



Technical Memorandum

2019 Transit On-board Survey Trip Assignment

Prepared for Atlanta Regional Commission and ETC Institute

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1. Introduction

WSP was tasked with conducting an analysis of the 2019 Atlanta Regional Commission (ARC) transit on-board survey. The goals of this analysis include (a) to characterize Atlanta transit trips, (b) highlight changes in transit travel behavior in the Atlanta region over the last 10 years, and (c) compare the most-recently validated regional model to this survey data patterns. This technical memo discusses the preparation of transit trip origin-destination matrices and their assignment to the 2015 ARC Activity-Based Model transit network.

The 2019 transit on-board survey was conducted by ETC Institute (ETC) on behalf of ARC in two stages – Spring 2019 and Fall 2019. The trip matrices were constructed by combining data from the two stages. The secondary expansion weights (Updated_LINKED_WGHT_FCTR) calculated by Connectics Transportation Group (CTG) were used to expand the survey trips to represent regional transit trips. Please refer to the memo “Atlanta Regional Commission 2019 Regional Transit On-Board Survey Secondary Expansion Technical Memorandum” for the details.

The 2015 ARC ABM transit network was used since it is the most recently available for a validated model scenario year.

2. Observed Transit Trips

The ARC ABM transit assignment procedures expect 50 transit trip tables, defined by the cartesian combination of two primary modes, five access modes and five time periods.

- Primary modes
 - Premium Transit Only
 - All Transit
- Access modes
 - Walk at origin & Walk at destination
 - Park and Ride (PNR) at origin & Walk at destination
 - Walk at origin & PNR at destination
 - Kiss and Ride (KNR) at origin & Walk at destination
 - Walk at origin & KNR at destination
- Time periods
 - Early AM (EA), 3:00 AM to 5:59 AM
 - AM Peak (AM), 6:00 AM to 9:59 AM
 - Midday (MD), 10:00 AM to 2:59 PM
 - PM Peak (PM), 3:00 PM to 6:59 PM
 - Evening (EV), 7:00 PM to 2:59 AM

Table 1 shows a summary of the transit trip tables developed from the transit onboard survey. Premium Transit Only trips sum to 57,185 (or 32%) of the total 178,682 transit trips and the rest are All Transit mode trips. Total transit trips in the region show 77% walk access trips, 17% PNR (park and ride at either end),

and 6% KNR (kiss and ride at either end). As expected, Premium Only transit trips show a high share of PNR trips at 47% or 26,689 trips of the total 57,185 trips.

Most of the Premium Only transit trips occur in the peak period (AM and PM peak periods together) at 65% share or 36,965 trips of the total 57,185 trips. The All Transit mode show peak period transit trips at 53% or 64,076 trips out of total 121,497 trips.

Table 1: Observed Transit Linked Trips

	Access & Egress Mode					Total	
Time Period	WLK_WLK	PNR_WLK	WLK_PNR	KNR_WLK	WLK_KNR		
	Premium Transit Only						
Early AM	599	1,173		305		2,077	4%
AM Peak	5,043	9,530		1,296		15,869	28%
Midday	8,705	2,322	2,661	1,571	789	16,048	28%
PM Peak	8,098		11,003		1,995	21,096	37%
Evening	2,095					2,095	4%
Daily	24,540	13,025	13,664	3,172	2,784	57,185	100%
	43%	23%	24%	6%	5%	100%	
	All Transit						
Early AM	5,811	270		454		6,535	5%
AM Peak	26,083	1,334		1,659		29,076	24%
Midday	32,805	369	262	1,123	577	35,136	29%
PM Peak	32,713		1,064		1,223	35,000	29%
Evening	15,750					15,750	13%
Daily	113,162	1,973	1,326	3,236	1,800	121,497	100%
	93%	2%	1%	3%	1%	100%	
	Total Transit						
Early AM	6,410	1,443	-	759	-	8,612	5%
AM Peak	31,126	10,864	-	2,955	-	44,945	25%
Midday	41,510	2,691	2,923	2,694	1,366	51,184	29%
PM Peak	40,811	-	12,067	-	3,218	56,096	31%
Evening	17,845	-	-	-	-	17,845	10%
Daily	137,702	14,998	14,990	6,408	4,584	178,682	100%
	77%	8%	8%	4%	3%	100%	

3. Onboard Assignment

The observed transit trip tables were assigned to the 2015 base year model transit networks, using the ARC ABM transit assignment procedures, without modifications. The outcome of this trip assignment was compared to observed unlinked trips (aka, boardings), summarized from the 2019 On-Board Survey.

Two limitations are worth noting:

- a. No observed estimate is available for unlinked trips on MARTA Rail; the survey records whether a trip was intercepted on MARTA Rail, but not which rail line(s) it used. The survey dataset identifies whether a rail transfer was involved, as well as the transfer station. However, for trips that require a rail transfer, the linked and unlinked trip weight is the same. Based on this information, we estimate that the rail-to-rail transfer rate is approximately 17%, based on 56,070 rail trips that do not require a transfer, and 11,368 rail trips that require a transfer (omitting trips with bus transfers).
- b. There are discrepancies between the model 2015 routes and the 2019 transit service at the time the survey was administered. Routes that are in the model network but not operational in 2019, and vice-versa, are listed below in the route-level comparison section. In addition, routes found in both the 2015 network and in the survey data may not reflect the same headways and/or travel times.

3.2. System Level Summary

Table 2 shows the system level comparison of survey boardings with assignment boardings. The observed trip assignment aggregate results (305,218 boardings) are within 1.6% of the total observed boardings. The system-wide assignment transfer rate is 71% which is close to observed transfer rate of 74%. However, since we know that the observed boardings are missing the rail-to-rail transfers, we expect that the assignment would overestimate Rail boardings by approximately 17%, and it does, by 15%. Conversely, bus boardings are under-estimated in all systems, ranging from -10% for COBB LINC to -23% for Gwinnett Transit. The assignment underestimates MARTA bus boardings by -15%.

Table 2: System Level Assignment Summary (Unlinked Trips)

System	Observed	Assigned	Difference
MARTA Rail	130,717	150,713	19,997 15%
MARTA Bus	159,287	135,686	-23,601 -15%
COBB LINC	9,752	8,822	-930 -10%
Gwinnett County Transit	5,843	4,499	-1,344 -23%
Cherokee Transit (CATS)	63	55	-8 -13%
Gainesville	552	474	-78 -14%
XPRESS	3,951	3,219	-732 -19%
Other	-	1,751	1,751
Total Boardings	310,164	305,218	-4,946 -1.6%
Linked Trips	178,682	178,682	
Transfer Rate	74%	71%	

1 Observed column shows linked trips on MARTA Rail. Actual boardings are approximately 17% higher.

Table 3 shows assigned and observed boardings by time of day period for all transit systems in the region. MARTA rail assignment boardings are closer to observed boardings (9% and 6%) in the PM peak and Evening periods compared to Early AM and AM peak periods for which difference is 40% and 25% percent respectively. Differences in MARTA bus assignment boardings are better (8% and 12%) in MD and PM peak periods respectively, compared to rest of the time periods. It is suggested that the review of model networks should focus on the time periods where higher differences are noticed.

Table 3: Assigned and Observed Transit Boardings by Time Period

System	Time Period					
	EA	AM	MD	PM	EV	Daily
Observed						
MARTA Rail	4,812	31,080	37,319	43,583	13,923	130,717
MARTA Bus	10,239	39,316	40,700	45,015	24,017	159,287
COBB LINC	258	1,994	3,180	2,959	1,361	9,752
Gwinnett County Transit	98	2,243	1,230	2,150	122	5,843
Cherokee Transit (CATS)	-	22	30	12	-	63
Gainesville	-	124	246	183	-	552
XPRESS	-	-	-	3,931	19	3,951
Other	-	-	-	-	-	-
Total	15,407	74,779	82,703	97,833	39,442	310,164
Linked Trips	8,612	44,945	51,184	56,096	17,845	178,682
Transfer Rate	79%	66%	62%	74%	121%	74%
Assigned						
MARTA Rail	6,741	38,697	42,812	47,708	14,754	150,713
MARTA Bus	7,238	33,480	37,516	39,703	17,750	135,686
COBB LINC	180	1,652	2,797	2,992	1,201	8,822
Gwinnett County Transit	112	1,627	941	1,613	205	4,499
Cherokee Transit (CATS)	-	20	24	10	-	55
Gainesville	-	99	205	170	-	474
XPRESS	-	1,155	224	1,803	36	3,219
Other	19	420	539	551	221	1,751
Total	14,291	77,150	85,058	94,552	34,168	305,218
Linked Trips	8,612	44,945	51,184	56,096	17,845	178,682
Transfer Rate	66%	72%	66%	69%	91%	71%
Difference						
MARTA Rail	1,929	7,617	5,494	4,125	831	19,997
MARTA Bus	-3,001	-5,837	-3,184	-5,313	-6,267	-23,601
COBB LINC	-78	-342	-383	33	-159	-930
Gwinnett County Transit	14	-615	-290	-537	84	-1,344
Cherokee Transit (CATS)	0	-2	-5	-1	0	-8
Gainesville	0	-25	-40	-13	0	-78
XPRESS	0	1,155	224	-2,128	17	-732
Other	19	420	539	551	221	1,751
Total	-1,116	2,371	2,355	-3,282	-5,274	-4,946
Percent Difference						
MARTA Rail	40%	25%	15%	9%	6%	15%
MARTA Bus	-29%	-15%	-8%	-12%	-26%	-15%
COBB LINC	-30%	-17%	-12%	1%	-12%	-10%
Gwinnett County Transit	14%	-27%	-24%	-25%	69%	-23%
Cherokee Transit (CATS)		-9%	-17%	-11%		-13%
Gainesville		-20%	-16%	-7%		-14%
XPRESS				-54%	87%	-19%
Other						
Total	-7%	3%	3%	-3%	-13%	-2%

3.3. Route Level Summary

This section shows route level summaries for non-premium transit bus and premium transit bus service. Most of the routes in the survey data have matching routes in the model transit network. However, there are some routes in the model transit networks that don't have matching route names in the survey database, and the other way around. It should be noted that the survey routes are from the year 2019 while the model network represents 2015 transit service. It may be that some routes have been re-named, revised, or dropped entirely.

Non-Premium Transit Bus

The following bus routes were operating at the time that the survey was administered but do not exist in the model transit network.

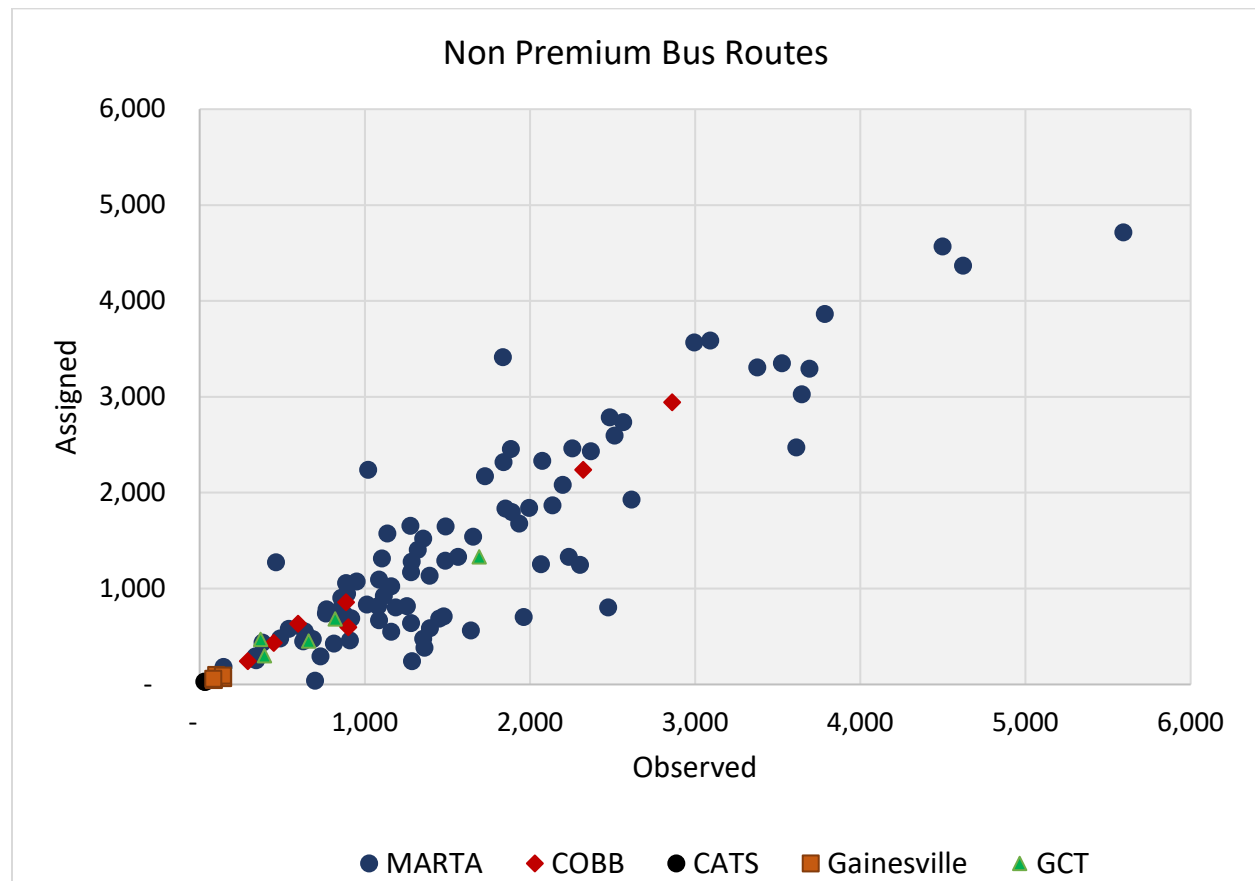
- | | |
|--|--|
| ▪ MARTA 14 - 14th Street / Blandtown | ▪ MARTA 850 - Carroll Heights / Fairburn Heights |
| ▪ MARTA 141 - Haynes Bridge Road / Milton | ▪ MARTA 853 - Collier Heights |
| ▪ MARTA 142 - East Holcomb Bridge Road | ▪ MARTA 856 - Baker Hills / Wilson Mill Meadows |
| ▪ MARTA 143 - Windward Park & Ride | ▪ MARTA 865 - Boulder Park Drive |
| ▪ MARTA 201 - Six Flags Over Georgia | ▪ MARTA 867 - Peyton Forest / Dixie Hills |
| ▪ MARTA 295 - Metropolitan Campus Express | ▪ MARTA 899 - Old Fourth Ward |
| ▪ MARTA 40 - Peachtree Street / Downtown | ▪ MARTA 94 - Northside Drive |
| ▪ MARTA 809 - Monroe Drive / Boulevard | ▪ CobbLINC ROUTE 25 |
| ▪ MARTA 813 - Atlanta Student Movement Boulevard | ▪ CobbLINC BLUE CIRCULATOR |
| ▪ MARTA 816 - North Highland Avenue | ▪ CobbLINC GREEN CIRCULATOR |
| ▪ MARTA 823 - Belvedere/Decatur | ▪ GWINNETT TRANSIT 110 - Emory University / CDC Emory University |
| ▪ MARTA 825 - Johnson Ferry Road | ▪ GWINNETT TRANSIT 45 - Sugarloaf Mills - Georgia Gwinnett College |
| ▪ MARTA 832 - Grant Park | |

The following bus routes exist in the model transit network but were not found in the survey data. The Emory, GSU, GT, KSU and LIFE routes were omitted from the survey on purpose. The MARTA routes shown in this list were no longer operating at the time the survey was administered. Similarly, Gainesville routes 11 and 41 have been discontinued.

- | | | |
|-------------------------|----------------|-------------------|
| ▪ MARTA 13 | ▪ EMORY 1525 | ▪ GSU BLUE |
| ▪ MARTA 16 | ▪ EMORY A | ▪ GSU GREEN |
| ▪ MARTA 170 | ▪ EMORY B | ▪ GT BLUE |
| ▪ MARTA 33 | ▪ EMORY C | ▪ GT GREEN |
| ▪ MARTA 53 | ▪ EMORY D | ▪ GT NARA/TEP |
| ▪ MARTA 56 BOULDER PARK | ▪ EMORY E | ▪ GT RAMBLER |
| ▪ MARTA 67 | ▪ EMORY LOOP | ▪ GT RED |
| ▪ MARTA 99 | ▪ EMORY M | ▪ GT TECH TROLLEY |
| ▪ ATLANTIC STATION | ▪ EMORY NORTH | ▪ KSU BLACK |
| ▪ AUC | ▪ DEKALB MALL | ▪ KSU GREEN |
| ▪ BUC LENOX PARK | ▪ EMORY OXFORD | ▪ KSU MARIETTA |
| ▪ GAINESVILLE 11 | ▪ EMORY PUBLIX | ▪ KSU RED |
| ▪ GAINESVILLE 41 | ▪ EMORY SOUTH | ▪ LIFE CAMPUS |
| ▪ SCAD ATLANTA ACADEMIC | ▪ DEKALB MALL | ▪ LIFE LOCAL A |
| ▪ UNG GAINESVILLE | ▪ EMORY YERKES | ▪ LIFE LOCAL B |
| | | ▪ LIFE REMOTE |

For all the local bus routes that exist in the survey data and model transit network, observed and assigned boardings were compared. Figure 1 shows route level comparison for four systems in the model region. Most of the routes show that assignment boardings are close to observed boardings as shown in the scatter plot.

Figure 1: Non-Premium Transit Bus Route Boardings Comparison



Premium Transit Bus

The following bus routes were operating at the time that the survey was administered but do not exist in the model transit network.

- *CobbLINC ROUTE 10A*
- *CobbLINC ROUTE 10B*
- *SRTA 417 - Sugarloaf Mills to Perimeter OUTBOUND TO SUGARLOAF MILLS*

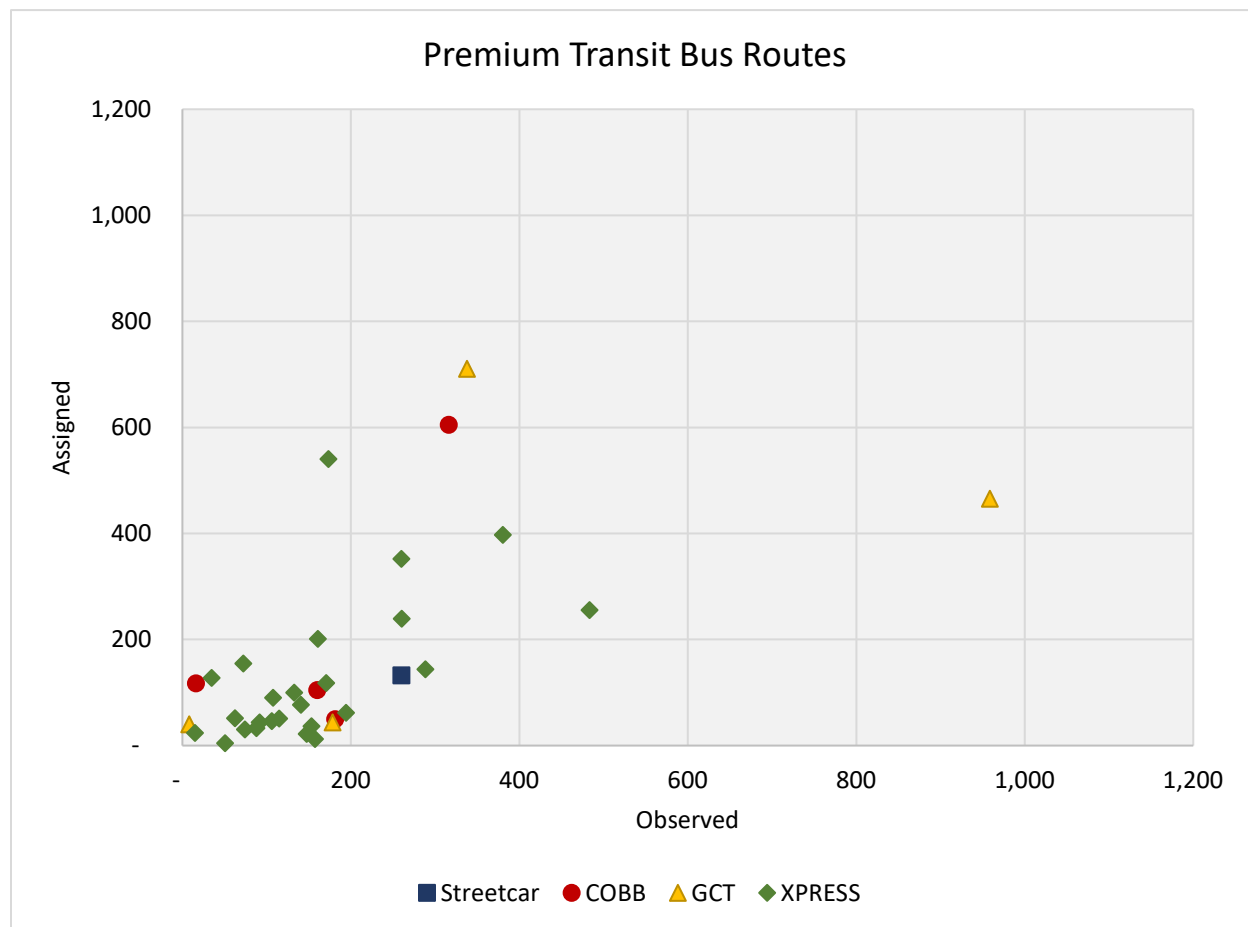
The following bus routes exist in the model network but were not found in the survey data.

- *MARTA 143 AM*

Figure 2 shows observed and assigned route level boardings for premium bus routes by transit system in the region, for the subset of routes that exist both in the survey and in the 2015 model network. Although, the points in the scatter plot shows that individual routes are more spread out, aggregate total for the 34 routes compares well. Total assigned boardings are 5,489 whereas total observed boardings

are 6,337 for all 34 premium bus routes. These are all low ridership routes, and given the differences in transit network, it can be expected that the route-level comparison shows relatively large deviations.

Figure 2: Premium Bus Boardings Comparison



3.4. Station Level Summary

Figure 3 shows observed and assigned MARTA Rail station boardings. The observed boarding station was obtained from the “Station On Address” field, while the transfer station was obtained from the “Rail transfer station for the route surveyed”, for records where the surveyed route is MARTA Rail. The vast majority of rail-to-rail transfers take place at Five Points Station. The survey estimates the Five Points transfer at 29,000 while the assignment estimates them at 27,500. The station with the second-highest number of boardings is Lindbergh Station, at 1,000 approximately. As shown in Figure 3, the assignment reproduces quite well the station boardings pattern.

Figure 3: Station Level Boardings Comparison

