Southeast Michigan Council of Governments

2019
Regional On-Board Transit Survey
Final Report

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Executive Summary

Background

In the fall of 2018 and spring of 2019, the Southeast Michigan Council of Governments (SEMCOG), with consultant support from ETC Institute, conducted a regional on-board origin-destination (OD) survey of all fixed-route transit systems in Southeast Michigan. The transit systems surveyed were those operated by the Detroit Department of Transportation (DDOT), Suburban Mobility Authority for Regional Transportation (SMART), Ann Arbor Transportation Authority (AAATA), University of Michigan (UM), Detroit People Mover (DPM), Blue Water Area Transit (BWT), Lake Erie Transit (LET), MTA Flint (FLT), and the Q Line (QLN).

The main purpose of this on-board transit survey is to update SEMCOG's Travel Demand Forecasting Model. The data collected was able to provide valuable, current information on travel patterns and demographics for transit riders as well as service characteristics.

Survey tasks involved developing a sampling plan, designing the survey instrument, conducting a pilot test, processing the data in terms of weight, expansion, and analyzing, and reporting the results. Data collection was performed from December 2018 through June 2019. A total of 17,927 completed questionnaires were collected.

Survey Design and Administration

The survey design process consisted of SEMCOG and ETC Institute collaborating to update the questionnaire that was used for this project based on SEMCOG's 2010-11 on-board survey and develop a sampling plan that would ensure adequate data collection to perform analysis. The goal was to obtain at least 15,388 completed surveys which were allocated among the region's transit systems.

Upon approval of the questionnaire, a pilot survey was conducted to test the efficiency of the survey. The pilot was intended to be a test-run of the full-scale data collection and the results were then used to develop and finalize the data quality assurance and control (QA/QC) plan.

Comparisons are made later in this report to the 2010-11 survey conducted by a different research firm using a different collection methodology during a different economic time in the Southeast Michigan area. Any perceived insights when comparing the results of the two surveys should consider the significant differences between the collections. For example, 2010-11 survey was paper-based, and the current survey was largely collected using tablet PCs. One example of a comparison that should consider these differences in collections centers around transfer rates. The transfer rates in 2010-11 were different than the rates in the 2019 survey which may initially spark concern, however, by looking at the decomposition analysis (described in Section 3.4 of this report) it shows that the current dataset does an excellent job of representing the transfers that occurred in each system surveyed. Successful linked decomposition analysis at the overall systems level and higher volume routes levels suggests that the data collected properly represents transfers. Without decomposition analysis for the 2010-11 dataset, the same cannot be said for that project. Additionally, the Detroit area was going through a significant economic depression during the previous survey when compared to the current effort.

Quality Control and Data Processing

Quality control and data processing tasks included the entire QA/QC process, as well as tasks related to sample weighting and expansion.

The QA/QC process was an intensive effort performed jointly by ETC Institute and SEMCOG through all phases of the survey. Records were thoroughly examined for validity, with checks executed to search for and correct many potential logical, duplication, and other errors. Minimizing data errors and increasing accuracy helped maximize the number of usable survey surveys that were collected. In addition, SEMCOG performed an in-depth review of the data based on knowledge of the region and understanding of local travel.

Due to transit system characteristics in Southeast Michigan, for the Iterative Proportional Fitting (IPF) process to work properly for this survey, stop-level IPF input data needed to be aggregated. There were more stop locations where boarding and alighting activity occurred in the population than the boarding and alighting locations captured in the survey samples, spreading the available data very thin. To compensate, SEMCOG and ETC Institute developed and implemented a logical and practical stop aggregation approach that accommodated the IPF process and preserved observed travel patterns.

Along with the IPF weighting factor, the final expansion weight was also a function of factors that accounted for rider non-response on sampled trips and for trips that were not sampled. In addition, the final expansion weight considered expected ridership calculated at both the route level, direction, and time-of-day level.

Survey Results

ETC Institute created sets of statistics at both the regional level and the individual transit system level. These statistics focused on passengers' attitude towards the transit services, transit traveler's demographics, transit travel patterns, trip purposes, and service coverage and quality.

Since the region is considering higher level rapid transit service to complement current bus service in major road corridors, additional survey statistics were developed for the Woodward, Gratiot and Michigan Avenue corridors.

Most riders reported not having to use any additional transfer to make their trip (65.5%) while a nominal percentage of riders used two or more transfers to complete their trip (2.4%).

More than fifteen percent (16.4%) of transit riders are transit dependent and could not make the one-way trip without transit services. Just under half (45.9%) of all transit riders did not have access to a vehicle on the survey day, and this number increased to three-quarters in the Blue Water service area. Another one-third (36.8%) of riders in the SEMCOG region do not have a valid driver's license, and furthermore, twenty-eight percent (28.3%) of riders surveyed in the region were unemployed.

The SEMCOG region's transit systems primarily serve people with lower incomes. While each system varies, the survey found that on average sixty-five percent (65.2%) of riders were from households with an annual income of $50,000 or less, and that fifteen percent (15.4%) of riders were from households making less than $10,000 annually. Percentage of low-income riders vary, and it ranges from 2% to 31%, depending upon the system.

For travel characteristics, most transit trips made by riders either begin or end at home (83.8%), and forty-two percent (41.5%) of riders used transit for work-related purposes. To access transit, ninety percent (90.4%) of respondents walked to transit from their origin, and for egress ninety-five percent (95.0%) walked from transit to their destination. Finally, eighty-six percent (86.3%) of riders used transit three or more days per week.

1. Introduction

The Federal Transit Administration (FTA) requires accurate and valid transit usage forecasts for investment purposes, and so to support the demand models' data requirements, up-to-date on-board transit surveys that are fully compliant are needed. Therefore, the Southeast Michigan Council of Governments (SEMCOG), working with transit research consultant ETC Institute, conducted a regional on-board survey for the riders on line-haul fixed bus routes operated by the Detroit Department of Transportation (DDOT), Suburban Mobility Authority for Regional Transportation (SMART), Ann Arbor Transportation Authority (AAATA), University of Michigan Transit Service (UM), Blue Water Area Transportation Commission (BWT), Lake Erie Transit Commission (LET), the Detroit People Mover (DPM), MTA Flint (FLT), and the Q Line (QLN).

The purpose of conducting the 2019 on-board transit survey is to update SEMCOG's Travel Demand Forecast Model (TDFM) and enhance the transit and mode choice component based on previously noted changes. The data collected should provide valid and current transit rider travel patterns, demographic information, and transit service characteristics.

SEMCOG defined a set of criteria for a successful survey that includes the following:

- Proper coverage and representation of transit users and all regional transit service providers;
- Sampling plan and data collection methodology focusing on trip purposes and transit access/egress mode;
- Completeness of detail in the trip OD records collected, including accurate geocoding;
- Comprehensive and transparent documentation of all methods, procedures, and outcomes in the survey.

SEMCOG and transit providers will use this data to characterize and predict travel patterns of customers traveling on transit systems in Southeast Michigan. The collected data will also be essential for the enhancement of the mode choice component of SEMCOG's TDFM and for producing model output that follows the recommendations of federal funding programs. Anticipated applications of these survey data include:

- Enhancement of the transit and mode-choice components of the SEMCOG Regional TDFM,
- Compliance with the travel model recommendations and guidelines for applications,
- Identification of current levels of service,
- Establishing baseline information for boardings/alightings and transfer rates, and
- Identification of ridership patterns on local and express services.

The OD survey was conducted among riders of fixed route bus services for all SEMCOG systems using intercept surveys conducted via transit interviewers on the bus/rail lines. Data collection was conducted on weekdays (Monday through Thursday) from December 2018 through June 2019. A total of 17,927 usable surveys, as included in the final data files, were collected for the OD survey.

This report summarizes the survey methods and findings. Chapter 2 provides a description of the sampling approach and survey instrument, Chapter 3 provides the Survey procedures, Chapter 4 lists the Quality Control and Quality Assurance (QA/QC) procedures, Chapter 5 goes over the extensive expansion process, Chapter 6 shows the analysis of the survey results by system and corridor.

2. Survey Preparation

2.1 Sampling Plan

In order to account for all various systems and their ridership in the SEMCOG region, a sampling plan was developed prior to the data collection with collaboration between SEMCOG and ETC Institute for the most appropriate sample distribution.

The proposed sample plan was based on three main factors:

- First, the plan ensured that the sample adequately met data needs at the regional level;
- Second, the plan ensured the collection of adequate samples at various times of day. Times of day (TOD) are defined as AM Peak, Midday, PM Peak, and Evening/Early Morning time periods; and
- Third, the plan ensured that SEMCOG staff would have the ability to segment the sample on key variables, such as route, time of day, and direction.

The population ridership figures were gathered by each agency from periods meant to best approximate the expected ridership to be encountered during the field data collection. Based on previous discussions with FTA regarding best current practices, ETC Institute suggested a 10 percent sample proportional to population ridership as a starting point in the sample design. However, after further discussions, certain concessions were made for specific systems. One exception to the initial 10 percent plan was for UM transit due to its large volume of passengers and homogenous trip types. UM routes were sampled at 2.5 percent for intra-campus routes and 5 percent for inter-campus routes. LET routes were surveyed at 14 percent in order to reach a minimal 150 sample size.

The average weekday ridership referenced in Table 1 was gathered at the beginning of this survey project. This is for sample design only. During the survey project, more accurate ridership number will be collected, and these numbers will be used as benchmark or goal for survey sample expansion process.

The population ridership and base sample rates for each system are contained in Table 2-1 on the following page.

Table 2-1: Year 2019 Average Ridership by System

System	Average Weekday Ridership	Sampling Goals at 10% (UM at 2.5% and 5%, LET 14%)
DDOT	74,655	7,461
SMART	28,082	2,806
AAATA	25,269	2,527
QLine	3,368	337
DPM	4,214	421
LET	1,061	150
BWAT	3,212	321
UM	38,659	1,365
FLT	Unavailable	30
Total	178,520	15,418

2.1.1 DDOT and SMART Samples

Meetings were held with DDOT and SMART to better describe each route and route type as well as better understand trip characteristics. SMART serves a larger square mileage area which includes multiple cities and jurisdictions while DDOT only serves the city of Detroit. For this reason, DDOT tends to have less variety in their type of trips compared to SMART. In the previously conducted 2010-11 SEMCOG OB survey, the sample was drawn at a higher percent for SMART than for DDOT, however, in the 2019 on-board survey both DDOT and SMART were kept at a 10% sampling goal at the route level.

DDOT

A 10 percent sample produced a sample goal of 7,461, which is significantly higher than the 5,624 samples collected during the 2010-11 survey.

ETC Institute implemented a 10 percent sample goal for DDOT routes, as shown in Table 2-2 on the following page.

Table 2-2: DDOT 10 Percent Route Sample Goals

Route	Name	Average Daily Weekday Ridership	10% Ridership Sample
1	VERNOR	945	94
2	MICHIGAN	1,644	164
3	GRAND RIVER	6,142	614
4	WOODWARD	8,817	882
5	VAN DYKE/LAFAYETTE	2,279	228
6	GRATIOT	4,222	422
7	SEVEN MILE	5,420	542
8	WARREN	3,703	370
9	JEFFERSON	2,276	228
10	GREENFIELD	4,286	429
11	CLAIRMOUNT	320	32
12	CONANT	532	53
13	CONNER	508	51
15	CHICAGO/DAVISON	1,262	126
16	DEXTER	5,691	569
17	EIGHT MILE	5,397	540
18	FENKELL	1,658	166
19	FORT	994	99
23	HAMILTON	810	81
27	JOY	1,499	150
29	LINWOOD	767	77
30	LIVERNOIS	704	70
31	MACK	2,213	221
32	MCNICHOLS	2,419	242
38	PLYMOUTH	1,695	170
39	PURITAN	401	40
40	RUSSELL	396	40
41	SCHAEFER	800	80
42	MID-CITY LOOP	179	18
43	SCHOOLCRAFT	789	79
46	SOUTHFIELD	347	35
47	TIREMAN	303	30
52	CHENE	683	68
54	WYOMING	688	69
60	EVERGREEN	1,797	180
67	CADILLAC/HARPER	1,090	109
68	CHALMERS	468	47
80	VILLAGES DIRECT	141	14
89	SOUTHWEST DIRECT	66	7
92	ROSEDALE EXPRESS	152	15
95	RYAN EXPRESS	50	5
96	JOY EXPRESS	102	10
Total for DDOT		74,655	7,461

SMART

A 10 percent sample rate produced a sample goal of 2,806 as shown in Table 2-3 starting below and continuing on to the next page.

Table 2-3: SMART 10 Percent Route Sample Goals

Route	Name	Average Daily Weekday Ridership	10% Ridership Sample
125	FORT ST-EUREKA RD	1,346	135
140	SOUTHSHORE	219	22
160	DOWNRIVER	141	14
200	MICHIGAN AVENUE LOCAL	1,255	125
250	FORD RD	344	34
255	FORD RD EXPRESS	209	21
261	FAST MICHIGAN	651	65
275	TELEGRAPH	1,301	130
280	MIDDLEBELT SOUTH	282	28
330	GRAND RIVER-BEECH DALY	463	46
400	SOUTHFIELD - ORCHARD RIDGE	134	13
405	NORTHWESTERN HIGHWAY	335	34
415/420	GREENFIELD – SOUTHFIELD	922	92
430	MAIN STREET - BIG BEAVER	87	9
445	WOODWARD TELEGRAPH LIMITED	69	7
450/460	WOODWARD LOCAL	1,688	169
461/462	FAST WOODWARD	1,881	188
465	AUBURN HILLS LIMITED	41	4
494	DEQUINDRE	563	56
495	JOHN R	1,262	126
510/515	VAN DYKE	2,122	212
530	SCHOENHERR	104	10
550	GARFIELD	205	21
560	GRATIOT	3,190	319
561/563	FAST GRATIOT	1,947	195
562	FAST GRATIOT	52	5
567	NEW BALTIMORE/LENOX	-	-
580	HARPER	103	10
610	KERCHEVAL-HARPER	701	70
615	JEFFERSON	170	17
620	CHARLEVOIX	74	7
635	JEFFERSON EXPRESS	144	14
710	NINE MILE CROSSTOWN	1,602	160
730	TEN MILE CROSSTOWN	643	64
740	TWELVE MILE CROSSTOWN	1,128	113
752	PONTIAC - NORTH HILL FARMS	171	17
753	PONTIAC - BALDWIN RD	236	24
756	PONTIAC - PERRY – OPDYKE	157	16

Route	Name	Average Daily Weekday Ridership	10% Ridership Sample
760	13 MILE/14 MILE CROSSTOWN	664	66
780	15 MILE CROSSTOWN	638	64
805	GRAND RIVER PARK & RIDE	350	35
830	DOWNRIVER PARK & RIDE	205	21
849	NORTHLAND LOOP PARK & RIDE	19	2
851	WEST BLOOMFIELD - FARMINGTON HILLS PARK & RIDE	237	24
Macomb		27	2
Total for SMART		28,082	2,806

2.1.2 University of Michigan (UM) & AAATA

The system displaying the greatest level of similarity for travel characteristics is UM, making it the most appropriate system (and routes within a system) on which to reduce the sample size. Through discussions with UM, each route was characterized based on the trip types made. Routes were classified into two groups as follows:

1) Housing area to campus with trips made primarily by students (intra-campus trips), and
2) Campus to different campus, park and ride, and campus/hospital with trips made primarily by students (also faculty, staff, and patients).

For classifications 1 a lower percentage of trips were recommended based on trips overwhelmingly beginning and ending on campus with common trip types. A higher percentage was recommended for classification 2, as compared to 1, because of the drive access/egress at the park and ride lots, which allowed trips to either begin or end off of campus, thus showing a larger variation in trip type (note that these are still relatively homogeneous trips when compared to "standard" transit systems).

Using these classifications, ETC Institute suggested a 2.5 percent sample for classifications 1 (intra-campus trips) and a 5.0 percent sample for classification 2 (trips where either the origin or destination is off campus), as shown in Table 2-4, on the following page.

Table 2-4: UM 5.0 Percent and 2.5 Percent Route Sample Goals

Route	Classification	Average Daily Weekday Ridership	2.5% Route Sample Goal (Intra-campus trips), 5% (Off Campus)
Bursley Baits	1	13,294	332
Diag-to-Diag Express	1	1,467	37
Northwood	1	5,687	142
Northwood Express	1	1,858	46
Oxford Shuttle	1	405	10
Crisler Express	2	121	6
Commuter North	2	10,548	527
Med Express	2	2,606	130
North-East Shuttle	2	1,449	72
Wall Street Express	2	59	3
Wall Street-NIB	2	1,165	58
Total for UM		38,659	1,365

For AAATA, ETC Institute implemented a 10 percent sample goal for AAATA routes, as shown in Table 2-5 starting below and continuing on to the following page.

Table 2-5: AAATA 10 Percent Route Sample Goals

Route	Name	Average Daily Weekday Ridership	10% Ridership Sample
3	HURON RIVER	1,181	118
4	WASHTENAW	4,366	437
5	PACKARD	2,330	233
6	ELLSWORTH	2,261	226
21	AMTRAK-DEPOT	156	16
22	PONTIAC-DHU VARREN	919	92
23	PLYMOUTH	2,438	244
24	S MAIN-EAST	1,053	105
25	ANN ARBOR-SALINE RD	300	30
26	SCIO CHURCH	164	16
27	W STADIUM-OAK VALLEY	389	39
28	PAULINE	699	70
29	LIBERTY	336	34
30	JACKSON	637	64
31	DEXTER	361	36
32	MILLER-MAPLE	1,049	105
33	NEWPORT	166	17
41	EMU COLLEGE OF BUSINESS SHUTTLE	480	48
42	FOREST-MACARTHUR	494	49
43	E MICHIGAN AVE	300	30
44	ECORSE-TYLER	483	48
45	GROVE	402	40
46	HURON-TEXTILE	332	33

Route	Name	Average Daily Weekday Ridership	10% Ridership Sample
47	HARRIET-W MICHIGAN	237	24
60	U-M-DEXTER	259	26
61	AIRPORT-AVIS FARMS	10	1
62	U-M STATE	1,586	159
63	U-M-PONTIAC	118	12
64	GEDDES-E. STADIUM	205	20
65	U-M-DOWNTOWN-GREEN	601	60
66	CARPENTER-HURON PKWY	763	76
67	PLATT-MICHIGAN	30	3
68	HARRIS-FORD	40	4
81	YPSILANTI TWP EXPRESS	9	1
91	EXPRESSRIDE-CHELSEA	56	6
92	EXPRESSRIDE-CANTON	59	6
98	AIRRIDE	-	-
Total for AAATA		25,269	2,527

2.1.3 Other Transit Providers

The route level sample sizes for BWT are presented in Table 2-6 below, while the route level sample sizes for LET are presented in Table 2-7 on the following page. LET sample rates were set to collect a minimum of 150 completed interviews thus allocating the sampling rate to be 14%.

Table 2-6: BWT 10 Percent Route Sample Goals

Route	Average Daily Weekday Ridership	10% Ridership Sample
Route 1	471	47
Route 2	464	46
Route 3	359	36
Route 4	191	19
Route 5	574	57
Route 6	375	37
Route 9	441	44
ShopperShuttle	285	29
I-94 Express	6	1
I-94 Express	-	-
M-29 North	24	2
M-29 South	22	2
Total for BWT	3,212	321

Table 2-7: LET 14 Percent Route Sample Goals

Route	Name	Average Daily Weekday Ridership	14% Ridership Sample
2	Elm	109	15
3	Southeast	122	17
4	Seventh Street	129	18
5	Telegraph	164	23
6	Macomb	76	11
7	South Monroe	141	20
8	North Monroe	204	29
9	South Custer	117	16
Total for LET		1,061	150

2.1.4 Rail Transit DPM & Q Line

There are two rail transit systems in Detroit metro, DPM & the Q Line. To investigate system operation characteristics, a station-based approach was utilized. Surveyors conducted intercept interviews with passengers on the DPM & Q Line which were then allocated to the individual stations where the passengers boarded the vehicles. The station level goals are provided in Table 2-8 for the Detroit People Mover.

Table 2-8: DPM 10 Percent Station Sample Goals

Station	Average Daily Weekday Ridership	10% Ridership Sample
TIMES SQUARE	262	26
MICHIGAN AVE	292	29
FORT/CASS	136	14
COBO	238	24
JOE LOUIS ARENA	318	32
FINANCIAL DISTRICT	383	38
MILLENDER	215	22
RENAISSANCE CENTER	639	64
BRICKTOWN	143	14
GREEKTOWN	648	65
CADILLAC	319	32
BROADWAY	177	18
GRAND CIRCUS	444	44
Total for DPM	4,214	421

The route level sample sizes for the Q Line are represented in Table 2-9 below and were developed at the station level similar to DPM.

Table 2-9: Q Line 10 Percent Station Sample Goals

Station	Average Daily Weekday Ridership	10% Ridership Sample
CONGRESS STREET	767	77
CAMPUS MARTIUS	461	46
GRAND CIRCUS	219	22
MONTCALM STREET	131	13
ADELAIDE/SPROAT STREET	241	24
MLK/MACK AVENUE	243	24
CANFIELD STREET	348	35
WARREN AVENUE	271	27
AMSTERDAM STREET	67	6
FERRY STREET	148	15
BALTIMORE STREET	71	7
GRAND BOULEVARD	401	40
Total for QLN	3,368	337

2.2 Survey Instrument

During the survey design process, SEMCOG and ETC Institute collaborated to design the survey instrument (Appendix A). The survey was designed to obtain information in three major categories: OD travel patterns, usage information, and rider demographics. Interviewers who were bilingual were available to administer the survey in languages other than English depending on the language the passenger spoke. For those passengers who didn't speak English and didn't encounter a bilingual interviewer, the interviewer would record the refusal as "Didn't Speak English" and provide information to the passenger to collect a telephone number so someone from the ETC Institute call center could call back later.

The SEMCOG 2010 On-board Transit Survey practices and instrument were also considered during the instrument design stage.

3. Survey Administration/Process

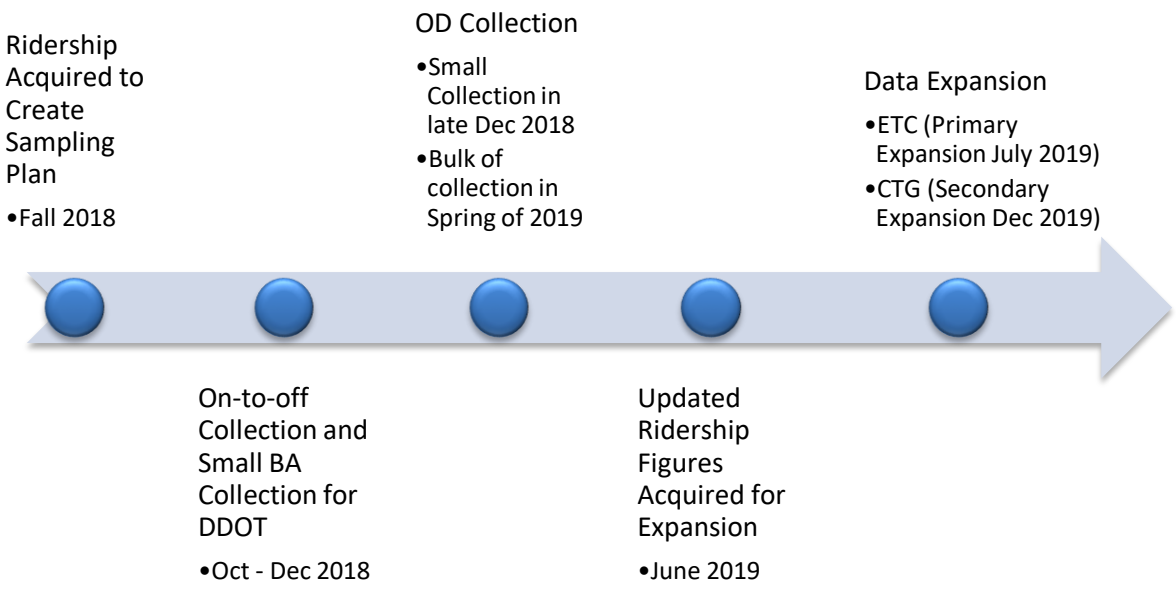
As proposed in the project RFP, the on-board transit Survey (OBTS) collects two sets of data:

1. Stop level On-Off ridership survey for passenger flow pattern, and
2. On-board transit O-D survey for travel characteristics.

This Chapter discusses the process of collecting stop level On-Off counts and transit travel characteristics (O-D survey), and project administration.

Figure 3-1 below shows the general timeline of the major project tasks.

Figure 3-1: Timeline of Major Project Tasks



3.1. Boarding and Alighting (BA) Counts

To effectively obtain On-Off flow patterns, the transit boarding & alighting counts (BA counts) at the stop level are also needed. These counts are usually obtained through APC data provided by transit providers, or through a separate collection effort to obtain.

While the original RFP suggested that BA counts could be collected to serve as a proxy for APC data for the expansion process, it was determined that this wasn't needed due to adequate APC data for all systems where this level of detail would benefit the expansion process.

For SMART and AAATA, the APC data was sufficient for stop-group level expansion. For the Qline, station level boarding and alighting APC counts were usable for expansion. For DPM, station level fare box boardings were available and used in conjunction with an O2O type data collection previously collected by AECOM to provide a proxy for APC data and O2O collection. For UM, stop level data was not available. However, based on the type of system and routes (large volume of passengers on homogenous sorter length trips) it was determined that the cost to collect a meaningful BA sample was not justified based on the utility it would provide to the expansion. For LET and BWT, stop level boarding and alighting were not available. Because the volume of passengers was so low for these systems, stop level data would not have provided any additional utility for the expansion.

For DDOT, the APC data was available, but ETC did collect data for DDOT in order to help them to validate their APC data and trip times. On a sample of trips ETC collected not only the BA counts, but

also collected on-time performance measures by capturing GPS locations at five seconds interval. Once this data was collected it was submitted to DDOT for their analysis.

3.2 Labor Recruitment and Training

Assembling a team of high-quality surveying staff was one of the most important steps in the survey administration process. ETC Institute collaborated with Stat Team to provide two groups of interviewers: On-to-Off surveyors and OD survey interviewers.

The training session focused on the survey purpose and objectives, the survey instrument, scripts on how to respond to passengers' questions, how to use data collection tools correctly, the random sampling protocol, instructions on how to conduct themselves when working with the public, and safety training. Survey staff were instructed to understand that while they were not SEMCOG employees, they were representing the agency while on transit vehicles or property, and that they always needed to act in a manner that reflected positively on SEMCOG. SEMCOG representatives also participated in the training session to provide an overview of the project as well as express their gratitude of the interviewers. There were additional training sessions conducted throughout the data collection process on an as-needed basis but with smaller groups.

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

3.3 On-to-Off Survey

3.3.1 On-to-Off Count Surveyor Roles

The On-to-Off count surveyors were responsible for the distribution and collection of the On-to-Off count cards. Typically, there were two surveyors assigned to each bus with one surveyor covering the front of the bus and a second surveyor positioned at the back of the bus. The surveyor at the front of the bus scanned and distributed bar-coded cards to boarding passengers while the surveyor at the back of the bus collected and scanned the cards as passengers alighted. The surveyors were equipped with handheld scanning devices to capture the boarding and alighting GPS locations and time stamps. The front door surveyor was designated "team leader". She/he communicated with the bus driver as needed. The rear door surveyor was the dedicated "note taker" who recorded any unusual activity, interruptions or delays on the route throughout the shift. This ensured there were no unexplained gaps in On-to-Off coverage. The note taker submitted daily shift notes to her/his supervisor at the end of each workday. The supervisor would then add those notes to an ongoing shift notes log maintained by the Field Supervisor throughout the project.

3.3.2 Training On-to-Off Surveyors

The ETC Institute field supervisor created the necessary training materials and conducted the On-to-Off training. The primary tool that was used for the training session was a PowerPoint presentation. The training went over the following details:

- Equipment use and set-up;
- Methodologies for collecting boarding and alighting pairs;
- The importance of achieving 100% coverage of the route;

- How to approach passengers;
- How to handle refusals;
- How to react in various situations that may be encountered; and
- Safety training.

Once surveyors had demonstrated that they could perform the On-to-Off counts, the surveyors were invited to field training. The field training provided hands on training that involved the actual conducting of the On-to-Off counts with all passengers. During the field training, surveyors were tested on their proficiency and were provided with additional coaching if needed. Any surveyor deemed unable to perform the On-to-Off count was replaced.

3.4 OD Interview Survey

3.4.1 Training OD Interviewers

The ETC Institute field supervisors created the training materials and conducted the OD training. The classroom training session included a PowerPoint presentation to explain the purpose and objectives of the survey, questionnaire content, interviewer procedures and requirements, random sampling protocol, survey logistics, how to maximize response rates (including difficult-to-survey passengers), and the data collection process in a step-by-step format. Other goals of the training included building interviewer staff confidence, helping interview staff feel that they are an important part of the survey's success and helping them understand the importance of the survey and the long-term benefits to their community.

ETC Institute ensured that the training addressed the following details:

- Tips on intercepting/interacting with non-English speakers and passengers with limited English proficiency;
- Cultural sensitivity;
- Importance of understanding the intent of the questions;
- Instructions on conveying the purpose of the survey to passengers;
- Importance of adhering to our random sampling protocol at the outset of every survey;
- Procedure for properly recording all refusals and completing a short observational assessment of the refusing passenger for internal purposes;
- Importance of data confidentiality and instruction on how to address passenger concerns regarding same;
- Overview of the SEMCOG system covering all topics covered in the tablet questionnaire with route-specific instruction as needed;
- How to handle passenger comments and complaints;
- Safety training.

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

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

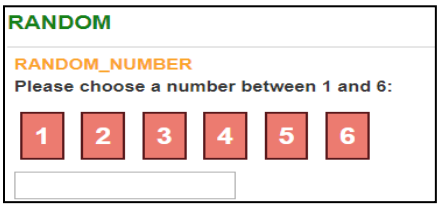
supervision, he/she was given a field test during which the prospective interviewer conducted surveys on his/her own. During this period, the interviewer's productivity and data quality were remotely assessed by ETC Institute's staff.

3.4.2 Selection of OD Survey Participants

For the OD surveys conducted by tablets, a random number generator (shown in Figure 3-2) was used to determine which passengers were asked to participate in the survey after boarding the surveying bus.

If six people boarded a bus, the tablet randomly generated a number from 1 to 6. If the answer was 2, the second person who boarded the bus was asked to participate in the survey. If the answer was 1, the first person was asked to participate in the survey, and so forth. The selection was limited to the first six people who boarded a bus/rail at any given stop to ensure the interviewer could keep track of the passengers as they boarded.

Figure 3-2: Random Number Generator



For example, if 20 people boarded a bus/rail, the tablet program would randomly pick one of the first six people for the survey. If the interview was refused by the randomly selected passenger, then the passenger who boarded before the passenger selected would be attempted (***after**, if 1 was elected*).

Respondents who did not have time to complete the survey during their bus trip or who spoke a language different from the interviewer were given the option of providing their phone numbers to conduct the survey at another time. Those who provided their phone numbers for call back were then contacted by ETC Institute's call center to complete the survey. Those interviewers that did speak the foreign language of the passenger translated the English tablet version and indicated which language the interview was conducted in.

3.4.3 OD Survey Procedure

All routes were classified as fixed routes and were surveyed using the tablet PC method. Fixed routes are routes that provide regular/continuous service throughout the day. A nominal number of routes on the SMART, AAATA, and BWT systems had routes that ran in the peak time periods only, which would be the AM Peak or PM Peak time periods. Typically, these routes are express routes and/or Park-and-Ride routes.

Interviewers selected people for the survey in accordance with the sampling procedures. Once an interviewer had employed random sampling protocol to identify the passenger to be surveyed, the interviewer:

- Approached the passenger who was identified and asked him or her to participate in the survey;
- If the person refused, the interviewer ended the survey, excused themselves and completed three observational questions;
- If the person agreed to participate, the interviewer asked the respondent if he/she had at least 5 minutes to complete the survey;

- If the person did not have at least 5 minutes on the bus/rail, the interviewer asked the person to provide his/her name and phone number for a later call back in the likely event that they alighted prior to completing the survey. A phone interviewer from ETC Institute's call center contacted the respondent and asked him/her to provide the information by phone. This methodology ensured that people who completed short trips on public transit were well represented. Most records were able to be completed on-board with only a nominal amount of records completed by phone;
- If the person had at least 5 minutes on the bus, the interviewer began administering the survey to the respondent as a face-to-face interview using a tablet.

3.4.4 OD Survey Administration Methodology

The tablet PCs were the preferred survey method as the tablet PCs have on-screen mapping features that allow for real-time geo-coding of addresses and places based off either address, intersection, or place searches using feedback from respondents. The respondents could then confirm the geocoded location based on the on-screen map that displayed the searched address/location via a Google Map indicator icon. In addition to using the mapping feature to collect the global positioning system coordinates of major survey locations (home address, origin address, destination address, boarding location and alighting location), the tablet PC also allowed the interviewer to walk through each question with the respondent. This allowed the interviewer to answer any questions as well as to ensure the accuracy of the data collected. The respondent could also select the answers to the questions directly on the tablet PC during the demographic section to allow for more privacy.

4. Survey Quality Control

This Chapter discusses how quality control (QC) measures are carried out for on On-Off survey and OD interview survey. Due to the complexity of the OD survey contents, QC process is more rigid.

The OD interview survey portion of the QC contains three areas: In-field QC, Preprocessing QC and post processing QC. Processing is defined as a series of operations (visual checks, logic checks, validations, etc.) conducted on the data set to eliminate records that do not meet the data quality threshold needed to be a part of the final dataset.

4.1 On-to-Off Counts Quality Control

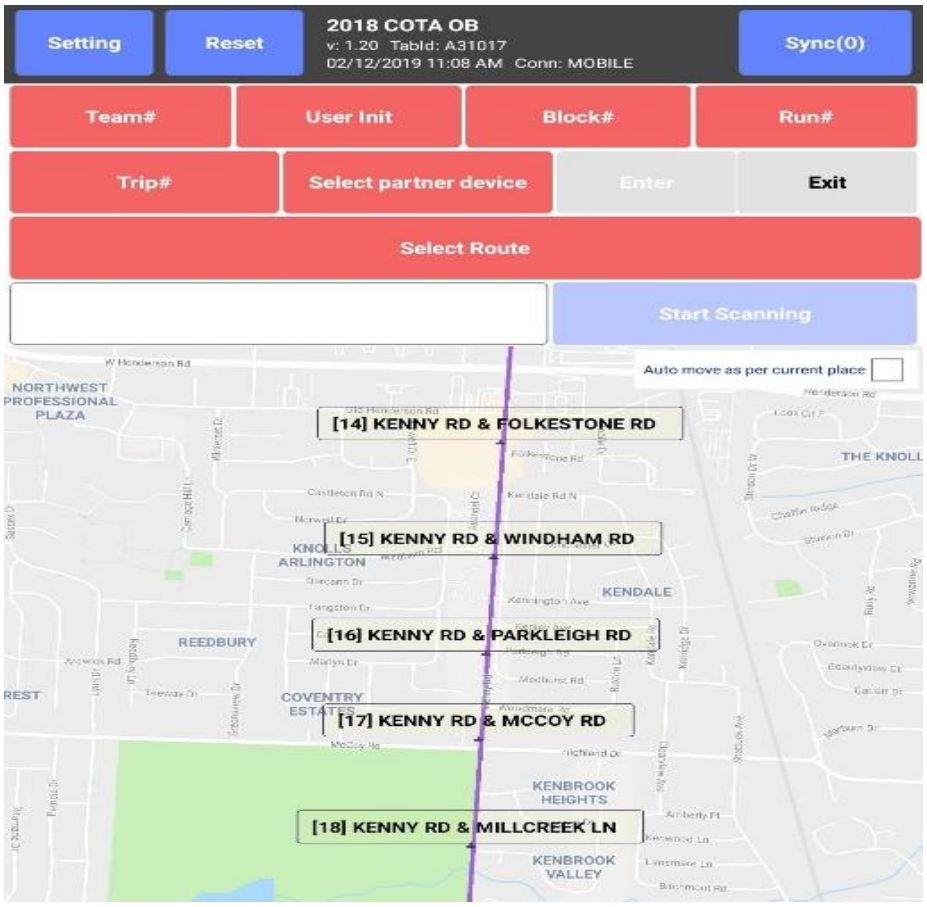
4.1.1 On-to-Off Counts Procedure

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

- Transit passengers were asked to participate as they entered the transit vehicle;
- Each passenger entering the bus was handed a barcoded card moments after the card was scanned by ETC Institutes on-board team member;
- Passengers were asked to keep the bar-coded card for the duration of their trip on that transit vehicle;
- Passengers were asked to hand their cards back as they exited the vehicle. The cards were scanned as the passengers exited the bus.

The On-to-Off software sent the scanned data to the On-to-Off server where a server-side processing system evaluated the data and paired up the boarding and alighting locations of each passenger based on the unique barcode, time stamps, and other variables. Before any collection took place, counter staff were trained on every aspect of the on-board process. Supervisory staff administered a variety of quality control checks during tablet set-up, including review of Route #, Team #, Block #, Run #, Bus #, and Partner Tablet ID #. The On-to-Off software was centered on a live map of the current transit route and associated stops. ETC Institute's on-board data collection staff could follow the map of the route and accurately select the passengers' boarding and alighting locations. Route termini were clearly marked on the map and the user was alerted when approaching a route terminus, where the session was closed, and a new session initiated when the bus/train began a new run. An example screenshot of the On-to-Off software is shown in Figure 4-1 on the following page.

Figure 4-1: On-to-Off Counts Software



4.1.2 On-to-Off Counts Pre-Processing Quality Assurance / Quality Control

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

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

4.1.3 On-to-Off Counts QA/QC Algorithm

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

- Route and Direction of the candidate scans should match; if one or both do not match, the reliability of the match is affected and marked

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

4.2 OD Survey In-Field Quality Assurance

The tablet PCs that were used to collect the Origin Destination (OD) survey data contained an on-screen mapping feature that allowed for real-time geocoding of locations based off of: address, intersection, or place searches gathered from feedback of respondents. The respondents then confirmed the geocoded location based on the on-screen map that showed the searched address/location via a Google Map indicator icon.

In addition to using the mapping feature to collect the GPS coordinates of major survey locations (home address, origin address, destination address, boarding location, and alighting location), the tablet PC program also allowed the interviewer to walk through each question with the respondent to answer any questions as well as to ensure appropriate interpretation of the survey questions.

Field supervisors or secret shoppers also rode on bus routes to gauge interviewers' demeanor, overall behavior, and adherence to protocols during interviews.

4.2.1 Field Supervisor Quality Checks

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

- Distribution of surveys by demographics;
- Distribution of surveys by trip characteristics;
- Length of each survey in minutes;
- Percentage of refusals.

In addition to daily reviews of demographic responses, length, etc., a comprehensive weekly report was created at the direction of the field supervisors which included a detailed itemized breakdown of each interviewer's performance for the week, specifically analyzing distribution of survey responses in relation to the norm. The supervisor would take the corrective action, then add a dated note to the weekly report describing in detail the remedial action taken. The same supervisor would be assigned to follow-up on the issue with the interviewer in question during the current week. If the corrective plan did not prove successful, the interviewer was removed from the schedule, either temporarily pending supplemental training or permanently, where such action was deemed appropriate by the field supervisor.

The online survey database that stores all the data collected in the field allows for connection to multiple Business Intelligence (BI) dashboards. They were instantly able to view the number of records completed by route, time period, and direction, which supports effective management of sampling goals. Individual interviewer data reviews were typically completed while the interviewer is on the bus/train and the findings were discussed with that interviewer when they checked in with the supervisor. This allowed the research team to provide immediate feedback to interviewers to improve their overall performance.

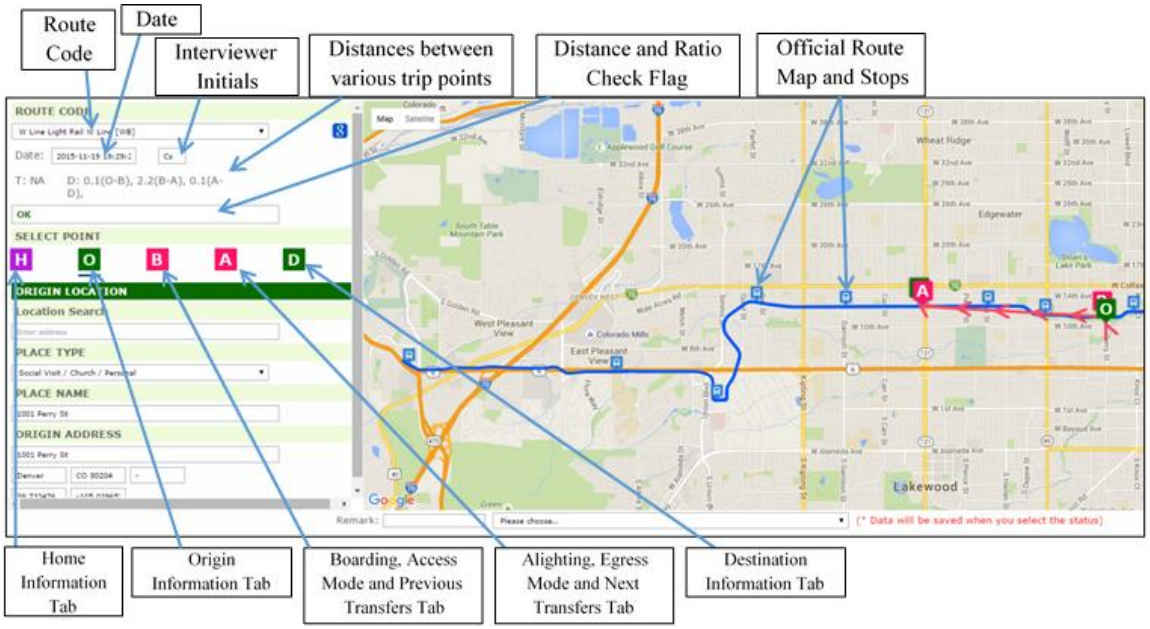
ETC Institute's field supervisors routinely conducted spot checks on assigned bus routes and made unannounced visits to stops and stations. Supervisors also utilized anonymous "secret shoppers" to pose as passengers on buses to check up on staff attitude, appearance, performance, and compliance with ETC Institute rules and procedures. Also, field supervisors could verify if an interviewer was on their assigned route by viewing the displayed geographic locations of where the interviews were taking place as well as track productivity and data accuracy down to the second it occurred. These checks ensured data integrity and helped identify any interviewer who was falling short of our standards for field survey collection.

4.2.2 Field Supervisor Online Review Tool

In addition to being able to review various breakdowns of data, Field Supervisors were also able to review each individual record. This was typically done in the field as a way to make sure that trip data was being collected accurately by individual interviewers. Another benefit of Field Supervisors being able to look up individual records by interviewer in database/spreadsheet form, is that it allowed them to call survey respondents in order to check on the accuracy of the data collected, as well as the job performance of the interviewer. Field Supervisors were also able to visually review individual records by using the non-editable version of the online visual review tool. This tool allowed Field Supervisors to see a visual representation of individual surveys.

An example screenshot of the Field Supervisor's version of this online tool is shown in Figure 4-2 on the following page.

Figure 4-2: Online Visual Review Tool



4.2.3 Call Center Field Checks

ETC Institute has an in-house call center that conducts random quality control check calls for each transit project. These calls are similar to the calls made by Field Supervisors just on a larger scale. The call center can conduct hundreds of quality control calls to respondents per project on a weekly basis. The goal of the call is to identify any missing or incorrect elements in the interview as well as gather any feedback regarding the interviewer's job performance during the interview.

4.2.4 Process for Identifying Complete Records

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

- Route used
- Direction of route
- Time of trip
- Home address
- Origin address
- Destination address
- Origin type place
- Destination type place
- Access mode
- Egress mode
- Boarding location
- Alighting location

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

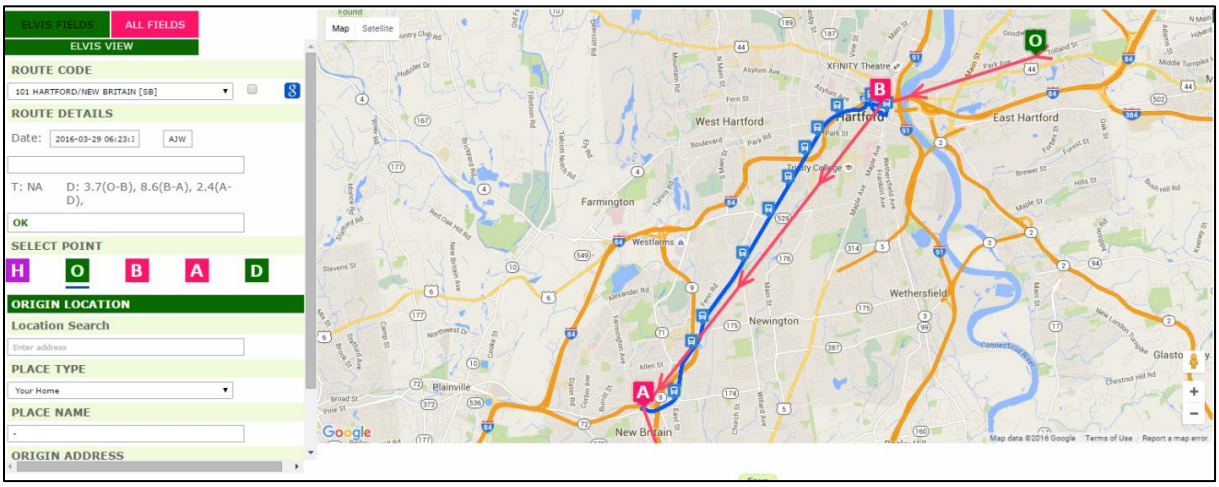
4.2.5 ETC In-Office Online Visual Review Tool

ETC Institute has a dedicated team of employees whose main priority is reviewing and editing completed records through the use of an online visual review tool. One of their other key responsibilities is the process of calling and completing "Callback" surveys. Callback surveys are surveys that were unable to be completed in the field. The "Callback" surveys were conducted within a week of when the initial survey began so that the information of the trip could be more easily be recalled by the respondent.

The Transit Review Team reviewed all complete records collected for the survey, paying special attention to records that were automatically flagged by the online visual review tool. Prior to making edits to any survey, they first attempted to contact the respondent to clarify any questionable answer choices regarding the trip. If no contact was made, or if contact was not possible, the following actions were taken.

For the people in ETC office, ETC Institute has created an online visual review tool that allows for the review of all completed records within the database. This tool shows all components of each individual trip as well as a series of preprogrammed distance and ratio checks as described on subsequent pages. After directions were finalized, the next step was to run each record through the Speed/Distance/Time checks. The figure below is an example of the online visual review tool. It is very similar to the online visual review tool used by Field Supervisors described previously, with the additional functionality of being able to review all aspects of the survey as well as being able to make edits when appropriate. The office online review tool is illustrated in Figure 4-3 on the following page.

Figure 3-3: Online Visual Review Tool – 2nd Example



4.3 Pre-Processing Distance Checks

A series of distance and ratio checks are preprogrammed into the online visual review tool in order to allow for ETC Institute's team of Transit Reviewers to take a more systematic approach in reviewing complete records. The Transit Review Team's process for editing surveys is described in a later section. *Note: The distance and ratio checks described were meant to alert the reviewer that closer evaluation was needed. It did not necessarily indicate that the record was inaccurate or unusable.*

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

4.3.1 Access/Egress Mode Distance Check

Table 4-1 on the following page shows the distance checks for access (Origin to Boarding stop location), and egress modes (Alighting stop location to Destination).

Table 4-10: Distance Checks for Access and Egress Modes

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

4.3.2 Origin to Destination Distance Check

Table 4-2 below shows the distance checks based on the origin and destination locations.

Table 4-2: Distance Checks Based on the Origin and Destination Locations

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

4.3.3 Boarding and Alighting Distance Check

Table 4-3 below shows the distance checks based on the boarding and alighting locations.

Table 4-3: Distance Checks on the Boarding and Alighting Locations

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

4.4 Pre-Processing Ratio Checks

After all transfer checks were completed, the next step in this process involved the application of a series of QA/QC Ratio Checks.

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

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

Lastly, the distance between alighting and destination was divided by the distance between origin and destination. If the rider had a high ratio for this check it meant that the alighting to destination distance was excessive compared to the origin to destination.

Table 4-4 below describes in more detail the ratio checks used, and the conditions in which a record would be flagged.

Table 11-4: Ratio Checks

Ratio Checks	Check	Result of Formula	Condition 1	Condition 2	Flag?
Boarding to Alighting distance divided by Origin to Destination distance	Boarding to Alighting Distance/Origin to Destination Distance	the result of this formula is 1.5 or greater			Yes
	Boarding to Alighting Distance/Origin to Destination Distance	the result of this formula is less than .3	Access and Egress modes are both Walk/Wheelchair/Skateboard	There are NO transfers involved in the trip	Yes
	Boarding to Alighting Distance/Origin to Destination Distance	the result of this formula is less than .3	Access or Egress mode - **ANY USE OF A VEHICLE**		No
	Boarding to Alighting Distance/Origin to Destination Distance	the result of this formula is less than .3	There is at least one transfer involved in the trip		No
Origin to Boarding distance divided by Origin to Destination distance	Origin to Boarding Distance/Origin to Destination Distance	the result of this formula is 1 or greater	there is at least one transfer from origin to boarding		No
	Origin to Boarding Distance/Origin to Destination Distance	the result of this formula is 1 or greater	Access Mode - **ANY USE OF A VEHICLE** (ie, dropped off, rode with others, drove, taxi...)		No
	Origin to Boarding Distance/Origin to Destination Distance	the result of this formula is 1 or greater	Access Mode - Walk/Wheelchair/Skateboard	There are no transfers from origin to boarding	Yes
Alighting to Destination divided by Origin to Destination	Alighting to Destination Distance/Origin to Destination Distance	the result of this formula is 1 or greater	there is at least one transfer from alighting to destination		No
	Alighting to Destination Distance/Origin to Destination Distance	the result of this formula is 1 or greater	Egress Mode - **ANY USE OF A VEHICLE** (ie, will get picked up, ride with others, drive, taxi...)		No
	Alighting to Destination Distance/Origin to Destination Distance	the result of this formula is 1 or greater	Egress Mode - Walk/Wheelchair/Skateboard	There are no transfers from alighting to destination	Yes

4.4.1 Pre-Processing General Issues and Actions

Table 4-5 below describes the general issues that could occur within a trip where changes may have been appropriate.

Table 4-5: General Issues

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

4.5 Post-Processing Additional Checks

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

Non-trip related checks included:

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

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

4.5.1 Post-Processing Quality Assurance / Quality Control

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

4.5.2 Directional Check

Following the boarding and alighting stop locations being geocoded, the direction of travel for each record was confirmed. Stop locations and IDs were then updated based on established direction. Table 4-6 shows actions that were taken if the direction was incorrect.

Table 4-6: Directionality of Record

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

4.5.3 Speed/Distance/Time Check

After directions were finalized, the next step was to run each record through the Speed/Distance/Time checks. If any of the conditions in the table on the following page, were met, the record was flagged for further review.

Table 4-12: On-to-Off Check Name

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

5. Survey Weighting and Expansion

After the survey, the OD survey sample data needs to be expanded to the ridership benchmarks or expansion goals. The ratio between the expansion goal and OD survey sample data is called weighting factor. SEMCOG OBTS data were expanded by route, direction, time-of-day, and by segments containing the boarding and corresponding alighting location of the passenger.

For the OD interview survey, about 10% of the riders were surveyed with OD information. These samples created a base for expansion.

In survey sample design stage, estimated ridership at route level was used to determine number of samples needed for each survey stratum. Earlier in this report, the ridership goals used were based on estimated ridership figures provided in the fall of 2018. During the OD data collection period, more accurate ridership data was collected and updated by various agencies. The updated ridership benchmark was then used for expansion purposes described in this section.

The following sections describe the methodology that was used to develop the weighting factors for unlinked transit trips.

5.1 Expansion Types and APC Segmentation

5.1.1 Expansion Types

To establish ridership benchmarks or expansion goals, the survey team collected at least one of the three types of ridership data:

1. Route and stop level boarding and alighting counts, usually from APC data provided by service provider. The data was then cleaned and consolidated by ETC survey team.
2. Estimated route level ridership data from transit providers.
3. Stop level on-to-off passenger flow pattern, and those accounted approximately 30% of the system flow.

Depending on the availability of ridership benchmark data, four types of data expansion can be defined at route level.

- Type 1: APC data and On-Off data.
- Type 2: APC data only
- Type 3: On-Off data only
- Type 4: Route level ridership only

All types of expansion are conducted at the route, time period, and direction level. Some more rudimentary expansion occurs when the level of ridership information is of a lower resolution.

Table 5-1 below is an illustration on each of the four OD data expansion types and how it is related to the availability of the ridership data collected.

Table 5-1: Expansion Types Relating to Ridership Data

Expansion Types	Benchmark/Expansion Goal			Samples
	APC Data	On-Off Data	Route Level Ridership	OD Survey Data
Type I	X	X		X
Type 2	X			X
Type 3		X		X
Type 4			X	X

Since Type 3 expansion was not utilized for this project, only Type 1, 2 and 4 are discussed in the subsequent sections.

5.1.2 Route Segmentation for Both APC and On-to-Off Data

When survey data expansion goals are created, they are typically based upon a percentage of the average weekday ridership for the routes in the system. These are further broken down by time periods and directions. The time periods that are created (e.g., 9 am to 3 pm) are based off the specific needs of SEMCOG systems.

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

There are two methods ETC Institute uses to create segments for bus routes:

1. Boarding percentages of the route from APC data by direction, and
2. Based on the number of stops for the route and direction

When possible, segmenting routes using APC data is the preferred way to segment routes as opposed to segmenting routes based on the number of stops. Since the second method of creating segments for bus routes was not utilized for this project only the first method is discussed in the subsequent section.

Routes with both APC data and On-to-Off counts are separated based on direction, then divided into three segments based on the total boardings. The three-segment approach was based on ETC Institute's practice in the past, while other variations of segmenting might be possible.

After approximately one-third of the route's total APC ridership has boarded, a new segment begins. After approximately two-thirds of the route's total APC ridership has boarded the third segment begins. This approach uses boarding numbers as a standard to define segments.

Figure 5-1 is a simplified example of APC Data Segmenting for a route with both APC data and On-to-Off counts.

Figure 5-1: Route Segmenting - APC Provided Routes with On-to-Off Counts

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

Note: For IPF to work properly, the overall boarding totals must match the overall alighting totals. For this reason, APC alightings are adjusted using a multiplying factor in order to make sure their overall totals match the overall boarding totals. These are typically nominal alterations, however, if there are significant differences in boarding and alighting totals by direction of a route, it may require additional review of the functionality of the route to ensure that the surveys are both collected and expanded appropriately.

5.1.3 Route Segmentation with APC Only

If On-to-Off counts are not collected, but APC data is available, those routes are typically segmented into 2 segments by time period and direction boarding totals. The reason for that is you can only accurately determine the flows between two segments when you only have APC data. Those routes are segmented similarly to the process above with the main difference being that the second segment begins after approximately half of the route's total APC ridership has boarded. When a route is segmented in half, you have the possibility of three boarding to alighting cell combinations: boarding segment 1 to alighting segment 1, boarding segment 1 to alighting segment 2, boarding segment 2 to alighting segment 2.

Boarding segment 2 to alighting segment 1 is not possible as that would indicate the individual was traveling in the opposite direction. Also, some route directions may only receive 2 segments if one stop (generally the first boarding stop for the specific route direction) has an inordinately high boarding percentage of greater than 50%.

When you have 3 segments you have twice (6) the number of possible boarding to alighting pair combination possibilities.

5.2 Type 1 Data Expansion

5.2.1 Approach

Of the four types of bus expansion discussed, Type 1 Expansion is the preferred method as it incorporates all three types of data available.

Typically, On-to-Off data collection is reserved for more heavily traveled routes, so this type of expansion was conducted on the more heavily traveled routes in the system and occurred after route stops were divided into three segments based on total boarding distribution by direction. The APC daily ridership totals were provided by the appropriate agencies. The segments were then appended to both the On-to-Off counts and the OD data.

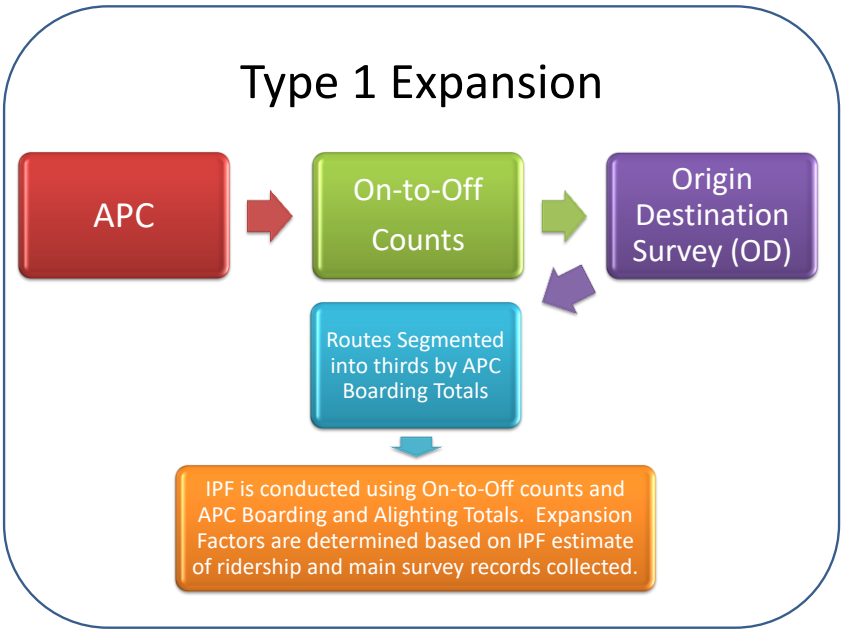
Once segments were attached, the On-to-Off trip flow table from the survey was then expanded to APC established total ridership benchmarks. This is done through an IPF process.

During the IPF process, the On-to-Off data serves as the "Seed" data while the APC boarding and alighting counts serve as the totals or "Benchmarks" that the On-to-off data is expanded to. After those two pieces of data finish going through the IPF process the result is a final estimate of ridership flows between segment pairs for that route, direction, and time period. These final estimated segment to segment pair ridership flow counts are then divided by the corresponding number of OD surveys in the same segment to segment pair.

In the subsequent explanation of expansion types, IPF is utilized where possible. IPF is an algorithm ETC Institute utilizes to balance the differences between the ridership projected from the On-to-Off counts and the APC ridership for each segment.

Figure 5-2 is an illustration of the Type 1 expansion process.

Figure 5-2: Type 1 Expansion



5.2.2 Type 1 Expansion Example: On-to-Off to APC

Once the segments were appended to the On-to-Off counts, APC data, and OD Survey databases, the records were ready for expansion.

The On-to-Off counts serve as the seed data in the IPF process while the APC boarding totals and alighting totals serve as the marginal totals that the On-to-Off counts are expanded to. IPF process is used here to properly expand observed On-to-Off flow pattern examples to the APC based benchmark.

Figure 5-3 shows an example of the segmented results for the On-to-Off counts that were administered for a certain route, direction, and time period. Each row in the table identifies the segment where passengers boarded the bus. The columns in the table identify where passengers alighted the bus. For example, 20 of the On-to-Off counts had passenger boarding in segment 2 and alighting in segment 3. This is an upper triangular matrix with 6 elements as travel on the segments is all one way.

Figure 5-3: Seed Matrix from Results of the On-to-Off Survey

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

Table 5-2 is an example of APC based boarding and alighting ridership totals by segment. In the IPF process, these numbers used as marginal goals to perform proportional fitting.

Table 5-2: APC Boarding and Alighting Totals by Segment

Route Example, Eastbound (6-9AM) From APC				
Average Weekday Ridership	SEG 1	SEG 2	SEG 3	Total
Boarding (Row. Margin)	100	100	120	320
Alighting (Col Margin)	20	100	200	320

Combining Figure 5-3 and Table 5-2 together, Table 5-3 gives a complete picture on how On-to-Off data and APC data are connected.

In Table 5-3, the Adjustment factors are multipliers, or gap, between surveyed On-to-Off ridership (samples) and APC ridership totals (expansion goals) for each row and column. The surveyed On-to-Off numbers are highlighted.

Table 5-3: Iteration 0 - Initial Input Matrix

Segments	SEG 1	SEG 2	SEG 3	On-Off Total	Boarding Total	Adjustment
SEG 1	5.0	15.0	40.0	60.0	100	1.667
SEG 2		25.0	20.0	45.0	100	2.222
SEG 3			10.0	10.0	120	12.000
On-OFF Total	5.0	40.0	70.0	115.0		
Alighting Total	20	100	200		320	
Adjustment	4.000	2.500	2.857			

The IPF is an iterative process with two steps per iteration: fitting for boarding and fitting for alighting. In the example, boarding numbers are selected to do the fitting first. For each row, the On-to-Off numbers in Table 5-3 are multiplied with corresponding Adjustment factor in that Row.

Table 5-4 is a display on how the initial On-to-Off seed matrix in Table 5-3 looks like after Iteration 1 of row fitting. The resulting On-to-Off matrix elements are also highlighted.

Table 5-4: Iteration 1 - On-to-Off Rows to Match Boarding Totals

Segments	SEG 1	SEG 2	SEG 3	On-Off Total	Boarding Total	Adjustment
SEG 1	8.3	25.0	66.7	100.0	100	1.000
SEG 2		55.6	44.4	100.0	100	1.000
SEG 3			120.0	120.0	120	1.000
On-OFF Total	8.3	80.6	231.1	320.0		
Alighting Total	20	100	200		320	
Adjustment	2.400	1.241	0.865			

Same approach was used for column fitting. For each column, the On-to-Off numbers in Table 5-4 were multiplied with corresponding Adjustment factor in that Column.

Table 5-5 is a display on how the On-to-Off flow matrix displayed in Table 5-4 looks like after Iteration 1 of column fitting. The resulting On-to-Off matrix elements are highlighted. Compare to Table 5-3 on Row totals, the Adjustment factors in Table 5-5 are much smaller. The IPF process seems converged quickly.

Table 5-5: Iteration 1 - On-to-Off Columns to Match Alighting Totals

Segments	SEG 1	SEG 2	SEG 3	On-Off Total	Boarding Total	Adjustment
SEG 1	20.0	31.0	57.7	108.7	100	0.920
SEG 2		69.0	38.5	107.4	100	0.931
SEG 3			103.8	103.8	120	1.156
On-OFF Total	20.0	100.0	200.0	320.0		
Alighting Total	20	100	200		320	
Adjustment	1.000	1.000	1.000			

After 7 iterations, the On-to-Off totals matched both boarding and alighting totals perfectly. Table 5-6 shows the results. Again, the resulting On-to-Off trip matrix is highlighted.

Table 5-6: Iteration 7 - Final IPF Output

Segments	SEG 1	SEG 2	SEG 3	On-Off Total	Boarding Total	Adjustment
SEG 1	20.0	32.0	48.0	100.0	100	1.000
SEG 2		68.0	32.0	100.0	100	1.000
SEG 3			120.0	120.0	120	1.000
On-OFF Total	20.0	100.0	200.0	320.0		
Alighting Total	20	100	200		320	
Adjustment	1.000	1.000	1.000			

5.2.3 Type 1 Expansion Example: OD to On-to-Off

Once expanded, the On-to-Off trip matrix then became the new expansion goal for OD survey samples to be expanded to. The calculation is rather simple process as shown in Figures 5-4 through 5-6. Figure 5-4 is the On-to-Off flow matrix served as target for expansion.

Figure 5-4: Final On-to-Off Flow Matrix

Route: Example Eastbound (6am-9am)				
Segment	Total	1	2	3
1	100	20	32	48
2	100	0	68	32
3	120	0	0	120
Total	320	20	100	200
DIFFERENCE FROM ACTUAL ALIGHTINGS	0	0	0	0

The actual number of OD records completed for each boarding to alighting segment pair is shown in Figure 5-5. To calculate the expansion factors, the final estimate of ridership between segments shown in Figure 5-4 was divided by the actual number of OD records collected, as shown in Figure 5-5. This calculation produces the expansion factors shown in Figure 5-6. For example, the 32 estimated passengers projected to board in segment 2 and alight in segment 3 were divided by the 10 OD records to produce an expansion factor of 3.15 to be applied to records who board in segment 2 and alighting in segment 3 as shown in Figure 5-6.

Figure 5-5: Number of Completed OD Survey Samples

Route: Example Eastbound (6am-9am)				
Segment	Total	1	2	3
1	32	3	9	20
2	17		7	10
3	8			8
Total	57	3	16	38

Figure 5-6: Weighting Factors

Route: Example Eastbound (6am-9am)				
Segment	Boarding Segment Expansion Factors	1	2	3
1	3.13	6.67	3.50	2.42
2	5.88	0.00	9.78	3.15
3	15.00	0.00	0.00	15.00
Alighting Segment Expansion Factors	5.61	6.67	6.25	5.26

5.2.4 Summary of Routes Using Type 1 Expansion

Not all the routes in the survey universe were expanded using Type 1 expansion approach due to the data availability. The following Table 5-6 shows expanded routes using the Type 1 expansion method described in this section.

Table 5-7: Routes Expanded Using Type 1 Expansion

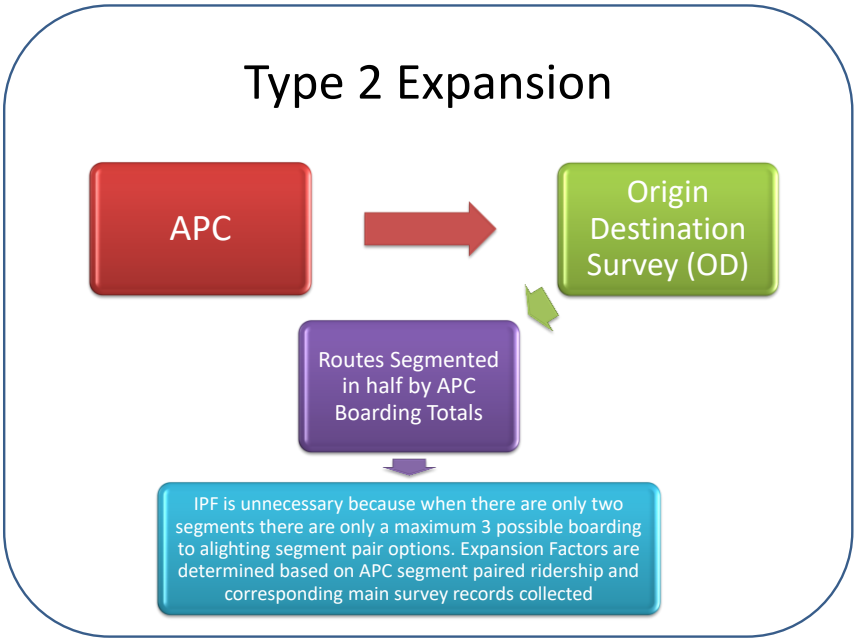
Agency	Route	Expansion Type
DDOT	DDOT 2 - MICHIGAN	Type 1
DDOT	DDOT 3 - GRAND RIVER	Type 1
DDOT	DDOT 4 - WOODWARD	Type 1
DDOT	DDOT 5 - VAN DYKE/LAFAYETTE	Type 1
DDOT	DDOT 6 - GRATIOT	Type 1
DDOT	DDOT 7 - SEVEN MILE	Type 1
DDOT	DDOT 8 - WARREN	Type 1
DDOT	DDOT 9 - JEFFERSON	Type 1
DDOT	DDOT 10 - GREENFIELD	Type 1
DDOT	DDOT 15 - CHICAGO/DAVISON	Type 1
DDOT	DDOT 16 - DEXTER	Type 1
DDOT	DDOT 17 - EIGHT MILE	Type 1
DDOT	DDOT 18 - FENKELL	Type 1
DDOT	DDOT 27 - JOY	Type 1
DDOT	DDOT 31 - MACK	Type 1
DDOT	DDOT 32 - McNICHOLS	Type 1
DDOT	DDOT 38 - PLYMOUTH	Type 1
DDOT	DDOT 60 - EVERGREEN	Type 1
DDOT	DDOT 67 - CADILLAC/HARPER	Type 1
SMART	SMART 125 - FORT ST-EUREKA RD	Type 1
SMART	SMART 200 - MICHIGAN AVENUE	Type 1
SMART	SMART 275 - TELEGRAPH	Type 1
SMART	SMART 495 - JOHN R	Type 1
SMART	SMART 560 - GRATIOT	Type 1
SMART	SMART 710 - NINE MILE	Type 1
SMART	SMART 740 - TWELVE MILE	Type 1

Qline	Qline	Type 1
AAATA	The Ride 23 - Plymouth	Type 1
AAATA	The Ride 24 - South Main - East	Type 1
AAATA	The Ride 3 - Huron River	Type 1
AAATA	The Ride 32 - Miller - Maple	Type 1
AAATA	The Ride 4 - Washtenaw	Type 1
AAATA	The Ride 5 - Packard	Type 1
AAATA	The Ride 6 - Ellsworth	Type 1
AAATA	The Ride 62 - U-M - State	Type 1

5.3 Type 2 Expansion: OD Data to APC Data

For Type 2 expansion, On-to-Off counts are not collected; however, these routes still have APC data available. This type of expansion divides the stops into ***two*** segments based on total boarding distribution by direction. Iterative Proportional Fitting (IPF) is unnecessary because when there are only 2 segments there are only a maximum of 3 possible boarding to alighting segment pair options. The boarding and alighting counts by segment pair can be determined without the need for IPF.

Figure 5-7: Type 2 Expansion



After the segmentation process, the segments were then appended to the APC dataset and OD dataset. The next step was to determine how much ridership belonged into each paired boarding to alighting segment for each route, direction, and time period. The figure below shows an example of what the segments look like after being appended to the APC data for the appropriate route, direction, and time period.

Figure 5-8: Segments Example for Type 2 Expansion

Route X Eastbound during the AM Peak			
Stops	Boardings	Alightings	Segment
Stop 1	15	0	1
Stop 2	3	3	1
Stop 3	5	4	1
Stop 4	3	7	1
Stop 5	3	3	1
Stop 6	4	3	2
Stop 7	3	4	2
Stop 8	10	5	2
Stop 9	8	10	2
Stop 10	7	5	2
Stop 11	1	8	2
Stop 12	0	10	2
	62	62	

In Figure 5-8 on the previous page, you can see the boardings and alightings for each stop along with the segments. With two segments you have four possible boarding to alighting pair options:

a. boarding segment 1 to alighting segment 1,
b. boarding segment 1 to alighting segment 2,
c. boarding segment 2 to alighting segment 2, and
d. boarding segment 2 to alighting segment 1

Option "d.", boarding segment 2 to alighting segment 1, is not possible as that means the rider would be going in the opposite direction. In the case of this example, the rider would be heading westbound if they boarded segment 2 and alighted on segment 1.

To make discussion easier, Table 5-8 summarizes boarding and alighting by segment based on Figure 5-8.

Table 5-7: Boarding and Alighting Segment Summary

Segments	Boarding	Alighting
1	29	17
2	33	45
Sum	62	62

To determine the ridership among all segment pairs, boarding segment 1 to alighting segment 1 was examined first. This was simple to determine as the alightings for those stops associated with segment 1 equals 17. These 17 people who alighted in segment 1 must have boarded on stops within segment 1, so boarding to alighting pair (1 to 1) for this route, time period, and direction has 17 boardings and 17 alightings.

For boarding to alighting segment pair 1 to 2, the total boardings at segment 1 are 29. Among those 29 boardings, 17 of those have already allocated to boarding to alighting segment pair 1 to 1. The leftover number of boardings is 12 for segment pair 1 to 2.

For boarding to alighting segment pair 2 to 2, the total boardings at segment 2 are 33. Those riders must have alighted within segment 2, and it is not possible to alight at segment 1. This determines boardings and alightings at segment pair 2 to 2 are 33.

Final boarding and alighting trip matrix can be seen in Table 5-9. Again, due to directional flow in transit ridership for the route examined, the matrix is an upper triangular matrix with only three elements.

Table 5-8: Sample Trip Matrix Derived from APC Counts

Segments	1	2	Total
1	17	12	29
2		33	33
Sum	17	45	62

Once target trip table is settled, final step in the process is simply to append the appropriate boarding and alighting segments to each record in the OD dataset based on route, direction, time period, boarding location, and alighting location. The weighting factors were then calculated using the same approach that was discussed in Type 1 expansion sections.

For example, there are 12 APC observed riders boarded from segment 1 and alighted at segment 2. Meanwhile, there are 4 OD samples surveyed in the same travel segment. The weighting factor would be 12 / 4 = 3.0

These unlinked weight factors were then appended to the OD dataset, summed by route, direction, and time period to ensure that the total summed unlinked weight factors matched the provided APC boardings by route, direction, and time period.

Table 5-10 is a list of routes expanded using the Type 2 expansion method described in this section.

Table 5-9: Routes Expanded Using Type 2 Expansion

Agency	Route	Expansion Type
DDOT	DDOT 1 - VERNOR	Type 2
DDOT	DDOT 11 - CLAIRMOUNT	Type 2
DDOT	DDOT 12 - CONANT	Type 2
DDOT	DDOT 13 - CONNER	Type 2
DDOT	DDOT 19 - FORT	Type 2
DDOT	DDOT 23 - HAMILTON	Type 2
DDOT	DDOT 29 - LINWOOD	Type 2
DDOT	DDOT 30 - LIVERNOIS	Type 2
DDOT	DDOT 40 - RUSSELL	Type 2
DDOT	DDOT 43 - SCHOOLCRAFT	Type 2
DDOT	DDOT 46 - SOUTHFIELD	Type 2
DDOT	DDOT 47 - TIREMAN	Type 2
DDOT	DDOT 52 - CHENE	Type 2
DDOT	DDOT 68 - CHALMERS	Type 2
DDOT	DDOT 80 - VILLAGES DIRECT	Type 2
DDOT	DDOT 89 - SOUTHWEST DIRECT	Type 2
DDOT	DDOT 92 - ROSEDALE EXPRESS	Type 2
DDOT	DDOT 95 - RYAN EXPRESS	Type 2
DDOT	DDOT 96 - JOY EXPRESS	Type 2
SMART	SMART 140 - SOUTHSHORE	Type 2
SMART	SMART 160 - DOWNRIVER	Type 2
SMART	SMART 250 - FORD RD	Type 2
SMART	SMART 255 - FORD RD EXPRESS	Type 2

Agency	Route	Expansion Type
SMART	SMART 261 - FAST MICHIGAN	Type 2
SMART	SMART 280 - MIDDLEBELT SOUTH	Type 2
SMART	SMART 330 - GRAND RIVER BEECH DALY	Type 2
SMART	SMART 400 - SOUTHFIELD - ORCHARD RIDGE	Type 2
SMART	SMART 405 - NORTHWESTERN HIGHWAY	Type 2
SMART	SMART 430 - MAIN STREET / BIG BEAVER	Type 2
SMART	SMART 445 - MAPLE / TELEGRAPH LIMITED	Type 2
SMART	SMART 465 - NORTHFIELD HILLS / AUBURN HILLS LIMITED	Type 2
SMART	SMART 494 - DEQUINDRE	Type 2
SMART	SMART 530 - SCHOENHERR	Type 2
SMART	SMART 550 - GARFIELD	Type 2
SMART	SMART 562 - FAST GRATIOT	Type 2
SMART	SMART 580 - HARPER	Type 2
SMART	SMART 610 - KERCHEVAL-HARPER	Type 2
SMART	SMART 615 - JEFFERSON	Type 2
SMART	SMART 620 - CHARLEVOIX	Type 2
SMART	SMART 730 - TEN MILE	Type 2
SMART	SMART 752 - NORTH HILL FARMS	Type 2
SMART	SMART 753 - BALDWIN RD	Type 2
SMART	SMART 756 - PERRY-OPDYKE	Type 2
SMART	SMART 760 - THIRTEEN MILE-FOURTEEN MILE	Type 2
SMART	SMART 780 - FIFTEEN MILE	Type 2
SMART	SMART 805 - GRAND RIVER PARK AND RIDE	Type 2
SMART	SMART 830 - DOWNRIVER PARK AND RIDE	Type 2
SMART	SMART 851 - OCC - NORTHLAND PARK & RIDE	Type 2
AAATA	The Ride 22 - Pontiac - Dhu Varren	Type 2
AAATA	The Ride 26 - Scio Church	Type 2
AAATA	The Ride 29 - Liberty	Type 2
AAATA	The Ride 30 - Jackson	Type 2
AAATA	The Ride 43 - E Michigan Ave	Type 2
AAATA	The Ride 45 - Grove	Type 2
AAATA	The Ride 46 - Huron - Textile	Type 2
AAATA	The Ride 60 - U-M - Dexter	Type 2
AAATA	The Ride 64 - Geddes - E Stadium	Type 2
AAATA	The Ride 65 - U-M - Downtown - Green	Type 2
AAATA	The Ride 66 - Carpenter - Huron Pkwy	Type 2
AAATA	The Ride 67 - Platt - Michigan Ave	Type 2
AAATA	The Ride 81 - Ypsilanti Twp Express	Type 2
AAATA	The Ride 91 - ExpressRide: Chelsea	Type 2
AAATA	The Ride 92 - ExpressRide: Canton	Type 2
SMART	SMART 415 - GREENFIELD - SOUTHFIELD	Type 2 [415/420 merge]
SMART	SMART 420 - GREENFIELD - SOUTHFIELD	Type 2 [415/420 merge]
SMART	SMART 450 - PONTIAC - SOMERSET	Type 2 [450/460 merge]
SMART	SMART 460 - PONTIAC - SOMERSET	Type 2 [450/460 merge]

Agency	Route	Expansion Type
SMART	SMART 461 - FAST WOODWARD	Type 2 [461/462 merge]
SMART	SMART 462 - FAST WOODWARD	Type 2 [461/462 merge]
SMART	SMART 510 - VAN DYKE	Type 2 [510/515 merge]
SMART	SMART 515 - VAN DYKE	Type 2 [510/515 merge]
SMART	SMART 515 - VAN DYKE LIMITED	Type 2 [510/515 merge]
SMART	SMART 561 - FAST GRATIOT	Type 2 [561/563 merge]
SMART	SMART 563 - FAST GRATIOT	Type 2 [561/563 merge]

5.4 Type 4 Expansion: OD Data to Route Level Ridership

For routes that ***only*** have OD survey data and route level ridership estimates, Type 4 expansion is utilized.

For this type of expansion there is no stop level APC data available. For this reason, a more rudimentary form of expansion must take place. The level of granularity for average daily ridership that can be provided from the agency determines the level of granularity for which expansion can occur. For example, when average daily ridership figures were available by route, time period, and direction the number of OD surveys captured for that route, time period, and direction were directly divided into the corresponding ridership provided. Alternatively, when average daily ridership figures were only available for the entire route and not broken down into time period or direction, the number of OD surveys captured for that route were directly divided into the corresponding ridership provided.

Table 5-11 lists the routes expanded using the Type 4 expansion method described in this section.

Table 5-10: Routes Expanded Using Type 4 Expansion

Agency	Route	Expansion Type
DDOT	DDOT 39 - PURITAN	Type 4
DDOT	DDOT 41 - SCHAEFER	Type 4
DDOT	DDOT 42 - MID-CITY LOOP	Type 4
DDOT	DDOT 54 - WYOMING	Type 4
SMART	SMART 635 - JEFFERSON EXPRESS	Type 4
UMT	UM TRANSIT Bursley Baits	Type 4
UMT	UM TRANSIT Commuter North	Type 4
UMT	UM TRANSIT Commuter South	Type 4
UMT	UM TRANSIT Crisler Express	Type 4
UMT	UM TRANSIT Diag-to-Diag Express	Type 4
UMT	UM TRANSIT Med Express	Type 4
UMT	UM TRANSIT North-East Shuttle	Type 4
UMT	UM TRANSIT Northwood	Type 4
UMT	UM TRANSIT Northwood Express	Type 4
UMT	UM TRANSIT Oxford Shuttle	Type 4
UMT	UM TRANSIT Wall Street-NIB	Type 4
UMT	UM TRANSIT Wall Street Express	Type 4
DPM	Detroit People Mover	Type 4
AAATA	The Ride 21 - Amtrak - Depot	Type 4
AAATA	The Ride 25 - Ann Arbor - Saline Rd	Type 4
AAATA	The Ride 27 - W Stadium - Oak Valley	Type 4
AAATA	The Ride 28 - Pauline	Type 4
AAATA	The Ride 31 - Dexter Ave	Type 4
AAATA	The Ride 33 - Newport	Type 4
AAATA	The Ride 41 - EMU College of Business	Type 4
AAATA	The Ride 42 - Forest - MacArthur	Type 4
AAATA	The Ride 44 - Ecorse - Tyler	Type 4
AAATA	The Ride 47 - Harriet - W Michigan	Type 4
AAATA	The Ride 61 - Airport - Avis Farms	Type 4
AAATA	The Ride 63 - U-M - Pontiac	Type 4
AAATA	The Ride 68 - Harris - Ford	Type 4

5.5 Discussion on Weighting & Expansion

5.5.1 General Rules

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

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

For example, if the sampling percentage is 10% for a route, then the guideline weight factor would be [1 / (10%)) * 3] = 30, so the guideline weight factor for that route would be 30. If a sampling percentage is 7.5% it would be 40 since [1 / (7.5%) * 3] = 40.

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

5.5.2 Linked Trip Weighting Factors for All Records

Most of the discussion in this Chapter is on unlinked trips. However, the linked-trip expansion factor helps to account for the number of transfers that were made by each passenger, so the linked expansion factors should better represent the overall system. Linked expansion factors are generated after the unlinked expansion factors are created. The equation that is used to calculate the linked trip multiplying factor is shown below:

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

If a passenger did not make a transfer, the linked trip multiplying factor would be 1.0 because the person would have only boarded one vehicle. If a person made two transfers, the linked trip expansion factor would be 0.33 because the person would have boarded three transit vehicles during his/her one-way trip. An example of how the linked trip expansion factors were calculated, and subsequent example results, are provided in Figure 5-9.

Figure 5-2: Calculations for Linked Weight Factors

Number of Transfers	Calculation [1/(1+Number of Transfers)]	Linked Trip Multiplying Factor	Unlinked Weight Factor	Linked Weight Factor
0	[1/(1+0)]	1	3	3
1	[1/(1+1)]	0.5	3	1.5
2	[1/(1+2)]	0.33	3	0.99
3	[1/(1+3)]	0.25	3	0.75

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

Table 5-12 below provides an overall view of how the various weighting factors impacted the raw survey counts:

Table 5-11: Overall View of Weighting Factors

Number of OD Surveys Collected	17,927
OD Surveys Weighted Using Unlinked Weight Factors (Represents Average Daily Boardings)	168,623
OD Surveys Weighted Using Linked Weight Factors (Represents Estimated Average Daily Trips)	139,375

5.5.3 Decomposition Analysis

Decomposition analysis measures the overall representativeness of the survey records relative to linked and unlinked trips on an individual route basis. Self-enumeration surveys have historically suffered from substantial errors in route level boarding levels when linked trips were determined by simply dividing the boarding factor by one plus the number of transfers. For example, in systems with both local bus and urban rail routes, the survey typically displayed significant differences in how many local bus riders indicated that they had transferred to/from urban rail compared to the same statistic measured from those who were interviewed on an urban rail route. Difficult decisions had to be made regarding what was the actual value of such transfers.

The advent of the personal interview, coupled with tablet technology, and more effective management of surveyors has greatly reduced this issue. The decomposition analysis examines each record and the recorded sequence of routes, and tabulates boardings for each route, using this information. After all records have been examined, total boardings by route are summarized and compared with the observed level of boardings. The result of this analysis will help to determine the relationship between observed and estimated boardings by route.

The decomposition analysis below and on the following pages show the summed link factors for the routes for which the survey was conducted along with the summed linked weight factors for those same routes that was captured in transfer information for both previous transfers and transfers that would occur after the rider alighted the route they were being surveyed on. The findings from the decomposition analysis show that the overall results for the onboard survey do an excellent job of representing the system. The routes that deviate the farthest from the summed linked factors compared to the observed counts are typically the routes that are expected to deviate the most as they are low volume ridership routes and therefore have a higher inherit error probability. The higher volume routes that were surveyed (routes over 2,000 daily boardings) which make up over sixty percent (61.4%) of the project's ridership, once summed, are extremely close to the overall ridership for those routes as seen in Figure 5-10 below.

Figure 5-3: Higher Volume Routes (Linked Weight Decomposition)

*Higher Volume Routes (Routes over 2,000 daily boardings)								
	Sum of Linked Weights							
Route	Route Surveyed	Previous Transfers	Next Transfers	Total Summed Linked	Transfer Rate	Observed Boardings	Total Difference	Percentage Difference
*Higher Volume Routes	88,229.4	7,288.6	8,040.9	103,558.9	17.39%	103,573.6	14.7	0.01%

This is an excellent outcome for this type of analysis. The figure on the following page shows the decomposition analysis for each system that was surveyed.

The linked decomposition analysis by system is also extremely good. The only system that had a percentage difference of greater than 5% was the QLine. However, considering that the QLine system only consists of one route and that route is only around 1,500 boardings per day on average, the percentage difference for the route is very reasonable.

Figure 5-4: System Totals (Linked Weight Decomposition)

System Totals

	Sum of Linked Weights							
SYSTEM	Route(s) Surveyed	Previous Transfers	Next Transfers	Total Summed Linked	Transfer Rate	Observed Boardings	Total Difference	Percentage Difference
Blue Water	2,114.0	434.4	501.9	3,050.4	43.69%	3,037.7	(12.7)	-0.42%
DDOT	51,179.2	8,164.0	8,860.5	68,203.7	33.40%	68,272.5	68.8	0.10%
Detroit People Mover	4,227.6	72.9	80.6	4,381.1	8.76%	4,597.9	216.8	4.72%
MTA Flint	295.3	-	-	295.3	1.59%	300.0	4.7	1.57%
LET	755.7	108.4	224.3	1,088.4	44.03%	1,088.4	-	0.00%
Qline	1,513.3	90.9	109.3	1,713.5	5.22%	1,592.3	(121.2)	-7.61%
SMART	18,994.5	2,947.3	2,827.7	24,769.4	29.72%	24,639.5	(129.9)	-0.53%
AAATA	21,113.5	2,373.1	1,998.3	25,484.9	18.34%	24,985.1	(499.8)	-2.00%
UMT	39,181.6	154.9	273.2	39,609.7	2.37%	40,109.5	499.8	1.25%
Total	**139,374.7**	**14,345.8**	**14,875.9**	**168,596.4**	**20.99%**	**168,622.9**	**26.4**	**0.02%**

5.5.4 Secondary Expansion

CTG conducted the secondary expansion for the AAATA and DDOT systems. Primary survey expansion occurs shortly after fieldwork. A weight is calculated for each record so that the sum of the weights across all records equals the systemwide ridership. In a similar way, primary expansion weights can be calculated for each route, time period, and direction.

Secondary expansion is the process of re-weighting the primary survey weights records by selected categories to correct for natural or unavoidable anomalies in survey sampling. Where independent counts by trip or rider types are available, secondary expansions provide results more accurate than the primary expansion. Rider and trip types can include elementary school trips, university student trips, park-ride trips, bicycle access trips, and other classifications where count data is available.

Independent count data was provided by AAATA and DDOT for the purpose of conducting a secondary expansion. Both datasets provided enough detail to re-weight the survey records for K-12 (both AAATA and DDOT) and university students (AAATA only). While secondary expansion was attempted for the other major systems in the region, those transit agencies did not have control data that could be used to conduct this effort.

A more detailed description of the secondary expansion process is contained in Appendix B.

5.6 Limitations of the Data

While quality checks on the data, such as the linked decomposition analysis, suggest that the data collected and the expansion process were of extremely high quality, there are still limitations.

For example, ETC Institute's process for creating segments focuses on the overall daily boardings for routes by direction. Creating segments this way has the potential to misrepresent the alightings for a particular route and direction.

To show an example of what can happen, below is a table that shows some On-to-Off data in a matrix after it has been segmented. As you can see there are no On-to-Off counts in the boarding segment 1 and alighting segment 1 pair. One possible reason for not collecting any On-to-Off counts in that particular boarding to alighting segment pair is because perhaps no one can actually alight that quickly on that route in that direction. In other words, if the first boarding stop were 33% of the overall boardings for that route and direction, through the current segmentation process it would have resulted in the first boarding stop receiving its own segment. With alightings not being possible on the first boarding stop of a route that is directional, you will not be able to capture any On-to-Off records. This results in a need to collapse the boarding segment 1 and alighting segment 1 paired cell into an adjacent cell, which means there are fewer segment to segment pair possibilities, which can potentially weaken your expansion for this route and direction.

Figure 5-5: Limitation of Segmentation Example

Route X Eastbound

Boardings \ Alightings	1	2	3
1	0	5	8
2		8	9
3			8

A similar limitation of the segmentation is that since the segments are made based on the entire day, it is possible that specific time of day variations may also be misrepresented.

There are other types of segmentation options available such as: 1) focusing on alightings instead of boardings, 2) averaging boarding and alightings before creating segments, 3) focusing more on land use, and so on. All of the different segmentation approaches have benefits and negatives. One possibility in future research could be the use of multiple types of segmentation approaches which could be used to create different sets of weight factors to be utilized for more individualized purposes.

Another limitation of the data is the ridership figures to which the data is ultimately expanded to. APC data is currently the best data available to expand to. The problem with this data is that different APC vendors can capture counts through various methods and output data in different structures. This data also tends to be quite "noisy" as the counters can interpret 1 person getting on and off the bus 5 times as 5 different people. This data can as well sometimes be slow to incorporate the addition of new stops and the removal of discontinued stops.

6. Analysis: Survey Results by System

The fully weighted and expanded SEMCOG data were used to create the following analyses, displayed in three separate sections. The first section displays system level frequencies of the survey questions, while the second section focuses on the Woodward, Gratiot, and Michigan corridors. For the third section, the SEMCOG and Greater Detroit area were compared against other major metropolitan areas where similar surveys have recently.

All tables are based on the secondary expansion numbers conducted by CTG and are showing the sum of the linked weight factors except where stated otherwise.

6.1 Regional Data Summary and Analysis

A total of 18,495 questionnaires from seven transit agencies were completed for the survey. The tables in the following section display the weighted frequency of responses to the survey based on the linked weight factors unless noted otherwise. The first question presented to respondents on the survey was the fare payment method they used for their one-way trip. This question was set up to be specific to the service passengers were using. Passengers that were using the DDOT service had the highest for a Regular fare type that was used on their one-way trip. AAATA riders were the next highest to use a regular fare type, while SMART had the highest percentage for using a senior fare payment.

Across the region, just over half of the surveyed trips are made 3-5 days per week, with just under a third being made more often. If the transit system was not available, 30 percent of riders would try to get a ride with someone else, a quarter percent would get a ride with someone else, and only 13 percent would drive their household vehicle. Unlike most transit systems, over half of the SEMCOG transit ridership population have a valid driver's license, although this is not the case for the DDOT service, where riders are more likely to not have one. Almost half of SEMCOG riders are from zero-vehicle households, however, UM service riders were more likely to have one or more vehicles in their household. The majority of SEMCOG riders come from households making less than $25,000 per year.

6.1.1 Survey Results by System

Riders on UMT service routes were the most likely to get to their destination with zero additional bus/train (95.5%). Out of the various systems, BWT riders are more likely to need more than one transfer to get to their destination (13.0%).

Table 6-1: Total Transfers by System (based on secondary unlinked weight factors)

System	Total Transfers				
	None	One	Two	Three or More	Total
AAA	67.8%	31.5%	0.7%	0.0%	**100.0%**
BWT	36.6%	50.4%	11.5%	1.5%	**100.0%**
DDT	50.7%	45.7%	3.6%	0.1%	**100.0%**
DPM	84.4%	13.7%	1.8%	0.0%	**100.0%**
FLT	95.1%	4.9%	0.0%	0.0%	**100.0%**
LET	35.9%	56.5%	7.7%	0.0%	**100.0%**
QLN	89.4%	10.0%	0.6%	0.0%	**100.0%**
SMD	55.0%	42.1%	2.8%	0.1%	**100.0%**
UMT	95.5%	4.3%	0.3%	0.0%	**100.0%**
Regional Statistics	**65.5%**	**32.1%**	**2.3%**	**0.1%**	**100.0%**

"Your HOME" was the most common origin place type respondents were coming from (49.0%) with "Your usual WORKPLACE" being the second most common place overall (18.5%). FLT was the highest percentage of system services coming from "Your usual WORKPLACE" (45.2%) compared to the regional statistics. The Other category was used to categorize any origin place type that was indicated less than 2.0% of the time including, but not limited to, School (K-12), Your HOTEL, and Airport (passengers only).

Table 6-2: Origin Purpose by System

System	Origin Trip Purpose									
	Your HOME	Your usual WORKPLACE	College or University (student only)	Social or recreational	Personal business	Shopping	Work related	Medical / dental	Other	Total
AAA	51.9%	18.2%	9.4%	5.2%	4.6%	4.1%	1.0%	1.8%	3.7%	**100.0%**
BWT	50.0%	11.3%	1.2%	7.6%	5.5%	13.4%	0.2%	5.5%	5.1%	**100.0%**
DDT	46.1%	22.5%	1.3%	7.4%	7.1%	4.0%	2.7%	3.2%	5.7%	**100.0%**
DPM	33.8%	18.3%	0.1%	14.1%	5.4%	1.6%	12.2%	0.1%	14.4%	**100.0%**
FLT	53.9%	45.2%	0.0%	0.9%	0.0%	0.0%	0.0%	0.0%	0.0%	**100.0%**
LET	55.4%	8.4%	1.2%	5.9%	6.4%	18.5%	0.0%	3.3%	0.9%	**100.0%**
QLN	35.4%	19.1%	5.5%	7.9%	10.5%	3.8%	3.5%	3.0%	11.4%	**100.0%**
SMD	51.7%	25.7%	0.7%	4.3%	6.2%	4.8%	2.1%	1.9%	2.5%	**100.0%**
UMT	51.9%	10.2%	31.0%	2.5%	0.7%	0.5%	1.0%	0.6%	1.7%	**100.0%**
Regional Statistics	**49.0%**	**18.5%**	**10.8%**	**5.5%**	**4.7%**	**3.3%**	**2.1%**	**2.0%**	**4.1%**	**100.0%**

Most riders walk to access the various transit systems (90.1% overall). Of the other types of access used to get from respondent's origin to transit, "Drove alone and parked" was the second highest used overall (5.1%) followed by "Was dropped off by someone going someplace else" (2.0%). Out of all the systems, FLT was least likely to walk and more likely to use another form of transportation to reach transit. The Other category was used to categorize any access mode that was indicated less than 2.0% of the time including, but not limited to, Drove or rode with others and parked, Personal Bike, and Wheelchair / scooter.

Table 6-3: Access Mode by System

System	Access				
	Walk	Drove alone and parked	Was dropped off by someone going someplace else	Other	Total
AAA	92.9%	3.0%	0.8%	3.3%	**100.0%**
BWT	96.5%	0.0%	2.3%	1.2%	**100.0%**
DDT	95.2%	0.1%	2.7%	2.0%	**100.0%**
DPM	77.4%	13.7%	0.1%	8.8%	**100.0%**
FLT	50.4%	7.6%	21.8%	20.2%	**100.0%**
LET	98.6%	0.0%	1.0%	0.4%	**100.0%**
QLN	92.2%	3.6%	0.6%	3.7%	**100.0%**
SMD	87.6%	2.9%	5.7%	3.8%	**100.0%**
UMT	84.1%	13.5%	0.1%	2.3%	**100.0%**
Regional Statistics	**90.1%**	**5.1%**	**2.0%**	**2.8%**	**100.0%**

"Your HOME" was the most common destination place type overall (34.8%) followed by "Your usual WORKPLACE" (23.0%). Of the various systems, UMT had the highest percentage of respondent's travelling to "College or University (student only)" (47.0%) and LET had the highest percentage of respondent's travelling to "Shopping" (29.1%). The Other category was used to categorize any origin place type that was indicated less than 2.0% of the time including, but not limited to, School (K-12), Your HOTEL, and Airport (passengers only).

Table 6-4: Destination Purpose by System

System	Destination Trip Purpose										
	Your HOME	Your usual WORKPLACE	College or University (student only)	Social or recreational	Personal business	Shopping	Dining / eating out / coffee	Work related	Medical / dental	Other	Total
AAA	36.1%	26.4%	12.6%	6.7%	4.6%	6.2%	2.5%	1.2%	1.6%	2.2%	**100.0%**
BWT	32.8%	17.0%	1.5%	11.7%	8.8%	12.8%	3.1%	1.6%	8.0%	2.6%	**100.0%**
DDT	42.3%	22.0%	1.6%	9.3%	9.4%	3.7%	1.7%	2.3%	3.1%	4.5%	**100.0%**
DPM	18.9%	24.6%	0.0%	22.2%	4.6%	2.0%	9.5%	10.3%	0.1%	8.0%	**100.0%**
FLT	43.3%	53.9%	0.0%	0.9%	0.0%	0.0%	0.9%	0.9%	0.0%	0.0%	**100.0%**
LET	26.3%	13.6%	1.0%	6.7%	8.5%	29.1%	2.0%	2.0%	7.4%	3.5%	**100.0%**
QLN	23.4%	20.9%	4.5%	21.4%	10.9%	2.0%	10.0%	3.1%	1.3%	2.6%	**100.0%**
SMD	36.7%	34.8%	0.6%	6.3%	8.0%	5.6%	1.7%	1.5%	2.6%	2.2%	**100.0%**
UMT	26.0%	16.9%	47.0%	4.1%	1.1%	0.5%	1.8%	1.8%	0.5%	0.3%	**100.0%**
Regional Statistics	**34.8%**	**23.0%**	**15.9%**	**7.6%**	**6.0%**	**3.6%**	**2.2%**	**2.1%**	**2.0%**	**2.7%**	**100.0%**

The majority of riders "Walk" to their destination from transit (94.8%). FLT riders were the least likely to walk from transit to their destination (59.1%) and were the most likely to "Get in a parked vehicle and drive alone" (16.8%). The Other category was used to categorize any access mode that was indicated less than 2.0% of the time including, but not limited to, Get in a parked vehicle and drive / ride with someone, Personal Bike, and Wheelchair / scooter.

Table 6-5: Egress Mode by System

System	Egress			
	Walk	Get in a parked vehicle and drive alone	Other	Total
AAA	95.1%	1.8%	3.1%	**100.0%**
BWT	97.9%	0.0%	2.1%	**100.0%**
DDT	96.9%	0.1%	3.0%	**100.0%**
DPM	91.9%	5.0%	3.0%	**100.0%**
FLT	59.1%	16.8%	24.1%	**100.0%**
LET	98.2%	0.0%	1.8%	**100.0%**
QLN	96.6%	1.1%	2.3%	**100.0%**
SMD	92.7%	2.2%	5.1%	**100.0%**
UMT	93.3%	5.4%	1.3%	**100.0%**
Regional Statistics	**94.8%**	**2.3%**	**2.9%**	**100.0%**

Respondents were asked if their employer helped pay for their transportation fare, and the majority of respondents indicated that "No", their employer did not help pay for any of their fare (63.9%). Of the thirty-six percent (36.1%) that indicated "Yes – their employer paid part or all of their fare", UMT had the highest number of riders (84.2%) followed in second by AAA riders (57.9%).

Table 6-6: Fare Subsidy by System

System	Employer Pay		
	No	Yes	Total
AAA	42.1%	57.9%	**100.0%**
BWT	92.9%	7.1%	**100.0%**
DDT	94.8%	5.2%	**100.0%**
DPM	83.1%	16.9%	**100.0%**
FLT	72.0%	28.0%	**100.0%**
LET	99.0%	1.0%	**100.0%**
QLN	91.8%	8.2%	**100.0%**
SMD	92.7%	7.3%	**100.0%**
UMT	15.8%	84.2%	**100.0%**
Regional Statistics	**63.9%**	**36.1%**	**100.0%**

Across the region, over half of transit riders make this trip 3–5 days per week (57.3%), with just under one-third making the trip more often (29.2%), and thirteen percent (13.4%) less than 3 – 5 days per week. It was more common for a DPM rider to indicate this being their first time to make this trip (9.7%) compared to other systems.

Table 13: Trip Frequency by System

System	Trip Frequency						
	6-7 days /week	3-5 days / week	1-2 days / week	1-3 days / month	Less than 1 day a month	First time to make this trip	Total
AAA	26.6%	63.4%	7.6%	1.4%	0.8%	0.2%	**100.0%**
BWT	35.3%	46.8%	11.1%	3.0%	0.1%	3.8%	**100.0%**
DDT	28.2%	55.8%	10.9%	2.9%	1.3%	0.8%	**100.0%**
DPM	12.6%	39.1%	10.8%	10.2%	17.6%	9.7%	**100.0%**
FLT	72.3%	26.4%	0.3%	0.9%	0.0%	0.0%	**100.0%**
LET	26.5%	48.1%	20.0%	1.0%	1.0%	3.3%	**100.0%**
QLN	19.7%	45.9%	19.8%	6.7%	4.4%	3.6%	**100.0%**
SMD	27.7%	59.5%	7.7%	3.0%	1.2%	0.8%	**100.0%**
UMT	34.1%	58.3%	6.0%	1.1%	0.2%	0.2%	**100.0%**
Regional Statistics	**29.2%**	**57.3%**	**8.7%**	**2.4%**	**1.4%**	**0.9%**	**100.0%**

Overall, the most common alternative travel mode if transit were not available would be to "Get a ride with someone else" (24.4%). The second highest alternative was to use "Uber, Lyft, etc." (19.2%). FLT service had the highest percentage of riders that "Could not make trip" if transit were not available (54.9%). BWT had the highest percentage that would take a "Taxi" (12.5%) and the second lowest that would "Drive (own car)" (1.7%).

Table 14: Alternative Travel Mode by System

System	Alternative Travel Mode									
	Get a ride with someone	Uber, Lyft, etc	Walk	Could not make trip	Drive (own car)	Bike	Taxi	Other	Not Provided	Total
AAA	20.3%	18.8%	16.5%	11.9%	21.2%	6.0%	1.8%	3.5%	0.0%	**100.0%**
BWT	28.9%	1.5%	24.3%	25.6%	1.7%	4.6%	12.5%	0.8%	0.0%	**100.0%**
DDT	37.9%	17.5%	11.6%	22.3%	3.7%	1.5%	4.4%	0.9%	0.1%	**100.0%**
DPM	4.3%	18.5%	46.4%	5.7%	17.5%	0.6%	5.6%	1.5%	0.0%	**100.0%**
FLT	12.7%	0.9%	0.0%	54.9%	31.5%	0.0%	0.0%	0.0%	0.0%	**100.0%**
LET	29.7%	4.8%	24.7%	36.6%	1.0%	2.6%	0.0%	0.5%	0.0%	**100.0%**
QLN	9.8%	30.3%	21.4%	7.0%	19.2%	6.8%	0.8%	4.8%	0.0%	**100.0%**
SMD	33.0%	21.8%	6.1%	20.5%	12.2%	3.2%	1.7%	0.5%	1.0%	**100.0%**
UMT	7.1%	21.4%	26.1%	10.2%	19.7%	13.0%	0.4%	2.0%	0.0%	**100.0%**
Regional Statistics	**24.4%**	**19.2%**	**17.1%**	**16.6%**	**12.6%**	**5.7%**	**2.6%**	**1.6%**	**0.2%**	100.0%

Across the region, transit riders are much more likely to have a valid driver's license than not (63.0%). The areas with the highest concentration of riders with driver's licenses are served by DPM (90.8%), UMT (88.2%), and QLN (78.2%). BWT (38.6%) and LET (28.4%) had the lowest concentration of riders with driver's licenses.

Table 6-915: Valid Driver's License by System

System	License		
	Yes	No	Total
AAA	71.7%	28.3%	**100.0%**
BWT	38.6%	61.4%	**100.0%**
DDT	41.7%	58.3%	**100.0%**
DPM	90.8%	9.2%	**100.0%**
FLT	69.0%	31.0%	**100.0%**
LET	28.4%	71.6%	**100.0%**
QLN	78.2%	21.8%	**100.0%**
SMD	55.2%	44.8%	**100.0%**
UMT	88.2%	11.8%	**100.0%**
Regional Statistics	**63.0%**	**37.0%**	**100.0%**

UMT (70.6%) followed by AAA (40.2%) systems had the highest percentage of riders under the age of 26. The age category that had the highest percentage of riders overall was 18 – 25 (35.6%). LET had the highest percentage of riders age 55 and older (29.2%).

Table 6-10: Age by System

System	Age										
	Under 6	6-12	13-15	16-17	18-25	26-34	35-54	55-64	65 and older	Unknown	Total
AAA	0.0%	0.2%	1.3%	3.3%	35.4%	26.1%	20.2%	7.7%	5.7%	0.1%	**100.0%**
BWT	0.0%	0.0%	0.7%	2.1%	14.7%	18.8%	39.2%	16.1%	8.4%	0.0%	**100.0%**
DDT	0.0%	0.2%	2.2%	5.7%	20.2%	24.9%	32.1%	10.7%	3.9%	0.1%	**100.0%**
DPM	0.0%	0.0%	0.0%	0.4%	10.4%	22.2%	46.3%	12.0%	8.7%	0.0%	**100.0%**
FLT	0.0%	0.0%	0.0%	0.0%	17.2%	28.6%	43.6%	9.6%	1.0%	0.0%	**100.0%**
LET	0.0%	0.0%	0.8%	1.8%	12.6%	22.7%	32.7%	17.5%	11.7%	0.0%	**100.0%**
QLN	0.0%	0.0%	0.6%	1.5%	21.9%	32.8%	28.1%	11.4%	3.7%	0.0%	**100.0%**
SMD	0.0%	0.0%	0.5%	2.1%	16.3%	25.8%	35.6%	13.4%	6.2%	0.1%	**100.0%**
UMT	0.0%	0.0%	0.1%	0.5%	70.0%	17.1%	9.1%	2.5%	0.6%	0.0%	**100.0%**
Regional Statistics	**0.0%**	**0.1%**	**1.1%**	**3.1%**	**35.6%**	**22.9%**	**24.8%**	**8.5%**	**3.8%**	**0.0%**	**100.0%**

One hundred percent (100.0%) of FLT riders were employed either part- or full-time. UMT had the highest percentage of riders not currently employed (40.6%) and either seeking or not seeking work. LET had the highest percentage of "Retired" riders (19.2%). The Other category was used to categorize any access mode that was indicated less than 2.0% of the time including Not employed (unspecified), Homemaker, and Unknown.

Table 6-11: Employment Status

System	Employment Status						
	Employed full-time	Employed part-time	Not currently employed, and not seeking work	Not currently employed, but seeking work	Retired	Other	Total
AAA	46.3%	29.4%	12.9%	5.4%	5.2%	0.8%	**100.0%**
BWT	31.9%	22.2%	20.0%	11.8%	13.7%	0.4%	**100.0%**
DDT	55.0%	19.3%	8.8%	8.8%	6.4%	1.7%	**100.0%**
DPM	81.7%	7.6%	1.4%	1.1%	7.7%	0.5%	**100.0%**
FLT	99.3%	0.7%	0.0%	0.0%	0.0%	0.0%	**100.0%**
LET	21.5%	22.7%	20.6%	13.0%	19.2%	3.0%	**100.0%**
QLN	65.4%	14.8%	7.7%	6.8%	5.1%	0.2%	**100.0%**
SMD	66.6%	15.1%	5.4%	5.7%	6.3%	0.9%	**100.0%**
UMT	26.3%	32.9%	27.3%	13.3%	0.1%	0.0%	**100.0%**
Regional Statistics	**47.7%**	**23.7%**	**14.2%**	**8.9%**	**4.6%**	**0.9%**	**100.0%**

Overall, most respondents indicated they are "Not a student" (61.7%), with UMT having the highest percentage of respondents indicate they are a "College / University" student (79.7%) and DDT riders having the highest percentage of respondents indicate they are a "K-12th grade" student (9.3%).

Table 6-12: Student Status

System	Student Status					
	Not a student	Yes - College / University	Yes - K - 12th grade	Yes - Other type of student	Unknown	Total
AAA	53.7%	40.8%	4.9%	0.5%	0.1%	**100.0%**
BWT	90.0%	5.6%	4.4%	0.0%	0.0%	**100.0%**
DDT	82.3%	7.7%	9.3%	0.7%	0.0%	**100.0%**
DPM	93.5%	6.2%	0.4%	0.0%	0.0%	**100.0%**
FLT	89.9%	7.4%	0.7%	2.0%	0.0%	**100.0%**
LET	91.9%	4.2%	1.8%	2.0%	0.0%	**100.0%**
QLN	77.9%	18.5%	2.1%	1.5%	0.0%	**100.0%**
SMD	89.0%	7.5%	3.2%	0.3%	0.1%	**100.0%**
UMT	19.7%	79.7%	0.4%	0.2%	0.0%	**100.0%**
Regional Statistics	**61.7%**	**33.0%**	**4.8%**	**0.4%**	**0.0%**	**100.0%**

The majority of riders do not have a working vehicle in their household (45.8%) followed closely by households that have "One (1)" working vehicle (32.2%). FLT had the highest percentage of riders indicate they have "One (1)" working vehicle in their household (61.2%), and DPM had the highest percentage of riders indicate they have "Three or More" working vehicles in their household (20.2%).

Table 6-13: Household Vehicles by System

System	Household Vehicle				
	None (0)	One (1)	Two (2)	Three or More	Total
AAA	38.3%	38.9%	17.1%	5.7%	**100.0%**
BWT	76.2%	16.8%	5.5%	1.5%	**100.0%**
DDT	55.6%	30.0%	12.0%	2.3%	**100.0%**
DPM	14.8%	31.2%	33.8%	20.2%	**100.0%**
FLT	18.3%	61.2%	14.0%	6.5%	**100.0%**
LET	79.8%	13.2%	4.6%	2.4%	**100.0%**
QLN	35.8%	37.4%	21.0%	5.8%	**100.0%**
SMD	41.8%	32.0%	19.8%	6.4%	**100.0%**
UMT	40.5%	32.6%	16.8%	10.0%	**100.0%**
Regional Statistics	**45.8%**	**32.2%**	**15.8%**	**6.1%**	**100.0%**

QLN and LET riders had the highest percentage of respondents indicate they come from "One (1)" person households (39.4% and 35.1% respectively). DDT and DPM riders had the highest percentage of respondents indicate they come from household with "Four or More" members (30.4% and 27.8% respectively). The household size that was most common overall was a "Two (2)" person household (30.2%).

Table 6-14: Household Size by System

System	Household Size				
	One (1)	Two (2)	Three (3)	Four or More	Total
AAA	25.6%	34.8%	18.5%	21.0%	**100.0%**
BWT	33.6%	24.6%	19.1%	22.6%	**100.0%**
DDT	24.9%	24.0%	20.8%	30.4%	**100.0%**
DPM	22.5%	30.4%	19.2%	27.8%	**100.0%**
FLT	19.2%	35.0%	19.2%	26.5%	**100.0%**
LET	35.1%	22.5%	15.3%	27.0%	**100.0%**
QLN	39.4%	30.0%	15.8%	14.8%	**100.0%**
SMD	27.0%	25.7%	20.2%	27.0%	**100.0%**
UMT	21.7%	38.3%	13.9%	26.1%	**100.0%**
Regional Statistics	**24.7%**	**30.2%**	**18.3%**	**26.9%**	**100.0%**

Overall, the majority of respondents indicate they only have "One (1)" employed person in the household (34.7%) followed very closely by "Two (2)" employed persons in the household (34.4%). LET and BWT had the highest percentage of riders indicate they have no employed persons in the household (45.3% and 32.2% respectively), while AAA had the highest percentage of "Three or More" employed people in their household (19.4%).

Table 6-15: Household Employees by System

System	Household Workers				
	None (0)	One (1)	Two (2)	Three or More	Total
AAA	12.6%	31.3%	36.8%	19.4%	**100.0%**
BWT	32.2%	34.2%	19.3%	14.2%	**100.0%**
DDT	10.4%	39.3%	36.5%	13.8%	**100.0%**
DPM	6.0%	32.1%	45.4%	16.5%	**100.0%**
FLT	0.0%	43.3%	49.1%	7.6%	**100.0%**
LET	45.3%	24.0%	14.2%	16.5%	**100.0%**
QLN	10.1%	45.3%	34.5%	10.1%	**100.0%**
SMD	9.0%	36.6%	35.4%	19.0%	**100.0%**
UMT	25.9%	29.8%	29.6%	14.7%	**100.0%**
Regional Statistics	**15.3%**	**34.7%**	**34.4%**	**15.6%**	**100.0%**

Overall, the majority of transit riders make "Below $25,000" total annual household income (41.2%). LET had the highest percentage of riders make "Below $25,000" total annual household income (57.0%), followed by BWT (55.5%). DPM riders had the highest percentage of respondents indicate they make "$100,000 or more" total annual household income (26.8%).

Table 6-16: Income by System

System	Income									
	Below $25,000	$25,000 - $29,999	$30,000 - $39,999	$40,000 - $49,999	$50,000 - $59,999	$60,000 - $74,999	$75,000 - $99,999	$100,000 or more	Not Provided	Total
AAA	32.0%	6.2%	10.1%	7.5%	6.3%	7.1%	6.5%	6.1%	18.2%	**100.0%**
BWT	55.5%	6.1%	6.8%	4.3%	3.0%	3.7%	0.6%	1.8%	18.1%	**100.0%**
DDT	54.3%	9.7%	11.5%	7.2%	3.4%	1.7%	0.7%	0.5%	11.0%	**100.0%**
DPM	10.0%	4.4%	8.9%	10.6%	8.9%	9.5%	10.0%	26.8%	10.8%	**100.0%**
FLT	49.8%	10.8%	19.4%	3.4%	5.9%	1.2%	1.5%	2.4%	5.5%	**100.0%**
LET	57.0%	1.8%	5.7%	1.0%	5.8%	1.6%	0.5%	0.0%	26.6%	**100.0%**
QLN	27.7%	7.8%	7.9%	11.6%	11.8%	6.2%	6.4%	6.7%	13.9%	**100.0%**
SMD	31.9%	9.2%	13.4%	8.9%	8.1%	6.8%	4.5%	5.0%	12.1%	**100.0%**
UMT	36.2%	3.3%	7.4%	4.5%	4.4%	6.4%	6.6%	9.9%	21.2%	**100.0%**
Regional Statistics	**41.2%**	**7.0%**	**10.2%**	**6.8%**	**5.1%**	**4.9%**	**4.1%**	**5.5%**	**15.3%**	**100.0%**

6.1.2 Types of Places for Origins and Destinations

The most common trip is from "Your HOME – Origin/Destination" to "Your usual WORKPLACE – Destination/Origin" (21.1% / 15.6%). The second most common trip type was from "Your HOME – Origin to "College or University (student only) – Destination" (11.6%). As noted previously, the Other category was used to categorize any origin place type that was indicated less than 2.0% of the time including, but not limited to, School (K-12), Your HOTEL, and Airport (passengers only).

Table 6-17: Regional Distribution of Origin Place Type by Destination Place Type

Origin Place Type	Destination Place Type										
	Your HOME	College or University (student only)	Your usual WORKPLACE	Social or recreational	Medical / dental	Personal business	Work related	Shopping	Dining / eating out / coffee	Other	Total
Your HOME	0.0%	11.6%	21.1%	4.1%	1.6%	3.8%	1.2%	2.4%	1.1%	2.0%	**49.0%**
Your usual WORKPLACE	15.6%	0.3%	0.2%	0.6%	0.1%	0.6%	0.5%	0.3%	0.2%	0.1%	**18.5%**
College or University (student only)	5.9%	3.4%	0.3%	0.5%	0.0%	0.1%	0.0%	0.1%	0.3%	0.0%	**10.8%**
Social or recreational	3.1%	0.1%	0.5%	0.9%	0.1%	0.3%	0.0%	0.2%	0.2%	0.1%	**5.5%**
Personal business	2.8%	0.1%	0.3%	0.3%	0.1%	0.6%	0.0%	0.2%	0.2%	0.1%	**4.7%**
Shopping	2.3%	0.1%	0.1%	0.3%	0.1%	0.2%	0.0%	0.2%	0.0%	0.0%	**3.3%**
Work related	1.2%	0.1%	0.1%	0.1%	0.0%	0.1%	0.1%	0.0%	0.1%	0.1%	**2.1%**
Medical / dental	1.3%	0.0%	0.1%	0.2%	0.0%	0.1%	0.0%	0.1%	0.0%	0.0%	**2.0%**
School (K-12) (student only)	1.6%	0.0%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	**1.9%**
Dining / eating out / coffee	0.8%	0.2%	0.1%	0.2%	0.0%	0.1%	0.0%	0.0%	0.0%	0.1%	**1.5%**
Other	0.2%	0.0%	0.1%	0.2%	0.0%	0.1%	0.1%	0.0%	0.0%	0.0%	**0.7%**
Total	**34.8%**	**15.9%**	**23.0%**	**7.6%**	**2.0%**	**6.0%**	**2.1%**	**3.6%**	**2.2%**	**2.7%**	**100.0%**

Over eighty-five percent of riders (85.8%) walked to both access and egress the transit system. Five percent (5.1%) of transit riders accessed transit by "Drove alone and parked" and then their egress mode was "Walk". As noted previously, the Other category was used to categorize any access mode that was indicated less than 2.0% of the time including, but not limited to, Drove or rode with others and parked, Get in a parked vehicle and drive / ride with someone, Personal Bike, and Wheelchair / scooter.

Table 6-18: Distribution of Access Mode by Egress Mode

Access	Egress			
	Get in a parked vehicle and drive alone	Walk	Other	Total
Walk	2.3%	85.8%	2.0%	**90.1%**
Drove alone and parked	0.0%	5.1%	0.0%	**5.1%**
Other	0.0%	2.0%	0.8%	**2.8%**
Was dropped off by someone going someplace else	0.0%	1.9%	0.1%	**2.0%**
Total	**2.3%**	**94.8%**	**2.9%**	**100.0%**

The most common trip type taken by transit riders in the region overall was "Home – Other" (27.9%). LET riders had the highest percentage of respondents indicate they took a "Home – Other" trip (41.8%), and FLT riders had the highest percentage of respondents indicate they took a "Home – Work" trip (53.1%).

Table 6-19: Distribution of Trip Types

System	Trip Type								
	Home - Other	Home - Work	Other - Home	Work - Home	Other - Other	Work - Other	Other - Work	Work - Work	Total
AAA	27.5%	24.5%	19.6%	16.4%	8.4%	1.7%	1.8%	0.1%	**100.0%**
BWT	33.9%	16.2%	23.9%	8.9%	13.9%	2.5%	0.8%	0.0%	**100.0%**
DDT	26.0%	20.2%	22.6%	19.7%	7.0%	2.6%	1.7%	0.2%	**100.0%**
DPM	11.8%	22.0%	8.7%	10.2%	36.7%	8.0%	2.5%	0.1%	**100.0%**
FLT	0.9%	53.1%	0.0%	43.3%	0.0%	1.8%	0.9%	0.0%	**100.0%**
LET	41.8%	13.6%	22.2%	4.1%	14.0%	4.3%	0.0%	0.0%	**100.0%**
QLN	19.5%	15.8%	15.0%	8.5%	25.9%	10.2%	4.6%	0.4%	**100.0%**
SMD	19.1%	32.6%	13.6%	23.0%	6.9%	2.5%	2.1%	0.2%	**100.0%**
UMT	36.6%	15.3%	18.4%	7.5%	18.0%	2.5%	1.4%	0.2%	**100.0%**
Regional Statistics	**27.9%**	**21.1%**	**19.2%**	**15.6%**	**11.6%**	**2.7%**	**1.7%**	**0.2%**	**100.0%**

6.2 Corridor Specific Analysis

Three of the most important regional corridors were also analyzed to show how these areas compare to the overall data. The three corridors selected were Woodward Avenue, Michigan Avenue, and Gratiot Avenue, which all lead into Downtown Detroit from the Northwest, West, and Northeast, respectively. To analyze the ridership characteristics along these corridors, records were selected that used these corridors on their trip, defined as the following:

- The Woodward Avenue corridor is defined as riders who traveled on Woodward Avenue while being surveyed on the SMART 420, 450, 465, 495, or 610.
- The Michigan Avenue corridor is defined as riders who used the SMART 200 or DDOT 37, covering Michigan Avenue between John Hix Road and Downtown Detroit, and the Q Line.
- The Gratiot Avenue corridor is defined as riders who traveled on Gratiot Avenue while being surveyed on the SMART 510, 515, 530, 560, 565, or 580, or DDOT 34 or 76 between 23 Mile Road and Downtown Detroit.

The majority of regional transit riders do not take any additional transfers to get from their origin to their final destination (66.0%). Michigan Corridor riders were more likely to take one or more additional transfers (50.6%) to get from their origin to their final destination compared to other corridor riders.

Table 6-20: Total Transfers by Corridor (based on secondary unlinked weight factors)

Cooridor	Total Transfers				
	None	One	Two	Three or More	Total
GRATIOT	50.2%	47.7%	2.1%	0.0%	100.0%
MICHIGAN	49.4%	50.0%	0.7%	0.0%	100.0%
WOODWARD	52.9%	46.6%	0.5%	0.0%	100.0%
SEMCOG	66.0%	31.5%	2.4%	0.1%	100.0%

Overall, the most common place type regional respondents are coming from are “Your HOME” (48.9%) and “Your usual WORKPLACE” (18.3%) while Michigan Corridor respondents were least likely to be coming from “Your HOME” (43.6%). The Michigan Corridor had the highest percentage of respondents indicate they are coming from “Your usual WORKPLACE” (28.4%).

Table 6-21: Origin Purpose by Corridor

Cooridor	Origin Trip Purpose									
	Your HOME	Your usual WORKPLACE	College or University (student only)	Social or recreational	Personal business	Shopping	Work related	Medical / dental	Other	Total
GRATIOT	49.4%	23.0%	0.7%	5.9%	7.7%	8.7%	3.1%	0.5%	1.0%	100.0%
MICHIGAN	43.6%	28.4%	0.0%	8.6%	8.2%	0.0%	3.7%	1.0%	6.5%	100.0%
WOODWARD	56.3%	20.6%	2.6%	4.5%	4.6%	4.1%	1.4%	3.0%	2.8%	100.0%
SEMCOG	48.9%	18.3%	11.1%	5.5%	4.7%	3.2%	2.1%	2.0%	4.2%	100.0%

The majority of regional transit riders use “Walk” as the most common method to access transit from their origin (90.2%). The next highest in the region overall was “Drove alone and parked” (5.2%) followed by “Was dropped off by someone going someplace else” (1.9%). Michigan Corridor riders were most likely to use an “Other” method of transportation to access transit (13.8%). The “Other” category was used to

categorize anything that was selected less than 2.0% of the time including, but not limited to, “Drove or rode with others and parked”, “Uber, Lyft, etc.”, and “E-scooter (e.g. Lime, Bird, etc.)”.

Table 6-22: Access by Corridor

Cooridor	Access				
	Walk	Drove alone and parked	Was dropped off by someone going someplace else	Other	Total
GRATIOT	86.2%	2.7%	8.2%	2.9%	100.0%
MICHIGAN	83.3%	2.2%	0.7%	13.8%	100.0%
WOODWARD	85.5%	3.7%	5.2%	5.6%	100.0%
SEMCOG	90.2%	5.2%	1.9%	2.7%	100.0%

The majority of transit riders in the region overall ended their trip at “Your HOME” (34.9%) followed by “Your usual WORKPLACE” (22.6%). Woodward Corridor respondents were nearly double the regional totals for travelling to “Social or recreational” (13.1% vs 7.6%).

Table 6-23: Destination Purpose by Corridor

Cooridor	Destination Trip Purpose										
	Your HOME	Your usual WORKPLACE	College or University (student only)	Social or recreational	Personal business	Shopping	Dining / eating out / coffee	Work related	Medical / dental	Other	Total
GRATIOT	35.8%	33.2%	1.1%	8.6%	7.8%	7.6%	1.2%	0.9%	2.2%	1.8%	100.0%
MICHIGAN	36.3%	36.7%	1.3%	2.6%	7.8%	2.6%	6.6%	0.0%	1.0%	5.1%	100.0%
WOODWARD	33.0%	36.4%	1.7%	13.1%	4.1%	4.7%	1.4%	1.7%	2.9%	1.1%	100.0%
SEMCOG	34.9%	22.6%	16.3%	7.5%	6.0%	3.6%	2.2%	2.2%	2.0%	2.7%	100.0%

The majority of regional transit riders used “Walk” as the most common method of transportation to get from transit to their destination (94.8%). The second most commonly used method of transportation to get from transit to the destination was “Get in a parked vehicle and drive alone” (2.4%). Michigan Corridor riders had the highest percentage of respondents indicate they used an “Other” method of transportation to get from transit to their destination (5.4%). The “Other” category was used to categorize anything that was selected less than 2.0% of the time and includes, but is not limited to, “Get in a parked vehicle and drive / ride with someone”, “Personal bike”, and “Wheelchair / scooter”.

Table 6-24: Egress by Corridor

Cooridor	Egress			
	Walk	Get in a parked vehicle and drive alone	Other	Total
GRATIOT	93.8%	1.4%	4.8%	100.0%
MICHIGAN	94.6%	0.0%	5.4%	100.0%
WOODWARD	94.7%	1.2%	4.1%	100.0%
SEMCOG	94.8%	2.4%	2.8%	100.0%

Riders using the Woodward Corridor were more likely to have their fare paid for by their employer either partially or fully (11.0%), while riders along the Gratiot and Michigan Corridors (8.8% & 2.2%

respectively) were less likely to have some or all of their fare paid by their employer, compared to the regional average (37.0%).

Table 6-25: Fare Subsidy by Corridor

Cooridor	Employer Pay		
	No	Yes	Total
GRATIOT	91.2%	8.8%	100.0%
MICHIGAN	97.8%	2.2%	100.0%
WOODWARD	89.0%	11.0%	100.0%
SEMCOG	63.0%	37.0%	100.0%

In the region overall, over half of riders make this trip 3 – 5 days per week (57.3%) followed by 6 – 7 days per week (29.3%) and 1 – 2 days per week (8.7%). Michigan Corridor riders were more likely to make the trip 3 – 5 days per week (66.1%) compared to the region overall, and also had the highest percentage of respondents indicate that this was their "First time to make this trip" (2.0%).

Table 6-26: Trip Frequency by Corridor

Cooridor	Trip Frequency						
	6-7 days /week	3-5 days / week	1-2 days / week	1-3 days / month	Less than 1 day a month	First time to make this trip	Total
GRATIOT	33.4%	54.3%	10.6%	0.6%	0.7%	0.5%	100.0%
MICHIGAN	12.6%	66.1%	4.2%	9.8%	5.2%	2.0%	100.0%
WOODWARD	22.8%	60.2%	7.1%	7.8%	1.3%	0.8%	100.0%
SEMCOG	29.3%	57.3%	8.7%	2.4%	1.4%	0.9%	100.0%

If bus service were not available, riders along the Gratiot and Michigan Corridors were more likely to report that they "Could not make trip" (31.0% and 33.7% respectively), compared to the riders overall in the region (16.3%). Woodward Corridor riders were more likely to "Get a ride with someone" to make the trip (30.6%) than any other method.

Table 6-27: Alternative Travel Mode by Corridor

Cooridor	Alternative Travel Mode									
	Get a ride with someone	Uber, Lyft, etc	Walk	Could not make trip	Drive (own car)	Bike	Taxi	Other	Not Provided	Total
GRATIOT	31.1%	17.1%	2.7%	31.0%	9.6%	3.1%	3.8%	0.0%	1.7%	100.0%
MICHIGAN	30.3%	21.2%	3.0%	33.7%	8.5%	2.8%	0.0%	0.4%	0.0%	100.0%
WOODWARD	30.6%	27.7%	1.2%	19.7%	16.4%	4.2%	0.0%	0.2%	0.0%	100.0%
SEMCOG	24.1%	19.1%	17.6%	16.3%	12.6%	5.8%	2.7%	1.6%	0.2%	100.0%

Riders in the region overall were more likely to have a valid driver's license (63.1%) than to not have a valid driver's license (36.9%). Of the three corridors, Michigan Corridor riders were more likely to have a valid driver's license (67.3%) compared to Gratiot (56.9%) and Woodward (65.0%).

Table 6-28: Valid Driver's License by Corridor

Cooridor	License		
	Yes	No	Total
GRATIOT	56.9%	43.1%	100.0%
MICHIGAN	67.3%	32.7%	100.0%
WOODWARD	65.0%	35.0%	100.0%
SEMCOG	63.1%	36.9%	100.0%

Just over one third of regional transit riders indicated they were between the ages of 18 – 25 (36.1%). Gratiot and Michigan Corridor had a higher percentage of respondents indicate they were between the ages of 26 – 34 (27.7% and 34.5% respectively), and Woodward had a higher percentage of respondents indicate they were between the ages of 35 – 54 (31.7%).

Table 6-2916: Age by Corridor

Cooridor	Age										
	Under 6	6-12	13-15	16-17	18-25	26-34	35-54	55-64	65 and older	Unknown	Total
GRATIOT	0.0%	0.0%	0.0%	1.2%	21.2%	27.7%	24.7%	17.0%	8.2%	0.0%	100.0%
MICHIGAN	0.0%	0.0%	0.0%	3.1%	21.4%	34.5%	33.3%	5.4%	2.3%	0.0%	100.0%
WOODWARD	0.0%	0.0%	0.0%	0.3%	16.1%	27.4%	31.7%	18.4%	6.1%	0.0%	100.0%
SEMCOG	0.0%	0.1%	1.2%	3.2%	36.1%	22.8%	24.7%	8.2%	3.7%	0.0%	100.0%

The Woodward Corridor has the highest percentage of retired riders (7.1%) versus the regional average (4.6%), and Michigan Corridor has the highest percentage of employed riders (90.0%) either full- or part-time versus the region overall (71.0%). Woodward Corridor also had the lowest percentage of "Not Employed" riders (7.3%) compared to the other two corridors and the regional average.

Table 6-30: Employment Status by Corridor

Cooridor	Employment Status						
	Employed full-time	Employed part-time	Not currently employed, and not seeking work	Not currently employed, but seeking work	Retired	Other	Total
GRATIOT	66.3%	16.8%	3.7%	5.9%	6.8%	0.5%	100.0%
MICHIGAN	71.7%	18.3%	5.5%	2.5%	2.0%	0.0%	100.0%
WOODWARD	72.1%	12.0%	5.6%	1.7%	7.1%	1.5%	100.0%
SEMCOG	47.0%	24.0%	14.5%	9.1%	4.6%	0.9%	100.0%

The majority of regional transit riders indicated they are "Not a student" (60.9%). Michigan Corridor riders had the highest percentage of respondents indicate they are a "College / University" student (19.9%), as well as the highest percentage of respondents indicate they are a "K – 12th grade" student (3.1%).

Table 6-31: Student Status by Corridor

Cooridor	Student Status					
	Not a student	Yes - College / University	Yes - K - 12th grade	Yes - Other type of student	Unknown	Total
GRATIOT	92.5%	6.3%	1.2%	0.0%	0.0%	100.0%
MICHIGAN	76.2%	19.9%	3.1%	0.7%	0.0%	100.0%
WOODWARD	90.4%	8.0%	1.6%	0.0%	0.0%	100.0%
SEMCOG	60.9%	33.8%	4.9%	0.5%	0.0%	100.0%

All three corridors have a higher percentage of riders without a household vehicle, while Michigan Corridor riders had a higher percentage of respondents indicate they have one more household vehicles (59.4%) compared to the region overall (54.1%).

Table 6-32: Household Vehicles by Corridor

Cooridor	Household Vehicle				
	None (0)	One (1)	Two (2)	Three or More	Total
GRATIOT	42.9%	29.4%	17.1%	10.6%	100.0%
MICHIGAN	40.6%	33.1%	12.6%	13.7%	100.0%
WOODWARD	42.6%	30.8%	23.8%	2.9%	100.0%
SEMCOG	45.9%	32.3%	15.7%	6.1%	100.0%

The Woodward Corridor has a larger percentage of riders from "One (1)" person households (39.4%) versus the regional average (24.4%). The Michigan Corridor had the highest percentage of respondents indicate they come from a household of "Four or More" people (28.0%) compared to the Gratiot and Woodward Corridors (25.1% and 17.3% respectively).

Table 6-33: Household Size by Corridor

Cooridor	Household Size				
	One (1)	Two (2)	Three (3)	Four or More	Total
GRATIOT	27.9%	28.1%	18.8%	25.1%	100.0%
MICHIGAN	26.5%	21.6%	23.8%	28.0%	100.0%
WOODWARD	39.4%	24.8%	18.5%	17.3%	100.0%
SEMCOG	24.4%	30.3%	18.2%	27.1%	100.0%

In the region overall, the highest percentage of respondents indicated they come from a household were "One (1)" person is employed (34.6%) followed extremely closely by households where "Two (2)" people are employed (34.3%). The Michigan Corridor had the least percentage of respondents indicate they come from a "None (0)" employed household (4.8%) compared to the Gratiot Corridor who had the highest percentage of respondents indicate they come from a household where there are "Three or More" employed people (19.3%).

Table 6-34: Household Employees by Corridor

Cooridor	Household Workers				
	None (0)	One (1)	Two (2)	Three or More	Total
GRATIOT	8.1%	38.6%	34.0%	19.3%	100.0%
MICHIGAN	4.8%	40.1%	37.9%	17.2%	100.0%
WOODWARD	10.2%	39.2%	35.7%	14.9%	100.0%
SEMCOG	15.5%	34.6%	34.3%	15.6%	100.0%

Just under half of the regional transit riders indicated they make "Below $25,000" for their annual household income (41.4%). Michigan Corridor respondents had the highest percentage of respondents indicate they make "$50,000 - $59,999" for their annual household income (16.7%) compared to the region overall (5.0%) and were least likely to indicate "Not Provided" (5.3%).

Table 6-35: Income by Corridor

Cooridor	Income									
	Below $25,000	$25,000 - $29,999	$30,000 - $39,999	$40,000 - $49,999	$50,000 - $59,999	$60,000 - $74,999	$75,000 - $99,999	$100,000 or more	Not Provided	Total
GRATIOT	39.1%	7.9%	13.8%	4.3%	6.0%	6.1%	2.3%	2.7%	17.8%	100.0%
MICHIGAN	39.6%	7.7%	13.6%	11.8%	16.7%	0.0%	1.9%	3.5%	5.3%	100.0%
WOODWARD	32.3%	8.9%	13.2%	12.4%	5.8%	5.9%	3.8%	4.7%	13.0%	100.0%
SEMCOG	41.4%	7.0%	10.1%	6.7%	5.0%	4.8%	4.1%	5.6%	15.4%	100.0%

7. Analysis: Survey Result Comparison

The survey result comparisons in this chapter are based on the previous 2010 report data and the current 2019 report data. In the previous 2010 report, the methodology used to obtain the onboard data was by a self-completion questionnaire, and defined only as "complete" and "usable" if the following questions were answered: origin address, destination address, mode of access, mode of egress, trip purposes, and trip path. In the most recent 2019 survey, the methodology used to obtain the onboard data was interviewer administered questionnaire utilizing the Tablet PC program as explained in further detail in Section 2.3.2 of this report.

In the 2010 survey the Q Line system was not operational and the MTA system was not surveyed, so comparisons could not be made for those systems.

All 2019 data in the tables are based on the secondary expansion numbers conducted by CTG and are showing the sum of the linked weight factors except where stated otherwise. The 2019 categories of "Unknown" or "Not Provided" have been removed from the subsequent tables for more accurate comparison purposes.

7.1 Trend Comparisons by System

Overall, for the region, respondents were more likely in 2019 to not need any additional transfers to make their trip compared to 2010 (65.5% vs. 52.3%). DDOT had the highest difference for respondents that indicated they took "None" additional transfer to make their trip (50.7% in 2019 vs. 39.9% in 2010) or took "Two" additional transfers to make their trip (3.6% in 2019 vs. 13.5% in 2010). SMART was similar in that in 2019 respondents were less likely to need "Two" additional transfers to make their trip (2.8%) compared to 2010 (11.5%).

Table 7-1: Total Transfers (2019 – based on secondary unlinked weight factors vs. 2010)

System	Year	Total Transfers				
		None	One	Two	Three or More	Total
AAATA	2019	67.8%	31.5%	0.7%	0.0%	**100.0%**
	2010	65.2%	31.2%	3.2%	0.4%	**100.0%**
BWATC	2019	36.6%	50.4%	11.5%	1.5%	**100.0%**
	2010	35.3%	52.2%	11.4%	1.1%	**100.0%**
DDOT	2019	50.7%	45.7%	3.6%	0.1%	**100.0%**
	2010	39.9%	44.0%	13.5%	2.6%	**100.0%**
DPM	2019	84.4%	13.7%	1.8%	0.0%	**100.0%**
	2010	84.0%	11.0%	4.9%	0.0%	**100.0%**
MTA	2019	95.1%	4.9%	0.0%	0.0%	**100.0%**
	2010					
LET	2019	35.9%	56.5%	7.7%	0.0%	**100.0%**
	2010	39.1%	44.4%	16.5%	0.0%	**100.0%**
Q Line	2019	89.4%	10.0%	0.6%	0.0%	**100.0%**
	2010					
SMART	2019	55.0%	42.1%	2.8%	0.1%	**100.0%**
	2010	49.2%	37.9%	11.5%	1.4%	**100.0%**
UMICH	2019	95.5%	4.3%	0.3%	0.0%	**100.0%**
	2010	90.0%	9.7%	0.3%	0.1%	**100.0%**
Regional Statistics	2019	**65.5%**	**32.1%**	**2.3%**	**0.1%**	**100.0%**
	2010	**52.3%**	**36.0%**	**10.0%**	**1.7%**	**100.0%**

Overall, there were no major differences for the regional statistics for the type of place respondents were coming from for 2010 compared to 2019. "Your HOME" remained consistent as the most common type of place respondents were coming from (49.0% in 2019 compared to 53.3% in 2010). Two of the biggest differences were in 2010 BWATC riders were more likely to say they were coming from "Your HOME"

(72.9% vs. 50.0%), and in 2010 UMICH riders were more likely to say they were coming from "College or University (student only)" (55.3% vs. 31.0%).

Table 7-2: Origin Trip Purpose by System (2019 vs. 2010)

System	Year	Origin Trip Purpose							
		Your HOME	College or University (student only)	Shopping	Social or recreational	Work or Work related	Medical / dental	Other	Total
AAATA	2019	51.9%	9.4%	4.1%	5.2%	19.2%	1.8%	8.3%	**100.0%**
	2010	55.2%	16.9%	2.1%	4.2%	17.9%	2.1%	1.5%	**100.0%**
BWATC	2019	50.0%	1.2%	13.4%	7.6%	11.5%	5.5%	10.7%	**100.0%**
	2010	72.9%	2.0%	5.0%	5.4%	9.6%	1.2%	4.0%	**100.0%**
DDOT	2019	46.1%	1.3%	4.0%	7.4%	25.2%	3.2%	12.8%	**100.0%**
	2010	56.7%	5.8%	3.1%	8.5%	18.3%	3.2%	4.4%	**100.0%**
DPM	2019	33.8%	0.1%	1.6%	14.1%	30.5%	0.1%	19.8%	**100.0%**
	2010	42.6%	1.2%	2.5%	26.4%	23.8%	2.2%	1.3%	**100.0%**
MTA	2019	53.9%	0.0%	0.0%	0.9%	45.2%	0.0%	0.0%	**100.0%**
	2010								
LET	2019	55.4%	1.2%	18.5%	5.9%	8.4%	3.3%	7.3%	**100.0%**
	2010	66.5%	3.8%	8.7%	9.2%	8.5%	0.2%	3.2%	**100.0%**
Q Line	2019	35.4%	5.5%	3.8%	7.9%	22.6%	3.0%	21.9%	**100.0%**
	2010								
SMART	2019	51.7%	0.7%	4.8%	4.3%	27.8%	1.9%	8.8%	**100.0%**
	2010	59.1%	5.2%	3.2%	6.3%	21.9%	2.1%	2.3%	**100.0%**
UMICH	2019	51.9%	31.0%	0.5%	2.5%	11.2%	0.6%	2.3%	**100.0%**
	2010	33.1%	55.3%	0.2%	1.4%	9.0%	0.8%	0.1%	**100.0%**
Regional Statistics	2019	**49.0%**	**10.8%**	**3.3%**	**5.5%**	**20.6%**	**2.0%**	**8.8%**	**100.0%**
	2010	**53.3%**	**14.3%**	**2.6%**	**6.9%**	**17.3%**	**2.5%**	**3.0%**	**100.0%**

The biggest difference overall between the 2010 and the 2019 surveys for access mode from origin to transit was for "Was dropped off by someone going someplace else", where respondents were more likely to choose that as their form of transportation from their origin to transit (8.5%) compared to 2019 (2.0%). The majority of respondents for both 2019 and 2010 chose "Walk" as their most commonly used method to get from their origin to transit.

Table 7-3: Access by System (2019 vs. 2010)

System	Year	Access				
		Walk	Drove alone and parked	Was dropped off by someone going someplace else	Other	Total
AAATA	2019	92.9%	3.0%	0.8%	3.3%	**100.0%**
	2010	86.6%	6.7%	4.4%	2.2%	**100.0%**
BWATC	2019	96.5%	0.0%	2.3%	1.2%	**100.0%**
	2010	86.9%	1.2%	9.3%	2.6%	**100.0%**
DDOT	2019	95.2%	0.1%	2.7%	2.0%	**100.0%**
	2010	89.1%	0.5%	9.4%	1.1%	**100.0%**
DPM	2019	77.4%	13.7%	0.1%	8.8%	**100.0%**
	2010	70.6%	8.3%	19.5%	1.5%	**100.0%**
MTA	2019	50.4%	7.6%	21.8%	20.2%	**100.0%**
	2010					
LET	2019	98.6%	0.0%	1.0%	0.4%	**100.0%**
	2010	80.6%	1.1%	18.3%	0.0%	**100.0%**
Q Line	2019	92.2%	3.6%	0.6%	3.7%	**100.0%**
	2010					
SMART	2019	87.6%	2.9%	5.7%	3.8%	**100.0%**
	2010	80.9%	2.7%	13.0%	3.3%	**100.0%**
UMICH	2019	84.1%	13.5%	0.1%	2.3%	**100.0%**
	2010	90.9%	7.0%	1.5%	0.6%	**100.0%**
Regional Statistics	2019	**90.1%**	**5.1%**	**2.0%**	**2.8%**	**100.0%**
	2010	**87.5%**	**2.6%**	**8.5%**	**1.6%**	**100.0%**

UMICH riders were more likely to be going to "College or University (student only)" in 2010 (60.0%) compared to 2019 (47.0%). LET riders were less likely to be going to "Social or recreational" for their destination in 2019 (6.7%) compared to 2010 (20.9%). BWATC riders were almost two times as likely to be going to "Work or Work related" in 2010 (31.5%) compared to 2019 (18.6%).

Table 7-4: Destination Trip Purpose by System (2019 vs. 2010)

System	Year	Destination Trip Purpose							
		Your HOME	College or University (student only)	Shopping	Social or recreational	Work or Work related	Medical / dental	Other	Total
AAATA	2019	36.1%	12.6%	6.2%	6.7%	27.6%	1.6%	9.3%	**100.0%**
	2010	32.6%	25.1%	6.2%	8.6%	23.1%	3.0%	1.5%	**100.0%**
BWATC	2019	32.8%	1.5%	12.8%	11.7%	18.6%	8.0%	14.6%	**100.0%**
	2010	21.6%	9.0%	14.6%	15.7%	31.5%	4.9%	2.7%	**100.0%**
DDOT	2019	42.3%	1.6%	3.7%	9.3%	24.3%	3.1%	15.7%	**100.0%**
	2010	33.2%	7.1%	4.6%	17.8%	26.2%	5.4%	5.8%	**100.0%**
DPM	2019	18.9%	0.0%	2.0%	22.2%	34.9%	0.1%	22.0%	**100.0%**
	2010	18.2%	2.7%	3.3%	39.1%	33.4%	2.5%	0.8%	**100.0%**
MTA	2019	43.3%	0.0%	0.0%	0.9%	54.8%	0.0%	0.9%	**100.0%**
	2010								
LET	2019	26.3%	1.0%	29.1%	6.7%	15.6%	7.4%	14.0%	**100.0%**
	2010	25.5%	8.4%	19.5%	20.9%	12.9%	11.9%	0.9%	**100.0%**
Q Line	2019	23.4%	4.5%	2.0%	21.4%	23.9%	1.3%	23.4%	**100.0%**
	2010								
SMART	2019	36.7%	0.6%	5.6%	6.3%	36.3%	2.6%	12.0%	**100.0%**
	2010	32.4%	6.4%	6.1%	12.3%	35.6%	4.3%	3.0%	**100.0%**
UMICH	2019	26.0%	47.0%	0.5%	4.1%	18.7%	0.5%	3.2%	**100.0%**
	2010	26.8%	60.0%	0.0%	3.9%	8.2%	1.0%	0.0%	**100.0%**
Regional Statistics	2019	**34.8%**	**15.9%**	**3.6%**	**7.6%**	**25.1%**	**2.0%**	**10.9%**	**100.0%**
	2010	**31.6%**	**16.9%**	**4.4%**	**14.3%**	**24.7%**	**4.3%**	**3.9%**	**100.0%**

The majority of regional transit riders both in 2019 and in 2010 "Walked" to their destination after transit (94.8% and 92.5% respectively). There were no statistically significant differences between the egress modes for 2019 compared to 2010. The largest difference was for LET riders who used "Other" to get from transit to their destination (1.8% in 2019 vs. 13.2% in 2010). The "Other" category was used to categorize anything that was chosen less than 2.0% of the time by riders and includes, but is not limited to, "Get in a parked vehicle and drive / ride with someone", "Be picked up by someone", and "Personal bike".

Table 7-5: Egress by System (2019 vs. 2010)

System	Year	Egress			
		Walk	Get in a parked vehicle and drive alone	Other	Total
AAATA	2019	95.1%	1.8%	3.1%	**100.0%**
	2010	91.0%	5.5%	3.5%	**100.0%**
BWATC	2019	97.9%	0.0%	2.1%	**100.0%**
	2010	93.9%	2.3%	3.8%	**100.0%**
DDOT	2019	96.9%	0.1%	3.0%	**100.0%**
	2010	93.9%	0.4%	5.9%	**100.0%**
DPM	2019	91.9%	5.0%	3.0%	**100.0%**
	2010	91.0%	3.6%	5.3%	**100.0%**
MTA	2019	59.1%	16.8%	24.1%	**100.0%**
	2010				
LET	2019	98.2%	0.0%	1.8%	**100.0%**
	2010	86.9%	0.0%	13.2%	**100.0%**
Q Line	2019	96.6%	1.1%	2.3%	**100.0%**
	2010				
SMART	2019	92.7%	2.2%	5.1%	**100.0%**
	2010	88.5%	2.2%	9.3%	**100.0%**
UMICH	2019	93.3%	5.4%	1.3%	**100.0%**
	2010	92.9%	5.7%	1.4%	**100.0%**
Regional Statistics	2019	**94.8%**	**2.3%**	**2.9%**	**100.0%**
	2010	**92.5%**	**2.0%**	**5.4%**	**100.0%**

There was a larger percentage of respondents in 2010 to indicate their employer did not pay any or all of their fare (89.9%) compared to 2019 (63.9%). BWATC was the only system where riders in 2010 indicated a higher percentage of employers that did not help pay for any or all of their fare (66.7%) compared to 2019 where a higher percentage of riders indicated their employer did help pay for some or all of their fare (57.9%). All other systems indicated a higher percentage for both years where their employer did not help pay for any or part of their fare.

Table 7-6: Employer Pay by System (2019 vs. 2010)

System	Year	Employer Pay		
		Yes	No	Total
AAATA	2019	57.9%	42.1%	**100.0%**
	2010	33.4%	66.7%	**100.0%**
BWATC	2019	7.1%	92.9%	**100.0%**
	2010	15.5%	84.5%	**100.0%**
DDOT	2019	5.2%	94.8%	**100.0%**
	2010	8.1%	91.9%	**100.0%**
DPM	2019	16.9%	83.1%	**100.0%**
	2010	7.3%	92.7%	**100.0%**
MTA	2019	28.0%	72.0%	**100.0%**
	2010			
LET	2019	1.0%	99.0%	**100.0%**
	2010	13.0%	87.0%	**100.0%**
Q Line	2019	8.2%	91.8%	**100.0%**
	2010			
SMART	2019	7.3%	92.7%	**100.0%**
	2010	9.1%	90.9%	**100.0%**
UMICH	2019	84.2%	15.8%	**100.0%**
	2010			
Regional Statistics	2019	**36.1%**	**63.9%**	**100.0%**
	2010	**10.1%**	**89.9%**	**100.0%**

In 2010, riders in the region indicated a higher percentage for making the trip 6-7 days a week (46.4%) compared to 2019 where a higher percentage of riders indicated making the trip 3-5 days a week (57.3%).

Table 7-7: Trip Frequency by System (2019 vs. 2010)

System	Year	Trip Frequency						
		6-7 days /week	3-5 days / week	1-2 days / week	1-3 days / month	Less than 1 day a month	First time to make this trip	Total
AAATA	2019	26.6%	63.4%	7.6%	1.4%	0.8%	0.2%	**100.0%**
	2010	20.7%	56.7%	11.7%	5.9%	2.1%	2.9%	**100.0%**
BWATC	2019	35.3%	46.8%	11.1%	3.0%	0.1%	3.8%	**100.0%**
	2010	24.9%	41.9%	20.0%	8.6%	2.0%	2.6%	**100.0%**
DDOT	2019	28.2%	55.8%	10.9%	2.9%	1.3%	0.8%	**100.0%**
	2010	26.6%	47.5%	11.0%	8.2%	3.0%	3.7%	**100.0%**
DPM	2019	12.6%	39.1%	10.8%	10.2%	17.6%	9.7%	**100.0%**
	2010	16.7%	29.0%	30.4%	7.7%	8.5%	7.6%	**100.0%**
MTA	2019	72.3%	26.4%	0.3%	0.9%	0.0%	0.0%	**100.0%**
	2010							
LET	2019	26.5%	48.1%	20.0%	1.0%	1.0%	3.3%	**100.0%**
	2010	5.5%	48.7%	20.7%	20.0%	4.0%	1.1%	**100.0%**
Q Line	2019	19.7%	45.9%	19.8%	6.7%	4.4%	3.6%	**100.0%**
	2010							
SMART	2019	27.7%	59.5%	7.7%	3.0%	1.2%	0.8%	**100.0%**
	2010	24.3%	52.4%	10.6%	7.0%	2.8%	2.9%	**100.0%**
UMICH	2019	34.1%	58.3%	6.0%	1.1%	0.2%	0.2%	**100.0%**
	2010	46.4%	42.2%	7.1%	2.3%	1.2%	0.8%	**100.0%**
Regional Statistics	2019	**29.2%**	**57.3%**	**8.7%**	**2.4%**	**1.4%**	**0.9%**	**100.0%**
	2010	**46.4%**	**42.2%**	**7.1%**	**2.3%**	**1.2%**	**0.8%**	**100.0%**

The 2010 survey showed a higher percentage of respondents that "Could not make trip" (30.5%) compared to 2019 (16.6%) if transit were not available. Additionally, respondents in 2010 showed a higher percentage of respondents that would "Get a ride with someone" (30.7%) compared to 2019 (24.4%). An "Other" and

"Not Provided" category were added to the 2019 survey to offer respondents the chance to write in or opt out of the alternative travel mode question.

Table 7-8: Alternative Travel Mode by System (2019 vs. 2010)

System	Year	Alternative Travel Mode								
		Walk	Drive (own car)	Get a ride with someone	Taxi	Bike	Could not make trip	Other	Not Provided	Total
AAATA	2019	16.5%	21.2%	20.3%	1.8%	6.0%	11.9%	22.3%	0.0%	**100.0%**
	2010	20.4%	34.9%	21.0%	10.9%	13.8%	18.6%			**100.0%**
BWATC	2019	24.3%	1.7%	28.9%	12.5%	4.6%	25.6%	2.4%	0.0%	**100.0%**
	2010	37.2%	4.0%	26.8%	20.5%	14.8%	27.8%			**100.0%**
DDOT	2019	11.6%	3.7%	37.9%	4.4%	1.5%	22.3%	18.4%	0.1%	**100.0%**
	2010	18.1%	10.2%	37.4%	15.7%	4.7%	33.5%			**100.0%**
DPM	2019	46.4%	17.5%	4.3%	5.6%	0.6%	5.7%	19.9%	0.0%	**100.0%**
	2010	48.1%	13.7%	25.4%	10.7%	2.2%	8.7%			**100.0%**
MTA	2019	0.0%	31.5%	12.7%	0.0%	0.0%	54.9%	0.9%	0.0%	**100.0%**
	2010									**100.0%**
LET	2019	24.7%	1.0%	29.7%	0.0%	2.6%	36.6%	5.3%	0.0%	**100.0%**
	2010	37.6%	10.5%	38.0%	4.7%	10.3%	34.8%			**100.0%**
Q Line	2019	21.4%	19.2%	9.8%	0.8%	6.8%	7.0%	35.0%	0.0%	**100.0%**
	2010									**100.0%**
SMART	2019	6.1%	12.2%	33.0%	1.7%	3.2%	20.5%	22.3%	1.0%	**100.0%**
	2010	12.1%	16.3%	31.9%	10.7%	6.5%	39.2%			**100.0%**
UMICH	2019	26.1%	19.7%	7.1%	0.4%	13.0%	10.2%	23.4%	0.0%	**100.0%**
	2010	25.7%	26.3%	14.0%	7.4%	19.3%	22.4%			**100.0%**
Regional Statistics	2019	**17.1%**	**12.6%**	**24.4%**	**2.6%**	**5.7%**	**16.6%**	**20.8%**	**0.2%**	**100.0%**
	2010	**19.4%**	**16.3%**	**30.7%**	**13.0%**	**8.4%**	**30.5%**			**100.0%**

In the region overall, respondents were more likely to have a valid driver's license than not for both 2010 and 2019 (53.47% and 63.0% respectively). Riders on the LET system were significantly less likely to have a valid driver's license in 2019 (28.4%) compared to 2010 (40.5%).

Table 7-9: License by System (2019 vs. 2010)

System	Year	License		
		Yes	No	Total
AAATA	2019	71.7%	28.3%	**100.0%**
	2010	72.5%	27.5%	**100.0%**
BWATC	2019	38.6%	61.4%	**100.0%**
	2010	36.1%	63.9%	**100.0%**
DDOT	2019	41.7%	58.3%	**100.0%**
	2010	39.0%	61.0%	**100.0%**
DPM	2019	90.8%	9.2%	**100.0%**
	2010	79.4%	20.6%	**100.0%**
MTA	2019	69.0%	31.0%	**100.0%**
	2010			
LET	2019	28.4%	71.6%	**100.0%**
	2010	40.5%	59.5%	**100.0%**
Q Line	2019	78.2%	21.8%	**100.0%**
	2010			
SMART	2019	55.2%	44.8%	**100.0%**
	2010	51.0%	49.0%	**100.0%**
UMICH	2019	88.2%	11.8%	**100.0%**
	2010	91.3%	8.7%	**100.0%**
Regional Statistics	2019	**63.0%**	**37.0%**	**100.0%**
	2010	**53.7%**	**46.3%**	**100.0%**

In both the 2010 and 2019 surveys, there was a higher percentage of regional transit riders that indicated they were between the ages of 18-25 (34.9% and 35.6% respectively), followed by the age category 35-54 (31.2% and 24.8% respectively). LET riders were significantly less likely to be between the ages of 18-25 in 2019 (12.6%) compared to 2010 (29.1%).

Table 7-10: Age by System (2019 vs. 2010)

System	Year	Age						
		Under 18	18-25	26-34	35-54	55-64	65 and older	Total
AAATA	2019	4.8%	35.4%	26.1%	20.2%	7.7%	5.7%	**100.0%**
	2010	3.3%	37.2%	23.3%	22.7%	10.1%	3.4%	**100.0%**
BWATC	2019	2.8%	14.7%	18.8%	39.2%	16.1%	8.4%	**100.0%**
	2010	7.3%	27.7%	19.8%	32.0%	10.0%	3.3%	**100.0%**
DDOT	2019	8.2%	20.2%	24.9%	32.1%	10.7%	3.9%	**100.0%**
	2010	7.8%	24.7%	16.5%	37.4%	11.8%	1.8%	**100.0%**
DPM	2019	0.4%	10.4%	22.2%	46.3%	12.0%	8.7%	**100.0%**
	2010	0.4%	11.9%	18.5%	49.5%	15.6%	4.1%	**100.0%**
MTA	2019	0.0%	17.2%	28.6%	43.6%	9.6%	1.0%	**100.0%**
	2010							
LET	2019	2.6%	12.6%	22.7%	32.7%	17.5%	11.7%	**100.0%**
	2010	0.6%	29.1%	15.6%	41.1%	7.6%	6.0%	**100.0%**
Q Line	2019	2.1%	21.9%	32.8%	28.1%	11.4%	3.7%	**100.0%**
	2010							
SMART	2019	2.6%	16.3%	25.8%	35.6%	13.4%	6.2%	**100.0%**
	2010	3.6%	21.7%	19.5%	40.7%	12.0%	2.6%	**100.0%**
UMICH	2019	0.6%	70.0%	17.1%	9.1%	2.5%	0.6%	**100.0%**
	2010	2.1%	80.9%	7.3%	6.3%	3.4%	0.0%	**100.0%**
Regional Statistics	2019	**4.3%**	**35.6%**	**22.9%**	**24.8%**	**8.5%**	**3.8%**	**100.0%**
	2010	**5.6%**	**34.9%**	**16.2%**	**31.2%**	**10.2%**	**1.8%**	**100.0%**

Regional respondents were more likely to be employed either full- or part-time in 2019 (71.4%) compared to 2010 (53.2%). UMICH riders were significantly more likely to be unemployed and either seeking work or not seeking work in 2019 (40.6%) compared to 2010 (3.2%). The percentage of retired employees has gone up slightly for all systems from 2010 to 2019.

Table 7-11: Employment Status by System (2019 vs. 2010)

System	Year	Employment Status						
		Employed full-time	Employed part-time	Not currently employed, but seeking work	Not currently employed, and not seeking work	Retired	Other / Homemaker	Total
AAATA	2019	46.3%	29.4%	5.4%	12.9%	5.2%	0.8%	**100.0%**
	2010	34.9%	22.2%	6.7%	1.9%	4.9%	2.4%	**100.0%**
BWATC	2019	31.9%	22.2%	11.8%	20.0%	13.7%	0.4%	**100.0%**
	2010	21.6%	31.9%	21.5%	4.8%	9.7%	6.0%	**100.0%**
DDOT	2019	55.0%	19.3%	8.8%	8.8%	6.4%	1.7%	**100.0%**
	2010	34.0%	20.9%	18.9%	2.5%	5.6%	6.3%	**100.0%**
DPM	2019	81.7%	7.6%	1.1%	1.4%	7.7%	0.5%	**100.0%**
	2010	66.0%	10.5%	8.8%	4.0%	5.7%	2.3%	**100.0%**
MTA	2019	99.3%	0.7%	0.0%	0.0%	0.0%	0.0%	**100.0%**
	2010							
LET	2019	21.5%	22.7%	13.0%	20.6%	19.2%	3.0%	**100.0%**
	2010	21.1%	26.1%	27.8%	11.2%	8.5%	13.1%	**100.0%**
Q Line	2019	65.4%	14.8%	6.8%	7.7%	5.1%	0.2%	**100.0%**
	2010							
SMART	2019	66.6%	15.1%	5.7%	5.4%	6.3%	0.9%	**100.0%**
	2010	46.3%	21.0%	14.0%	2.5%	5.5%	4.5%	**100.0%**
UMICH	2019	26.3%	32.9%	13.3%	27.3%	0.1%	0.0%	**100.0%**
	2010	10.1%	19.8%	1.4%	1.8%	0.2%	0.4%	**100.0%**
Regional Statistics	2019	**47.7%**	**23.7%**	**8.9%**	**14.2%**	**4.6%**	**0.9%**	**100.0%**
	2010	**32.3%**	**20.9%**	**13.9%**	**2.4%**	**4.7%**	**4.6%**	**100.0%**

The percentage of regional respondents had little change from 2010 to 2019 for those respondents who indicated they were a College/University student (32.4% vs 33.0%), and a K-12th grade student (5.8% vs. 4.8%). The biggest difference is for BWATC riders where a larger percentage of riders indicated they were a College/University student in 2010 (17.8%) compared to 2019 (5.6%). The 2019 survey included the option to indicate a respondent was "Not a student" and "Unknown".

Table 7-12: Student Status by System (2019 vs. 2010)

System	Year	Student Status				
		Not a student	Yes - College / University	Yes - K - 12th grade	Yes - Other type of student	Total
AAATA	2019	53.8%	40.8%	4.9%	0.5%	**100.0%**
	2010		45.4%	2.9%	2.5%	-
BWATC	2019	90.0%	5.6%	4.4%	0.0%	**100.0%**
	2010		17.8%	6.3%	2.7%	-
DDOT	2019	82.3%	7.7%	9.3%	0.7%	**100.0%**
	2010		18.2%	8.9%	4.6%	-
DPM	2019	93.5%	6.2%	0.4%	0.0%	**100.0%**
	2010		5.6%	0.4%	0.4%	-
MTA	2019	89.9%	7.4%	0.7%	2.0%	**100.0%**
	2010					
LET	2019	91.9%	4.2%	1.8%	2.0%	**100.0%**
	2010		15.0%	0.6%	3.4%	-
Q Line	2019	77.9%	18.5%	2.1%	1.5%	**100.0%**
	2010					
SMART	2019	89.1%	7.5%	3.2%	0.3%	**100.0%**
	2010		18.1%	3.5%	2.6%	-
UMICH	2019	19.7%	79.7%	0.4%	0.2%	**100.0%**
	2010		87.6%	0.1%	0.4%	-
Regional Statistics	2019	**61.8%**	**33.0%**	**4.8%**	**0.4%**	**100.0%**
	2010		**32.4%**	**5.8%**	**3.3%**	-

Regional respondents in 2010 were more likely to have zero household vehicles (51.8%) compared to 2019 (45.8%). DPM riders were nearly twice as likely in 2019 to indicate they had three or more working vehicles in their household (20.2%) compared to 2010 (10.3%), while UMICH riders were nearly half as likely to indicate they had three or more working vehicles in their household in 2019 (10.0%) compared to 2010 (19.4%).

Table 7-13: Household Vehicles by System (2019 vs. 2010)

System	Year	Household Vehicle				
		None (0)	One (1)	Two (2)	Three or More	Total
AAATA	2019	38.3%	38.9%	17.1%	5.7%	**100.0%**
	2010	37.8%	35.6%	19.6%	7.1%	**100.0%**
BWATC	2019	76.2%	16.8%	5.5%	1.5%	**100.0%**
	2010	73.1%	18.8%	7.4%	0.7%	**100.0%**
DDOT	2019	55.6%	30.0%	12.0%	2.3%	**100.0%**
	2010	60.4%	27.5%	9.2%	2.9%	**100.0%**
DPM	2019	14.8%	31.2%	33.8%	20.2%	**100.0%**
	2010	23.7%	38.7%	27.3%	10.3%	**100.0%**
MTA	2019	18.3%	61.2%	14.0%	6.5%	**100.0%**
	2010					
LET	2019	79.8%	13.2%	4.6%	2.4%	**100.0%**
	2010	64.0%	26.7%	3.3%	6.1%	**100.0%**
Q Line	2019	35.8%	37.4%	21.0%	5.8%	**100.0%**
	2010					
SMART	2019	41.8%	32.0%	19.8%	6.4%	**100.0%**
	2010	51.7%	32.1%	12.0%	4.2%	**100.0%**
UMICH	2019	40.5%	32.6%	16.8%	10.0%	**100.0%**
	2010	33.8%	28.9%	18.0%	19.4%	**100.0%**
Regional Statistics	2019	**45.8%**	**32.2%**	**15.8%**	**6.1%**	**100.0%**
	2010	**51.8%**	**29.3%**	**12.4%**	**6.4%**	**100.0%**

Regional respondents in 2010 were more likely to have four or more household members (33.4%) compared to 2019 (26.9%). There were no statistically significant differences in household size from the 2010 survey to the 2019 survey.

Table 17: Household Size by System (2019 vs. 2010)

System	Year	Household Size				
		One (1)	Two (2)	Three (3)	Four or More	Total
AAATA	2019	25.6%	34.8%	18.5%	21.0%	**100.0%**
	2010	28.4%	37.6%	14.6%	19.4%	**100.0%**
BWATC	2019	33.6%	24.6%	19.1%	22.6%	**100.0%**
	2010	25.5%	26.6%	18.8%	29.1%	**100.0%**
DDOT	2019	24.9%	24.0%	20.8%	30.4%	**100.0%**
	2010	18.1%	24.0%	21.5%	36.4%	**100.0%**
DPM	2019	22.5%	30.4%	19.2%	27.8%	**100.0%**
	2010	26.7%	29.3%	22.0%	22.0%	**100.0%**
MTA	2019	19.2%	35.0%	19.2%	26.5%	**100.0%**
	2010					
LET	2019	35.1%	22.5%	15.3%	27.0%	**100.0%**
	2010	32.0%	31.5%	19.1%	17.3%	**100.0%**
Q Line	2019	39.4%	30.0%	15.8%	14.8%	**100.0%**
	2010					
SMART	2019	27.0%	25.7%	20.2%	27.0%	**100.0%**
	2010	20.4%	26.9%	23.7%	29.0%	**100.0%**
UMICH	2019	21.7%	38.3%	13.9%	26.1%	**100.0%**
	2010	16.3%	29.1%	16.4%	38.2%	**100.0%**
Regional Statistics	2019	**24.7%**	**30.2%**	**18.3%**	**26.9%**	**100.0%**
	2010	**19.5%**	**26.9%**	**20.2%**	**33.4%**	**100.0%**

Regionally, the percentage of household workers has decreased for zero and one-person household workers in 2010 compared to 2019 and has subsequently increased for two and three or more household workers from 2010 to 2019.

Table 7-15: Household Workers by System (2019 vs. 2010)

System	Year	Household Workers				
		None (0)	One (1)	Two (2)	Three or More	Total
AAATA	2019	12.6%	31.3%	36.8%	19.4%	**100.0%**
	2010	21.1%	40.0%	29.8%	9.0%	**100.0%**
BWATC	2019	32.2%	34.2%	19.3%	14.2%	**100.0%**
	2010	37.2%	30.5%	21.1%	11.2%	**100.0%**
DDOT	2019	10.4%	39.3%	36.5%	13.8%	**100.0%**
	2010	29.0%	40.1%	22.6%	8.3%	**100.0%**
DPM	2019	6.0%	32.1%	45.4%	16.5%	**100.0%**
	2010	15.6%	43.8%	33.5%	7.1%	**100.0%**
MTA	2019	0.0%	43.3%	49.1%	7.6%	**100.0%**
	2010					
LET	2019	45.3%	24.0%	14.2%	16.5%	**100.0%**
	2010	43.3%	33.6%	16.0%	7.2%	**100.0%**
Q Line	2019	10.1%	45.3%	34.5%	10.1%	**100.0%**
	2010					
SMART	2019	9.0%	36.6%	35.4%	19.0%	**100.0%**
	2010	23.8%	39.2%	27.4%	9.5%	**100.0%**
UMICH	2019	25.9%	29.8%	29.6%	14.7%	**100.0%**
	2010	30.2%	28.8%	27.5%	13.6%	**100.0%**
Regional Statistics	2019	**15.3%**	**34.7%**	**34.4%**	**15.6%**	**100.0%**
	2010	**27.6%**	**37.9%**	**25.0%**	**9.5%**	**100.0%**

The percentage of regional transit riders that indicated they make "Less than $30,000" for an annual household income decreased from 2010 (66.9%) to 2019 (48.2%). One of the largest differences from 2010 to 2019 were the percentage of DPM riders who indicated they make "$75,000 or more" significantly increased from 2010 (10.7%) to 2019 (36.8%).

Table 18: Income by System (2019 vs. 2010)

System	Year	Income						
		Less than $30,000	$30,000 - $39,999	$40,000 - $49,999	$50,000 - $59,999	$60,000 - $74,999	$75,000 or more	Total
AAATA	2019	46.8%	12.3%	9.2%	7.7%	8.6%	15.3%	**100.0%**
	2010	53.0%	12.9%	10.9%	11.8%	6.6%	4.8%	**100.0%**
BWATC	2019	75.3%	8.3%	5.3%	3.7%	4.5%	2.9%	**100.0%**
	2010	87.7%	5.1%	5.3%	0.5%	1.5%	0.0%	**100.0%**
DDOT	2019	71.9%	12.9%	8.1%	3.8%	1.9%	1.3%	**100.0%**
	2010	75.2%	11.2%	7.4%	4.8%	0.8%	0.7%	**100.0%**
DPM	2019	16.1%	10.0%	11.9%	10.0%	10.7%	41.3%	**100.0%**
	2010	28.8%	14.3%	18.4%	19.4%	8.4%	10.7%	**100.0%**
MTA	2019	64.2%	20.5%	3.6%	6.2%	1.3%	4.1%	**100.0%**
	2010							
LET	2019	80.1%	7.7%	1.4%	7.9%	2.2%	0.7%	**100.0%**
	2010	87.5%	7.3%	2.7%	0.6%	1.9%	0.0%	**100.0%**
Q Line	2019	41.2%	9.2%	13.4%	13.8%	7.2%	15.3%	**100.0%**
	2010							
SMART	2019	46.8%	15.2%	10.1%	9.3%	7.8%	10.8%	**100.0%**
	2010	61.6%	13.7%	10.0%	8.6%	3.0%	3.1%	**100.0%**
UMICH	2019	50.2%	9.3%	5.7%	5.6%	8.1%	21.0%	**100.0%**
	2010	53.0%	7.0%	5.9%	8.1%	7.9%	18.2%	**100.0%**
Regional Statistics	2019	**57.0%**	**12.0%**	**8.0%**	**6.0%**	**5.7%**	**11.3%**	**100.0%**
	2010	**66.9%**	**11.1%**	**8.0%**	**6.7%**	**3.0%**	**4.4%**	**100.0%**

7.2 Trend Comparisons by Place Type & Access/Egress Modes

7.2.1 Place Type Comparisons

The following trend comparisons look at the Origin Place Type by the Destination Place Type for the survey years 2019 and 2010. Some categories for the 2019 survey have been grouped together to better represent comparisons, such as “Your usual WORKPLACE” and “Work Related”.

Regionally, there was not a large difference from the 2010 to the 2019 surveys for the distribution of origin place type to destination place type. Over half of respondents were coming from home in 2010 (53.3%), and just under half of respondents were coming from home in 2019 (49.5%). The percentage of respondent going to “School (K-12) (student only)” decreased slightly from 2010 (3.7%) to 2019 (1.7%).

Table -7-17: Regional Distribution of Origin Place Type by Destination Place Type (2019)

Origin Place Type (2019)	Destination Place Type (2019)								
	Your HOME or Hotel	Work or Work related	College or University (student only)	Social or Eating Out	Shopping	Medical / dental	School (K-12) (student only)	Other	Total
Your HOME or Hotel	0.0%	22.5%	11.6%	5.4%	2.5%	1.6%	1.6%	4.3%	49.5%
Work or Work related	17.0%	0.9%	0.4%	1.1%	0.4%	0.1%	0.0%	0.8%	20.6%
College or University (student only)	6.0%	0.4%	3.4%	0.8%	0.1%	0.0%	0.0%	0.1%	10.8%
Social or Eating Out	4.0%	0.6%	0.3%	1.4%	0.2%	0.1%	0.0%	0.4%	7.0%
Shopping	2.3%	0.1%	0.1%	0.3%	0.2%	0.1%	0.0%	0.2%	3.3%
Medical / dental	1.4%	0.1%	0.0%	0.2%	0.1%	0.0%	0.0%	0.1%	2.0%
School (K-12) (student only)	1.6%	0.1%	0.0%	0.1%	0.0%	0.0%	0.1%	0.0%	1.9%
Other	3.0%	0.4%	0.1%	0.5%	0.2%	0.1%	0.0%	0.6%	5.0%
Total	35.3%	25.1%	15.9%	9.8%	3.6%	2.0%	1.7%	6.5%	100.0%

Table 19: Regional Distribution of Origin Place Type by Destination Place Type (2010)

Origin Trip Purpose (2010)	Destination Trip Purpose (2010)								
	Home	University/ College	Shopping	Social, Eat Out, etc.	Work or Work-Related	High School/ Middle School	Medical Services	Other	Total
Home	0.0%	10.7%	3.4%	10.4%	21.9%	3.4%	3.5%	0.0%	53.3%
University/College	7.5%	5.4%	0.2%	0.6%	0.5%	0.0%	0.1%	0.0%	14.3%
Shopping	2.0%	0.1%	0.2%	0.2%	0.1%	0.0%	0.1%	0.0%	2.6%
Social, Eat Out, Recreati	4.2%	0.2%	0.2%	1.5%	0.5%	0.1%	0.2%	0.0%	6.9%
Work or Work-Related	13.7%	0.4%	0.2%	1.2%	1.6%	0.0%	0.2%	0.0%	17.3%
High School/ Middle School	2.4%	0.0%	0.0%	0.2%	0.1%	0.2%	0.0%	0.0%	2.9%
Medical Services	1.8%	0.0%	0.1%	0.2%	0.1%	0.0%	0.2%	0.0%	2.5%
Other	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%
Total	31.6%	16.9%	4.4%	14.3%	24.7%	3.7%	4.3%	0.1%	100.0%

7.2.2 Access/Egress Type Comparisons

The following trend comparisons look at the Access mode by the Egress mode for the survey years 2019 and 2010. Some categories for the 2019 survey have been grouped together to better represent comparisons, such as “Walk” and “Wheelchair / Scooter”.

Walk remained the predominantly used method of transportation to get both from origin to transit, and from transit to destination, for both 2010 and 2019 surveys. Those respondents that were dropped off from their origin to transit, and were picked up from transit to their destination, decreased from 2010 (2.0%) to 2019 (0.0%).

Table 7-19: Distribution of Access Mode by Egress Mode (2019)

Access (2019)	Egress (2019)							
	Walk / Wheelchair	Get in a parked vehicle and drive alone	Get in a parked vehicle and drive / ride with someone	Be picked up by someone	Personal bike	Taxi	Other	Total
Walk / Wheelchair	85.9%	2.3%	0.9%	0.7%	0.1%	0.0%	0.2%	90.2%
Drove alone and parked	5.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	5.1%
Was dropped off by someone going someplace else	1.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.0%
Drove or rode with others and parked	1.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.5%
Personal Bike	0.1%	0.0%	0.0%	0.0%	0.6%	0.0%	0.0%	0.8%
Taxi	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Other	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.4%
Total	94.9%	2.3%	0.9%	0.8%	0.8%	0.0%	0.3%	100.0%

Table 7-20: Distribution of Access Mode by Egress Mode (2010)

Access (2010)	Egress (2010)						
	Walked/ Wheelchair	Picked up	Drive alone	Carpool	Bicycled	Taxi	Total
Walked/Wheelchair	83.8%	1.9%	1.2%	0.2%	0.2%	0.1%	87.5%
Dropped off	6.2%	2.0%	0.1%	0.1%	0.0%	0.0%	8.5%
Drove alone	1.8%	0.1%	0.7%	0.0%	0.0%	0.0%	2.6%
Carpool	0.3%	0.0%	0.0%	0.1%	0.0%	0.0%	0.4%
Bicycle	0.3%	0.0%	0.0%	0.0%	0.5%	0.0%	0.8%
Taxi	0.2%	0.0%	0.0%	0.0%	0.0%	0.1%	0.4%
Total	92.5%	4.1%	2.0%	0.3%	0.7%	0.3%	100.0%

7.3 Trend Comparisons by Corridor

The trend comparisons by corridor are related to the following three corridors and the definition of the corridors is the same as discussed in Chapter 6 Analysis: Survey Result by System, Section 2: Corridor Specific Analysis.

- Gratiot Corridor serves riders who travel on Gratiot Avenue while being surveyed on both SMART and DDOT routes.
- Michigan Corridor which serves riders who use the SMART, DDOT and Q Line routes. The Q Line, however, was not surveyed during the 2010 survey, so Michigan Corridor percentages may be significantly more different than other corridors.
- Woodward Corridor which serves riders who traveled on Woodward Avenue while being surveyed on the SMART routes.

Woodward Corridor riders were less likely to have zero additional transfers in 2010 (40.8%) compared to 2019 (52.9%). Additionally, Woodward Corridor respondents were far more likely to have two or more transfers in 2010 (16.1%) compared to 2019 (0.5%).

Table 7-21: Total Transfers by Corridor

Corridor	Year	Total Transfers				
		None	One	Two	Three or More	Total
GRATIOT	2019	50.2%	47.7%	2.1%	0.0%	100.0%
	2010	47.4%	38.8%	11.0%	2.8%	100.0%
MICHIGAN	2019	49.4%	50.0%	0.7%	0.0%	100.0%
	2010	41.2%	46.9%	10.0%	1.9%	100.0%
WOODWARD	2019	52.9%	46.6%	0.5%	0.0%	100.0%
	2010	40.8%	43.1%	13.3%	2.8%	100.0%
SEMCOG	2019	66.0%	31.5%	2.4%	0.1%	100.0%
	2010	52.3%	36.0%	10.0%	1.7%	100.0%

Note: in Table 7-21, 2019 based on secondary unlinked weight factors vs. 2010

Gratiot Corridor respondents were less likely in 2010 to be coming from "Work or work related" (19.8%) compared to 2019 (26.1%). The 2010 survey respondents were more likely to be coming from Home in the Gratiot and Michigan Corridors and the region overall compared to the 2019 survey respondents.

Table 7-22: Origin Trip Purpose by Corridor (2019 vs. 2010)

Corridor	Year	Origin Trip Purpose							
		Your HOME	College or University (student only)	Shopping	Social or recreational	Work or Work related	Medical / dental	Other	Total
GRATIOT	2019	49.4%	0.7%	8.7%	5.9%	26.1%	0.5%	1.0%	100.0%
	2010	58.0%	4.2%	5.9%	7.8%	19.8%	2.0%	2.2%	100.0%
MICHIGAN	2019	43.6%	0.0%	0.0%	8.6%	32.1%	1.0%	6.5%	100.0%
	2010	57.5%	9.3%	1.6%	9.7%	17.8%	0.8%	3.4%	100.0%
WOODWARD	2019	56.3%	2.6%	4.1%	4.5%	22.0%	3.0%	2.8%	100.0%
	2010	56.0%	5.3%	2.7%	6.6%	20.3%	5.6%	3.5%	100.0%
SEMCOG	2019	48.9%	11.1%	3.2%	5.5%	20.4%	2.0%	4.2%	100.0%
	2010	53.3%	14.3%	2.6%	6.9%	17.3%	2.5%	3.0%	100.0%

The 2019 survey respondents had higher percentages in the Gratiot and Michigan Corridors to use "Walk" as the method they used to get from their origin to transit compared to the 2010 survey respondents. Michigan Corridor respondents were significantly more likely to use "Was dropped off by someone going someplace else" (14.9%) compared to the 2019 survey respondents (0.7%). The "Other" category was used to categorize anything that was chosen less than 2.0% of the time as the method respondents used to get from their origin to transit.

Table 7-23: Access by Corridor (2019 vs. 2010)

Corridor	Year	Access				
		Walk	Was dropped off by someone going someplace else	Drove alone and parked	Other	Total
GRATIOT	2019	86.2%	8.2%	2.7%	2.9%	100.0%
	2010	83.4%	12.9%	1.2%	2.5%	100.0%
MICHIGAN	2019	83.3%	0.7%	2.2%	13.8%	100.0%
	2010	83.2%	14.9%	0.6%	1.3%	100.0%
WOODWARD	2019	85.5%	5.2%	3.7%	5.6%	100.0%
	2010	86.7%	10.2%	0.6%	2.6%	100.0%
SEMCOG	2019	90.2%	1.9%	5.2%	2.7%	100.0%
	2010	87.5%	8.5%	2.6%	1.6%	100.0%

Respondents in all of the corridors were much more likely to be going to "Social or recreational" in 2010 (16.6%, 9.9%, and 17.5%) compared to 2019 (8.6%, 2.6%, and 13.1%). "Your HOME" was the top destination place type among all corridors and regionally for both 2010 and 2019 with the exception of the Michigan Corridor which had a higher percentage of respondents going to "Work or Work related" for both 2010 and 2019, and the Woodward Corridor which had a higher percentage of respondents indicating they were going to "Work or Work related" in 2019.

Table 7-24: Destination Trip Purpose by Corridor (2019 vs. 2010)

Corridor	Year	Destination Trip Purpose							
		Your HOME	College or University (student only)	Shopping	Social or recreational	Work or Work related	Medical / dental	Other	Total
GRATIOT	2019	35.8%	1.1%	7.6%	8.6%	34.1%	2.2%	1.8%	100.0%
	2010	32.3%	6.0%	7.2%	16.6%	27.9%	3.3%	6.6%	100.0%
MICHIGAN	2019	36.3%	1.3%	2.6%	2.6%	36.7%	1.0%	5.1%	100.0%
	2010	30.8%	8.6%	8.4%	9.9%	34.6%	4.3%	3.4%	100.0%
WOODWARD	2019	33.0%	1.7%	4.7%	13.1%	38.1%	2.9%	1.1%	100.0%
	2010	30.8%	7.7%	5.6%	17.5%	26.5%	8.7%	3.2%	100.0%
SEMCOG	2019	34.9%	16.3%	3.6%	7.5%	24.8%	2.0%	2.7%	100.0%
	2010	31.6%	16.9%	4.4%	14.3%	24.7%	4.3%	3.9%	100.0%

The largest difference between the 2010 survey and the 2019 survey in regard to how respondents travelled from transit to their destination was in the "Other" category. Respondents of the 2010 survey were more likely to use an "Other" method of transportation to get from transit to their destination compared to respondents of the 2019 survey.

Table 7-25: Egress by Corridor (2019 vs. 2010)

Corridor	Year	Egress			
		Walk	Get in a parked vehicle and drive alone	Other	Total
GRATIOT	2019	93.8%	1.4%	4.8%	100.0%
	2010	91.2%	1.9%	6.8%	100.0%
MICHIGAN	2019	94.6%	0.0%	5.4%	100.0%
	2010	90.0%	0.6%	9.3%	100.0%
WOODWARD	2019	94.7%	1.2%	4.1%	100.0%
	2010	92.1%	0.6%	7.2%	100.0%
SEMCOG	2019	94.8%	2.4%	2.8%	100.0%
	2010	92.5%	2.0%	5.4%	100.0%

Respondents in the Michigan Corridor were more likely in 2010 to have their employer pay for part or all of their fare (11.1%) compared to 2019 (2.2%). Adversely, in the region overall respondents were more likely in 2019 to have their employer pay for their fare (37.0%) compared to 2010 (10.1%).

Table 7-26: Employer Paid by Corridor (2019 vs. 2010)

Corridor	Year	Employer Paid		
		Yes	No	Total
GRATIOT	2019	8.8%	91.2%	100.0%
	2010	8.4%	91.6%	100.0%
MICHIGAN	2019	2.2%	97.8%	100.0%
	2010	11.1%	88.9%	100.0%
WOODWARD	2019	11.0%	89.0%	100.0%
	2010	9.4%	90.6%	100.0%
SEMCOG	2019	37.0%	63.0%	100.0%
	2010	10.1%	89.9%	100.0%

Woodward Corridor residents were significantly more likely to make the trip 3-5 days a week in 2019 (60.2%) compared to 2010 (49.1%). There were no other statistically significant differences between 2010 to 2019.

Table 7-27: Trip Frequency by Corridor (2019 vs. 2010)

Corridor	Year	Trip Frequency						
		6-7 days /week	3-5 days / week	1-2 days / week	1-3 days / month	Less than 1 day a month	First time to make this trip	Total
GRATIOT	2019	33.4%	54.3%	10.6%	0.6%	0.7%	0.5%	100.0%
	2010	28.0%	45.2%	13.5%	6.2%	3.9%	3.2%	100.0%
MICHIGAN	2019	12.6%	66.1%	4.2%	9.8%	5.2%	2.0%	100.0%
	2010	19.7%	55.9%	10.8%	8.0%	3.6%	1.9%	100.0%
WOODWARD	2019	22.8%	60.2%	7.1%	7.8%	1.3%	0.8%	100.0%
	2010	21.9%	49.1%	12.5%	9.3%	3.5%	3.8%	100.0%
SEMCOG	2019	29.3%	57.3%	8.7%	2.4%	1.4%	0.9%	100.0%
	2010	25.2%	49.7%	11.2%	7.7%	2.9%	3.5%	100.0%

Respondents from the 2010 survey were significantly more likely to not make the trip at all if transit were not available in all three corridors and the region overall compared to 2019 survey respondents.

Table 7-28: Alternative Travel Mode by Corridor (2019 vs. 2010)

Corridor	Year	Alternative Travel Mode						
		Walk	Drive (own car)	Get a ride with someone	Taxi	Bike	Could not make trip	Total
GRATIOT	2019	2.71%	9.56%	31.10%	3.77%	3.06%	30.97%	100.00%
	2010	14.1%	12.2%	35.5%	11.9%	4.8%	38.0%	100.0%
MICHIGAN	2019	3.00%	8.48%	30.27%	0.00%	2.84%	33.75%	100.00%
	2010	13.3%	11.4%	34.5%	14.7%	6.0%	40.2%	100.0%
WOODWARD	2019	1.22%	16.41%	30.57%	0.00%	4.17%	19.71%	100.00%
	2010	18.3%	13.1%	36.6%	13.8%	4.7%	31.8%	100.0%
SEMCOG	2019	17.58%	12.59%	24.15%	2.65%	5.80%	16.32%	100.00%
	2010	19.4%	16.3%	30.7%	13.0%	8.4%	30.5%	100.0%

SEMCOG respondents overall had lower percentages in 2010 (53.7%) compared to 2019 (63.1%) to have a valid driver's license.

Table 7-29: Driver's License by Corridor (2019 vs. 2010)

Corridor	Year	Driver's License		
		Yes	No	Total
GRATIOT	2019	56.9%	43.1%	100.0%
	2010	40.8%	59.2%	100.0%
MICHIGAN	2019	67.3%	32.7%	100.0%
	2010	36.2%	63.8%	100.0%
WOODWARD	2019	65.0%	35.0%	100.0%
	2010	46.2%	53.8%	100.0%
SEMCOG	2019	63.1%	36.9%	100.0%
	2010	53.7%	46.3%	100.0%

Survey respondents in all three corridors and in the region overall were more likely to be under the age of 18 in the 2010 survey compared to the 2019 survey. Subsequently, survey respondents were more likely to be age 65 and older in 2019 compared to 2010.

Table 7-30: Age by Corridor (2019 vs. 2010)

Corridor	Year	Age						
		Under 18	18-25	26-34	35-54	55-64	65 and older	Total
GRATIOT	2019	1.2%	21.2%	27.7%	24.7%	17.0%	8.2%	100.0%
	2010	5.1%	24.7%	19.3%	37.6%	11.2%	2.1%	100.0%
MICHIGAN	2019	3.1%	21.4%	34.5%	33.3%	5.4%	2.3%	100.0%
	2010	7.1%	20.8%	17.6%	43.6%	10.2%	0.7%	100.0%
WOODWARD	2019	0.3%	16.1%	27.4%	31.7%	18.4%	6.1%	100.0%
	2010	4.9%	15.0%	14.5%	43.8%	18.1%	3.8%	100.0%
SEMCOG	2019	4.4%	36.1%	22.8%	24.7%	8.2%	3.7%	100.0%
	2010	5.6%	34.9%	16.2%	31.2%	10.2%	1.8%	100.0%

Survey respondents were much more likely to be employed either part- or full-time in 2019 compared to in 2010. The "Not Employed" category could include respondents that were not employed and seeking work, or not employed and not seeking work.

Table 7-31: Employment Status by Corridor (2019 vs. 2010)

Corridor	Year	Employment Status				
		Employed	Not Employed	Retired	Homemaker	Total
GRATIOT	2019	83.1%	9.6%	6.8%	0.5%	100.0%
	2010	59.3%	17.8%	4.6%	6.4%	100.0%
MICHIGAN	2019	90.0%	8.0%	2.0%	0.0%	100.0%
	2010	57.0%	23.8%	4.5%	8.4%	100.0%
WOODWARD	2019	84.1%	7.3%	7.1%	1.5%	100.0%
	2010	55.0%	22.8%	10.9%	5.5%	100.0%
SEMCOG	2019	71.0%	23.6%	4.6%	0.9%	100.0%
	2010	53.2%	16.3%	4.7%	4.6%	100.0%

The Gratiot, Michigan, and Woodward Corridor respondents were more likely to be College/University students in 2010 (17.3%, 21.1%, & 16.8%) compared to 2019 (6.3%, 19.9%, & 8.0%), while in the region overall respondents were less likely to be College/University students in 2010 (32.4%) compared to 2019 (33.8%). The category "Not a student" was added to the 2019 survey to allow for respondents to indicate they were not a student at all if applicable.

Table 7-32: Student Status by Corridor (2019 vs. 2010)

Corridor	Year	Student Status				
		Not a student	Yes - College / University	Yes - K - 12th grade	Yes - Other type of student	Total
GRATIOT	2019	92.5%	6.3%	1.2%	0.0%	100.0%
	2010	-	17.3%	7.2%	5.7%	-
MICHIGAN	2019	76.2%	19.9%	3.1%	0.7%	100.0%
	2010	-	21.1%	6.1%	3.1%	-
WOODWARD	2019	90.4%	8.0%	1.6%	0.0%	100.0%
	2010	-	16.8%	5.3%	3.0%	-
SEMCOG	2019	60.9%	33.8%	4.9%	0.5%	100.0%
	2010	-	32.4%	5.8%	3.3%	-

The Gratiot Corridor and Michigan Corridor respondents were more likely in 2019 to have three or more working vehicles in their household (10.6% and 13.7% respectively) compared to in 2010 (4.2% and 2.4% respectively). Woodward Corridor respondents were much more likely to have two working vehicles in their household in 2019 (23.8%) compared to 2010 (9.4%).

Table 7-33: Household Vehicle by Corridor (2019 vs. 2010)

Corridor	Year	Household Vehicle				
		None (0)	One (1)	Two (2)	Three or More	Total
GRATIOT	2019	42.9%	29.4%	17.1%	10.6%	100.0%
	2010	58.2%	27.5%	10.1%	4.2%	100.0%
MICHIGAN	2019	40.6%	33.1%	12.6%	13.7%	100.0%
	2010	54.4%	31.3%	11.8%	2.4%	100.0%
WOODWARD	2019	42.6%	30.8%	23.8%	2.9%	100.0%
	2010	61.7%	26.5%	9.4%	2.4%	100.0%
SEMCOG	2019	45.9%	32.3%	15.7%	6.1%	100.0%
	2010	51.8%	29.3%	12.4%	6.4%	100.0%

On average, corridor respondents were more likely to have either one or two people in their household in 2019 compared to 2010 yet were less likely to have three or four or more people in their household in 2019 compared to 2010.

Table 7-34: Household Size by Corridor (2019 vs. 2010)

Corridor	Year	Household Size				
		One (1)	Two (2)	Three (3)	Four or More	Total
GRATIOT	2019	27.9%	28.1%	18.8%	25.1%	100.0%
	2010	18.6%	26.5%	20.2%	34.7%	100.0%
MICHIGAN	2019	26.5%	21.6%	23.8%	28.0%	100.0%
	2010	15.9%	22.9%	28.6%	32.6%	100.0%
WOODWARD	2019	39.4%	24.8%	18.5%	17.3%	100.0%
	2010	28.1%	26.7%	19.5%	25.7%	100.0%
SEMCOG	2019	24.4%	30.3%	18.2%	27.1%	100.0%
	2010	19.5%	26.9%	20.2%	33.4%	100.0%

Woodward Corridor respondents were more likely to have one, two, or three or more people in their household who were employed in 2019 compared to in 2010. All three of the corridor's respondents were more than twice as likely to have zero household workers in 2010 compared to 2019.

Table 7-35: Household Workers by Corridor (2019 vs. 2010)

Corridor	Year	Household Workers				
		None (0)	One (1)	Two (2)	Three or More	Total
GRATIOT	2019	8.1%	38.6%	34.0%	19.3%	100.0%
	2010	26.1%	41.6%	24.6%	7.7%	100.0%
MICHIGAN	2019	4.8%	40.1%	37.9%	17.2%	100.0%
	2010	26.3%	38.3%	23.0%	12.3%	100.0%
WOODWARD	2019	10.2%	39.2%	35.7%	14.9%	100.0%
	2010	32.9%	42.0%	17.7%	7.4%	100.0%
SEMCOG	2019	15.5%	34.6%	34.3%	15.6%	100.0%
	2010	27.6%	37.9%	25.0%	9.5%	100.0%

All three corridors respondents and the region overall were significantly more likely to have annual household incomes of less than $30,000 in 2010 compared to 2019 and were all more likely to have annual household incomes of more than $60,000 in 2019 compared to 2010.

Table 7-36: Income by Corridor (2019 vs. 2010)

Corridor	Year	Income						
		Below $30,000	$30,000 - $39,999	$40,000 - $49,999	$50,000 - $59,999	$60,000 - $74,999	$75,000 or more	Total
GRATIOT	2019	47.1%	13.8%	4.3%	6.0%	6.1%	5.0%	100.0%
	2010	71.3%	11.5%	8.6%	6.4%	1.3%	0.9%	100.0%
MICHIGAN	2019	47.3%	13.6%	11.8%	16.7%	0.0%	5.4%	100.0%
	2010	66.2%	10.4%	14.0%	6.2%	2.2%	0.9%	100.0%
WOODWARD	2019	41.2%	13.2%	12.4%	5.8%	5.9%	8.5%	100.0%
	2010	69.2%	14.0%	8.6%	5.2%	1.7%	1.3%	100.0%
SEMCOG	2019	48.4%	10.1%	6.7%	5.0%	4.8%	9.7%	100.0%
	2010	66.9%	11.1%	8.0%	6.7%	3.0%	4.4%	100.0%

7.4 Comparison of SEMCOG Survey Results to Other Agencies

ETC has compiled a database of six recent onboard surveys (completed within the last 5 years) for transit agencies serving large metropolitan areas (populations greater than 250,000) in order to provide comparative benchmarks on a few select items. These benchmarks include onboard OD data results from the following agencies:

- MUNI (San Francisco, CA)
- AC Transit (Oakland, CA)
- H-GAC (Houston-Galveston, TX)
- IndyGo (Indianapolis, IN)
- LYNX (Orlando, FL)
- MTA (Nashville, TN)

Notes: 1) The percentages in the following charts are weighted in a similar manner to the SEMCOG survey results. 2) Some SEMCOG answer choices were grouped for comparative reasons.

The number of transfers indicated by respondents both before and after the route they were surveyed on was very similar to the number of transfers provided by respondents in the other large metropolitan area surveys.

Table 7-37: Next Transfers (SEMCOG compared to Large Metropolitan Benchmark)

Next Transfers	SEMCOG	Large Metro Benchmark
(0) None	82.1%	81.0%
(1) One	17.9%	17.1%
(2) Two	0.1%	1.8%
(3) Three	0.0%	0.1%

Table 7-38: Previous Transfers (SEMCOG compared to Large Metropolitan Benchmark)

Previous Transfers	SEMCOG	Large Metro Benchmark
(0) None	82.6%	82.8%
(1) One	15.8%	15.4%
(2) Two	1.5%	1.7%
(3) Three	0.1%	0.1%

SEMCOG survey respondents were most likely to be in the 18 to 34 age range compared to respondents in the other large metropolitan area surveys who were most likely to be in the 35 and older age range.

Table 7-39: Age (SEMCOG compared to Large Metropolitan Benchmark)

Age	SEMCOG	Large Metro Benchmark
Under 18	4.3%	5.3%
18 to 34	58.5%	42.4%
35 and Older	37.1%	52.3%

SEMCOG respondents had a slightly lower number of workplace/work-related origin and destination place types when compared to respondents in the other large metropolitan area surveys.

Table 7-40: Origin Place Type (SEMCOG compared to Large Metropolitan Benchmark)

Origin Place Type	SEMCOG	Large Metro Benchmark
Home	49.0%	48.6%
Workplace/Work-related	20.6%	25.6%
Other	30.4%	25.8%

Table 7-41: Destination Place Type (SEMCOG compared to Large Metropolitan Benchmark)

Destination Place Type	SEMCOG	Large Metro Benchmark
Home	34.8%	37.4%
Workplace/Work-Related	25.1%	31.4%
Other	40.0%	31.2%

SEMCOG respondents are more likely to only speak English at home compared to respondents in the other large metropolitan area surveys.

Table 7-42: Language Other than English Spoken at Home (SEMCOG compared to Large Metropolitan Benchmark)

Speak another language at home	SEMCOG	Large Metro Benchmark
Yes	11.9%	29.0%
No	88.1%	71.0%

A slightly higher number of males participated in the SEMCOG survey compared to respondents in the other large metropolitan area surveys.

Table 7-43: Gender (SEMCOG compared to Large Metropolitan Benchmark)

Gender	SEMCOG	Large Metro Benchmark
Female	44.3%	48.4%
Male	55.6%	51.2%
Other	0.2%	0.4%

SEMCOG respondents were more likely to have an annual household income of less than $25,000 compared to respondents in the other large metropolitan area surveys.

sTable 7-44: Income (SEMCOG compared to Large Metropolitan Benchmark)

Income	SEMCOG	Large Metro Benchmark
Less than $25,000	48.7%	29.8%
$25,000 - $50,000	28.3%	32.2%
$50,000 - $74,999	11.7%	17.0%
$75,000 - $99,999	4.8%	8.1%
$100,000 or more	6.5%	12.9%