RSG inc.
RESOURCE SYSTEMS GROUP, INC.

Charlotte Area Transit System Origin-Destination Study

Final Working Papers

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Submitted by
RSG
ETC Institute

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1.0 INTRODUCTION

This document represents the compendium of working papers documenting each phase of the Charlotte Area Transit System (CATS) Origin-Destination Study conducted in the spring and fall of 2013. These documents describe the purpose of the study and the methods used, including the sampling plan, survey design, survey administration procedures, and data cleaning.

2.0   WORK PLAN

2.1   Introduction

Charlotte Area Transit System (CATS) is charged with the development of a Before-and-After Study report, which is submitted to the Federal Transit Administration (FTA), as required under 49 U.S.C. § 5309 Requirements for New Starts Project Grantees. As part of this project, CATS must collect data to document the system conditions prior to the construction of the LYNX Blue Line Extension (LYNX BLE) Northeast Corridor Light Rail Project. CATS must document system travel patterns, transit use, and related information to preserve the "Before" conditions.

CATS retained Resource Systems Group, Inc. (RSG) and ETC Institute, Inc. (ETC) to conduct an onboard origin-destination (OD) study to understand current travel patterns on the existing transit system. The OD Study gathered travel behavior data from transit users in the CATS service area. The data collected will also be used to improve transit forecasts by updating CATS' regional travel demand model, mainly the mode choice model component. A recalibrated mode choice model, based on quality data, will enhance CATS' future competitiveness for federal funds.

In the spring and fall of 2013, RSG and ETC conducted this system-wide OD study. The study surveyed all CATS weekday fixed transit routes, including both bus and rail modes. The study used a multiple step process, with an On-to-Off study proceeded by a full OD study. All methodologies and techniques were designed to be consistent with FTA guidance and requirements.

2.2   Overall Schedule Considerations

Survey work and the corresponding tasks were prioritized in order to complete data collection prior to any major service disruptions associated with construction. Advanced utility relocation for the LYNX BLE began in July 2013 and resulted in potential service disruptions to the existing LYNX Blue Line light rail and the bus routes located within the Northeast Corridor. Additionally, there were several routes serving University of North Carolina at Charlotte (UNC Charlotte) that needed to be prioritized, as they could not be surveyed after April 29th due to final exams and the end of the school term. Meanwhile, surveying of other routes was conducted until May 30th and the remainder were surveyed in September.

Therefore, the Northeast Corridor bus routes (including the UNC Charlotte routes) and the LYNX Blue Line light rail were prioritized ahead of all other routes to ensure that surveying was completed prior to May 2nd (with all UNC Charlotte routes completed by April 29th). These routes included:

▪ 3	▪ 29	▪ 80x
▪ 4	▪ 39	▪ 204
▪ 11	▪ 47	▪ 211
▪ 13	▪ 49	▪ LYNX Blue Line
▪ 22	▪ 50	
▪ 23	▪ 54x	

Table 1: Survey Distribution Blackout Dates

	Date Range	Reason
No Surveying	1/21/13 – 1/22/2013	Federal Holiday
	2/4/2013	CATS Service Change
	2/18/2013	Federal Holiday
	2/25/2013 – 3/2/2013	CIAA
	3/25/2013 – 4/5/2013	Spring Break
	5/17/2013 – 5/24/2013	NASCAR All-Star/Speed Street/Sprint Cup
	5/27/2013	Federal Holiday
	6/3/2013	CATS Service Change
	6/8/2013 – 8/25/2013	Elementary/Middle/High School Not in Session
	9/2/2013	Federal Holiday
	10/7/2013	CATS Service Change
	10/10/2013 – 10/12/2013	NASCAR Sprint Cup/Nationwide Cup
	10/14/2013	Federal Holiday
	11/11/2013	Federal Holiday
	11/27/2013 – 11/29/2013	Thanksgiving Holiday
	12/23/2013 – 1/1/2014	Winter Break
Limited Surveying	3/8/2013 – 3/14/2013	No UNC Charlotte Routes
	3/11/2013 – 3/15/2013	No CPCC Routes
	4/29/2013 – 5/10/2013	No UNC Charlotte Routes
	Spring after 5/9/2013	Limited Surveying for UNC Charlotte, JCSU and JWU Routes

The RSG/ETC team will ensured that the Northeast Corridor bus routes and LYNX Blue Line light rail are surveyed within the scheduled timeframe; as such, RSG and ETC divided the tasks into subtasks. For example, the sampling plan for the Full OD was broken into two parts: Northeast Corridor bus routes/LYNX Blue Line light rail, and all other bus routes. This level of organization aided in maintaining the project schedule; this schedule included the time necessary for CATS staff to review and approve each submittal. It also provided additional time to prepare the complex sampling plans for the remaining routes.

2.3 Task-by-Task Description of Technical Work

2.3.1 Quality Assurance/Quality Control (QA/QC) Plan

Quality assurance/quality control (QA/QC) occurred throughout the data collection process to ensure high quality and usable data for CATS. Prior to the field effort, a QA/QC Plan was developed and described the QA/QC procedures RSG and ETC used, including:

- Real-time data review;
- Real-time geocoding;
- Interview tracker;
- QA/QC ride and communication procedure monitoring;
- Verification of data collection;
- Visual inspection of survey records; and
- Methods for reducing non-response bias.

Table 2: Deliverables: Quality Assurance/Quality Control (QA/QC) Plan

Deliverable	Date of Delivery
QA/QC Plan Memo	1/29/13

2.3.2 Sampling Plan

The study team developed a sampling plan for weekday travel between 6:30am and 9pm. The surveys were administered during weekdays, when schools were in session, and avoided the aforementioned blackout dates.

The RSG team prepared sampling plans for two separate and sequential surveys. The first survey was an On-to-Off survey that collects only passenger boarding and alighting pairs for all fixed routes by utilizing plastic cards equipped with barcodes. The Full OD survey was a full tablet-based survey that focuses on understanding the travel patterns and key characteristics of current riders.

2.3.2.1 On-to-Off Survey Sampling Plan

The sampling plan for the On-to-Off survey was designed to obtain completed surveys from a minimum of 20% of the trips on CATS weekday fixed transit routes (bus and rail). For routes with average daily ridership under 500 riders, the RSG team does not recommend conducting the on-to-off survey due to the lower ridership levels. This was consistent with the fielding of other similar FTA studies across the country and ensures riders do not get survey fatigue and that budget/time is spent on more critical routes and tasks. Furthermore, lower volume routes tend to be sampled at higher rates, meaning the actual surveys themselves should closely replicate the actual On-to-Off pairs. The exception to this was the routes that were either close to the cutoff or within the Northeast Corridor. CATS was interested in obtaining additional information for these routes; therefore, these routes have also been included in the On-to-Off survey.

The sampling plan was designed to ensure that a minimum number of On-to-Off surveys are completed on each fixed route based on the direction of travel and time of day to ensure that the On-to-Off survey database

can adequately support data expansion requirements for the full survey. Data needs for preparing this sampling plan are discussed in the Data Needed from CATS Section.

2.3.2.2 Full OD Survey Sampling Plan

Using the data from the On-to-Off survey, the RSG team prepared sampling plans for each of the CATS weekday fixed routes. The sampling plans identify the number of surveys that were targeted on each route by direction, time of day, and by boarding/alighting pair. The goal for the sampling plans was to guide data collection efforts on each route in a manner that will support stop-to-stop expansion (or segment-to-segment) by time of day and direction. On average, 10% of the average daily boardings were planned to be surveyed on each route (7,300 completed surveys), allocated mostly proportionally based on route ridership and On-to-Off patterns.

Below is a table showing the routes sampled, the Northeast Corridor bus routes/LYNX Blue Line light rail that were prioritized, and for which routes the On-to-Off Survey was conducted.

Table 3: Surveyed Routes/Lines

Route Number	Route Type	Average Weekday Boardings	Priority Routes	On-to-Off Survey Not Recommended
1	Local	1,163		
2	Local	667		
3	Local	1,389	X	
4	Local	507	X	
5	Local (Limited Stop)	1,222		
6	Local	649		
7	Local	3,545		
8	Local	1,359		
9	Local	4,012		
10	Local	1,345		
11	Local	4,325	X	
12	Local	550		
13	Local	953	X	
14	Local	890		
15	Local	1,765		
16	Local	1,713		
17	Local	1,123		
18	Local	301		
19	Local	865		
20	Local	648		
21	Local	353		X
22	Local	1,408	X	
23	Local	1,749	X	
24	Local	494		
25	Local - Crosstown	258		X
26	Local	541		

Route Number	Route Type	Average Weekday Boardings	Priority Routes	On-to-Off Survey Not Recommended
27	Local	2,073		
29	Local - Crosstown	474	X	
30	Local - Crosstown	744		
34	Local	1,359		
39	Local	1,088	X	
42	Local – Rail Shuttle	30		X
43	Local – Rail Shuttle	306		X
47	Local – Campus Shuttle	491	X	
49	Local – Campus Shuttle	615	X	
50	Local – Campus Shuttle	889	X	
55	Local – Rail Shuttle	423		
56	Local – Rail Shuttle	1,181		
57	Local – Rail Shuttle	346		
58	Local – Rail Shuttle	404		
60	Local – Rail Shuttle	320		
84	Local – Uptown Circulator Shuttle	1,058		
86	Local – Uptown Circulator Shuttle	2,066		
94	Local – Town Shuttle	6		X
97	Local – Town Shuttle	196		X
98	Local – Town Shuttle	116		X
99	Local – Town Shuttle	108		X
201	Local – Neighborhood Shuttle	238		X
204	Local – Neighborhood Shuttle	620	X	
211	Local – Neighborhood Shuttle	1,120	X	
221	Local – Neighborhood Shuttle	774		
222	Local – Neighborhood Shuttle	481		X
232	Local – Neighborhood Shuttle	912		
235	Local – Neighborhood Shuttle	367		X
40x	Express	339		
41x	Express	180		X
45x	Express	111		X
48x	Express	332		X
51x	Express	153		X
53x	Express	133		X
54x	Express	659	X	
61x	Express	287		X
62x	Express	158		X
64x	Express	292		X
65x	Express	214		X
74x	Regional Express	159		X
77x	Express	682		
80x	Regional Express	258	X	

Route Number	Route Type	Average Weekday Boardings	Priority Routes	On-to-Off Survey Not Recommended
82x	Regional Express	139		X
85x	Regional Express	184		X
88x	Regional Express	71		X
LYNX	Light Rail	15,800	X	
Total		**72,750**		

2.3.2.3 Auxiliary Data

Additionally, auxiliary data was collected from CATS Park and Ride lots. The primary purpose of the park and ride counts was to create control totals for mode access (walk or drive) to allow for representative data expansion. Obtaining this data is traditionally a concern for self-administered on-board studies, due to the difference in response rates between passengers who walk and drive (with drive access ridership being more likely to complete questionnaires than walk mode), which may result in sample bias. By utilizing the tablet PC interview method of collection an overall response rate of close to 90% is expected. This method of data collection controls the traditional bias associated with mode access for self-administered questionnaires and therefore makes the need to conduct full counts less necessary than previous methods.

However, a good reason to count park and ride lots is to also understand the rate of parking turnover, which is not something the surveys will tell us, thus the reason we targeted more active and larger park and ride lots, as discussed below. Thus, the Park and Rides were separated into two categories:

1. CATS owned Park and Rides and several higher volume leased Park and Rides (see Table 4), where more involved full day of auxiliary data collection were performed, as described below
2. Leased and lower volume Park and Rides (Table 5), where a simpler and smaller set of data was collected, as described below

For the first group of Park and Rides (Table 4), data was collected from 6:30am to 9pm for one weekday. For these lots, ingress, egress, and vehicle occupancy were collected in 15 minute increments; this will allow CATS to understand vehicle turnover in these larger lots for weighting purposes. Vehicle occupancy was also collected in the survey and due to high response rates (as described above); this data should accurately reflect travel patterns as well.

Table 4: CATS Park and Rides to Collect Detailed Data from 6:30am and 9pm

Park and Ride Name	Type of Lot	Address	Number of Spaces	Routes/Lines Served
Albemarle Road	Owned Park and Ride Lot	6810 Lawyers Rd Charlotte, NC 28227		9, 40x
Archdale Station	Rail Station	6230 South Blvd Charlotte, NC 28217	432	LYNX, 57
Arrowood Station	Rail Station	7717 England St Charlotte, NC 28273	289	LYNX, 24, 56
Huntersville Gateway Park and Ride	Owned Park and Ride Lot	10300 Compass St Huntersville, NC 28078	209	48x, 77x, 98, 99
Huntersville Northcross Park and Ride	Owned Park and Ride Lot	17126 Northcross Drive Huntersville, NC 28078	326	77x, 97
I-485/South Boulevard Station	Rail Station	9508 South Blvd Charlotte, NC 28273	1,120	LYNX, 12, 42, 58, 251
Mallard Creek Park and Ride	Owned Park and Ride Lot	1712 JN Pease Charlotte, NC 28262	210	54x, 22
Matthews Independence Pointe Park and Ride	Owned Park and Ride Lot	9614 Independence Point Pkwy Matthews, NC 28105	304	64x, 65x
Northlake Mall	Leased Park and Ride Lot	6801 Northlake Mall Drive Charlotte, NC 28216		53x, 99, 7
Scaleybark Station	Rail Station	3750 South Blvd Charlotte, NC 28209	315	LYNX, 12, 30
Sharon Road West Station	Rail Station	8815 Crump Rd Charlotte, NC 28134	188	LYNX, 12, 19, 43, 55
Tyvola Station	Rail Station	5703 Old Pineville Rd Charlotte, NC 28217	456	LYNX, 16, 60
Woodlawn Station	Rail Station	4756 Old Pineville Rd Charlotte, NC 28217	382	LYNX, 24

For the second group of Park and Rides (Table 5), a simpler data collection effort occurred, which included counting the total number of vehicles parked in the lots once the AM Peak was over on one weekday. These data will give CATS the sense of how many vehicles are parked for the day, but since these lots are smaller and riders are likely parked there all day, knowing vehicle turnover is unnecessary. Here again, vehicle occupancy was also accurately collected from the survey data.

Table 5: CATS Leased Park and Rides to Collect Post-AM Peak Parking Counts Only

Park and Ride Name	Address	Routes/Lines Served
Abbey Plaza Shopping Center	601 Park Street Belmont, NC 28012	85x
Arboretum Shopping Center	8008 Providence Road Charlotte, NC 28277	61x, 14
Big Lots	280 Highway 29 South Concord, NC 28025	80x
Cheddar's Café	620 University Center Blvd Charlotte, NC	80x
Charlotte Motor Speedway	5555 Concord Pwy Concord, NC 28075	80x
Calvary Church	5801 Pineville-Matthews Rd Charlotte, NC 28226	62x
Carmel Road Park	2350 Carmel Rd Charlotte, NC 28226	45x
Carolina Place Mall	11001 Carolina Place Pkwy Pineville, NC 28134	20, 58
Central Church of God	5301 Sardis Rd Charlotte, NC 28270	45x
Central Steele Creek Presbyterian Church	9401 S. Tryon Charlotte, NC 28273	41x, 56, 55
Church of Jesus Christ of Latter Day Saints	5815 Carmel Rd Charlotte, NC 28226	45x
Cokesbury United Methodist Church	6701 Idlewild Rd Charlotte, NC 28212	51x
Cornelius Town Hall	21445 Catawba Ave Cornelius, NC 28031	77x, 97
Cornerstone Baptist Church	8947 Albemarle Road Charlotte, NC 28227	40x
Coulwood Shopping Center	8410 Bellhaven Road Charlotte, NC 28216	88x
Eastland Mall	5471 Central Ave Charlotte, NC 28212	9
Gastonia Transit Center (Bradley Transfer Center)	121 North Oakland St Gastonia, NC 28052	85x
Good Shepherd Presbyterian Church	3307 Rea Rd Charlotte, NC 28226	62x
Home Depot	2815 Home Depot Dr Rock Hill, SC 29732	82x

Park and Ride Name	Address	Routes/Lines Served
K-Mart	2120 W. Roosevelt Blvd Monroe, NC 28110	74x
Manchester Theater	1935 Cinema Dr Rock Hill, SC 29730	82x
Matthews Presbyterian	207 W John St Matthews, NC 28105	65x, 27
Plaza Fiesta Carolinas	3700 Avenue of the Carolinas Fort Mill, SC 29715	82x
Providence Baptist	4921 Randolph Rd Charlotte, NC 28211	45x
Providence Methodist	2810 Providence Rd Charlotte, NC 28211	61x, 62x, 14
Providence Presbyterian	10140 Providence Church Lane Charlotte, NC 28277	61x
Rock Hill Town Hall	138 E. White Street Rock Hill, SC 29730	82x
Sharon Baptist Church	6411 Sharon Rd, Charlotte, NC 28210	20
St. John Neumann Catholic Church	8451 Idlewild Rd, Charlotte, NC 28227	51x
St. Matthews Catholic Church	8015 Ballantyne Commons Pkwy, Charlotte NC 28226	62x
Trinity Presbyterian Church	3115 Providence Rd Charlotte, NC 28211	61x, 62x, 14
Union Town Center Shopping	5850 E. Hwy 74 Indian Trail, NC 28079	74x
Whitehall Commons	8031 S Tryon Charlotte, NC 28273	41x, 56
City Save-a-Lot #2 (Strawberry Hill)	4309 Providence Rd Charlotte, NC 28211	14, 45x, 61x, 62x
Promenade Shopping Center	5415 Ballantyne Commons Pkwy Charlotte, NC	61x
Target/Home Depot	3333 Cloverly Parkway Concord, NC 28083	80x

Listed below are the deliverables expected from this task.

Table 6: Deliverables: Sampling Plan

Deliverable	Date of Delivery
Sampling Plan for On-to-Off Survey	2/15/13
Sampling Plan for Full OD Survey	4/11/13
Sampling Plan for Auxiliary Data Collection at Park and Rides	3/22/13

2.3.3 Survey Design

The RSG team designed each of the three data collection components during this task:

1. On-to-Off Survey;
2. Full OD Survey; and
3. Auxiliary Data Collection.

Once CATS was satisfied with the sampling plans and survey design, CATS reviewed the designs with FTA staff; particularly the on-board OD questionnaire and sampling plan prior to the RSG team programming the instrument. Gaining FTA approval early on in the process generally puts the project on the path towards success and ensures high quality data that will meet model and data preservation needs.

The On-to-Off survey captured only boarding and alighting information. On buses, plastic cards with barcodes printed on them were distributed to each rider on sampled trips. These cards contained both English and Spanish language instructions. The card was scanned with a GPS-enabled barcode reader as the rider boarded and again as the rider alighted the bus. For LYNX, a brief tablet-based survey was conducted onboard to ask riders where they boarded and where they would be alighting. The results will be used by the modeling consultant in developing expansion factors for the survey results.

For the Full OD survey, the RSG team designed a tablet-based (iPad or other tablet device) personal interview. The RSG team used tablets that integrate with GIS software to allow for accurate geocoding of most survey data as the survey is taken. The full OD survey was conducted in both English and Spanish.

In addition to the on-to-off and Full OD survey efforts, auxiliary data was also be collected from Park-n-Rides.

2.3.4 Data to Be Collected

The data collected for the On-to-Off survey were as follows:

- Route;
- Boarding location;
- Boarding time;
- Alighting location;
- Alighting time; and
- Direction of travel.

The data collected for the full OD survey were as follows:

- Route surveyed on;
- Direction of travel;
- Any other transit routes used;
- Time of trip;
- Origin;
- Boarding location;
- Alighting location;
- Destination;
- Lat/lon and TAZ for each location;
- Access and egress modes;
- Vehicle occupancy (if drove and parked or carpooled);
- Trip purpose; and
- Demographics of respondent.

The auxiliary data collected from Park-n-Rides were as follows:

- Number of cars present before counts begin;
- Ingress number of vehicles;
- Ingress number of people in vehicles;
- Egress number of vehicle
- Egress number of people in vehicle; and
- Number of cars present after counts end.

Table 7: Deliverables: Survey Design

Deliverable	Date of Delivery
Survey Design for On-to-Off Survey	1/29/13
Survey Design for Full OD Survey	3/1/13
Auxiliary Data Collection Design	2/25/13

2.3.5 Survey Management Plan

2.3.5.1 Staffing Plan

ETC created a staffing plan that indicated an organizational structure as follows:

- Designated Field Project Manager
- QA/QC Coordinator
- Field Supervisors
- Data Collectors (including collectors fluent in Spanish, when necessary)
- Data Editors

2.3.5.2 Survey Training

ETC conducted training prior to both the On-to-Off survey and the Full OD survey; training included classroom training and in-field training. ETC was responsible for preparing all training materials including the Surveyor's Manual, securing a facility for conducting the training, and providing moderators to conduct the training; RSG reviewed all training materials.

Each interviewer was required to demonstrate that they could proficiently conduct the survey before they were allowed to administer the survey. Interviewers who could not demonstrate proficiency in all tasks related to the administration of the survey were replaced. Surveyors were reviewed throughout the data collection effort and were retrained if issues were encountered. If the surveyor continued to perform below standards, the surveyor was dismissed.

See the Survey Management Plan section for more details on the training content, dates and locations.

Table 8: Deliverables: Survey Management Plan

Deliverable	Date of Delivery
Survey Management and Staffing Plan for On-to-Off Survey	1/29/13
Survey Management and Staffing Plan for Full OD Survey	3/15/13
Surveyor Manual for On-to-Off Survey	2/15/13
Surveyor Manual for Full OD Survey	3/29/13
Surveyor Training for On-to-Off Survey	3/4/13
Surveyor Training for Full OD Survey – Spring	4/15/13

2.3.6 Surveys Administration

2.3.6.1 On-to-Off Survey

ETC conducted an On-to-Off survey from March 5 to March 21, 2013, excluding the blackout dates detailed in the CATS/RSG contract. The survey was administered to a random sample of at least 20% of the riders on each route.

Following the administration of the On-to-Off survey, a boarding and alighting matrix was prepared for each route that showed the number of boardings at each stop along the route on one axis and the number of alighting at each stop along the route on the other axis. These matrices were used to prepare the data expansion plans for the full survey.

2.3.6.2 Conduct a Pilot Test for Full Survey

ETC conducted a pilot test of the full survey during the last week of the On-to-Off survey. The pilot test involved the administration of at least 100 surveys and replicated all tasks that would be conducted for the administration of the full survey. The pilot test also served as the opportunity to conduct training of all field supervisors who were overseeing the Full OD survey.

2.3.6.3 Update Methodologies

Following the completion of the pilot test, the RSG/ETC Team updated the work plan. The updated work plan contained an updated description of all tasks that were completed. The RSG/ETC Team also updated the tablet programming as needed to ensure that any problems identified during the pre-test were corrected.

2.3.6.4   Full OD Survey

ETC administered the main survey in the spring and fall of 2013 (April 6 to May 30 and September 9 to September 26). The main survey was administered to approximately 10% of the system ridership (7,300 surveys).

2.3.6.5   Survey Administration Team Organization

The survey was administered by three teams who were directly supervised by ETC. Two groups of staff were present during the field efforts.

Leadership Team. The leadership team consisted of the deputy project manager, assistant project manager, and 2-3 support personnel. The leadership group was responsible for reviewing the performance of each team and ensuring that the sampling goals for each route were met. The leadership team operated from centralized locations, such as transit centers, so that the performance of all teams could be evaluated.

Field Teams. The field teams focused their efforts on the administration of surveys on several bus routes per week. Each of the team leaders supervised a group of approximately 6-10 surveyors per day. On high volume routes, up to six interviewers were deployed per route. On low volume routes, just one interviewer was deployed on a route.

2.3.6.6   Survey Administration Procedures

Timing of the Survey. The surveys were administered during weekdays (Monday-Thursday) when schools were in session and avoided blackout dates in Table 1. The surveys were administered from 6:30am-9:00pm or during the hours for which the route was operating.

During the Administration of the Survey. Interviewers selected riders at random to participate in the survey based on the sampling goals that were established for each route. Once an interviewer selected a rider for the survey, the interviewer did the following:

- The interviewer approached the person selected and asked them to participate in the survey.
- If the person refused, the interviewer ended the survey, but the refusal was recorded on the tablet to help assess the overall response rate to the survey.
- If the rider agreed to participate, the interviewer asked if he/she had at least five minutes to complete the survey.
- If the rider did NOT have at least five minutes, the surveyor asked the rider to provide his/her boarding location, alighting location, name, and phone number. ETC Institute's call center then contacted the respondent within 24 hours and asked him/her to complete the survey by phone. If a respondent did not have a phone number, then a printed copy of the survey with a postage-paid return was provided. This helped ensure "short-trips" were well represented. This method was the method ETC has used previously and continues to use on OD studies.
- If a rider had at least five minutes, the surveyor administered the full survey to the respondent as a face-to-face interview using a tablet computer.
- The RSG/ETC team provided weekly progress reports during the data collection effort detailing the survey effort.

After the Administration of the Survey. After the surveys were administered, the field team leaders consolidated the survey data. They then reviewed each survey record to ensure that all necessary information had been provided. If any information was missing, they forwarded the survey record and the name and

phone number of the survey respondent to ETC Institute's call center. Interviewers working in the call center then called respondents to retrieve missing information by phone.

2.3.6.7   Review of Surveyor Performance

Surveyors and the data they collected were reviewed periodically to ensure they were performing up to standard. If they were not, the surveyor was retrained in the problem areas. If the surveyor continued to underperform, they were dismissed from the project.

Table 9: Deliverables: Survey Administration

Deliverable	Date of Delivery
On-to-Off Survey Field	3/5/13 – 3/21/13
Full OD Survey – Spring Field (priority routes first)	4/16/13 – 5/30/13
Full OD Survey – Fall Field	9/9/13 – 9/26/13
Weekly Progress Reports	Weekly during field

2.3.7   Data Processing and Analysis

During this task, additional QA/QC and cleaning was conducted. The draft database included locations geocoded to the lat/lon at the address level and assigned to the appropriate TAZ, trips verified, and only included "complete/usable" records.

Table 10: Deliverables: Data Processing and Analysis

Deliverable	Date of Delivery
Draft Database of Spring Data	8/12/13
Draft Database of Fall Data	12/10/13
Summary of Cleaning and Results Verification Procedures	1/7/14

2.3.8   Final Data File

The RSG team prepared final versions of all working papers that reflect feedback from CATS and summarize the entire survey effort.

The final data files were provided to CATS on a CD or DVD, as well as a full data dictionary.

Table 11: Deliverables: Final Data File

Deliverable	Date of Delivery
Final Versions of All Working Papers	3/14/14
Survey Effort Summary	3/14/14
Final and Raw Data Files	3/14/14

2.4   Project Management Plan

CATS, RSG, and ETC held a weekly progress update call for the first two months of this project; and once the Full OD survey was in the field, reduced calls to a biweekly or monthly basis (or calls as-needed) that were supplemented with the field progress reports via email.

RSG was responsible for overall project management, with Greg Spitz as the Project Manager overseeing the process and ensuring the project was conducted to the specifications in this Work Plan. Margaret Campbell served as Deputy Project Manager for RSG, managing the day-to-day project work. Polly Ramsey provided support on this project.

ETC Institute took the lead on survey design, management, administration, and implementation and was involved in the planning.

Below is a table showing each task and the lead firm and staff.

Table 12: Summary of Task Responsibilities

Task	Lead Firm	Lead Staff	Lead Firm Support Staff	Support Firm
Work Plan	RSG	Greg Spitz	Margaret Campbell, Polly Ramsey	ETC
QA/QC Plan	RSG	Greg Spitz	Margaret Campbell, Polly Ramsey	ETC
Sampling Plan	ETC	Chris Tatham	Fred Gsell, Aaron Hekele, Nick Jones	RSG
Survey Design	ETC	Chris Tatham	Fred Gsell, Aaron Hekele, Nick Jones	RSG
Survey Management Plan	ETC	Chris Tatham	Fred Gsell, Aaron Hekele, Nick Jones	RSG
Survey Administration	ETC	Chris Tatham	Fred Gsell, Aaron Hekele, Nick Jones	ABC, Inc. CEO Inc.
Data Processing and Analysis	ETC	Chris Tatham	Dr. Elaine Tatham, Nick Jones, Aaron Hekele, Fred Gsell	RSG
Prepare Final Data *Dataset* *Summary Report/Papers*	ETC RSG	Chris Tatham Margaret Campbell	Polly Ramsey	RSG ETC

2.4.1   Project Team Contact Information

Listed below is the contact information for all key project team members.

Table 13: Contact Information

Person	Firm	Email	Phone

Greg Spitz	RSG	Greg.Spitz@rsginc.com	802-295-4999 x1424
Margaret Campbell	RSG	Margaret.Campbell@rsginc.com	619-375-0717
Polly Ramsey	RSG	Polly.Ramsey@rsginc.com	802-295-4999 x3309
Chris Tatham	ETC	CTathamETC@aol.com	913-254-4512
Fred Gsell	ETC	fgsell@etcinstitute.com	512-653-5551
Aaron Hekele	ETC	ahekele@etcinstitute.com	913-523-5681
Nick Jones	ETC	njones@etcinstitute.com	913-687-2174

2.4.2   Project Invoices

RSG submitted lump sum invoices with a progress report when project deliverable milestones were reached.

2.5   Data Needed from CATS

The RSG/ETC team needed CATS system data to build sampling plans, design the survey and validate the results. The RSG/ETC team requested the following data:

Table 14: Data Needs from CATS

Data Needed	Preferred Format	Task Data Needed For	Date Needed By	Received
Average weekday boardings by route, time of day, and direction	Excel or a flat file	Sampling Plan for On-to-Off Survey	As soon as possible (no later than 1/15)	✓
Route schedule data for post-February 4th schedule change	Excel or a flat file	Survey Management Plan for On-to-Off Survey	As soon as possible (no later than 1/15)	✓
Stop lists by route (an up-to-date GTFS file will work)	Excel or a flat file	Survey Design (Full OD Survey) so that stops can be included in the survey itself	1/25/13	✓
Automatic Passenger Data by route, stop, direction, and time of day	Excel or a flat file	Validate On-to-Off data collected, also can be used for weighting and expansion	3/1/13	✓

3.0   QA/QC PLAN

Quality assurance/quality control (QA/QC) occurred throughout the data collection process to ensure high quality and usable data for CATS. The following section describes the QA/QC procedures RSG and ETC Institute used.

3.1   Overall Plan

3.1.1 Sufficient Sample Collection

The Survey Sampling Plan detailed the number of surveys which we planned to collect on each route in order to obtain statistically robust data. This Sampling Plan was created by RSG and ETC using ridership data and sample quotas were closely tracked and reported. All surveyors were aware of these quotas and their importance. If a survey team was not able to reach a given quota, they returned to the same route on a different day. If the problem could be attributed to a specific surveyor continually failing to meet our performance expectations, that surveyor was replaced.

3.1.2 Completeness of Data

An incomplete survey was not counted toward the survey returns. In order to ensure complete data collection, the importance of data completeness was emphasized to the surveyors and incomplete surveys would not be accepted.

For the On-to-Off survey, a complete survey simply required the return of the plastic card containing a bar code at the respondent's alight stop or station. Bar codes which were distributed but not returned were not considered completed surveys.

For the Full OD study, the tablet survey tool would not allow the interviewer to continue through the survey if a question was left unanswered. The only exception was household income, which some respondents can be uncomfortable answering. Therefore, a completed survey was one which had every question answered, except household income. If, while interviewing a respondent, it was found the respondent could not finish the survey, that survey was marked incomplete and was not counted toward the quota goal. If possible, the respondents contact information was obtained and they were contacted later to complete the survey.

While much of the review for completeness occurred during the field effort (see the Detailed QA/QC Procedure Section below), additional cleaning and review occurred once fieldwork is finished.

3.1.3 Data Collection Schedule

The data collection schedule was tailored to observe blackout dates, holidays and construction that could significantly affect or alter service. In particular, the Northeast Corridor routes were scheduled to be surveyed before construction began on the LYNX Blue Line Extension light rail project.

3.1.4 Reducing Non-Response Bias

Non-response bias was addressed through the use of tablet-based in-person interview. This survey method addressed:

- Language bias—Spanish interviewers were hired to administer the interview to non-English speakers;
- Literacy bias—since the survey was primarily administered by a surveyor, the number of surveys that could potentially be affected by the literacy of those surveyed was significantly reduced.
- For those making a short trip, a phone-based interview was conducted and as a last resort if no phone number was available, a paper survey was provided, so literacy bias may have still affected a very small number of individuals;
- Sample size distribution bias—based on the on-to-off flow survey, the sampling plan was adjusted in order to obtain a minimum sample size for each cell in the on-to-off matrix;
- Short trip bias—the on-to-off flow survey and real-time quota tracking minimized short trip bias. Individuals who made trips that were less than five minutes long were asked for their contact information and were contacted by the team's call center later that day to finish the survey. If the respondent did not have a phone number, then a paper survey was provided; and
- Heavy load conditions/seat availability bias—this was also minimized with the in-person interview, as we were not relying on riders to be seated and have room to complete the survey. This was true for bus and rail.

3.1.5 Review of Deliverables

Each deliverable was reviewed prior to sending to CATS staff. For example, if RSG lead the task, then ETC Institute provided review and vice versa.

4.0 SAMPLING PLAN

4.1 Sampling Plan

4.1.1 Important Dates for On-to-Off Survey

The On-to-Off survey captured travel flows between 6:30 am and 9:00 pm. The surveys were administered during weekdays when schools were in session, and avoided all blackout dates. The training for data collectors occurred on March 4th, followed by data collection from March 5th –March 21st.

4.1.2 Sampling Plan Design

The On-to-Off survey collected passenger boarding and alighting pairs for all fixed bus routes by utilizing plastic cards equipped with barcodes. For LYNX, interviews occurred for all boarding passengers capturing their boarding and alighting stations via in-person interview using an iPad. This method was more effective for LYNX, as it would have otherwise been difficult to effectively distribute and collect the barcode cards on these trains with multiple larger doors that several passengers could pass through at once.

The sampling plan for the On-to-Off survey was designed to obtain completed boarding and alighting pairs from a minimum of 20% of the transit rider trips on CATS weekday fixed bus and rail routes. Routes with average daily ridership under 500 riders were not surveyed with exceptions of routes that were either close to the cutoff or within the Northeast Corridor, in addition to a few other routes of interest. For the purposes of developing the sample goals, average weekday ridership from March of 2012 was utilized.

For bus routes, the sampling plan was designed to ensure that a minimum number of On-to-Off surveys were completed on each fixed bus route based on the direction of travel and time period. The time periods were defined as follows:

- AM Peak (6:30 – 9:29 am)
- Midday (9:30 am – 3:29 pm)
- PM Peak (3:30 – 6:29 pm)
- Evening (6:30 – 8:59 pm)

For the LYNX Blue Line light rail, each station was an individual sampling unit with samples collected based on direction of travel and time period. The same time period definitions were used for LYNX Blue Line sampling.

The data obtained in the On-to-Off survey was a major data source for data expansion for the Full OD survey. The completed survey quotas set for bus and rail ensured that the On-to-Off survey database could adequately support data expansion requirements for the Full OD survey.

Routes 60, 40x, 54x, 77x, and 80x did not reach the On-to-Off sampling goal due to low ridership and were therefore oversampled in the Full OD.

The complete sampling plans are shown in Table 15 and Table 16 below.

Table 15: Bus Sampling Plan

Route	Total Ridership	On-to-Off Sampling Goal	Full OD Sampling Goal	Route (cont.)	Total Ridership	On-to-Off Sampling Goal	Full OD Sampling Goal
1	1,163	233	116	50	889	178	89
2	667	133	67	55	423	85	42
3	1,389	278	139	56	1,181	236	118
4	507	101	51	57	346	69	35
5	1,222	244	122	58	404	81	40
6	649	130	65	60	320	64	32
7	3,545	709	355	84	1,058	212	106
8	1,359	272	136	86	2,066	413	207
9	4,012	802	401	94	6	0	1
10	1,345	269	135	97	153	0	15
11	4,325	865	433	98	125	0	13
12	550	110	55	99	112	0	11
13	953	191	95	201	195	0	20
14	890	178	89	204	493	99	49
15	1,765	353	177	211	811	162	81
16	1,713	343	171	221	424	85	42
17	1,123	225	112	222	383	0	38
18	301	60	30	232	708	142	71
19	865	173	87	235	326	0	33
20	648	130	65	40x	246	49	25
21	353	0	35	41x	174	0	17
22	1,408	282	141	45x	73	0	7
23	1,749	350	175	48x	329	0	33
24	494	99	49	51x	118	0	12
25	258	0	26	53x	94	0	9
26	541	108	54	54x	659	132	66
27	2,073	415	207	61x	304	0	30
29	474	95	47	62x	145	0	15
30	744	149	74	64x	248	0	25
34	1,359	272	136	65x	187	0	19
39	1,088	218	109	74x	120	0	12
42	30	0	3	77x	695	139	70
43	306	0	31	80x	191	38	19
47	491	98	49	82x	109	0	11
49	615	123	62	85x	187	0	19
				88x	55	0	6
				Total	**55,331**	**10,188**	**5,533**

Table 16: Rail Sampling Plan

Station	Total Ridership	On-to-Off Sampling Goal	Full OD Sampling Goal
I485 / South Blvd	1,937	387	194
Sharon Rd. West	1,114	223	111
Arrowood	1,005	201	101
Archdale	1,051	210	105
Tyvola	788	158	79
Woodlawn	699	140	70
Scaleybark	772	154	77
Newbern	453	91	45
East / West	577	115	58
Bland	331	66	33
Carson	231	46	23
Stonewall	244	49	24
3rd St / Convention Center	1,028	206	103
CTC	3,127	625	313
7th St	853	171	85
Total	**14,210**	**2,842**	**1,421**

5.0 SURVEY DESIGN

The following is the survey design for the study which included three data collection components:

1. On-to-off survey;
2. On-board origin-destination survey;
3. Auxiliary data collection

5.1 Survey Administration

5.1.1 On-to-Off Survey

Plastic cards with barcodes printed on them were distributed to each rider on sampled trips. The cards were scanned with a GPS-enabled barcode reader as the rider boarded and again as the rider alighted the bus, collecting the following data automatically:

- Route;
- Boarding location;
- Boarding time;
- Alighting location;
- Alighting Time; and
- Direction of travel.

The card contained instructions, written in both Spanish and English, on how the rider could return the barcode card to a survey administrator. These cards were scanned by the survey administrator when they were distributed, and again when they were returned. This allowed all of the above information to be stored for analysis and the full boarding/alighting pair to be obtained.

5.1.2 Full OD Survey

The Full OD Survey was conducted on-board via personal interview. Conducting a personal interview minimized non-response bias for customers with literacy issues, as the interviewer asked the questions and filled out the survey. There were also Spanish-speaking interviewers available to administer the survey in Spanish, if needed.

As noted in the Work Plan, the Full OD Survey collected the following data:

- Route surveyed on;
- Direction of travel;
- Any other transit routes used;
- Time of trip;
- Origin;
- Boarding location;
- Alighting location;
- Destination;
- TAZ for each location;
- Access and egress modes;
- Vehicle occupancy (if drove and parked or carpooled)

- Trip purpose; and
- Demographics of respondent.

For the full personal interview surveys, the survey team used tablets that integrated with GIS software to allow for accurate geocoding of most survey data as the survey was taken. In addition to the address information, the TAZ for each location was captured, which minimized the need for extensive data entry/cleaning efforts after the survey was administered.

The tablet survey included a series of logic checks, including:

- Feasibility of transfers;
- Ratio of the access/egress distance to transit from the rider's origin/destination relative to the distance traveled on transit and total travel distance; and
- Total travel distance relative to the mode of access and egress.

Paper-based surveys were created in order to provide an alternate administration method for if the tablet-based survey malfunctions. These paper-based surveys were printed in both English and Spanish. Additionally, the paper-based survey was provided to passengers who didn't have sufficient time to complete the interview on the vehicle; their contact information was also obtained during this time so that they could be contacted via phone if they did not complete the survey within 5 days. Finally, this method was used for some express routes because the literacy levels on these routes and the limited number of stops that occur made this a more efficient means of surveying these routes.

5.1.3 Auxiliary Data

In addition to the on-to-off and on-board survey efforts, auxiliary data was also collected from Park and Rides. As detailed in the Work Plan, the Park and Rides were divided into two groups with varying data collection plans.

1. CATS owned Park and Rides and several higher volume leased Park and Rides, where more involved full day of auxiliary data collection were performed; ingress, egress, and vehicle occupancy were collected.
2. Leased and lower volume Park and Rides, where an abbreviated set of data were collected. At these lots, a count of the parked vehicles in the lot was conducted after the AM Peak.

5.2 Survey Instruments

5.2.1 On-to-Off Survey

As explained above, the On-to-Off survey design involved only cards with barcodes and both English and Spanish language instructions. An example of one of these cards is shown in the figure below (only includes English text).

Figure 1: Example On-to-Off Survey Card

5.2.2 Full OD Survey

Please see Appendix A for the Full OD Survey.

5.2.3 Auxiliary Data

Please see Appendix A for the auxiliary data forms.

5.3   Survey Coding Scheme and Data Dictionary

The coding scheme and data dictionary were provided once the tablet-based Full OD Survey was programmed. Once prepared, CATS was given a chance to review the database format and coding scheme with their modeling consultant. All data were clearly labeled so that CATS and their modeling consultant could easily use the data.

6.0 SURVEY MANAGEMENT PLAN

This section provides detail on the survey management practices, including the staffing plan, staff recruitment, and training.

6.1 Staffing Plan

The organizational structure of the staffing plan is as follows:

- Designated Project Manager—the Project Manager is Greg Spitz, Director at RSG, and he worked closely with Deputy Project Manager, Chris Tatham of ETC institute.
- QA/QC Coordination—Aaron Hekele, Fred G'sell, and Jason Jones were named the persons responsible for QA/QC Coordination, and were on site in Charlotte to monitor the entire field process.
- Field Supervisors—the field supervisors for this survey effort can be found in Table 17.

Table 17: Field Supervisors

Name	Company	Email Address
Fred G'sell	ETC Institute	fgsell@etcinstitute.com
Aaron Hekele	ETC Institute	ahekele@etcinstitute.com
Jason Jones	ETC Institute	jjones@etcinstitute.com

- Data Collectors and Editors—Based on the project management and sampling plans, it was decided that about 30 data collectors and editors were required for this survey effort. These surveyors were hired through two certified DBE firms, Absolute Business Connections, Inc. and CEO, Inc. About ten of these surveyors were able to speak Spanish fluently, and could therefore administer the survey in Spanish if necessary.

6.2 Recruitment

All field supervisors were permanently employed by ETC Institute and had more than three years of field survey experience. They all had the professional and management skills required to successfully lead a team of surveyors.

Data collectors and editors were recruited from two certified DBE firms: Absolute Business Connections, Inc. and CEO, Inc. Both firms; both firms performed a nationwide background check on all surveyors.

6.3 Training

Each interviewer received a Surveyor's Manual, and was expected to familiarize themselves with all included information.

6.3.1 On-to-Off Survey Training

ETC Institute conducted training on how to conduct the On-to-Off survey; it included classroom training and in-field training. The specific topics that were covered during the training will include:

- How to properly use the interviewing equipment;

- Sampling procedures;
- How to approach riders to ask them to participate in the survey;
- How to react in various situations that may be encountered; and
- CATS Operations and Safety Training.

Each interviewer was required to demonstrate that they could proficiently conduct the On-to-Off survey by the end of the day. Interviewers who could not demonstrate proficiency in all tasks related to the administration of the survey were replaced.

This training took place on March 4th at the South Tryon bus garage training room.

6.3.2 Pilot Full OD Survey Training

There was only a brief surveyor training for a few select staff from the On-to-Off Survey for the pilot survey. The focus of the pilot was more about ensuring the protocols and equipment work more than the specifics of the collection; thus, a full training was unnecessary for the pilot.

6.3.3 Main Full OD Survey Training

Following the completion of the On-to-Off survey and prior to the start of the main survey, ETC Institute conducted a training on how to conduct the main survey; it included classroom training and in-field training. Some of the topics that were covered during the training included:

- Purpose and objectives for the surveys;
- Questionnaire content;
- Surveyor responsibilities and standards for performance;
- Getting to and from an assignment;
- Data reporting requirements;
- Interlined routes;
- Goals for passenger response rate;
- How to properly use the interviewing equipment;
- Sampling procedures;
- How to react in various situations that may be encountered;
- Procedures for conducting debriefs with passengers who complete printed versions of the survey;
- How to conduct the survey if rider has at least 5 minutes for the survey;
- How to conduct the survey if the rider has less than 5 minutes for the survey;
- What to do if a rider refuses to participate in the survey;
- Frequently asked questions; and
- CATS Operations and Safety Training.

Each interviewer was required to demonstrate that they could proficiently conduct the full survey before they were allowed to administer the survey. Interviewers who could demonstrate proficiency in all tasks related to the administration of the survey were replaced. Surveyor performance was reviewed throughout the data collection effort and surveyors were retrained if issues were encountered; if the surveyor continued to perform below standards, the surveyor was dismissed.

This training took place April 15th at the South Tryon bus garage training room.

7.0 FULL OD PILOT SURVEY

ETC Institute conducted a pilot test of the CATS On-Board OD Transit Survey during the week of March 18th, 2013. The purpose of the pilot test was to assess all aspects of the survey including: survey design, sampling methodology, implementation, and data processing tasks.

Two versions of the survey were administered: one for rail and one for buses. The goal was to obtain 100 completed surveys of each version. The actual number of completed survey was 232 (130 - Rail Version and 102 - Bus Version).

This section briefly summarizes the major findings.

7.1 Routes/Lines Involved

The pilot test was administered to transit riders on five bus routes and the LYNX rail line between the hours of 7am and 7pm. The bus routes that were included in the pilot are listed below:

- 11 North Tryon / Sugar Creek
- 27 Monroe Road
- 56 Arrowood / South Tryon
- 58 Pineville
- 9 Central Avenue

7.2 Personnel and Training

All interviewers who participated in the pilot test were also previously involved in the On-to-Off Survey collection. This served two purposes – allowing a sufficient number of routes to be surveyed while continuing the On-to-Off Survey and also providing pre-training and screening for potential interviewers for the full-scale study.

An additional training was held focusing on the specifics of the Full OD pilot test. The training activities that were covered included:

- An introduction to the purpose of this portion of the project including a review of the hard copy instrument

- Training on the different types of tablet PCs

- On-site reconnaissance of the routes and rail lines that were included in the pilot test; team members rode each bus route that was included in the pilot test multiple times

- Training on survey administration and sampling procedures

- Practical exercise to ensure that all interviewers were technically competent enough to perform all tasks that would be required in the field

7.2.1 Perceptions of Staffing

The overall quality of the staffing for the pilot test was excellent. Of the interviewers who were initially recruited, only two were dismissed for not being technically competent. The remaining staff were able to

quickly understand and demonstrate an ability to perform the tasks required. Another staff member had motion sickness issues that also prevented her from continuing on this portion.

7.3   Assessment of Survey Length

Two versions of the survey were tested. Each version had the same core set of questions. The difference between the two versions involved differences related to the mode of travel (Bus vs. Rail).

The time it took survey participants to fully complete the survey on a tablet PC ranged from minimum of 3.90 minutes to a maximum of 13.24 minutes. The average time was 5.68 minutes, with the bus version taking slightly longer (5.83 minutes) than the rail version (5.56 minutes).

7.4   Assessment of Survey Design

Overall, the questions on both versions of the survey worked very well. Interviewers did not have any difficulty administering the questions, and respondents did not seem to have difficulty understanding them. No changes were recommended to the survey design.

7.5   Assessment of Sampling Procedures

There were no problems with the sampling procedures. The process for randomly selecting riders on buses and trains that is described in the work plan worked very well. No changes to the sampling procedures were recommended.

7.6   Assessment of Survey Participation

Overall Rate of Participation. Overall, 89.3% of the riders who were asked to complete a survey agreed to participate.

Short Trip Participation. Among those who agreed to complete the survey, 94% indicated they had time to complete the FULL version of the survey and 6% indicated that they did not have time to complete the FULL version of the survey, but were willing to do the SHORT version.

Among the 16 people who agreed to do the short version of the survey, ETC Institute was able to complete the FULL version by phone with 11 of these 16 people (69% completion rate). None of the riders who were given a mail-back version of the survey returned it by mail, so phone follow-up the next day appeared to be the best method of ensuring that short trips were well-represented.

7.7   Assessment of Survey Quality

A total of 311 passengers were asked to participate in the pilot test. Of these, 278 agreed, and ETC Institute was able to obtain a complete survey from 233 people (5 people who did the SHORT version of the survey were not reached).

Of the 233 surveys that were completed using ETC Institute's Google-maps integrated survey, 211 passed the first two phases of ETC Institute QA/QC review, which are conducted in the field and immediately after the

data is retrieved. This means that 90.6% (211 of 233) of the data collected for the pilot test has been deemed "usable" so far.

For the pilot test, ETC Institute did not complete a visual review of each record or perform a series of logic checks to test each record, but it was expected that most of the records would pass these tests.

7.8   Conclusions

Based on the results of the pilot test, ETC Institute recommended that we proceed with the administration of the main survey as scheduled with no modifications to the survey design or procedures.

8.0 DATA VERIFICATION

The following section describes the data verification procedures RSG and ETC Institute used prior to delivering the final datasets for the CATS OD study.

A total of 9,221 surveys were obtained from the primarily tablet-based field effort. After cleaning and data verification was complete, 8,476 were deemed usable and included in the dataset, for a recovery rate of 92%. This is significantly higher than the recovery rate for a full paper survey administration method, which typically sees recovery rates around 70-75%.

8.1 Detailed Full OD Data Verification

8.1.1 Real-Time Data Review

For the Full OD study, the tablet survey tool did not allow the interviewer to continue through the survey if a question was left unanswered. The only exception was household income, which some respondents were uncomfortable answering. Therefore, a completed survey was one which had every question answered, except income.

While in the field, to ensure that accurate and quality data was collected, completed surveys were reviewed by field supervisors upon receipt. If any issues were found (e.g., an interviewer accepted an unreasonably long walk access trip), field supervisors then provided feedback and additional training to interviewers. Where possible, the data were corrected by the supervisor if the correct information was apparent. If a fix could not be made based on the information supplied, a follow up was done with respondents via phone to obtain missing information or clarify inconsistent information.

8.1.2 Real-Time Geocoding

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

8.1.3 Paper Surveys

For the paper-based survey returns, the data were entered into the tablet survey. This has the advantage of stepping through the survey so the data can be checked in real-time. If information was missing but the correction needed was obvious, the data were populated by data cleaners. For example, if the respondent reported a walk access mode but did not provide their boarding stop, the data cleaner assigned the closest stop to their origin on the first route taken.

If information was unclear or major information was missing, an attempt was made to reach the respondent via phone to correct the information; if the respondent could not be reached, the data were discarded.

Because the paper surveys were entered directly into the tablet system, there is not a way to differentiate surveys that were completed on paper v. tablet.

8.1.4 Verification of Data Collection

As noted, much of the data verification occurred in real-time; however, additional checking was done after data collection was complete. One staff person was responsible for reviewing all records, providing a consistent source of review for the full study. The following data verification steps were taken and applied consistently across all records:

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

8.1.5 Visual Inspection

This step involved a visual inspection of the trip record. The key tasks completed as part of this visual inspection included the following:

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

If a record passes all of the visual checks and verifications listed above, the record was classified as "useable" and included in the final survey database. A total of 726 surveys (8%) were not included in the final database due to missing or illogical data; these surveys were discarded and are not available. Several iterations of the visual inspection were conducted in cooperation with CATS' modeling consultant as they reviewed and began working with the data.

8.2   On-To-Off Survey Data Processing

The On-to-Off survey data were processed to assign the boarding/alighting stop ID which matched with the stop ID in the Full OD dataset for easier analysis. The route names and stop names were also standardized.

8.3   Park-And-Ride Data Verification

The Park-And-Ride data from lots counted for the full day were checked by reviewing the vehicle count at the start of the day, the number of vehicles that entered and exited, and the number remaining at the end of the day. It was confirmed that the combination of these numbers totaled up to 0 at the end of each day for each of the lots.

8.4   Results

The result of the data verification process was a set of fully cleaned, labeled, and geocoded datasets. The final On-to-Off dataset contains a total of 29,691 records (20,922 bus surveys, 8,769 LYNX surveys), well in excess of sampling goals. The final Full OD dataset contains 8,476 total records (6,439 bus surveys, 2,037 LYNX surveys), again, well in excess of the sampling goals.

Table 18: Sampling Goals v. Surveys Collected

Route	# On/Off Surveys Targeted	# On/Off Surveys Completed	Difference	# Full OD Surveys Targeted	# Full OD Surveys Completed	Difference
1	233	584	351	116	136	20
2	133	483	350	67	108	41
3	278	529	251	139	162	23
4	101	265	164	51	66	15
5	244	433	189	122	131	9
6	130	239	109	65	71	6
7	709	1,217	508	355	366	12
8	272	655	383	136	156	20
9	802	1,465	663	401	405	4
10	269	558	289	135	143	9
11	865	1,590	725	433	446	14
12	110	247	137	55	59	4
13	191	375	184	95	118	23
14	178	419	241	89	113	24
15	353	582	229	177	188	12
16	343	971	628	171	181	10
17	225	505	280	112	132	20
18	60	97	37	30	43	13
19	173	502	329	87	119	33

Route	# On/Off Surveys Targeted	# On/Off Surveys Completed	Difference	# Full OD Surveys Targeted	# Full OD Surveys Completed	Difference
20	130	323	193	65	83	18
21				35	48	13
22	282	689	407	141	166	25
23	350	726	376	175	205	30
24	99	177	78	49	75	26
25				26	32	6
26	108	243	135	54	80	26
27	415	867	452	207	208	1
29	95	222	127	47	63	16
30	149	266	117	74	81	7
34	272	661	389	136	149	13
39	218	510	292	109	133	24
42				3	8	5
43				31	45	14
47	98	192	94	49	70	21
49	123	220	97	62	57	-5
50	178	402	224	89	85	-4
55	85	223	138	42	47	5
56	236	495	259	118	117	-1
57	69	172	103	35	46	11
58	81	205	124	40	55	15
60	64	60	-4	32	38	6
84	211	310	99	106	70	-36
86	413	614	201	207	220	13
94				1	4	3
97				15	29	14
98				13	20	8
99				11	18	7
201				20	29	10
204	99	228	129	49	55	6
211	162	491	329	81	103	22
221	85	140	55	42	42	0
222				38	58	20
232	142	386	244	71	88	17
235				33	45	12
40X*	49	0	-49	25	42	17
41X				17	22	5

Route	# On/Off Surveys Targeted	# On/Off Surveys Completed	Difference	# Full OD Surveys Targeted	# Full OD Surveys Completed	Difference
45X				7	10	3
48X				33	52	19
51X				12	16	4
53X				9	14	5
54X	132	204	72	66	130	64
61X				30	28	-2
62X				15	31	17
64X				25	31	6
65X				19	24	5
74X				12	24	12
77X	139	180	41	70	81	12
80X*	38	0	-38	19	42	23
82X				11	31	20
85X				19	33	14
88X				6	13	8
LYNX	2,817	8,769	5,952	1,421	2,037	616
Total	**12,794**	**29,691**	**16,897**	**6,954**	**8,476**	**1,522**

Note: Route 40x and 80x were small routes but CATS requested On-to-Off data for them. Rather than conduct a separate On-to-Off survey for these small routes, twice as much full OD data was collected to provide the same level of data (20% of ridership).

APPENDIX A: SURVEY INSTRUMENTS

2013 On-Board Transit Survey

BUS VERSION   *(for office use only)* Route Code: [____]   Time: [____] am / pm   Interviewer: [____]   Serial #: [____]

Please take a few moments to help CATS plan for your transit needs by filling out this survey.

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

Did you have a MOTOR VEHICLE AVAILABLE to make THIS ONE-WAY TRIP? (If your car is in the shop or someone else is using your car right now, then you did **NOT** have a vehicle available and must fill in "No.")

○ **Yes**   ○ **No**

What is your HOME ADDRESS and PHONE number: (please be specific, ex: 123 W. Main St):
(*If you are visiting the Charlotte area, please list the address where you are staying*)

_____   _____   _____   _____

Street Address   City   State   Zip Code

_____

*Phone Number   * *We will only call you to confirm these survey responses*

COMING FROM?

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

- ○ Your **HOME** → *Go to Question #3*
- ○ Work
- ○ College / University (student only)
- ○ School (K-12) (student only)
- ○ Shopping
- ○ Airport (air passenger only)
- ○ Doctor's appointment / hospital visit
- ○ Restaurant (eat meal)
- ○ Other: _____

2. What is the <u>NAME</u> of the place you are coming from now?

_____

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

_____

City: _____ State: _____ Zip: _____

4. How did you GET FROM the place in Question #1 TO THE FIRST bus or train you used for this one-way trip?

- ○ **Walked** ___ short walk (less than 1/2 mi OR less than 10 minutes)
  ___ medium walk (1/2 - 1 mile OR 10 - 20 minutes)
  ___ long walk (>1 mile OR >20 minutes)

- ○ **Bicycled** ___ short ride (less than 1/2 mi OR less than 5 minutes)
  ___ medium ride (1/2 - 2 miles OR 5 - 20 minutes)
  ___ long ride (>2 mile OR >20 minutes)

- ○ **Dropped off by someone** _____
  Name of Parking Lot <u>OR</u> Intersection

- ○ **Carpooled and parked** _____
  Name of Parking Lot <u>OR</u> Intersection

  How many people were in the car with you?

  ___One   ___Two   ___Three   ___Four or more

- ○ **Drove alone and parked** _____
  Name of Parking Lot <u>OR</u> Intersection

GOING TO?

5. What type of place are you GOING TO NOW (the <u>ending place</u> for your one-way trip)?

- ○ Your **HOME** → *Go to Question #7*
- ○ Work
- ○ College / University (student only)
- ○ School (K-12) (student only)
- ○ Shopping
- ○ Airport (air passenger only)
- ○ Doctor's appointment / hospital visit
- ○ Restaurant (eat meal)
- ○ Other: _____

6. What is the <u>NAME</u> of the place you are going to now?

_____

7. What is the <u>EXACT ADDRESS</u> of this place? (OR Intersection if you do not know the exact address:)

_____

City: _____ State: _____ Zip: _____

8. How will you GET TO your destination (listed in Question #5) after you get off the LAST bus or train you will use for this one-way trip?

- ○ **Walk** ___ short walk (less than 1/2 mi OR less than 10 minutes)
  ___ medium walk (1/2 - 1 mile OR 10 - 20 minutes)
  ___ long walk (>1 mile OR >20 minutes)

- ○ **Bicycle** ___ short ride (less than 1/2 mi OR less than 5 minutes)
  ___ medium ride (1/2 - 2 miles OR 5 - 20 minutes)
  ___ long ride (>2 mile OR >20 minutes)

- ○ **Get picked up from** _____
  Name of Parking Lot <u>OR</u> Intersection

- ○ **Carpool from** _____
  Name of Parking Lot <u>OR</u> Intersection

  How many people will be in the car with you?

  ___One   ___Two   ___Three   ___Four or more

- ○ **Drive alone from** _____
  Name of Parking Lot <u>OR</u> Intersection

Continue ⟶

THIS BUS

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

10. **What is the NEAREST INTERSECTION where you BOARDED this bus?**

Street 1 (OR name of place): _____ & Street 2: _____

11. **What is the NEAREST INTERSECTION where you will GET OFF this bus?**

Street 1 (OR name of place): _____ & Street 2: _____

12. **INCLUDING THIS BUS, how many TOTAL BUSES AND TRAINS will you use to make THIS ONE WAY TRIP?**

○ **One, only this bus**   ○ **Two**   ○ **Three**   ○ **Four or more**

List the ROUTES in the exact order you use them for this one way trip.

START → [1st Route #] → [2nd Route #] → [3rd Route #] → [4th Route #] → **END**

13. **Did you / Will you make THIS TRIP in EXACTLY the opposite direction today?**

○ **No**   ○ **Yes – what time?** _____ : _____ am / pm (circle one)

14. **Do you receive a DISCOUNT for your FARE?**

○ **Yes - what kind?**   ○ **No**

↳ ___Employer offers pass discount ___Youth/Student discount ___Senior/ADA discount ___Free fare

OTHER IMPORTANT ITEMS

15. **How many years have you been using public transit in the Charlotte area?**
   ○ **3 years or more**   ○ **Less than 3 years**

   If you marked LESS THAN 3 YEARS, why did you start using public transit in the Charlotte area? (Check all that apply)

   ___ Moved to the area within the last 3 years   ___ Started a new job   ___ Environmental benefits
   ___ The LYNX Blue Line light rail service   ___ Started school   ___ To save money   ___ Other (specify below)
   ___ Employer offers incentives to ride transit   ___ Lost my job   ___ Do not have a car   _____

16. **If bus / rail service was NOT AVAILABLE, how would you make this entire one-way trip?**
   ○ **I would not make this trip**   ○ **Walk / bike**   ○ **Drive myself**   ○ **Get dropped off by someone**

17. **How many WORKING vehicles (cars, trucks, or motorcycles) ARE AVAILABLE to your household?**
   ○ **None**   ○ **One**   ○ **Two**   ○ **Three**   ○ **Four or more**

18. **INCLUDING YOU, how many people LIVE in your household?**   _____ people

19. **INCLUDING YOU, how many people have a VALID driver's license in your household?**
   _____ people

20. **Do YOU have a valid driver's license?**   ○ **Yes**   ○ **No**

21. **Are YOU a student?**
   ○ **Not a student**
   ○ **Yes – student, K thru 12th grade (specify school name):** _____
   ○ **Yes – student, other (specify institution name):** _____

22. **What best describes your current work status:**
   ○ **Employed full-time (at least 35 hours per week)**   ○ **Employed part-time (less than 35 hours per week)**
   ○ **Not currently employed, but not retired**   ○ **Retired**

23. **INCLUDING YOU, how many people living in your household are EMPLOYED?** ___ people

24. **Which of the following categories BEST describes your TOTAL ANNUAL HOUSEHOLD INCOME in 2012 before taxes?**
   ○ **Less than $16,000**   ○ **$16,000 – $24,999**   ○ **$25,000 – $33,999**   ○ **$34,000 – $49,999**
   ○ **$50,000 – $59,999**   ○ **$60,000 – $74,999**   ○ **$75,000 or more**

RETURN the COMPLETED SURVEY to the SURVEYOR
OR return it within 24 hours using the provided postage-paid envelope.   **Thank you!**

CATS CHARLOTTE AREA TRANSIT SYSTEM

2013 On-Board Transit Survey

Please take a few moments to help CATS plan for your transit needs by filling out this survey.

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

Did you have a MOTOR VEHICLE AVAILABLE to make THIS ONE-WAY TRIP? (If your car is in the shop or someone else is using your car right now, then you did NOT have a vehicle available and must fill in "No.")

○ **Yes**   ○ **No**

What is your HOME ADDRESS and PHONE number: (please be specific, ex: 123 W. Main St):
(If you are visiting the Charlotte area, please list the address where you are staying)

_____   _____   _____   _____
Street Address   **City**   **State**   **Zip Code**

_____
*Phone Number   ***We will only call you to confirm these survey responses***

COMING FROM?

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

- ○ Your **HOME** ➔ *Go to Question #3*
- ○ Work
- ○ College / University (student only)
- ○ School (K-12) (student only)
- ○ Shopping
- ○ Airport (air passenger only)
- ○ Doctor's appointment / hospital visit
- ○ Restaurant (eat meal)
- ○ Other: _____

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 the place in Question #1 TO THE FIRST bus or train you used for this one-way trip?

- ○ **Walked** ___ short walk (less than 1/2 mi OR less than 10 minutes)
  ___ medium walk (1/2 - 1 mile OR 10 - 20 minutes)
  ___ long walk (>1 mile OR >20 minutes)

- ○ **Bicycled** ___ short ride (less than 1/2 mi OR less than 5 minutes)
  ___ medium ride (1/2 - 2 miles OR 5 - 20 minutes)
  ___ long ride (>2 mile OR >20 minutes)

- ○ **Dropped off by someone** _____
  Name of Parking Lot OR Intersection

- ○ **Carpooled and parked** _____
  Name of Parking Lot OR Intersection

  How many people were in the car with you?

  ___One   ___Two   ___Three   ___Four or more

- ○ **Drove alone and parked** _____
  Name of Parking Lot OR Intersection

GOING TO?

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

- ○ Your **HOME** ➔ *Go to Question #7*
- ○ Work
- ○ College / University (student only)
- ○ School (K-12) (student only)
- ○ Shopping
- ○ Airport (air passenger only)
- ○ Doctor's appointment / hospital visit
- ○ Restaurant (eat meal)
- ○ Other: _____

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

_____

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

_____

City: _____ State: _____ Zip: _____

8. How will you GET TO your destination (listed in Question #5) after you get off the LAST bus or train you will use for this one-way trip?

- ○ **Walk** ___ short walk (less than 1/2 mi OR less than 10 minutes)
  ___ medium walk (1/2 - 1 mile OR 10 - 20 minutes)
  ___ long walk (>1 mile OR >20 minutes)

- ○ **Bicycle** ___ short ride (less than 1/2 mi OR less than 5 minutes)
  ___ medium ride (1/2 - 2 miles OR 5 - 20 minutes)
  ___ long ride (>2 mile OR >20 minutes)

- ○ **Get picked up from** _____
  Name of Parking Lot OR Intersection

- ○ **Carpool from** _____
  Name of Parking Lot OR Intersection

  How many people will be in the car with you?

  ___One   ___Two   ___Three   ___Four or more

- ○ **Drive alone from** _____
  Name of Parking Lot OR Intersection

Continue ⟹

THIS TRAIN

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

10. At what STATION did you BOARD this train?

- 7th St
- Bland
- Tyvola
- CTC/Arena
- East/West Blvd
- Archdale
- 3rd St / Convention Center
- New Bern
- Arrowood
- Stonewall
- Scaleybark
- Sharon Rd. West
- Carson
- Woodlawn
- I-485 / South Blvd

11. At what STATION will you GET OFF this train?

- 7th St
- Bland
- Tyvola
- CTC/Arena
- East/West Blvd
- Archdale
- 3rd St / Convention Center
- New Bern
- Arrowood
- Stonewall
- Scaleybark
- Sharon Rd. West
- Carson
- Woodlawn
- I-485 / South Blvd

12. INCLUDING THIS TRAIN, how many TOTAL BUSES AND TRAINS will you use to make THIS ONE WAY TRIP?

- ○ One, only this rail
- ○ Two
- ○ Three
- ○ Four or more

List the ROUTES in the exact order you use them for this one way trip.

START → [1st Route #] → [2nd Route #] → [3rd Route #] → [4th Route #] → END

13. Did you / Will you make THIS TRIP in EXACTLY the opposite direction today?

- ○ No
- ○ Yes – what time? _____ : _____ am / pm (circle one)

14. Do you receive a DISCOUNT for your FARE?

- ○ Yes - what kind?
- ○ No

↳ ___Employer offers pass discount ___Youth/Student discount ___Senior/ADA discount ___Free fare

OTHER IMPORTANT ITEMS

15. How many years have you been using public transit in the Charlotte area?

- ○ 3 years or more
- ○ Less than 3 years

*If you marked **LESS THAN 3 YEARS**, why did you start using public transit in the Charlotte area? (Check all that apply)*

- ___ Moved to the area within the last 3 years
- ___ The LYNX Blue Line light rail service
- ___ Employer offers incentives to ride transit
- ___ Started a new job
- ___ Started school
- ___ Lost my job
- ___ Environmental benefits
- ___ To save money
- ___ Do not have a car
- ___ Other (specify below)

_____

16. If bus / rail service was NOT AVAILABLE, how would you make this entire one-way trip?

- ○ I would not make this trip
- ○ Walk / bike
- ○ Drive myself
- ○ Get dropped off by someone

17. How many WORKING vehicles (cars, trucks, or motorcycles) ARE AVAILABLE to your household?

- ○ None
- ○ One
- ○ Two
- ○ Three
- ○ Four or more

18. INCLUDING YOU, how many people LIVE in your household?   _____ people

19. INCLUDING YOU, how many people have a VALID driver's license in your household?   _____ people

20. Do YOU have a valid driver's license?   ○ Yes   ○ No

21. Are YOU a student?

- ○ Not a student
- ○ Yes – student, K thru 12th grade (specify school name): _____
- ○ Yes – student, other (specify institution name): _____

22. What best describes your current work status:

- ○ Employed full-time (at least 35 hours per week)
- ○ Employed part-time (less than 35 hours per week)
- ○ Not currently employed, but not retired
- ○ Retired

23. INCLUDING YOU, how many people living in your household are EMPLOYED? ___ people

24. Which of the following categories BEST describes your TOTAL ANNUAL HOUSEHOLD INCOME in 2012 before taxes?

- ○ Less than $16,000
- ○ $16,000 – $24,999
- ○ $25,000 – $33,999
- ○ $34,000 – $49,999
- ○ $50,000 – $59,999
- ○ $60,000 – $74,999
- ○ $75,000 or more

RETURN the **COMPLETED SURVEY** to the **SURVEYOR**

OR return it within 24 hours using the provided postage-paid envelope.   **Thank you!**

Park and Ride Count Sheet Form

Facility_____ Surveyor_____ Date_____ Cars_____

Start	End	Enter Cars		Enter People		Exit Cars		Exit People
6:30a	- 6:45a							
6:45a	- 7:00a							
7:00a	- 7:15a							
7:15a	- 7:30a							
7:30a	- 7:45a							
7:45a	- 8:00a							
8:00a	- 8:15a							
8:15a	- 8:30a							
8:30a	- 8:45a							
8:45a	- 9:00a							
9:00a	- 9:15a							
9:15a	- 9:30a							
9:30a	- 9:45a							
9:45a	- 10:00a							
10:00a	- 10:15a							
10:15a	- 10:30a							
10:30a	- 10:45a							
10:45a	- 11:00a							

Facility_____ **Surveyor**_____ **Date**_____ **Cars**_____

Start	End	Enter Cars		Enter People		Exit Cars		Exit People
11:00a	- 11:15a							
11:15a	- 11:30a							
11:30a	- 11:45a							
11:45a	- 12:00p							
12:00p	- 12:15p							
12:15p	- 12:30p							
12:30p	- 12:45p							
12:45p	- 1:00p							
1:00p	- 1:15p							
1:15p	- 1:30p							
1:30p	- 1:45p							
1:45p	- 2:00p							
2:00p	- 2:15p							
2:15p	- 2:30p							
2:30p	- 2:45p							
2:45p	- 3:00p							
3:00p	- 3:15p							
3:15p	- 3:30p							
3:30p	- 3:45p							
3:45p	- 4:00p							
4:00p	- 4:15p							
4:15p	- 4:30p							

Facility_____ **Surveyor**_____ **Date**_____ **Cars**_____

Start	End	Enter Cars		Enter People		Exit Cars		Exit People
4:30p	- 4:45p							
4:45p	- 5:00p							
5:00p	- 5:15p							
5:15p	- 5:30p							
5:30p	- 5:45p							
5:45p	- 6:00p							
6:00p	- 6:15p							
6:15p	- 6:30p							
6:30p	- 6:45p							
6:45p	- 7:00p							
7:00p	- 7:15p							
7:15p	- 7:30p							
7:30p	- 7:45p							
7:45p	- 8:00p							
8:00p	- 8:15p							
8:15p	- 8:30p							
8:30p	- 8:45p							
8:45p	- 9:00p							

APPENDIX B: SURVEYOR MANUALS

WELCOME

Charlotte On-Board Transit Survey
Charlotte Area Transit System (CATS)

On-to-Off Survey Training
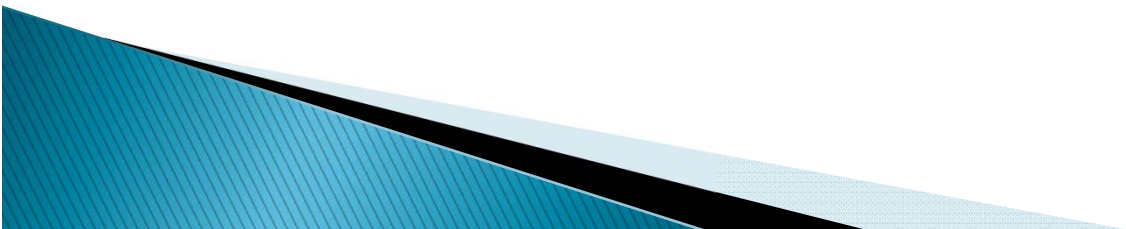
Agenda

- Safety protocols
- Overview of the project
- What you will be doing
- Show you how to use the equipment and conduct the survey
- Administrative issues
  - Photos
  - Passes for access
  - Dress/Conduct
- Schedule
- Questions

CATS Security Protocols

- CATS presentation

Overview of the Survey

- Data gathered will be used as a "before" study prior to the northeastern extension on the LYNX Blue Line
- Two Phases:
  - On-to-Off Survey (Spring 2013)
  - Full Survey (Spring & Fall 2013)

What You Will Be Doing

- On-to-Off Survey
- Asking rail riders where they GOT ON and WILL GET OFF the rail
- Collecting this information for bus riders using tablet and survey cards
- The data you gather will help us develop the sampling plan for the full survey, which will be conducted later in the Spring and Fall.

How to Use the Rail Equipment

- Select the Rail icon
- Position yourself as described by the supervisor
- Administer the survey to everyone on the train on which you are working
  - Where did you get on?
  - Where are you getting off?
- Continue to survey rail riders

BUSES
GPS Based Scanners Will Be Used to Capture Nearly 100% of the Boarding and Alighting Pairs on Routes Included in the Survey

12001

Please give this card to the survey administrator as you exit the bus.

Your participation will help us make transit improvements in the region.
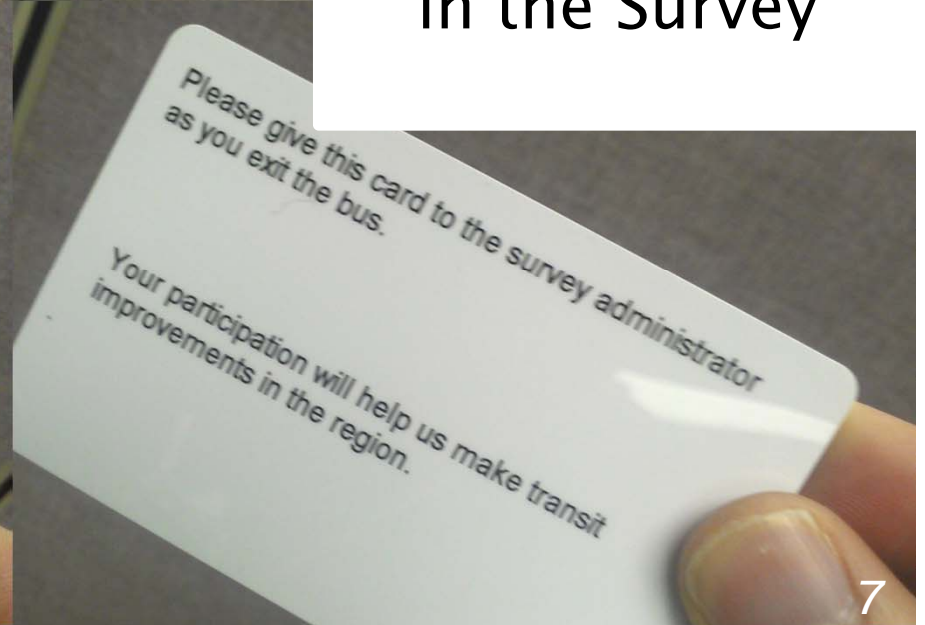
Administrative Issues

- Passes for Buses
- Photos for ID
- Dress Code
  - Pants, close-toed shoes, and shirt (no T-shirts)
  - Blue vest
  - ID Badge
- Conduct
  - Arrive on-time
  - No eating, drinking, chewing, or smoking while on buses or trains
  - Drivers are always right
  - Treat passengers with the greatest respect

Schedule – this week

- Tues – Wed (Mar 5–6) – 2 shifts on bus
  - Group 1: 6:30am–1:30pm
  - Group 2: 1:30–9:00pm
- Thursday (Mar 7) – Rail line
  - Group 1: 6:30am–1:30pm
  - Group 2: 1:30–9:00pm

Schedule – next week

- Monday – Tuesday (Mar 11-12), Thursday (Mar 14) – 2 Shifts
  - Group 1: 6:30am-1:30pm
  - Group 2: 1:30-9:00pm
- Wednesday (Mar 13) – Rail (as needed), bus – 2 shifts
  - Group 1: 6:30am-1:30pm
  - Group 2: 1:30-9:00pm

Schedule – two weeks

- Monday (Mar 18)
  - Training for Bus / Rail Full Study Pilots
- Monday – Thursday (Mar 18-21) – pilot survey and on-to-off survey
  - Group 1: 6:30am-1:30pm
  - Group 2: 1:30-9:00 pm

Questions

WELCOME

Charlotte On-Board Transit Survey
Charlotte Area Transit System (CATS)
Full OD Survey Training
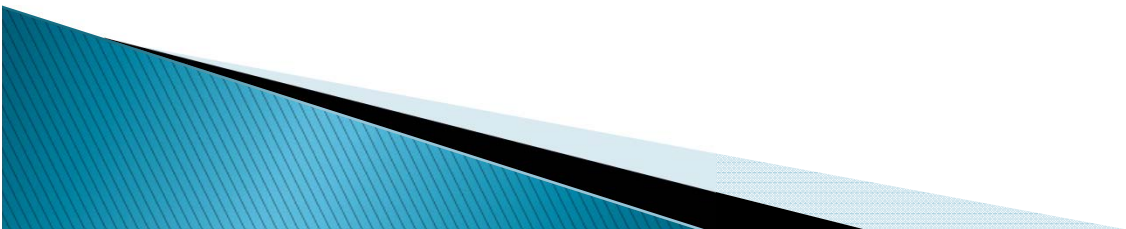
Agenda

- Overview of the Project
- Safety Training
- What you will be doing
- Expectations for Conduct
- How to use the equipment
- How to conduct the survey
- Practical exercise for conducting the survey
  - YOU WILL BE TESTED AT THE END OF THE DAY TODAY
- Schedule for this week
- Adjourn

Overview of the Survey

‣ Data gathered will be used to improve the quality of regional transportation in Charlotte and also provide a snapshot prior to the Blue Line extension

‣ Two Phases:
  ◦ On-to-Off Survey (March 2013)
  ◦ Full Survey (Spring / Fall 2013)

‣ This effort will collect over 7000 interviews

Transit Agency

- CATS
  - Local
  - Express
  - UNCC campus shuttles
  - Light Rail

What You Will Be Doing

- Gathering detailed information from riders about their transit trip
  - Where they live
  - Where they started their trip
  - Where their ONE-WAY trip will end
  - Where they got on/off the bus or train
  - Whether they transferred to/from other routes
  - Other personal and demographic information
- The data you gather will help us develop improve regional transit planning in the Greater Charlotte area

Expectations for Conduct: General

- Be On-time
- Drivers/CATS employees are ALWAYS right.
- Business Casual Attire – Jeans are okay but make sure jeans are appropriate (no tears, excessively baggy). No saggy pants.
- Be Polite and Courteous to EVERYONE (CATS Employees/Passengers).
- Good hygiene is important.
- No headphones on the bus. If you want to listen to headphones, keep them hidden and use them only on break.
- Cell phone calls from the bus should be to supervisors or other survey staff for work purposes only. Personal cell phone calls should be made on break and should not involve cussing if on CATS property including bus stop shelters.
- Do not use the internet on the tablets for personal use.
- No disrespectful behavior of any kind will be tolerated.

Conduct on Buses/Trains

- Do **NOT** hold up the line when people are getting on or off the bus
- The survey is **ALWAYS** voluntary. There is never a good reason to argue with anyone who doesn't want to participate in the survey.
- Standing in front of the white line on the bus is against the law. **DO NOT STAND IN FRONT OF WHITELINE ON THE BUS.** The driver can be ticketed if you stand in front of that line.
- No eating/drinking/chewing tobacco/smoking on the bus. No smoking in your vest/near CATS facilities including shelters

Conduct Statement

▸ Everyone will sign a statement to acknowledge your understanding of these items

QUESTIONS ABOUT CONDUCT?

How to Use the Equipment

▸ <u>**Two Types: Samsung Galaxies and / or iPads**</u>

▸ <u>**Review Basics**</u>

- ◦ How to turn it on/off
- ◦ How to log into the survey
- ◦ How to adjust brightness and other settings
- ◦ How to check you battery strength

Equipment Test
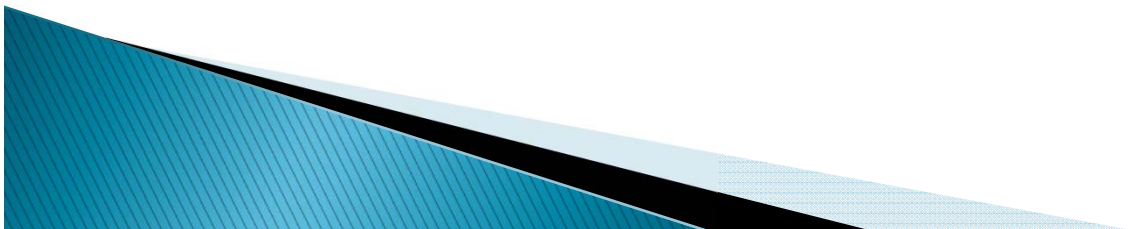
Equipment Test

▸ You have 3 minutes to:
  ◦ Set the brightness on your tablet to 75%
  ◦ Set the sound to mute
  ◦ Add 1 hour to the time

How to Conduct Survey

▶ <u>**Selecting Participants**</u>

- Everyone who boards the bus/train is eligible to be selected
- The computer will select the people that are to be interviewed
- DO NOT skip children or persons with disabilities
- If you encounter a child who is accompanied by an adult, ask the parent or adult with him/her for permission.
- VERY IMPORTANT – the selection process must ALWAYS BE DONE AT RANDOM

How to Conduct Survey

▶ <u>Getting People to Do the Survey</u>

○ "Hi, I am Fred, you were randomly selected to participate in a short survey to improve public transportation services in the Charlotte area. Would you mind answering a few questions?"

How to Conduct Survey

- **<u>Three Response Options:</u>**

  - NO – survey ends
  - YES – you will ask if they have at lease five minutes to determine whether you will administer
    - Full Survey
    - Short Survey

How to Distribute Incentives

▸ <u>Free Ride Passes</u>
1. When a long version of the survey is completed
2. IF not completed, passes not distributed under any condition
3. Everyone randomly selected.
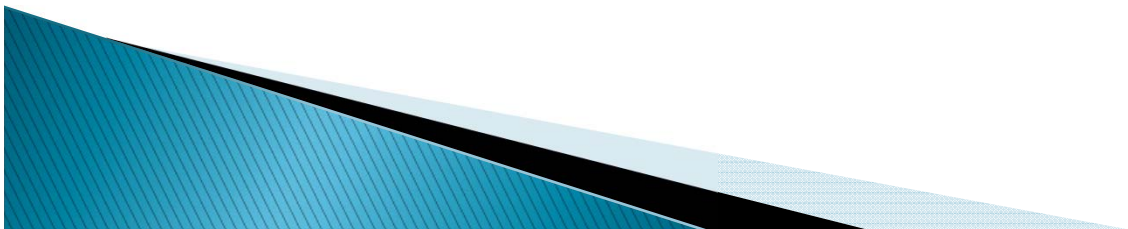
How to Conduct Survey

- **<u>Survey Structure – 3 Major Parts</u>**
  1. Get Key Addresses
     - Home
     - Origin – one way trip
     - Destination – one way trip
     - On and Off location for current route
  2. Transfer Information
  3. Demographic and Personal Information

How to Conduct Survey

- Lets Walk Thru the Survey

How to Conduct Survey

▸ Questions

▸ Breakout in Small Groups

FINAL EXAM

▸ Test Questions
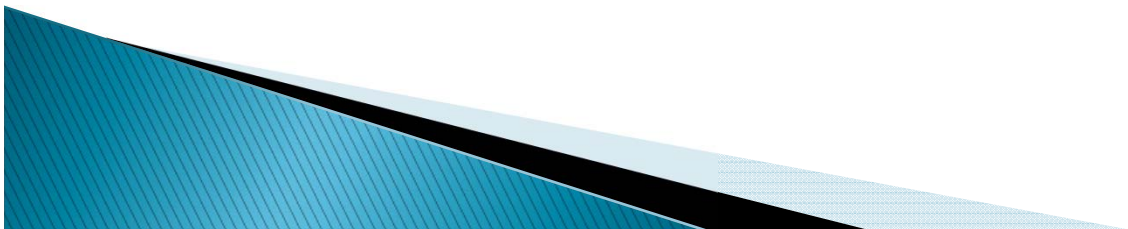
FINAL EXAM

1. Can the origin and destination for a person's trip be the same place for a one-way trip?
2. Can the place a person gets on and off a bus or train be the same location for a one-way trip?
3. When can you smoke, drink, and eat on the bus and CATS facilities?
4. Can a person have more than one transfer?
5. TRUE or FALSE: You should ask children to participate in the survey?

FINAL EXAM

6. Are all passengers are required to complete the survey?

7. What are the two ways you can search for an address on the survey maps?

8. If you cannot finish the long version of the survey, which button do you press to save the data?

9. Can someone access transit by bus transfers when they are asked "how they got from their starting point to the first bus/train they used for their trip?"

FINAL EXAM

10. When do you enter your initials into the survey?
11. Name the transit agencies involved in this survey and three of the route types?
12. How do you determine the direction that is to be selected when you select routes?
13. When do you select the participants for the survey?
14. If an airport employee is coming from the airport on the bus, what type of place is he/she coming from?
15. When do you distribute an incentive?

FINAL EXAM

1. Can the origin and destination for a person's trip be the same place? NO
2. Can the place a person gets on and off a bus or train be the same location?   NO
3. When can you smoke, drink, and eat on the bus and CATS facilities? NEVER
4. Can a person have more than one transfer? YES
5. TRUE or FALSE: You should ask children to participate in the survey? TRUE

6. Are all passengers are required to complete the survey? NO – it is voluntary

7. What are the two ways you can search for an address on the survey maps? Address or Place

8. If you cannot finish the long version of the survey, which button do you press to save the data? Callback

9. Can someone access transit by bus when they are asked how they got from their starting point to the first bus/train they used for their trip? NO

10. When do you wear you enter your initials into the survey?   Beginning and End

11. Name the transit agencies involved in this survey and three of the route types? CATS local, campus, express, and rail

12. How do you determine the direction that is to be selected when you select routes?   End point of the route, ask the driver, assignment sheet

13. When do you select the participants for the survey?   NEVER – it is always done at random

14. If an airport employee is coming from the airport on the bus, what type of place is he/she coming from?   Workplace

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OTHER IMPORTANT THINGS

▸ $50 fee if you don't turn-in your vest and pass

▸ Do NOT bring anything with you that you cannot afford to lose

Schedule – this week

- TOMORROW –
  - Practical Test at CTC AM and PM
  - Do NOT Be Late

- **If you are selected**
- Wednesday / Thursday –
  - Meet at CTC
  - Conduct surveys on Blue Line and select bus routes

Questions

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APPENDIX C: DATA DICTIONARY

Variable Labels

Variable	Label
ID	Unique ID for each record
MODE	Mode: Bus or rail
DATE	Date survey was administered
ROUTE	Route Number
ROUTE_DESCRIPTION	Route name/number
ROUTE_CODE	Route number/direction of Travel
DIRECTION	Direction of travel
SPANISH	Interview conducted with a Spanish speaking respondent
MOTOR_VH_AVAILABLE	Motor vehicle available to make this one-way trip
HOME_ADDRESS	Home address
HOME_CITY	Home city of the Respondent
HOME_STATE	Home state where the respondent lives
HOME_ZIP	Zip code where the respondent lives
HOME_LAT	Latitude coordinates where the respondent lives
HOME_LON	Longitude coordinates where the respondent lives
ORIGIN_PLACE_TYPE	Type of place respondent is coming from now
ORIGIN_NAME	Name of place where the trip began
ORIGIN_ADDRESS	Street address where the trip began
ORIGIN_CITY	City where the trip began
ORIGIN_STATE	State where the trip began
ORIGIN_ZIP	Zip code where the trip began
ORIGIN_LAT	Latitude coordinates where the trip began
ORIGIN_LON	Longitude coordinates where the trip began
ACCESS_MODE	Mode of access to transit
ACCESS_MODE_other	Mode of access to transit: Other, please specify
ACCESS_LOCATION_IF_DROVE	Address where the respondent parked/dropped off
ACCESS_WALK_DISTANCE	Distance respondent walked from the origin to transit
ACCESS_BICYCLED_DISTANCE	Distance respondent biked from the origin to transit
ACCESS_CARPOOL_SIZE	Number of people in the carpool the respondent used to get to transit from the trip origin
DESTINATION_PLACE_TYPE	Type of place respondent is going to now
DESTINATION_NAME	Name of place where the trip ended
DESTINATION_ADDRESS	Street address where the trip ended
DESTINATION_CITY	City where the trip ended
DESTINATION_STATE	State where the trip ended
DESTINATION_ZIP	Zip code where the trip ended
DESTINATION_LAT	Latitude coordinates where the trip ended
DESTINATION_LON	Longitude coordinates where the trip ended
EGRESS_MODE	Mode of egress from transit
EGRESS_MODE_other	Mode of egress from transit: Other, please specify
EGRESS_LOCATION_IF_DROVE	Address where the respondent parked//was picked up
EGRESS_WALK_DISTANCE	Distance respondent will walk from transit to his/her destination
EGRESS_BICYCLED_DISTANCE	Distance respondent will bike from transit to his/her destination
EGRESS_CARPOOL_SIZE	Number of people in the carpool the respondent used to get from transit to his/her destination
BOARD_TIME	At what time did respondent board surveyed bus?
PERIOD_FROM_BOARD_TIME	Time Period of respondent boarding surveyed bus
BOARDING_LOCATION	Name/description/Intersection where the respondent boarded the Bus/Rail
BOARDING_LAT	Latitude coordinates of the boarding location
BOARDING_LON	Longitude coordinates of the boarding location
BOARDING_STOPID	Unique ID for each Bus Stop
ALIGHTING_LOCATION	Name/description/Intersection where the respondent alighted the Bus/Rail

ALIGHTING_LAT	Latitude coordinates of the alighting location
ALIGHTING_LON	Longitude coordinates of the alighting location
ALIGHTING_STOPID	Unique ID for each Bus Stop
TRANSFERS_FROM	Number of transfers a respondent took before surveyed route from Origin
TRANSFER_FROM_1st	Name of first route (if taken)
TRANSFER_FROM_2nd	Name of second route (if taken)
TRANSFER_FROM_3rd	Name of third route (if taken)
TRANSFER_TO	Number of transfers a respondent took after surveyed route to Destination
TRANSFER_TO_1st	Name of first route (if taken)
TRANSFER_TO_2nd	Name of second route (if taken)
TRANSFER_TO_3rd	Name of third route (if taken)
Trip_in_Opposite_Direction	Did respondent / will respondent make this trip in exactly the opposite direction today
Opposite_Direction_Depart	Time when respondent took same trip in exactly opposite direction
FARE_DISCOUNT	Did respondent receive a discount for their fare?
FAIR_DISCOUNT_TYPE	What kind (of fare discount)?
YEARS_USING_CATS	How many years have respondent been using public transit in the Charlotte area?
REASONSTARTED_MOVEDTOAREA	Moved to the area within the last 3 years (Reason respondent started using public transit within the last 3 years)
REASONSTARTED_LYNXOPENED	The LYNX Blue Line light rail service (Reason respondent started using public transit within the last 3 years)
REASONSTARTED_EMPLOYERINCENT	Employer offers incentives to ride transit (Reason respondent started using public transit within the last 3 years)
REASONSTARTED_NEWJOB	Started a new job (Reason respondent started using public transit within the last 3 years)
REASONSTARTED_NEWSCHOOL	Started school (Reason respondent started using public transit within the last 3 years)
REASONSTARTED_LOSTJOB	Lost my job (Reason respondent started using public transit within the last 3 years)
REASONSTARTED_ENVIRONMENT	Environmental benefits (Reason respondent started using public transit within the last 3 years)
REASONSTARTED_SAVEMONEY	To save money (Reason respondent started using public transit within the last 3 years)
REASONSTARTED_NOCAR	Do not have a car (Reason respondent started using public transit within the last 3 years)
REASONSTARTED_OTHER	Other (specified by respondent) (Reason respondent started using public transit within the last 3 years)
TRANSPORT_ALTERNATIVE	If bus/rail service was not available, how would respondent make this entire one-way trip?
WORKING_VEHICLES	Number of working vehicles available in household
TOTAL_IN_HOUSEHOLD	Number of people live in respondent's household
LICENSE_IN_HOUSEHOLD	Number of people live in respondent's household that have a valid drivers license
DRIVER_LICENSE	Does respondent have a valid drivers license
STUDENT_STATUS	Is respondent a student?
SCHOOL_NAME	Name of the respondent's school
EMPLOYMENT_STATUS	What best describes respondents work status?
EMPLOYED_IN_HOUSEHOLD	Including respondent, how many people living in household are employed?
INCOME	Annual household income of the respondent
GENDER	Gender of respondent

Variable Values

Variable	Value	Label
MODE	1	Bus
	2	Rail
DIRECTION	1	In
	2	Out
SPANISH	1	Yes
	2	No
MOTOR_VH_AVAILABLE	1	Yes
	2	No
ORIGIN_PLACE_TYPE	1	Home
	2	Work
	3	College/University (student only)
	4	School (K-12) (student only)
	5	Shopping
	6	Airport (air passengers only)
	7	Doctor's appointment/hospital visit
	8	Restaurant (eat meal)
	9	Other
ACCESS_MODE	1	Walked
	2	Bicycled
	3	Was dropped off by someone
	4	Carpooled and parked
	5	Drove alone and parked
ACCESS_WALK_DISTANCE	1	short walk (less than 1/2 mi OR less than 10 minutes)
	2	medium walk (1/2 - 1 mile OR 10 - 20 minutes)
	3	long walk (>1 mile OR >20 minutes)
ACCESS_BICYCLED_DISTANCE	1	short ride (less than 1/2 mi OR less than 5 minutes)
	2	medium ride (1/2 - 2 miles OR 5 - 20 minutes)
	3	long ride (>2 mile OR >20 minutes)
ACCESS_CARPOOL_SIZE	1	One
	2	Two
	3	Three
	4	Four or more
DESTINATION_PLACE_TYPE	1	Home
	2	Work
	3	College/University (student only)
	4	School (K-12) (student only)
	5	Shopping
	6	Airport Air passengers only)
	7	Doctor's appointment/hospital visit
	8	Restaurant (eat meal)
	9	Other

EGRESS_MODE	1	Walk
	2	Bicycle
	3	Get picked up by someone
	4	Carpool with others
	5	Drive alone
EGRESS_WALK_DISTANCE	1	short walk (less than 1/2 mi OR less than 10 minutes)
	2	medium walk (1/2 - 1 mile OR 10 - 20 minutes)
	3	long walk (>1 mile OR >20 minutes)
EGRESS_BICYCLED_DISTANCE	1	short ride (less than 1/2 mi OR less than 5 minutes)
	2	medium ride (1/2 - 2 miles OR 5 - 20 minutes)
	3	long ride (>2 mile OR >20 minutes)
EGRESS_CARPOOL_SIZE	1	One
	2	Two
	3	Three
	4	Four or more
BOARD_TIME	1	Before 630 a.m.
	2	630 - 7 a.m.
	3	7 - 8 a.m.
	4	8 - 9 a.m.
	5	9 - 930 a.m.
	6	930 - 10 a.m.
	6	10 - 11 a.m.
	7	11 a.m. - 12 p.m.
	8	12 - 1 p.m.
	9	1 - 2 p.m.
	10	2 - 3 p.m.
	11	3 - 330 p.m.
	12	330 - 4 p.m.
	12	4 - 5 p.m.
	13	5 - 6 p.m.
	14	6 - 630 p.m.
	15	630 - 7 p.m.
	15	7 - 8 p.m.
	16	After 8 p.m.
PERIOD_FROM_BOARD_TIME	1	AM Peak (6:30-9:29am)
	2	Midday (9:30am-3:29pm)
	3	PM Peak (3:30-6:29pm)
	4	Evening (6:30pm-8:59pm)
TRANSFERS_FROM	0	None
	1	One
	2	Two
	3	Three or more

TRANSFER_TO	0	None
	1	One
	2	Two
	3	Three or more
Trip_in_Opposite_Direction	1	Yes
	2	No
Opposite_Direction_Depart	1	Before 6 a.m.
	2	6 - 7 a.m.
	3	7 - 8 a.m.
	4	8 - 9 a.m.
	5	9 - 930 a.m.
	6	930 - 10 a.m.
	6	10 - 11 a.m.
	7	11 a.m. - 12 p.m.
	8	12 - 1 p.m.
	9	1 - 2 p.m.
	10	2 - 3 p.m.
	11	3 - 330 p.m.
	12	330 - 4 p.m.
	12	4 - 5 p.m.
	13	5 - 6 p.m.
	14	6 - 630 p.m.
	15	630 - 7 p.m.
	15	7 - 8 p.m.
	16	After 8 p.m.
FARE_DISCOUNT	1	Yes
	2	No
FAIR_DISCOUNT_TYPE	1	Employer
	2	Youth/Student
	3	Senior/ADA
	4	Free Fare
YEARS_USING_CATS	1	Less than 3 years
	2	3 years or more
REASONSTARTED_MOVEDTOAREA	1	Yes
	2	No
REASONSTARTED_LYNXOPENED	1	Yes
	2	No
REASONSTARTED_EMPLOYERINCENTIVE	1	Yes
	2	No
REASONSTARTED_NEWJOB	1	Yes
	2	No
REASONSTARTED_NEWSCHOOL	1	Yes
	2	No
REASONSTARTED_LOSTJOB	1	Yes
	2	No
REASONSTARTED_ENVIRONMENT	1	Yes
	2	No

REASONSTARTED_SAVEMONEY	1	Yes
	2	No
REASONSTARTED_NOCAR	1	Yes
	2	No
TRANSPORT_ALTERNATIVE	1	I would not make this trip
	2	Walk/Bike
	3	Drive myself
	4	Get dropped off by someone
WORKING_VEHICLES	0	None (0)
	1	One (1)
	2	Two (2)
	3	Three (3)
	4	Four or more (4+)
TOTAL_IN_HOUSEHOLD	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+)
LICENSE_IN_HOUSEHOLD	0	Zero (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)
	10	Ten or More (10+)
DRIVER_LICENSE	1	Yes
	2	No
STUDENT_STATUS	1	Not a student
	2	Yes - Full Time college/university
	3	Yes - student, K thru 12th grade
	4	Yes - Part Time college/university
	5	Yes - Other
EMPLOYMENT_STATUS	1	Employed full-time (at least 35 hours per week)
	2	Employed part-time (less than 35 hours per week)
	3	Not currently employed, but not retired
	4	Retired

EMPLOYED_IN_HOUSEHOLD	0	Zero (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)
	10	Ten or More (10+)
INCOME	1	Less than $16,000
	2	$16,000 - $24,999
	3	$25,000 - $33,999
	4	$34,000 - $49,999
	5	$50,000 - $59,999
	6	$60,000 - $74,999
	7	$75,000 or more
	99	Refused / Would Not Provide
GENDER	1	Male
	2	Female