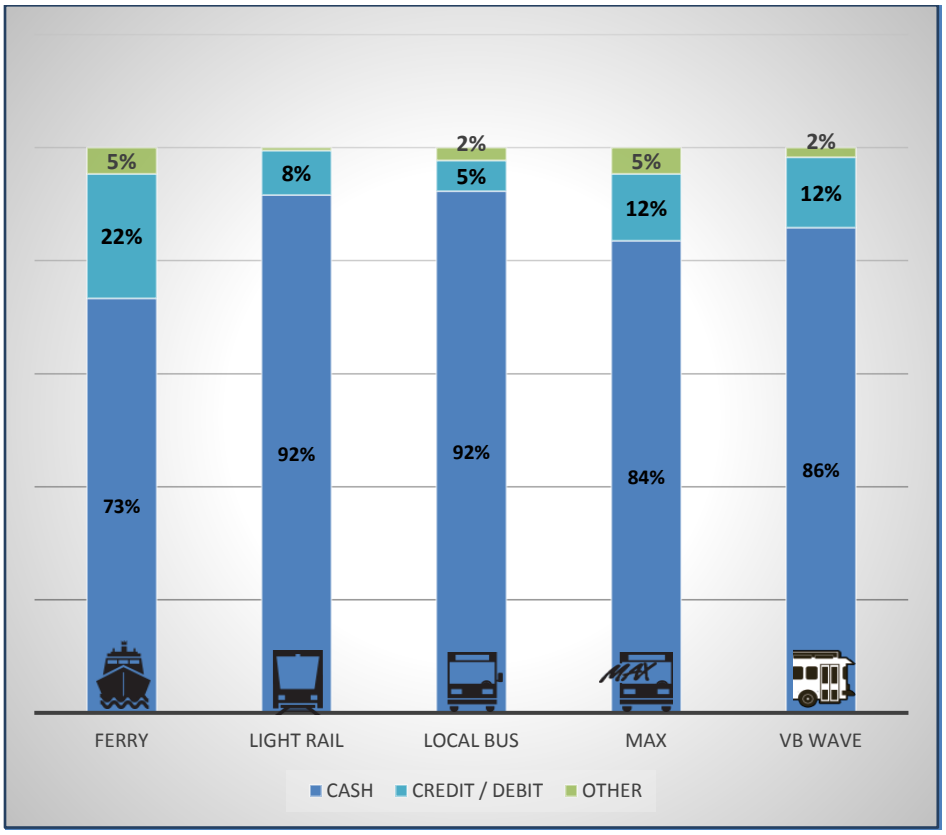
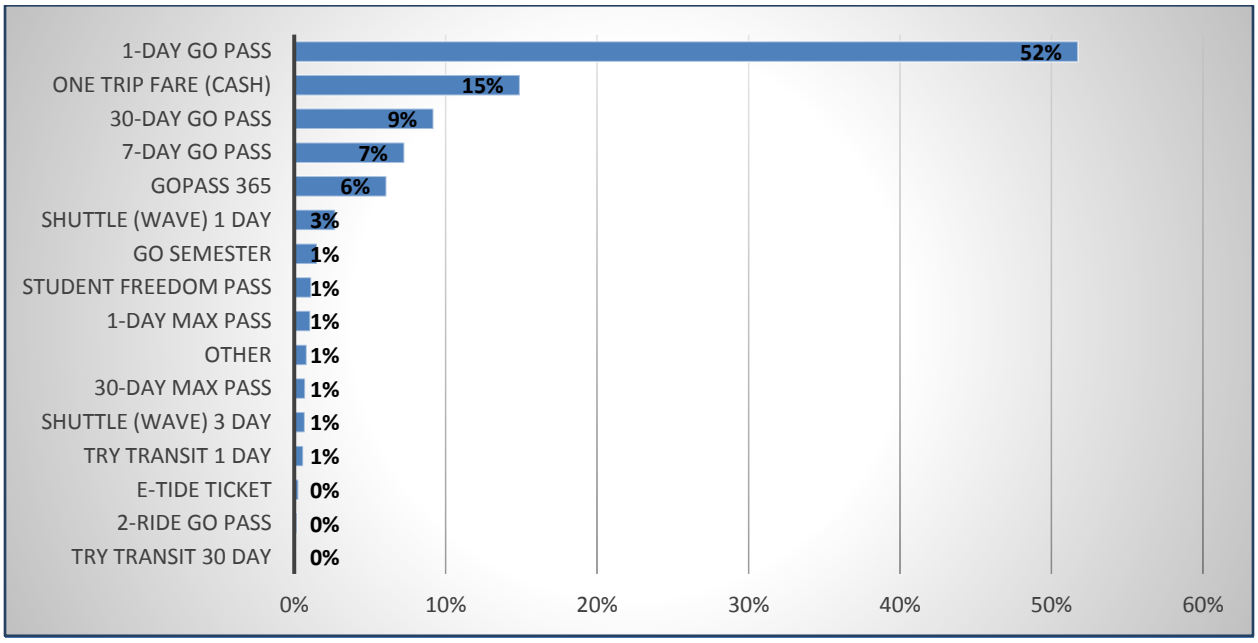


Table 2-7: Fare Payment

	CASH	CREDIT/DEBIT	OTHER
System Total	**91%**	**6%**	**2%**
Ferry	73%	22%	5%
Light Rail	92%	8%	0%
Local Bus	92%	5%	2%
MAX	84%	12%	5%
VB Wave	86%	12%	2%

Figure 2-8: Fare Payment by Pass Type



Fare Payment by Service Type

Table 2-8: Fare Payment by Service Type

	1-DAY GOPASS	GOPASS 365	ONE TRIP FARE (CASH)	7-DAY GOPASS	30-DAY GOPASS	30-DAY MAX PASS	TRY TRANSIT 1-DAY	OTHER	STUDENT FREEDOM PASS
Ferry	33%	39%	14%	4%	2%	3%	4%	2%	1%
Light Rail	49%	12%	10%	10%	9%	-	-	1%	1%
Local Bus	55%	6%	16%	8%	10%	-	1%	1%	1%
MAX	35%	-	-	2%	3%	20%	-	1%	1%
VB Wave	20%	-	13%	1%	3%	-	-	-	1%

	E-RIDE TICKET	GO SEMESTER	1-DAY MAX PASS	SHUTTLE (WAVE) 3-DAY	SHUTTLE (WAVE) 1-DAY
Ferry	-	-	-	-	-
Light Rail	4%	6%	-	-	-
Local Bus	-	1%	-	-	-
MAX	-	-	26%	-	-
VB Wave	-	-	-	12%	49%

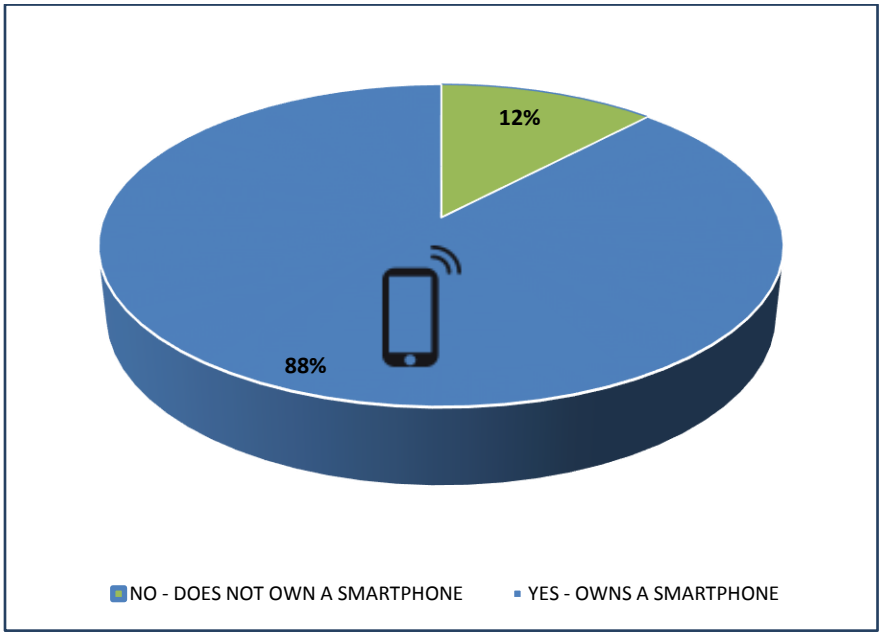
Discounted Fares

Table 2-9: Discounted Fares

MODE	REGULAR	SENIOR	DISABLED	YOUTH	HRT EMPLOYEES/ SPOUSE/ RETIREES	UNKNOWN/NO RESPONSE
System Total	**93%**	**3%**	**2%**	**1%**	**0%**	**1%**
Ferry	97%	3%	0%	0%	0%	0%
Light Rail	95%	1%	2%	0%	1%	1%
Local Bus	93%	3%	2%	1%	0%	1%
MAX	91%	1%	6%	0%	0%	1%
VB Wave	91%	8%	0%	1%	0%	1%

Technology – Smartphone

Figure 2-9: Smartphone Utilization



Technology – Smartphone by Mode

Figure 2-10: Smartphone Utilization by Mode

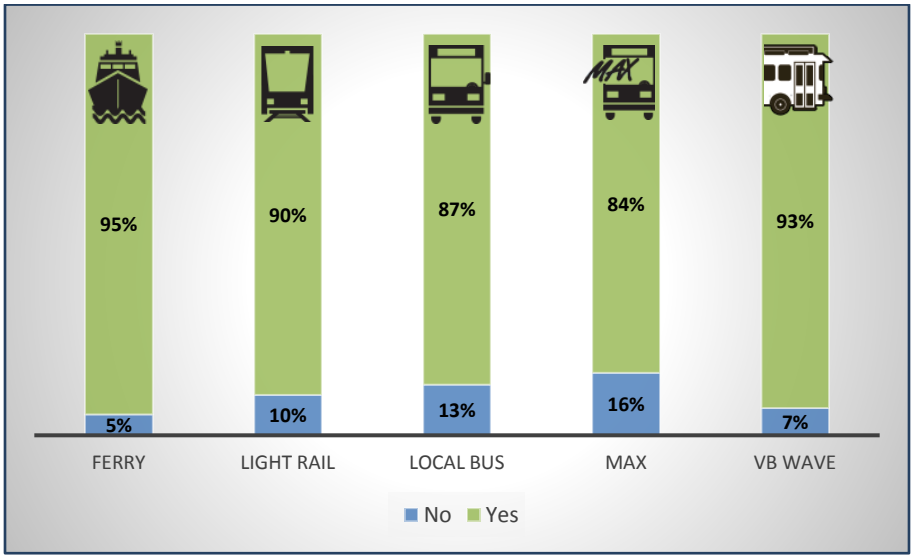


Table 2-10: Smartphone Ownership

	YES – OWNS A SMARTPHONE	NO – DOES NOT OWN A SMARTPHONE
System Total	**88%**	**12%**
Ferry	95%	5%
Light Rail	90%	10%
Local Bus	87%	13%
MAX	84%	16%
VB Wave	93%	7%

Chapter 3

System Demographics

HAMPTON ROADS TRANSIT

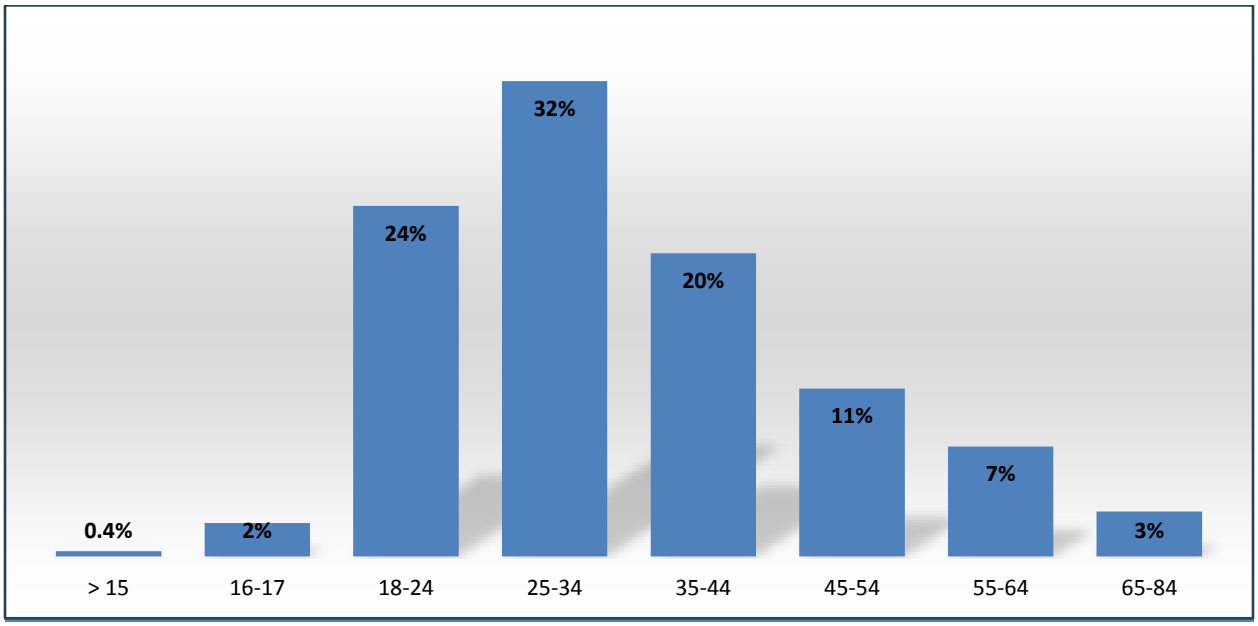
CHAPTER 3: SYSTEM DEMOGRAPHICS

HRT System Demographics

Age

The disbursement of transit riders by age is primarily concentrated in the generations typically identified as "Millennials" and "Generation X." The most concentrated percentage of riders included those in the age ranges of 18-24 (23.5%), 25-34 (31.9%), and 35-44 (20.3%). These three categories, ranging from 18-44, made up approximately 76% of HRT's riders.

Figure 3-1: Demographics - Age



Age by Service Type

Figure 3-2: Demographics by Service Type - Age

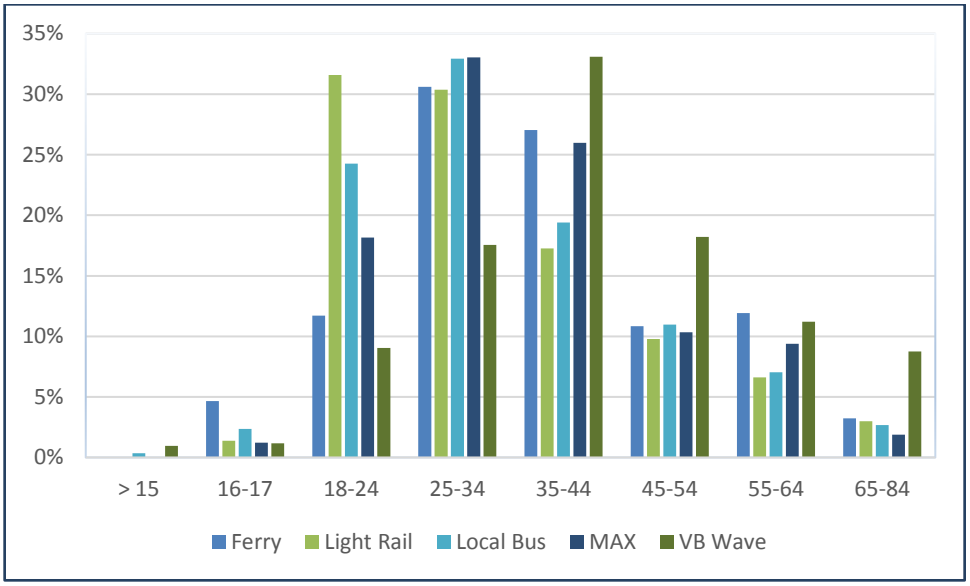


Table 3-1: Demographics by Service Type - Age

	> 15	16-17	18-24	25-34	35-44	45-54	55-64	65-84
System Total	**0.4%**	**2%**	**24%**	**32%**	**20%**	**11%**	**7%**	**3%**
Ferry	0%	5%	12%	31%	27%	11%	12%	3%
Light Rail	0%	1%	32%	30%	17%	10%	7%	3%
Local Bus	0%	2%	24%	33%	19%	11%	7%	3%
MAX	0%	1%	18%	33%	26%	10%	9%	2%
VB Wave	1%	1%	9%	18%	33%	18%	11%	9%

Gender by Service Type

Across all transit modes, the system-wide average shows that women are a higher percentage of riders than men by approximately 10%. Women make up 55% of HRT's overall ridership and men make up 45%. Further evaluation of the data show that the highest ridership by mode for year-round service by gender is light rail for women (57%) and Ferry service for men (55%).

Figure 3-3: Gender by Service Type

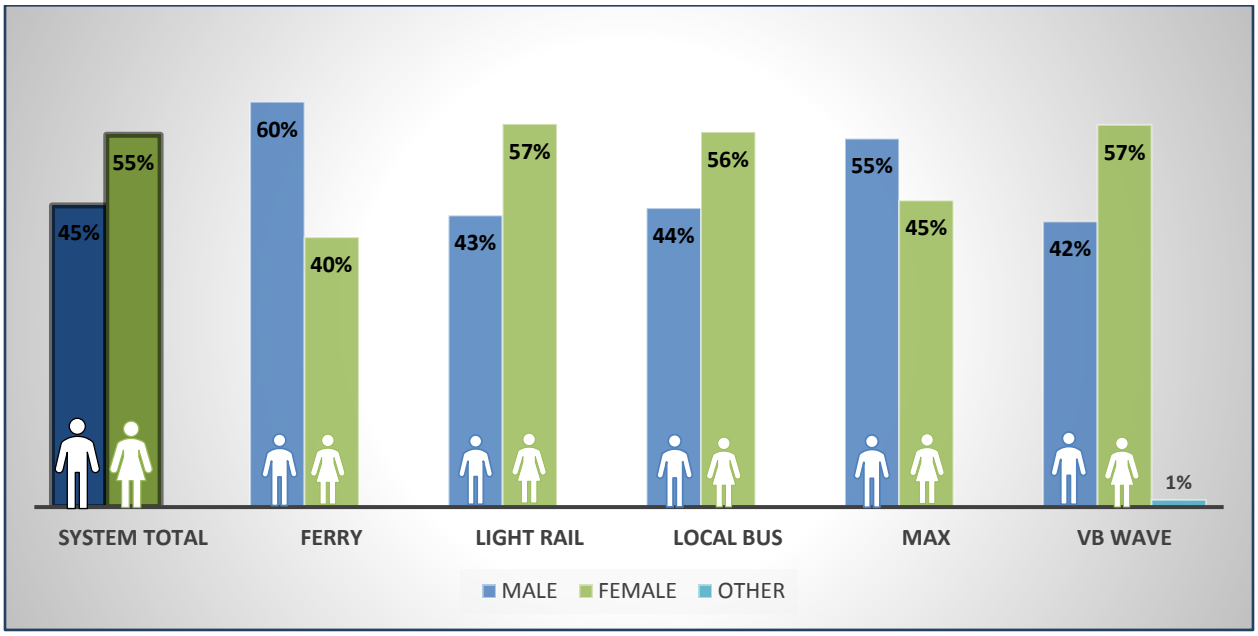


Table 3-2: Gender by Service Type

	MALE	FEMALE	OTHER
System Total	**45%**	**55%**	**0%**
Ferry	60%	40%	0%
Light Rail	43%	57%	0%
Local Bus	44%	56%	0%
MAX	55%	45%	0%
VB Wave	42%	57%	1%

Race/Ethnicity by Service Type

Figure 3-4: Minority Status by Service Type

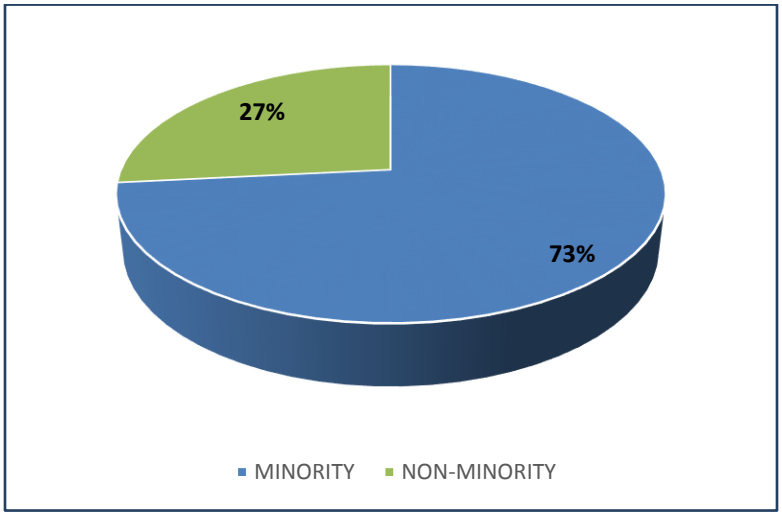


Table 3-3: Minority Status by Mode

	MINORITY	NON-MINORITY
System Total	**73%**	**27%**
Ferry	34%	66%
Light Rail	64%	36%
Local Bus	78%	22%
MAX	70%	30%
VB Wave	33%	67%

Table 3-4: Race/Ethnicity by Service Type

	SYSTEM TOTAL	FERRY	LIGHT RAIL	LOCAL BUS	MAX	VB WAVE
American Indian/Alaskan Native	1%	5%	0%	2%	0%	2%
Asian	2%	2%	2%	2%	4%	3%
Black/African American	74%	29%	67%	79%	70%	22%
Hispanic/Latino	5%	4%	5%	5%	5%	13%
Native Hawaiian/Pacific Islander	1%	0%	0%	0%	0%	2%
White/Caucasian	27%	66%	36%	22%	30%	67%

Language

The primary language spoken at home by over 95% of HRT riders is English. The percentage of riders who stated that their primary language spoken at home was not English, was with 4.62 %. Table 3-6 below provides a detailed breakdown of the languages identified in the study that are spoken.

Figure 3-5: Primary Language Spoken at Home

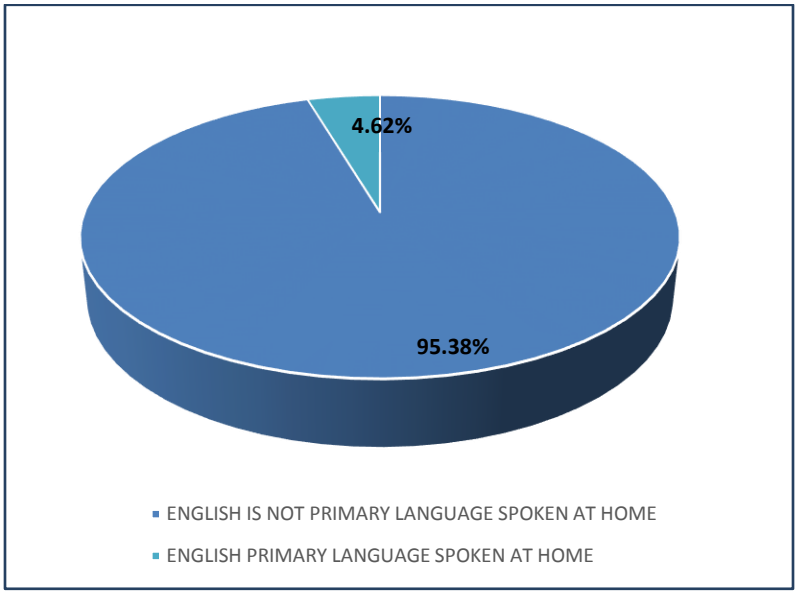


Table 3-5: Primary Language Spoken at Home

	ENGLISH IS NOT PRIMARY LANGUAGE SPOKEN AT HOME	ENGLISH PRIMARY LANGUAGE SPOKEN AT HOME
System Total	**95.38%**	**4.62%**
Ferry	100.00%	0.00%
Light Rail	95.25%	4.75%
Local Bus	96.06%	3.94%
MAX	95.62%	4.38%
VB Wave	83.73%	16.27%

Respondent Language other than English at Home

Table 3-6: Primary Language Spoken at Home – All languages, Detailed

	System Total
Afrikaans	0.03%
American Sign Language (ASL)	0.12%
Arabic, Standard	0.04%
Armenian	0.05%
Chamorro	0.01%
Chinese	0.08%
Chinese, Mandarin	0.03%
Farsi, Eastern	0.02%
Filipino	0.06%
French	0.39%
German	0.13%
Greek	0.00%
Haitian Creole French	0.07%
Hindi	0.03%
Indo-Portuguese	0.01%
Irish Gaelic	0.01%
Italian	0.02%
Japanese	0.06%
Korean	0.02%
Middle English	0.01%
Nepali	0.01%
Old English	0.02%
Old Spanish	0.02%
Other	0.02%
Pennsylvania German	0.02%
Pidgin, Nigerian	0.01%
Portuguese	0.03%
Potawatomi	0.00%
Russian	0.05%
Sinhala	0.04%
Somali	0.08%
Spanish	2.88%
Swahili	0.02%
Tagalog	0.10%
Thai	0.03%
Turkish	0.01%
Ukrainian	0.01%
Uzbek	0.01%
Vietnamese	0.04%

Employment Status

Figure 3-6: Employment Status

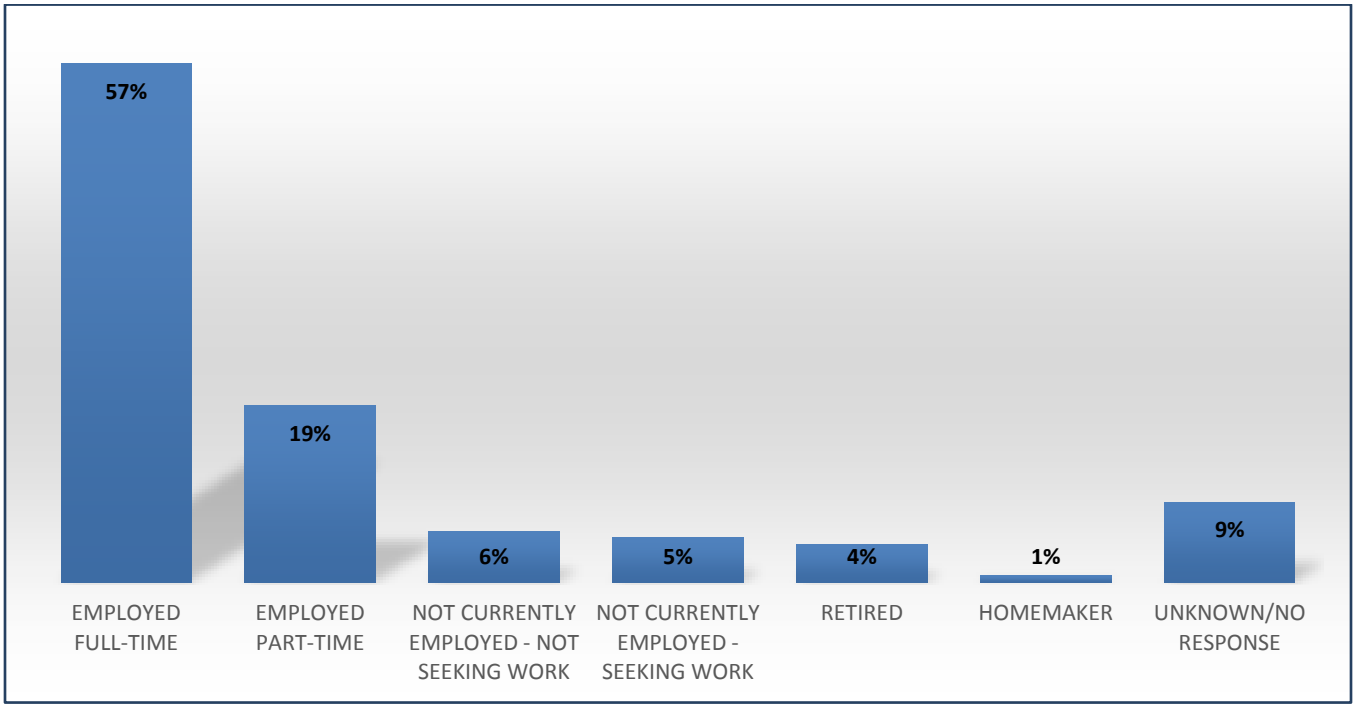


Table 3-7: Employment Status

	EMPLOYED FULL-TIME	EMPLOYED PART-TIME	HOMEMAKER	NOT CURRENTLY EMPLOYED - NOT SEEKING WORK	NOT CURRENTLY EMPLOYED - SEEKING WORK	RETIRED	NO RESPONSE
System Total	**57%**	**19%**	**1%**	**6%**	**5%**	**4%**	**9%**
Ferry	53%	7%	0%	1%	0%	5%	33%
Light Rail	65%	16%	1%	7%	4%	2%	5%
Local Bus	59%	22%	1%	6%	5%	5%	3%
MAX	73%	8%	0%	4%	4%	4%	8%
VB Wave	6%	1%	0%	1%	1%	0%	91%

Driver's License

Figure 3-7: Driver's License

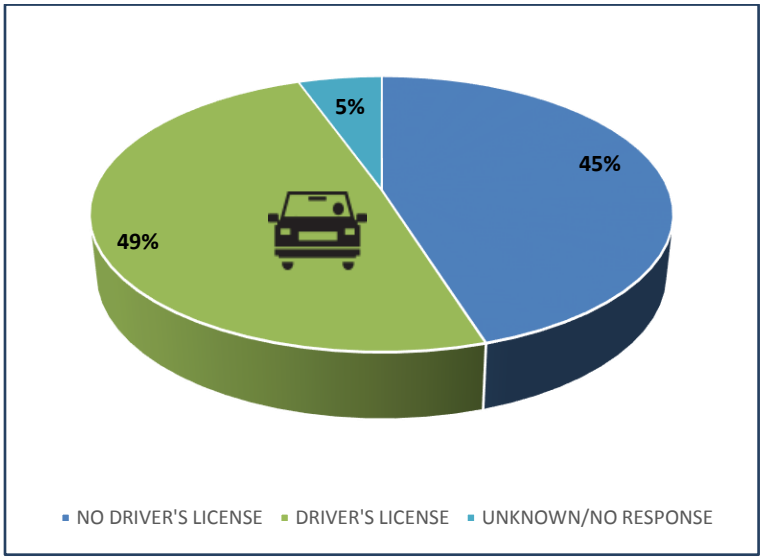


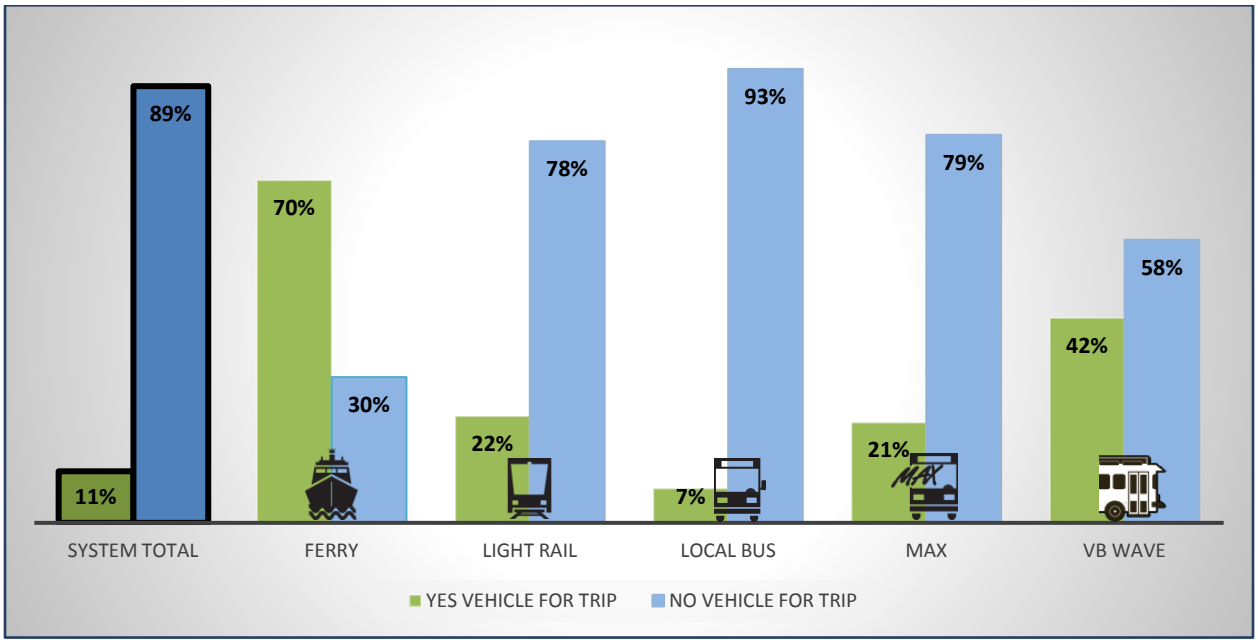
Table 3-8: Driver's License

	NO DRIVER'S LICENSE	DRIVER'S LICENSE	UNKNOWN/NO RESPONSE
System Total	**45%**	**49%**	**5%**
Ferry	17%	66%	17%
Light Rail	34%	66%	0%
Local Bus	50%	50%	0%
MAX	37%	61%	2%
VB Wave	5%	5%	91%

Car Availability by Service Type

Based on the results of the data HRT has a highly transit dependent population. Eighty-percent of riders could not access a car to complete their trip. For that rider, there was no car option available. Those who had access represented approximately 20% of those surveyed.

Figure 3-8: Car Availability by Service Type



*Based on those who responded to the survey. Does not include "no response"

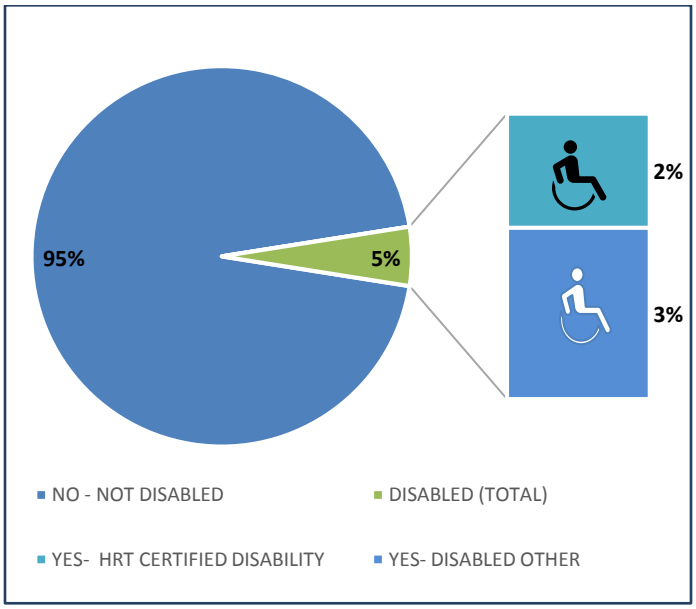
Table 3-9: Car Availability by Service Type

MODE	YES - VEHICLE FOR TRIP	NO - VEHICLE FOR TRIP
System Total	**11%**	**89%**
Ferry	70%	30%
Light Rail	22%	78%
Local Bus	7%	93%
MAX	21%	79%
VB Wave	42%	58%

Disability Status

Respondents were asked if they had a disability that limits their mobility that has been verified by HRT or another organization. Respondents were given the option to state that; Yes, they had a disability that has been verified through HRT; Yes, they had a disability that was verified by another organization; or No, they did not have a disability.

Figure 3-9: Disability Status



Student Status

Respondents' were asked their student status, this question allowed them to answer whether they were a full-time or part-time college/university student, a student in grades K-12, or that they did not identify as a student.

Figure 3-10: Student Status

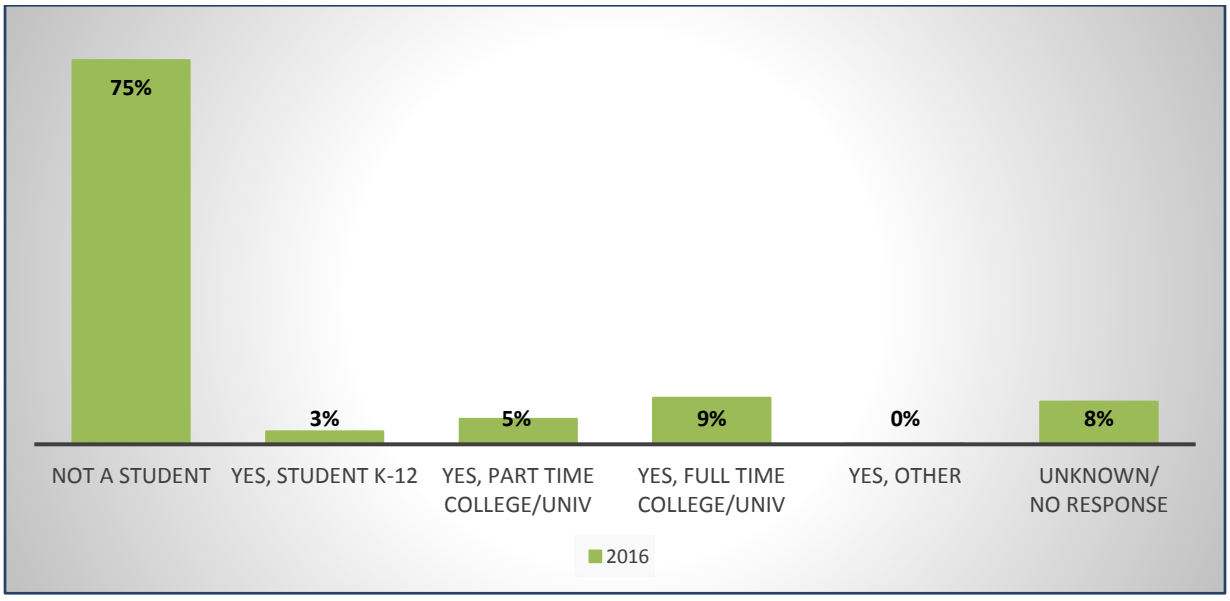


Table 3-10: Student Status

	NOT A STUDENT OR INTERN	OTHER	YES, FULL TIME COLLEGE/ UNIVERSITY	YES, GRADE K - 12	YES, PART TIME COLLEGE/ UNIVERSITY	UNKNOWN/ NO RESPONSE
System Total	**75%**	**0%**	**9%**	**3%**	**5%**	**8%**
Ferry	69%	0%	1%	2%	9%	18%
Light Rail	67%	0%	24%	1%	4%	3%
Local Bus	80%	0%	9%	3%	5%	3%
MAX	81%	0%	8%	1%	1%	8%
VB Wave	7%	0%	1%	0%	1%	91%

City of Trip Origin

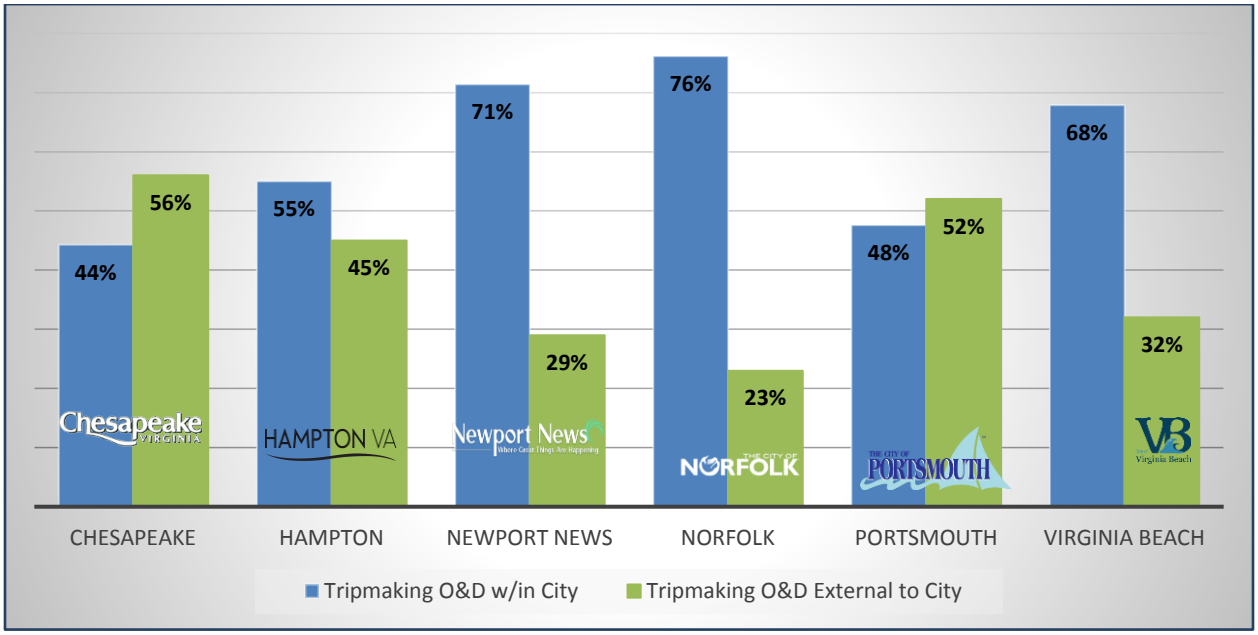
Table 3-11: City of Trip Origin

	SYSTEM TOTAL	FERRY	LIGHT RAIL	LOCAL BUS	MAX	VB WAVE
Carrollton	**0.03%**	0.00%	0.00%	0.04%	0.00%	0.00%
Chesapeake	**6.52%**	6.78%	5.89%	6.74%	11.54%	1.31%
Chester	**0.02%**	0.00%	0.00%	0.00%	0.00%	0.40%
Gloucester Courthouse	**0.01%**	0.00%	0.00%	0.01%	0.00%	0.00%
Hampton	**10.03%**	0.00%	0.72%	11.40%	17.01%	0.00%
Newport News	**16.60%**	0.00%	0.00%	19.32%	17.88%	0.00%
Norfolk	**40.77%**	32.34%	65.05%	42.09%	24.06%	2.71%
Out of State	**0.06%**	1.93%	0.40%	0.00%	0.00%	0.00%
Portsmouth	**7.72%**	41.76%	3.45%	8.00%	3.74%	0.00%
Smithfield	**0.07%**	0.00%	0.00%	0.08%	0.00%	0.00%
Suffolk	**0.30%**	11.36%	0.00%	0.09%	0.00%	0.53%
Virginia Beach	**17.65%**	4.76%	24.48%	11.98%	25.77%	95.04%
Williamsburg	**0.16%**	0.00%	0.00%	0.19%	0.00%	0.00%
Yorktown	**0.07%**	1.07%	0.00%	0.06%	0.00%	0.00%

Top Cities of Origin to Top Cities of Destination

The figure below highlights the regional nature of HRT's transit system. Across all cities approximately ¼ or more of trips either or more of trips either originate in one city and end in a different city within the region. This highlights the point that customers do not recognize city lines when they make their trips and that they see HRT as one single regional transit system.

Figure 3-11: City of Trip Origin



Park and Ride

Figure 3-12: Park and Ride

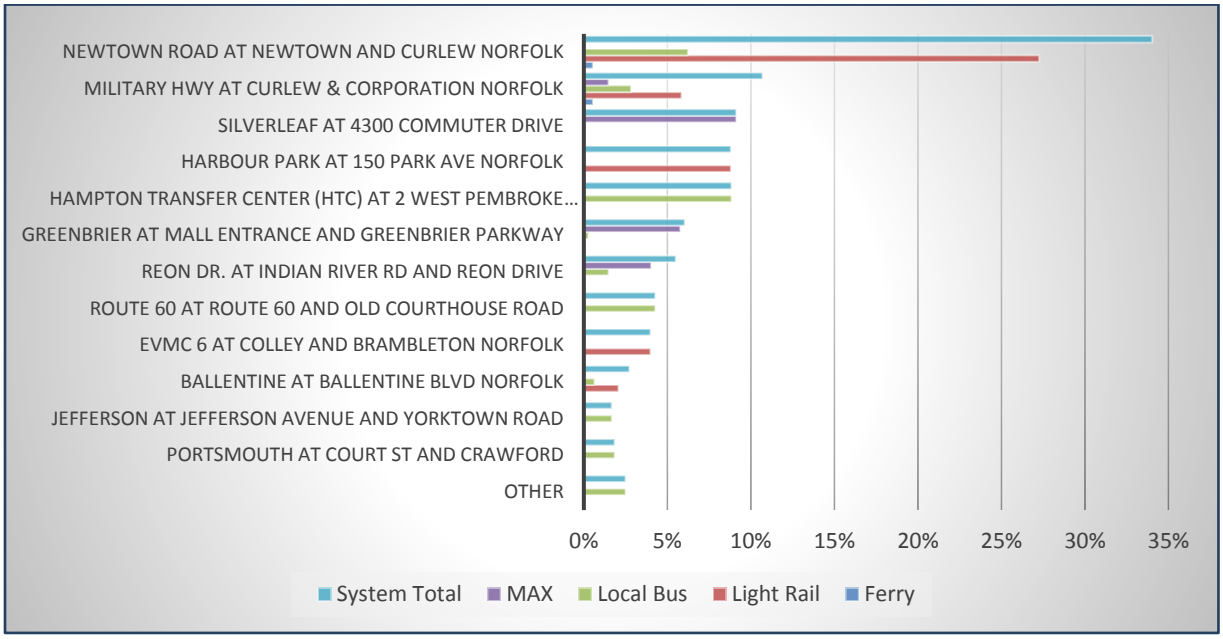


Table 3-12: Park and Ride Utilization

PARK AND RIDE LOCATION	SYSTEM TOTAL	FERRY	LIGHT RAIL	LOCAL BUS	MAX
Ballentine at Ballentine Blvd Norfolk	**3%**	0%	2%	1%	0%
EVMC 6 at Colley and Brambleton Norfolk	**4%**	0%	4%	0%	0%
Greenbrier at Mall Entrance and Greenbrier Parkway	**6%**	0%	0%	0%	6%
Hampton Transfer Center (HTC) at 2 West Pembroke Avenue Hampton	**9%**	0%	0%	9%	0%
Harbor Park at 150 Park Ave Norfolk	**9%**	0%	9%	0%	0%
Jefferson at Jefferson Avenue and Yorktown Road	**2%**	0%	0%	2%	0%
Military Hwy at Curlew and Corporation Norfolk	**11%**	1%	6%	3%	1%
Newtown Road at Newtown and Curlew Norfolk	**34%**	1%	27%	6%	0%
Other	**2%**	0%	0%	2%	0%
Court St and Crawford - Portsmouth	**2%**	0%	0%	2%	0%
Reon Dr. at Indian River Rd and Reon Drive - Chesapeake	**6%**	0%	0%	1%	4%
Route 60 at Route 60 and Old Courthouse Road	**4%**	0%	0%	4%	0%
Silverleaf at 4300 Commuter Drive – Virginia Beach	**9%**	0%	0%	0%	9%
System Total	**100%**	**1%**	**48%**	**31%**	**20%**

Chapter 4

Regional System Maps

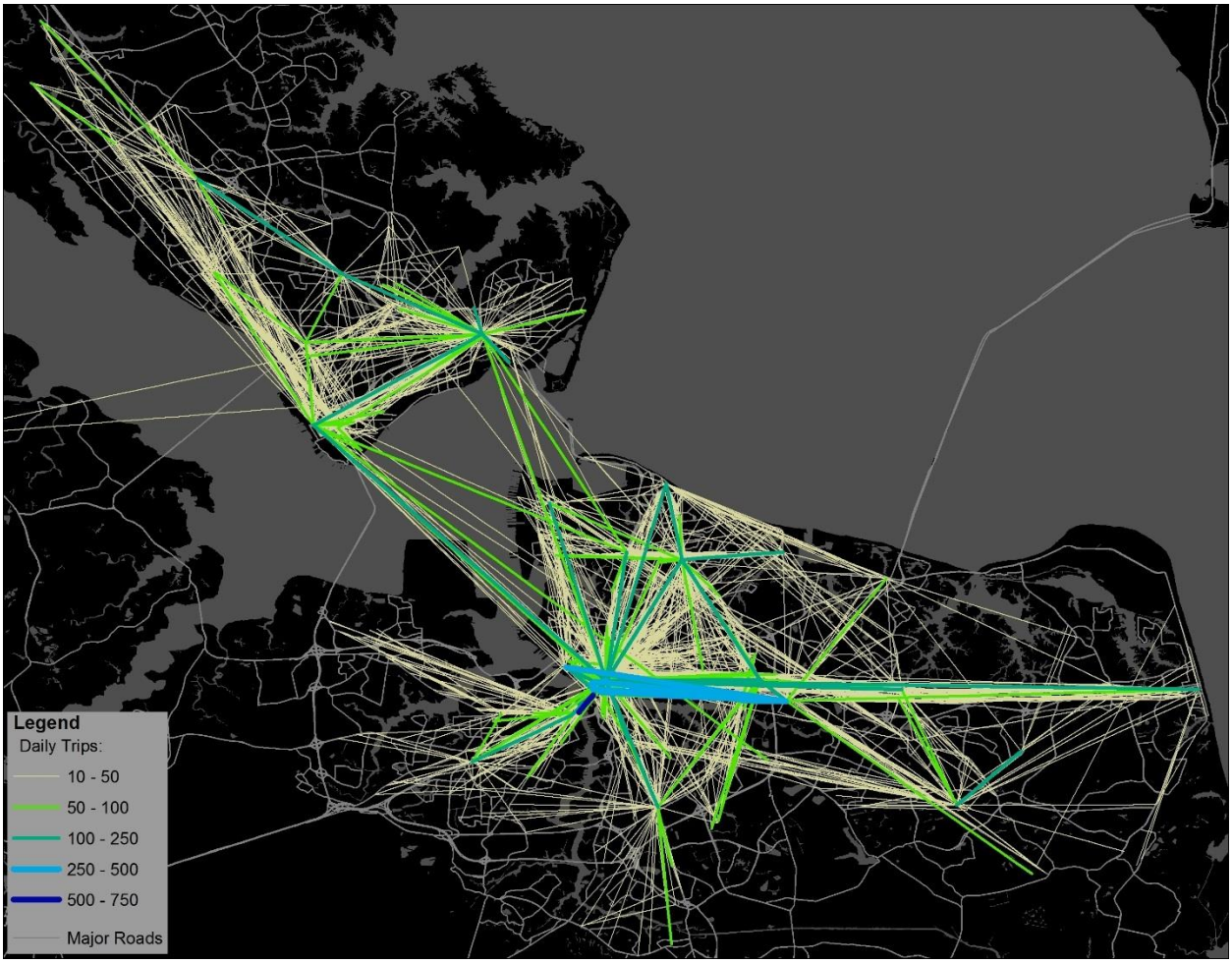
HAMPTON ROADS TRANSIT

CHAPTER 4: REGIONAL SYSTEM MAPS

Hampton Roads Transit's service extends beyond the boundary of each individual city that it serves. The maps below provide insight into the truly regional nature of the transit system. In many cases, the trip-making patterns of our customers extend beyond the individual city borders and occur throughout the transit system. The maps that follow will look at information; including origins and destinations by daily and weekly trips and route specific origin and destination data. The maps provide a pictorial representation of origin and destination travel behavior.

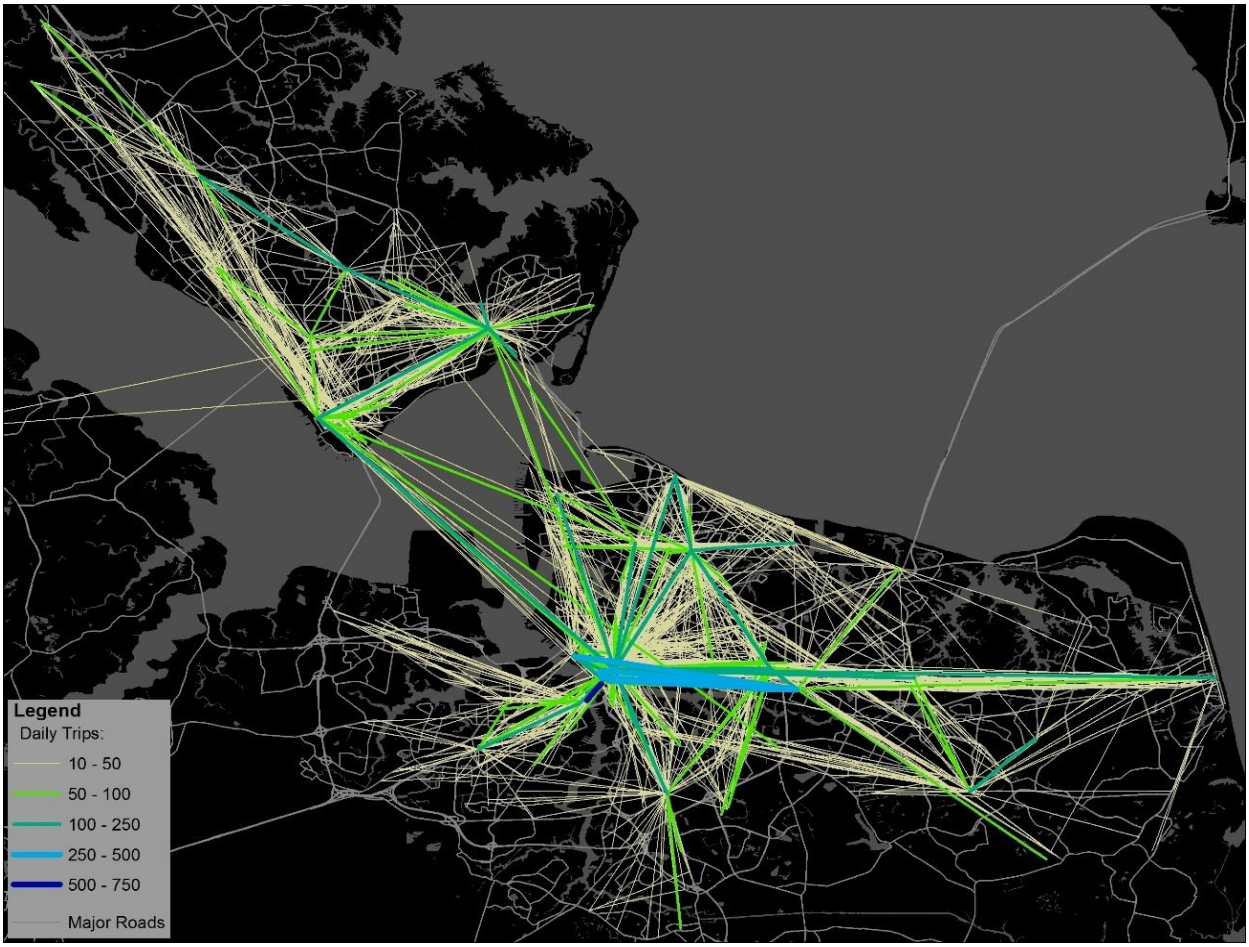
Origins and Destinations by Daily Trips

Figure 4-1: Origins and Destinations by Daily Trips



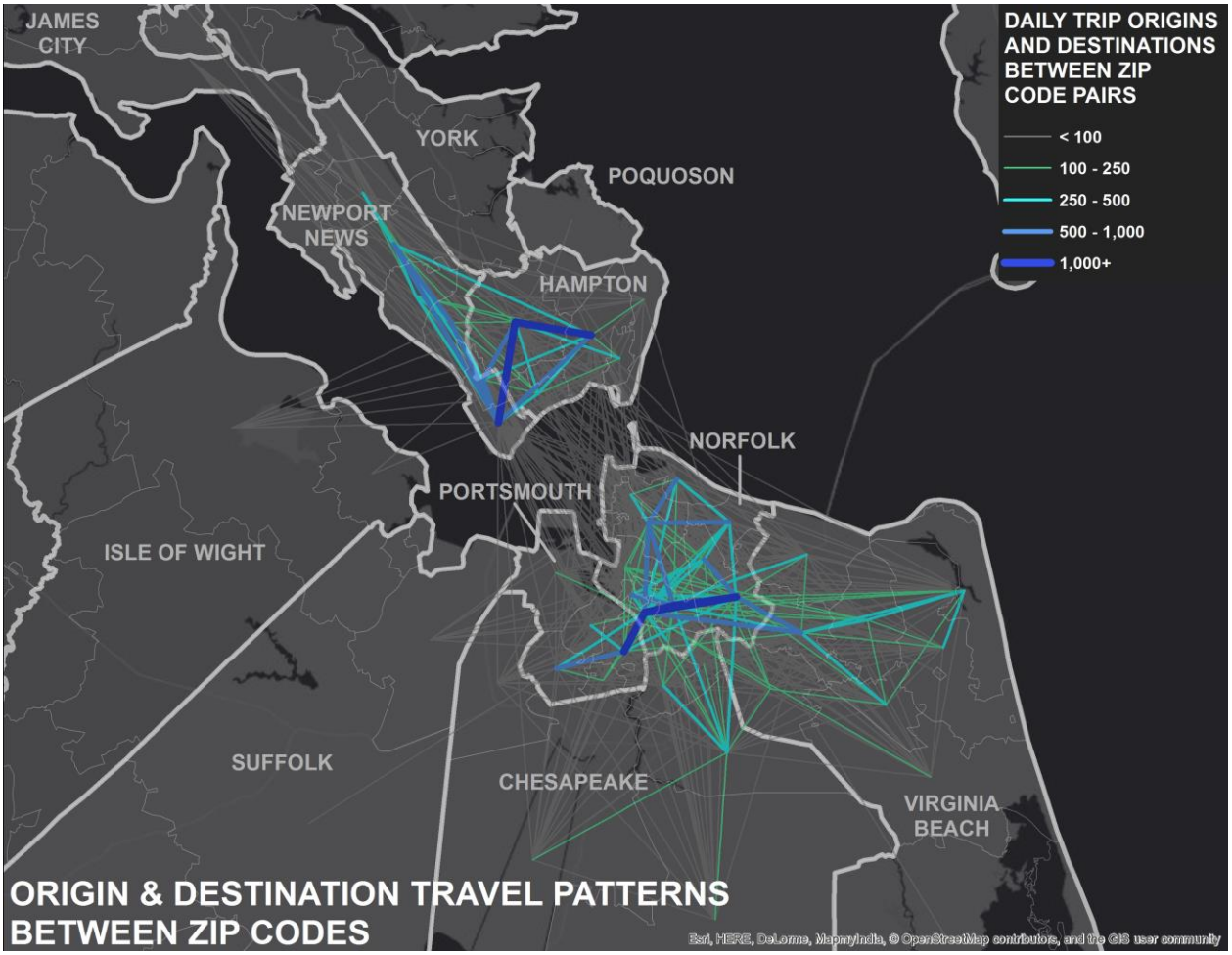
Travel Between All Routes – Aggregate

Figure 4-2: Travel Between All Routes - Aggregate



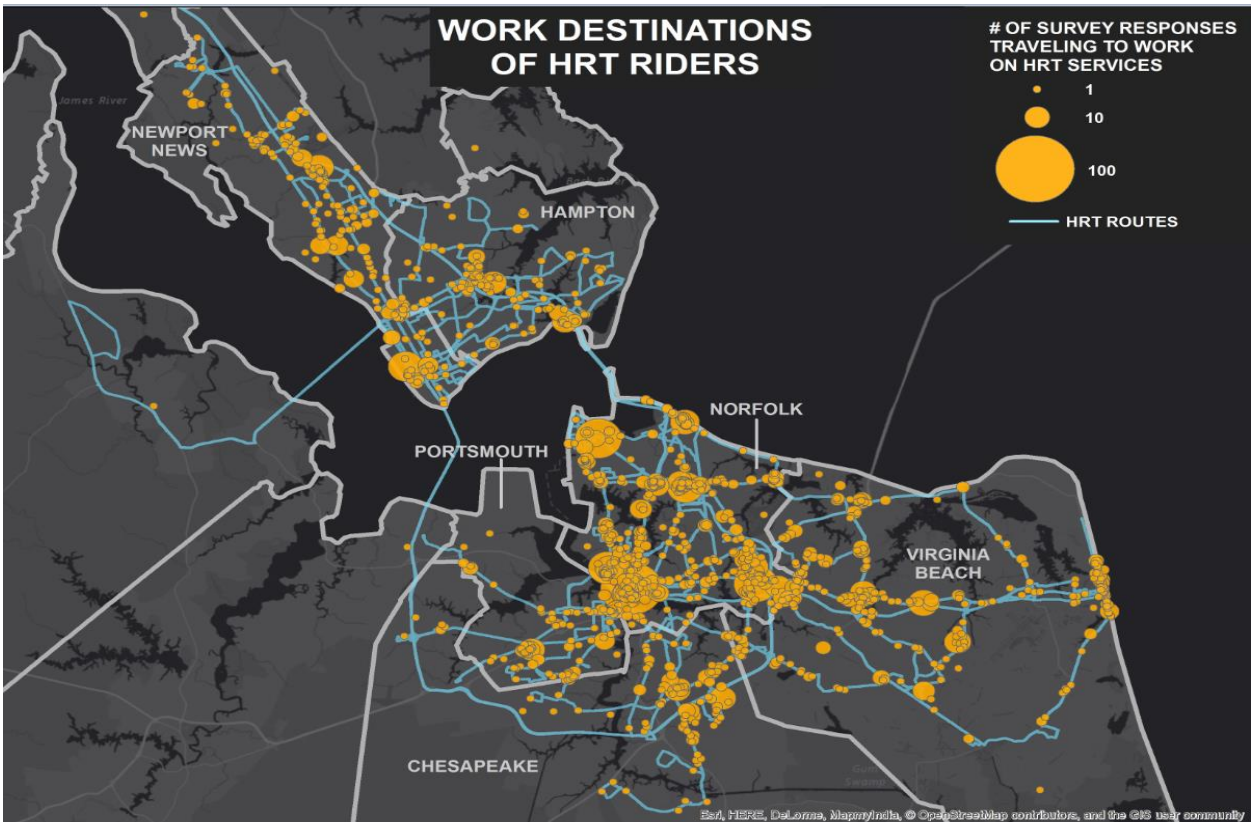
Travel Between Zip Codes

Figure 4-3: Travel Between Zip Codes



Employment Destinations

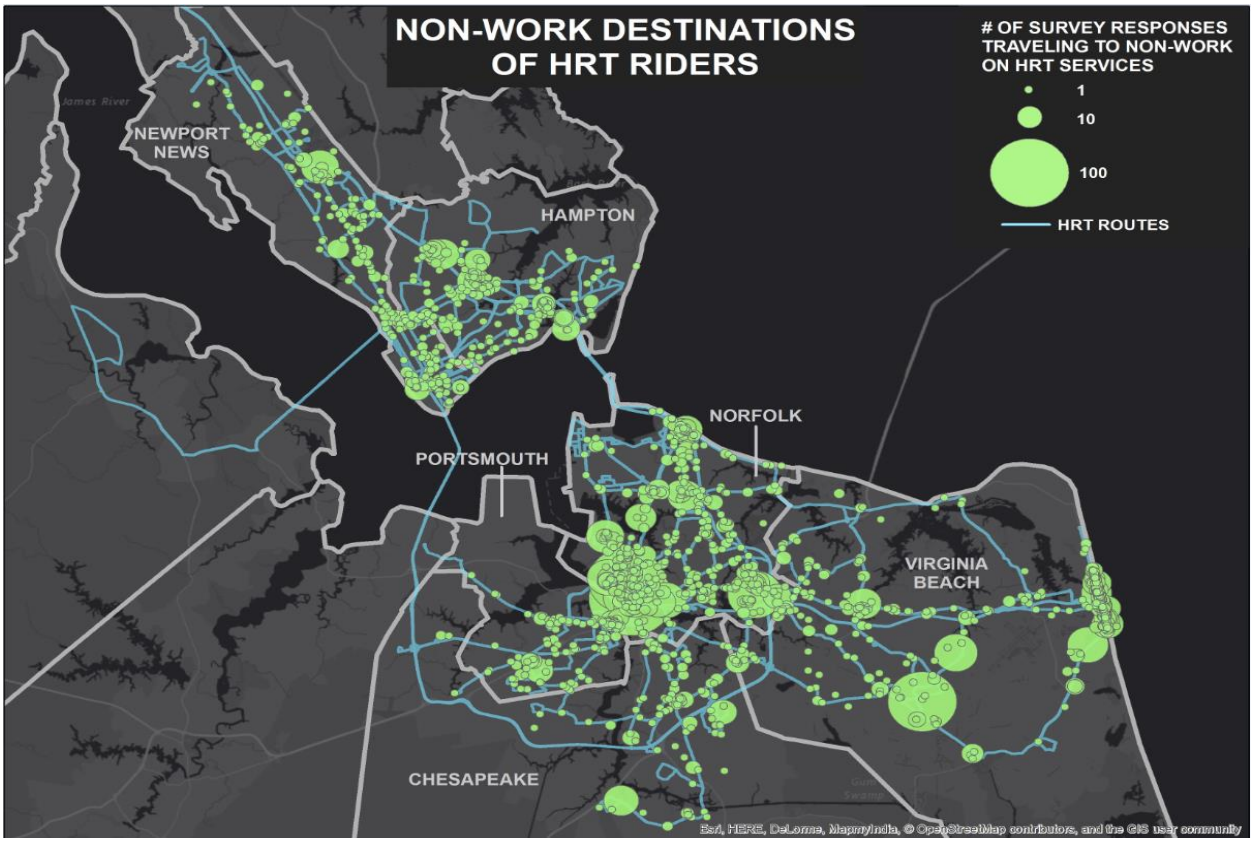
Figure 4-4: Employment Destinations



The map above utilizes data and information collected during the survey to depict survey respondents' identification of work location destinations. Key areas include: Coliseum Central, Downtown Norfolk, Greenbrier, Military Highway, Naval Station Norfolk, Newport News Shipyard, the Oceanfront, and Victory Crossing.

Destinations – Non-Work

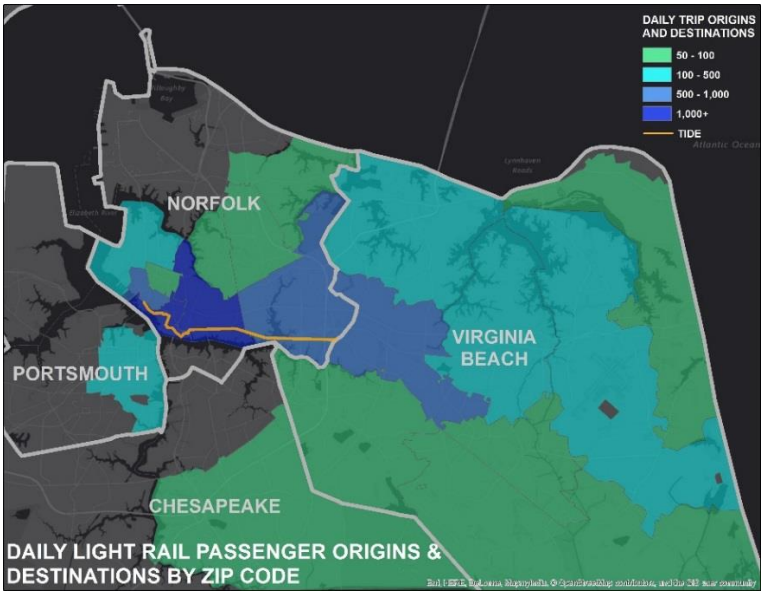
Figure 4-5: Destinations Non-Work



The map above utilizes data and information collected during the survey to depict survey respondents' identification of non-work location destinations. Key areas include: Downtown Norfolk, Government Centers, Military Circle, the Oceanfront, Patrick Henry Mall, Peninsula Town Center, Tidewater Community College (TCC), and Thomas Nelson Community College (TNCC), and Victory Crossing.

Light Rail – Origins and Destinations

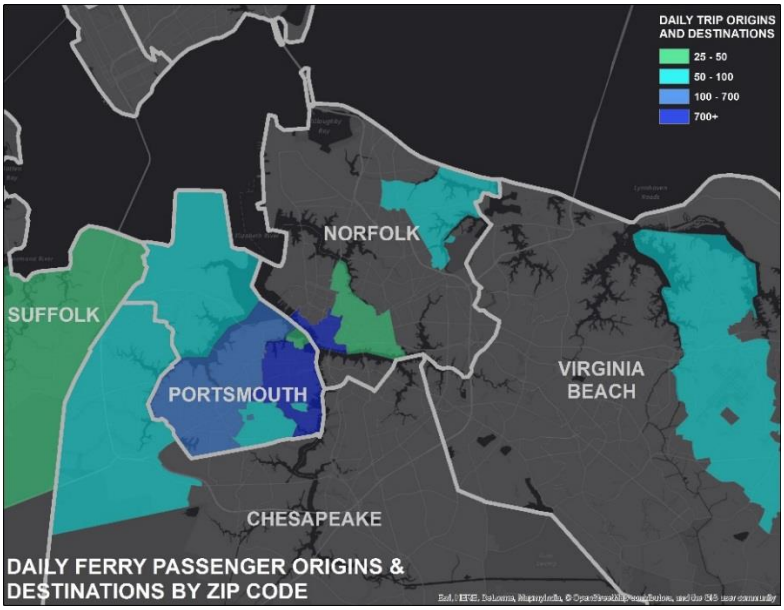
Figure 4-6: Light Rail - Origins and Destinations



The Tide light rail system's boundaries lie within the City of Norfolk. However, the map included shows how many of the trip origins and destinations occur outside of Norfolk's city boundaries. These include a significant number of trips that originate and/or terminate in the cities of Chesapeake, Portsmouth, and Virginia Beach, with additional trips (under 50 boardings - origins and destinations) occurring both within and outside of the region not shown on the map.

Ferry – Origins and Destinations

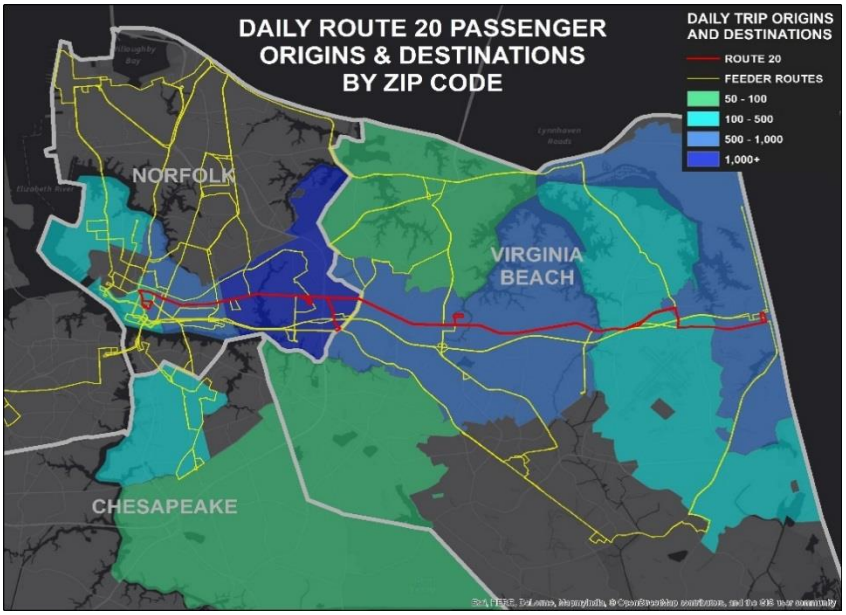
Figure 4-7: Ferry - Origins and Destinations



The Elizabeth River Ferry provides service between the cities of Norfolk and Portsmouth. These include trips that originate and/or terminate in the cities of Chesapeake, Suffolk, and Virginia Beach, with additional trips (under 50 boardings - origins and destinations) occurring both within and outside of the region not shown on the map.

Route 20: Origins and Destinations – Zip Code

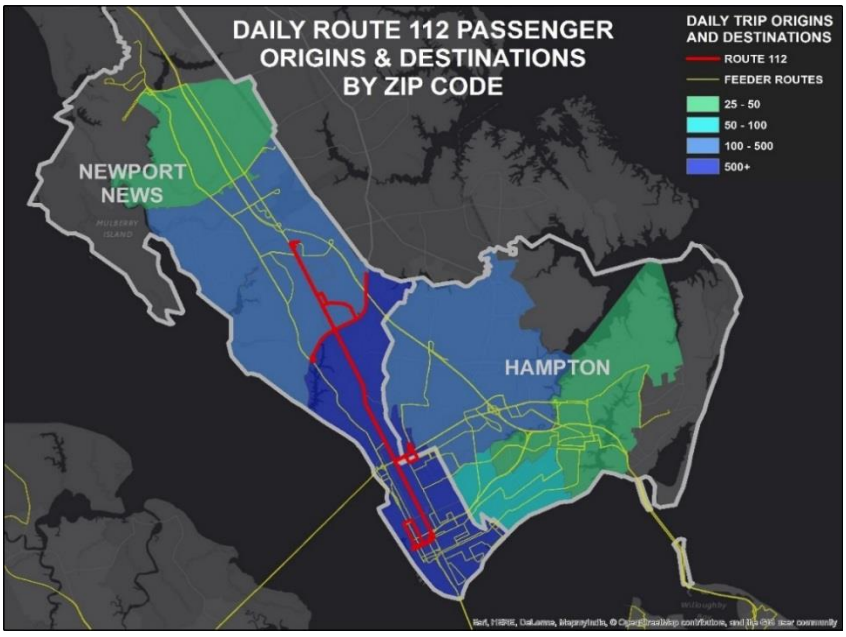
Figure 4-8: Route 20 - Origins and Destinations



The Route 20 provides service on the Southside of HRT's service area and is the highest performing local bus route system-wide, with 1,204,112 passenger trips generated in FY16. The map included shows how many of the trip origins and destinations occur in the cities of Chesapeake, Norfolk, and Virginia Beach. The map shows how feeder routes connect to the Route 20 highlighting its impact in the region and the impact the service has on areas and routes that are and are not physically connected along the route's path.

Route 112 – Origins and Destinations

Figure 4-9: Route 112 - Origins and Destinations



The Route 112 provides service on the Northside of HRT's service area and is the highest performing local bus route on the north side, with 523,512 passenger trips generated in FY16. The map included shows how many of the trip origins and destinations occur in the cities of Hampton and Newport News. The map shows how feeder routes connect to the Route 112 highlighting it as a route that serves as a "spine" of the Northside and the feeder route that supports its structure and generates ridership based on its connectedness.

Chapter 5

Survey Methodology

HAMPTON ROADS TRANSIT

CHAPTER 5: SURVEY METHODOLOGY

SAMPLING PLAN

To ensure that the distribution of completed surveys mirrored the actual distribution of riders, ETC Institute developed a sampling plan that ensured the completion of Boarding-Alighting Counts on over 700 system trips, On-to-Off counts with at least 8,500 of the system's riders, Park and Ride counts, and an Origin and Destination survey with at least 5,300 of the system's riders during the weekdays based on Tuesday – Thursday average weekday ridership. ETC Institute also developed a sampling plan that ensured the survey completion of 800 of the system's riders on the weekend. The time periods for the weekday collection of this survey were as follows:

TIME PERIOD	TIME RANGE
AM PEAK	Before 8am
MIDDAY	8am-2pm
PM PEAK	2pm-6pm
EVENING	After 6pm

Sources of Ridership Data

The source of the original ridership used to plan for and expand the survey came from HRT and was based on the August and September 2015 average daily ridership, this data source was summarized by ETC. ETC created stop-level ridership data by normalizing the Boarding and Alighting Survey results by the daily ridership totals. The new Stop-Level ridership created by ETC used to fine tune the collection and conduct the expansion, was from average daily ridership from September and October 2016. In both instances, the Virginia Beach (VB) Wave bus routes and Ferry utilized August data and the remaining routes used September data. Per HRT direction, the Virginia Beach (VB) Wave bus and Ferry routes utilized August 2016 data because of seasonal usage.

Sampling Plan for Boarding Alighting Counts

The sampling plan for the Boarding and Alighting Counts was designed to obtain ridership counts from a minimum of 50% of the daily trips on each bus route operated by HRT that has a minimum daily ridership of 500. The cutoff of 500 was selected based on the same cutoff being used for On-to-Off counts. The VB Wave route, with at least a count of 500 in ridership, was not counted due to the contract extension not occurring until after this route was discontinued for the summer season. **Error! No bookmark name given.** shows the g oals and the actual number of completed Boarding-Alighting counts that were obtained for a bus trip by Route, Time Period, and Direction.

Table 5-1 shows the goals and actual number of BA counts that were obtained for a bus trip by Route, Time Period, and Direction. ETC collected 72 more trips than the sampling goal. Overall, 27 of 27 (100.0%) weekday total route goals were fully achieved.

TABLE 5-1: HRT SAMPLING GOALS AND BA COUNTS COMPLETED BY TIME OF DAY AND DIRECTION (BUS)

Route #	Population of Trips						Sampling Goals						COMPLETED						GOAL (10%)
	AM PEAK (Before 8am)	Midday (8:00am-1:59pm)	PM Peak (2:00-5:59pm)	Night (After 6:00pm)	Total	Total Trips	AM PEAK (Before 8am)	Midday (8:00am-1:59pm)	PM Peak (2:00-5:59pm)	Night (After 6:00pm)	Total	Total Surveys	AM PEAK (Before 8am)	Midday (8:00am-1:59pm)	PM Peak (2:00-5:59pm)	Night (After 6:00pm)	Total	Total Surveys	
1 Downtown Norfolk Pembroke East INBOUND [HRT]	11	13	13	5	42	81	6	7	7	3	21	41	2	11	8	3	24	47	YES
1 Downtown Norfolk Pembroke East OUTBOUND [HRT]	10	12	13	4	39		5	6	7	2	20		5	9	8	1	23		
2 Naval Station Norfolk/Hampton Blvd INBOUND [HRT]	5	12	6	4	27	56	3	6	3	2	14	28	3	5	3	3	14	28	YES
2 Naval Station Norfolk/Hampton Blvd OUTBOUND [HRT]	7	12	6	4	29		4	6	3	2	15		3	6	2	3	14		
3 Downtown Norfolk/Naval Station INBOUND [HRT]	9	14	13	6	42	80	5	7	7	3	21	40	5	8	6	3	22	40	YES
3 Downtown Norfolk/Naval Station OUTBOUND [HRT]	9	12	13	4	38		5	6	7	2	19		4	6	7	1	18		
6 Downtown Norfolk/South Norfolk/Robert Hall Blvd INBOUND [HRT]	4	5	5	5	19	40	2	3	3	3	10	20	3	3	2	3	11	23	YES
6 Downtown Norfolk/South Norfolk/Robert Hall Blvd OUTBOUND [HRT]	6	5	4	6	21		3	3	2	3	11		5	3	2	2	12		
8 Downtown Norfolk / Evelyn T. Butts Ave INBOUND [HRT]	6	12	5	2	25	48	3	6	3	1	13	24	2	12	5	2	21	40	YES
8 Downtown Norfolk / Evelyn T. Butts Ave OUTBOUND [HRT]	5	12	4	2	23		3	6	2	1	12		2	11	4	2	19		
9 Downtown Norfolk/Sewells Point Road INBOUND [HRT]	4	12	8	5	29	58	2	6	4	3	15	29	1	7	7	4	19	38	YES
9 Downtown Norfolk/Sewells Point Road OUTBOUND [HRT]	4	12	7	6	29		2	6	4	3	15		1	7	6	5	19		
12 South Norfolk/TCC – Virginia Beach INBOUND [HRT]	2	6	4	3	15	31	1	3	2	2	8	16	1	3	2	2	8	16	YES
12 South Norfolk/TCC – Virginia Beach OUTBOUND [HRT]	3	6	4	3	16		2	3	2	2	8		2	3	2	1	8		
13 Downtown Norfolk/Robert Hall Blvd/TCC – Chesapeake INBOUND [HRT]	6	7	4	1	18	35	3	4	2	1	9	18	2	6	4	1	13	25	YES
13 Downtown Norfolk/Robert Hall Blvd/TCC – Chesapeake OUTBOUND [HRT]	5	6	4	2	17		3	3	2	1	9		2	5	4	1	12		
15 Evelyn Butts to Robert Hall/Greenbrier Mall INBOUND [HRT]	9	14	14	8	45	93	5	7	7	4	23	47	5	8	7	4	24	49	YES
15 Evelyn Butts to Robert Hall/Greenbrier Mall OUTBOUND [HRT]	12	14	15	7	48		6	7	8	4	24		5	9	8	3	25		
20 Downtown Norfolk/Virginia Beach Oceanfront INBOUND [HRT]	10	11	16	5	42	78	5	6	8	3	21	39	5	11	10	1	27	52	YES
20 Downtown Norfolk/Virginia Beach Oceanfront OUTBOUND [HRT]	10	11	11	4	36		5	6	6	2	18		7	11	5	2	25		
21 Little Creek Rd. INBOUND [HRT]	6	12	8	7	33	66	3	6	4	4	17	33	3	6	5	3	17	35	YES
21 Little Creek Rd. OUTBOUND [HRT]	7	12	8	6	33		4	6	4	3	17		4	6	4	4	18		
23 Medical Tower/Military Circle/JANAF INBOUND [HRT]	6	12	8	6	32	66	3	6	4	3	16	33	3	7	4	3	17	33	YES
23 Medical Tower/Military Circle/JANAF OUTBOUND [HRT]	7	12	8	7	34		4	6	4	4	17		3	6	4	3	16		
36 (Holland) Pembroke East INBOUND [HRT]	3	3	5	4	15	31	2	2	3	2	8	16	1	1	2	3	7	16	YES
36 (Holland) Pembroke East OUTBOUND [HRT]	4	3	5	4	16		2	2	3	2	8		2	2	2	3	9		
45 Downtown Norfolk/Portsmouth INBOUND [HRT]	11	14	10	8	43	86	6	7	5	4	22	43	3	8	7	4	22	46	YES
45 Downtown Norfolk/Portsmouth OUTBOUND [HRT]	10	14	10	9	43		5	7	5	5	22		4	10	6	4	24		
47 Downtown Portsmouth/Churchland INBOUND [HRT]	9	12	10	1	32	64	5	6	5	1	16	32	1	9	6	0	16	33	YES
47 Downtown Portsmouth/Churchland OUTBOUND [HRT]	8	12	8	4	32		4	6	4	2	16		2	9	6	0	17		
101 (Kecoughtan) Downtown Newport News/Downtown Hampton INBOUND [HRT]	4	10	8	7	29	57	2	5	4	4	15	29	2	5	4	4	15	30	YES
101 (Kecoughtan) Downtown Newport News/Downtown Hampton OUTBOUND [HRT]	3	10	7	8	28		2	5	4	4	14		2	5	3	5	15		
103 (Shell Rd.) Downtown Newport News/Downtown Hampton INBOUND [HRT]	5	12	8	8	33	66	3	6	4	4	17	33	3	6	5	3	17	34	YES
103 (Shell Rd.) Downtown Newport News/Downtown Hampton OUTBOUND [HRT]	6	12	8	7	33		3	6	4	4	17		3	6	4	4	17		
104 (Marshall) Downtown Newport News/Newmarket INBOUND [HRT]	4	12	8	8	32	65	2	6	4	4	16	33	2	6	5	4	17	34	YES
104 (Marshall) Downtown Newport News/Newmarket OUTBOUND [HRT]	5	12	8	8	33		3	6	4	4	17		3	6	4	4	17		
105 (Briarfield) Maple Avenue & 27th Street/Peninsula Town Center INBOUND [HRT]	2	6	4	6	18	35	1	3	2	3	9	18	1	3	2	3	9	18	YES
105 (Briarfield) Maple Avenue & 27th Street/Peninsula Town Center OUTBOUND [HR	2	6	4	5	17		1	3	2	3	9		1	3	2	3	9		
106 Newport News / Warwick Boulevard / Denbigh / Fort Eustis INBOUND [HRT]	2	4	2	4	12	25	1	2	1	2	6	13	1	2	1	2	6	13	YES
106 Newport News / Warwick Boulevard / Denbigh / Fort Eustis OUTBOUND [HRT]	2	4	3	4	13		1	2	2	2	7		1	2	2	2	7		
107 Newport News / Warwick Boulevard / Denbigh INBOUND [HRT]	1	4	3	3	11	23	1	2	2	2	6	12	1	2	1	2	6	12	YES
107 Newport News / Warwick Boulevard / Denbigh OUTBOUND [HRT]	2	4	3	3	12		1	2	2	2	6		1	2	1	2	6		
110 (Thomas Nelson) Downtown Hampton/Thomas Nelson INBOUND [HRT]	2	3	3	2	10	21	1	2	2	1	5	11	1	2	2	0	5	11	YES
110 (Thomas Nelson) Downtown Hampton/Thomas Nelson OUTBOUND [HRT]	2	4	2	3	11		1	2	1	2	6		1	2	2	1	6		
111 (Denbigh – TNCC) Thomas Nelson/Riverside/Denbigh INBOUND [HRT]	1	1	1	2	5	11	1	1	1	1	3	6	0	1	0	2	3	6	YES
111 (Denbigh – TNCC) Thomas Nelson/Riverside/Denbigh OUTBOUND [HRT]	2		2	2	6		1	0	1	1	3		1	0	1	1	3		
112 Downtown Newport News / Patrick Henry Mall INBOUND [HRT]	5	12	8	11	36	73	3	6	4	6	18	37	2	6	4	6	18	37	YES
112 Downtown Newport News / Patrick Henry Mall OUTBOUND [HRT]	6	12	8	11	37		3	6	4	6	19		3	7	4	5	19		
114 (Weaver Rd.) Newmarket/Downtown Hampton INBOUND [HRT]	3	12	8	7	30	60	2	6	4	4	15	30	2	6	4	3	15	30	YES
114 (Weaver Rd.) Newmarket/Downtown Hampton OUTBOUND [HRT]	4	12	8	6	30		2	6	4	3	15		2	6	4	3	15		
118 (Magruder) Langley/Semple Farm Road INBOUND [HRT]	2	6	4	4	16	32	1	3	2	2	8	16	1	3	2	2	8	16	YES
118 (Magruder) Langley/Semple Farm Road OUTBOUND [HRT]	2	6	4	4	16		1	3	2	2	8		1	3	2	2	8		
961 MAX Newport News-Hampton to Norfolk INBOUND [HRT]	6	6	7	5	24	50	3	3	4	3	12	25	3	4	3	2	12	25	YES
961 MAX Newport News-Hampton to Norfolk OUTBOUND [HRT]	5	8	8	5	26		3	4	4	3	13		2	5	3	3	13		
TOTAL	286	492	378	275	1431	1431	143	246	189	138	716	716	131	301	213	142	787	787	YES

Sampling Plan for On-to-Off Counts

The sampling plan for the On-to-Off counts was designed to obtain completed surveys from a minimum of 20% of the daily ridership on each route operated by HRT that has a minimum daily ridership of 500. This is consistent with the previous HRT survey effort in 2013. Collecting at least 100 on-to-off surveys typically yield positive data results for the route/direction/time of day/segment breakdown during the expansion process. Surveying routes below 500 would have provided a sample size smaller than the preferred 100 surveys which is needed in order to provide valuable data for an expansion type that utilizes on-to-off survey's distribution.

Table 5-2 shows the goals and the actual number of actual completed On-to-Off surveys that were obtained for each bus by Route, Time Period, and direction. Table 5-2 through Table 5-4 show that ETC collected 8,067 more responses than the sampling goal. Overall, 40 of 40 (100%) weekday total route goals were fully achieved.

TABLE 5-2: HRT SAMPLING GOALS AND ON-TO-OFF SURVEYS COMPLETED BY TIME OF DAY AND DIRECTION (BUS)

Route #	Sampling Goals						COMPLETED						GOAL (10%)
	AM PEAK (Before 8am)	Midday (8:00am-1:59pm)	PM Peak (2:00-5:59pm)	Night (After 6:00pm)	Total	Total Surveys	AM PEAK (Before 8am)	Midday (8:00am-1:59pm)	PM Peak (2:00-5:59pm)	Night (After 6:00pm)	Total	Total Surveys	
1 Downtown Norfolk Pembroke East INBOUND [HRT]	48	100	100	26	**274**	**597**	84	280	115	40	**519**	**1007**	YES
1 Downtown Norfolk Pembroke East OUTBOUND [HRT]	57	114	112	41	**323**		96	144	136	112	**488**		
2 Naval Station Norfolk/Hampton Blvd INBOUND [HRT]	14	35	33	8	**90**	**203**	59	72	56	29	**216**	**446**	YES
2 Naval Station Norfolk/Hampton Blvd OUTBOUND [HRT]	21	45	36	11	**113**		61	92	55	22	**230**		
3 Downtown Norfolk/Naval Station INBOUND [HRT]	49	80	69	20	**218**	**407**	55	139	71	31	**296**	**602**	YES
3 Downtown Norfolk/Naval Station OUTBOUND [HRT]	25	60	78	26	**189**		39	125	83	59	**306**		
6 Downtown Norfolk/South Norfolk/Robert Hall Blvd INBOUND [HRT]	16	30	29	6	**81**	**166**	51	71	34	67	**223**	**435**	YES
6 Downtown Norfolk/South Norfolk/Robert Hall Blvd OUTBOUND [HRT]	20	28	29	7	**85**		91	64	35	22	**212**		
8 Downtown Norfolk / Evelyn T. Butts Ave INBOUND [HRT]	19	49	34	11	**113**	**259**	100	201	67	59	**427**	**849**	YES
8 Downtown Norfolk / Evelyn T. Butts Ave OUTBOUND [HRT]	15	56	54	21	**146**		100	96	158	68	**422**		
9 Downtown Norfolk/Sewells Point Road INBOUND [HRT]	16	32	27	7	**81**	**172**	28	54	43	31	**156**	**307**	YES
9 Downtown Norfolk/Sewells Point Road OUTBOUND [HRT]	12	35	30	14	**91**		32	38	52	29	**151**		
12 South Norfolk/TCC – Virginia Beach INBOUND [HRT]	3	15	20	4	**43**	**106**	5	67	96	61	**229**	**454**	YES
12 South Norfolk/TCC – Virginia Beach OUTBOUND [HRT]	14	28	18	4	**63**		25	135	49	16	**225**		
13 Downtown Norfolk/Robert Hall Blvd/TCC – Chesapeake INBOUND [HRT]	24	44	37	14	**119**	**221**	54	151	81	55	**341**	**697**	YES
13 Downtown Norfolk/Robert Hall Blvd/TCC – Chesapeake OUTBOUND [HRT]	17	33	41	11	**101**		91	98	159	8	**356**		
15 Evelyn Butts to Robert Hall/Greenbrier Mall INBOUND [HRT]	46	93	82	22	**242**	**519**	67	182	119	9	**377**	**793**	YES
15 Evelyn Butts to Robert Hall/Greenbrier Mall OUTBOUND [HRT]	42	93	106	36	**277**		22	196	124	74	**416**		
20 Downtown Norfolk/Virginia Beach Oceanfront INBOUND [HRT]	50	120	132	50	**351**	**802**	50	237	142	76	**505**	**1417**	YES
20 Downtown Norfolk/Virginia Beach Oceanfront OUTBOUND [HRT]	85	158	148	59	**451**		222	294	341	55	**912**		
21 Little Creek Rd. INBOUND [HRT]	37	78	64	15	**193**	**402**	42	148	67	22	**279**	**549**	YES
21 Little Creek Rd. OUTBOUND [HRT]	30	77	78	24	**209**		60	87	83	40	**270**		
23 Medical Tower/Military Circle/JANAF INBOUND [HRT]	17	44	38	12	**112**	**241**	46	53	42	16	**157**	**345**	YES
23 Medical Tower/Military Circle/JANAF OUTBOUND [HRT]	21	49	48	12	**130**		23	97	44	24	**188**		
30 Wave: Atlantic Avenue Shuttle INBOUND [HRT]	0	22	42	78	**143**	**400**	0	98	149	174	**421**	**834**	YES
30 Wave: Atlantic Avenue Shuttle OUTBOUND [HRT]	0	60	73	123	**257**		0	114	109	190	**413**		
36 (Holland) Pembroke East INBOUND [HRT]	11	25	26	7	**69**	**132**	13	41	34	13	**101**	**221**	YES
36 (Holland) Pembroke East OUTBOUND [HRT]	10	24	23	7	**63**		31	28	53	8	**120**		
45 Downtown Norfolk/Portsmouth INBOUND [HRT]	43	70	63	23	**199**	**384**	73	176	98	64	**411**	**785**	YES
45 Downtown Norfolk/Portsmouth OUTBOUND [HRT]	29	66	69	21	**185**		86	126	88	74	**374**		
47 Downtown Portsmouth/Churchland INBOUND [HRT]	24	60	49	9	**142**	**197**	27	56	64	9	**156**	**298**	YES
47 Downtown Portsmouth/Churchland OUTBOUND [HRT]	8	26	18	3	**55**		10	77	53	2	**142**		
101 (Kecoughtan) Downtown Newport News/Downtown Hampton INBOUND [HRT]	13	38	38	10	**99**	**194**	48	50	71	22	**191**	**350**	YES
101 (Kecoughtan) Downtown Newport News/Downtown Hampton OUTBOUND [HRT]	15	33	35	13	**95**		24	54	65	16	**159**		
103 (Shell Rd.) Downtown Newport News/Downtown Hampton INBOUND [HRT]	14	39	36	15	**104**	**206**	28	50	64	29	**171**	**347**	YES
103 (Shell Rd.) Downtown Newport News/Downtown Hampton OUTBOUND [HRT]	13	41	34	14	**102**		33	48	76	19	**176**		
104 (Marshall) Downtown Newport News/Newmarket INBOUND [HRT]	9	31	34	12	**87**	**188**	19	73	61	18	**171**	**350**	YES
104 (Marshall) Downtown Newport News/Newmarket OUTBOUND [HRT]	13	41	32	14	**101**		15	84	60	20	**179**		
105 (Briarfield) Maple Avenue & 27th Street/Peninsula Town Center INBOUND [HRT]	6	21	25	14	**66**	**155**	5	28	38	28	**99**	**247**	YES
105 (Briarfield) Maple Avenue & 27th Street/Peninsula Town Center OUTBOUND [HRT]	13	36	27	12	**88**		29	54	44	21	**148**		
106 Newport News / Warwick Boulevard / Denbigh / Fort Eustis INBOUND [HRT]	28	47	43	20	**139**	**267**	40	50	55	42	**187**	**353**	YES
106 Newport News / Warwick Boulevard / Denbigh / Fort Eustis OUTBOUND [HRT]	28	46	38	17	**128**		28	83	35	20	**166**		
107 Newport News / Warwick Boulevard / Denbigh INBOUND [HRT]	3	28	37	20	**88**	**205**	2	53	37	18	**110**	**285**	YES
107 Newport News / Warwick Boulevard / Denbigh OUTBOUND [HRT]	18	49	37	14	**117**		46	58	40	31	**175**		
110 (Thomas Nelson) Downtown Hampton/Thomas Nelson INBOUND [HRT]	3	24	21	9	**57**	**122**	12	34	48	14	**108**	**251**	YES
110 (Thomas Nelson) Downtown Hampton/Thomas Nelson OUTBOUND [HRT]	9	29	19	8	**65**		19	65	50	9	**143**		
111 (Denbigh – TNCC) Thomas Nelson/Riverside/Denbigh INBOUND [HRT]	6	24	19	6	**55**	**125**	14	43	30	10	**97**	**208**	YES
111 (Denbigh – TNCC) Thomas Nelson/Riverside/Denbigh OUTBOUND [HRT]	8	29	25	8	**70**		14	46	44	7	**111**		
112 Downtown Newport News / Patrick Henry Mall INBOUND [HRT]	23	63	53	19	**158**	**345**	33	71	84	53	**241**	**581**	YES
112 Downtown Newport News / Patrick Henry Mall OUTBOUND [HRT]	24	74	68	22	**188**		69	130	115	26	**340**		
114 (Weaver Rd.) Newmarket/Downtown Hampton INBOUND [HRT]	10	52	45	16	**122**	**265**	29	101	90	30	**250**	**472**	YES
114 (Weaver Rd.) Newmarket/Downtown Hampton OUTBOUND [HRT]	12	61	54	16	**143**		26	105	72	19	**222**		
118 (Magruder) Langley/Semple Farm Road INBOUND [HRT]	5	27	19	5	**56**	**151**	14	69	28	21	**132**	**296**	YES
118 (Magruder) Langley/Semple Farm Road OUTBOUND [HRT]	13	44	29	10	**95**		38	74	36	16	**164**		
961 MAX Newport News-Hampton to Norfolk INBOUND [HRT]	19	16	20	11	**67**	**142**	32	72	42	13	**159**	**344**	YES
961 MAX Newport News-Hampton to Norfolk OUTBOUND [HRT]	16	23	31	6	**76**		21	93	31	40	**185**		
TOTAL	1,142	2,765	2,625	1,042	**7575**	7,575	2,381	5,425	4,216	2,101	**14,123**	14,123	YES

TABLE 5-3: HRT SAMPLING GOALS AND ON-TO-OFF SURVEYS COMPLETED BY TIME OF DAY AND DIRECTION (RAIL)

		Sampling Goals						COMPLETED						GOAL (10%)
Station	Dir	AM PEAK (Before 8am)	Midday (8:00am-1:59pm)	PM Peak (2:00-5:59pm)	Night (After 6:00pm)	Total	Total Surveys	AM PEAK (Before 8am)	Midday (8:00am-1:59pm)	PM Peak (2:00-5:59pm)	Night (After 6:00pm)	Total	Total Surveys	
EVMC/Fort Norfolk Station	The Tide (Light Rail) Outbound	10	38	28	8	**85**	**85**	28	136	100	22	**286**	**286**	YES
York Street/Freemason	The Tide (Light Rail) Outbound	3	9	6	3	**21**	**33**	8	29	37	11	**85**	**126**	YES
York Street/Freemason	The Tide (Light Rail) Inbound	9	2	1	0	**12**		12	20	9	0	**41**		
Monticello	The Tide (Light Rail) Outbound	7	26	18	13	**65**	**111**	15	48	80	31	**174**	**271**	YES
Monticello	The Tide (Light Rail) Inbound	26	10	6	3	**46**		41	27	24	5	**97**		
MacArthur Square	The Tide (Light Rail) Outbound	3	37	46	17	**103**	**163**	5	44	107	33	**189**	**267**	YES
MacArthur Square	The Tide (Light Rail) Inbound	37	11	8	4	**61**		42	20	9	7	**78**		
Civic Plaza	The Tide (Light Rail) Outbound	15	27	22	6	**72**	**117**	29	72	66	36	**203**	**291**	YES
Civic Plaza	The Tide (Light Rail) Inbound	27	14	4	1	**46**		30	41	8	9	**88**		
Harbor Park	The Tide (Light Rail) Outbound	1	5	2	12	**21**	**41**	2	6	11	24	**43**	**95**	YES
Harbor Park	The Tide (Light Rail) Inbound	5	8	2	5	**20**		5	22	2	23	**52**		
NSU Station	The Tide (Light Rail) Outbound	4	10	7	8	**28**	**65**	9	16	19	23	**67**	**155**	YES
NSU Station	The Tide (Light Rail) Inbound	10	13	8	5	**36**		23	22	24	19	**88**		
Ballentine/Broad Creek Station	The Tide (Light Rail) Outbound	4	8	5	5	**22**	**56**	7	13	18	18	**56**	**148**	YES
Ballentine/Broad Creek Station	The Tide (Light Rail) Inbound	8	15	7	4	**34**		12	38	22	20	**92**		
Ingleside Road Station	The Tide (Light Rail) Outbound	1	2	1	1	**5**	**15**	2	6	5	6	**19**	**45**	YES
Ingleside Road Station	The Tide (Light Rail) Inbound	2	5	2	1	**10**		2	15	3	6	**26**		
Military Highway Station	The Tide (Light Rail) Outbound	4	7	6	3	**19**	**74**	11	13	14	15	**53**	**168**	YES
Military Highway Station	The Tide (Light Rail) Inbound	7	22	19	7	**55**		13	45	34	23	**115**		
Newtown Road Station	The Tide (Light Rail) Inbound	38	70	54	24	**185**	**185**	115	196	234	68	**613**	**613**	YES
TOTAL		223	339	254	130	946	946	411	829	826	399	2,465	2,465	YES

TABLE 5-4: HRT SAMPLING GOALS AND ON-TO-OFF SURVEYS COMPLETED BY TIME OF DAY AND DIRECTION (FERRY)

	Sampling Goals						COMPLETED						GOAL (10%)
Dir	AM PEAK (Before 8am)	Midday (8:00am-1:59pm)	PM Peak (2:00-5:59pm)	Night (After 6:00pm)	Total	Total Surveys	AM PEAK (Before 8am)	Midday (8:00am-1:59pm)	PM Peak (2:00-5:59pm)	Night (After 6:00pm)	Total	Total Surveys	
HRT FERRY	34	53	33	53	**174**	**174**	68	76	139	71	**354**	**354**	YES
Totals	34	53	33	53	**174**	**174**	68	76	139	71	**354**	**354**	YES

Sampling Goals for O&D Survey

ETC Institute developed a sampling plan that would ensure the completion of the O&D Survey with approximately 5,300, or 10%, of the system's weekday riders as well as 800 weekend riders.

Weekday

Table 5-5 shows the goals and the actual number of completed surveys that were obtained by Route, Time Period, and Direction. The sampling plan for the O&D Survey was designed to obtain completed surveys from a minimum of 10% of the ridership on each of the bus routes operated by HRT. ETC Institute collected surveys to represent the overall distribution by time of day. The 10% sample was requested by HRT in the RFP. Overall, 74 of 83 (89.2%) weekday total route goals were fully achieved. For each route's goal that wasn't achieved, an interview team spent at least three days attempting to target that specific route/set of cells.

TABLE 5-5A: HRT SAMPLING GOALS AND O&D SURVEYS COMPLETED BY TIME OF DAY AND DIRECTION (BUS)

Route #	Route Name	Direction	Ridership Data (Sept-Oct 2016 Average) Total Ridership	Original Sampling Goals AM PEAK (Before 8am)	Midday (8:00am-1:59pm)	PM Peak (2:00-5:59pm)	Night (After 6:00pm)	Total	Total Surveys	COMPLETED AM PEAK (Before 8am)	Midday (8:00am-1:59pm)	PM Peak (2:00-5:59pm)	Night (After 6:00pm)	Total	Total Surveys	GOAL (10%)
1	Downtown Norfolk Pembroke East	INBOUND	2758	21	45	45	12	123	299	22	126	53	14	215	401	YES
		OUTBOUND		26	51	50	18	145		28	92	50	16	186		
2	Naval Station Norfolk/Hampton Blvd	INBOUND	909	6	16	15	3	40	102	7	22	16	1	46	102	YES
		OUTBOUND		9	20	16	5	51		11	19	20	6	56		
3	Downtown Norfolk/Naval Station	INBOUND	2056	22	36	31	9	98	204	23	37	31	12	103	203	NO
		OUTBOUND		11	27	35	12	85		12	38	38	12	100		
4	Downtown Norfolk/ODU	INBOUND	322	3	7	5	4	18	34	6	19	6	4	35	65	YES
		OUTBOUND		2	5	5	2	13		2	18	6	4	30		
5	Willoughby – Evelyn Butts	INBOUND	252	3	5	3	0	11	27	2	72	59	0	133	246	YES
		OUTBOUND		1	5	6	0	13		4	63	46	0	113		
6	Downtown Norfolk/South Norfolk/Robert Hall Blvd	INBOUND	780	7	13	13	3	37	83	15	25	36	3	79	143	YES
		OUTBOUND		9	13	13	3	38		21	18	23	2	64		
8	Downtown Norfolk / Evelyn T. Butts Ave	INBOUND	1187	8	22	15	5	51	129	10	41	15	9	75	159	YES
		OUTBOUND		7	25	24	9	66		24	23	31	6	84		
9	Downtown Norfolk/Sewells Point Road	INBOUND	785	7	14	12	3	37	86	8	19	13	7	47	89	YES
		OUTBOUND		5	16	14	6	41		6	17	13	6	42		
11	Downtown Norfolk/Colonial Place	INBOUND	181	2	3	3	0	8	16	4	7	10	0	21	43	YES
		OUTBOUND		0	3	3	0	6		4	8	10	0	22		
12	South Norfolk/TCC – Virginia Beach	INBOUND	497	1	7	9	2	19	53	1	27	22	10	60	123	YES
		OUTBOUND		6	12	8	2	29		12	39	9	3	63		
13	Downtown Norfolk/Robert Hall Blvd/TCC – Chesapeake	INBOUND	1106	11	20	17	6	54	110	8	36	23	12	79	146	YES
		OUTBOUND		8	15	18	5	46		12	27	26	2	67		
14	Robert Hall Blvd / TCC Chesapeake	INBOUND	417	1	7	8	0	17	47	1	27	22	10	60	107	YES
		OUTBOUND		5	14	7	0	26		3	24	18	2	47		
15	Evelyn Butts to Robert Hall/Greenbrier Mall	INBOUND	2281	21	42	37	10	109	260	35	54	41	20	150	265	YES
		OUTBOUND		19	42	48	16	125		3	70	36	6	115		
18	Downtown Norfolk/Ballentine Boulevard	INBOUND	254	2	3	2	1	7	18	4	3	3	0	10	27	YES
		OUTBOUND		1	3	4	1	9		6	5	5	1	17		
20	Downtown Norfolk/Virginia Beach Oceanfront	INBOUND	3827	23	54	59	22	158	401	25	77	56	53	211	443	YES
		OUTBOUND		38	71	67	27	203		36	70	103	23	232		
21	Little Creek Rd.	INBOUND	1755	16	35	29	7	87	201	14	46	30	8	98	206	YES
		OUTBOUND		13	35	35	11	94		17	38	43	10	108		
22	Newtown Road Station/Joint Expeditionary Base Little Creek	INBOUND	298	3	5	4	0	13	30	3	46	34	0	83	156	YES
		OUTBOUND		2	6	7	0	15		4	29	40	0	73		
23	Medical Tower/Military Circle/JANAF	INBOUND	1164	8	20	17	5	50	121	15	20	31	4	70	133	YES
		OUTBOUND		9	22	22	5	58		12	25	19	7	63		
25	(Newtown) Military Circle/Princess Anne	INBOUND	471	2	8	5	2	17	48	4	27	21	2	54	90	YES
		OUTBOUND		4	12	7	4	26		3	17	12	4	36		
26	Lynnhaven Mall / TCC Virginia Beach	INBOUND	248	1	4	8	0	13	29	0	10	10	2	22	54	YES
		OUTBOUND		1	7	4	0	12		1	13	16	2	32		
27	Pleasure House Rd./Newtown Road Light Rail Station	INBOUND	352	5	6	5	2	17	37	6	6	10	2	24	49	YES
		OUTBOUND		2	4	6	3	16		3	10	7	5	25		
29	(Lynnhaven) Pleasure House Road	INBOUND	327	3	8	5	1	18	37	2	10	10	1	23	46	YES
		OUTBOUND		1	6	7	2	15		2	12	7	2	23		

TABLE 5-5B: HRT SAMPLING GOALS AND O&D SURVEYS COMPLETED BY TIME OF DAY AND DIRECTION (BUS)

Route #	Route Name	Direction	Ridership Data (Sept-Oct 2016 Average) Total Ridership	Original Sampling Goals AM PEAK (Before 8am)	Midday (8:00am-1:59pm)	PM Peak (2:00-5:59pm)	Night (After 6:00pm)	Total	Total Surveys	COMPLETED AM PEAK (Before 8am)	Midday (8:00am-1:59pm)	PM Peak (2:00-5:59pm)	Night (After 6:00pm)	Total	Total Surveys	GOAL (10%)
30	Wave: Atlantic Avenue Shuttle	INBOUND		0	10	19	35	64	200	0	48	67	38	153	309	YES
		OUTBOUND		0	27	33	55	116		0	32	64	60	156		
31	Wave: Aquarium and Campground Shuttle	INBOUND		0	6	3	1	10	34	0	8	8	4	20	41	YES
		OUTBOUND		0	7	8	6	20		0	11	6	4	21		
32	Wave: Shoppers Shuttle	INBOUND		0	1	3	2	6	16	0	3	4	3	10	30	YES
		OUTBOUND		0	4	3	1	8		0	11	4	5	20		
33	(General Booth) North Seashore/Municipal Center	INBOUND	451	2	8	7	1	18	47	2	24	7	5	38	71	YES
		OUTBOUND		4	9	8	3	23		4	12	11	6	33		
36	(Holland) Pembroke East	INBOUND	621	5	11	11	3	31	66	4	12	13	5	34	68	YES
		OUTBOUND		4	11	10	3	28		6	10	15	3	34		
41	Downtown Portsmouth/Cradock	INBOUND	370	3	11	8	0	23	40	4	25	14	3	46	93	YES
		OUTBOUND		2	6	4	0	13		1	25	18	3	47		
43	County Street / Bart Street	INBOUND	129	1	5	3	0	9	13	0	8	2	0	10	19	YES
		OUTBOUND		0	1	1	0	3		0	4	5	0	9		
44	Norfolk General Hospital/Midtown Portsmouth	INBOUND	429	3	8	5	1	18	48	2	11	8	4	25	56	YES
		OUTBOUND		2	12	10	2	25		6	14	10	1	31		
45	Downtown Norfolk/Portsmouth	INBOUND	1794	19	31	28	10	90	192	20	25	29	19	93	192	YES
		OUTBOUND		13	30	31	9	83		16	33	37	13	99		
47	Downtown Portsmouth/Churchland	INBOUND	873	11	27	22	4	64	99	10	28	20	7	65	110	YES
		OUTBOUND		4	12	8	1	25		6	20	17	2	45		
50	Academy Park/Victory Crossing	INBOUND	192	3	9	7	0	19	24	2	16	11	1	30	45	YES
		OUTBOUND		0	1	1	0	2		2	10	3	0	15		
55	Greenbrier Circulator	INBOUND	192	0	2	4	1	6	17	0	3	3	3	9	26	YES
		OUTBOUND		2	5	2	0	9		1	9	5	2	17		
57	Robert Hall Boulevard/Airline Boulevard	INBOUND	382	4	9	8	0	22	45	3	25	9	0	37	70	YES
		OUTBOUND		3	8	8	0	19		4	21	8	0	33		
58	South Norfolk/Bainbridge Boulevard	INBOUND	205	1	4	4	0	9	24	2	11	7	0	20	49	YES
		OUTBOUND		2	6	4	0	12		2	21	6	0	29		
64	To Smithfield/Gwaltney and Newport News Shipyard	INBOUND	83	2	0	1	0	3	9	2	0	2	0	4	7	NO
		OUTBOUND		1	0	2	1	5		1	0	2	0	3		
101	(Kecoughtan) Downtown Newport News/Downtown Hampton	INBOUND	922	6	17	17	5	45	97	7	21	18	5	51	101	YES
		OUTBOUND		7	15	16	6	43		6	21	16	7	50		
102	(Coliseum) Peninsula Town Center/Downtown Hampton	INBOUND	205	1	2	1	0	4	24	3	8	3	1	15	28	YES
		OUTBOUND		2	9	7	0	18		2	5	6	0	13		
103	(Shell Rd.) Downtown Newport News/Downtown Hampton	INBOUND	934	6	18	16	7	47	103	8	19	20	7	54	99	NO
		OUTBOUND		6	18	15	6	46		6	21	13	5	45		
104	(Marshall) Downtown Newport News/Newmarket	INBOUND	775	4	14	15	5	39	94	7	15	17	9	48	108	YES
		OUTBOUND		6	19	14	6	46		10	25	16	9	60		
105	(Briarfield) Maple Avenue & 27th Street/Peninsula Town Center	INBOUND	733	3	10	11	6	30	77	3	16	9	7	35	82	YES
		OUTBOUND		6	16	12	6	40		9	17	15	6	47		
106	Newport News / Warwick Boulevard / Denbigh / Fort Eustis	INBOUND	1231	13	21	20	9	63	133	13	20	22	9	64	130	NO
		OUTBOUND		12	21	17	7	57		12	26	20	8	66		
107	Newport News / Warwick Boulevard / Denbigh	INBOUND	965	1	13	17	9	40	103	5	17	16	9	47	112	YES
		OUTBOUND		8	22	17	6	53		11	29	19	6	65		
108	Patrick Henry Mall / Lee Hall	INBOUND	435	4	10	7	2	22	44	4	15	8	3	30	48	YES
		OUTBOUND		2	6	6	3	17		4	5	6	3	18		
109	(Pembroke) Downtown Hampton/Buckroe	INBOUND	201	1	5	3	1	10	22	3	11	3	1	18	34	YES
		OUTBOUND		1	3	4	2	10		2	6	6	2	16		
110	(Thomas Nelson) Downtown Hampton/Thomas Nelson	INBOUND	593	1	11	9	4	26	61	2	19	11	5	37	79	YES
		OUTBOUND		4	13	9	4	29		3	16	20	3	42		
111	(Denbigh – TNCC) Thomas Nelson/Riverside/Denbigh	INBOUND	401	3	11	8	3	25	63	10	12	7	2	31	65	YES
		OUTBOUND		4	13	11	4	32		2	15	12	5	34		
112	Downtown Newport News / Patrick Henry Mall	INBOUND	1856	10	29	24	8	71	173	11	33	27	14	85	174	YES
		OUTBOUND		11	33	30	10	84		16	31	26	16	89		
114	(Weaver Rd.) Newmarket/Downtown Hampton	INBOUND	1203	4	23	20	7	55	132	7	25	24	9	65	136	YES
		OUTBOUND		5	28	24	7	64		5	28	27	11	71		
115	Buckroe/Willow Oaks/Downtown Hampton	INBOUND	434	7	12	5	2	25	47	9	20	8	2	39	59	YES
		OUTBOUND		0	4	8	4	17		1	6	9	4	20		
116	(Mall Hall) Lee Hall/Patrick Henry Mall Loop	INBOUND	257	1	3	3	1	9	24	3	2	7	2	14	30	YES
		OUTBOUND		1	5	5	2	13		2	7	3	4	16		
117	(Phoebus) Hampton University/V.A. Hospital	INBOUND	217	0	3	4	0	8	25	1	2	2	1	6	24	NO
		OUTBOUND		4	8	3	1	15		5	8	4	1	18		
118	(Magruder) Langley/Semple Farm Road	INBOUND	658	2	12	9	2	25	76	5	19	10	5	39	78	YES
		OUTBOUND		6	20	13	4	43		6	16	12	5	39		
119	Fishing Point Dr/Riverside Regional Medical Center	INBOUND	173	1	2	2	0	4	11	1	1	2	0	4	13	YES
		OUTBOUND		1	3	2	0	6		1	5	3	0	9		
120	(Mallory) Downtown Hampton/Mallory/Buckroe	INBOUND	211	1	5	3	1	9	20	1	9	3	2	15	25	YES
		OUTBOUND		1	4	4	1	9		1	3	5	1	10		
121	Newport News Transportation Center / Williamsburg	INBOUND	32	1	0	0	0	1	5	1	0	3	0	4	7	YES
		OUTBOUND		1	0	2	0	3		1	0	2	0	3		
403	Buckroe Shopping Center	INBOUND	26	0	0	0	0	0	4	0	0	0	0	0	1	NO
		OUTBOUND		3	1	0	0	3		1	0	0	0	1		
405	NNTC/Buckroe	INBOUND	47	3	0	0	0	3	6	6	0	0	0	6	8	YES
		OUTBOUND		0	0	2	0	2		0	0	2	0	2		
414	NNTC/Jefferson/Oakland	INBOUND	97	0	0	4	0	4	11	0	0	6	0	6	11	YES
		OUTBOUND		5	0	1	0	6		4	0	1	0	5		
415	NNTC/Denbigh	INBOUND	21	0	0	0	0	0	3	0	0	0	0	0	8	YES
		OUTBOUND		0	0	3	0	3		0	0	8	0	8		
427	Denbigh Midnight	INBOUND	4	0	0	0	0	0	0	0	0	0	0	0	0	YES
		OUTBOUND		0	0	0	0	0		0	0	0	0	0		
430	Denbigh Fringe	INBOUND	95	4	0	0	0	5	7	3	0	0	0	3	7	YES
		OUTBOUND		0	0	1	0	1		0	0	4	0	4		
918	MAX Virginia Beach to Joint Forces Staff College Norfolk/Naval Station N	INBOUND	19	2	0	0	0	2	4	2	0	0	0	2	3	NO
		OUTBOUND		0	0	1	0	1		0	0	1	0	1		
919	MAX Virginia Beach to Joint Forces Staff College Norfolk/Naval Station N	INBOUND	94	5	0	0	1	6	13	5	0	0	0	5	9	NO
		OUTBOUND		0	0	6	0	6		0	0	4	0	4		
922	MAX Chesapeake-Virginia Beach to Naval Station Norfolk	INBOUND	81	3	0	0	0	4	10	5	0	0	0	5	12	YES
		OUTBOUND		1	0	4	0	5		0	0	7	0	7		
960	MAX Virginia Beach to Norfolk	INBOUND	235	2	2	5	0	9	24	2	2	5	0	9	24	YES
		OUTBOUND		4	4	4	0	13		3	4	8	0	15		
961	MAX Newport News-Hampton to Norfolk	INBOUND	674	8	7	9	5	30	71	10	12	8	6	36	73	YES
		OUTBOUND		7	10	14	3	34		6	13	14	4	37		
965	MAX Patrick Henry Mall to Naval Station Norfolk	INBOUND	21	0	0	1	0	1	2	0	0	1	0	1	2	YES
		OUTBOUND		1	0	0	0	1		1	0	0	0	1		
966	MAX Silverleaf Park & Ride/Newport News Transit Center	INBOUND	43	1	0	0	0	2	4	2	0	0	0	2	4	YES
		OUTBOUND		0	0	2	0	2		0	0	2	0	2		
967	MAX Virginia Beach-Chesapeake to Newport News (MHS)	INBOUND	225	9	0	0	3	12	29	9	0	0	0	9	31	YES
		OUTBOUND		0	0	13	0	14		0	0	22	0	22		
		TOTALS	42,066	668	1,578	1,507	536	4288	4,764	809	2,517	2,098	683	6,107	6,107	YES

TABLE 5-6: HRT SAMPLING GOALS AND O&D SURVEYS COMPLETED BY TIME OF DAY AND DIRECTION (RAIL)

Station	Dir	Ridership Data (Aug-Oct 2016 Average) Total Ridership	Original Sampling Goals: AM PEAK (Before 8am)	Midday (8:00am-1:59pm)	PM Peak (2:00-5:59pm)	Night (After 6:00pm)	Total	Total Surveys	COMPLETED: AM PEAK (Before 8am)	Midday (8:00am-1:59pm)	PM Peak (2:00-5:59pm)	Night (After 6:00pm)	Total	Total Surveys	GOAL (10%)
EVMC/Fort Norfolk Station	Outbound	441	5	19	14	4	42	42	9	28	22	13	72	72	YES
York Street/Freemason	Inbound	113	4	1	0	0	6	16	7	2	1	0	10	47	YES
	Outbound		2	4	3	1	10		6	11	12	8	37		
Monticello	Inbound	459	13	5	3	2	23	54	14	4	4	2	24	71	YES
	Outbound		3	13	9	7	31		5	13	13	16	47		
MacArthur Square	Inbound	555	18	5	4	2	30	80	17	12	5	2	36	102	YES
	Outbound		2	18	22	8	50		4	20	29	13	66		
Civic Plaza	Inbound	473	13	7	2	0	22	57	12	11	5	2	30	82	YES
	Outbound		8	13	11	3	35		13	18	15	6	52		
Harbor Park	Inbound	170	3	4	1	2	10	20	10	17	2	7	36	70	YES
	Outbound		1	3	1	6	10		4	8	5	17	34		
NSU Station	Inbound	349	5	6	4	3	18	32	6	7	10	5	28	61	YES
	Outbound		2	5	3	4	14		4	14	8	7	33		
Ballentine/Broad Creek Station	Inbound	304	4	7	4	2	17	27	7	11	9	5	32	50	YES
	Outbound		2	4	2	2	11		3	6	5	4	18		
Ingleside Road Station	Inbound	85	1	2	1	0	5	7	3	10	6	4	23	33	YES
	Outbound		1	1	0	0	3		2	3	3	2	10		
Military Highway Station	Inbound	427	3	11	9	3	27	36	12	15	15	10	52	62	YES
	Outbound		2	3	3	1	9		2	3	3	2	10		
Newtown Road Station	Inbound	896	19	34	26	12	90	90	24	49	35	17	125	125	YES
TOTAL		4,270	109	165	124	63	461	461	164	262	207	142	775	775	YES

TABLE 5-7: HRT SAMPLING GOALS AND O&D SURVEYS COMPLETED BY TIME OF DAY AND DIRECTION (FERRY)

Route #	Ridership Data (Sept-Oct 2016 Average): AM PEAK (Before 8am)	Midday (8:00am-1:59pm)	PM Peak (2:00-5:59pm)	Night (After 6:00pm)	Total Ridership	Sampling Goals: AM PEAK (Before 8am)	Midday (8:00am-1:59pm)	PM Peak (2:00-5:59pm)	Night (After 6:00pm)	Total	Total Surveys	COMPLETED: AM PEAK (Before 8am)	Midday (8:00am-1:59pm)	PM Peak (2:00-5:59pm)	Night (After 6:00pm)	Total	Total Surveys	GOAL (10%)
HRT FERRY	63	223	275	277	838	15	24	15	24	78	87	15	25	17	20	77	77	No

Weekend

Table 5-8 shows the goals and the actual number of completed surveys that were obtained by Route, Time Period, and Direction. The sampling plan for the origin and destination survey was designed to obtain completed surveys from 800 weekend riders. The 800 records were collected so that the data could be segmented into two groups of 400 and still have a confidence interval (CI) of 95% with a margin of error (ME) of ±5%. The full 800 records provide a 95% CI with a ME of ±3.4%. The original weekend ridership average was provided by HRT. ETC Institute then used average weekend ridership from September and October 2016 to conduct the expansion. Overall, the weekend total routes goal of 800 was fully achieved.

TABLE 5-8A: HRT SAMPLING GOALS AND O&D SURVEYS COMPLETED BY TIME OF DAY AND DIRECTION (WEEKEND)

Route #	Route Name	Ridership Data (Sept-Oct 2016 Average)	% of Ridership (BUS)	Total Surveys Collected
TIDE	TIDE	3630	-	148
FERRY	FERRY	1573	-	29
1	Downtown Norfolk Pembroke East	1356	6.0%	75
2	Naval Station Norfolk/Hampton Blvd	275	1.2%	7
3	Downtown Norfolk/Naval Station	1074	4.7%	69
4	Downtown Norfolk/ODU	161	0.7%	0
5	Willoughby – Evelyn Butts	120	0.5%	0
6	Downtown Norfolk/South Norfolk/Robert Hall Blvd	256	1.1%	0
8	Downtown Norfolk / Evelyn T. Butts Ave	681	3.0%	26
9	Downtown Norfolk/Sewells Point Road	180	0.8%	0
11	Downtown Norfolk/Colonial Place	76	0.3%	0
12	South Norfolk/TCC – Virginia Beach	163	0.7%	0
13	Downtown Norfolk/Robert Hall Blvd/TCC – Chesapeake	472	2.1%	8
14	Robert Hall Blvd / TCC Chesapeake	127	0.6%	0
15	Evelyn Butts to Robert Hall/Greenbrier Mall	1008	4.4%	54
18	Downtown Norfolk/Ballentine Boulevard	41	0.2%	0
20	Downtown Norfolk/Virginia Beach Oceanfront	1952	8.6%	57
21	Little Creek Rd.	872	3.8%	37
22	Newtown Road Station/Joint Expeditionary Base Little Creek	80	0.4%	0
23	Medical Tower/Military Circle/JANAF	578	2.6%	35
25	(Newtown) Military Circle/Princess Anne	128	0.6%	0
26	Lynnhaven Mall / TCC Virginia Beach	62	0.3%	0
27	Pleasure House Rd./Newtown Road Light Rail Station	122	0.5%	0
29	(Lynnhaven) Pleasure House Road	98	0.4%	0
30	Wave: Atlantic Avenue Shuttle	2948	13.0%	16
31	Wave: Aquarium and Campground Shuttle	479	2.1%	8
32	Wave: Shoppers Shuttle	147	0.6%	5
33	(General Booth) North Seashore/Municipal Center	189	0.8%	0
36	(Holland) Pembroke East	163	0.7%	0
41	Downtown Portsmouth/Cradock	121	0.5%	0
43	County Street / Bart Street	38	0.2%	0
44	Norfolk General Hospital/Midtown Portsmouth	140	0.6%	0

TABLE 5-8B: HRT SAMPLING GOALS AND O&D SURVEYS COMPLETED BY TIME OF DAY AND DIRECTION (WEEKEND)

Route #	Route Name	Ridership Data (Sept-Oct 2016 Average)	% of Ridership (BUS)	Total Surveys Collected
45	Downtown Norfolk/Portsmouth	844	3.7%	68
47	Downtown Portsmouth/Churchland	364	1.6%	0
50	Academy Park/Victory Crossing	73	0.3%	0
57	Robert Hall Boulevard/Airline Boulevard	132	0.6%	0
58	South Norfolk/Bainbridge Boulevard	100	0.4%	0
101	(Kecoughtan) Downtown Newport News/Downtown Hampton	462	2.0%	7
102	(Coliseum) Peninsula Town Center/Downtown Hampton	78	0.3%	9
103	(Shell Rd.) Downtown Newport News/Downtown Hampton	520	2.3%	10
104	(Marshall) Downtown Newport News/Newmarket	361	1.6%	3
105	(Briarfield) Maple Avenue & 27th Street/Peninsula Town Center	438	1.9%	12
106	Newport News / Warwick Boulevard / Denbigh / Fort Eustis	638	2.8%	14
107	Newport News / Warwick Boulevard / Denbigh	540	2.4%	14
108	Patrick Henry Mall / Lee Hall	327	1.4%	15
109	(Pembroke) Downtown Hampton/Buckroe	167	0.7%	2
110	(Thomas Nelson) Downtown Hampton/Thomas Nelson	256	1.1%	3
111	(Denbigh – TNCC) Thomas Nelson/Riverside/Denbigh	215	0.9%	1
112	Downtown Newport News / Patrick Henry Mall	1084	4.8%	42
114	(Weaver Rd.) Newmarket/Downtown Hampton	713	3.1%	17
115	Buckroe/Willow Oaks/Downtown Hampton	179	0.8%	2
116	(Mall Hall) Lee Hall/Patrick Henry Mall Loop	195	0.9%	0
117	(Phoebus) Hampton University/V.A. Hospital	47	0.2%	0
118	(Magruder) Langley/Semple Farm Road	282	1.2%	8
120	(Mallory) Downtown Hampton/Mallory/Buckroe	86	0.4%	2
960	MAX Virginia Beach to Norfolk	183	0.8%	0
961	MAX Newport News-Hampton to Norfolk	274	1.2%	0
TOTAL		27870	-	803

PILOT TEST

ETC Institute conducted a pilot test for the Hampton Roads Origin and Destination Study from August 16 - 17, 2016. The purpose of the pilot test was to assess all aspects of the survey including survey design, sampling methodology, implementation, and data processing tasks. The overall goal was to complete 100 Origin & Destination (O&D) Intercept Surveys. The actual number of O&D Intercept Surveys that were completed in the field was 201, of these 164 surveys were classified as useable (82% recovery rate). Useable records were defined as a trip that made logistical sense and all other variables answered. For a Rolling Pilot test, a 75% recovery rate is acceptable, understanding that as the interviewers become more experienced this figure of useable records will increase. Useable records were defined as a trip that made logistical sense and all other variables answered. Based on the results of the pilot test, the survey administrator recommended that the Origin & Destination survey proceed as scheduled with limited superficial changes. This included slight changes to the mapping features of the tablet PC base.

Routes Involved

With the Virginia Beach Wave (seasonal service) schedule, it was necessary to conduct the pilot test on the three (3) Wave routes prior to the end of August 2016 and begin surveying on these three routes for the full collection. The pilot test was administered to transit riders on all three Wave routes on weekdays between the hours of 6:00 am and 9:00 pm. The routes that were included in the pilot test are listed below:

- Route 30 – Atlantic Ave. Shuttle
- Route 31 – VA Aquarium and Campground
- Route 32 – Shopper Shuttle

Pilot Test Results

Assessment of Survey Length

The time it took survey participants to complete the survey on a tablet PC ranged from a minimum of 5.25 minutes to a maximum of 28 minutes. The average time was 8.75 minutes.

The issues with the individual stops loading, for the boarding and alighting questions, added approximately one and a half to two minutes to each bus survey. The cause was related to the number of individual patterns in each route and a multitude of stops associated to each pattern. ETC refined the mapping features in the route/stop files after the pilot test concluded and reduced the lag time. After the pilot test was concluded and the stop list mapping features were reprogramed with new algorithms, the boarding and alighting questions took less than five seconds to load all individual bus stops associated with each route.

Assessment of Survey Design

Overall, the survey design worked well and was understood by both the interviewers and passengers. No changes were needed to the survey design after the pilot test concluded.

Assessment of Survey Participation and Usability of Surveys

The goal was to complete 100 O&D Intercept Interviews. Overall, 201 interviews were conducted with 164 records passing secondary post processing. Test results by route are provided in the graph on the following page:

HRT Pilot Test Results

Route	Surveys Collected	Usable Surveys	Recovery %
30	164	147	90%
31	19	4	21%
32	18	13	72%
Total	**201**	**164**	**82%**

Route 31 had more records fall out of both field review and post processing due to survey staff not performing well.

Respondent Participation

A total of 235 passengers were asked to participate in the pilot test. Of these, 211 agreed to participate (201 participated on the vehicle) with the in-person interview, while 10 respondents provided call back information. When averaged, 86% of those who were asked to participate with the in-person interview agreed to participate either on the vehicle or by phone.

Note: For the pre-test, callbacks to complete the survey via phone were not conducted due to adding the callback feature once the survey was finalized. The callbacks were not considered in the recovery rate because they were not traditionally attempted on rolling pilot test surveys.

Assessment of Refusals

Twenty-three riders refused to complete the survey. Of these:

Reasons for Refusals:

- 56 percent indicated “Not interested/busy doing other things at the moment”
- 20 percent indicated “Rider did not give one of the above reasons”
- 24 percent indicated either “Disability impacting ability to complete interview” or “Already did the interview”

Conclusions

Based on the results of the pilot test, ETC Institute recommended that the Origin and Destination Survey proceed as scheduled. ETC Institute made changes to the mapping features of the tablet PC base on pilot test findings.

Considerations for future on-board survey

While the project was successful in its implementation, during the actual study there are always improvements that can be made for future projects. For future efforts, a more thorough review of the scope and the data to be collected should be conducted prior to official contracting to determine if any additional items are needed or adjusted based on the overall goal of the project. This includes any modifications to the contracting firm's approach to data collection and analysis.

One notable change from the 2014 Study to the current 2016 Study was the selection of Race/Ethnicity. The 2016 Survey allowed multiple responses for the Race/Ethnicity question. This is the current practice for O&D Surveys, rather than collecting the variable as a single response selection as was the case in the 2014 Study. HRT's percentage of mixed/other ethnicities may have increased from 41% (2014) to 61% (2016), based on these new standards from the previous study.

The number of customers that did not transfer has increased significantly from 2014 to 2016, from 41% (2014) to 61% (2016) This is due in part to a change in methodology. In the 2014 study, the raw number of transfers was expanded using a multiplier for each route. However, in 2016, the raw number was expanded in a way to be consistent with the ridership of both linked and unlinked trips in all routes. This new method generates a more accurate representation of the transfers occurring in the HRT system.

An additional area of improvement for future efforts is a review of the ridership data and sample plan at regular intervals during the study. Because the sample plan is built on historic data, new routes introduced in the current service schedule are not easily identified leading into the data collection. By conducting this review collectively between HRT and the contractor new routes can by more easily referenced, accounted for in the sample plan, and in the data collected during the core data collection.

SURVEY INSTRUMENT

The tablet PCs were the preferred survey method as the tablet PC's have an on-screen mapping features that allows for real-time geocoding of addresses and places based off either address, intersection or place searches based on feedback from respondents. The respondents can then confirm the geocoded location based on the on-screen map that shows the searched address/location via a Google Map indicator icon. In addition to using the mapping feature to collect the GPS coordinates of major survey locations (home address, origin address, destination address, boarding location, and alighting location), the tablet PC also allows the surveyor to walk through each question with the respondent. This allows the surveyor to answer any questions as well as to ensure the quality of the data collected. The respondent can also press the answers to the questions directly

on the tablet PC during the demographic section to allow for more privacy. Respondents who did not have time to complete the survey during their bus trip were also given the option of providing their phone numbers. Those who provided their phone numbers were then contacted by ETC Institute's call center to complete the survey. Examples from the tablet PC survey are below and in Figures 5-1, 5-2, 5-3, and 5-4.

FIGURE 5-1: TABLET PC SCREENSHOT FOR QUESTION: "WHAT TYPE OF PLACE ARE YOU COMING FROM NOW?"

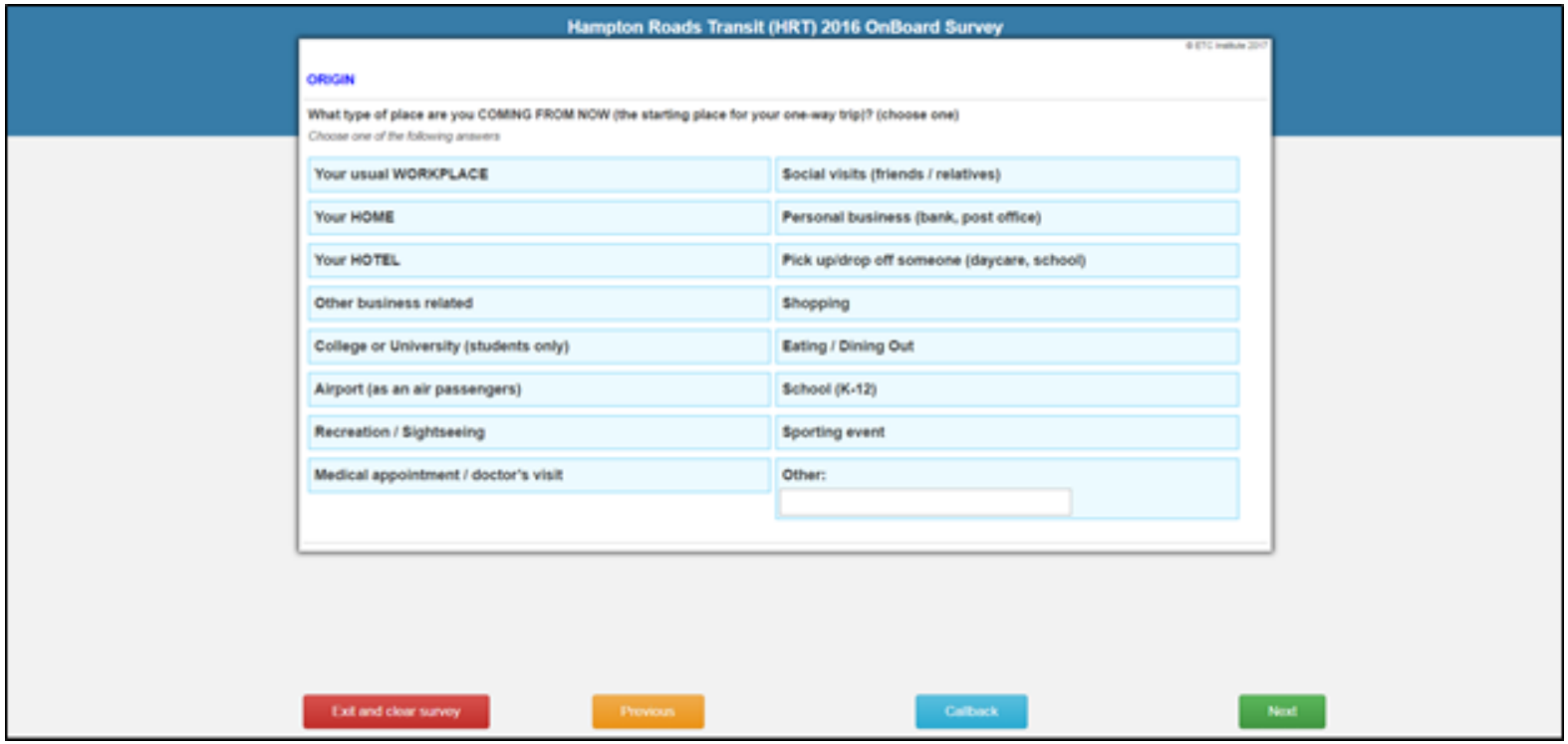


FIGURE 5-2: TABLET PC SCREENSHOT FOR QUESTION: "WHAT IS THE EXACT STREET ADDRESS OF THIS PLACE?"

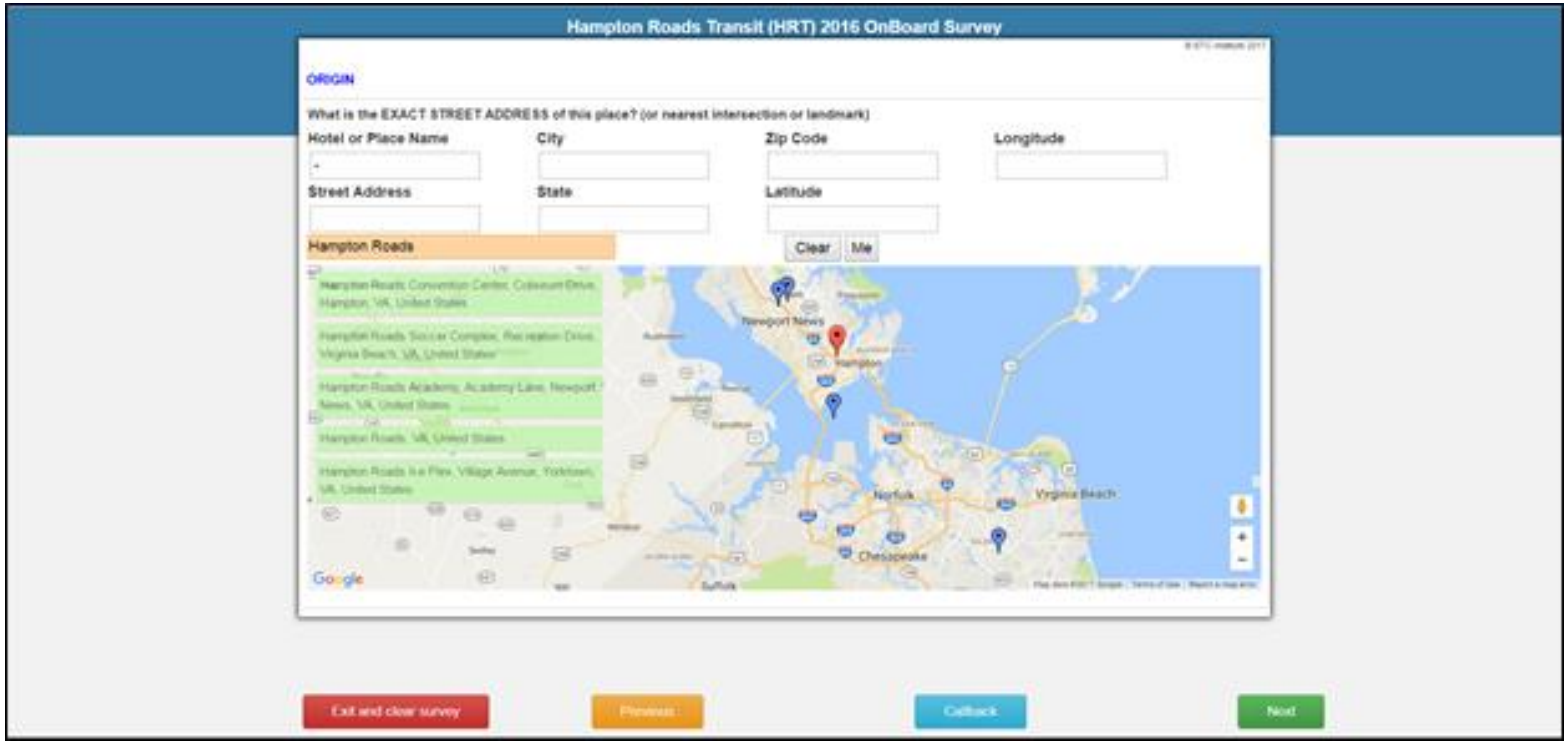


FIGURE 5-3: TABLET PC SCREENSHOT FOR QUESTION: "WHERE DID YOU GET ON THIS BUS?"

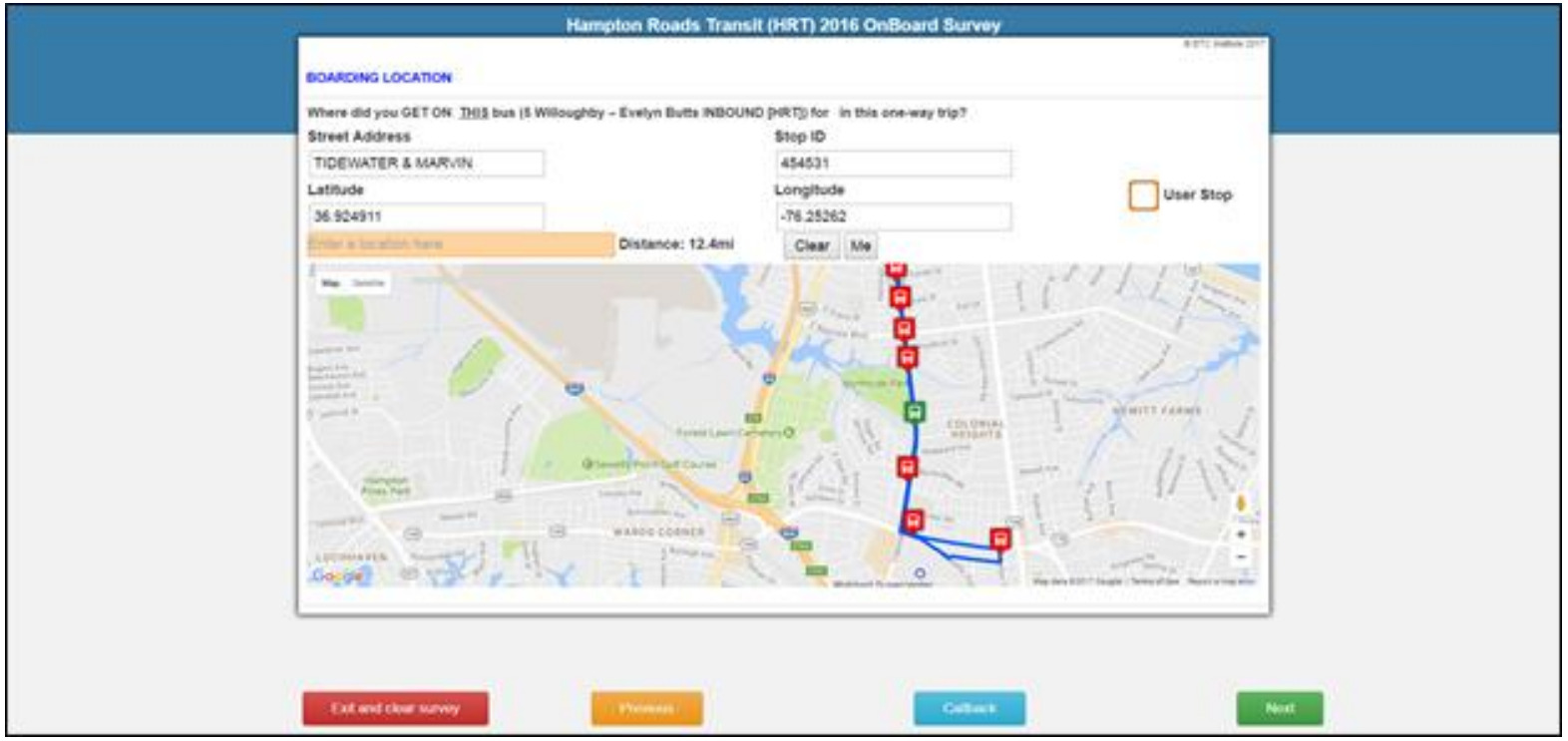
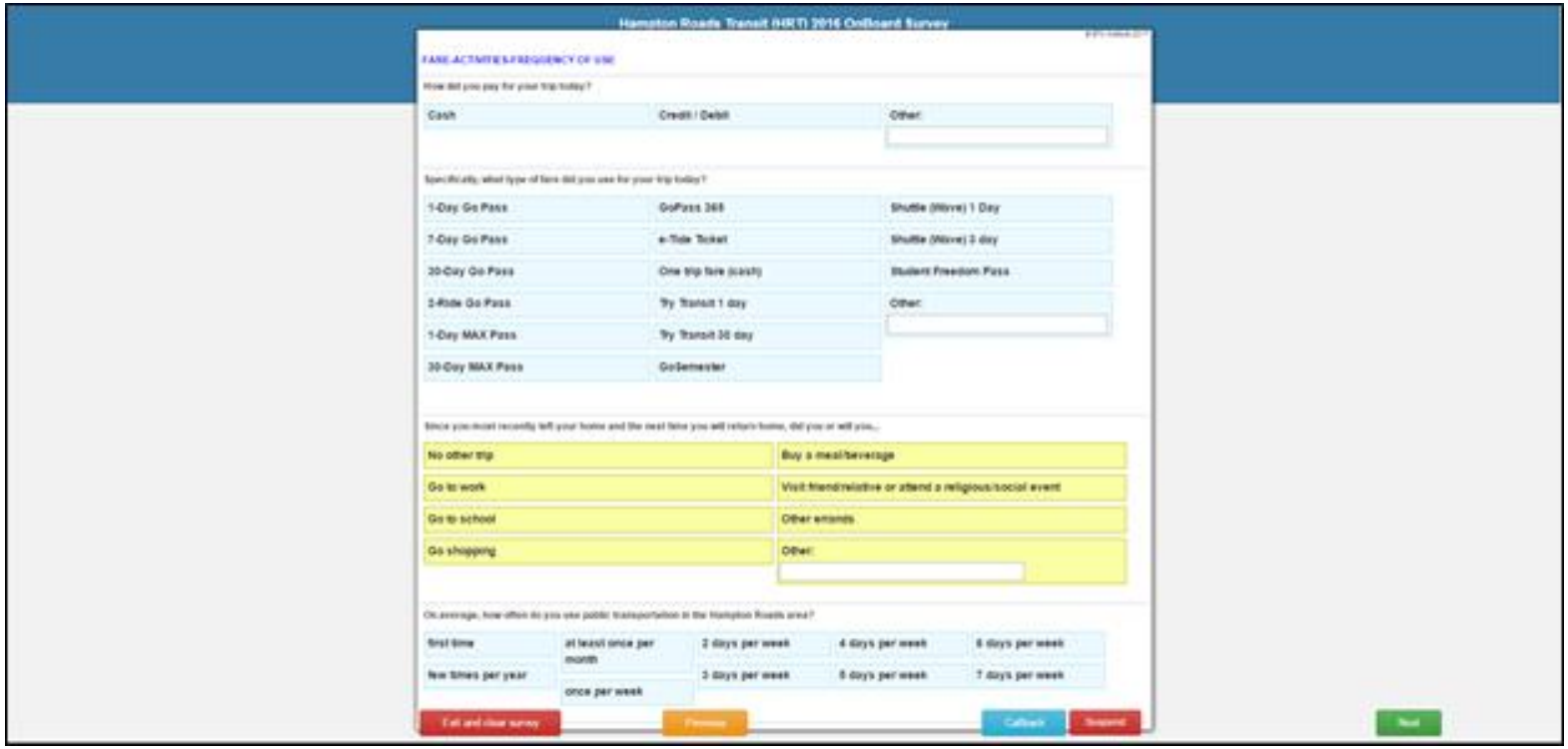


FIGURE 5-4: TABLET PC SCREENSHOT FOR QUESTIONS ABOUT FARE/SERVICE



For higher volume MAX/Express services, the respondent generally has a longer ride time, and the ease of distributing the paper surveys to a higher number of passengers often leads to a much higher percentage of surveys being captured than would have been possible by just using a tablet PC. Each paper questionnaire that was used by ETC Institute tracked the route and trip time (the paper questionnaire is provided in Appendix A). The paper surveys that were collected on these routes were then entered into the online database with the tablet PC survey collection.

SURVEY ADMINISTRATION

Labor Recruitment and Training

ETC Institute conducted two major training sessions throughout the data collection phases. The first major training was for the O2O counts and the second major training session was for the O&D survey collection. There were additional training sessions conducted throughout the data collection process on an as needed basis but with smaller groups. Additionally, ETC Institute trained select surveyors who participated in the O2O counts training and/or O&D training to conduct park-n-ride counts and Boarding Alighting (BA) count tasks.

Training sessions focused on the study purpose and objectives, the survey instruments, scripts on how to respond to passengers' questions, how to use data collection tools, instructions on how to conduct themselves when working with the public, and safety training. The survey staff were instructed to understand that while they are not HRT employees, they were representing HRT while on HRT vehicles or property and they needed to act in a manner that reflected positively.

Maximizing participation and legitimizing the survey among passengers depended on the public response to the survey staff. To support a good public image, ETC Institute imposed strict dress code standards that required survey staff to wear clean appropriate clothing to present a casual, yet neat, appearance that ensured professionalism and comfort. Survey staff were provided with surveyor badges and vests, identifying surveyors to the HRT staff and passengers to further legitimize their appearance. The badge and dress code standards promoted a professional appearance and reinforced survey legitimacy, which increased passengers' trust in the interviewers and the process.

As survey staff are the key ingredient to the success of a project, ETC provided an in-depth project specific training to ensure a successful data collection. The surveyor training reviewed project specifics and field procedures and provided training on how to actively engage customers (passengers). Key highlights in ETC's training focused on courtesy, professionalism, and person-to-person interactions.

Recruiting and Training Surveyors

The O2O counter training involved two (2) hours of classroom training and four (4) hours of field training for a total of six (6) hours per surveyor. The ETC Institute Project Manager and field supervisor created the necessary training materials and conducted the O2O training. The primary tool that was used for the training session was a PowerPoint presentation. The training went over the following details:

- Equipment use and setup
- Methodologies for collecting bus boarding and alighting pairs
- How to approach passengers
- Distribution and collection of bus on-to-off cards
- How to handle refusals

- How to react in various situations that may be encountered
- Safety training

Once surveyors had demonstrated that they can perform the O2O counts, the surveyors were invited to field training. The field training provided hands on training that involved the actual conducting of the O2O counts with bus and train passengers. During the field training, surveyors were tested on their proficiency and were provided with additional coaching if needed. If the surveyor was deemed unable to perform the on-to-off count, they were replaced.

Recruiting and Training Interviewers

The O&D training involved four (4) hours of classroom training and eight (8) hours of field training, with an additional two (2) hours of follow up training for a total of 14 hours per interviewer. The ETC Institute Data Collection Manager created the necessary training materials and conducted the O&D training. The classroom training session included a PowerPoint presentation to explain the purpose and objectives of the survey, questionnaire content, interviewer procedures and requirements, survey logistics, how to maximize response rates (including hard-to-survey passengers), and the data collection process in a step-by-step format. Other goals of the training included building interview staff confidence, helping interview staff feel that they are an important part of the survey's success, and helping them understand the importance of the survey and the long-term benefits to their community.

ETC Institute ensured that the training addressed the following details:

- Tips on intercepting/interacting with passengers with disabilities
- Tips on intercepting/interacting with limited English proficient passengers
- Cultural sensitivity
- Importance of understanding the intent of the questions
- Importance of random selection and properly recording all refusals
- Importance of data confidentiality
- Overview of the HRT system covering all topics covered in the tablet questionnaire
- How to handle passenger comments and complaints
- Instructions on conveying the purpose of the survey to passengers
- Safety training

Towards the end of training, interviewers conducted mock interviews using the survey tablets. This allowed ETC Institute staff to gauge each interviewer's comprehension of the survey and instrument and provide feedback as needed. After the training, interviewers were tested on items discussed in training.

Following classroom training, applicants got a chance to conduct interviews under the supervision of an experienced ETC Institute supervisor. Supervisors oversaw interviewers and provided feedback on performance throughout the day.

Interviewers who were conducting the survey properly could go to the next phase of field training. Interviewers who needed more help, but showed promise, were asked to spend a second day in the field under direct supervision. Once an interviewer had demonstrated proficiency under direct supervision, he/she was given a field test during which the prospective interviewer conducted surveys on his/her own. During this period, the interviewer's productivity and data quality were remotely assessed by ETC's staff.

Organization of Survey Team

On-to-off (O2O) Count Administrators Roles

The O2O count administrators (surveyors) were responsible for the distribution and collection of the on-to-off count cards. Typically, there were two surveyors assigned to each bus with one surveyor covering the front of the bus and a second surveyor positioned at the back of the bus. The surveyor at the front of the bus scanned and distributed barcoded cards to boarding passengers, while the surveyor at the back of the bus collected and scanned the cards as passengers alighted. The surveyors were equipped with handheld scanning devices to capture the boarding and alighting locations.

For light rail, counters asked the riders at which stop they entered (if not observed) and then what stop they exited the train. The rationale is two-fold. First, with relatively few stops with names overwhelmingly known by riders the ability to collect accurate on and off stops verbally is significantly more efficient than on buses. Second, the logistics of having staff at each door handling both the boarding and alighting activity is overwhelming for the counters. ETC Institute utilized a staff of at least 20 - 25 surveyors for the on-to-off count.

Origin Destination (O&D) Passenger Survey Administrators Roles

For the O&D survey, interviewers boarded their assigned bus/train/ferry and selected riders at random to participate in the survey. While conducting the interview, interviewers asked the respondent each question from the survey tablet and recorded each response provided to them by the passenger. Interviewers needed to be capable of establishing conversation in regard to the survey with bus passengers and inputting passenger responses. For the passenger survey, ETC utilized a staff of at least 15-20 surveyors for the Origin-Destination Survey.

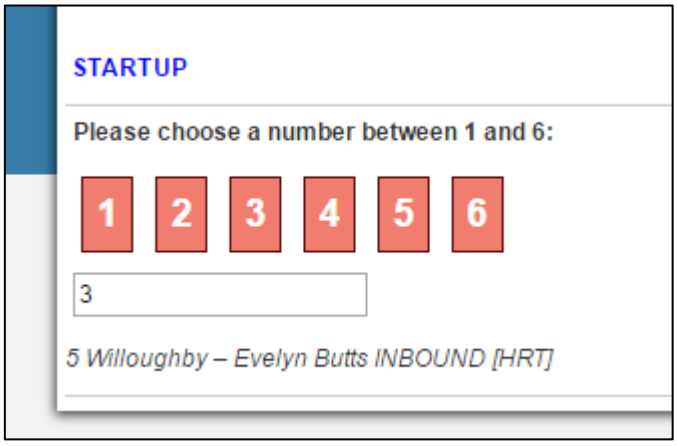
Survey Administration

Selection of participants

Each rider was provided the opportunity to participate in the on-to-off collection. For every sampled trip or individual bus/rail trip that was surveyed for the on-to-off counts, every passenger that boarded the vehicle was offered a barcoded card that was scanned when the passenger boarded and scanned again when the passenger alighted the vehicle. For express and regional routes, a hardcopy questionnaire was attempted to be administered to all boarding passengers.

For the O&D tablet surveys, a random number generator was used to determine which passengers were asked to participate in the survey after boarding the surveying bus shown in Figure 5-5. If four (4) people boarded a bus, the tablet PC randomly generated a number from 1 to 6. If the number generated was 2, the second person who boarded the bus was asked to participate in the survey. If the number generated was 1, the first person was asked to participate in the survey, and so forth. The selection was limited to the first six (6) people who boarded a bus or train at any given stop to ensure the interviewer could keep track of the passengers as they boarded. For example, if 20 people boarded a bus or train, the tablet PC program would randomly pick one of the first six people for the survey. If the interview is refused by the randomly selected rider, then the rider who boarded before the rider selected would be attempted.

FIGURE 5-5: ORIGIN-DESTINATION SURVEY RANDOM NUMBER GENERATOR



No-Time or Spanish/Other Language Speaking Rider Procedure

Respondents who did not have time to complete the survey during their bus trip or spoke a language other than the interviewers' were given the option of providing their phone numbers to conduct the survey at another time. Those who provided their phone numbers were then contacted by ETC Institute's call center to complete the survey. The vast majority of records were able to be completed on-board, less than 0.2% of records were completed by phone. Those interviewers that did speak the foreign language of the rider translated the English Tablet PC version.

Survey Incentives

Respondents who participated in the O&D Survey did receive an option to be entered in a random drawing for one of five $100 Visa gift cards. Drawings were completed after the conclusion of the collection.

On-to-off program procedure

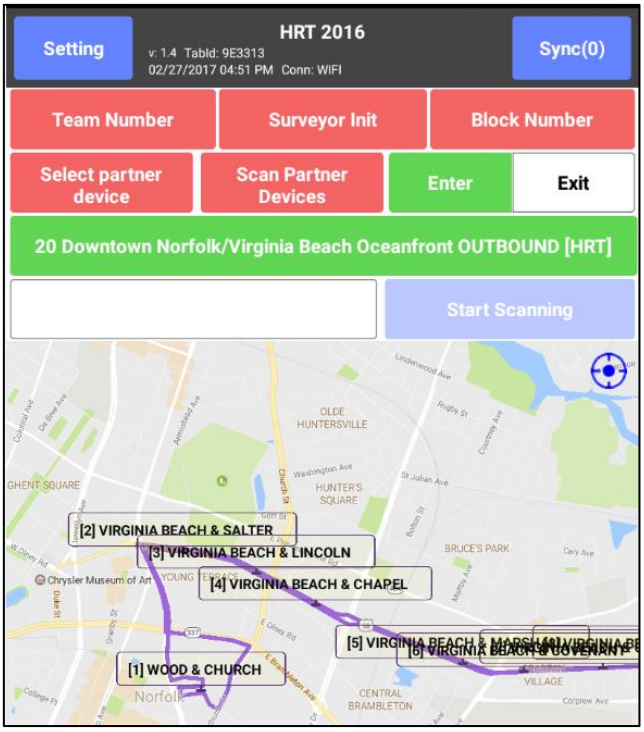
The O2O counts were collected using ETC's proprietary software running on GPS-capable tablets equipped with barcode scanners. Tablets onboard the same bus were paired up before a data collection session began. The riders' route, direction, boarding and alighting information (time, latitude and longitude) were captured with high degree of accuracy via the following process:

- Transit riders were asked to participate as they entered the transit vehicle.

- Each rider entering the bus was handed a barcoded card a moment after the card is scanned by the onboard team member.
- Riders were asked to keep the barcoded card for the duration of their trip on that transit vehicle.
- Riders were asked to hand their cards back as they exited the vehicle. The cards were scanned as the riders exited the bus.

The O2O software sent the scanned data to the O2O server where a server-side processing system evaluated the data and paired up the boarding and the alighting locations of each rider based on the unique barcode, time stamps, and other variables.

FIGURE 5-6: ON-TO-OFF SOFTWARE INTERFACE SCREENSHOT



Before any collection took place, counter staff were trained on every aspect of the onboard process. Supervisory staff administered a variety of quality control checks during tablet set-up; including, review of Route #, Team #, Block #, Run #, Bus #, and Partner Tablet ID#.

The O2O software was centered on a live map of the current transit route and associated stops. Our onboard data collection staff could follow the map of the route and accurately select the riders' boarding and alighting locations. Route termini were clearly marked on the map and the user was alerted when approaching a route terminus, where the session was closed and a new session began when the bus/train began a new run.

An example screen shot of the O2O software is shown Figure 5-6.

O&D Survey Procedure

Local Bus/Ferry/Light Rail (Fixed-route Procedure)

All routes were classified as *fixed-route*s and were surveyed using the tablet PCs. Fixed-routes are routes that provide regular/continuous service throughout the day. Interviewers selected people for the survey in accordance with the sampling procedures described earlier in this sub-section. Once an interviewer had selected a person for the survey, the interviewer:

- Approached the person who was selected and asked him or her to participate in the survey.
- If the person refused, the interviewer ended the survey.

- If the person agreed to participate, the interviewer asked the respondent if he/she had at least 5 minutes to complete the survey.
- If the person did not have at least 5 minutes on the bus, the interviewer asked the person to provide his/her boarding location, alighting location, name, and phone number. A phone interviewer from ETC Institute's call center contacted the respondent and asked him/her to provide the information by phone. This methodology ensured that people who completed "short-trips" on public transit were well represented. The vast majority of records were able to be completed on-board, only a nominal number of records were completed by phone.
- If the person had at least 5 minutes on the bus, the interviewer began administering the survey to the respondent as a face-to-face interview using a tablet PC.

Short Trip Route Procedure

"Short trips" were defined as trips when the distance between the boarding and alighting locations were less than one mile. If a route was identified as a possible short trip route and/or segment, additional interviewers were staffed on the route and interviewers were told to conduct the full interview even if the rider said that he/she did not have enough time to complete the survey. The interviewer would then get off the bus with the rider and complete the survey after getting off the bus.

MAX/Express Service (Express Procedure)

Described earlier in this report, for higher volume MAX/Express Services, the respondent generally has a longer ride time. The combination of longer ride time, and the ease of distributing the paper surveys to a higher number of passengers often leads to a much higher percentage of surveys being captured than would have been possible by using tablet PCs alone, while still maintaining a high level of accuracy. Each paper survey contained a serial number that was used by ETC Institute to track the route and sequence in which surveys were completed. Surveys were then inserted into the database by an ETC data entry team member (the paper version of the survey is provided in APPENDIX A: SURVEY INSTRUMENT).

Reducing Non-Response Bias

The various forms of known bias were combated in a number of different ways using the tablet-based in-person interview, including:

- Sample size distribution bias — Travel flows are typically not normally distributed, which leads to severe under-sampling and results in poor representation of travel flows. If farebox data is not available, the best alternative is to collect On-to-Off counts, expanding it to Stop-Level Ridership data, and utilizing the results for O&D Survey expansion. Besides producing much more accurate flows, this solution eliminates the burden on the O&D survey, and provides for lower O&D sampling rates;
- Access Bias — The tablet-based methodology increases the participation of the walking respondents. This is due to the random nature of the selection and higher response rates. Paper methods

traditionally over represents driver access due to their affluence and appreciation of the service provided;

- Language bias — The tablet-based methodology, with multilingual staff, and a call back option, improves the responses from non-English speaking respondents as described in the data collection task;
- Age Bias — The tablet based methodology allows interviewers to hand hold the younger respondent through the survey instrument. All riders age 15 and over will be eligible to participate. For those who are under 15 and are with a caretaker, then the caretaker can complete the interview on behalf of the younger rider. ETC worked with HRT to develop these protocols and cut off ages to maximize the representative population goals;
- Afternoon and Evening Fatigue — The goals were reached for the afternoon and evening times of day. However, the more important issue involves lower response rates that may occur during these time periods impacting the trip type distribution. ETC did not see any issues of afternoon fatigue based on the data collection results;
- Heavy Load Conditions — The tablet based methodology allows for the collection of information better than the paper based surveyed when heavy load conditions occur. Using paper, it is extremely difficult to distribute questionnaires to the entire bus (the sampling unit). Using the interview method, the sampling unit becomes the individual being surveyed;
- Short Trips — Overall, the tablet interview can be completed faster than a paper based instrument (with an experienced interviewer walking the respondent through the process rather than having to read and complete it themselves). For those riders who are only on the bus for a few stops, their name and phone number can be collected and a call back can be made as described in the data collection task. Paper based instruments traditionally have a very low mail back rate for short trips;
- Literacy bias — because the survey is administered by a surveyor, literacy is not an issue.

Timing of the Survey Administration

On-to-Off (O2O) Timing

The on-to-off survey was administered during weekdays with the exceptions of holidays and breaks for colleges/schools. Administration of the on-to-off survey began as early as 5am and continued as late as 10pm. This was to ensure that the on-to-off data would provide the O&D survey with an accurate sampling plan for administration and for the data expansion. See the service breakout below:

SERVICE TYPE	TIME RANGE
Local Bus	5am – 9pm
MAX/Express Service	6am – 8pm
Ferry	5am – 7pm
Light Rail	6am – 10pm

The bulk of the on-to-off survey was administered August 2016 through October 2016. Targeting for the rail line occurred during January 2017. See the breakout below:

SERVICE TYPE	DATE RANGE
Local Bus	August 2016 – October 2016
MAX/Express Service	August 2016 – October 2016
Ferry	August 2016
Light Rail	September 2016 – October 2016, January 2017

Boarding-Alighting Counts (BA) Timing

The Boarding-Alighting Counts was administered during weekdays with the exceptions of holidays and breaks for colleges/schools. Administration of the Boarding-Alighting Counts began as early as 4am and continued as late as 12am. This was to ensure that the Boarding-Alighting data would provide the O&D survey with an accurate sampling plan for administration and for the data expansion. See Service breakout below:

SERVICE TYPE	TIME RANGE
Local Bus	4am – 12am
MAX/Express Service	5am – 11pm

The bulk of the Boarding-Alighting Counts was administered November 2016 through early December 2016. Targeting trips occurred during January 2017. See the breakout below:

SERVICE TYPE	DATE RANGE
Local Bus	November 2016 – December 2016, January 2017
MAX/Express Service	November 2016 – December 2016, January 2017

Origin & Destination (O&D) Weekday Passenger Survey Timing

The O&D survey was conducted during weekdays (Tuesday through Thursday) from 5am to 11pm and avoided all school and college breaks.

SERVICE TYPE	TIME RANGE
Local Bus	5am – 11pm
MAX/Express Service	6am – 8pm
Ferry	5am – 7pm
Light Rail	5am – 9pm

The bulk of O&D Survey data collection was administered August 2016 through early December 2016. Minimal data collection occurred during the month of January and February 2017 to improve the overall distribution, by targeting specific route, direction, and time of day, and the additional collection of Route 55.

SERVICE TYPE	DATE RANGE
Local Bus	August 2016 – December 2016, January2017 - February 2017
MAX/Express Service	August 2016 – December 2016, January2017 - February 2017
Ferry	August 2016 – October 2016
Light Rail	September 2016 – November 2016

Origin & Destination (O&D) Weekend Passenger Survey Timing

The O&D survey was conducted on Saturdays from 6am to 10pm.

SERVICE TYPE	TIME RANGE
Local Bus	5am – 10pm
Ferry	1pm – 3pm
Light Rail	6am – 9pm

The Weekend O&D Survey data collection was administered August 2016 through November 2016.

SERVICE TYPE	DATE RANGE
Local Bus	August 2016 – November 2016
Ferry	August 2016
Light Rail	October 2016 – November 2016

Surveyor/Interviewer Assignments

Surveyors/interviewers were provided their collection assignments based on that day's sampling goal. Figure 5-7 is an example of a survey assignment card. Cards were handed out each morning or the night before. The surveyor was to stay on the given route/block to maintain sampling distribution. Breaks were assigned by the supervisor to maintain their sampling goal distribution as well.

FIGURE 5-7: SURVEYOR ASSIGNMENT CARD

Asn	ROUTE	BLOCK	OP DAY	DIR	START LOC	START TIME	END LOC	END TIME
105-2	105	105 - 2	muwtf	Outbound	27TH & MAPLE	6:15:00 AM	PENINSULA TOWN CENTER	7:10:00 AM
105-2	105	105 - 2	muwtf	Inbound	PENINSULA TOWN CENTER	7:15:00 AM	27TH & MAPLE	8:13:00 AM
105-2	105	105 - 2	muwtf	Outbound	27TH & MAPLE	8:15:00 AM	PENINSULA TOWN CENTER	9:10:00 AM
105-2	105	105 - 2	muwtf	Inbound	PENINSULA TOWN CENTER	9:15:00 AM	27TH & MAPLE	10:13:00 AM
105-2	105	105 - 2	muwtf	Outbound	27TH & MAPLE	10:15:00 AM	PENINSULA TOWN CENTER	11:10:00 AM
Break								
105-2	105	105 - 2	muwtf	Inbound	PENINSULA TOWN CENTER	1:15:00 PM	27TH & MAPLE	2:13:00 PM
105-2	105	105 - 2	muwtf	Outbound	27TH & MAPLE	2:15:00 PM	PENINSULA TOWN CENTER	3:10:00 PM
105-2	105	105 - 2	muwtf	Inbound	PENINSULA TOWN CENTER	3:15:00 PM	27TH & MAPLE	4:13:00 PM
105-2	105	105 - 2	muwtf	Outbound	27TH & MAPLE	4:15:00 PM	PENINSULA TOWN CENTER	5:10:00 PM
105-2	105	105 - 2	muwtf	Inbound	PENINSULA TOWN CENTER	5:15:00 PM	27TH & MAPLE	6:13:00 PM
105-2	105	105 - 2	muwtf	Outbound	27TH & MAPLE	6:15:00 PM	PENINSULA TOWN CENTER	7:10:00 PM
105-2	105	105 - 2	muwtf	Inbound	PENINSULA TOWN CENTER	7:15:00 PM	27TH & MAPLE	8:13:00 PM
105-2	105	105 - 2	muwtf	Outbound	27TH & MAPLE	8:15:00 PM	PENINSULA TOWN CENTER	9:10:00 PM

In-Field Quality Assurance/Quality Control

Daily, ETC's field supervisor reviewed each employee's data regarding the following issues to assess whether the employee was conducting the survey properly:

- Distribution of surveys by demographics
- Distribution of surveys by trip characteristics
- Length of each survey in minutes
- Percentage of refusals
- Percentage of short trips

ETC's field supervisor also conducted checks on the locations of where the interviews took place. These checks ensured data integrity and identified if an interviewer was being negligent. The ETC field supervisor could verify if an interviewer was on their assigned route by viewing the displayed geographic locations of where the interviews were taking place.

If any item listed above was missing or incomplete, the supervisor flagged the record for reviewing. ETC Instiute then forwarded all incomplete survey records and the corresponding name and phone number to ETC Institute's call center. Interviewers working in ETC Institute's call center then called respondents who had

provided their names and phone numbers to retrieve the missing information by phone. For this project, these actions ultimately resulted in changes to a nominal amount of records.

Status Reporting

ETC Institute provided HRT with weekly updates throughout the data collection effort via a sample completion report. This included data collection for the On-to-Off counts, Origin and Destination interviews, and Boarding and Alighting counts. The sample collected for each was monitored at both the overall route level as well direction and time of day. An example of a completion report is shown in Figure 5-8.

FIGURE 5-8: EXAMPLE OF A COMPLETION REPORT

			Ridership Data						Original Sampling Goals						COMPLETED					
Route #	Route Name	Direction	AM PEAK (Before 8am)	Midday (8:00am-1:59pm)	PM Peak (2:00-5:59pm)	Night (After 6:00pm)	Total	Total Ridership	PEAK (Before 8am)	Midday (8:00am-1:59pm)	PM Peak (2:00-5:59pm)	Night (After 6:00pm)	Total	Total Surveys	PEAK (Before 8am)	Midday (8:00am-1:59pm)	PM Peak (2:00-5:59pm)	Night (After 6:00pm)	Total	Total Surveys
1	Downtown Norfolk Pembroke East	INBOUND	239	501	501	129	1,370	2986	21	45	45	12	123	299	22	126	53	14	215	401
		OUTBOUND	287	568	558	203	1,616		26	51	50	18	145		28	92	50	16	186	
2	Naval Station Norfolk/Hampton Blvd	INBOUND	72	174	164	38	448	1016	6	16	15	3	40	102	7	22	16	1	46	102
		OUTBOUND	104	226	180	57	567		9	20	16	5	51		11	19	20	6	56	
3	Downtown Norfolk/Naval Station	INBOUND	245	401	347	39	1,032	2037	22	36	31	9	98	204	23	37	31	12	103	203
		OUTBOUND	123	302	330	131	945		11	27	35	12	85		12	38	38	12	100	
4	Downtown Norfolk/ODU	INBOUND	30	74	57	39	199	339	3	7	5	4	18	34	6	19	6	4	35	65
		OUTBOUND	18	54	51	17	140		2	5	5	2	13		2	18	6	4	30	
5	Willoughby - Evelyn Butts	INBOUND	34	61	29	0	125	266	3	5	3	0	11	27	2	72	59	0	133	246
		OUTBOUND																		

Data Quality Assurance and Processing

Many of the processes described in previous sections of this report were essential elements of the overall quality assurance/quality control (QA/QC) process that was implemented throughout the survey administration process. The establishment of specific sampling goals and procedures for managing the goals ensured that a representative sample was obtained from each bus route. Training of interviewers and the high levels of oversight provided by team leaders and the Project Manager ensured that the survey was administered properly. Also, the use of the latest geocoding tools such as ETC Institute's Tablet PC survey with integrated real-time geocoding; ETC Institute Elvis editing program; and Caliper® Maptitude GIS Software all contributed to the high quality of geocoding accuracy that was achieved during this study.

The sub-sections below describe the QA/QC processes that were implemented after the data was collected.

Process for Identifying Complete Records

To classify a survey as being completed, the record must have contained all elements of the one-way trip. ETC has classified required trip data as containing the complete answers to the following:

- Route/Direction
- Time of trip
- Transfers made
- Home address
- Origin address
- Destination address
- Origin type place
- Destination type place
- Access mode
- Egress mode
- Boarding location
- Alighting location

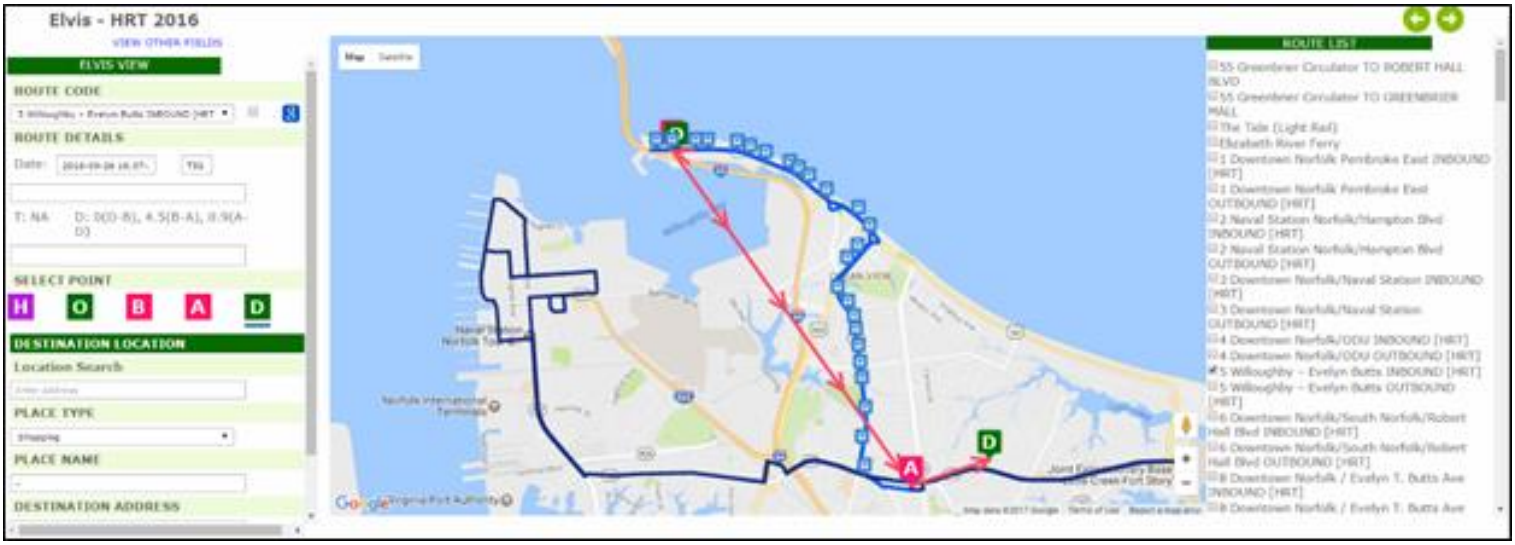
In addition to the required trip data questions, a survey must be marked as complete by the online survey program which occurs only if the interviewer has navigated through every required question on the online survey instrument including demographic questions.

Online Visual Review Tool

ETC has created an online visual review tool that allows for the review of all completed records within the database. This tool shows all components of each individual trip as well as a series of preprogrammed distance and ratio checks as described on subsequent pages. After directions were finalized, the next step was to run each record through the Speed/Distance/Time checks.

Figure 5-9 shows an example of the online visual review tool.

FIGURE 5-9: ONLINE VISUAL REVIEW TOOL (EDITABLE VERSION)



Pre-Processing Distance Checks

A series of distance and ratio checks are preprogrammed into the online visual review tool. This allowed for ETC Institute's Transit Review Team to take a more systematic approach in reviewing complete records. The Transit Review Team process for editing surveys is described later in this section.

Note: The distance and ratio checks described were meant to alert the reviewer that closer evaluation was needed. It did not necessarily indicate that the record was inaccurate or unusable.

The distances used for the checks were created using the great-circle distance formula, which is based on a straight line from point A to point B that considers the curvature of the earth.

Access/Egress Mode Distance Check

Table 5-9 shows the distance checks for access (Origin to Boarding) and egress modes (Alighting to Destination).

TABLE 5-9: ORIGIN TO BOARDING AND ALIGHTING TO DESTINATION DISTANCE CHECKS

Distance Check Name	Check	Condition 1	Condition 2	Flag?
Origin to Boarding	Origin to Boarding distance is greater than 1.75 linear miles	Access Mode - ANY USE OF A VEHICLE (i.e., dropped off, rode with others, drove, taxi...)		No
		Access Mode - Walk/Wheelchair/Skateboard	There is at least one transfer from origin to boarding	No
		Access Mode - Walk/Wheelchair/Skateboard	There are no transfers from origin to boarding	Yes
	Origin to Boarding distance is less than .25 linear miles	Access Mode - ANY USE OF A VEHICLE (i.e., dropped off, rode with others, drove, taxi...)		Yes
		Access Mode - Every mode	There is at least one transfer from origin to boarding	Yes
		Access Mode - Walk/Wheelchair/Skateboard	There are no transfers from origin to boarding	No
Alighting to Destination	Alighting to Destination distance is greater than 1.75 linear miles	Egress Mode - ANY USE OF A VEHICLE (i.e., will get picked up, ride with others, drive, taxi...)		No
		Egress Mode - Walk/Wheelchair/Skateboard	There is at least one transfer from alighting to destination	No
		Egress Mode - Walk/Wheelchair/Skateboard	There are no transfers from alighting to destination	Yes
	Alighting to Destination distance is less than .25 linear miles	Egress Mode - ANY USE OF A VEHICLE (i.e., will get picked up, ride with others, drive, taxi...)		Yes
		Egress Mode - Every mode	There is at least one transfer from alighting to destination	Yes
		Egress Mode - Walk/Wheelchair/Skateboard	There are no transfers from alighting to destination	No

Origin to Destination Distance Check

Table 5-10 shows the distance checks based on the origin and destination locations.

TABLE 5-10: ORIGIN TO DESTINATION DISTANCE CHECKS

Distance Check Name	Check	Flag?
Origin to Destination	Origin equals the Destination	Yes
	Origin to Destination is greater than 50 miles	Yes
	Origin to Destination is less than .25 miles	Yes

Boarding and Alighting Distance Check

Table 5-11 shows the distance checks based on the boarding and alighting locations.

TABLE 5-11: BOARDING TO ALIGHTING DISTANCE CHECKS

Distance Check Name	Check	Flag?
Boarding to Alighting	Boarding equals the Alighting	Yes
	Boarding to Alighting is less than .25 miles	Yes

Pre-Processing Ratio Checks

After all transfer checks were completed, the next step in this process involved the application of a series of QA/QC Ratio Checks (see: Table 5-14: Transfer Issues).

Three ratio checks were conducted for each record. First, the distance between boarding and alighting was divided by the distance between origin and destination. If the rider had a high ratio, then the rider was on the bus for an extensive time compared to the origin to destination distance. If the check created an extremely low ratio, the use of transit seemed unnecessary.

Second, the distance between origin and boarding was divided by the distance between origin and destination. If the rider had a high ratio, the origin to boarding distance was excessive compared to the origin to destination.

Third, the distance between alighting and destination was divided by the distance between origin and destination. If the rider had a high ratio, the alighting to destination distance was excessive compared to the origin to destination.

Table 5-12 a and b describe in more detail the ratio checks used, and the conditions in which a record would be flagged.

TABLE 5-12A: RATIO CHECKS

Ratio Checks	Check	Result of Formula	Condition 1	Condition 2	Flag?
Boarding to Alighting distance divided by Origin to Destination distance	Boarding to Alighting Distance/Origin to Destination Distance	the result of this formula is 1.5 or greater			Yes
	Boarding to Alighting Distance/Origin to Destination Distance	the result of this formula is less than .3	Access and Egress modes are both Walk/Wheelchair/Skateboard	There are NO transfers involved in the trip	Yes
	Boarding to Alighting Distance/Origin to Destination Distance	the result of this formula is less than .3	Access or Egress mode - ANY USE OF A VEHICLE		No
	Boarding to Alighting Distance/Origin to Destination Distance	the result of this formula is less than .3	There is at least one transfer involved in the trip		No

TABLE 5-12B: RATIO CHECKS

Ratio Checks	Check	Result of Formula	Condition 1	Condition 2	Flag?
Origin to Boarding distance divided by Origin to Destination distance	Origin to Boarding Distance/Origin to Destination Distance	the result of this formula is 1 or greater	there is at least one transfer from origin to boarding		No
	Origin to Boarding Distance/Origin to Destination Distance	the result of this formula is 1 or greater	Access Mode - ANY USE OF A VEHICLE (i.e., dropped off, rode with others, drove, taxi...)		No
	Origin to Boarding Distance/Origin to Destination Distance	the result of this formula is 1 or greater	Access Mode - Walk/Wheelchair/Skateboard	there are no transfers from origin to boarding	Yes
Alighting to Destination divided by Origin to Destination	Alighting to Destination Distance/Origin to Destination Distance	the result of this formula is 1 or greater	there is at least one transfer from alighting to destination		No
	Alighting to Destination Distance/Origin to Destination Distance	the result of this formula is 1 or greater	Egress Mode - ANY USE OF A VEHICLE (i.e., will get picked up, ride with others, drive, taxi...)		No
	Alighting to Destination Distance/Origin to Destination Distance	the result of this formula is 1 or greater	Egress Mode - Walk/Wheelchair/Skateboard	There are no transfers from alighting to destination	Yes

Transit Review Team

ETC Institute has a dedicated team whose priority is reviewing and editing completed records using an online visual review tool. The Transit Review Team reviewed all completed records collected for the survey, paying special attention to records that were automatically flagged for automated distance checks. Typically, around 10% of all records receive an automatic flag. Prior to making edits to any survey, they first attempted to contact the respondent to clarify any questionable answer choices regarding the trip. If no contact was made, or if contact was not possible which occurs in the vast majority of cases, the actions as described in Table 5-13 were taken. The following actions generally result in changes that allow about 30% of those records that are automatically flagged to be retained, or approximately 3% of all completed surveys.

Pre-Processing General Issues and Actions

Table 5-13 describes the general issues that could occur within a trip where changes may have been appropriate.

TABLE 5-13: GENERAL ISSUES

Issue	Description of Issue	Action
Origin/Destination Condition 1	Origin/Destination appears incorrect because the wrong location of a multiple-location organization was selected	If for example, an Origin/Destination appears illogical based on the college campus that was selected, but an appropriate campus of the same college does appear logical given the other points and answer choices of the trip, then the appropriate campus will be selected.
Origin/Destination Condition 2	Origin/Destination appears to have been geocoded to the incorrect city/state	If for example, an Origin/Destination appears illogical based on the city/state that was geocoded, but the address/intersection is logical within the trip if the city/state are changed. This occurs occasionally because the surveyor selects the wrong choice from the list of possible address choices that appear in the online survey instrument, then the appropriate address information will be inserted.
Access/Egress Mode	Access/Egress Mode seems illogical based on trip	If the access/egress mode involves the use of a vehicle and the distance from either origin to boarding or alighting to destination is less than .2 miles, then the access/egress mode is recoded to walk/walked and that change will be reflected in the database.
Directionality of Record	Boarding and alighting locations indicate that the trip is going in the opposite direction of what was selected by the surveyor.	Change Direction of Route Selected and if necessary update boarding and alighting locations based on appropriate direction.

Transfer Issues and Actions

Table 5-14 describes the transfer issues that could occur within a trip where changes may have been appropriate.

TABLE 5-14: TRANSFER ISSUES

Issue #	Description of Issue	Action
Transfer Issue - 1	The transfer(s) seems illogical based on either the origin to boarding or alighting to destination	If the transfer appears to have been selected incorrectly based on surveyor mis-selection error (IE Route 24 selected which is illogical but Route 23 is logical) or passenger error (passenger gives inaccurate transfer), then an appropriate transfer(s) will be inserted based on the geocoded points of the trip (origin and destination), the time of day of the trip and the direction of travel. If no appropriate transfers can be found, then the record will be removed from the database.
Transfer Issue - 2	The transfer(s) seems unnecessary based on either the origin to boarding or alighting to destination	If the transfer(s) appears to be unnecessary because the distance from the origin to boarding or alighting to destination is less than 0.2 miles, then the trip will be reviewed in further detail to determine if the transfer(s) are inappropriate. Aspects that will determine appropriateness are: the landscape (0.1 miles for example is a very short distance but a river in-between the origin and boarding location could require an individual to use a transfer as opposed to being able to walk), disability, age, and alternate access/egress modes (IE if someone indicates walking 1 mile from origin to boarding but then indicates taking 2 transfers from alighting to destination to travel a total of 0.1 miles they have likely indicated transfers for a future trip later in the day). *NOTE: The 0.2 distance is only used as guideline to create a flag for closer review. Typically, only extreme distances have transfers removed*
Transfer Issue - 3	The passenger indicated that they did not use a transfer but based on their access/egress mode and the distance between either the origin to boarding or alighting to destination suggests that a transfer should have been used.	If the access/egress mode is "walked/walk" and no transfer is indicated, and the distance between either origin to boarding or alighting to destination is greater than 2 miles, then an appropriate transfer(s) will be inserted based on the geocoded points of the trip (origin and destination), the time of day of the trip and the direction of travel. If no appropriate transfers can be found, then the record will be removed from the database.
Transfer Issue - 4	Duplicate Transfers in the Route Path	If duplicate transfers exist in the route path, the trip path is reviewed visually to determine which route(s) were incorrectly entered. If a review of the record suggests that the transfer route(s) is/are unnecessary then they will be removed. If the transfers suggest that trip is a round trip (i.e. home to home) and not a one-way trip, then the record will be removed from the database.

Post-Processing Additional Checks

After all records were reviewed by the Transit Review Team, the next step in this process involved the application of a series of QA/QC "non-trip" checks. Non-trip checks are described as anything not pertaining to the respondent's actual trip, i.e. demographic information.

Non-trip related checks included:

- Ensuring the respondents who indicated that they were employed also reported that at least one member of their household was employed.
- Ensuring the time of day, determining if a survey was completed was reasonable given the published operating schedule for the route.
- Ensuring that the appropriate fare type was used in response to the age of respondent.
- Checking that there is a representative demographic distribution based on age, gender, and income status.
- Removing any personal contact information used for quality control purposes during the data collection portion of the project to protect the anonymity of the respondents.

Once all records had gone through the pre-processing and post-processing QA/QC checks, those that were deemed complete and usable were then used to update the completion report used by the Field Staff to ensure that all contractual goals had been met. After the final high-level review was completed, metadata (a codebook) was created to suitably explain the data in the database.

On-to-Off Quality Assurance/Quality Control (QA/QC) Plan

Pre-Processing Quality Assurance/Quality Control

A thorough analysis of the stop list within the study area is conducted by ETC Institute's GIS Analyst before the study. Effective stop geocoding depends on the initial quality of the stop data. Some of the specific checks that are conducted during the pre-processing phase include:

- Sort and delete low confidence records that were created. Confidence levels are created based on the *on-to-off* software's QA/QC algorithm (described below)
- Check completeness of all fields for each record
- Verify the time of day when a survey set was completed was reasonable given the published operating schedule for the route

QA/QC algorithm

The record matching algorithm uses the barcode value and time stamp of the scan to match the ON and OFF records. The level of confidence of the match, expressed as a number (e.g. 100 means perfect match) is determined based on auxiliary attributes of the scans falling within certain tolerances or matching expected values. These auxiliary attributes include:

- Route and Direction of the candidate scans should match; if one or both do not match, the reliability of the match is affected and marked
- Enter and Exit modes – the ON scan is expected to have the Enter mode tag while the OFF scan should have the Exit mode tag; if either scan does not, a capture error is recorded and match reliability is affected
- Paired device ID – the OFF scan is expected to have been captured on a device that was paired up with the ON-scan device
- Session Number – an auto-generated globally unique session ID assigned to each scan and is combined with the device ID and the ID of any paired devices
- Time gap between two consecutive candidate scans must be between a minimum and a maximum value, e.g. 1 min to 3 hours; the maximum value is set for the specific transit system under study
- If travel time is greater than X (e.g. 30 min), vehicle speed must be greater than Y (e.g. 5 mph)
- Distance between location of two matching scans must be greater than L (e.g. 0.1 mile)

Post-Processing Quality Assurance / Quality Control

After all boardings/alightings were successfully geocoded, the next step in this process involved the application of a series of QA/QC checks.

Directional Check

Following the boarding and alighting stop locations being geocoded, the direction of travel for each record was confirmed. Stop locations and IDs were then updated based on established direction. Figure 5-10 shows actions that were taken if the direction was incorrect.

FIGURE 5-10: O2O DIRECTION CHECK

Issue	Description of Issue	Suggested Action
Directionality of Record	Boarding and alighting locations indicate that the trip is going in the opposite direction of what was selected by the surveyor.	Change Direction of Route Selected and if necessary update boarding and alighting locations based on appropriate direction.

Speed/Distance/Time Check

After directions were finalized, the next step was to run each record through the speed/distance/time checks. If any of the conditions in Figure 5-11 were met, the record was flagged for further review.

FIGURE 5-11: SPEED/DISTANCE/TIME CHECK

On-to-Off Check Name	Check	Condition 1	Flag?
Speed Check	Checks Speed between boarding and alighting pair	< 1mph	Yes
		>70mph	Yes
Distance Check	Checks Distance between boarding and alighting pair	< 0.12 miles	Yes
		Exceeds route terminus to terminus distance	Yes
Time Check	Checks time between boarding and alighting pair	< 1 minute	Yes
		Exceeds route terminus to terminus average time	Yes

Survey Weighting and Expansion

Data Expansion Overview

When survey goals are created, they are typically based off a percentage of the average weekday ridership for the routes in the system. That is further broken down by time periods and directions. The time periods that are created (6am to 9am for example) are based off the specific request of the client and match the Travel Demand Model. Once a sample percentage is agreed upon, the goals for the survey collection are based off the ridership for each route by time period and direction, and then multiplied by the sampling percentage. For "Circular" or "Loop" routes, the ridership is typically only broken down into time period as there are many riders that will board going in one direction but alight going the other direction due to the functionality of the route. This typically is also the case if there are directional routes where many riders travel through the terminus and alight going the opposite direction of initial boarding.

The purpose of developing survey goals is to collect an appropriate number of survey records that will be "Expanded" to represent the total average weekday ridership of each route by time period and direction. To further increase the specificity of the expansion process, segments were created for each route. Stops were grouped into segments along the route so that boarding segments could be paired with alighting segments when creating the expansion factor. Segmentation occurs on bus routes because it is unrealistic to expand bus survey data at the stop level. Stop, or station, level expansion is generally reserved for rail lines.

Sources of Ridership Data for Expansion

ETC created Stop-Level Ridership data by normalizing the Boarding & Alighting Survey results to the daily ridership totals. See Table 5-15 to see the process for creating Stop-Level Ridership. The new Stop-Level Ridership created by ETC was used to fine tune the collection and conduct the expansion; the data was from average daily ridership from September through October 2016. Routes with conducted Boarding-Alighting Counts were expanded to match the daily average ridership by route/direction/time of day and the result distribution was used to produce segments based on boarding percentages (see: Route Segmentation with Stop-Level Ridership Data).

TABLE 5-15: EXAMPLE: CREATING STOP-LEVEL RIDERSHIP FROM AVERAGE DAILY RIDERSHIP

Ridership of Route X = 50						
Time Period 1 going Eastbound						
Route X	Boarding & Alighting Counts		Distribution of Boarding & Alighting Counts Stop divided by Total		Applying B&A Distibution to Ridership Figures	
	Boarding	Alighting	Boarding	Alighting	Boarding	Alighting
Stop 1	60	0	55%	0%	27.3	0.0
Stop 2	20	10	18%	9%	9.1	4.5
Stop 3	5	30	5%	27%	2.3	13.6
Stop 4	10	10	9%	9%	4.5	4.5
Stop 5	10	20	9%	18%	4.5	9.1
Stop 6	5	40	5%	36%	2.3	18.2
TOTAL	110	110	100%	100%	50	50

Route Segmentation with Stop-Level Ridership Data

There are two ways ETC creates segments for bus routes: 1) boarding percentages of the route from Ridership data, and 2) based on the number of stops for the route. When possible, segmenting routes using Stop-Level Ridership data is the preferred way to segment routes as opposed to segmenting routes based on the number of stops. Routes with Stop-Level Ridership data were separated based on direction, then divided into three segments based on the total boardings. After approximately one-third of the route's total ridership had boarded, a new segment began. After approximately two-thirds of the route's total ridership had boarded the final third segment began. Table 5-16 is a simplified example of segmentation with stop-level ridership. *(Note: Iterative Proportional Fitting (IPF) is used in multiple types of expansion discussed later in this document. In order for IPF to work properly, the boarding totals must match the alighting totals. For this reason, ridership alightings are adjusted using a multiplying factor in order to make sure their totals match the boarding totals. These are typically nominal alterations; however, if there are significant differences in boarding and alighting totals by direction of a route, it may require additional review of the functionality of the route to ensure that the surveys are both collected and expanded appropriately.)*

TABLE 5-16: EXAMPLE: SEGMENTATION WITH STOP-LEVEL RIDERSHIP

Segmentation with STOP-LEVEL RIDERSHIP Example					
Direction: Eastbound	STOP-LEVEL RIDERSHIP		Segmentation		
Stops	Boardings	Alightings	Running Total of Boardings	Running Percentage of Total Boardings	Segment
Stop 1	35	0	35	23.0%	1
Stop 2	20	10	55	36.2%	1
Stop 3	20	5	75	49.3%	2
Stop 4	15	10	90	59.2%	2
Stop 5	5	12	95	62.5%	2
Stop 6	4	4	99	65.1%	2
Stop 7	19	4	118	77.6%	3
Stop 8	12	3	130	85.5%	3
Stop 9	15	5	145	95.4%	3
Stop 10	3	10	148	97.4%	3
Stop 11	2	15	150	98.7%	3
Stop 12	2	11	152	100.0%	3
Stop 13	0	10	152	100.0%	3
Stop 14	0	15	152	100.0%	3
Stop 15	0	38	152	100.0%	3
	152	152			

Route Segmentation without Stop-Level Ridership Data

Routes without Stop-Level Ridership data were divided into three segments based on the number of stops. After approximately one-third of the route's stops occurred, a new segment began. After approximately two-third of the route's stops occurred, the final third segment was determined. Table 5-17 is an example of segmenting without Stop-Level Ridership data.

TABLE 5-17: SEGMENTATION WITH NUMBER OF STOPS

Segmentation with STOP-LEVEL RIDERSHIP Example															
Direction: Eastbound															
Stops	Stop 1	Stop 2	Stop 3	Stop 4	Stop 5	Stop 6	Stop 7	Stop 8	Stop 9	Stop 10	Stop 11	Stop 12	Stop 13	Stop 14	Stop 15
Segment	1	1	1	1	1	2	2	2	2	2	3	3	3	3	3

FIGURE 5-12A: ROUTE SEGMENTATION PER HRT ROUTE TYPE CHART

ROUTE 5-12B: ROUTE SEGMENTATION TYPE CHART

ROUTE NAME	ROUTE	METHOD	ROUTE NAME	ROUTE	METHOD
30 Wave: Atlantic Avenue Shuttle INBOUND [HRT]	30	STOP METHOD	403 Buckroe Shopping Center OUTBOUND [HRT]	403	STOP METHOD
30 Wave: Atlantic Avenue Shuttle OUTBOUND [HRT]	30	STOP METHOD	405 NNTC/Buckroe INBOUND [HRT]	405	STOP METHOD
31 Wave: Aquarium and Campground Shuttle INBOUND [HRT]	31	STOP METHOD	405 NNTC/Buckroe OUTBOUND [HRT]	405	STOP METHOD
31 Wave: Aquarium and Campground Shuttle OUTBOUND [HRT]	31	STOP METHOD	414 NNTC/Jefferson/Oakland INBOUND [HRT]	414	STOP METHOD
32 Wave: Shoppers Shuttle INBOUND [HRT]	32	STOP METHOD	414 NNTC/Jefferson/Oakland OUTBOUND [HRT]	414	STOP METHOD
32 Wave: Shoppers Shuttle OUTBOUND [HRT]	32	STOP METHOD	415 NNTC/Denbigh OUTBOUND [HRT]	415	STOP METHOD
33 (General Booth) North Seashore/Municipal Center INBOUND [HRT]	33	STOP METHOD	430 Denbigh Fringe INBOUND [HRT]	430	STOP METHOD
33 (General Booth) North Seashore/Municipal Center OUTBOUND [HRT]	33	STOP METHOD	430 Denbigh Fringe OUTBOUND [HRT]	430	STOP METHOD
36 (Holland) Pembroke East INBOUND [HRT]	36	B&A/STOP-LEVEL METHOD	918 MAX Virginia Beach to Joint Forces Staff College Norfolk/Naval Station Norfolk INBOUND [HRT]	918	STOP METHOD
36 (Holland) Pembroke East OUTBOUND [HRT]	36	B&A/STOP-LEVEL METHOD	918 MAX Virginia Beach to Joint Forces Staff College Norfolk/Naval Station Norfolk OUTBOUND [HRT]	918	STOP METHOD
41 Downtown Portsmouth/Cradock INBOUND [HRT]	41	STOP METHOD	919 MAX Virginia Beach to Joint Forces Staff College Norfolk/Naval Station Norfolk INBOUND [HRT]	919	STOP METHOD
41 Downtown Portsmouth/Cradock OUTBOUND [HRT]	41	STOP METHOD	919 MAX Virginia Beach to Joint Forces Staff College Norfolk/Naval Station Norfolk OUTBOUND [HRT]	919	STOP METHOD
43 County Street / Bart Street INBOUND [HRT]	43	STOP METHOD	922 MAX Chesapeake-Virginia Beach to Naval Station Norfolk INBOUND [HRT]	922	STOP METHOD
43 County Street / Bart Street OUTBOUND [HRT]	43	STOP METHOD	922 MAX Chesapeake-Virginia Beach to Naval Station Norfolk OUTBOUND [HRT]	922	STOP METHOD
44 Norfolk General Hospital/Midtown Portsmouth INBOUND [HRT]	44	STOP METHOD	960 MAX Virginia Beach to Norfolk INBOUND [HRT]	960	STOP METHOD
44 Norfolk General Hospital/Midtown Portsmouth OUTBOUND [HRT]	44	STOP METHOD	960 MAX Virginia Beach to Norfolk OUTBOUND [HRT]	960	STOP METHOD
45 Downtown Norfolk/Portsmouth INBOUND [HRT]	45	B&A/STOP-LEVEL METHOD	961 MAX Newport News-Hampton to Norfolk INBOUND [HRT]	961	B&A/STOP-LEVEL METHOD
45 Downtown Norfolk/Portsmouth OUTBOUND [HRT]	45	B&A/STOP-LEVEL METHOD	961 MAX Newport News-Hampton to Norfolk OUTBOUND [HRT]	961	B&A/STOP-LEVEL METHOD
47 Downtown Portsmouth/Churchland INBOUND [HRT]	47	B&A/STOP-LEVEL METHOD	965 MAX Patrick Henry Mall to Naval Station Norfolk INBOUND [HRT]	965	STOP METHOD
47 Downtown Portsmouth/Churchland OUTBOUND [HRT]	47	B&A/STOP-LEVEL METHOD	965 MAX Patrick Henry Mall to Naval Station Norfolk OUTBOUND [HRT]	965	STOP METHOD
50 Academy Park/Victory Crossing INBOUND [HRT]	50	STOP METHOD	966 MAX Silverleaf Park & Ride/Newport News Transit Center INBOUND [HRT]	966	STOP METHOD
50 Academy Park/Victory Crossing OUTBOUND [HRT]	50	STOP METHOD	966 MAX Silverleaf Park & Ride/Newport News Transit Center OUTBOUND [HRT]	966	STOP METHOD
55 Greenbrier Circulator TO GREENBRIER MALL	55	STOP METHOD	967 MAX Virginia Beach-Chesapeake to Newport News (MHS) INBOUND [HRT]	967	STOP METHOD
55 Greenbrier Circulator TO ROBERT HALL BLVD	55	STOP METHOD	967 MAX Virginia Beach-Chesapeake to Newport News (MHS) OUTBOUND [HRT]	967	STOP METHOD
57 Robert Hall Boulevard/Airline Boulevard INBOUND [HRT]	57	STOP METHOD	Elizabeth River Ferry	90	STOP METHOD
57 Robert Hall Boulevard/Airline Boulevard OUTBOUND [HRT]	57	STOP METHOD	The Tide (Light Rail)	800	STATION-TO-STATION

Types of Data Expansion

The type of bus data expansion conducted depended on the data available for the specific bus route. The three (3) types of data that created the combinations that guided the type of expansion used were: Stop-Level Ridership (from Client/BA Counts collected by ETC), On-to-Off Counts Data (collected by ETC), and Origin & Destination (O&D) Survey Data (collected by ETC). Figure 5-13 below shows the data combinations, the corresponding route segmentation, and type of expansion used.

FIGURE 5-13: TYPES OF DATA EXPANSION

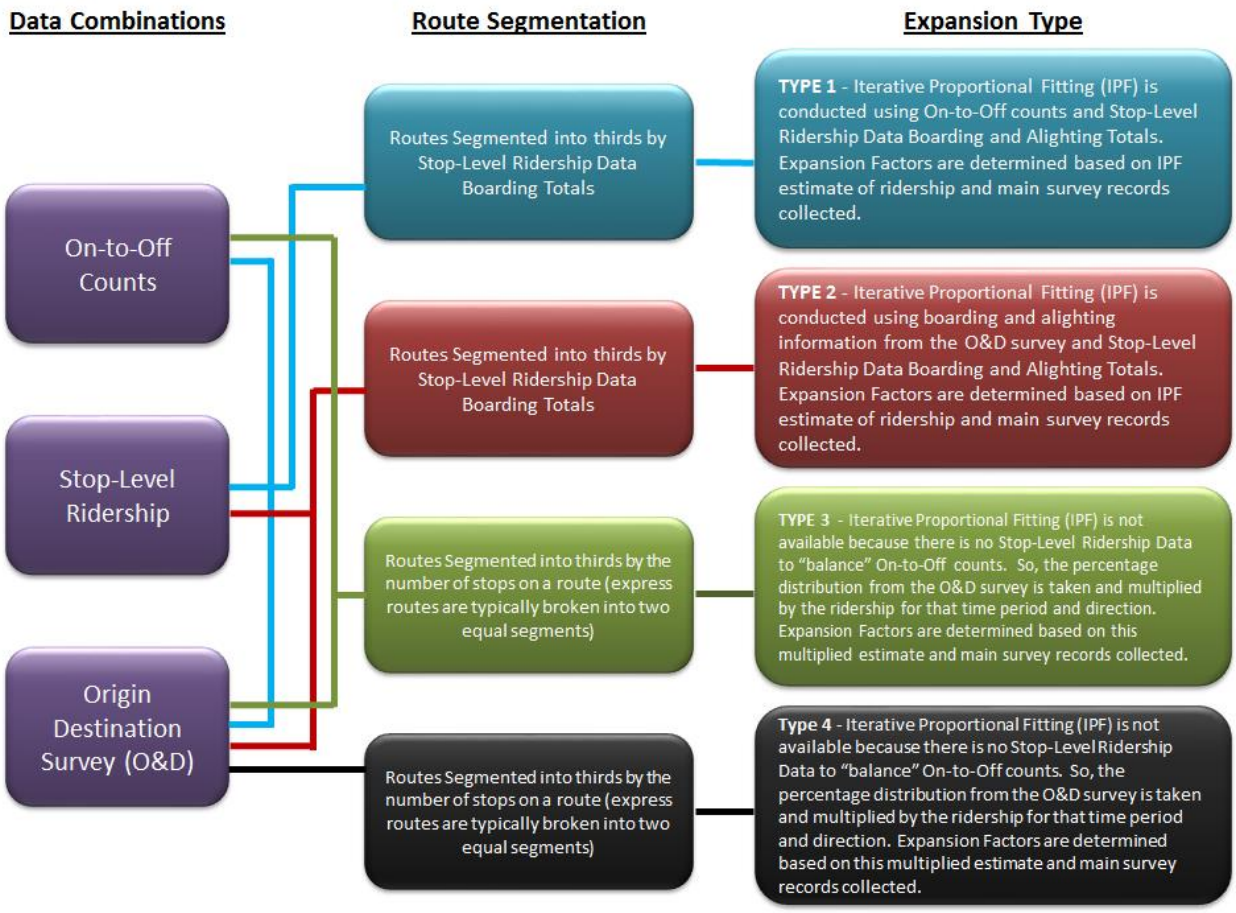


Figure 5-14 below shows the type of expansion used per HRT route.

FIGURE 5-14A: TYPES OF DATA EXPANSION

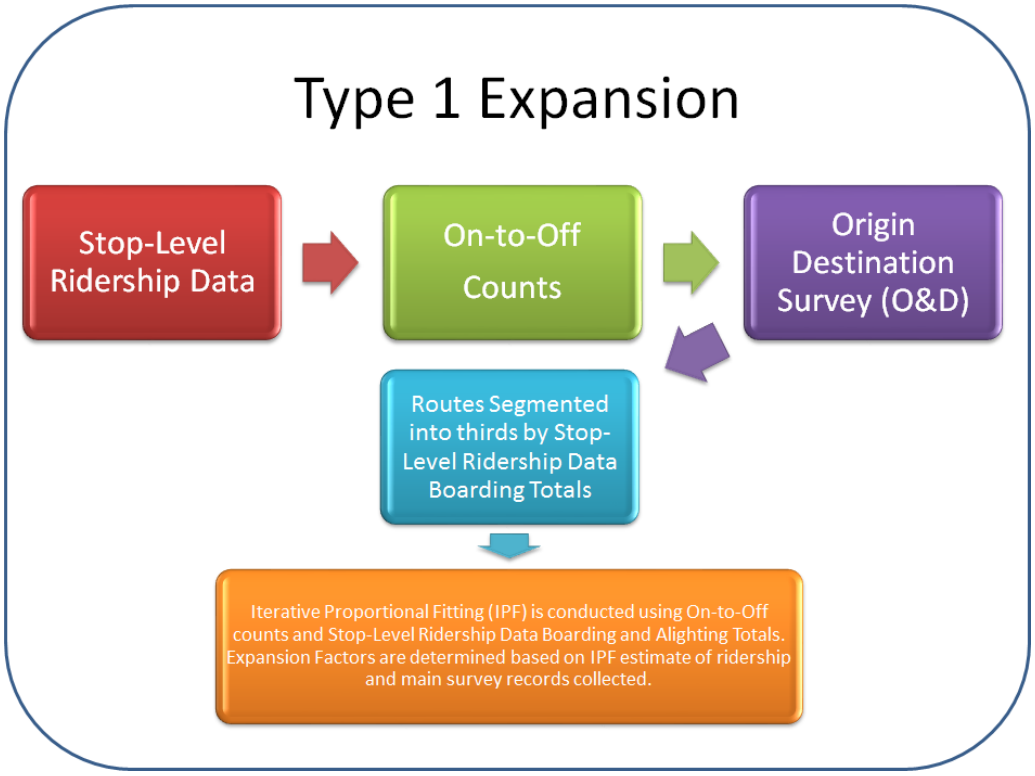
ROUTE NAME	ROUTE	METHOD	ROUTE NAME	ROUTE	METHOD
1 Downtown Norfolk Pembroke East INBOUND [HRT]	1	TYPE 1 EXPANSION	58 South Norfolk/Bainbridge Boulevard INBOUND [HRT]	58	TYPE 4 EXPANSION
1 Downtown Norfolk Pembroke East OUTBOUND [HRT]	1	TYPE 1 EXPANSION	58 South Norfolk/Bainbridge Boulevard OUTBOUND [HRT]	58	TYPE 4 EXPANSION
2 Naval Station Norfolk/Hampton Blvd INBOUND [HRT]	2	TYPE 1 EXPANSION	64 To Smithfield/Gwaltney and Newport News Shipyard INBOUND [HRT]	64	TYPE 4 EXPANSION
2 Naval Station Norfolk/Hampton Blvd OUTBOUND [HRT]	2	TYPE 1 EXPANSION	64 To Smithfield/Gwaltney and Newport News Shipyard OUTBOUND [HRT]	64	TYPE 4 EXPANSION
3 Downtown Norfolk/Naval Station INBOUND [HRT]	3	TYPE 1 EXPANSION	101 (Kecoughtan) Downtown Newport News/Downtown Hampton INBOUND [HRT]	101	TYPE 1 EXPANSION
3 Downtown Norfolk/Naval Station OUTBOUND [HRT]	3	TYPE 1 EXPANSION	101 (Kecoughtan) Downtown Newport News/Downtown Hampton OUTBOUND [HRT]	101	TYPE 1 EXPANSION
4 Downtown Norfolk/ODU INBOUND [HRT]	4	TYPE 4 EXPANSION	102 (Coliseum) Peninsula Town Center/Downtown Hampton INBOUND [HRT]	102	TYPE 4 EXPANSION
4 Downtown Norfolk/ODU OUTBOUND [HRT]	4	TYPE 4 EXPANSION	102 (Coliseum) Peninsula Town Center/Downtown Hampton OUTBOUND [HRT]	102	TYPE 4 EXPANSION
5 Willoughby – Evelyn Butts INBOUND [HRT]	5	TYPE 4 EXPANSION	103 (Shell Rd.) Downtown Newport News/Downtown Hampton INBOUND [HRT]	103	TYPE 1 EXPANSION
5 Willoughby – Evelyn Butts OUTBOUND [HRT]	5	TYPE 4 EXPANSION	103 (Shell Rd.) Downtown Newport News/Downtown Hampton OUTBOUND [HRT]	103	TYPE 1 EXPANSION
6 Downtown Norfolk/South Norfolk/Robert Hall Blvd INBOUND [HRT]	6	TYPE 1 EXPANSION	104 (Marshall) Downtown Newport News/Newmarket INBOUND [HRT]	104	TYPE 1 EXPANSION
6 Downtown Norfolk/South Norfolk/Robert Hall Blvd OUTBOUND [HRT]	6	TYPE 1 EXPANSION	104 (Marshall) Downtown Newport News/Newmarket OUTBOUND [HRT]	104	TYPE 1 EXPANSION
8 Downtown Norfolk / Evelyn T. Butts Ave INBOUND [HRT]	8	TYPE 1 EXPANSION	105 (Briarfield) Maple Avenue & 27th Street/Peninsula Town Center INBOUND [HRT]	105	TYPE 1 EXPANSION
8 Downtown Norfolk / Evelyn T. Butts Ave OUTBOUND [HRT]	8	TYPE 1 EXPANSION	105 (Briarfield) Maple Avenue & 27th Street/Peninsula Town Center OUTBOUND [HRT]	105	TYPE 1 EXPANSION
9 Downtown Norfolk/Sewells Point Road INBOUND [HRT]	9	TYPE 1 EXPANSION	106 Newport News / Warwick Boulevard / Denbigh / Fort Eustis INBOUND [HRT]	106	TYPE 1 EXPANSION
9 Downtown Norfolk/Sewells Point Road OUTBOUND [HRT]	9	TYPE 1 EXPANSION	106 Newport News / Warwick Boulevard / Denbigh / Fort Eustis OUTBOUND [HRT]	106	TYPE 1 EXPANSION
11 Downtown Norfolk/Colonial Place INBOUND [HRT]	11	TYPE 4 EXPANSION	107 Newport News / Warwick Boulevard / Denbigh INBOUND [HRT]	107	TYPE 1 EXPANSION
11 Downtown Norfolk/Colonial Place OUTBOUND [HRT]	11	TYPE 4 EXPANSION	107 Newport News / Warwick Boulevard / Denbigh OUTBOUND [HRT]	107	TYPE 1 EXPANSION
12 South Norfolk/TCC – Virginia Beach INBOUND [HRT]	12	TYPE 1 EXPANSION	108 Patrick Henry Mall / Lee Hall INBOUND [HRT]	108	TYPE 4 EXPANSION
12 South Norfolk/TCC – Virginia Beach OUTBOUND [HRT]	12	TYPE 1 EXPANSION	108 Patrick Henry Mall / Lee Hall OUTBOUND [HRT]	108	TYPE 4 EXPANSION
13 Downtown Norfolk/Robert Hall Blvd/TCC – Chesapeake INBOUND [HRT]	13	TYPE 1 EXPANSION	109 (Pembroke) Downtown Hampton/Buckroe INBOUND [HRT]	109	TYPE 4 EXPANSION
13 Downtown Norfolk/Robert Hall Blvd/TCC – Chesapeake OUTBOUND [HRT]	13	TYPE 1 EXPANSION	109 (Pembroke) Downtown Hampton/Buckroe OUTBOUND [HRT]	109	TYPE 4 EXPANSION
14 Robert Hall Blvd / TCC Chesapeake INBOUND [HRT]	14	TYPE 4 EXPANSION	110 (Thomas Nelson) Downtown Hampton/Thomas Nelson INBOUND [HRT]	110	TYPE 1 EXPANSION
14 Robert Hall Blvd / TCC Chesapeake OUTBOUND [HRT]	14	TYPE 4 EXPANSION	110 (Thomas Nelson) Downtown Hampton/Thomas Nelson OUTBOUND [HRT]	110	TYPE 1 EXPANSION
15 Evelyn Butts to Robert Hall/Greenbrier Mall INBOUND [HRT]	15	TYPE 1 EXPANSION	111 (Denbigh – TNCC) Thomas Nelson/Riverside/Denbigh INBOUND [HRT]	111	TYPE 1 EXPANSION
15 Evelyn Butts to Robert Hall/Greenbrier Mall OUTBOUND [HRT]	15	TYPE 1 EXPANSION	111 (Denbigh – TNCC) Thomas Nelson/Riverside/Denbigh OUTBOUND [HRT]	111	TYPE 1 EXPANSION
18 Downtown Norfolk/Ballentine Boulevard INBOUND [HRT]	18	TYPE 4 EXPANSION	112 Downtown Newport News / Patrick Henry Mall INBOUND [HRT]	112	TYPE 1 EXPANSION
18 Downtown Norfolk/Ballentine Boulevard OUTBOUND [HRT]	18	TYPE 4 EXPANSION	112 Downtown Newport News / Patrick Henry Mall OUTBOUND [HRT]	112	TYPE 1 EXPANSION
20 Downtown Norfolk/Virginia Beach Oceanfront INBOUND [HRT]	20	TYPE 1 EXPANSION	114 (Weaver Rd.) Newmarket/Downtown Hampton INBOUND [HRT]	114	TYPE 1 EXPANSION
20 Downtown Norfolk/Virginia Beach Oceanfront OUTBOUND [HRT]	20	TYPE 1 EXPANSION	114 (Weaver Rd.) Newmarket/Downtown Hampton OUTBOUND [HRT]	114	TYPE 1 EXPANSION
21 Little Creek Rd. INBOUND [HRT]	21	TYPE 1 EXPANSION	115 Buckroe/Willow Oaks/Downtown Hampton INBOUND [HRT]	115	TYPE 4 EXPANSION
21 Little Creek Rd. OUTBOUND [HRT]	21	TYPE 1 EXPANSION	115 Buckroe/Willow Oaks/Downtown Hampton OUTBOUND [HRT]	115	TYPE 4 EXPANSION
22 Newtown Road Station/Joint Expeditionary Base Little Creek INBOUND [HRT]	22	TYPE 4 EXPANSION	116 (Mall Hall) Lee Hall/Patrick Henry Mall Loop INBOUND [HRT]	116	TYPE 4 EXPANSION
22 Newtown Road Station/Joint Expeditionary Base Little Creek OUTBOUND [HRT]	22	TYPE 4 EXPANSION	116 (Mall Hall) Lee Hall/Patrick Henry Mall Loop OUTBOUND [HRT]	116	TYPE 4 EXPANSION
23 Medical Tower/Military Circle/JANAF INBOUND [HRT]	23	TYPE 1 EXPANSION	117 (Phoebus) Hampton University/V.A. Hospital INBOUND [HRT]	117	TYPE 4 EXPANSION
23 Medical Tower/Military Circle/JANAF OUTBOUND [HRT]	23	TYPE 1 EXPANSION	117 (Phoebus) Hampton University/V.A. Hospital OUTBOUND [HRT]	117	TYPE 4 EXPANSION
25 (Newtown) Military Circle/Princess Anne INBOUND [HRT]	25	TYPE 4 EXPANSION	118 (Magruder) Langley/Semple Farm Road INBOUND [HRT]	118	TYPE 1 EXPANSION
25 (Newtown) Military Circle/Princess Anne OUTBOUND [HRT]	25	TYPE 4 EXPANSION	118 (Magruder) Langley/Semple Farm Road OUTBOUND [HRT]	118	TYPE 1 EXPANSION

FIGURE 5-14B: TYPES OF DATA EXPANSION

ROUTE NAME	ROUTE	METHOD	ROUTE NAME	ROUTE	METHOD
26 Lynnhaven Mall / TCC Virginia Beach INBOUND [HRT]	26	TYPE 4 EXPANSION	119 Fishing Point Dr/Riverside Regional Medical Center INBOUND [HRT]	119	TYPE 4 EXPANSION
26 Lynnhaven Mall / TCC Virginia Beach OUTBOUND [HRT]	26	TYPE 4 EXPANSION	119 Fishing Point Dr/Riverside Regional Medical Center OUTBOUND [HRT]	119	TYPE 4 EXPANSION
27 Pleasure House Rd./Newtown Road Light Rail Station INBOUND [HRT]	27	TYPE 4 EXPANSION	120 (Mallory) Downtown Hampton/Mallory/Buckroe INBOUND [HRT]	120	TYPE 4 EXPANSION
27 Pleasure House Rd./Newtown Road Light Rail Station OUTBOUND [HRT]	27	TYPE 4 EXPANSION	120 (Mallory) Downtown Hampton/Mallory/Buckroe OUTBOUND [HRT]	120	TYPE 4 EXPANSION
29 (Lynnhaven) Pleasure House Road INBOUND [HRT]	29	TYPE 4 EXPANSION	121 Newport News Transportation Center / Williamsburg INBOUND [HRT]	121	TYPE 4 EXPANSION
29 (Lynnhaven) Pleasure House Road OUTBOUND [HRT]	29	TYPE 4 EXPANSION	121 Newport News Transportation Center / Williamsburg OUTBOUND [HRT]	121	TYPE 4 EXPANSION
30 Wave: Atlantic Avenue Shuttle INBOUND [HRT]	30	TYPE 3 EXPANSION	403 Buckroe Shopping Center OUTBOUND [HRT]	403	TYPE 4 EXPANSION
30 Wave: Atlantic Avenue Shuttle OUTBOUND [HRT]	30	TYPE 3 EXPANSION	405 NNTC/Buckroe INBOUND [HRT]	405	TYPE 4 EXPANSION
31 Wave: Aquarium and Campground Shuttle INBOUND [HRT]	31	TYPE 4 EXPANSION	405 NNTC/Buckroe OUTBOUND [HRT]	405	TYPE 4 EXPANSION
31 Wave: Aquarium and Campground Shuttle OUTBOUND [HRT]	31	TYPE 4 EXPANSION	414 NNTC/Jefferson/Oakland INBOUND [HRT]	414	TYPE 4 EXPANSION
32 Wave: Shoppers Shuttle INBOUND [HRT]	32	TYPE 4 EXPANSION	414 NNTC/Jefferson/Oakland OUTBOUND [HRT]	414	TYPE 4 EXPANSION
32 Wave: Shoppers Shuttle OUTBOUND [HRT]	32	TYPE 4 EXPANSION	415 NNTC/Denbigh OUTBOUND [HRT]	415	TYPE 4 EXPANSION
33 (General Booth) North Seashore/Municipal Center INBOUND [HRT]	33	TYPE 4 EXPANSION	430 Denbigh Fringe INBOUND [HRT]	430	TYPE 4 EXPANSION
33 (General Booth) North Seashore/Municipal Center OUTBOUND [HRT]	33	TYPE 4 EXPANSION	430 Denbigh Fringe OUTBOUND [HRT]	430	TYPE 4 EXPANSION
36 (Holland) Pembroke East INBOUND [HRT]	36	TYPE 1 EXPANSION	918 MAX Virginia Beach to Joint Forces Staff College Norfolk/Naval Station Norfolk INBOUND [HRT]	918	TYPE 4 EXPANSION
36 (Holland) Pembroke East OUTBOUND [HRT]	36	TYPE 1 EXPANSION	918 MAX Virginia Beach to Joint Forces Staff College Norfolk/Naval Station Norfolk OUTBOUND [HRT]	918	TYPE 4 EXPANSION
41 Downtown Portsmouth/Cradock INBOUND [HRT]	41	TYPE 4 EXPANSION	919 MAX Virginia Beach to Joint Forces Staff College Norfolk/Naval Station Norfolk INBOUND [HRT]	919	TYPE 4 EXPANSION
41 Downtown Portsmouth/Cradock OUTBOUND [HRT]	41	TYPE 4 EXPANSION	919 MAX Virginia Beach to Joint Forces Staff College Norfolk/Naval Station Norfolk OUTBOUND [HRT]	919	TYPE 4 EXPANSION
43 County Street / Bart Street INBOUND [HRT]	43	TYPE 4 EXPANSION	922 MAX Chesapeake-Virginia Beach to Naval Station Norfolk INBOUND [HRT]	922	TYPE 4 EXPANSION
43 County Street / Bart Street OUTBOUND [HRT]	43	TYPE 4 EXPANSION	922 MAX Chesapeake-Virginia Beach to Naval Station Norfolk OUTBOUND [HRT]	922	TYPE 4 EXPANSION
44 Norfolk General Hospital/Midtown Portsmouth INBOUND [HRT]	44	TYPE 4 EXPANSION	960 MAX Virginia Beach to Norfolk INBOUND [HRT]	960	TYPE 4 EXPANSION
44 Norfolk General Hospital/Midtown Portsmouth OUTBOUND [HRT]	44	TYPE 4 EXPANSION	960 MAX Virginia Beach to Norfolk OUTBOUND [HRT]	960	TYPE 4 EXPANSION
45 Downtown Norfolk/Portsmouth INBOUND [HRT]	45	TYPE 1 EXPANSION	961 MAX Newport News-Hampton to Norfolk INBOUND [HRT]	961	TYPE 1 EXPANSION
45 Downtown Norfolk/Portsmouth OUTBOUND [HRT]	45	TYPE 1 EXPANSION	961 MAX Newport News-Hampton to Norfolk OUTBOUND [HRT]	961	TYPE 1 EXPANSION
47 Downtown Portsmouth/Churchland INBOUND [HRT]	47	TYPE 1 EXPANSION	965 MAX Patrick Henry Mall to Naval Station Norfolk INBOUND [HRT]	965	TYPE 4 EXPANSION
47 Downtown Portsmouth/Churchland OUTBOUND [HRT]	47	TYPE 1 EXPANSION	965 MAX Patrick Henry Mall to Naval Station Norfolk OUTBOUND [HRT]	965	TYPE 4 EXPANSION
50 Academy Park/Victory Crossing INBOUND [HRT]	50	TYPE 4 EXPANSION	966 MAX Silverleaf Park & Ride/Newport News Transit Center INBOUND [HRT]	966	TYPE 4 EXPANSION
50 Academy Park/Victory Crossing OUTBOUND [HRT]	50	TYPE 4 EXPANSION	966 MAX Silverleaf Park & Ride/Newport News Transit Center OUTBOUND [HRT]	966	TYPE 4 EXPANSION
55 Greenbrier Circulator TO GREENBRIER MALL	55	TYPE 4 EXPANSION	967 MAX Virginia Beach-Chesapeake to Newport News (MHS) INBOUND [HRT]	967	TYPE 4 EXPANSION
55 Greenbrier Circulator TO ROBERT HALL BLVD	55	TYPE 4 EXPANSION	967 MAX Virginia Beach-Chesapeake to Newport News (MHS) OUTBOUND [HRT]	967	TYPE 4 EXPANSION
57 Robert Hall Boulevard/Airline Boulevard INBOUND [HRT]	57	TYPE 4 EXPANSION	Elizabeth River Ferry	90	TYPE 4 EXPANSION
57 Robert Hall Boulevard/Airline Boulevard OUTBOUND [HRT]	57	TYPE 4 EXPANSION	The Tide (Light Rail)	800	RAIL EXPANSION

Type 1 Expansion: Bus Routes with Stop-Level Ridership Data, On-to-Off Counts Data, and O&D Survey Data

Of the four types of bus expansion discussed, Type 1 Expansion was the preferred method as it incorporated all three types of data that were available. Typically, On-to-Off data collection is reserved for more heavily traveled routes. These heavier ridership routes are also typically more likely to have adequate Stop-Level Ridership. ETC Institute created Stop-Level Ridership data by normalizing the Boarding & Alighting Survey results to the daily ridership totals. See Table 5-15 for the process of creating Stop-Level Ridership with boarding & alighting counts. This type of expansion was conducted on the more heavily traveled routes in the system and occurred after route stops were divided into three segments based on total boarding distribution by direction, as described previously. The segments were then appended to both the On-to-Off counts and O&D data based on the boarding and alighting locations. Type 1 Expansion was used for 38% percent of the HRT routes. See Figure 5-13: Types of Data Expansion for route details. The methodology for Type 1 Expansion is as follows:



Type 1: Expansion Methodology for Bus Routes with Stop-Level Ridership Data, On-to-Off Data and O&D Survey Data

Once the segments were appended to the On-to-Off counts and O&D survey databases, the records were ready for expansion. The process for how the data was expanded in Type 1 Expansion is explained below:

Figure 5-15 shows the segmented results for the On-to-Off counts that was administered for a certain route, direction, and time period. Each row in the Table identifies the segment where passengers boarded the bus. The columns in the Table identify the segments where people alighted the bus. For example, 20 of the On-to-Off counts had riders board in segment 2 and alight in segment 3.

FIGURE 5-15: BUS DATA EXPANSION TABLE RESULTS OF ON-TO-OFF SURVEY

TABLE 1: RESULTS OF THE ON-TO-OFF SURVEY

Route: Example Eastbound (6am-9am)		ACTUAL RIDERSHIP COUNTS FROM THE ON/OFF SURVEY		
Segment	Total	1	2	3
1	60	5	15	40
2	45		25	20
3	10			10
Total	115	5	40	70

Figure 5-16 shows the distribution of the data in Figure 5-15 expressed as a percentage of all boardings for the specific time period and direction. Figure 5-16 was created by dividing each on-to-off cell in Figure 5-15 by the sum of all On-to-Off counts in Figure 5-15, which is 115. For example, 20/115 (17.4%) of all trips boarded in segment 2 and alighted in segment 3 as shown in Figure 5-16.

FIGURE 5-16: BUS DATA EXPANSION TABLE DISTRIBUTION OF ON-TO-OFF SURVEY

TABLE 2: DISTRIBUTION OF THE ON-TO-OFF SURVEY

Route: Example Eastbound (6am-9am)		PERCENTAGE DISTRIBUTION OF RIDERSHIP COUNTS FROM THE ON/OFF SURVEY		
Segment	Total	1	2	3
1	52.2%	4.3%	13.0%	34.8%
2	39.1%	0.0%	21.7%	17.4%
3	8.7%	0.0%	0.0%	8.7%
Total	100.0%	4.3%	34.8%	60.9%

The total ridership for the route, time period, and direction was applied to the on-to-off distribution percentages shown in Figure 5-16.

Figure 5-16 produces an estimate of the ridership flow for the boarding segment to the alighting segment as shown in Figure 5-17. Applying the actual ridership of 320 creates an initial estimate of 56 trips (17.4% x 320) boarding in segment 2 and alighting in segment 3.

FIGURE 5-17: BUS DATA EXPANSION TABLE INITIAL ESTIMATE OF RIDERSHIP FLOWS BETWEEN SEGMENTS

TABLE 3: INITIAL ESTIMATE OF RIDERSHIP FLOWS BETWEEN STATION

(percentages in table 2 were applied to the total boardings for this time period in this direction)

Route: Example Eastbound (6am-9am)		PROJECTED RIDERSHIP BASED ON THE ON-TO-OFF SURVEY		
Segment	Total	1	2	3
1	167	14	42	111
2	125	0	70	56
3	28	0	0	28
Total	320	14	111	195

In order to develop a more accurate estimate of the ridership flows between segments on each route, ETC developed an Iterative Proportional Fitting (IPF) Algorithm to balance the differences between the ridership projected from the On-to-Off counts (shown in Figure 5-17) and the Stop-Level ridership for each segment (shown in Figure 5-18). The IPF process is described below:

FIGURE 5-18: STOP-LEVEL RIDERSHIP

TABLE 4: BOARDINGS and ALIGHTINGS BY STATION

Route: Example Eastbound (6am-9am)				
Average Weekday Ridership	Total	1	2	3
BOARDINGS	320	100	100	120
ALIGHTINGS	320	20	100	200
DIFFERENCE FROM PROJECTED				
BOARDINGS	0	-67	-25	92
ALIGHTINGS	0	6	-11	5

Step 1: Correction for the Boardings. The estimated ridership from the On-to-Off counts for each route (as shown in Figure 5-17) was multiplied by the ratio of the actual boardings from Stop-Level Ridership Data for each segment by the estimated boardings for each segment. For example, if the actual boardings for Segment

1 were 120 and the estimated boardings were 100, each cell associated with Segment 1 would have been multiplied by 1.2 (120/100) to adjust the estimated boardings to actual boardings.

Step 2: Correction for the Alightings. Once the correction in Step 1 was applied, the estimated boardings would be equal to the actual boardings. However, the adjustment to the boardings total may have changed the alighting estimates. To correct the alighting estimates, the new values calculated in Step 1 were adjusted by multiplying the ratio of the actual alightings from the Stop-Level Ridership Data for each stop by the estimated alightings for each segment from Step 1. For example, if the actual alightings for Segment 2 were 220 and the estimated alightings from Step 1 were 200, each cell associated with Segment 2 would have been multiplied by 1.1 (220/200) to adjust the estimated alightings from Step 1 to actual alightings.

The processes described in Steps 1 and Steps 2 were repeated sequentially until the difference between the actual and estimated boardings and alightings was zero. Figure 5-19 shows that after seven balancing iterations in this algorithm, there were no differences between the projected distribution and the actual boardings and alightings.

FIGURE 5-19: ITERATIVE BALANCE PROCESS

7th STEP of ITERATIVE BALANCING TO CORRECT DISTRIBUTION OF RIDERSHIP BY ALIGHTING Location					
Segment	Total	DIFFERENCE FROM ACTUAL BOARDINGS	1	2	3
1	100	0	20	32	49
2	100	0	0	68	32
3	120	0	0	0	120
Total	320	0	20	100	200
DIFFERENCE FROM ACTUAL ALIGHTINGS	0		0	0	0
7th STEP of ITERATIVE BALANCING TO CORRECT DISTRIBUTION OF RIDERSHIP BY ALIGHTING Location					
Segment	Total	DIFFERENCE FROM ACTUAL BOARDINGS	1	2	3
1	100	0	20	32	48
2	100	0	0	68	32
3	120	0	0	0	120
Total	320	0	20	100	200
DIFFERENCE FROM ACTUAL ALIGHTINGS	0		0	0	0

The final estimate for ridership flows is shown in Figure 5-20.

FIGURE 5-20: FINAL ESTIMATE OF RIDERSHIP FLOWS BETWEEN STATIONS

TABLE 6: FINAL ESTIMATE OF RIDERSHIP FLOWS BETWEEN STATIONS

Route: Example Eastbound (6am-9am)

Segment	Total	1	2	3
1	100	20	32	48
2	100	0	68	32
3	120	0	0	120
Total	320	20	100	200
DIFFERENCE FROM ACTUAL ALIGHTINGS	0	0	0	0

The actual number of O&D records completed for each boarding to alighting segment pair is shown in Figure 5-21. To calculate the expansion factors, the final estimate of ridership between segments shown in Figure 5-20 was divided by the actual number of O&D records collected, as shown in Figure 5-21. This calculation produces the expansion factors shown in Figure 5-22. For example, the 32 estimated riders projected to board in segment 2 and alight in segment 3 were divided by the 10 O&D records to produce an expansion factor of 3.15 to be applied to records who board in segment 2 and alighting in segment 3 as shown in Figure 5-22.

FIGURE 5-21: NUMBER OF COMPLETED SURVEYS (BUS)

TABLE 7: NUMBER OF COMPLETED SURVEYS

Route: Example Eastbound (6am-9am)

Segment	Total	1	2	3
1	32	3	9	20
2	17		7	10
3	8			8
Total	57	3	16	38

FIGURE 5-22: WEIGHTING FACTORS (BUS)

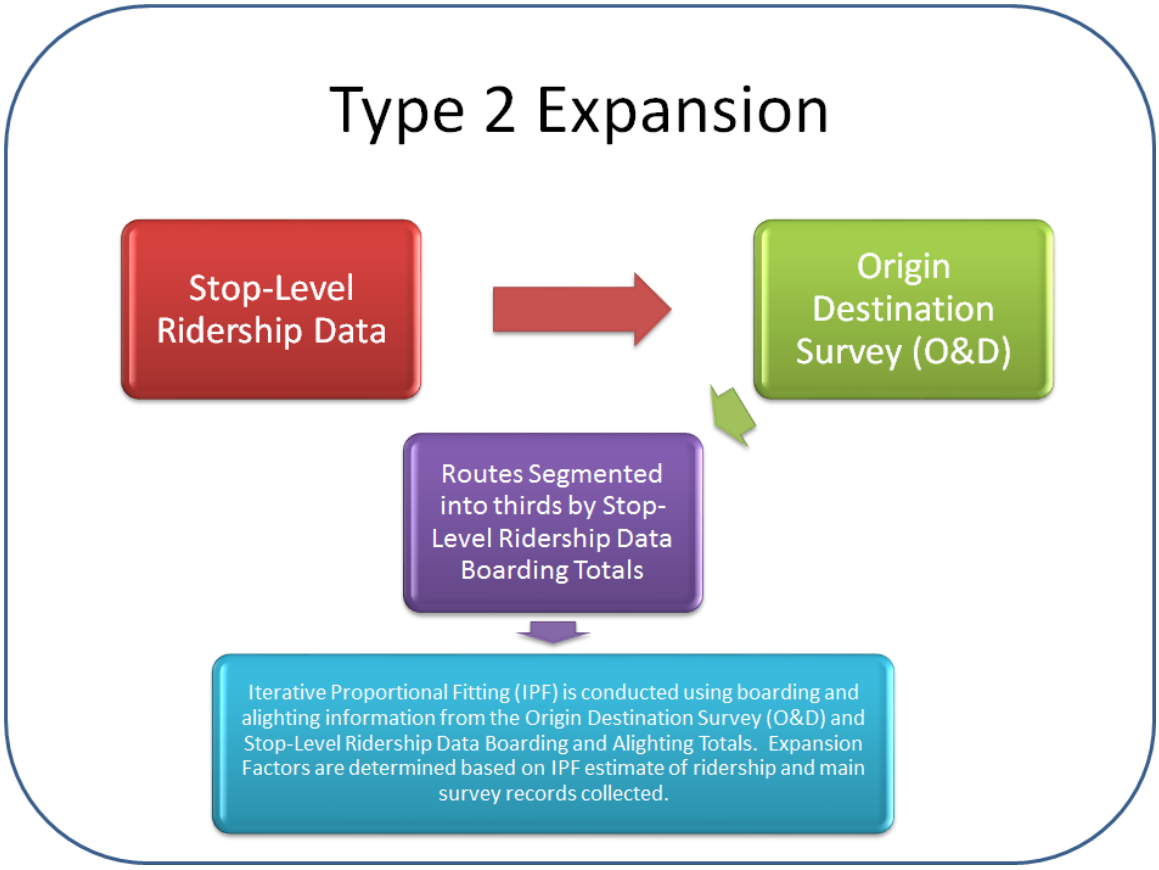
TABLE 8: WEIGHTING FACTORS

Route: Example Eastbound (6am-9am)

Segment	Total	1	2	3
1	3.13	6.67	3.50	2.42
2	5.88	0.00	9.78	3.15
3	15.00	0.00	0.00	15.00
Total	5.61	6.67	6.25	5.26

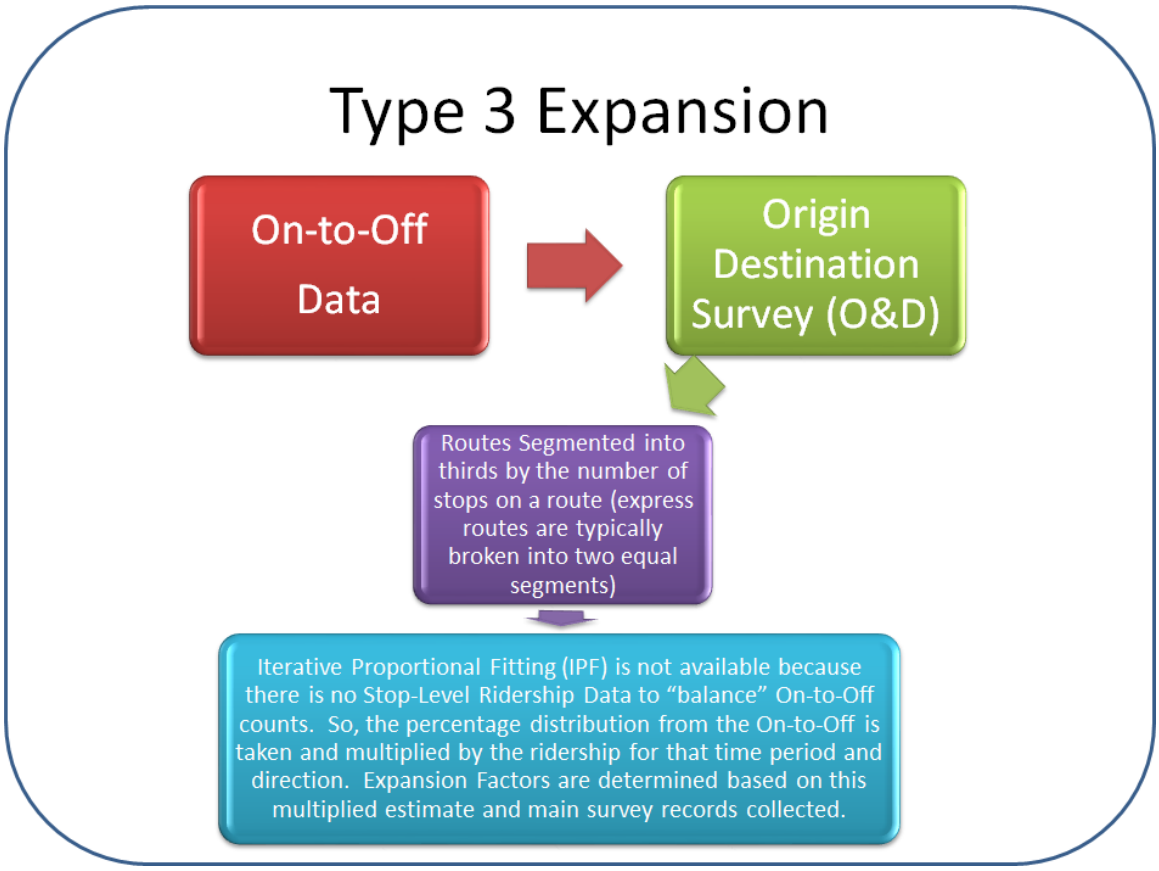
Type 2 Expansion: Bus Routes with Stop-Level Ridership Data, O&D Survey Data, but no On-to-Off Counts Data

On-to-Off counts are not collected for lower ridership routes. However, sometimes these routes will have Stop-Level Ridership Data available. In this case, Type 2 Expansion is appropriate. This type of expansion also divided stops into three segments based on total boarding distribution by direction. These segments were then appended to the O&D records based on the boarding and alighting locations. The expansion method is similar to Type 1 Expansion, the only difference being that the distribution of O&D records was substituted for the On-to-Off counts data in Table 1. This type of Expansion was not utilized for the HRT Expansion. See Figure 5-13: Types of Data Expansion for route details.



Type 3 Expansion: Bus Routes with On-to-Off Counts and O&D Survey Data, but without Stop-Level Ridership Data

Type 3 Expansion is utilized for routes where On-to-Off counts are collected, but Stop-Level Ridership Data is not available. Routes without Stop-Level Ridership Data are segmented into three segments based on number of stops along a route. These segments were then appended to the On-to-Off and O&D Survey databases. This expansion method is less complex than the two types of expansion previously discussed. Type 3 Expansion was just utilized for VB Wave (Route 30). The methodology for Type 3 expansion is as follows:



Type 3: Expansion Methodology for Bus Routes with On-to-Off Counts and O&D Survey Data but without Stop-Level Ridership Data

Figure 5-23 displays the results for the On-to-Off counts. Each row in the Table identifies the segment where passengers board the bus. The columns in the Table identify the segments where people alight the bus. For example, 20 of the On-to-Off counts captured riders boarding on Segment 2 and alighting on Segment 3.

FIGURE 5-23: BUS DATA EXPANSION TABLE RESULTS OF ON-TO-OFF SURVEY

TABLE 1: ON-TO-OFF SURVEYS COMPLETED		Total Boardings this Direction During this Time Period =	300
Route: Example Eastbound (6-9am)	DISTRIBUTION OF COMPLETED ON2OFF SURVEYS		
Segment		1	2	3
1	55	5	20	30
2	30		10	20
3	15			15
Total	**100**	**5**	**30**	**65**

Figure 5-24 shows the distribution of the data in Figure 5-23 expressed as a percentage of all boardings for the route, time period, and direction. Figure 5-24 was created by dividing each on-to-off cell in Figure 5-23 by the sum of all on-to-off counts (100) in Figure 5-23. For example, 20/100 (20.00%) of all trips board in Segment 2 and alight in Segment 3 as shown in Figure 5-24.

FIGURE 5-24: BUS DATA EXPANSION TABLE DISTRIBUTION OF ON-TO-OFF SURVEY

TABLE 2: DISTRIBUTION OF THE ON-TO-OFF SURVEY				
Route: Example Eastbound (6-9am)	DISTRIBUTION OF ON2OFF SURVEYS AS % OF ALL COMPLETED ON2OFF SURVEYS			
Segment		1	2	3
1	55.00%	5.00%	20.00%	30.00%
2	30.00%	0.00%	10.00%	20.00%
3	15.00%	0.00%	0.00%	15.00%
Total	100%	5.00%	30.00%	65.00%

The total ridership for the route, time period, and direction was applied to the on-to-off distribution shown in Figure 5-24. This produces an estimate of the ridership flow on the route based on the boarding to the alighting segment, shown in Figure 5-25. Applying the actual ridership (300) to the distribution creates an estimate that 60 trips (20.00% x 300) boarded in Segment 2 and alighted in Segment 3.

FIGURE 5-25: BUS DATA EXPANSION TABLE INITIAL ESTIMATE OF RIDERSHIP FLOWS BETWEEN SEGMENTS

TABLE 3: ESTIMATE OF RIDERSHIP FLOWS BETWEEN SEGMENTS				
(percentages in Table 2 were applied to the total boardings for this time period in this direction)				
Route: Example Eastbound (6-9am)	ESTIMATED RIDERSHIP BASED ON THE ON-TO-OFF SURVEY			
Segment		1	2	3
1	165	15	60	90
2	90	0	30	60
3	45	0	0	45
Total	300	15	90	195

The actual number of O&D records completed for each boarding to alighting segment is shown in Figure 5-26. To calculate the expansion factors, the estimate of ridership between segments, shown in Figure 5-25, was divided by the actual number of O&D records completed between segments, shown in Figure 5-26. The calculation produces the expansion factors shown in Figure 5-27. So, the 60 estimated riders were divided by the seven (7) O&D records to produce a factor of 8.57 to be applied to riders who board in Segment 2 and alighting in Segment 3 as shown in Figure 5-27.

FIGURE 5-26: NUMBER OF COMPLETED SURVEYS

TABLE 4: NUMBER OF COMPLETED INTERCEPT SURVEYS		Total Number of Surveys =	30	
Route: Example Eastbound (6-9am)	NUMBER OF COMPLETED SURVEYS			
Segment		1	2	3
1	16	4	4	8
2	10		3	7
3	4			4
Total	30	4	7	19

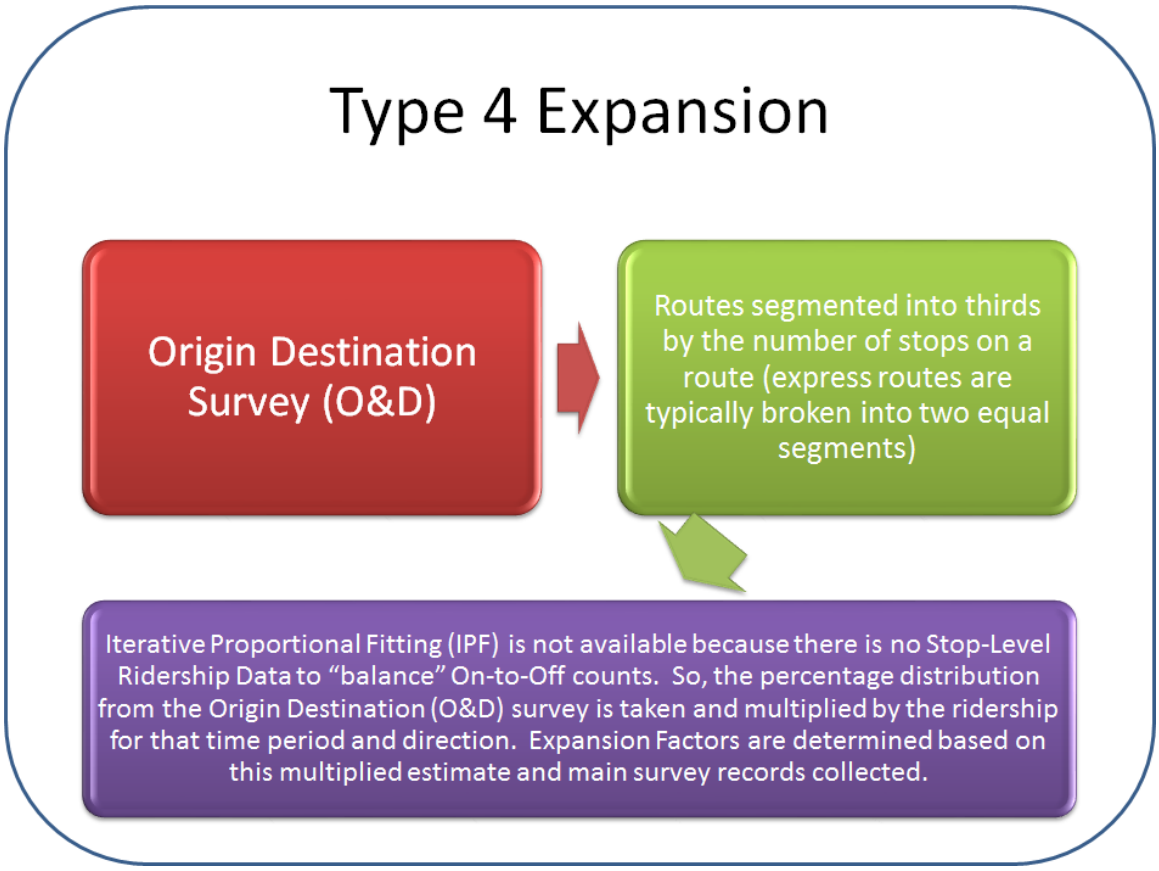
FIGURE 5-27: WEIGHTING FACTORS

TABLE 5: Weighting Factors				
Route: Example Eastbound (6-9am)				
Segment		1	2	3
1	10.312500	3.750000	15.000000	11.250000
2	9.000000		10.000000	8.571429
3	11.250000			11.250000
Total	10.000000	3.750000	12.857143	10.263158

Once all the expansion factors were calculated, each factor was applied to all surveys with the same route, direction, time of day, boarding segment, and alighting segment.

Type 4 Expansion: Bus Routes with O&D Survey Data, without On-to-Off Counts Data or Stop-Level Ridership Data

For routes that only have O&D Survey data, Type 4 Expansion is utilized. Routes are divided into three segments based on number of stops along a route. These segments were then appended to the O&D Survey database. Type 4 Expansion was used for 60% percent of the routes. The methodology for Type 4 Expansion is as follows:



Type 4: Expansion Methodology for Bus Routes with O&D Survey Data, without On-to-Off Counts Data or Stop-Level Ridership Data

Figure 5-28 shows the segmented results from the O&D survey that replaced the On-to-Off counts. Each row in the Table identifies the segment where passengers boarded the bus. The columns in the Table identify the segments where people alighted. For example, seven (7) of the O&D surveys had riders board in Segment 2 and alight in Segment 3.

FIGURE 5-28: BUS DATA EXPANSION TABLE RESULTS OF ON-TO-OFF SURVEY

TABLE 1: Main Survey Results (Replacing On-to-Off Results)		Total Boardings this Direction During this Time Period =	300
Route: Example Eastbound (6-9am)	DISTRIBUTION OF COMPLETED ON2OFF SURVEYS		
Segment		1	2	3
1	16	4	4	8
2	10		3	7
3	4			4
Total	30	4	7	19

Figure 5-29 shows the distribution of the data in Figure 5-28 as a percentage of all boardings for the route. Figure 5-29 was created by dividing each on-to-off cell in Figure 5-28 by the sum of all O&D records replacement data in Figure 5-28, which is 30. For example, 7/30 or 23.33% of all trips that boarded in Segment 2, alighted in Segment 3 as shown in Figure 5-29.

FIGURE 5-29: BUS DATA EXPANSION TABLE DISTRIBUTION OF ON-TO-OFF SURVEY

TABLE 2: DISTRIBUTION OF THE ON-TO-OFF SURVEY				
Route: Example Eastbound (6-9am)	DISTRIBUTION OF ON2OFF SURVEYS AS % OF ALL COMPLETED ON2OFF SURVEYS			
Segment		1	2	3
1	53.33%	13.33%	13.33%	26.67%
2	33.33%	0.00%	10.00%	23.33%
3	13.33%	0.00%	0.00%	13.33%
Total	100%	13.33%	23.33%	63.33%

The total ridership for the route, time period, and direction was applied to the on-to-off distribution shown in Figure 5-29. This produces an estimate of the ridership flow on the route based on the boarding segment to the alighting segment as shown in Figure 5-30. Applying the actual ridership of 300 to the distribution creates an estimate that 70 trips (23.33% x 300) board in Segment 2 and alight in Segment 3.

FIGURE 5-30: BUS DATA EXPANSION TABLE INITIAL ESTIMATE OF RIDERSHIP FLOWS BETWEEN SEGMENTS

TABLE 3: ESTIMATE OF RIDERSHIP FLOWS BETWEEN SEGMENTS				
(percentages in Table 2 were applied to the total boardings for this time period in this direction)				
Route: Example Eastbound (6-9am)	ESTIMATED RIDERSHIP BASED ON THE ON-TO-OFF SURVEY			
Segment		1	2	3
1	160	40	40	80
2	100	0	30	70
3	40	0	0	40
Total	300	40	70	190

The actual number of O&D records that were completed for each boarding to alighting segment pair is shown in Figure 5-31. To calculate the expansion factors, the estimate of ridership between segments, shown in Figure 5-30, was divided by the actual number of O&D records that were completed between segments shown in Figure 5-31. This calculation produces the expansion factors shown in Figure 5-32. So, the 70 estimated riders were divided by the seven (7) completed O&D records to produce a factor of 10.00 to be applied to riders who boarded in Segment 2 and alighted in Segment 3 as shown in Figure 5-32.

FIGURE 5-31: NUMBER OF COMPLETED SURVEYS

TABLE 4: NUMBER OF COMPLETED INTERCEPT SURVEYS		Total Number of Surveys = 30		
Route: Example Eastbound (6-9am)	NUMBER OF COMPLETED SURVEYS			
Segment		1	2	3
1	16	4	4	8
2	10		3	7
3	4			4
Total	30	4	7	19

FIGURE 5-32: WEIGHTING FACTORS

TABLE 5: Weighting Factors

Route: Example Eastbound (6-9am)

Segment		1	2	3
1	10.00	10.00	10.00	10.00
2	10.00		10.00	10.00
3	10.00			10.00
Total	10.00	10.00	10.00	10.00

Once all the expansion factors are calculated, each factor is applied to all surveys with the same route, direction, time of day, boarding segment, and alighting segment.

General Rule for Expansion Factors

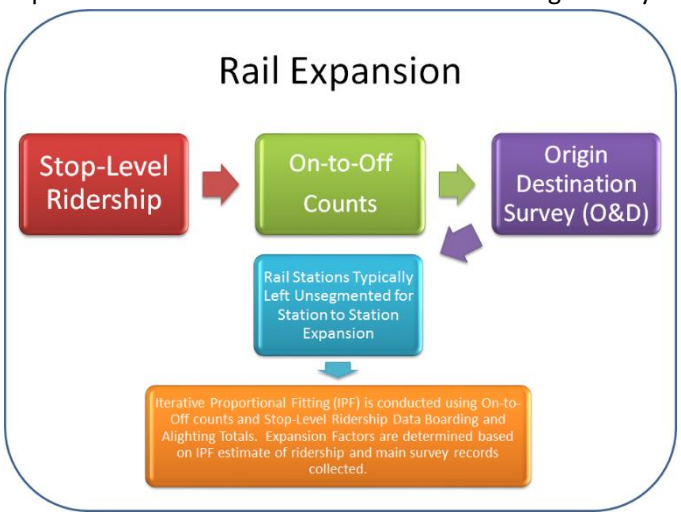
While there are no specific guidelines for the expansion factor values, ETC Institute uses a guideline of keeping expansion factors below 3 times the average expansion factor based on the sampling percentage. This is done to keep any one record from representing a markedly high number of riders in the system. The formula for determining this guideline is:

1/(Sampling %) x 3 = Guideline Weight Factor

If the expansion factor for a boarding segment to alighting segment pair is greater than 3 times the average expansion factor, then it is aggregated into the adjacent boarding to alighting segment where it will have the least impact on the previously existing expansion factors. This guideline is standard for all the various expansion types.

Rail Expansion

Rail expansion is typically conducted in a similar manner to Type 1 Bus Expansion with one major exception. Rail expansion is typically conducted by boarding station to alighting station rather than boarding segment to alighting segment, although segment to segment expansion for rail lines do occur. Rail lines are generally of great interest to transit authorities as they usually transport a significantly higher number of riders than most bus routes. Additionally, rail lines typically have considerably fewer stops than bus routes, thus allowing boarding station to alighting station expansion to be possible. The only other table difference for rail line expansion is the use of dummy/mock records.



Rail Expansion- Dummy Records

Since rail expansion is conducted at such a precise level it makes capturing all possible boarding station to alighting station IPF estimates for every time period and direction extremely difficult. For this reason, boarding station to alighting station pairs that are projected in the IPF rider estimates for each time period and direction that do not have a corresponding O&D survey is filled with a dummy record. A dummy record is a record in the database that has: an ID, the name of the rail line in the route code, a direction of travel, a time period, a boarding station, an alighting station, and a factor representing the missing ridership value. The use of dummy records is kept to a minimum using detailed sampling plans created using the IPF process involving Stop-Level Ridership Data and On-to-Off counts prior to the O&D survey. The use of dummy records is usually greater in the more extreme time periods/off-peak time periods where the logistics of data collection are more complex. In addition, more extreme/off-peak time periods usually have more variability in ridership patterns increasing the difficulty in creating accurate sampling plans.

Weekend Expansion

For weekend routes, ETC used average weekend ridership from September through October 2016. Without having Boarding and Alighting data, ETC was unable to produce Stop-Level Ridership for any of the weekend routes. For this reason, Type 4 Expansion was utilized for expanding all weekend data. Routes were divided into three segments based on the number of stops along a route. These segments were then appended to the O&D Survey database. See Type 4 Expansion for details.

Park-n-Ride Expansion

After the initial expansion, which resulted in the unlinked and linked weighting factors, the number of riders captured accessing the various HRT park-and-ride locations was reviewed. This ridership information was then compared to person count data that was collected at those same park-and-ride locations. The O&D surveys that were collected were not necessarily collected at the same time as the count data. Since there is variability in the number of people who access transit at various park-and-ride locations on a day-to-day basis, the weighted ridership data collected during the O&D survey was not expected to completely match the count data. Instead the weighted data was expected to be within +/- 20% of the count data figures. For example, if the weighted unlinked ridership equaled 90 riders and the count data showed 100 (acceptable range of 80 to 120) riders, the park-and-ride location would have been within the acceptable range. If the unlinked ridership for the park-and-ride location was not within the acceptable range, the O&D weight factors for those records that included those specific park-and-ride locations were adjusted within their appropriate route, time period and direction so that the weight factors still reflected the appropriate ridership for that route, time period and direction while also accounting for the number of riders accessing that park-and-ride location.

Summary

After all the factors are appended to the O&D survey database (regardless of type of expansion) the factors are summed by route, time period, and direction. If expansion was done properly, the summed factors will equal the boarding ridership provided in the Stop-Level Ridership Data by route, time period, and direction.

Linked Trip Expansion Factors for All Records

The linked trip expansion factor helps to account for the number of transfers that were made by each passenger, so the linked expansion factors should better represent the overall system. Linked expansion factors are generated after the unlinked expansion factors are created.

The equation that is used to calculate the linked trip multiplying factor is shown below:

Linked Trip Multiplying Factor = [1 / (1 + # of transfers)]

If a passenger did not make a transfer, the linked trip multiplying factor would be 1.0 because the person would have only boarded one vehicle. If a person made two transfers, the linked trip expansion factor would be 0.33 because the person would have boarded three transit vehicles during his/her one-way trip. An example of how the linked trip expansion factors were calculated is provided in Figure 5-33.

FIGURE 5-33: SAMPLE CALCULATIONS OF LINKED TRIP MULTIPLYING FACTORS

Number of Transfers	Calculation [1/(1+Number of Transfers)]	Linked Trip Multiplying Factor
0	[1/(1+0)]	1
1	[1/(1+1)]	0.5
2	[1/(1+2)]	0.33
3	[1/(1+3)]	0.25

Once the linked trip multiplier is created it is multiplied by the unlinked expansion factor to create the linked expansion factor.

APPENDICES

APPENDIX A: SURVEY INSTRUMENT

Hampton Roads Transit (HRT) 2016 OnBoard Survey

Please take a few minutes to be counted as we plan the future of your transit system.

All personal information will be kept strictly confidential and WILL NOT be shared or sold.

What is your **HOME ADDRESS** (please be specific, ex: 123 W. Main St):
(If you are visiting the Hampton Roads area, please list the hotel name or address where you are staying)

Street Address _____ City _____ State _____ Zip Code _____

COMING FROM?

1. What type of place are you **COMING FROM NOW?** (the starting place for your one-way trip)

O Your usual WORKPLACE
O Other business related
O College / University (students only)
O Airport (as an air passenger)
O Recreation / sightseeing
O Medical appointment / doctor's visit
O Social visits (friends/relatives)
O Personal business (bank, post office)
O Pick up/drop off someone (daycare, school)
O Your **HOME** → *Go to Question #4*
O Your **HOTEL** → *Go to Question #4*
O Other: _____
O Shopping
O Eating/Dining Out
O School (K-12)
O Sporting event

2. What is the **NAME** of the place you are coming from now?

_____

3. What is the **EXACT ADDRESS** of this place? (**OR** Intersection if you do not know the exact address:)

_____

City: _____ State: _____ Zip: _____

4. How did you **GET FROM** your origin (the place in Question #1) TO THE VERY **FIRST** bus / train you used for this one-way trip?

O Walk
O Wheelchair or scooter
O Bike
O Was dropped off by someone (answer 4a)
O Drove alone and parked (answer 4a)
O Drove or rode with others and parked (answer 4a)
O Car share (e.g. Zipcar, etc.) (answer 4a)
O Taxi. (answer 4a)
O Uber, Lyft, etc. (answer 4a)
O Other

4a. Where did you board the first bus / train you used for this one-way trip (Nearest intersection / Park-n-Ride lot):

_____

5. Where did you get ON this bus? Please provide the nearest intersection / station name / Park-n-Ride lot:

_____

GOING TO?

6. What type of place are you **GOING TO NOW?** (the ending place for your one-way trip)

O Your usual WORKPLACE
O Other business related
O College / University (students only)
O Airport (as an air passenger)
O Recreation / sightseeing
O Medical appointment / doctor's visit
O Social visits (friends/relatives)
O Personal business (bank, post office)
O Pick up/drop off someone (daycare, school)
O Your **HOME** → *Go to Question #9*
O Your **HOTEL** → *Go to Question #9*
O Other: _____
O Shopping
O Eating/Dining Out
O School (K-12)
O Sporting event

7. What is the **NAME** of the place you are going to now?

_____

8. What is the **EXACT ADDRESS** of this place? (**OR** Intersection if you do not know the exact address:)

_____

City: _____ State: _____ Zip: _____

9. How will you **GET TO** your destination (listed in Question #6) after you get off the **LAST** bus / train you will use for this one-way trip?

O Walk
O Wheelchair or scooter
O Bike
O Be picked up by someone (answer 9a)
O Get in a parked vehicle & drive alone (answer 9a)
O Get in a parked vehicle & drive/ride w/others (answer 9a)
O Car share (e.g. Zipcar, etc.) (answer 9a)
O Taxi (answer 9a)
O Uber, Lyft, etc. (answer 9a)
O Other

9a. Where will you get off the last bus / train you are using for this one-way trip (Nearest intersection / Park-n-Ride lot):

_____

10. Where will you get OFF this bus? Please provide the nearest intersection / station name / Park-n-Ride lot:

_____

11a. Did you transfer FROM another bus/train BEFORE getting on this vehicle? O Yes O No

11b. Will you transfer TO another bus/train AFTER getting off this vehicle? O Yes O No

11c. Please list the BUS / TRAIN ROUTES in the exact order you use them for this one-way trip

START → [ ] → [ ] → [ ] → [ ] → END

1st Route 2nd Route 3rd Route 4th Route

Continue

OTHER INFORMATION ABOUT THIS TRIP

12. What time did you BOARD this bus/train? _____ : _____ am / pm (circle one)

13. Will you (or did you) make this same trip in exactly the opposite direction today? O No
O Yes - At what time did/will you leave for this trip in the opposite direction? ____:____ am/pm (circle one)

14. How did you pay for your trip today? O Cash O Credit/Debit O Other

15. Specifically, what type of fare did you use for your trip today?
O 1-Day Go Pass O 7-Day Go Pass O 30-Day Go Pass O 2-Ride Go Pass O 1-Day MAX Pass
O 30-Day MAX Pass O GoPass 365 O e-Tide Ticket O One trip fare (cash) O Try Transit 1 day
O Try Transit 30 day O GoSemester O Shuttle (Wave) 1 Day O Shuttle (Wave) 3 day
O Student Freedom Pass (skip to 17)

16. Did you receive any of the following special fare discounts for your trip today? (Check one)
O Youth O Senior O Disabled O HRT Employees/Spouse/Retirees

17. Since you most recently left your home and the next time you will return home, did you or will you... *(check all that apply)*
O No other trip O Go to work O Go to school
O Go shopping O Buy a meal/beverage O Visit friend/relative or attend a religious/social event
O Other errands O Other (please specify):_____

18. On average, how often) do you use public transportation in the Hampton Roads area?
O first time O few times per year O at least once per month O once per week O 2 days per week
O 3 days per week O 4 days per week O 5 days per week O 6 days per week O 7 days per week

ABOUT YOU AND YOUR HOUSEHOLD

19. Are you a visitor to the Hampton Roads region? ONo O Yes (if YES, please skip to Q25 after a & b)
19a. [Visitors & Wave Only] Did the trolley's appearance influence your choice to ride today? OYes O No
19b. [Visitors & Wave Only] Do you feel safer boarding a trolley than a traditional bus? OYes O No

20. What is your employment status? (check the one response that BEST describes you)
O Employed full-time O Not currently employed – seeking work O Retired
O Employed part-time O Not currently employed – not seeking work O Homemaker

21. What is your student status? (check the one response that BEST describes you)
O Not a student or internet O Yes – Full time College/University (institution name):_____
O Yes – K - 12th grade O Yes – Part time College/University (institution name):_____
O Other, institution name_____

22. How many working vehicles (cars, trucks, motorcycles) are available to your household? _____ vehicles
22a. [If #22 is more than "0"] Could you have used one of these vehicles for this trip? OYes ONo

23. Including YOU, how many people live in your household? _____ people

24. Including YOU, how many people at least age 16 in your household are employed full/part time?___ people

25. Do you have a valid driver's license? OYes ONo

26. What is your AGE? O 15 and Under O 16-17 O 18-24 O 25-34 O 35-44
O 45-54 O 55-64 O 65-84 O 85 and over

27. What is your race / ethnicity? *(check all that apply)*
O American Indian/Alaska Native O Asian O Black/African/African American O Hispanic/Latino
O Native Hawaiian/Pacific Islander O White O Other: _____

28. What is your gender? O Male O Female O Other (ask like income if unsure)

29. Which of the following BEST describes your TOTAL ANNUAL HOUSEHOLD INCOME in 2015 before taxes?
O Less than $10,000 O $14,000 - $24,999 O $35,000 - $49,999 O $75,000 or more
O $10,000 - $14,999 O $25,000 - $34,999 O $50,000 – $74,999

30. Do you speak language other than English at home? O No OYes - Which language? _____
30a. [If #30 is Yes] How well do you speak English? O Very Well O Well O Less than well O Not at all

31. Do you have a disability that has been verified by Hampton Roads Transit or another organization that limits your mobility? O Yes – HRT Verified disability O Yes – other verified O No
[If "Yes" to 31] 31a. Do you use a mobility device or service animal when going places? *(check all that apply)*
O No O Service Animal O Wheelchair O Scooter O Walker O Prosthesis
O Cane O White Cane O Crutches O Other_____

32. Do you have a smartphone *(e.g. iPhone, Android / Windows Phone, Blackberry, etc.)*? O Yes O No

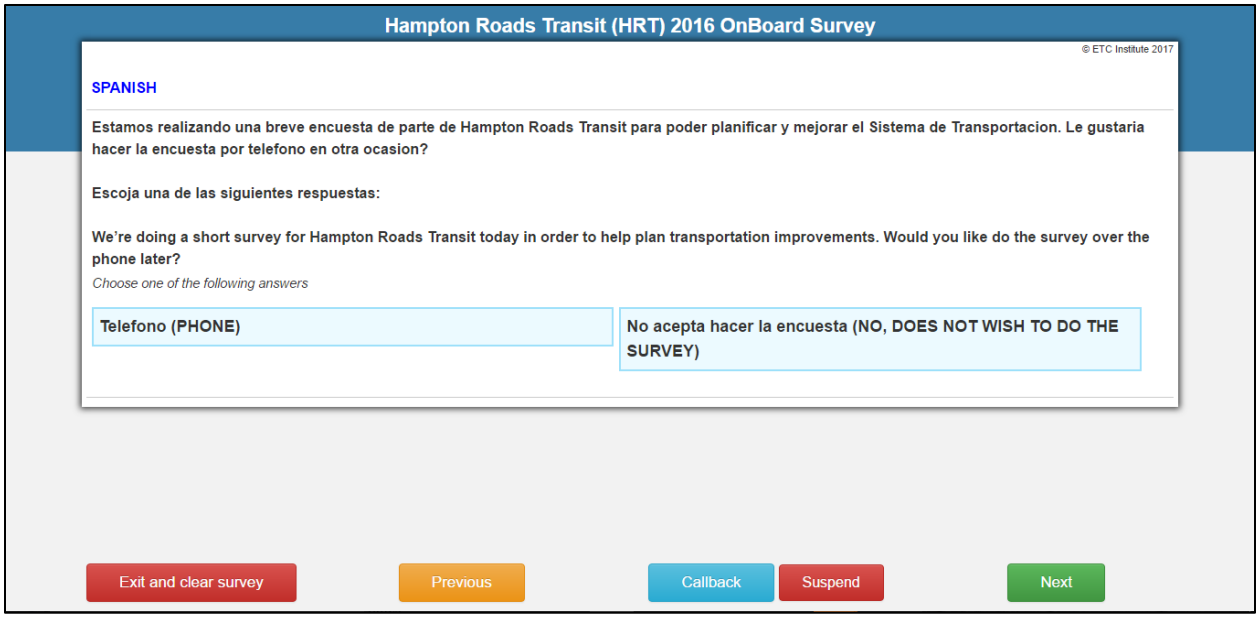
REGISTER TO WIN $100

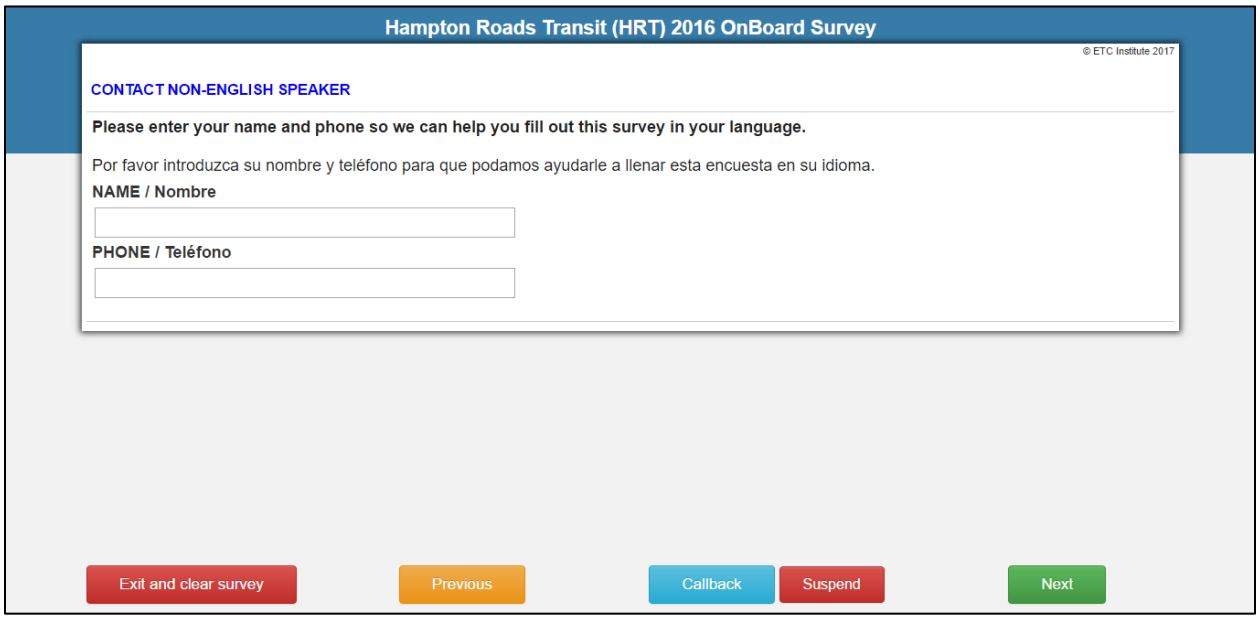
People who submit an accurately completed survey will be entered in a random drawing for one of Five $100 Visa gift cards. You must provide your home address at the beginning of the survey and answer all questions to be eligible.

Your Name: _____

Phone Number: (____) _____

Thank you for your help!


Hampton Roads Transit (HRT) 2016 OnBoard Survey
© ETC Institute 2017
SPANISH
Estamos realizando una breve encuesta de parte de Hampton Roads Transit para poder planificar y mejorar el Sistema de Transportacion. Le gustaria hacer la encuesta por telefono en otra ocasion?
Escoja una de las siguientes respuestas:
We're doing a short survey for Hampton Roads Transit today in order to help plan transportation improvements. Would you like do the survey over the phone later?
Choose one of the following answers
Telefono (PHONE)
No acepta hacer la encuesta (NO, DOES NOT WISH TO DO THE SURVEY)
Exit and clear survey
Previous
Callback
Suspend
Next


Hampton Roads Transit (HRT) 2016 OnBoard Survey
© ETC Institute 2017
CONTACT NON-ENGLISH SPEAKER
Please enter your name and phone so we can help you fill out this survey in your language.
Por favor introduzca su nombre y teléfono para que podamos ayudarle a llenar esta encuesta en su idioma.
NAME / Nombre
PHONE / Teléfono
Exit and clear survey
Previous
Callback
Suspend
Next

APPENDIX B: DATA DICTIONARY

FIELD NAME	DESCRIPTION	CODE VALUES
ID	Unique Identifier for each record	Actual Value
COMPLETED	Date survey was completed	Actual Value
DAY_TYPE	Day of the week survey was completed	Actual Value
ROUTE_SURVEYED[Code]	Route survey was conducted on (Code)	Actual Value
ROUTE_SURVEYED	Route survey was conducted on	Actual Value
HOME_OR_HOTEL_ADDR [ADDR]	Home Address where the respondent lives	Actual Value
HOME_OR_HOTEL_ADDR [CITY]	Home City where the respondent lives	Actual Value
HOME_OR_HOTEL_ADDR [STATE]	Home State where the respondent lives	Actual Value
HOME_OR_HOTEL_ADDR [ZIP]	Zip code where the respondent lives	Actual Value
HOME_OR_HOTEL_ADDR [LAT]	Latitude coordinates where the respondent lives	Actual Value
HOME_OR_HOTEL_ADDR [LONG]	Longitude coordinates where the respondent lives	Actual Value
ORIGIN_PLACE_TYPE[Code]	Type of place respondent is coming from now (Code)	1=Your usual WORKPLACE 2=Other business related 3=College or University (students only) 4=Airport (as an air passengers) 5=Recreation / Sightseeing 6=Medical appointment / doctor's visit 7=Social visits (friends / relatives) 8=Personal business (bank, post office) 9=Pick up/drop off someone (daycare, school) 10=Your HOME 11=Your HOTEL 12=Shopping 13=Eating / Dining Out 14=School (K-12) 15=Sporting event 99=Other
ORIGIN_PLACE_TYPE	Type of place respondent is coming from now	Actual Value
ORIGIN_ADDRESS [ADDR]	Street address where the trip began	Actual Value
ORIGIN_ADDRESS [CITY]	City where the trip began	Actual Value
ORIGIN_ADDRESS [STATE]	State where the trip began	Actual Value
ORIGIN_ADDRESS [ZIP]	Zip code where the trip began	Actual Value
ORIGIN_ADDRESS [LAT]	Latitude coordinates where the trip began	Actual Value
ORIGIN_ADDRESS [LONG]	Longitude coordinates where the trip began	Actual Value
STOP_ON_BUS [ADDR]	Name/description/intersection where the respondent boarded transit	Actual Value
STOP_ON_BUS [STPID]	Unique Stop ID for transit	Actual Value
STOP_ON_BUS [LAT]	Latitude coordinates of the boarding location	Actual Value
STOP_ON_BUS [LONG]	Longitude coordinates of the boarding location	Actual Value
PREV_TRANSFERS[Code]	Number of transfers a respondent took before surveyed route from Origin (Code)	0=(0) None 1=(1) One 2=(2) Two 3=(3) Three 4=(4+) Four or more

PREV_TRANSFERS	Number of transfers a respondent took before surveyed route from Origin	Actual Value
TRIP_FIRST_ROUTE[Code]	First Transfer from Origin (Code)	Actual Value
TRIP_FIRST_ROUTE	First Transfer from Origin	Actual Value
TRIP_SECOND_ROUTE[Code]	Second Transfer to Origin (Code)	Actual Value
TRIP_SECOND_ROUTE	Second Transfer to Origin	Actual Value
TRIP_THIRD_ROUTE[Code]	Third Transfer to Origin (Code)	Actual Value
TRIP_THIRD_ROUTE	Third Transfer to Origin	Actual Value
TRIP_FOURTH_ROUTE[Code]	Fourth Transfer to Origin (Code)	Actual Value
TRIP_FOURTH_ROUTE	Fourth Transfer to Origin	Actual Value
ORIGIN_TRANSPORT[Code]	How respondent got from their origin to transit (Code)	L001=Walk L002=Wheelchair or scooter L003=Bike L004=Was dropped off by someone L005=Drove alone and parked L006=Drove or rode with others and parked L008=Taxi L009=Uber, Lyft, etc. L999=Other
ORIGIN_TRANSPORT	How respondent got from their origin to transit	Actual Value
ORIGIN_PARK_YN_PNR[Code]	For respondents who used a vehicle as their origin transport mode, whether respondent parked or was dropped off at a park and ride lot (Code)	1=Yes 2=No
ORIGIN_PARK_YN_PNR	For respondents who used a vehicle as their origin transport mode, whether respondent parked or was dropped off at a park and ride lot	Actual Value
ORIGIN_PARK_PNR	For respondents who used a vehicle as their origin transport mode, and who parked or were dropped off at a park and ride lot, the lot location	Actual Value
ORIGIN_PARK_PNR [Other]	For respondents who used a vehicle as their origin transport mode, and who parked or were dropped off at a park and ride lot, the lot location (Other)	Actual Value
ORIGIN_DROPOFF [ADDR]	If respondent used a vehicle for their origin transport mode, the location they parked or got dropped off (ADDRESS)	Actual Value
ORIGIN_DROPOFF [CITY]	If respondent used a vehicle for their origin transport mode, the location they parked or got dropped off (CITY)	Actual Value
ORIGIN_DROPOFF [STATE]	If respondent used a vehicle for their origin transport mode, the location they parked or got dropped off (STATE)	Actual Value
ORIGIN_DROPOFF [ZIP]	If respondent used a vehicle for their origin transport mode, the location they parked or got dropped off (ZIP)	Actual Value
ORIGIN_DROPOFF [LAT]	If respondent used a vehicle for their origin transport mode, the location they parked or got dropped off (LAT)	Actual Value
ORIGIN_DROPOFF [LONG]	If respondent used a vehicle for their origin transport mode, the location they parked or got dropped off (LON)	Actual Value
DESTIN_PLACE_TYPE[Code]	Type of place respondent is going to now (Code)	1=Your usual WORKPLACE 2=Other business related 3=College or University (students only) 5=Recreation / Sightseeing 6=Medical appointment / doctor's visit 7=Social visits (friends / relatives) 8=Personal business (bank, post

		office) 9=Pick up/drop off someone (daycare, school) 10=Your HOME 11=Your HOTEL 12=Shopping 13=Eating / Dining Out 14=School (K-12) 15=Sporting event 99=Other
DESTIN_PLACE_TYPE	Type of place respondent is going to now	Actual Value
DESTIN_ADDRESS [ADDR]	Street address where the trip ended	Actual Value
DESTIN_ADDRESS [CITY]	City where the trip ended	Actual Value
DESTIN_ADDRESS [STATE]	State where the trip ended	Actual Value
DESTIN_ADDRESS [ZIP]	Zip code where the trip ended	Actual Value
DESTIN_ADDRESS [LAT]	Latitude coordinates where the trip ended	Actual Value
DESTIN_ADDRESS [LONG]	Longitude coordinates where the trip ended	Actual Value
STOP_OFF_BUS [ADDR]	Name/description/intersection where the respondent alighted transit	Actual Value
STOP_OFF_BUS [STPID]	Unique Stop ID for transit	Actual Value
STOP_OFF_BUS [LAT]	Latitude coordinates of the alighting location	Actual Value
STOP_OFF_BUS [LONG]	Longitude coordinates of the alighting location	Actual Value
NEXT_TRANSFERS[Code]	Number of transfers a respondent took after surveyed route to Destination (Code)	0=(0) None 1=(1) One 2=(2) Two 3=(3) Three 4=(4+) Four or more
NEXT_TRANSFERS	Number of transfers a respondent took after surveyed route to Destination	Actual Value
TRIP_NEXT1ST_ROUTE[Code]	First Transfer to Destination (Code)	Actual Value
TRIP_NEXT1ST_ROUTE	First Transfer to Destination	Actual Value
TRIP_NEXT1ST_ROUTE [Other]	First Transfer to Destination (Other)	Actual Value
TRIP_AFTER2ND_ROUTE[Code]	Second Transfer to Destination (Code)	Actual Value
TRIP_AFTER2ND_ROUTE	Second Transfer to Destination	Actual Value
TRIP_3RD_ROUTE[Code]	Third Transfer to Destination (Code)	Actual Value
TRIP_3RD_ROUTE	Third Transfer to Destination	Actual Value
TRIP_3RD_ROUTE [Other]	Third Transfer to Destination (Other)	Actual Value
DESTIN_TRANSPORT[Code]	How respondent got from transit to their destination (Code)	L001=Walk L002=Wheelchair or scooter L003=Bike L004=Picked up by someone L005=Got in parked vehicle and drove alone L006=Got in parked vehicle and drove/rode with others L007=Car share (e.g. Zipcar, etc.) L008=Taxi L009=Uber, Lyft, etc. L999=Other
DESTIN_TRANSPORT	How respondent got from transit to their destination	Actual Value
DESTIN_PARK_YN_PNR[Code]	For respondents who used a vehicle as their destination transport mode, whether or not respondent drove off or was picked up at a park and ride lot (Code)	1=Yes 2=No

DESTIN_PARK_YN_PNR	For respondents who used a vehicle as their destin transport mode, whether respondent drove off or was picked up at a park and ride lot	Actual Value
DESTIN_PARK_PNR	For respondents who used a vehicle as their destin transport mode, and who drove off or were picked up at a park and ride lot, the lot location	Actual Value
DESTIN_DROPOFF [ADDR]	If respondent used a vehicle for their destin transport mode, the location they parked or got picked up (ADDRESS)	Actual Value
DESTIN_DROPOFF [CITY]	If respondent used a vehicle for their destin transport mode, the location they parked or got picked up (CITY)	Actual Value
DESTIN_DROPOFF [STATE]	If respondent used a vehicle for their destin transport mode, the location they parked or got picked up (STATE)	Actual Value
DESTIN_DROPOFF [ZIP]	If respondent used a vehicle for their destin transport mode, the location they parked or got picked up (ZIP)	Actual Value
DESTIN_DROPOFF [LAT]	If respondent used a vehicle for their destin transport mode, the location they parked or got picked up (LAT)	Actual Value
DESTIN_DROPOFF [LONG]	If respondent used a vehicle for their destin transport mode, the location they parked or got picked up (LON)	Actual Value
TIME_ON[Code]	At what time did respondent board this bus (Code)	1=Before 6:00 am 2=6:00 - 7:00 am 3=7:00 - 8:00 am 4=8:00 - 9:00 am 5=9:00 - 10:00 am 6=10:00 - 11:00 am 7=11:00 am - 12:00 pm 8=12:00 pm - 1:00 pm 9=1:00 - 2:00 pm 10=2:00 - 3:00 pm 11=3:00 - 4:00 pm 12=4:00 - 5:00 pm 13=5:00 - 6:00 pm 14=6:00 - 6:30 pm 15=6:30 - 7:00 pm 16=7:00 - 8:00 pm 17=8:00 - 9:00 pm 18=After 9:00 pm
TIME_ON	At what time did respondent board this bus	Actual Value
TIME_PERIOD	Time period respondent boarded this bus	Actual Value
Trip_in_Opposite_Dir[Code]	Did respondent take same trip in exact opposite direction (Code)	1=Yes 2=No
Trip_in_Opposite_Dir	Did respondent take same trip in exact opposite direction	Actual Value
Opp_Dir_Trip_Time[Code]	Time when respondent took same trip in exact opposite direction	1=Before 6:00 am 2=6:00 - 7:00 am 3=7:00 - 8:00 am 4=8:00 - 9:00 am 5=9:00 - 10:00 am 6=10:00 - 11:00 am 7=11:00 am - 12:00 pm 8=12:00 pm - 1:00 pm 9=1:00 - 2:00 pm 10=2:00 - 3:00 pm 11=3:00 - 4:00 pm 12=4:00 - 5:00 pm 13=5:00 - 6:00 pm 14=6:00 - 6:30 pm 15=6:30 - 7:00 pm

		16=7:00 - 8:00 pm 17=8:00 - 9:00 pm 18=After 9:00 pm
Opp_Dir_Trip_Time	Period of Day the reverse trip was Administered	Actual Value
PAYMENT_METHOD[Code]	Type of payment method used for trip (Code)	1=Cash 2=Credit / Debit 99=Other
PAYMENT_METHOD	Type of payment method used for trip	Actual Value
PAYMENT_METHOD [Other]	Type of payment method used for trip (Other)	Actual Value
FARE_TYPE[Code]	Type of fare respondent used for their trip (Code)	1=1-Day Go Pass 2=7-Day Go Pass 3=30-Day Go Pass 4=2-Ride Go Pass 5=1-Day MAX Pass 6=30-Day MAX Pass 7=GoPass 365 8=e-Tide Ticket 9=One trip fare (cash) 10=Try Transit 1 day 11=Try Transit 30 day 12=GoSemester 13=Shuttle (Wave) 1 Day 14=Shuttle (Wave) 3 day 15=Student Freedom Pass 99=Other
FARE_TYPE	Type of fare respondent used for their trip	Actual Value
FARE_TYPE [Other]	Type of fare respondent used for their trip (Other)	Actual Value
FARE_DISCOUNTS[Code]	Whether respondent received any fare discounts (Code)	1=Youth 2=Senior 3=Disabled 4=HRT Employees/Spouse/Retirees 5=Regular 99=Other
FARE_DISCOUNTS	Whether respondent received any fare discounts	Actual Value
OTHER_ACTIVITIES [NO OTHER TRIP]	If respondent participated in other activities during the day of their trip (No Other Trip)	Actual Value
OTHER_ACTIVITIES [GO TO WORK]	If respondent participated in other activities during the day of their trip (Go to Work)	Actual Value
OTHER_ACTIVITIES [GO TO SCHOOL]	If respondent participated in other activities during the day of their trip (Go to School)	Actual Value
OTHER_ACTIVITIES [GO SHOPPING]	If respondent participated in other activities during the day of their trip (Go Shopping)	Actual Value
OTHER_ACTIVITIES [BUY A MEAL/BEVERAGE]	If respondent participated in other activities during the day of their trip (Buy a Meal/Beverage)	Actual Value
OTHER_ACTIVITIES [VISIT FRIEND/RELATIVE OR ATTEND A RELIGIOUS/SOCIAL EVENT]	If respondent participated in other activities during the day of their trip (Visit friend/relative or attend a religious/social event)	Actual Value
OTHER_ACTIVITIES [OTHER ERRANDS]	If respondent participated in other activities during the day of their trip (Other Errands)	Actual Value
OTHER_ACTIVITIES [Other]	If respondent participated in other activities during the day of their trip (Other)	Actual Value
FREQ_USE_TRANSIT[Code]	How often respondent uses transit system (Code)	1=first time 2=few times per year 3=at least once per month 4=once per week

		5=2 days per week 6=3 days per week 7=4 days per week 8=5 days per week 9=6 days per week 10=7 days per week
FREQ_USE_TRANSIT	How often respondent uses transit system	Actual Value
VISITOR[Code]	If respondent is a visitor of the area (Code)	1=No 2=Yes
VISITOR	If respondent is a visitor of the area	Actual Value
Trolley_Opinion[Code]	If respondent was a visitor to the area and rode on the Wave, whether the trolley appearance influenced if they rode the wave on their day of travel (Code)	1=Yes 2=No
Trolley_Opinion	If respondent was a visitor to the area and rode on the Wave, whether the trolley appearance influenced if they rode the wave on their day of travel	Actual Value
Trolley_Safety[Code]	If respondent was a visitor to the area and rode on the Wave, if respondent felt safer boarding a trolley than a traditional bus (Code)	1=Yes 2=No
Trolley_Safety	If respondent was a visitor to the area and rode on the Wave, if respondent felt safer boarding a trolley than a traditional bus	Actual Value
COUNT_VH_HH[Code]	Number of Vehicles in respondent's household (Code)	0=None (0) 1=One (1) 2=Two (2) 3=Three (3) 4=Four (4) 5=Five (5) 6=Six (6) 9=Nine (9) 10P=Ten or more (10+)
COUNT_VH_HH	Number of Vehicles in respondent's household	Actual Value
CAN_USE_VEH_TRIP[Code]	Whether respondent could have used a vehicle for their trip (Code)	1=Yes 2=No
CAN_USE_VEH_TRIP	Whether respondent could have used a vehicle for their trip	Actual Value
COUNT_MEMBER_HH[Code]	Number of household members in respondent's house (Code)	1=One (1) 2=Two (2) 3=Three (3) 4=Four (4) 5=Five (5) 6=Six (6) 7=Seven (7) 8=Eight (8) 9=Nine (9) 10=Ten or More (10+)
COUNT_MEMBER_HH	Number of household members in respondent's house	Actual Value
COUNT_EMPLOYED_HH[Code]	Number of employed household members in respondent's house (Code)	0=None (0) 1=One (1) 2=Two (2) 3=Three (3) 4=Four (4) 5=Five (5) 6=Six (6) 7=Seven (7) 8=Eight (8) 9=Nine (9)
COUNT_EMPLOYED_HH	Number of employed household members in respondent's house	Actual Value

STATUS_EMPLOYMENT[Code]	Employment Status of respondent (Code)	1=Employed Full-time 2=Employed Part-time 3=Not currently employed - seeking work 4=Not currently employed - not seeking work 5=Retired 6=Homemaker
STATUS_EMPLOYMENT	Employment Status of respondent	Actual Value
STUDENT_STATUS[Code]	Respondent student status (Code)	1=Not a student or internet 2=Yes - Full time College/University 3=Yes - K - 12th grade 4=Yes - Part time College/University 99=Other
STUDENT_STATUS	Respondent student status	Actual Value
STUDENT_STATUS [Other]	Respondent student status (Other)	Actual Value
SCHOOL_NAME[Code]	Name of school respondent attends if indicated they are a student (Code)	Actual Value
SCHOOL_NAME	Name of school respondent attends if indicated they are a student	Actual Value
SCHOOL_NAME [Other]	Name of school respondent attends if indicated they are a student (Other)	Actual Value
HAS_DRIVE_LICENSE[Code]	Whether respondent has driver's license (Code)	1=Yes 2=No
HAS_DRIVE_LICENSE	Whether respondent has driver's license	Actual Value
AGE[Code]	Age of respondent (Code)	1=Under 15 2=16-17 3=18-24 4=25-34 5=35-44 6=45-54 7=55-64 8=65-84 9=85 and Over
AGE	Age of respondent	Actual Value
RACE_ETHNICITY [AMERICAN INDIAN / ALASKA NATIVE]	Whether respondent indicated they were American Indian/Alaskan Native	Actual Value
RACE_ETHNICITY [ASIAN]	Whether respondent indicated they were Asian	Actual Value
RACE_ETHNICITY [BLACK/AFRICAN/AFRICAN AMERICAN]	Whether respondent indicated they were Black/African American	Actual Value
RACE_ETHNICITY [HISPANIC/LATINO]	Whether respondent indicated they were Hispanic/Latino	Actual Value
RACE_ETHNICITY [NATIVE HAWAIIAN / PACIFIC ISLANDER]	Whether respondent indicated they were Native Hawaiian/Pacific Islander	Actual Value
RACE_ETHNICITY [WHITE]	Whether respondent indicated they were White	Actual Value
RACE_ETHNICITY [Other]	Whether respondent indicated they were another race or ethnicity	Actual Value
INCOME[Code]	Total annual household income (Code)	1=Less than $10,000 2=$10,000 - $14,999 3=$14,000 - $24,999 4=$25,000 - $34,999

		5=$35,000 - $49,999 6=$50,000 - $74,999 7=$75,000 or more 99=Unknown
INCOME	Total annual household income	Actual Value
HOME_LANG_OTHER[Code]	Does respondent speak a language other than English spoken in home (Code)	1=Yes 2=No
HOME_LANG_OTHER	Does respondent speak a language other than English spoken in home	Actual Value
HOME_OTHER_LANG[Code]	Language respondent speaks at home other than English (Code)	Actual Value
HOME_OTHER_LANG	Language respondent speaks at home other than English	Actual Value
HOME_OTHER_LANG [Other]	Language respondent speaks at home other than English (Other)	Actual Value
ENGLISH_ABILITY[Code]	How well did respondent speaks English (Code)	A1=Very well A2=Well A4=Less than well
ENGLISH_ABILITY	How well did respondent speaks English	Actual Value
DISABILITY[Code]	Whether respondent has a verified disability that limits their mobility (Code)	1=Yes - HRT Verified disability 2=Yes - other verified 3=No
DISABILITY	Whether respondent has a verified disability that limits their mobility	Actual Value
MOBILITY_DEVICES[Code]	If respondent indicated they do have a disability, whether they use a mobility device or service animal when travelling (Code)	1=No 3=Wheelchair 4=Scooter 5=Walker 6=Prosthesis 7=Cane 9=Crutches 99=Other
MOBILITY_DEVICES	If respondent indicated they do have a disability, whether they use a mobility device or service animal when travelling	Actual Value
MOBILITY_DEVICES [Other]	If respondent indicated they do have a disability, whether they use a mobility device or service animal when travelling (Other)	Actual Value
SMARTPHONE[Code]	If respondent has a smartphone (Code)	1=Yes 2=No 3=Unknown
SMARTPHONE	If respondent has a smartphone	Actual Value
GENDER[Code]	Gender of respondent (Code)	1=Male 2=Female 3=Other
GENDER	Gender of respondent	Actual Value
HRT_EASYUSE[Code]	Is the HRT system easy to use? (Code)	1=Yes 2=No
HRT_EASYUSE	Is the HRT system easy to use?	Actual Value
HRT_STOPLOC[Code]	Are your bus stops conveniently located? (Code)	1=Yes 2=No
HRT_STOPLOC	Are your bus stops conveniently located?	Actual Value
HRT_STOPACCESS[Code]	Are your bus stops accessible for all people (handicap)? (Code)	1=Yes 2=No
HRT_STOPACCESS	Are your bus stops accessible for all people (handicap)?	Actual Value
HRT_SATIS[Code]	Are you satisfied with this route? (Code)	1=Yes 2=No
HRT_SATIS	Are you satisfied with this route?	Actual Value
HRT_SAFE_RIDE[Code]	Do you feel safe while riding HRT services? (Code)	1=Yes 2=No

HRT_SAFE_RIDE	Do you feel safe while riding HRT services?	Actual Value
HRT_SAFE_WAIT[Code]	Do you feel safe while waiting at the bus stop? (Code)	1=Yes 2=No
HRT_SAFE_WAIT	Do you feel safe while waiting at the bus stop?	Actual Value
HRT_STOP_CLEAN[Code]	Are your bus stops generally clean? (Code)	1=Yes 2=No
HRT_STOP_CLEAN	Are your bus stops generally clean?	Actual Value
HRT_BIKERACK_FULL[Code]	Have you ever been unable to ride the bus because the bike rack was full? (Code)	1=Yes 2=No
HRT_BIKERACK_FULL	Have you ever been unable to ride the bus because the bike rack was full?	Actual Value
HRT_BIKERACK_SAFE[Code]	Do you feel safe leaving your bike at a bus stop if the bike rack on the bus is full? (Code)	1=Yes 2=No
HRT_BIKERACK_SAFE	Do you feel safe leaving your bike at a bus stop if the bike rack on the bus is full?	Actual Value
HRT_PROF_HELP[Code]	Are the bus operators professional and helpful? (Code)	1=Yes 2=No
HRT_PROF_HELP	Are the bus operators professional and helpful?	Actual Value
HRT_FOR_FUN[Code]	Do you use public transportation to go to recreational or cultural activities? (Code)	1=Yes 2=No
HRT_FOR_FUN	Do you use public transportation to go to recreational or cultural activities?	Actual Value
WGHT_NAME	Unique expansion identifier for record, indicating Route_Direction_TimePeriod_BoardingSegment_AlightingSegment	Actual Value
UNLINKED_WGHT_FACTOR	Weight factor given to each record meant to represent number of boardings per day	Actual Value
TOTAL_TRANSFERS	Total number of previous and next transfers	Actual Value
LINKED_WGHT_FCTR	Adjusted unlinked weight factor meant to represent the number of trips per day instead of number of boardings per day	Actual Value
PNR_ADJ_UNLK_WGHT_FCTR	Adjusted unlinked weight factor meant to adjust for park and ride counts	Actual Value
PNR_ADJ_LNKD_WGHT_FCTR	Adjusted linked weight factor meant to adjust for park and ride counts	Actual Value

APPENDIX C: ROUTE SEGMENT/EXPANSION TYPES

ROUTE NAME	ROUTE	METHOD	ROUTE NAME	ROUTE	METHOD
1 Downtown Norfolk Pembroke East INBOUND [HRT]	1	B&A/STOP-LEVEL METHOD	58 South Norfolk/Bainbridge Boulevard INBOUND [HRT]	58	STOP METHOD
1 Downtown Norfolk Pembroke East OUTBOUND [HRT]	1	B&A/STOP-LEVEL METHOD	58 South Norfolk/Bainbridge Boulevard OUTBOUND [HRT]	58	STOP METHOD
2 Naval Station Norfolk/Hampton Blvd INBOUND [HRT]	2	B&A/STOP-LEVEL METHOD	64 To Smithfield/Gwaltney and Newport News Shipyard INBOUND [HRT]	64	STOP METHOD
2 Naval Station Norfolk/Hampton Blvd OUTBOUND [HRT]	2	B&A/STOP-LEVEL METHOD	64 To Smithfield/Gwaltney and Newport News Shipyard OUTBOUND [HRT]	64	STOP METHOD
3 Downtown Norfolk/Naval Station INBOUND [HRT]	3	B&A/STOP-LEVEL METHOD	101 (Kecoughtan) Downtown Newport News/Downtown Hampton INBOUND [HRT]	101	B&A/STOP-LEVEL METHOD
3 Downtown Norfolk/Naval Station OUTBOUND [HRT]	3	B&A/STOP-LEVEL METHOD	101 (Kecoughtan) Downtown Newport News/Downtown Hampton OUTBOUND [HRT]	101	B&A/STOP-LEVEL METHOD
4 Downtown Norfolk/ODU INBOUND [HRT]	4	STOP METHOD	102 (Coliseum) Peninsula Town Center/Downtown Hampton INBOUND [HRT]	102	STOP METHOD
4 Downtown Norfolk/ODU OUTBOUND [HRT]	4	STOP METHOD	102 (Coliseum) Peninsula Town Center/Downtown Hampton OUTBOUND [HRT]	102	STOP METHOD
5 Willoughby - Evelyn Butts INBOUND [HRT]	5	STOP METHOD	103 (Shell Rd.) Downtown Newport News/Downtown Hampton INBOUND [HRT]	103	B&A/STOP-LEVEL METHOD
5 Willoughby - Evelyn Butts OUTBOUND [HRT]	5	STOP METHOD	103 (Shell Rd.) Downtown Newport News/Downtown Hampton OUTBOUND [HRT]	103	B&A/STOP-LEVEL METHOD
6 Downtown Norfolk/South Norfolk/Robert Hall Blvd INBOUND [HRT]	6	B&A/STOP-LEVEL METHOD	104 (Marshall) Downtown Newport News/Newmarket INBOUND [HRT]	104	B&A/STOP-LEVEL METHOD
6 Downtown Norfolk/South Norfolk/Robert Hall Blvd OUTBOUND [HRT]	6	B&A/STOP-LEVEL METHOD	104 (Marshall) Downtown Newport News/Newmarket OUTBOUND [HRT]	104	B&A/STOP-LEVEL METHOD
8 Downtown Norfolk / Evelyn T. Butts Ave INBOUND [HRT]	8	B&A/STOP-LEVEL METHOD	105 (Briarfield) Maple Avenue & 27th Street/Peninsula Town Center INBOUND [HRT]	105	B&A/STOP-LEVEL METHOD
8 Downtown Norfolk / Evelyn T. Butts Ave OUTBOUND [HRT]	8	B&A/STOP-LEVEL METHOD	105 (Briarfield) Maple Avenue & 27th Street/Peninsula Town Center OUTBOUND [HRT]	105	B&A/STOP-LEVEL METHOD
9 Downtown Norfolk/Sewells Point Road INBOUND [HRT]	9	B&A/STOP-LEVEL METHOD	106 Newport News / Warwick Boulevard / Denbigh / Fort Eustis INBOUND [HRT]	106	B&A/STOP-LEVEL METHOD
9 Downtown Norfolk/Sewells Point Road OUTBOUND [HRT]	9	B&A/STOP-LEVEL METHOD	106 Newport News / Warwick Boulevard / Denbigh / Fort Eustis OUTBOUND [HRT]	106	B&A/STOP-LEVEL METHOD
11 Downtown Norfolk/Colonial Place INBOUND [HRT]	11	STOP METHOD	107 Newport News / Warwick Boulevard / Denbigh INBOUND [HRT]	107	B&A/STOP-LEVEL METHOD
11 Downtown Norfolk/Colonial Place OUTBOUND [HRT]	11	STOP METHOD	107 Newport News / Warwick Boulevard / Denbigh OUTBOUND [HRT]	107	B&A/STOP-LEVEL METHOD
12 South Norfolk/TCC - Virginia Beach INBOUND [HRT]	12	B&A/STOP-LEVEL METHOD	108 Patrick Henry Mall / Lee Hall INBOUND [HRT]	108	STOP METHOD
12 South Norfolk/TCC - Virginia Beach OUTBOUND [HRT]	12	B&A/STOP-LEVEL METHOD	108 Patrick Henry Mall / Lee Hall OUTBOUND [HRT]	108	STOP METHOD
13 Downtown Norfolk/Robert Hall Blvd/TCC – Chesapeake INBOUND [HRT]	13	B&A/STOP-LEVEL METHOD	109 (Pembroke) Downtown Hampton/Buckroe INBOUND [HRT]	109	STOP METHOD
13 Downtown Norfolk/Robert Hall Blvd/TCC – Chesapeake OUTBOUND [HRT]	13	B&A/STOP-LEVEL METHOD	109 (Pembroke) Downtown Hampton/Buckroe OUTBOUND [HRT]	109	STOP METHOD
14 Robert Hall Blvd / TCC Chesapeake INBOUND [HRT]	14	STOP METHOD	110 (Thomas Nelson) Downtown Hampton/Thomas Nelson INBOUND [HRT]	110	B&A/STOP-LEVEL METHOD
14 Robert Hall Blvd / TCC Chesapeake OUTBOUND [HRT]	14	STOP METHOD	110 (Thomas Nelson) Downtown Hampton/Thomas Nelson OUTBOUND [HRT]	110	B&A/STOP-LEVEL METHOD
15 Evelyn Butts to Robert Hall/Greenbrier Mall INBOUND [HRT]	15	B&A/STOP-LEVEL METHOD	111 (Denbigh - TNCC) Thomas Nelson/Riverside/Denbigh INBOUND [HRT]	111	B&A/STOP-LEVEL METHOD
15 Evelyn Butts to Robert Hall/Greenbrier Mall OUTBOUND [HRT]	15	B&A/STOP-LEVEL METHOD	111 (Denbigh - TNCC) Thomas Nelson/Riverside/Denbigh OUTBOUND [HRT]	111	B&A/STOP-LEVEL METHOD
18 Downtown Norfolk/Ballentine Boulevard INBOUND [HRT]	18	STOP METHOD	112 Downtown Newport News / Patrick Henry Mall INBOUND [HRT]	112	B&A/STOP-LEVEL METHOD
18 Downtown Norfolk/Ballentine Boulevard OUTBOUND [HRT]	18	STOP METHOD	112 Downtown Newport News / Patrick Henry Mall OUTBOUND [HRT]	112	B&A/STOP-LEVEL METHOD
20 Downtown Norfolk/Virginia Beach Oceanfront INBOUND [HRT]	20	B&A/STOP-LEVEL METHOD	114 (Weaver Rd.) Newmarket/Downtown Hampton INBOUND [HRT]	114	B&A/STOP-LEVEL METHOD
20 Downtown Norfolk/Virginia Beach Oceanfront OUTBOUND [HRT]	20	B&A/STOP-LEVEL METHOD	114 (Weaver Rd.) Newmarket/Downtown Hampton OUTBOUND [HRT]	114	B&A/STOP-LEVEL METHOD
21 Little Creek Rd. INBOUND [HRT]	21	B&A/STOP-LEVEL METHOD	115 Buckroe/Willow Oaks/Downtown Hampton INBOUND [HRT]	115	STOP METHOD
21 Little Creek Rd. OUTBOUND [HRT]	21	B&A/STOP-LEVEL METHOD	115 Buckroe/Willow Oaks/Downtown Hampton OUTBOUND [HRT]	115	STOP METHOD
22 Newtown Road Station/Joint Expeditionary Base Little Creek INBOUND [HRT]	22	STOP METHOD	116 (Mall Hall) Lee Hall/Patrick Henry Mall Loop INBOUND [HRT]	116	STOP METHOD
22 Newtown Road Station/Joint Expeditionary Base Little Creek OUTBOUND [HRT]	22	STOP METHOD	116 (Mall Hall) Lee Hall/Patrick Henry Mall Loop OUTBOUND [HRT]	116	STOP METHOD
23 Medical Tower/Military Circle/JANAF INBOUND [HRT]	23	B&A/STOP-LEVEL METHOD	117 (Phoebus) Hampton University/V.A. Hospital INBOUND [HRT]	117	STOP METHOD
23 Medical Tower/Military Circle/JANAF OUTBOUND [HRT]	23	B&A/STOP-LEVEL METHOD	117 (Phoebus) Hampton University/V.A. Hospital OUTBOUND [HRT]	117	STOP METHOD
25 (Newtown) Military Circle/Princess Anne INBOUND [HRT]	25	STOP METHOD	118 (Magruder) Langley/Semple Farm Road INBOUND [HRT]	118	B&A/STOP-LEVEL METHOD
25 (Newtown) Military Circle/Princess Anne OUTBOUND [HRT]	25	STOP METHOD	118 (Magruder) Langley/Semple Farm Road OUTBOUND [HRT]	118	B&A/STOP-LEVEL METHOD
26 Lynnhaven Mall / TCC Virginia Beach INBOUND [HRT]	26	STOP METHOD	119 Fishing Point Dr/Riverside Regional Medical Center INBOUND [HRT]	119	STOP METHOD
26 Lynnhaven Mall / TCC Virginia Beach OUTBOUND [HRT]	26	STOP METHOD	119 Fishing Point Dr/Riverside Regional Medical Center OUTBOUND [HRT]	119	STOP METHOD
27 Pleasure House Rd./Newtown Road Light Rail Station INBOUND [HRT]	27	STOP METHOD	120 (Mallory) Downtown Hampton/Mallory/Buckroe INBOUND [HRT]	120	STOP METHOD
27 Pleasure House Rd./Newtown Road Light Rail Station OUTBOUND [HRT]	27	STOP METHOD	120 (Mallory) Downtown Hampton/Mallory/Buckroe OUTBOUND [HRT]	120	STOP METHOD
29 (Lynnhaven) Pleasure House Road INBOUND [HRT]	29	STOP METHOD	121 Newport News Transportation Center / Williamsburg INBOUND [HRT]	121	STOP METHOD
29 (Lynnhaven) Pleasure House Road OUTBOUND [HRT]	29	STOP METHOD	121 Newport News Transportation Center / Williamsburg OUTBOUND [HRT]	121	STOP METHOD

ROUTE NAME	ROUTE	METHOD	ROUTE NAME	ROUTE	METHOD
30 Wave: Atlantic Avenue Shuttle INBOUND [HRT]	30	STOP METHOD	403 Buckroe Shopping Center OUTBOUND [HRT]	403	STOP METHOD
30 Wave: Atlantic Avenue Shuttle OUTBOUND [HRT]	30	STOP METHOD	405 NNTC/Buckroe INBOUND [HRT]	405	STOP METHOD
31 Wave: Aquarium and Campground Shuttle INBOUND [HRT]	31	STOP METHOD	405 NNTC/Buckroe OUTBOUND [HRT]	405	STOP METHOD
31 Wave: Aquarium and Campground Shuttle OUTBOUND [HRT]	31	STOP METHOD	414 NNTC/Jefferson/Oakland INBOUND [HRT]	414	STOP METHOD
32 Wave: Shoppers Shuttle INBOUND [HRT]	32	STOP METHOD	414 NNTC/Jefferson/Oakland OUTBOUND [HRT]	414	STOP METHOD
32 Wave: Shoppers Shuttle OUTBOUND [HRT]	32	STOP METHOD	415 NNTC/Denbigh OUTBOUND [HRT]	415	STOP METHOD
33 (General Booth) North Seashore/Municipal Center INBOUND [HRT]	33	STOP METHOD	430 Denbigh Fringe INBOUND [HRT]	430	STOP METHOD
33 (General Booth) North Seashore/Municipal Center OUTBOUND [HRT]	33	STOP METHOD	430 Denbigh Fringe OUTBOUND [HRT]	430	STOP METHOD
36 (Holland) Pembroke East INBOUND [HRT]	36	B&A/STOP-LEVEL METHOD	918 MAX Virginia Beach to Joint Forces Staff College Norfolk/Naval Station Norfolk INBOUND [HRT]	918	STOP METHOD
36 (Holland) Pembroke East OUTBOUND [HRT]	36	B&A/STOP-LEVEL METHOD	918 MAX Virginia Beach to Joint Forces Staff College Norfolk/Naval Station Norfolk OUTBOUND [HRT]	918	STOP METHOD
41 Downtown Portsmouth/Cradock INBOUND [HRT]	41	STOP METHOD	919 MAX Virginia Beach to Joint Forces Staff College Norfolk/Naval Station Norfolk INBOUND [HRT]	919	STOP METHOD
41 Downtown Portsmouth/Cradock OUTBOUND [HRT]	41	STOP METHOD	919 MAX Virginia Beach to Joint Forces Staff College Norfolk/Naval Station Norfolk OUTBOUND [HRT]	919	STOP METHOD
43 County Street / Bart Street INBOUND [HRT]	43	STOP METHOD	922 MAX Chesapeake-Virginia Beach to Naval Station Norfolk INBOUND [HRT]	922	STOP METHOD
43 County Street / Bart Street OUTBOUND [HRT]	43	STOP METHOD	922 MAX Chesapeake-Virginia Beach to Naval Station Norfolk OUTBOUND [HRT]	922	STOP METHOD
44 Norfolk General Hospital/Midtown Portsmouth INBOUND [HRT]	44	STOP METHOD	960 MAX Virginia Beach to Norfolk INBOUND [HRT]	960	STOP METHOD
44 Norfolk General Hospital/Midtown Portsmouth OUTBOUND [HRT]	44	STOP METHOD	960 MAX Virginia Beach to Norfolk OUTBOUND [HRT]	960	STOP METHOD
45 Downtown Norfolk/Portsmouth INBOUND [HRT]	45	B&A/STOP-LEVEL METHOD	961 MAX Newport News-Hampton to Norfolk INBOUND [HRT]	961	B&A/STOP-LEVEL METHOD
45 Downtown Norfolk/Portsmouth OUTBOUND [HRT]	45	B&A/STOP-LEVEL METHOD	961 MAX Newport News-Hampton to Norfolk OUTBOUND [HRT]	961	B&A/STOP-LEVEL METHOD
47 Downtown Portsmouth/Churchland INBOUND [HRT]	47	B&A/STOP-LEVEL METHOD	965 MAX Patrick Henry Mall to Naval Station Norfolk INBOUND [HRT]	965	STOP METHOD
47 Downtown Portsmouth/Churchland OUTBOUND [HRT]	47	B&A/STOP-LEVEL METHOD	965 MAX Patrick Henry Mall to Naval Station Norfolk OUTBOUND [HRT]	965	STOP METHOD
50 Academy Park/Victory Crossing INBOUND [HRT]	50	STOP METHOD	966 MAX Silverleaf Park & Ride/Newport News Transit Center INBOUND [HRT]	966	STOP METHOD
50 Academy Park/Victory Crossing OUTBOUND [HRT]	50	STOP METHOD	966 MAX Silverleaf Park & Ride/Newport News Transit Center OUTBOUND [HRT]	966	STOP METHOD
55 Greenbrier Circulator TO GREENBRIER MALL	55	STOP METHOD	967 MAX Virginia Beach-Chesapeake to Newport News (MHS) INBOUND [HRT]	967	STOP METHOD
55 Greenbrier Circulator TO ROBERT HALL BLVD	55	STOP METHOD	967 MAX Virginia Beach-Chesapeake to Newport News (MHS) OUTBOUND [HRT]	967	STOP METHOD
57 Robert Hall Boulevard/Airline Boulevard INBOUND [HRT]	57	STOP METHOD	Elizabeth River Ferry	90	STOP METHOD
57 Robert Hall Boulevard/Airline Boulevard OUTBOUND [HRT]	57	STOP METHOD	The Tide (Light Rail)	800	STATION-TO-STATION

ROUTE NAME	ROUTE	METHOD	ROUTE NAME	ROUTE	METHOD
1 Downtown Norfolk Pembroke East INBOUND [HRT]	1	TYPE 1 EXPANSION	58 South Norfolk/Bainbridge Boulevard INBOUND [HRT]	58	TYPE 4 EXPANSION
1 Downtown Norfolk Pembroke East OUTBOUND [HRT]	1	TYPE 1 EXPANSION	58 South Norfolk/Bainbridge Boulevard OUTBOUND [HRT]	58	TYPE 4 EXPANSION
2 Naval Station Norfolk/Hampton Blvd INBOUND [HRT]	2	TYPE 1 EXPANSION	64 To Smithfield/Gwaltney and Newport News Shipyard INBOUND [HRT]	64	TYPE 4 EXPANSION
2 Naval Station Norfolk/Hampton Blvd OUTBOUND [HRT]	2	TYPE 1 EXPANSION	64 To Smithfield/Gwaltney and Newport News Shipyard OUTBOUND [HRT]	64	TYPE 4 EXPANSION
3 Downtown Norfolk/Naval Station INBOUND [HRT]	3	TYPE 1 EXPANSION	101 (Kecoughtan) Downtown Newport News/Downtown Hampton INBOUND [HRT]	101	TYPE 1 EXPANSION
3 Downtown Norfolk/Naval Station OUTBOUND [HRT]	3	TYPE 1 EXPANSION	101 (Kecoughtan) Downtown Newport News/Downtown Hampton OUTBOUND [HRT]	101	TYPE 1 EXPANSION
4 Downtown Norfolk/ODU INBOUND [HRT]	4	TYPE 4 EXPANSION	102 (Coliseum) Peninsula Town Center/Downtown Hampton INBOUND [HRT]	102	TYPE 4 EXPANSION
4 Downtown Norfolk/ODU OUTBOUND [HRT]	4	TYPE 4 EXPANSION	102 (Coliseum) Peninsula Town Center/Downtown Hampton OUTBOUND [HRT]	102	TYPE 4 EXPANSION
5 Willoughby – Evelyn Butts INBOUND [HRT]	5	TYPE 4 EXPANSION	103 (Shell Rd.) Downtown Newport News/Downtown Hampton INBOUND [HRT]	103	TYPE 1 EXPANSION
5 Willoughby – Evelyn Butts OUTBOUND [HRT]	5	TYPE 4 EXPANSION	103 (Shell Rd.) Downtown Newport News/Downtown Hampton OUTBOUND [HRT]	103	TYPE 1 EXPANSION
6 Downtown Norfolk/South Norfolk/Robert Hall Blvd INBOUND [HRT]	6	TYPE 1 EXPANSION	104 (Marshall) Downtown Newport News/Newmarket INBOUND [HRT]	104	TYPE 1 EXPANSION
6 Downtown Norfolk/South Norfolk/Robert Hall Blvd OUTBOUND [HRT]	6	TYPE 1 EXPANSION	104 (Marshall) Downtown Newport News/Newmarket OUTBOUND [HRT]	104	TYPE 1 EXPANSION
8 Downtown Norfolk / Evelyn T. Butts Ave INBOUND [HRT]	8	TYPE 1 EXPANSION	105 (Briarfield) Maple Avenue & 27th Street/Peninsula Town Center INBOUND [HRT]	105	TYPE 1 EXPANSION
8 Downtown Norfolk / Evelyn T. Butts Ave OUTBOUND [HRT]	8	TYPE 1 EXPANSION	105 (Briarfield) Maple Avenue & 27th Street/Peninsula Town Center OUTBOUND [HRT]	105	TYPE 1 EXPANSION
9 Downtown Norfolk/Sewells Point Road INBOUND [HRT]	9	TYPE 1 EXPANSION	106 Newport News / Warwick Boulevard / Denbigh / Fort Eustis INBOUND [HRT]	106	TYPE 1 EXPANSION
9 Downtown Norfolk/Sewells Point Road OUTBOUND [HRT]	9	TYPE 1 EXPANSION	106 Newport News / Warwick Boulevard / Denbigh / Fort Eustis OUTBOUND [HRT]	106	TYPE 1 EXPANSION
11 Downtown Norfolk/Colonial Place INBOUND [HRT]	11	TYPE 4 EXPANSION	107 Newport News / Warwick Boulevard / Denbigh INBOUND [HRT]	107	TYPE 1 EXPANSION
11 Downtown Norfolk/Colonial Place OUTBOUND [HRT]	11	TYPE 4 EXPANSION	107 Newport News / Warwick Boulevard / Denbigh OUTBOUND [HRT]	107	TYPE 1 EXPANSION
12 South Norfolk/TCC – Virginia Beach INBOUND [HRT]	12	TYPE 1 EXPANSION	108 Patrick Henry Mall / Lee Hall INBOUND [HRT]	108	TYPE 4 EXPANSION
12 South Norfolk/TCC – Virginia Beach OUTBOUND [HRT]	12	TYPE 1 EXPANSION	108 Patrick Henry Mall / Lee Hall OUTBOUND [HRT]	108	TYPE 4 EXPANSION
13 Downtown Norfolk/Robert Hall Blvd/TCC – Chesapeake INBOUND [HRT]	13	TYPE 1 EXPANSION	109 (Pembroke) Downtown Hampton/Buckroe INBOUND [HRT]	109	TYPE 4 EXPANSION
13 Downtown Norfolk/Robert Hall Blvd/TCC – Chesapeake OUTBOUND [HRT]	13	TYPE 1 EXPANSION	109 (Pembroke) Downtown Hampton/Buckroe OUTBOUND [HRT]	109	TYPE 4 EXPANSION
14 Robert Hall Blvd / TCC Chesapeake INBOUND [HRT]	14	TYPE 4 EXPANSION	110 (Thomas Nelson) Downtown Hampton/Thomas Nelson INBOUND [HRT]	110	TYPE 1 EXPANSION
14 Robert Hall Blvd / TCC Chesapeake OUTBOUND [HRT]	14	TYPE 4 EXPANSION	110 (Thomas Nelson) Downtown Hampton/Thomas Nelson OUTBOUND [HRT]	110	TYPE 1 EXPANSION
15 Evelyn Butts to Robert Hall/Greenbrier Mall INBOUND [HRT]	15	TYPE 1 EXPANSION	111 (Denbigh – TNCC) Thomas Nelson/Riverside/Denbigh INBOUND [HRT]	111	TYPE 1 EXPANSION
15 Evelyn Butts to Robert Hall/Greenbrier Mall OUTBOUND [HRT]	15	TYPE 1 EXPANSION	111 (Denbigh – TNCC) Thomas Nelson/Riverside/Denbigh OUTBOUND [HRT]	111	TYPE 1 EXPANSION
18 Downtown Norfolk/Ballentine Boulevard INBOUND [HRT]	18	TYPE 4 EXPANSION	112 Downtown Newport News / Patrick Henry Mall INBOUND [HRT]	112	TYPE 1 EXPANSION
18 Downtown Norfolk/Ballentine Boulevard OUTBOUND [HRT]	18	TYPE 4 EXPANSION	112 Downtown Newport News / Patrick Henry Mall OUTBOUND [HRT]	112	TYPE 1 EXPANSION
20 Downtown Norfolk/Virginia Beach Oceanfront INBOUND [HRT]	20	TYPE 1 EXPANSION	114 (Weaver Rd.) Newmarket/Downtown Hampton INBOUND [HRT]	114	TYPE 1 EXPANSION
20 Downtown Norfolk/Virginia Beach Oceanfront OUTBOUND [HRT]	20	TYPE 1 EXPANSION	114 (Weaver Rd.) Newmarket/Downtown Hampton OUTBOUND [HRT]	114	TYPE 1 EXPANSION
21 Little Creek Rd. INBOUND [HRT]	21	TYPE 1 EXPANSION	115 Buckroe/Willow Oaks/Downtown Hampton INBOUND [HRT]	115	TYPE 4 EXPANSION
21 Little Creek Rd. OUTBOUND [HRT]	21	TYPE 1 EXPANSION	115 Buckroe/Willow Oaks/Downtown Hampton OUTBOUND [HRT]	115	TYPE 4 EXPANSION
22 Newtown Road Station/Joint Expeditionary Base Little Creek INBOUND [HRT]	22	TYPE 4 EXPANSION	116 (Mall Hall) Lee Hall/Patrick Henry Mall Loop INBOUND [HRT]	116	TYPE 4 EXPANSION
22 Newtown Road Station/Joint Expeditionary Base Little Creek OUTBOUND [HRT]	22	TYPE 4 EXPANSION	116 (Mall Hall) Lee Hall/Patrick Henry Mall Loop OUTBOUND [HRT]	116	TYPE 4 EXPANSION
23 Medical Tower/Military Circle/JANAF INBOUND [HRT]	23	TYPE 1 EXPANSION	117 (Phoebus) Hampton University/V.A. Hospital INBOUND [HRT]	117	TYPE 4 EXPANSION
23 Medical Tower/Military Circle/JANAF OUTBOUND [HRT]	23	TYPE 1 EXPANSION	117 (Phoebus) Hampton University/V.A. Hospital OUTBOUND [HRT]	117	TYPE 4 EXPANSION
25 (Newtown) Military Circle/Princess Anne INBOUND [HRT]	25	TYPE 4 EXPANSION	118 (Magruder) Langley/Semple Farm Road INBOUND [HRT]	118	TYPE 1 EXPANSION
25 (Newtown) Military Circle/Princess Anne OUTBOUND [HRT]	25	TYPE 4 EXPANSION	118 (Magruder) Langley/Semple Farm Road OUTBOUND [HRT]	118	TYPE 1 EXPANSION

ROUTE NAME	ROUTE	METHOD	ROUTE NAME	ROUTE	METHOD
26 Lynnhaven Mall / TCC Virginia Beach INBOUND [HRT]	26	TYPE 4 EXPANSION	119 Fishing Point Dr/Riverside Regional Medical Center INBOUND [HRT]	119	TYPE 4 EXPANSION
26 Lynnhaven Mall / TCC Virginia Beach OUTBOUND [HRT]	26	TYPE 4 EXPANSION	119 Fishing Point Dr/Riverside Regional Medical Center OUTBOUND [HRT]	119	TYPE 4 EXPANSION
27 Pleasure House Rd./Newtown Road Light Rail Station INBOUND [HRT]	27	TYPE 4 EXPANSION	120 (Mallory) Downtown Hampton/Mallory/Buckroe INBOUND [HRT]	120	TYPE 4 EXPANSION
27 Pleasure House Rd./Newtown Road Light Rail Station OUTBOUND [HRT]	27	TYPE 4 EXPANSION	120 (Mallory) Downtown Hampton/Mallory/Buckroe OUTBOUND [HRT]	120	TYPE 4 EXPANSION
29 (Lynnhaven) Pleasure House Road INBOUND [HRT]	29	TYPE 4 EXPANSION	121 Newport News Transportation Center / Williamsburg INBOUND [HRT]	121	TYPE 4 EXPANSION
29 (Lynnhaven) Pleasure House Road OUTBOUND [HRT]	29	TYPE 4 EXPANSION	121 Newport News Transportation Center / Williamsburg OUTBOUND [HRT]	121	TYPE 4 EXPANSION
30 Wave: Atlantic Avenue Shuttle INBOUND [HRT]	30	TYPE 3 EXPANSION	403 Buckroe Shopping Center OUTBOUND [HRT]	403	TYPE 4 EXPANSION
30 Wave: Atlantic Avenue Shuttle OUTBOUND [HRT]	30	TYPE 3 EXPANSION	405 NNTC/Buckroe INBOUND [HRT]	405	TYPE 4 EXPANSION
31 Wave: Aquarium and Campground Shuttle INBOUND [HRT]	31	TYPE 4 EXPANSION	405 NNTC/Buckroe OUTBOUND [HRT]	405	TYPE 4 EXPANSION
31 Wave: Aquarium and Campground Shuttle OUTBOUND [HRT]	31	TYPE 4 EXPANSION	414 NNTC/Jefferson/Oakland INBOUND [HRT]	414	TYPE 4 EXPANSION
32 Wave: Shoppers Shuttle INBOUND [HRT]	32	TYPE 4 EXPANSION	414 NNTC/Jefferson/Oakland OUTBOUND [HRT]	414	TYPE 4 EXPANSION
32 Wave: Shoppers Shuttle OUTBOUND [HRT]	32	TYPE 4 EXPANSION	415 NNTC/Denbigh OUTBOUND [HRT]	415	TYPE 4 EXPANSION
33 (General Booth) North Seashore/Municipal Center INBOUND [HRT]	33	TYPE 4 EXPANSION	430 Denbigh Fringe INBOUND [HRT]	430	TYPE 4 EXPANSION
33 (General Booth) North Seashore/Municipal Center OUTBOUND [HRT]	33	TYPE 4 EXPANSION	430 Denbigh Fringe OUTBOUND [HRT]	430	TYPE 4 EXPANSION
36 (Holland) Pembroke East INBOUND [HRT]	36	TYPE 1 EXPANSION	918 MAX Virginia Beach to Joint Forces Staff College Norfolk/Naval Station Norfolk INBOUND [HRT]	918	TYPE 4 EXPANSION
36 (Holland) Pembroke East OUTBOUND [HRT]	36	TYPE 1 EXPANSION	918 MAX Virginia Beach to Joint Forces Staff College Norfolk/Naval Station Norfolk OUTBOUND [HRT]	918	TYPE 4 EXPANSION
41 Downtown Portsmouth/Cradock INBOUND [HRT]	41	TYPE 4 EXPANSION	919 MAX Virginia Beach to Joint Forces Staff College Norfolk/Naval Station Norfolk INBOUND [HRT]	919	TYPE 4 EXPANSION
41 Downtown Portsmouth/Cradock OUTBOUND [HRT]	41	TYPE 4 EXPANSION	919 MAX Virginia Beach to Joint Forces Staff College Norfolk/Naval Station Norfolk OUTBOUND [HRT]	919	TYPE 4 EXPANSION
43 County Street / Bart Street INBOUND [HRT]	43	TYPE 4 EXPANSION	922 MAX Chesapeake-Virginia Beach to Naval Station Norfolk INBOUND [HRT]	922	TYPE 4 EXPANSION
43 County Street / Bart Street OUTBOUND [HRT]	43	TYPE 4 EXPANSION	922 MAX Chesapeake-Virginia Beach to Naval Station Norfolk OUTBOUND [HRT]	922	TYPE 4 EXPANSION
44 Norfolk General Hospital/Midtown Portsmouth INBOUND [HRT]	44	TYPE 4 EXPANSION	960 MAX Virginia Beach to Norfolk INBOUND [HRT]	960	TYPE 4 EXPANSION
44 Norfolk General Hospital/Midtown Portsmouth OUTBOUND [HRT]	44	TYPE 4 EXPANSION	960 MAX Virginia Beach to Norfolk OUTBOUND [HRT]	960	TYPE 4 EXPANSION
45 Downtown Norfolk/Portsmouth INBOUND [HRT]	45	TYPE 1 EXPANSION	961 MAX Newport News-Hampton to Norfolk INBOUND [HRT]	961	TYPE 1 EXPANSION
45 Downtown Norfolk/Portsmouth OUTBOUND [HRT]	45	TYPE 1 EXPANSION	961 MAX Newport News-Hampton to Norfolk OUTBOUND [HRT]	961	TYPE 1 EXPANSION
47 Downtown Portsmouth/Churchland INBOUND [HRT]	47	TYPE 1 EXPANSION	965 MAX Patrick Henry Mall to Naval Station Norfolk INBOUND [HRT]	965	TYPE 4 EXPANSION
47 Downtown Portsmouth/Churchland OUTBOUND [HRT]	47	TYPE 1 EXPANSION	965 MAX Patrick Henry Mall to Naval Station Norfolk OUTBOUND [HRT]	965	TYPE 4 EXPANSION
50 Academy Park/Victory Crossing INBOUND [HRT]	50	TYPE 4 EXPANSION	966 MAX Silverleaf Park & Ride/Newport News Transit Center INBOUND [HRT]	966	TYPE 4 EXPANSION
50 Academy Park/Victory Crossing OUTBOUND [HRT]	50	TYPE 4 EXPANSION	966 MAX Silverleaf Park & Ride/Newport News Transit Center OUTBOUND [HRT]	966	TYPE 4 EXPANSION
55 Greenbrier Circulator TO GREENBRIER MALL	55	TYPE 4 EXPANSION	967 MAX Virginia Beach-Chesapeake to Newport News (MHS) INBOUND [HRT]	967	TYPE 4 EXPANSION
55 Greenbrier Circulator TO ROBERT HALL BLVD	55	TYPE 4 EXPANSION	967 MAX Virginia Beach-Chesapeake to Newport News (MHS) OUTBOUND [HRT]	967	TYPE 4 EXPANSION
57 Robert Hall Boulevard/Airline Boulevard INBOUND [HRT]	57	TYPE 4 EXPANSION	Elizabeth River Ferry	90	TYPE 4 EXPANSION
57 Robert Hall Boulevard/Airline Boulevard OUTBOUND [HRT]	57	TYPE 4 EXPANSION	The Tide (Light Rail)	800	RAIL EXPANSION

HAMPTON ROADS TRANSIT

gohrt.com