An Onboard Survey of Transit Customers in The Triangle Region

2018

GO Durham

GO Raleigh

GO Triangle

GO Cary

A study conducted by:

CJI Research

In Conjunction with:

NELSON NYGAARD

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Triangle Region Transit Customers
Of GoDurham, GoRaleigh, GoTriangle and GoCary

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Executive Summary

Introduction

In early October 2018, CJI Research conducted an onboard survey of transit customers of four transit systems, GoDurham, GoRaleigh, GoTriangle, and GoCary. The total number of questionnaires completed was 4,523. A random sample survey of this size, when used as a total sample, has a margin of error of +/- 1.5% at the 95% level of confidence. Sub-samples for each of the systems have higher margins noted in the individual system reports. All margin of error statistics assume a split of 50:50 in response. Margin of error is slightly lower when response proportions are unequal, as for example 60:40, 75:25, or 90:10.

Perception of Major Service Improvements

- The survey obtained customer ratings of overall Triangle Region service and nineteen specific elements of service. A seven-point scale was used on which a score of 1 means very poor and 7 means excellent. The percent rating Triangle Region service overall as 7, or "Excellent," is 27%. Another 25% rated service as 6 on the same scale, meaning that the total rating service as excellent or very good is 52%.
- GoDurham (27%), GoRaleigh (28%), and GoTriangle (26%) varied very little in this top score, but GoCary was the exception with 53% offering a score of Excellent for service overall.
- Regionally, top rated elements with high percentages of scores of 6 or 7 include three aspects of service that help define the environment in which customers travel:
    - Fare medium options (60%)
    - Usefulness of printed information (60%)
    - Bus operator helpfulness (58%)
- Top rated operational aspects of service used by almost all customers include weekday service hours (55%), ease of intra-system transfer (55%), and weekday service frequency (54%). Lower percentages of positive scores were given to three other operational aspects of service, specifically service to all destinations desired (46%), buses operating on time (43%), and total duration of the trip (42%).
- When asked to rank areas for improvement:
    - "Buses running on time" is by far the most frequently cited aspect of service to improve. It was cited by 60% of customers as first, second, or third most important to improve among the nineteen specific aspects of service examined.
    - Second most important in this sense is "Service to all destinations," i.e., coverage, (22%).
    - Third most important: Cleanliness of the bus interiors (21%).
- Another way to consider service improvement priorities is to examine the correlation of each aspect of service with the overall service rating. That technique identified five priorities that would have would have a significant impact on the overall quality of service rating. They are, in ascending order of the impact on the overall satisfaction score: Buses running on time, Service to all destinations, Total average trip time, Total average time to make a trip, service to all destination desired (coverage), cleanliness of bus interiors, and cleanliness of bus shelters and transit centers.
- Trip purpose is primarily oriented to employment (68%) and school or college (13%), but some customers (totaling 19%) also use Triangle Region transit services for shopping, medical/dental visits, recreation or other purposes.

Demographics

- Triangle Region transit systems provide key support for employment and education. Of all Triangle Region customers, 48% are employed full time and another 18% part time, for a total of 66% being employed. Another 21% are students.
- In 2018, 61% of the respondents identified as African American/Black and 22% identified themselves as Caucasian/White. Another 7% identified as Asian, 7% Hispanic and 3% Native American, and 5% as "Other".
- Like most U.S. bus systems, the ridership of Triangle Region is young, with 49% younger than thirty-five.
- Unlike the customer base of most transit systems in the United States, a roughly similar proportion of women (47%) as men (51%) use one or more of the Triangle Region systems. (2% preferred not to answer the gender identity question.)
- Similar to the ridership of many bus systems, many Triangle Region customer households report that they have low household incomes. In this survey, 65% report income of less than $25,000.
- Triangle Region customers are similar to the national norm in terms of having a vehicle available for their use. Nationally, 61% of bus riders say they lacked a vehicle to use for the trip they were making when surveyed. Conversely 39% had a vehicle. The Triangle Region ridership is only slightly more likely than the national ridership to have a vehicle available: 43% have vehicles available, while 57% do not.

Travel characteristics

- 35% of Triangle Region customers say they are using transit more often than in the previous year and another 18% say they began riding only in 2018. Only 9% say they are riding less often now. Given that ridership has not increased by 18% as the new ridership might suggest, or even more given that many customers are now riding more often, there must be very substantial churn within the ridership with almost as many ceasing to ride as are beginning to ride.

Mobile communication and transit apps

- Mobile Communication. A transit app has been downloaded by 45% of Triangle Region customers.
- While the use of transit apps is still very much inversely related to age, the use of basic cellphones is not. For example, 87% of customers over the age of sixty-five use a cell phone, but only 27% of that group uses a transit app. Yet, it is interesting that even in this oldest group in the survey, more than one-fourth of the customers use a transit app.

Ridesharing

- 44% have used Uber or Lyft at least once in the thirty days prior to the survey.
    - Of the 44% using Uber or Lyft in the previous thirty days, 72% (which amounts to 32% of all Triangle Region customers) used Uber or Lyft to replace a Triangle Region trip.
    - Of that same 44% who have used Uber or Lyft at least once in the past thirty days, 43% (or 19% of all customers) have used them as part of a Triangle Region trip.

Fare media

- Region-wide, the day pass, either purchased on the bus (19%) or before boarding (12%), for a total of 31%, is the most widely used fare medium. Cash fare, at 28%, is the second most used fare medium. Longer term passes for 7 or 31 days are used by 12%, while a university ID or a GoPass is used by 9% and 19%, respectively.

Introduction and Methodology

Background

As part of a regional customer satisfaction measurement program, CJI Research, LLC conducted surveys of customers onboard buses in each of four systems serving the Triangle Region, GoDurham, GoRaleigh, GoTriangle, and GoCary. Surveys were conducted between October 9 and November 3, 2018.

The survey questionnaire used among GoRaleigh customers was longer and the sample larger than for the other systems. The purpose of the larger survey is to gather more detail, and to collect a sample sufficiently large to analyze at the route level. The other systems had smaller samples and a shorter questionnaire.

The multi year measurement program includes plans to conduct a route level, long-form survey once every three years on one of the systems in rotation (with GoTriangle and GoCary conducted in the same year). The systems not conducting a long-form route level survey in a given year will conduct smaller sample with a shorter questionnaire to provide a system overview but without sufficient sample size for analysis down to the route level. In 2019 the three-year study will be conducted with GoTriangle and GoCary, and in 2020 with GoDurham.

Methods: How the Survey Was Conducted

Sample

For each of the four system surveys, a random sample of runs was drawn from a list of all runs. These initial draft samples of runs and routes to be included were examined to determine whether the randomization process had omitted any significant portion of the systems' overall route structures. The samples were adjusted slightly to take any such omissions into account.

Survey data collection occurred onboard the buses. On the buses, survey staff approached all customers rather than a sample. The only exception was that customers who appeared younger than sixteen were not approached for reasons of propriety and because children are typically unable to provide meaningful answers to several of the questions.

Because all customers were asked to participate rather than a sample of customers on the bus, there was little or no opportunity for a survey staff member to introduce bias in selection of persons to survey. In effect, a bus operating within a specified window of time became a sample cluster point in a sample of such clusters throughout the total system.

The combined sample size is 4,523. A random sample survey of this size has a margin of error of +/-1.5% at the 95% level of confidence, and assuming a split of 50:50 in response. Margin of error is lower when response proportions are unequal.

Sample sizes vary among the four systems both because of the three year rotation of the long form survey used at GoRaleigh in 2018, and because GoCary ridership is of a size that makes it impractical to collect a large sample. The sample sizes are as follows:

GoDurham	836	GoTriangle	810
GoRaleigh	2,629	GoCary	248

Because the sample sizes are – intentionally – so unequal, and not proportional to the riderships, treating the combined sample as a unitary regional sample required weighting by the total annual ridership to get correct proportions. However, each sample also was weighted by route within each system to correct any disproportions within the individual system samples. Thus, the final dual weighting factor assures that the samples are appropriately weighted within each system's sample, and between systems as well, thus producing a sound regional sample.

With a few exceptions, all percentages are rounded to the nearest whole number. In a few cases, when this could have caused important categories to round to zero, or when comparisons between charts would appear inconstant if tenths were not included, percentages are carried to tenths. Rounding causes some percentage columns to total 99% or 101%. These are not errors and should be ignored.

The reader may notice small differences or, say, 1% or even as much as 3%, in the system-wide figures presented in this report when compared to the analogous tables in the individual system report. This is not an error in either study. Such differences are usually due to how rounding will sometimes vary slightly depending upon how a sample is analyzed.

Results can also vary slightly because the weighting factors used for the regional study differ from the factors used in the individual system analyses. Thus, a more important factor in this case is the weighting necessary to properly combine the individual system files into a unit. For the individual survey reports, the individual system survey files are weighted to a single factor: Route level average daily ridership. The regional combined sample, however, is weighted by two factors: (1) Route level average daily ridership and (2) The proportion of the total annual ridership of the four systems accounted for by each of the four systems. The latter is essential in order to keep proper proportions among the systems which differ considerably in their total ridership.

In any event, what we are after here is a set of big picture comparisons. Surveys are very rarely precise to one or two percent, and such differences should be ignored.

Data Collection

Temporary workers from the Greer Group Inc. of Cary, NC were trained to administer the surveys under the supervision of CJI Research staff. Surveyors wore smocks identifying them in large print as "Transit Survey" workers. This uniform helps customers visually understand the purpose of why an interviewer would be approaching them, thus increasing cooperation rate.

In most cases, the survey personnel met the bus operators at pull-out, and accompanied them at the beginning of their shifts and rode the buses throughout the driver's assignment. In some instances, in order to assure broader coverage of certain routes, surveyors rode partial runs and then transferred to another route or run or were dropped off by survey supervisors at a meeting point.

At the end of each sampled trip on a given run, the survey personnel placed the completed surveys in an envelope marked with the route, the run, the time, and the day and reported to the survey supervisors who completed a log form detailing the assignment.

In the analysis, those who did not respond to a question are eliminated from the computation of percentages and means unless there was a way to infer the response. For example, if a rider gave as a trip

purpose *getting to or from school,* it was apparent that this was a student, and that employment could be coded as "student," even if the respondent had not responded to the employment question.

QUESTIONNAIRE

The questionnaire was self-administered. Survey personnel handed surveys and a pen to customers and asked them to complete the survey. The questionnaire was printed in English on one side and Spanish on the other to facilitate use by speakers of either language. The basic “short form”’ questionnaire (used for this report) is reproduced in Appendix A.

The questionnaires for the four systems are identical in their common questions in terms of wording of the question and response choices provided. Thus, they are able to be combined in this joint report. The common basic questionnaire used in the survey was initially developed by Hugh Clark of CJI Research refined a coordinating committee from led by Elizabeth Raskopf of GoTriangle, the agency coordinating the multi-system project. The committee included representatives of all four transit agencies and CAMPO.

The questionnaires were serial numbered so that records could be kept for the route and day of the week on which the questionnaire was completed as well as which system the data apply to. This is a more accurate method than asking customers which route they are riding when completing the survey.

ANALYSIS

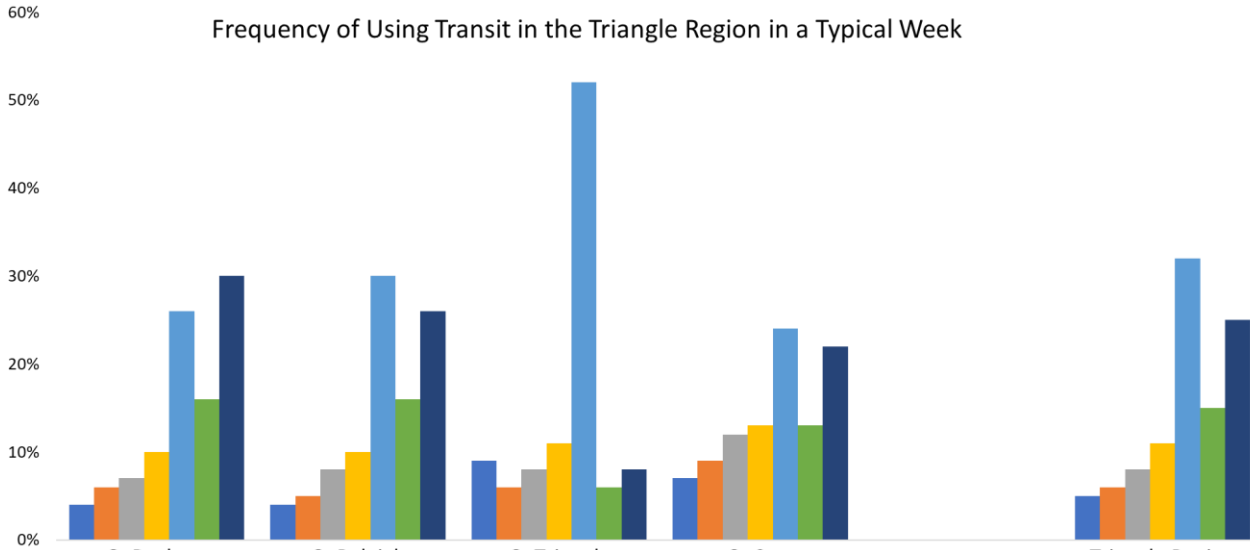
Analysis consists primarily of crosstabulations and frequency distributions. Tables were prepared in SPSS, version 26 and charts in Excel 2016. The survey data will be archived by CJI Research so that it will be available for further analysis as needed.

Rider Profile

Frequency of Using Transit in the Triangle Region

The first and arguably the most basic characteristic of a transit riders is how frequently they typically use transit in a typical week. GoDurham and GoRaleigh are quite similar in this respect. For example, 26% use GoRaleigh every day, and 30% use GoDurham daily in a "typical week."

Figure 1 Frequency of Using

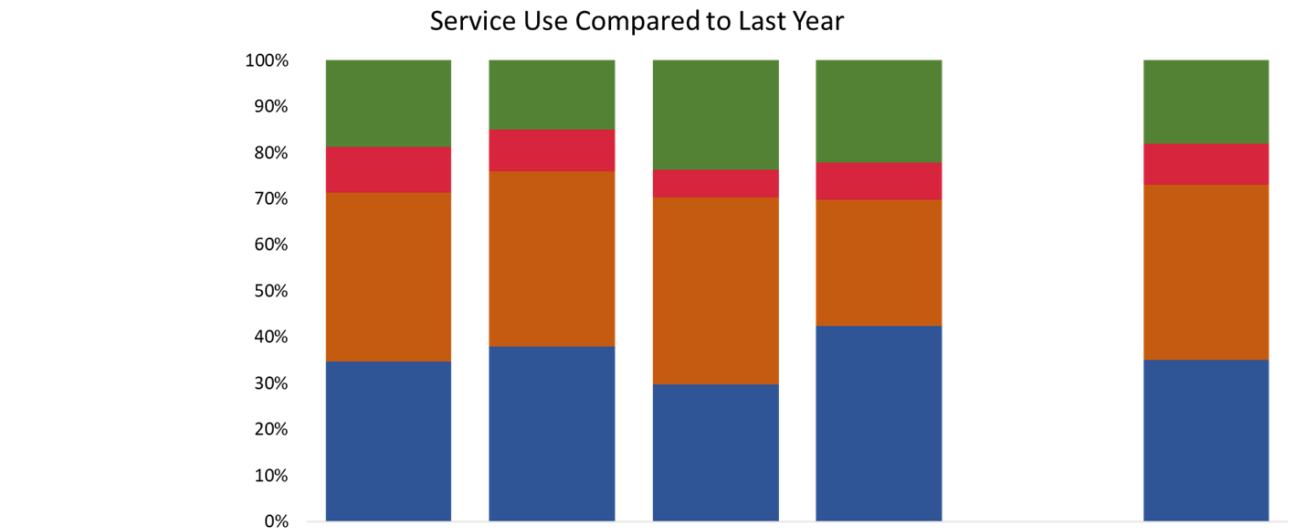


	GoDurham	GoRaleigh	GoTriangle	GoCary	Triangle Region
One day	4%	4%	9%	7%	5%
Two days	6%	5%	6%	9%	6%
Three days	7%	8%	8%	12%	8%
Four days	10%	10%	11%	13%	11%
Five days	26%	30%	52%	24%	32%
Six days	16%	16%	6%	13%	15%
Everyday	30%	26%	8%	22%	25%

GoTriangle differs in this regard. More than half (52%) of GoTriangle's customers ride five days a week and only 8% use it daily. While GoDurham and GoRaleigh riders divide predominantly between those using the systems five or seven days a week GoTriangle is dominated by the five day a week pattern. This pattern is an indicator of the types of employment the riders hold which apparently are primarily five days a week jobs.

GoCary customers are more similar to GoDurham and GoRaleigh in this respect in that its riders tend to follow a five or seven day pattern. However, GoCary riders also are more likely to be occasional one to four day riders than are the customers of the other systems.

Figure 2 Compared to a Year Ago, Do You Ride More Often, Less Often or the Same?



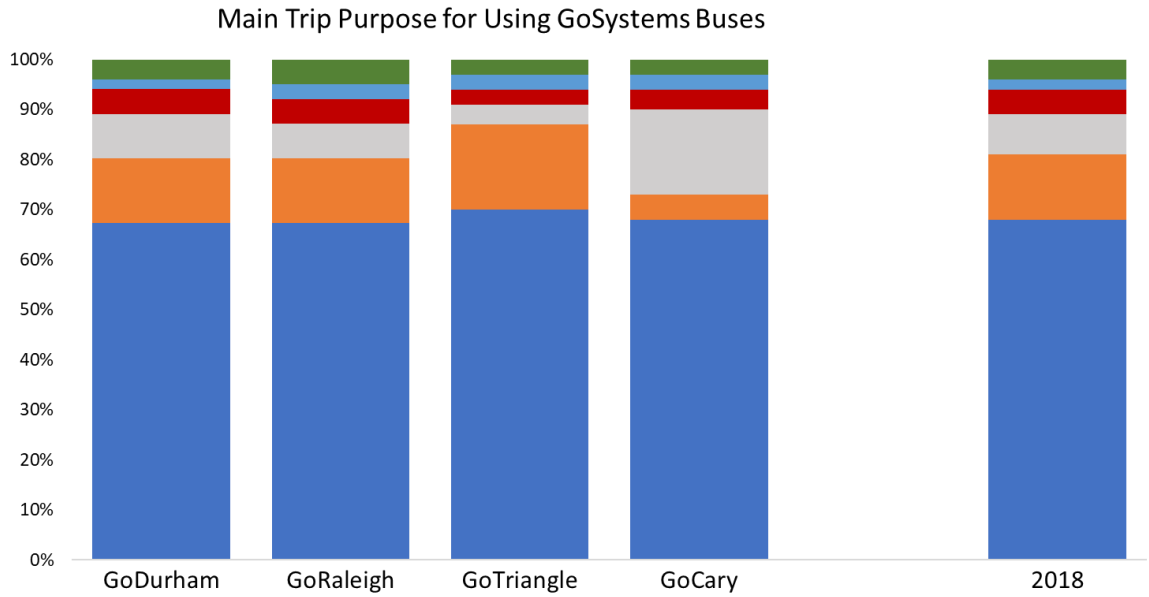
	GoDurham	GoRaleigh	GoTriangle	GoCary	2018
Did not ride a year ago	19%	15%	24%	22%	18%
Less often	10%	9%	6%	8%	9%
The same	37%	38%	41%	27%	38%
More often	35%	38%	30%	42%	35%

Compared to a Year Ago, Do You Ride More Often, Less Often or the Same?

Overwhelmingly, respondents say that they are riding either with same frequency (38%) or more often (35%) than a year ago, and 23% say they are new riders. Only 5% say they are riding less often.

The percentages differ somewhat among the four systems, but the overall patterns are similar. GoCary appears to have the highest proportion of riders who are using GoCary more often, while both GoTriangle and GoCary have somewhat higher percentages of new riders than GoDurham and GoRaleigh. But the general proportions are similar. Similarity in this respect is strongest when we compare the two most urban and largest systems, GoDurham and GoRaleigh.

Figure 3 Trip Purpose



	GoDurham	GoRaleigh	GoTriangle	GoCary	2018
Other	4%	5%	3%	3%	4%
Recreational Event	2%	3%	3%	3%	2%
Medical/Dental	5%	5%	3%	4%	5%
Shopping	9%	7%	4%	17%	8%
School/College	13%	13%	17%	5%	13%
Work	68%	68%	70%	68%	68%

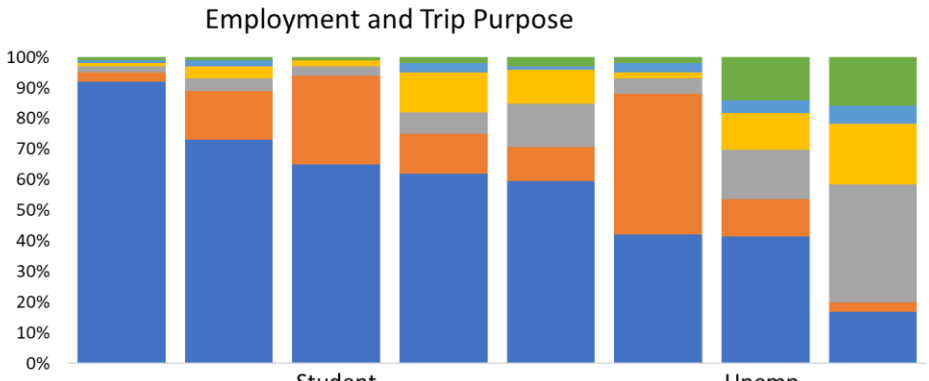
Trip Purpose: Use of the Four Systems for Various Purposes

Customers were asked to name the single main purpose for which they most often use the system on which they were surveyed.

- For all four systems, getting to or from work is the primary trip-purpose, with 68% of customers overall citing work as their most frequent trip purpose.
- School and college trips make up another 13% of trips. Thus, these systems carry a large proportion of their customers (81%) either for work trips or for school trips, indicators of their economic impact through the labor force mobility.
- Another 8% of the customers indicate that they use transit in the Triangle Region to make shopping trips, another source of economic impact.
- Medical (5%) and recreational (2%) trips account for 7%.

The four systems differ very little with respect to trip purposes of their customers. However, GoTriangle appears to have a somewhat higher percentage of school/college trips than either GoDurham or GoRaleigh. Also, GoCary has a much lower level of school/college trips, and a much higher level of shopping trips than any of the others.

Figure 4 Employment and Trip Purpose



	Full time	Part time	Student emp-loyed full or pt	Volun-teer position	Homema ker	Student	Unemp-loyed but seeking work	Retired
Other	1%	1%	1%	2%	3%	2%	14%	16%
Recreation-Event	1%	2%	0%	3%	1%	3%	4%	6%
Medical-Dental	1%	4%	2%	13%	11%	2%	12%	20%
Shopping	2%	4%	3%	7%	14%	5%	16%	39%
School-College	3%	16%	29%	13%	11%	46%	12%	3%
Work	92%	73%	65%	62%	59%	42%	41%	17%

Employment and Trip Purpose

That employment would be closely related to trip purpose would appear self-evident. However, there are some variations. As expected, 92% of those employed full time use one of the transit systems to get to or from work. Also, 73% of part-time workers are headed for work, and 46% of students (not also employed) are headed for school. These are as anticipated.

Figure 5 Unweighted employment subsample sizes[1]

Regional unweighted employment category subsample sizes

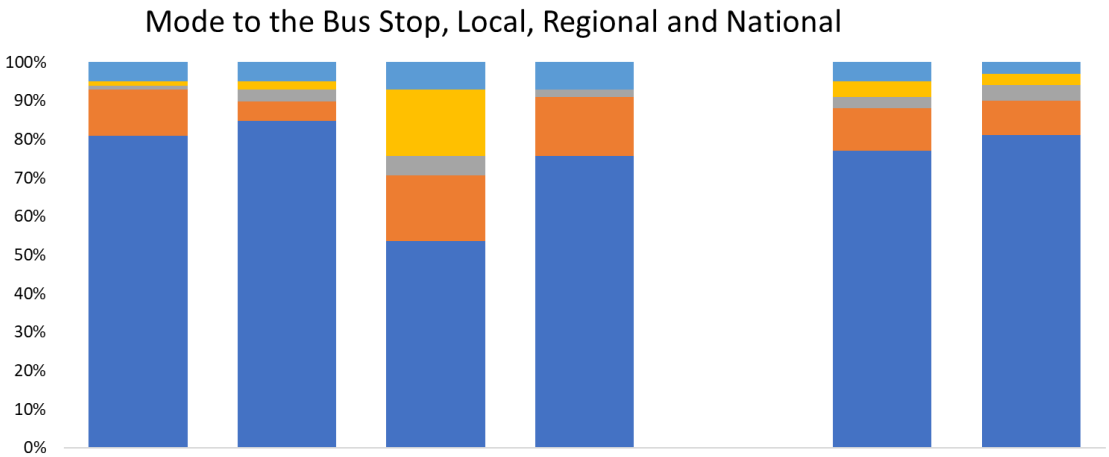
Employment	Subsample size
Full time	2176
Student	917
Part time	798
Student employed full or part time	440
Unemployed but seeking work	346
Retired	321
Homemaker	179
Volunteer position	158

It was observed in the separate reports for each of the systems, that there was a surprisingly high percentage of customers who said they were unemployed but that their trip purpose was getting to or from work (41% in the combined regional sample). This is interesting in that it is higher than a category labeled "Unemployed" would lead one to expect.

In the individual system samples, the numbers of respondents in this category of unemployed-but-going-to-work were small, and reliability was in question for that reason. However, in the combined regional sample, the sub-samples are quite robust (See Figure 5. N=346 in this subsample). One possibility is that unemployed riders traveling to work consider themselves unemployed but hold temporary jobs while looking for work. Similarly, 31% of retirees say that, although retired, they are making a work trip, probably working part time but still consider themselves to be primarily retired. Nearly three-fourths of homemakers (70%) say they too are going to work. These individuals could be working part time but consider homemaker to be their main occupation. Students, as expected, are going either to school (55%) or to work (31%).

[1] Note that the sum of these sub-samples exceed the total combined regional sample size because multiple employment responses were allowed.

Figure 6 Mode to the Bus Stop



	GoDurham	GoRaleigh	GoTriangle	GoCary	2018 - region	APTA - Who Rides
Other	5%	5%	7%	7%	5%	3%
Drove	1%	2%	17%	0%	4%	3%
Dropped off	1%	3%	5%	2%	3%	4%
Transit	12%	5%	17%	15%	11%	9%
Walked	80%	84%	53%	75%	77%	81%

Mode to the Bus Stop

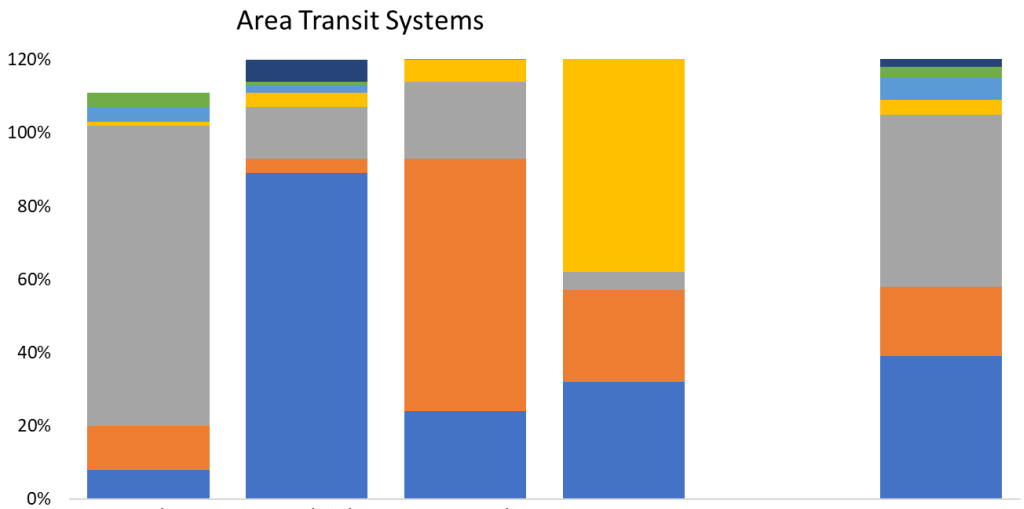
Figure 6 presents information on the mode used to get to the first bus stop of each system. It also shows the national norms based on the 2016 APTA publication "Who Rides Public Transportation. [2]"

Regionally, about three-fourths of users (77%), most often simply walk to the nearest bus stop. This is slightly lower than the national figure of 81%.

There are differences among the several systems in this respect. GoTriangle is the outlier in this respect. It has the lowest percentage of those who walk (53%) and the highest percentage who drive (17%). The latter is far above the national norm of 3%. At 5% GoRaleigh is an outlier at the low-end with regard to the percent who say they used another bus (either a GoRaleigh or other system bus) to access their stop.

[2] See APTA , Who Rides Public Transportation, CJI Research, 2016.

Figure 7 Bus Systems Used in a Typical Week



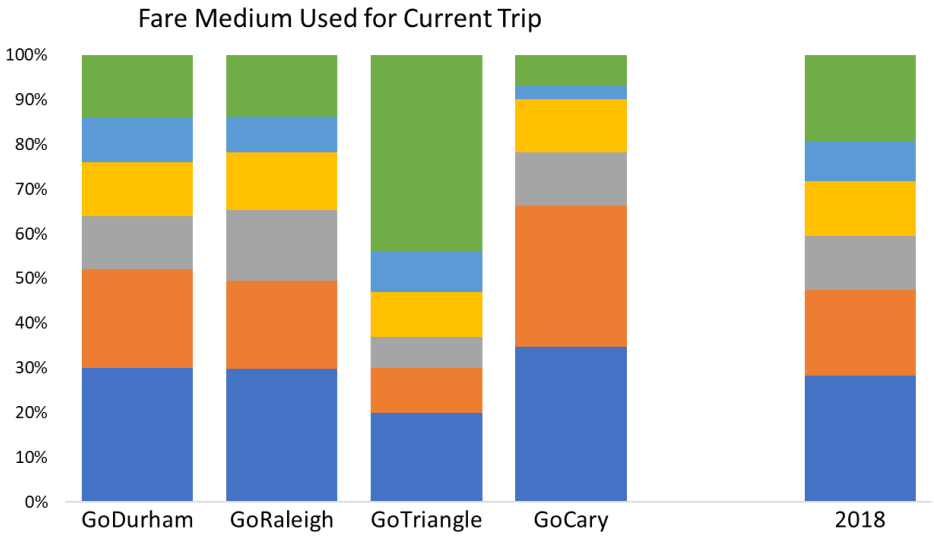
	GoDurham	GoRaleigh	GoTriangle	GoCary	2018
Wolfline	0%	6%	3%	2%	3%
Duke Transit	4%	1%	3%	1%	3%
Chapel Hill Transit	4%	2%	19%	0%	6%
GoCary/GoCary Door-to-door	1%	4%	6%	59%	4%
GoDurham/GoDurham Access	82%	14%	21%	5%	47%
GoTriangle/GoTraingle Access	12%	4%	69%	25%	19%
GoRaleigh/GoRaleigh Access	8%	89%	24%	32%	39%

Use of Area Bus Systems

Respondents were asked which of the transit systems in the region they use in a typical week. Since they can use multiple systems, the sums of the percentages exceed 100% in Figure 7.

As one would expect, during a "typical week" most, but not all, of the respondents use the system on which they were surveyed. For example, of GoDurham customers 82% said that they use GoDurham in a typical week, but conversely 18% do not. GoRaleigh has the highest level of single-system use at 89%, and GoCary the least, with 59%. GoTriangle, with 69%, lies in between those extremes, not surprising, given its role as a regional system.

Figure 8 Fare Medium Used



	GoDurham	GoRaleigh	GoTriangle	GoCary	2018
Used GoPass	14%	14%	44%	7%	19%
Used university/other ID	10%	8%	9%	3%	9%
Used 7 or 31 day pass	12%	13%	10%	12%	12%
Used day pass bought previously	12%	16%	7%	12%	12%
Bought day pass on bus	22%	20%	10%	32%	19%
Paid cash fare for this trip only	30%	30%	20%	35%	28%

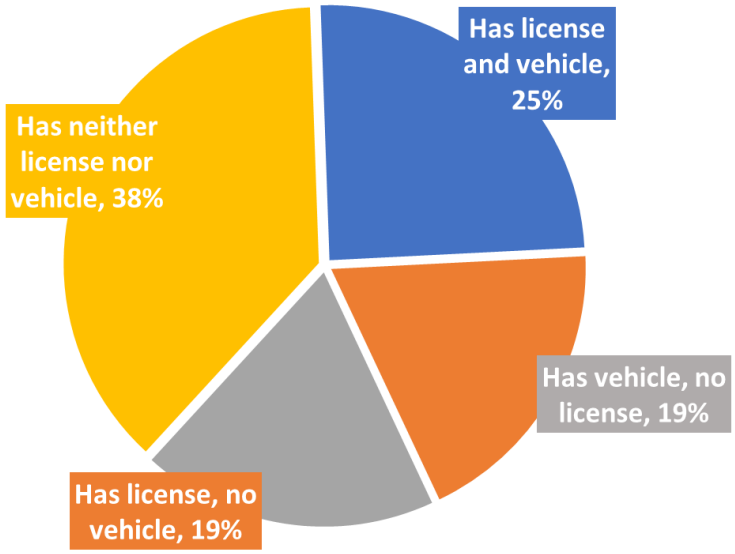
Type of Fare Used

How do the systems' customers vary in terms of their use of fare media. Region-wide, the day pass, either purchased on the bus (19%) or before boarding (12%) for a total of 31% is the most widely used fare medium. Cash fare, at 28%, is the second most used fare medium. Longer term passes for 7 or 31 days are used by 12%, while a university ID or a GoPass is used by 9% and 19%, respectively.

GoDurham and GoRaleigh are quite similar in terms of the percentages of customers using the various fare media available. GoTriangle is the primary outlier in that more than three times as many customers of GoTriangle use the GoPass (44%) compared to GoDurham or GoRaleigh (14% each). GoCary is a bit exceptional in that it has the highest percentage of customers (32%) who buy a day pass on the bus.

Figure 9 Aspects of Mode Choice: Having a License and Having a Vehicle

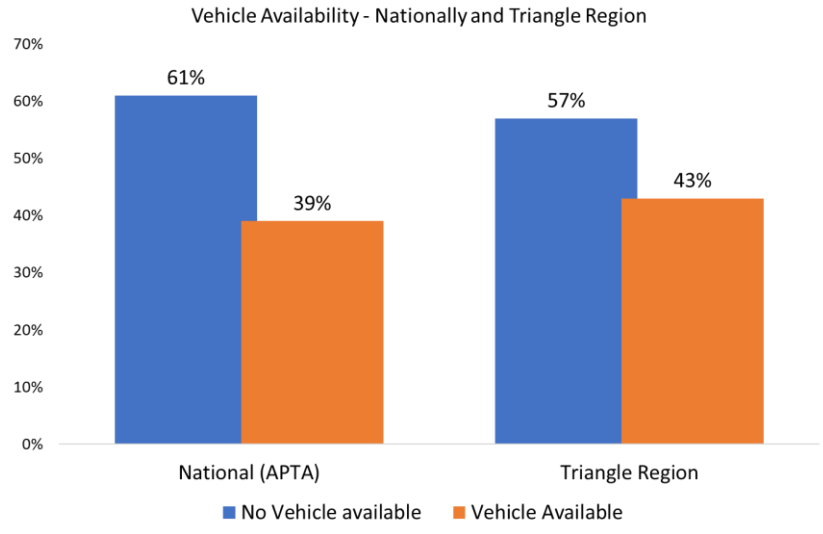
Having Valid Driver's License and Vehicle Available



Three Aspects of Mode Choice: Access to a Vehicle, Having a Valid License, Using Uber or Lyft

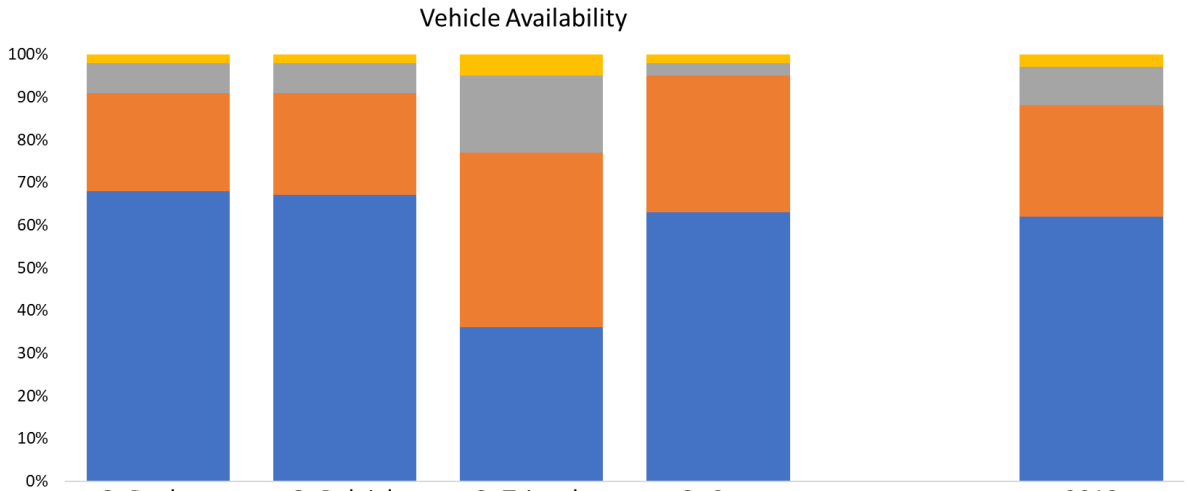
Having a choice of local transportation mode depends not only on the availability of a vehicle but also on having a valid driver's license. Figure 9 above indicates that only 25% of Triangle Region transit customers both hold a valid license and have a vehicle available for their use. Some have a license but no vehicle (19%) while another 19% have a vehicle but no valid license. More than one-third of customers have (38%) have neither license nor vehicle.

Figure 10 Vehicle Availability (APTA, *op cit*)



Nationally, CJI's study for APTA of more than 200 onboard surveys indicated that among bus riders, 61% lacked a vehicle for the trip they were making when surveyed. Conversely 39% had a vehicle. The Triangle Region is similar to the national norm, but with slightly fewer lacking a vehicle (57%) and slightly more (43%) having one available.

Figure 11 Availability of a Vehicle

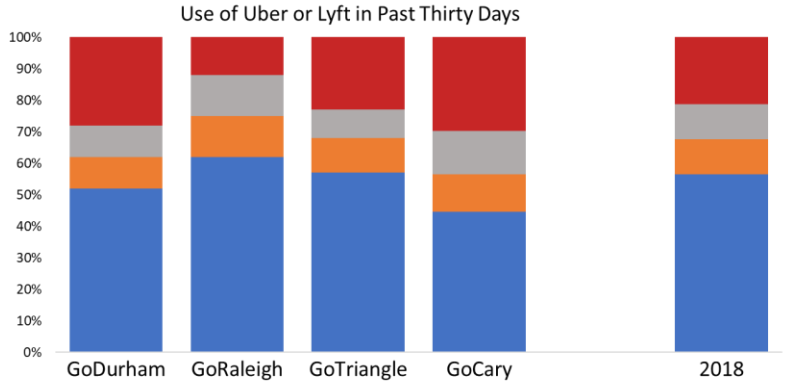


	GoDurham	GoRaleigh	GoTriangle	GoCary	2018
Three or more	2%	2%	5%	2%	3%
Two	7%	7%	18%	3%	9%
One	23%	24%	41%	32%	26%
No vehicle	68%	67%	36%	63%	62%

Availability of a Vehicle

Availability of a vehicle is very similar among three of the four Triangle Region systems, varying only from a high of 37% among GoCary customers to a low of 32% among GoDurham customers. GoRaleigh customers, at 33% are similar. GoTriangle customers are the outliers, with 64% reporting that they have a vehicle available.

Figure 12 Use of Uber or Lyft in Past Thirty Days



	GoDurham	GoRaleigh	GoTriangle	GoCary	2018
Three+ times	28%	12%	23%	30%	21%
Twice	10%	13%	9%	14%	11%
Once	10%	13%	11%	12%	11%
Not at all	52%	62%	57%	45%	56%

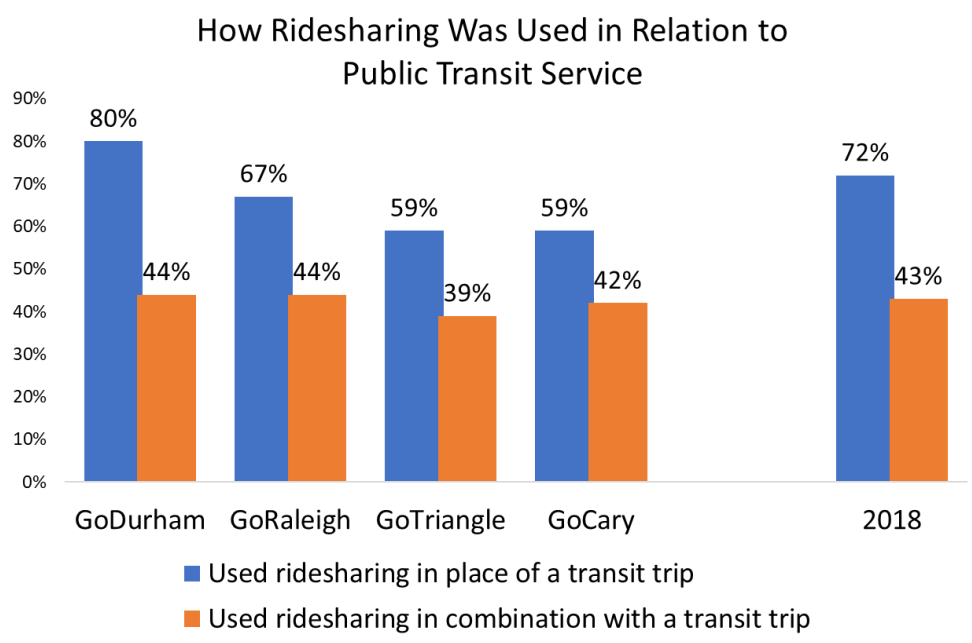
Use of Uber or Lyft in past thirty days

Mode choice is no longer simply about owning or leasing a personal vehicle. Since 2015, car sharing has become mainstream.

Of all Triangle Region transit customers, 56% say they have not used car sharing services in the past thirty days. Conversely, this means that 44% have used one of the car-sharing services. This includes 11% who have used them only once, 11% twice, and 21% three or more times[3].

[3] In future surveys it may be useful to determine if customers using shared rides are doing so with dependents because that may be no more costly than multiple cash bus fares.

Figure 13 Use of Uber and/or Lyft to Supplement or Replace a Transit Trip



Use of Uber and/or Lyft to Supplement or Replace a Transit Trip

Figure 12 indicated that 44% of Triangle Region transit customers had used Uber or Lyft in the past thirty days. How have those trips interacted with the transit systems? Figure 13 provides basic answers.

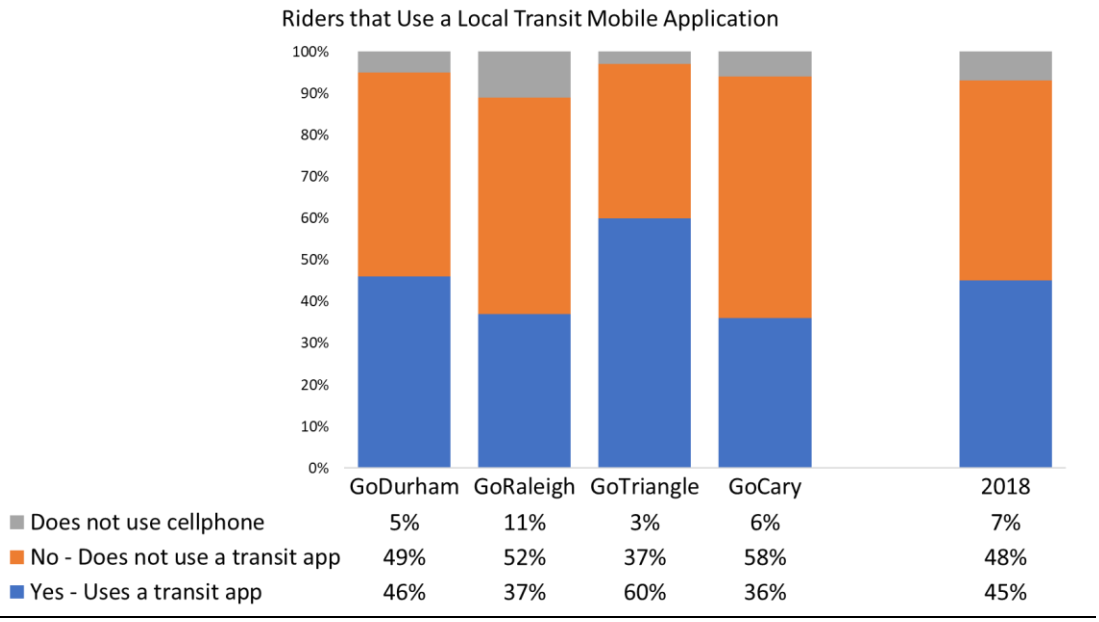
Of the 44% of Triangle Region customers who have used Uber or Lyft, 72% say they replaced a transit trip with a ridesharing trip. This amounts to 25% of all Triangle Region transit customers (i.e. 72% of 44% = 32%).

Of the 44% of customers who have used Uber or Lyft in the past thirty days, 43%, say they combined a ridesharing trip with a transit trip. This amounts to 19% of the ridership (i.e., 43% of 44% = 19% of the ridership) who have used a ride-sharing service, and say that they have used it as part of a bus trip.

We do not know for what purpose some Uber/Lyft riders have combined a rideshare trip with a transit trip. However, from data not shown on previous pages, only 2% said they used Uber/Lyft to get to the bus stop for their current trip. Other customers must have used ridesharing for other purposes. This issue will be worth exploring in some manner in the coming years, assuming that ridesharing continues to grow. One question that would be helpful to understand is whether use of ridesharing is filling gaps in coverage, span, or in weekend service.

Mobile Communication

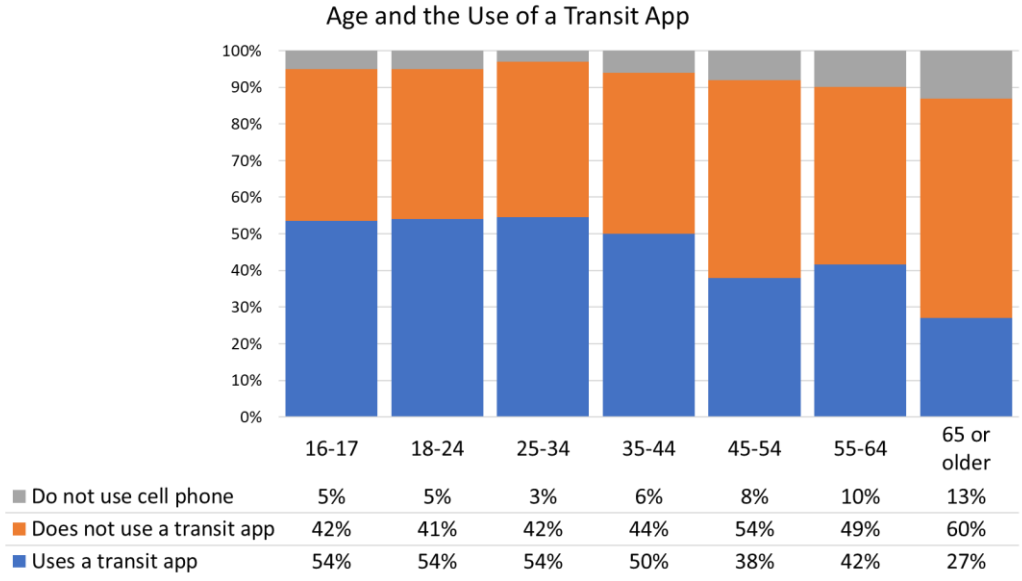
Figure 14 Use of Cell and Smart Phones



Use of Cell and Smart Phones

Among Triangle Region transit customers, cell phone use is high, but not quite universal, with 93% of customers indicating they use a cell phone. Forty-five percent (45%) of customers use a transit app on their phones.

Figure 15 Age and the Use of Mobile Transit App

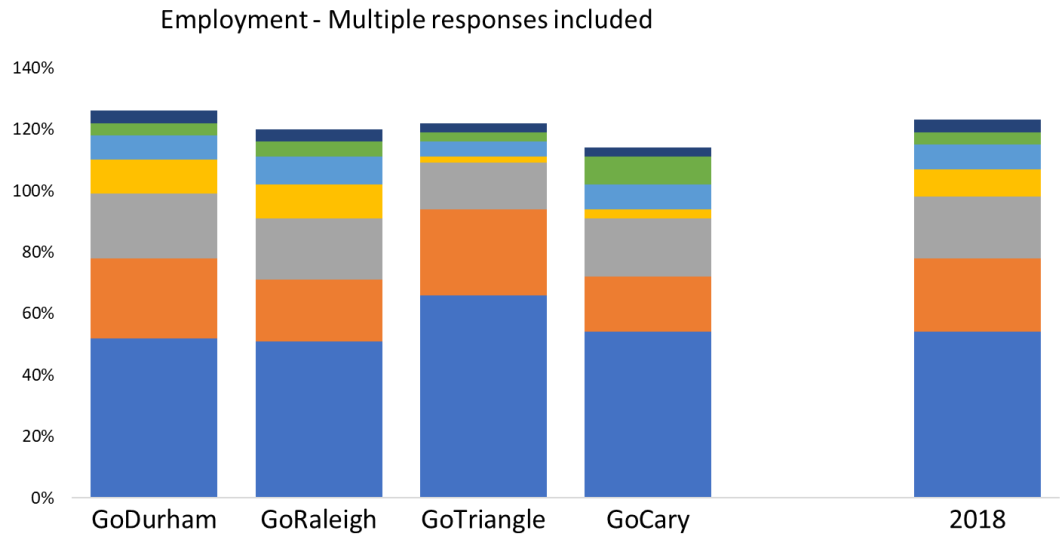


The number of customers using a transit app indicates that fewer than 50% of customers are now using their smartphones as transit information sources. In short, regionally, that practice is by no means universal. Other communication modes continue to be necessary.

That mobile apps cannot (yet) be relied on to provide the only communications channel to the ridership is illustrated by the results shown in Figure 15. That figure demonstrates that the use of such apps is related to age with a general downward trend in utilization as age increases. This means that unless something occurs to change this relationship between age and the use of mobile technology for transit, it will take at least several years for transit apps to become the primary source of information for a substantial majority of regional customers.

Demographics

Figure 16 Employment of Customers



	GoDurham	GoRaleigh	GoTriangle	GoCary	2018
Volunteer position	4%	4%	3%	3%	4%
Homemaker	4%	5%	3%	9%	4%
Retired	8%	9%	5%	8%	8%
Unemployed but seeking	11%	11%	2%	3%	9%
Part time	21%	20%	15%	19%	20%
Student	26%	20%	28%	18%	24%
Full time	52%	51%	66%	54%	54%

Employment of Customers

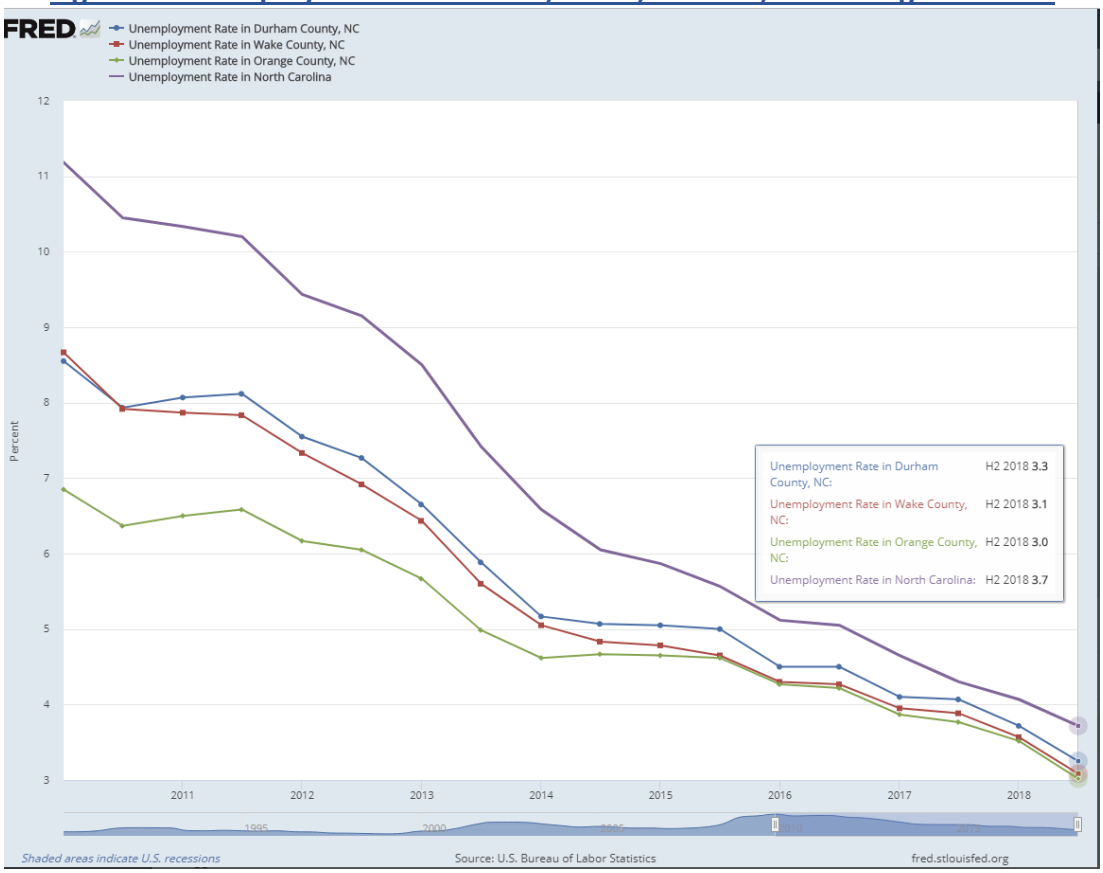
Respondents were asked about their employment. In 2018, a total of 54% of Triangle Region transit customers reported being employed full time, while another 20% said they were employed part time, and 24% said they are students[4].

Although it is not displayed in the chart, students who are also employed full comprise 23% of all students who are riders, while 30% are students also employed part-time, and 47% are students who are not also employed. Given that 24% are students, translating the employment of students into percentages of ridership, this means that in the Triangle Region 5% of riders are people who are employed full time and students, 7% are people employed part time and students, and 12% are students who are not also employed.

The important finding is that the region's ridership is productively engaged in the region's economy and community life.

[4] There are small differences between the employment numbers cited in Figure 16 and employment figures in the individual system reports. The reason for this is that a slightly different, and improved, method was used in this report to compensate for those respondents who failed to answer the employment question. Individual system reports can be updated upon request. The differences however, do not materially affect any conclusions.

Figure 17 Unemployment Rates in NC, Wake, Durham, and Orange Counties



Source: U.S. Bureau of Labor Statistics, Unemployment Rates in North Carolina [NCUR], and selected NC counties, retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/NCUR, February 15, 2019.

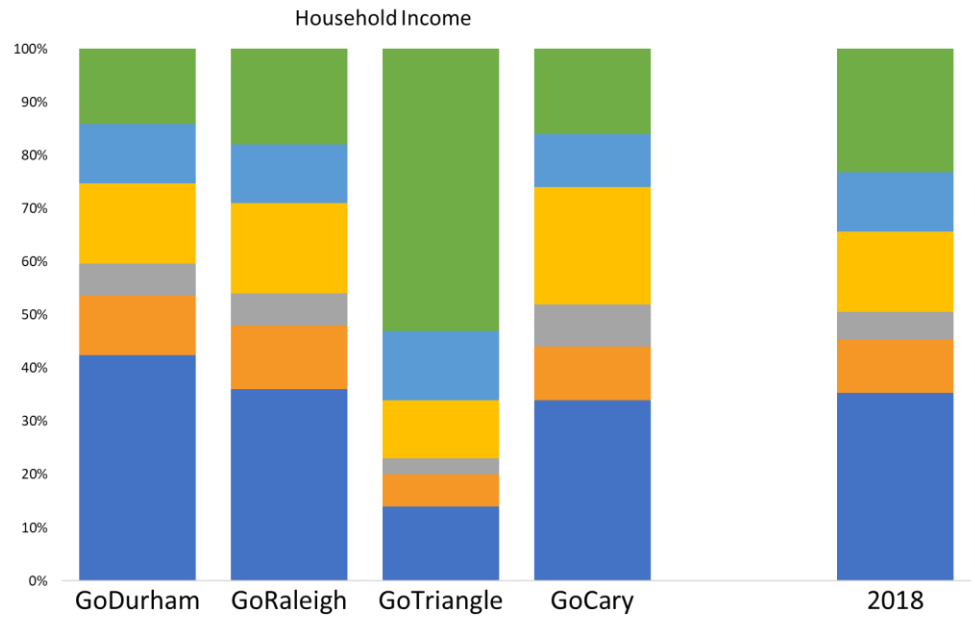
Unemployment Rates in NC, Wake, Durham, and Orange Counties

In the surveys, 9% indicated that they consider themselves unemployed and seeking work. We also saw in Figure 4 that 41% of these "unemployed" riders said that their trip purpose was getting to or from work. Thus, they are employed in terms used by the Department of Labor, although their employment may be only an interim tactic while seeking a new job. This would amount to about 3.7% of the ridership, leaving 5.3% unemployed and not working in the interim.

The substantial decrease in unemployment in the Triangle Region since the Great Recession is shown clearly in Figure 17. At the time of the survey, the rate of unemployment was 3.7% statewide and 3.3%, 3.1%, and 3.0% in Durham, Wake, and Orange Counties respectively. Thus the 5.3% rate for customers of the several systems in the region would be somewhat higher than the general public rate for the three county area.

However the data are interpreted, it is clear that the vast majority of Triangle Region transit users are gainfully employed or are students (or both).

Figure 18 Income of Rider Households



	GoDurham	GoRaleigh	GoTriangle	GoCary	2018
$35,000 or more	14%	18%	53%	16%	23%
$25,000 to $34,999	11%	11%	13%	10%	11%
$20,000 to $24,999	15%	17%	11%	22%	15%
$15,000 to $19,999	6%	6%	3%	8%	5%
$10,000 to $14,999	11%	12%	6%	10%	10%
Less than $10,000	42%	36%	14%	34%	35%

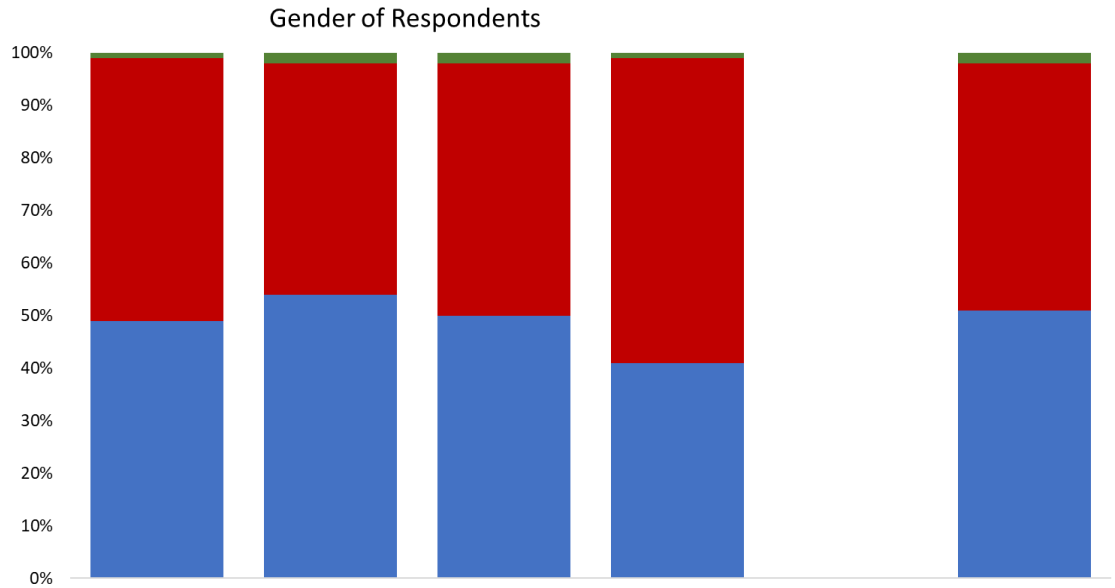
Income of Rider Households

As is true of riders in many passenger transit surveys of other systems in the United States, many Triangle Region transit users have low household incomes. In 2018, 65% report household incomes of less than $25,000.

In terms of household income, GoTriangle is, again, an outlier among the four systems. While the income level of $35,000 or more includes only from 14% to 18% of the other three systems' riders 53% of GoTriangle riders fall into that higher category.

GoDurham and GoRaleigh have similar distributions of income levels although a greater percentage of GoDurham customers are at the low end the income continuum: 42% less than $10,000 compared to 36% for GoRaleigh.

Figure 19 Rider Segment by Gender



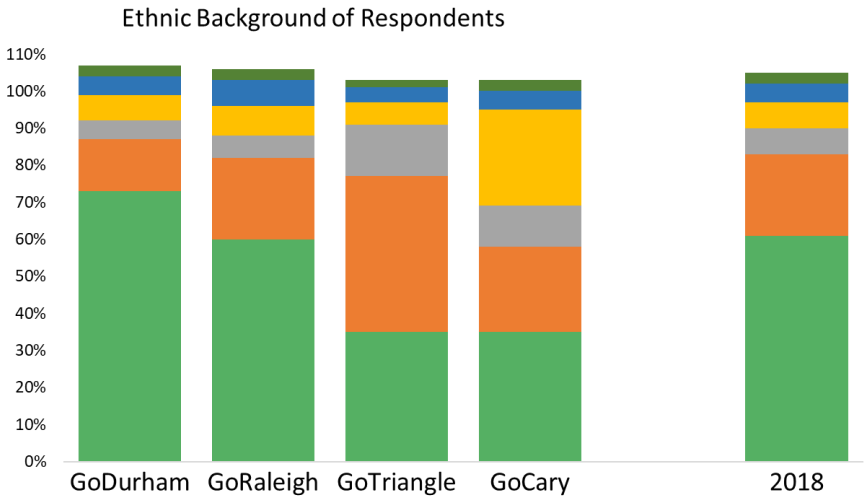
	GoDurham	GoRaleigh	GoTriangle	GoCary	2018
Prefer not to answer	1%	2%	2%	1%	2%
Female	50%	44%	48%	58%	47%
Male	49%	54%	50%	41%	51%

Gender of the Customers

Transit customers in the region are 51% male and 47% female, with 2% preferring not to state a gender identity. The gender balance varies somewhat among the four systems. At 58% female, GoCary has the highest rate of customers who are women. Other variations between systems are minor.

Nationally, according to the CJI APTA report cited earlier, among bus customers, 56% are women. GoCary is closest to that norm. The region as a whole, however, is quite different from the national figure. The rough male/female balance in the Triangle Region, then, differs from the national norm. However, recent surveys by CJI and others have found a majority of males among the riders in several rider surveys. A recent joint study by CJI with EMC Research Inc in Columbus, Ohio, for example, found a 56% male ridership. Whether or not this represents a significant change in the transit market will not be known until additional studies are conducted.

Figure 20 Ethnicity of Triangle Region Transit Customers



	GoDurham	GoRaleigh	GoTriangle	GoCary	2018
Native American Indian	3%	3%	2%	3%	3%
Other	5%	7%	4%	5%	5%
Hispanic	7%	8%	6%	26%	7%
Asian	5%	6%	14%	11%	7%
Caucasian/White	14%	22%	42%	23%	22%
African American/Black	73%	60%	35%	35%	61%

Ethnicity of Customers

In measuring ethnicity, it is important to focus on self-identification by asking "Which do you consider yourself…?" and asking that respondents note all descriptions that apply to them. In this way surveys usually capture some overlap among the several groups.

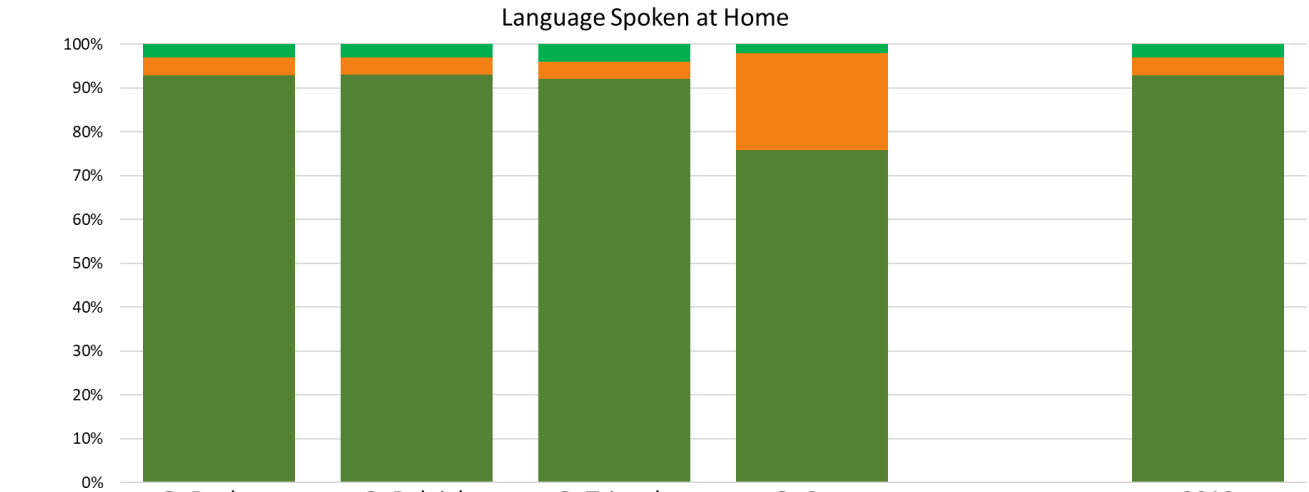
In 2018, 61% of the regional respondents identified as African American/Black and 22% identified themselves as Caucasian/White. Another 7% identified as Asian, 7% Hispanic and 3% Native American, and 5% as “Other”.

The “Other” category (5%) allowed for a handwritten response. But regardless of the system, the write-ins were predominantly expressions of nationality or cultural groups (Hawaiian, African, Middle Eastern, Turkish, Black Hebrew, etc.) or notations such as “biracial,” or sardonic (e.g. Human) and are not helpful.

The ethnic profiles differ substantially among the Triangle Region systems. In terms of customers identifying as African American, GoDurham, with 73%, has the largest proportion, with GoRaleigh next at 60%. The overall profile of those two systems is similar, however, in that the African -American ridership is the largest ethnic/racial identity group, Caucasian/White next, with smaller segments of Asians, Hispanics, Native Americans and others.

GoTriangle and GoCary are quite different from the two larger systems in this respect. In both cases, African Americans constitute 35% of the ridership, while more of the GoTriangle ridership identifies as Caucasian/white (42%) than any other group. GoCary has by far the largest percentage of Hispanic riders (26%).

Figure 21 Language Spoken Most Often at Home

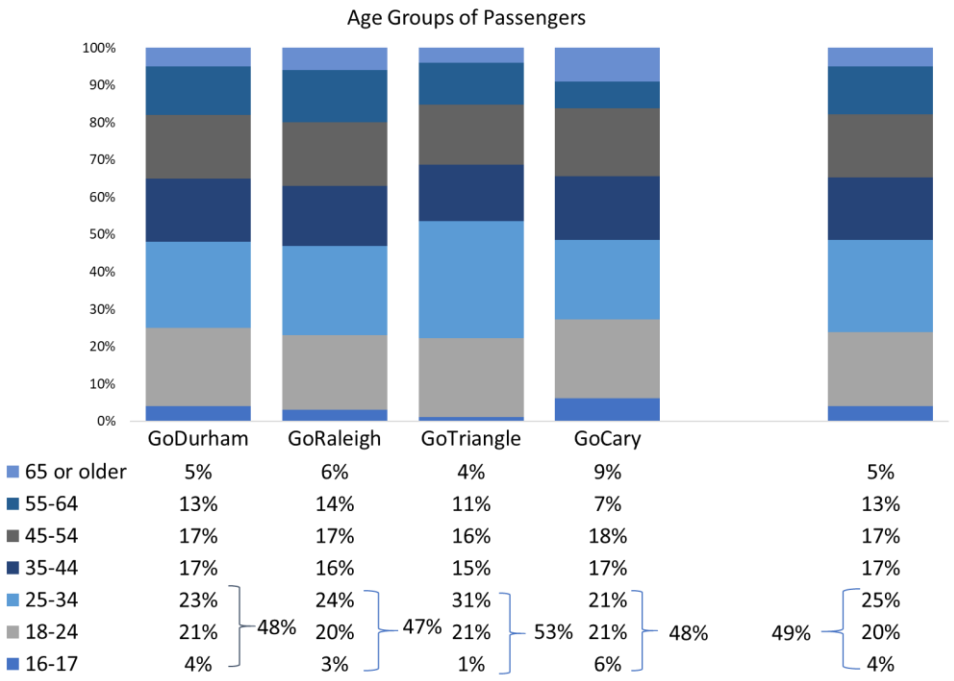


	GoDurham	GoRaleigh	GoTriangle	GoCary	2018
Other	3%	3%	4%	2%	3%
Spanish	4%	4%	4%	22%	4%
English	92%	93%	92%	75%	92%

Language Spoken Most Often at Home

The overwhelming majority (92%) of Triangle Region customers most often speak English at home while only 4% speak Spanish and 4% another language. The GoCary riders, who have the largest proportion of Hispanic customers, are more than five times more likely than more likely than riders on other systems to speck Spanish as their primary language.

Figure 22 Age of Customers



Age of Customers

Like most bus transit systems in the United States, the Triangle Region has a young ridership. Of all regional riders, almost half (49%) are under the age of 35.

This percentage may actually underestimate the youth somewhat because for reasons of data validity and ethical practice, we did not attempt to survey anyone who appeared to be younger than 16.

The age distributions are similar among the systems but they do differ somewhat. They are similar in rider under the age of 35 comprise roughly half of the ridership in each of the four systems. They differ slightly in that GoTriangle has a noticeably larger cohort of customers in the 25-34 age range.

Age Profile of Transit Customers Nationally

Figure 23 demonstrates that nationally, the age distribution among Triangle Region transit customers is similar to the age distribution among bus system customers in general nationally, but the Triangle Region skews slightly younger.

- The major difference between the national and the Triangle Region figures is in the 20 to 34 year old range. Nationally, 31% are between twenty and thirty-four, but among Triangle Region transit users 40% are in this age range.
- In all age ranges above 34, the national and local region riderships are almost identical until the age of 55, when the national ridership skews a bit older.

Figure 23 Age Profile of Transit Customers Nationally (APTA, *op cit*)

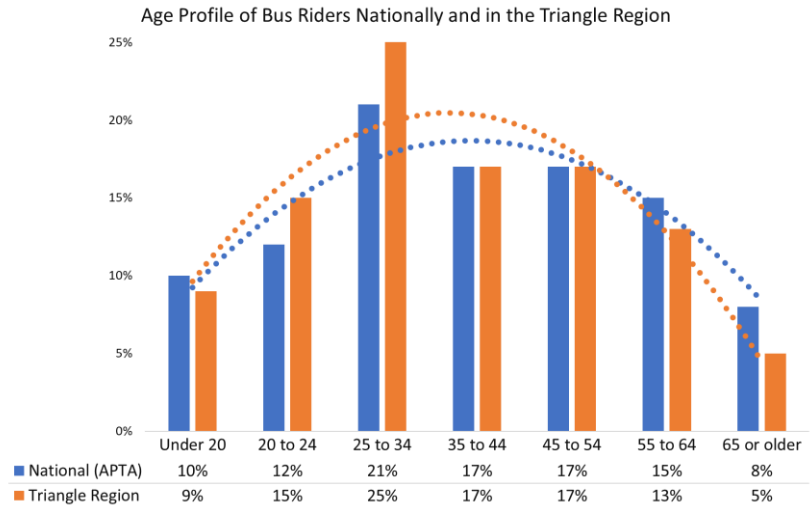
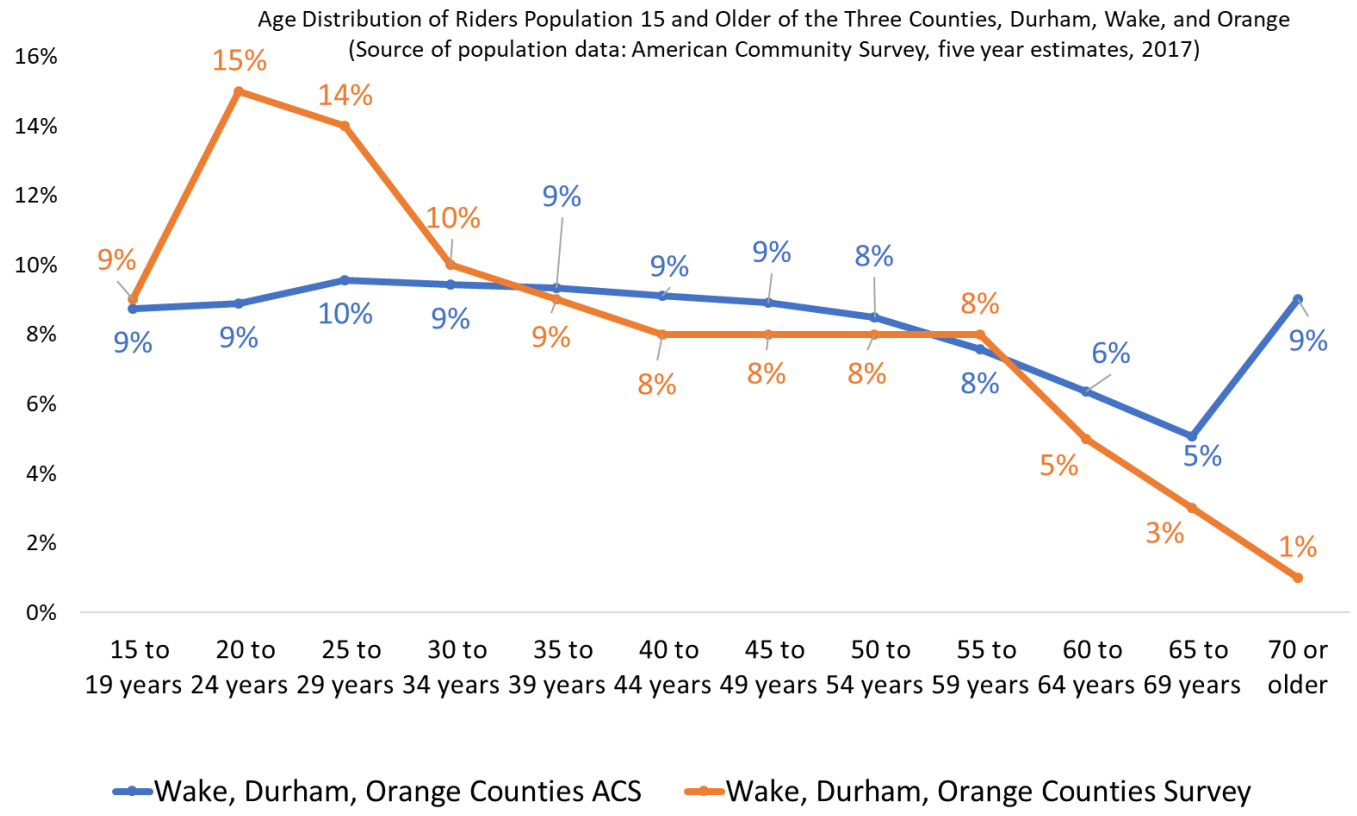


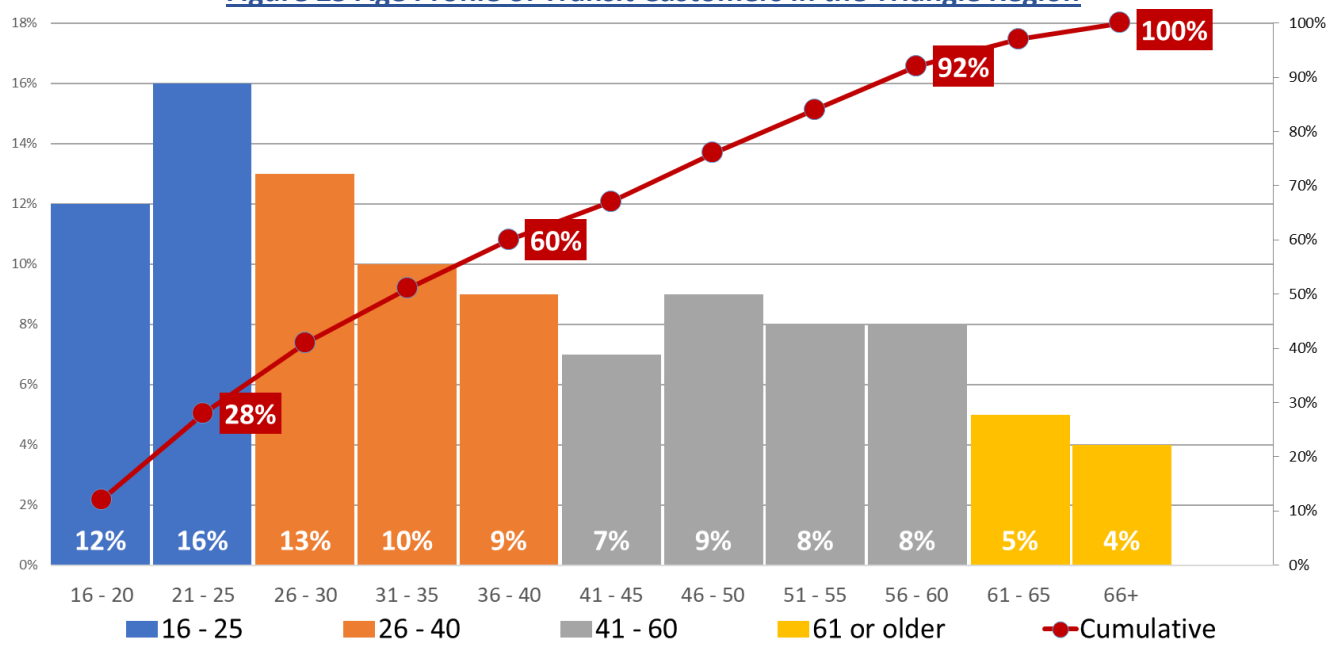
Figure 24 Ages of Triangle Region Transit Customers and the Wake, Durham, & Orange County Populations



Ages of Triangle Region Transit Customers and the Wake, Durham, & Orange County Populations

Relative to the percentages in each age group among the Wake, Durham, & Orange County Populations fifteen and older, Triangle Region ridership diverges most in the age ranges from twenty to twenty-nine, and above fifty-five. The twenty to twenty-nine year old age cohort in the Triangle Region accounts for 19% of the population fifteen or older, while among the ridership it accounts for 29%. And at the age of fifty-five and older, the percentage of the population is 20% while among riders it is only 9%. The percentages largely converge between the ages of thirty and fifty-four, but once the age curves cross at the age of fifty-five, the percent in each five year age cohort among the Triangle Region ridership is increasingly smaller than the general population.

Figure 25 Age Profile of Transit Customers in the Triangle Region



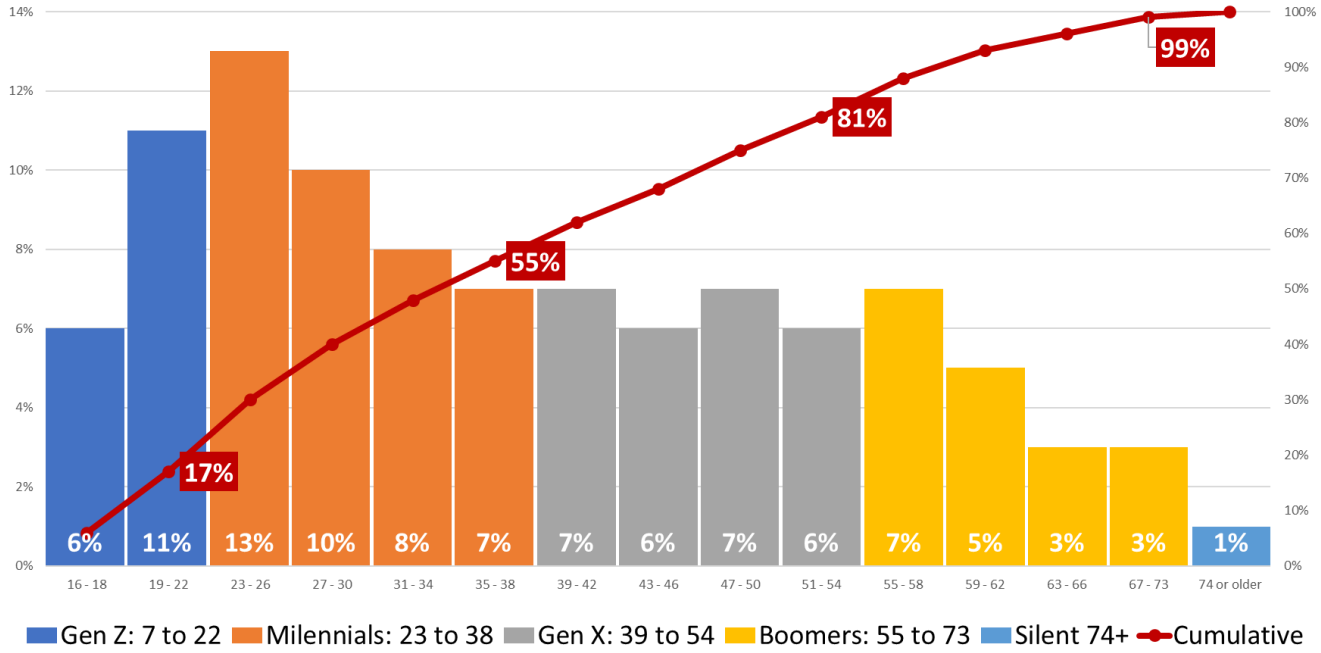
An Age Profile of Triangle Region transit Customers

A quick glance at the chart above reinforces what we have already observed about the regional ridership: Riders tend to be young. More than one-fourth (28%) of Triangle Region riders are twenty-five or younger. Sixty-three percent (60%) are forty or younger. Only 9% are over the age of sixty.

In several studies of transit customers in other cities, CJI has found that the age profile of any given system's bus ridership tends to follow an age progression similar, in very general terms, to that shown above in Figure 25. Generally, about one-fourth to one-third of ridership falls into a youthful cohort that is often in school or college preparing for work-life and ranging in age from sixteen to approximately twenty-five. Among customers of most systems, after the age of twenty-five the percentage of transit customers in each of the next five year age cohorts tends to drop off quickly. The decline suggests that with increasing age, more and more customers are ceasing to use transit, probably because they are entering a career phase of life, earning more and often buying a vehicle.

After a decline beginning in the mid to late twenties until about the age of forty, the percent in each age group tends to stabilize. Then, after the age of 60, the percent of ridership again tends to fall off and stabilize at a low level as people retire.

Figure 26 Generations and Ridership



Generations and Ridership

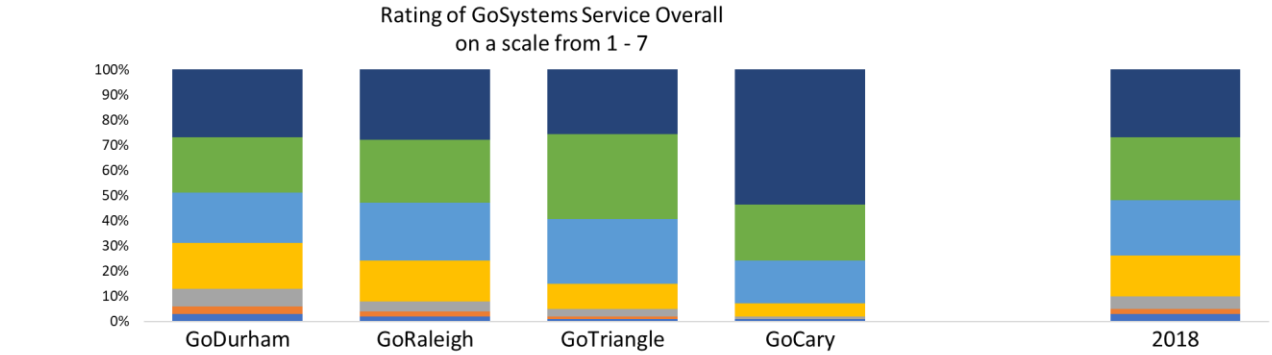
For purposes of visualizing the age characteristics of the Triangle Region transit customer base, another way to think about the age distribution of the ridership is to apply the age-ranges popularly used to describe generational groups. We have used definitions proposed by Pew Research Center[5]. The age cohorts used by PEW and those in Figure 26 are very similar but do not correspond precisely because while Pew defines Gen Z as between the ages of seven and twenty-two, the survey interviewed no one who appeared to be younger than sixteen. Also, while Baby Boomers are said to be no older than seventy-three, there are too few riders in the survey older than that to create a separate group for the older generation ("The Silent Generation") and they are grouped with the Boomers for purposes of the chart. However, the PEW definitions provide an adequate guide.

In Figure 26, we see a pattern very similar to that presented in Figure 25. Both charts make the point that a disproportionately large proportion of the ridership is young. In the case of generations, the youthful Gen Z and Millennial generations together account for more than half of the total ridership (55%).

[5] See http://www.pewresearch.org/fact-tank/2019/01/17/where-millennials-end-and-generation-z-begins/

Customer Satisfaction

Figure 27 Overall Service Rating by Rider Segment



	GoDurham	GoRaleigh	GoTriangle	GoCary	2018
7 Excellent	27%	28%	26%	53%	27%
6	22%	25%	34%	22%	25%
5	20%	23%	26%	17%	22%
4 Neutral	18%	16%	10%	5%	16%
3	7%	4%	3%	1%	5%
2	3%	2%	1%	0%	2%
1 Very poor	3%	2%	1%	1%	3%

Overall System Rating Score by Rider Segment

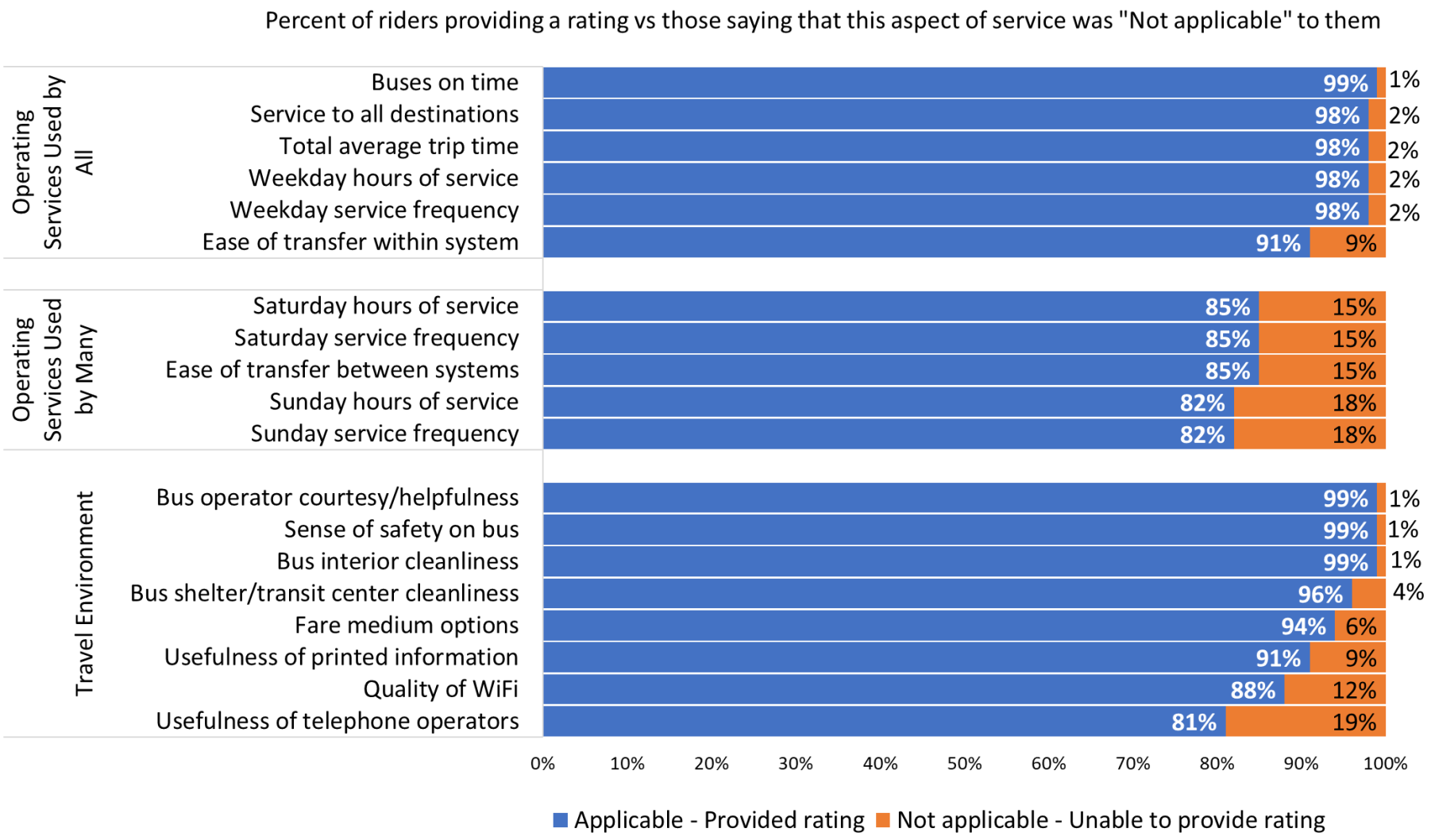
Customers were asked to rate nineteen aspects of transit service using a scale from 1 to 7 on which a score of 7 means "Excellent," and 1 means "Very poor." They were then asked to rate the service overall (See questionnaire page 56). We begin this section of the report with the overall rating of service.

More than one quarter (27%) of the total regional sample rate service overall as 7, or excellent. Another 25% score it 6, giving a total of 57% with high satisfaction scores. As is typically the case in such rating scales, the scores differ primarily in the degree of positive ratings, not between positive and negative ratings. In other words most of the variation (i.e., statistical variance) is between scores of 4 and 7, not between 1 and 7.

With the exception of GoCary, the systems have virtually identical percentages in the top score category, with Excellent scores ranging only from 26% to 28%. However, GoCary scores an unusually positive 53% in the top category. There are some lesser variations among the scores of the other three systems, with GoTriangle higher in the 5 and 6 categories (26% and 34% respectively) and lower in the neutral category of 4.

In terms of improving customer satisfaction scores, the challenge is not primarily a matter of moving people from giving scores of one or two to giving scores of six or seven. The task instead involves improving service such that riders' perceptions of service move from 4 to 5, and/or from 5 to 6, and to a lesser extent from 6 to 7. It is for the purpose of capturing this kind of marginal change that scales ranging from one to seven are more useful than scales of one to five.

Figure 28 Services Included in the Survey, Grouped by Type and Showing Percentage Unable to Provide a Rating



Services Included in the Survey, Grouped by Type and Showing Percentage Stating that the Service was not Applicable to Them

Two interacting parameters help shape the distributions of the rating scores.

(1) One parameter is simply the proportion of all customers who can provide a rating, thus presumably indicating that they use the service at least occasionally. We refer to this as "Use" or "Utilization." Figure 28 displays in blue bars the percent able to provide any rating whether positive, neutral or negative. It displays in the orange portion of the bars the percent who answered that the service was not applicable to them.
(2) The second parameter is the type of service being rated. These types are explained below, but the essence is that some are operational and used by all customers while others are operational, but are used by fewer customers, and, finally, some are simply static aspects of the travel experience.

UTILIZATION

Some aspects of service such as weekend service, were given ratings by fewer customers than others. We consider the extent to which customers can provide ratings a proxy for *utilization* of the service. To illustrate this, Figure 28 displays the percent of all respondents who offered any rating, whether positive or negative, and the percent who said that the service did not apply to them. Ratings for services with fewer users than others have a different denominator when percentages are computed for the ratings and they are thus reflective of only those who use them. The computation of the percentages in the charts which follow and show service ratings are based on only those who answered the rating question, not on the total sample.

TYPE OF SERVICE

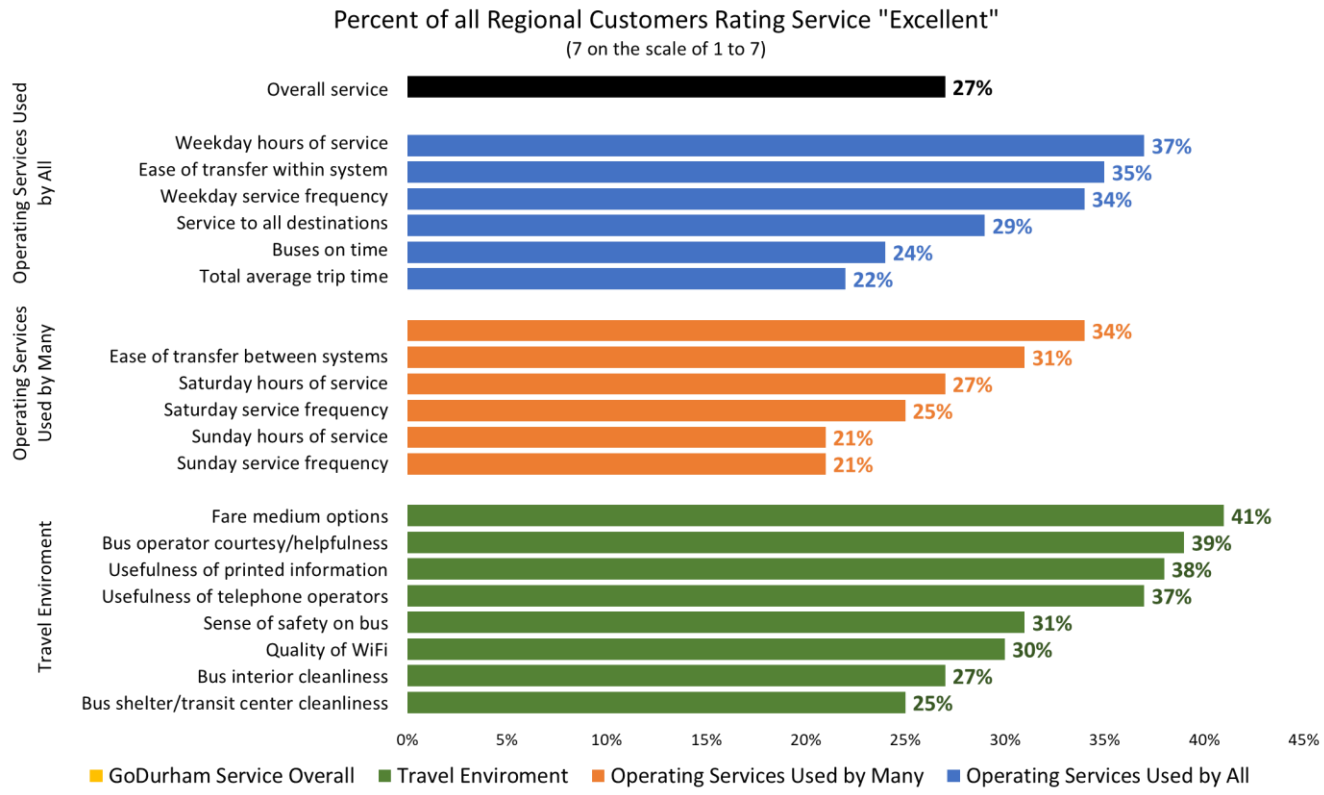
The second parameter involves the type of service. The typology is intended to put comparisons of ratings among the various services on an apples-to-apples basis. One major factor differentiating the nineteen services included in the survey is whether the service element is *operational* in the sense that it involves some combination of system design and the ongoing process of keeping the vehicles moving and serving passengers on a daily basis or is the type of service that sets the general environment in which the customer experiences transit services. To take an example, clearly the "Quality of Wi-Fi" and "Fare medium options" are service elements that help set a general environment, while "service to all destinations" and "Buses running on time" are operational matters.

In Figure 28, we apply this reasoning to differentiate three types of service elements based on two criteria: (1) the type of service (operational or travel environment) and (2) the extent to which operational services service are utilized, using the "not applicable" response as a proxy for not utilizing the service.

One can obviously debate the categorizations. For example, is interior cleanliness of the buses an operational factor or a factor that affects the customer's perception of the travel environment? It certainly involves operational activity by transit providers, but on the other hand, it does not impact such things as the time customers wait for a bus or their ability to get to various locations. Thus, it is categorized with other factors affecting the environment in which people travel, rather than with operations.

No specific conclusion is to be drawn from Figure 28. It is provided only to give the reader a perspective on the differences among the elements in terms of service type and the proportion of customers using the service, as scores are compared in the several figures that follow.

Figure 29 Scores of "Excellent" in 2018 on Individual Components of Transit Service in the Triangle Region



Rating Scores: Scores of "Excellent" in 2018 on Individual Components of Triangle Region Transit Service

Figure 29 above presents a first look at customer rating scores for individual elements of service. This chart includes only the top score of seven, or "Excellent," on the seven-point scale.

Like Figure 28, Figure 29 is organized by the type of service being rated. At the top of the chart are the six operational services fundamental to all customers. The top three of these each has more than 30% scoring it as excellent. The top three are Weekday hours of service (37%), Ease of transferring within the systems (35%), and Weekday service frequency (34%). The three lowest in this tier are coverage ("Service to all destinations", 29%), buses running on time (24%), and total average trip time (22%).

Operational aspects of service that are used by fewer customers than other services, tend to have somewhat fewer ratings of excellent than the more nearly universally used service elements[6]. This is due to the fact that most of these services are not very strong, and that is a major reason for their lack of constant use. However, riders will use them occasionally, and thus can provide a rating. This tendency to give lower scores to this tier of services is particularly true for Saturday and Sunday service. Saturday service hours receives excellent ratings by nearly one third (31%) and Saturday service frequency falls below that level at 27%. The two other weekend service elements in this set both involve Sunday service, and both get scores of excellent by fewer than one quarter of the customers, 24% and 22% for both service span and frequency respectively

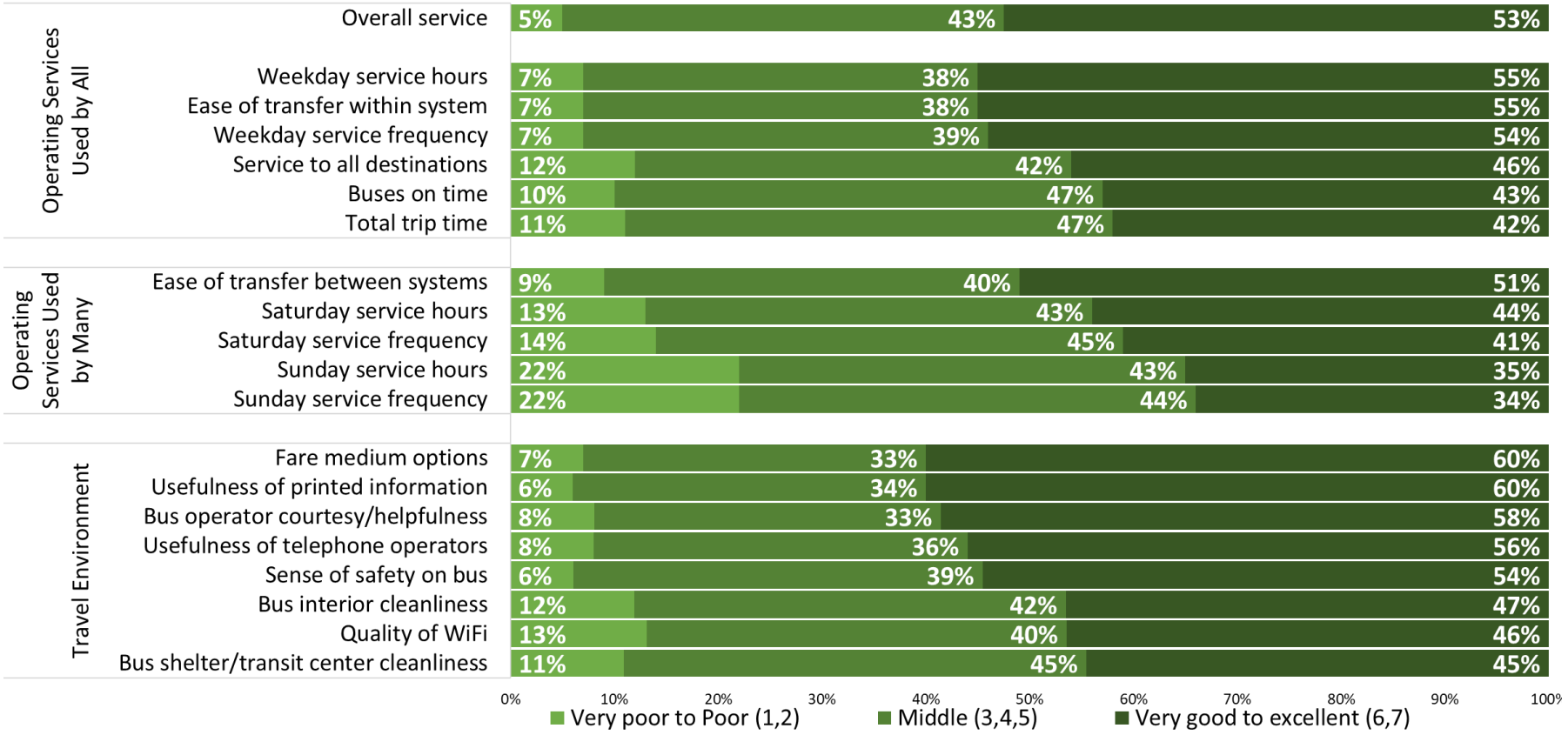
[6] Note that the percentage is based on only those who were able to provide a rating, not the total sample so that the percent "excellent" is not falsely reduced by inclusion of those who answered "not applicable" in the denominator.

Transferring between systems (34% excellent) is the one element included in this set that does not involve weekend service. It is in this set because 15% said the question did not apply to them, implying that they do not make such inter-system transfers in a "typical week."

The third set of services involves the environment in which transit customers travel. Of the eight services included in this set, the top four get excellent scores by more than 35% of the respondents. Fare media options, with 41% excellent is in the top place with courtesy and helpfulness of the bus operators second in the list with 39%. Usefulness of information sources, specifically printed materials, and telephone operators take third and fourth positions with 38% and 37% respectively. Two items, sense of safety while on the bus and the quality of WiFi stand at 31% and 30% respectively.

Two items fall below 30%. Both involve cleanliness of facilities, including the bus interiors (27%) and bus shelters and transit centers (25%).

Figure 30 Distribution of Grouped Service Rating Scores



Service Rating Distributions

The previous chart, Figure 29, showed only the top percentages on the seven-point scale. However, so that we can see what the balance is between positive and negative ratings, it is important to also consider the distribution of scores within the full 1 – 7 range.

To simplify the chart showing the distributions, the scores of 1 to 7 have been combined into three sets as shown in Figure 30 above. The top two positive scores (6 and 7) are combined as are the bottom two scores (1 and 2). The combined middle scores of 3, 4, and 5 can be considered

a mid-point neither extremely positive nor extremely negative. The scores of six or seven represent either excellent or nearly excellent scores. This is simply a way to summarize the results that also allows us to visualize the distribution of the scores.

RESULTS TEND TO BE POSITIVE

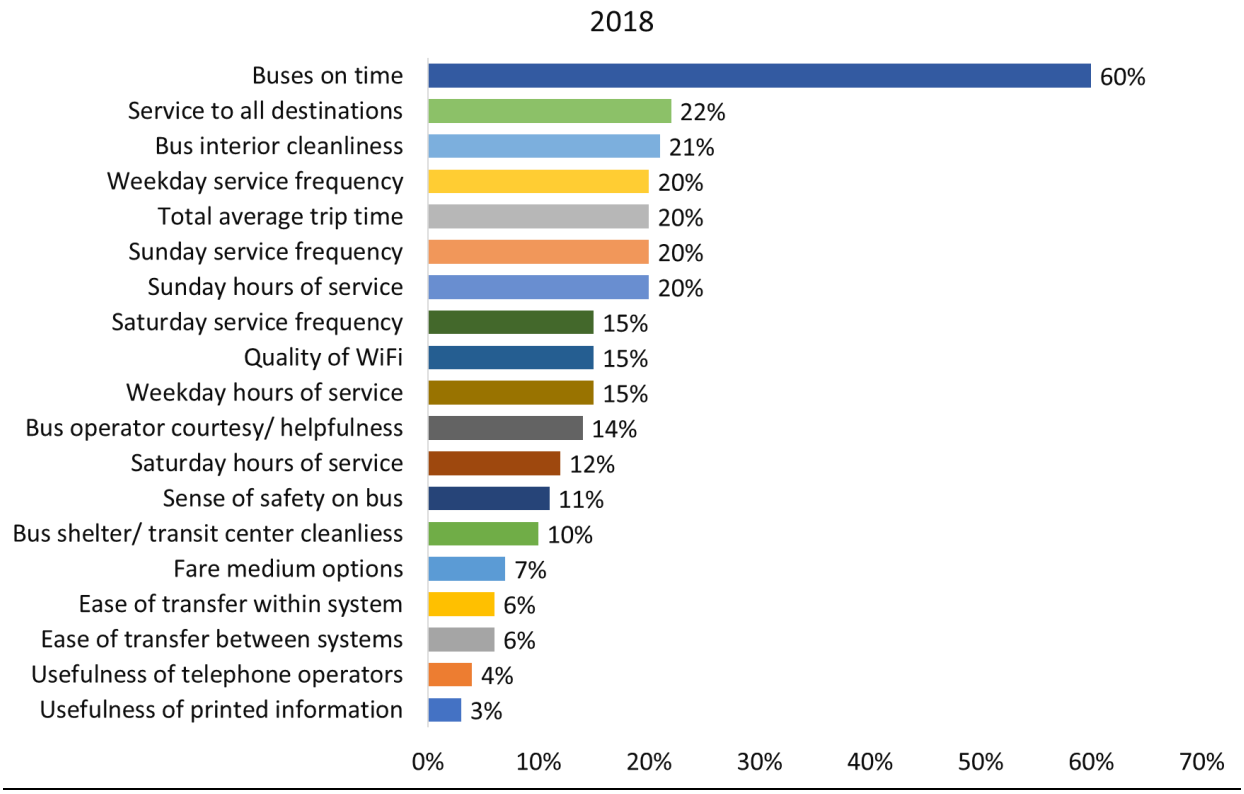
The basic story of this chart is that, as with most similar surveys for other transit systems, the ratings differ primarily in the degrees of positive ratings, not in stark differences between positive and negative ratings. The tendency to give positive ratings to a service used regularly is sufficiently strong, that as a rule-of-thumb, CJI uses 10% as a threshold at or above which there should be concern. When low ratings significantly exceed 10% of the customer base in any industry, it is a clear signal that a significant proportion of the core customers is pushing at the limits of what the services as structured can currently provide. For the Triangle Region transit customers, the percentages in the lowest rating categories of 1 and 2 tend to be less than 10%, though there are exceptions.

Of the six operational high utilization characteristics, all have positive ratings above 40%, and three have ratings above 50% positive. The latter are: Weekday service hours (55%), ease of transfer within system (55%), and weekday service frequency (54%). Each of these also has a negative rating of 7%. However, the three lowest within this set, service to all destinations (46%), buses being on time (43%) and total trip time (42%) all have negatives between 10% and 12%.

Among the less-used operational elements shown in the second tier of Figure 30, ease of transfer between systems scores 51% positive and 9% negative, a sign of substantial customer satisfaction. On the other hand, all weekend services fall below 50%. Saturday service levels, including hours of service (44%) and frequency (41%) score better than Sunday services, but both have negative scores exceeding 10%. Sunday service hours (35% positive, 22% negative) and Sunday service frequency (34% positive, 22% negative) an indication that there is significant dissatisfaction and perhaps latent demand in these respects.

The aspects of service we have labeled “Travel Environment” score more positively than the operational aspects, with five of the eight elements garnering positive percentages above 50%, including two of 60% (fare media options and usefulness of printed information). Three elements fall below 50% positive and have negatives greater than 10%. One of these, quality of WiFi, (46% positive/13% negative) is a convenience factor. But the other two involve the cleanliness of the travel environment and should be of concern. They are: bus interior cleanliness (47% positive, 12% negative) and bus shelter and transit center cleanliness (45% positive, 11% negative).

Figure 31 Top Three Aspects of Service to Improve

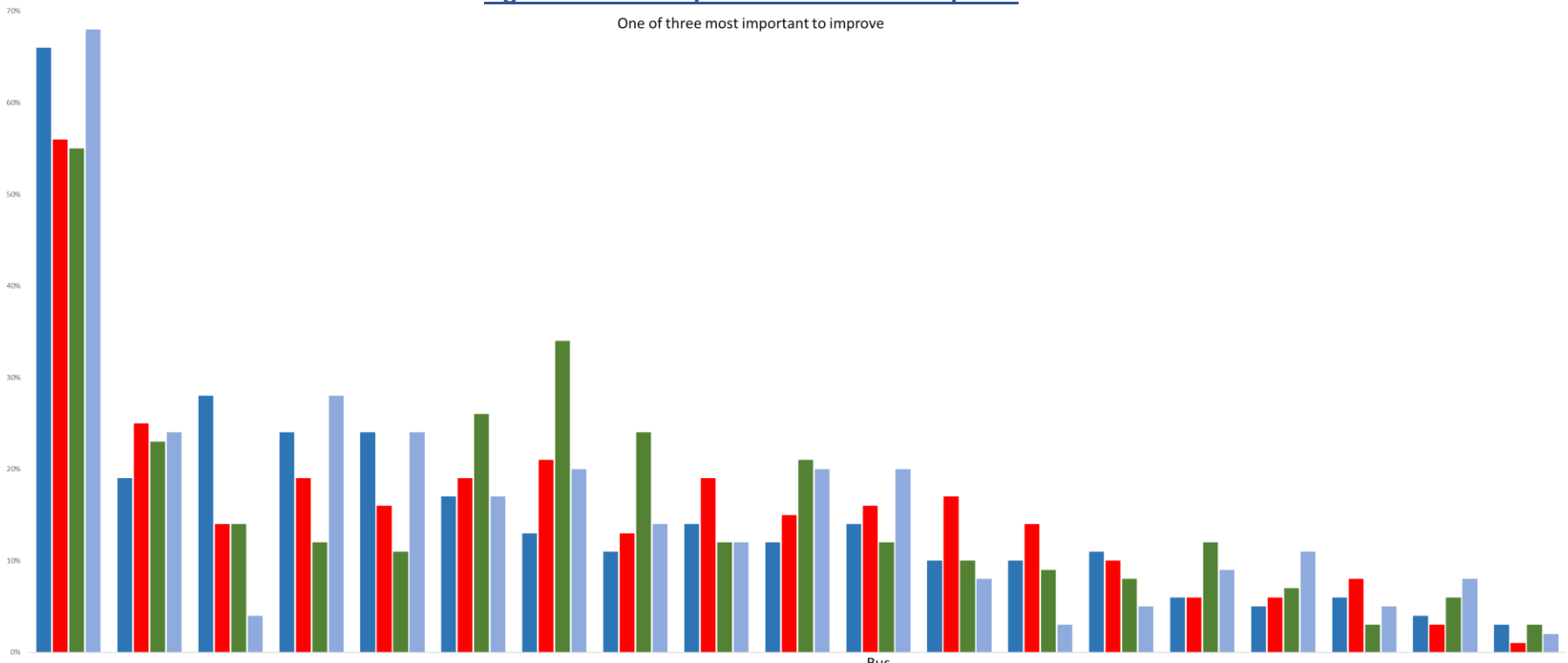


Top Three Aspects of Service to Improve

As is almost universally the case with transit customer satisfaction surveys (and therefore not surprising here), on-time-performance is cited by the overwhelming majority of Triangle Region transit customers (60%) as one of the top three aspects of service to improve. More interesting is the integrated set of six elements of service next in priority, all of which are cited by 20% to 22% of Triangle Region transit customers as one of the top three in need of improvement. Three of these are high utilization operational elements: Service to all destinations (coverage), weekday service frequency, and total average time one's trip takes. Notice that weekday service span (weekday hours of service in the chart) is not among these, nor is transferring within or between systems.

Also in the second tier are the cleanliness of bus interiors, a semi-operational element listed in other charts as part of the travel environment set. The other two elements involve Sunday service, both frequency and hours of service. CJI's focus group studies and surveys elsewhere have shown that demand for Sunday service is often related to work in service jobs that require weekend and evening hours. Transit customers with those jobs often complain that while they can usually get to work on Sunday, they cannot get home using transit service, especially from evening shifts. For this reason they have the greatest tendency to say that they will cease using transit as soon as possible. These studies predate 2015 and the advent of car-sharing. We suspect that some of the demand for ridesharing among transit users is related to this problem, but that there is a preference for the less costly (for the customer) transit solution. Yet the numbers of riders are too small to justify much fixed route service under usual formulas. For this reason, a ridesharing agreement that provided discounted ridesharing service for weekend evening workers might help fill the gap and aid customer retention.

Figure 32 Most Important Element to Improve



	Buses on time	Service to all destina-tions	Bus interior cleanliness	Sunday hours of service	Sunday service frequency	Total average trip time	Weekday service frequency	Quality of WiFi	Saturday service frequency	Weekday hours of service	Bus operator courtesy/ helpful-ness	Saturday hours of service	Sense of safety on bus	Bus shelter/ transit center cleanli-ess	Fare medium options	Ease of transfer between systems	Ease of transfer within system	Usefulness of telephone operators	Usefulness of printed information
GoDurham	66%	19%	28%	24%	24%	17%	13%	11%	14%	12%	14%	10%	10%	11%	6%	5%	6%	4%	3%
GoRaleigh	56%	25%	14%	19%	16%	19%	21%	13%	19%	15%	16%	17%	14%	10%	6%	6%	8%	3%	1%
GoTriangle	55%	23%	14%	12%	11%	26%	34%	24%	12%	21%	12%	10%	9%	8%	12%	7%	3%	6%	3%
GoCary	68%	24%	4%	28%	24%	17%	20%	14%	12%	20%	20%	8%	3%	5%	9%	11%	5%	8%	2%

Three Most Important Services to Improve, by System

While customers of the four Triangle Region transit systems are in agreement that on-time performance is the top priority for improvement, they differ considerably on the other aspects of service. The chart is too detailed to describe service by service and system by system, but it is clear that the top priorities beyond on-time performance differ among the systems. While patterns are difficult to discern, it is apparent that both GoDurham, GoTriangle, and perhaps GoCary priorities are distinct from one another. For example, customers of GoDurham show a special interest in interior cleanliness of the buses while weekday service frequency is of higher interest to GoTriangle customers than to others. Also, hours and frequency of service are of particular interest to customers of GoDurham and GoCary. `

Another way to prioritize: Determine Which Service Elements Would Move the Needle of the Overall Transit Service Rating if They Were to Be Improved

Using survey data to prioritize elements of service that customers feel need improvements is a challenge. Figure 32 presented one way to do it. Figure 33 on page 53 presents a second way to accomplish it. This approach takes the pool of nineteen services and answers the question: Which of these are more important and which are less important in determining the customers' rating of Triangle Region transit service overall? This question is answered in a matrix. The matrix itself (Figure 33, page 53) is actually less complex than it may seem, but it does require some explanation.

- The concept of the matrix in Figure 33 is as follows: Respondents rated nineteen separate aspects of transit service as shown in Figure 32 on the previous page. They also rated "The quality of transit services overall." We can assume that customers' ratings of the quality of services overall sum up their ratings of quality of the nineteen specific elements of service. Assuming this, we can answer the key question which is: Which elements of services would, if improved, move the needle of the rating of service overall?

- Two basic statistics are involved in this analysis, first the average or "mean" rating of service quality on the scale from 1 – 7 and, second, a correlation statistic that measures the strength of the relationship (i.e., the *correlation)* between each element of service and the overall service rating for Triangle Region transit service. These statistics, when used together, answer two questions: How do customers rate each of the nineteen elements of service? And how closely related is each of those ratings to the overall rating?

- To visually display the results of this kind of analysis means using a simple graph with the 1-7 rating on one axis and the correlation on the other axis. However, there are two challenges to doing this.

    - First, the numbers are of different types. The rating scale uses whole numbers specified in the questionnaire from 1 – 7. The correlation coefficients are decimal numbers ranging from -1 to +1. A perfectly negative relationship is -1 and a perfectly positive relationship is +1. As a practical matter, the correlation is always a decimal since perfect positive or negative relationships just do not exist. Rather than trying to represent whole numbers on one axis and decimals on the other, it helps to have common measurement units. Standard deviation provides that tool in this case.

    - The second and more important challenge for the analysis is that the ratings tend to skew positive and to vary more between scores of 4 through 7 than between 1 and 3 (see Figure 27). There are very few poor ratings. This only makes sense, since if many riders rated service negatively, it would be odd if they continued to use the service. But for analysis of how to "move the needle" on the overall service rating, the positive tilt of the ratings means that if we are to use the ratings to prioritize service improvements, we have to examine how the best scores differ from the merely good scores, not how the best scores differ from the worst scores.

One way to solve both of these challenges is to *standardize* the scores. This simply means to convert them statistically to comparable scores based on how each mean rating score and each correlation differs from the average of such ratings and correlations. This procedure enables us to construct a matrix that shows the services which, if improved, would have the most powerful effect on the rating of service overall.

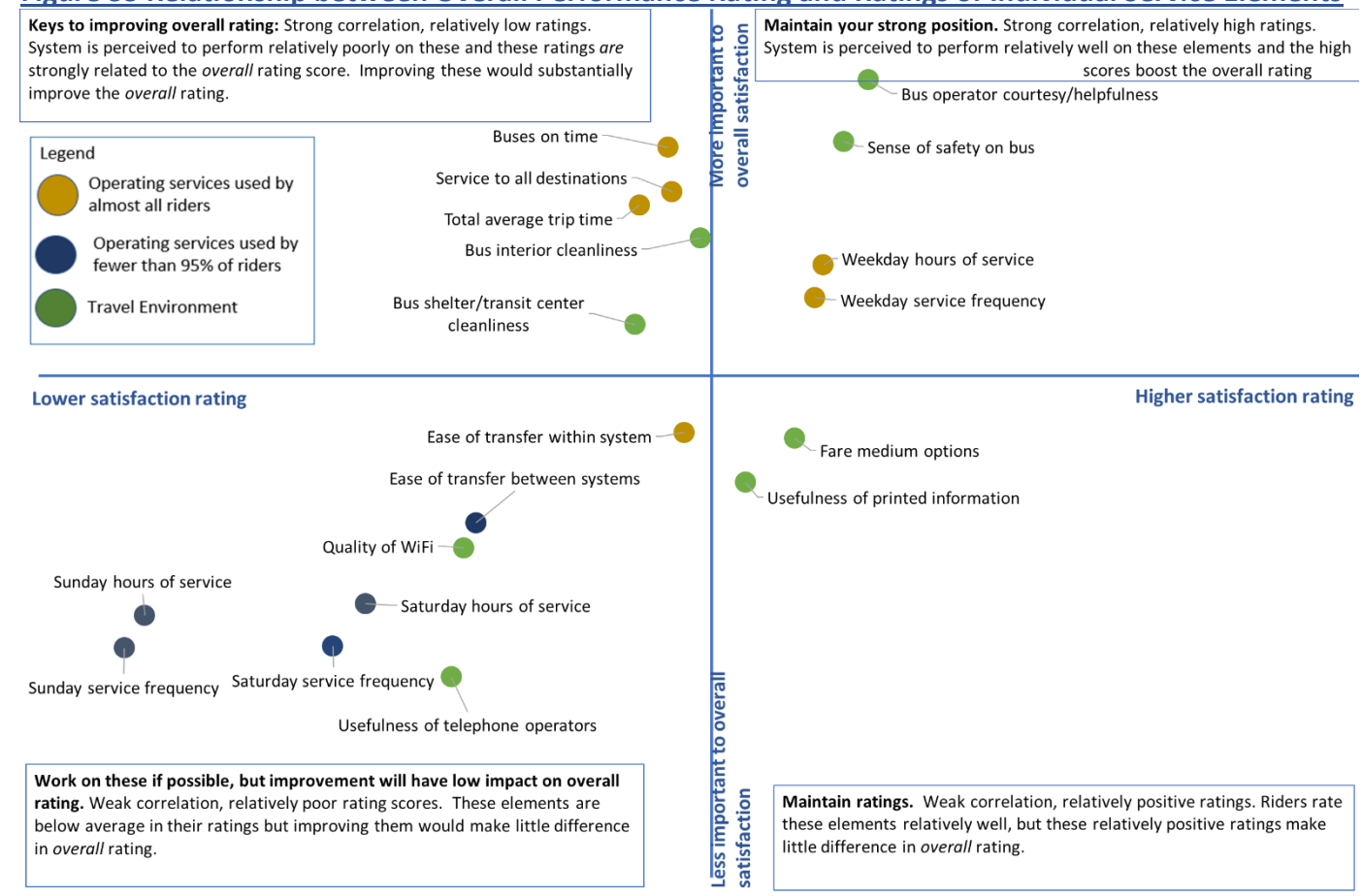
The matrix will help answer the question: What service improvements would move the needle on the rating of service overall? To do this we look at the ratings and at the correlation of each of those ratings with the rating of service overall. The results can be charted in a matrix like this:

When we add the actual survey statistics to fill out the matrix, it will show service improvement action priorities as shown below:

Correlation of each service rating with the rating of overall service	Low rating	High rating
High correlation	Relatively low ratings but relatively important to the overall rating, dragging it down *Improvement here moves the needle most, but these tend to be structural and the most difficult to change*	Relatively high ratings and relatively important to the overall rating *Service already good and core to the overall system score. Important to maintain it or risk losing the overall rating*
Low correlation	Relatively low ratings but relatively unimportant to the overall rating *Improvement desirable, but unlikely to move the overall quality needle much*	Relatively high ratings and relatively unimportant to the overall rating *Service good. Further improvement unlikely to move the overall quality needle, but deterioration may reduce the rating.*
	Service ratings	

Figure 33 on the following page displays how the nineteen elements of service are positioned within this priority matrix.

Figure 33 Relationship between Overall Performance Rating and Ratings of Individual Service Elements



Relationship between Overall Performance and Individual Service Elements

In the chart, the location of a service vertically, up or down along the *vertical axis indicates the strength of its correlation* with, and presumably influence on, the overall rating for Triangle Region service. The higher on that axis, the more important we can assume that element is in influencing the score for service overall. The lower on the line, the weaker it is. The *horizontal axis indicates the rating score* for the individual element of service relative to all rating scores. The farther to the left, the poorer the rating compared to the average of all ratings, and the farther to the right, the better the rating compared to the average of all ratings. The two lines cross at the mid-points of the scores.

In considering Figure 33, keep in mind that the position of a service element in the matrix is based on its rating *relative to* the *average for all scores*. For example, a service element appearing at the right means that it is rated *better than the average of all service elements*. If, for example, the average score for all nineteen service elements were, say, 3.0, and the score for a specific element were 4, it would have a *relatively* positive score in spite of the fact that in absolute terms on a scale from 1 – 7, a 4 would be a neutral score, not a highly positive score. It would be, in short, better than average[7].

[7] The statistic is called the Z-score in statistics jargon and is based on the number of standard deviations from the mean for both the correlation and the satisfaction score. The scores from -2.5 to +2.5 shown on the axes are counts of the number of standard deviations from the mean.

TOP, BOTTOM, LEFT, RIGHT

- Services appearing above the horizontal line are more important to the overall rating of service than those that appear below the line, those that appear below the line are less important.

- Services appearing at the right of the vertical line are rated better in quality than the services as the left of the line. The closer to the far right, the better the rating; the closer to the far left, the lower the rating.

Elements in the upper right of the chart are currently helping to boost the overall service rating by being better rated than the average of all nineteen elements of service, while others (top left quadrant) are currently detracting from it. It is elements in the latter group that require particular attention given that the objective is to improve overall customer ratings, a proxy for customer satisfaction. Elements in the lower left of the chart receive relatively poor performance scores but have relatively little influence on the overall score. Similarly, elements in the lower right quadrant have relatively high rating scores, but they too have little statistical relationship to the overall score and can be assumed to have little influence on it.

COLOR CODING SHOWS THE LOCATION OF THE SERVICE TYPES IN THE MATRIX

Notice the color coding of the service elements:

- All but one of the aspects of service we have labeled "Operating services used by almost all riders" are *above* the horizontal line that indicates average importance to the overall service rating. This means that they are above average in their importance to the overall score. One, ease of transfer with the system falls slightly below the line indicating that of all the operational elements it is somewhat less important than the others in the overall rating, perhaps because not everyone transfers regularly.
- All of the five elements we have labeled "Operating services used by fewer than 95% of riders," are *below* the line of average importance to the overall score. Improving these would be well received, especially those (weekend service) that also appear as priorities in the "Top Three to Improve" chart.

THE UPPER LEFT QUADRANT: IMPROVING THESE WOULD MOVE THE OVERALL RATING NEEDLE THE MOST

Improving service and thus, presumably, the ratings of the five elements in the upper left quadrant would have the greatest positive impact on the rating of Triangle Region transit service overall. Service coverage ("Service to all destinations"), Buses running on time, duration of the trip are fundamental aspects of service, and all appear in this quadrant. Buses running on time is a perennial desire of transit customers and is often found in this position in the matrix. In addition, it was clearly the top priority (60%) when respondents were asked to name the top three aspects to improve. Two elements dealing with the travel environment also appear in this quadrant, cleanliness of bus interiors, and or bus shelters and transit centers.

Of course, none of these services in the upper left quadrant – including the issues of cleanliness -- can be easily changed and maintained.

THE UPPER RIGHT QUADRANT: MAINTAIN THIS RELATIVELY STRONG POSITION

At the upper right of the matrix are seven elements of service that represent strengths because they score relatively well and they are important to the overall rating. Compared to all other aspects of service, these are relatively strong and support the current overall rating. Two of these, weekday hours of service and weekday service frequency are operational services relied on by virtually all riders. Two relate to the travel environment: Bus operators' courtesy/helpfulness (perennially in this quadrant), and the sense of safety on the bus.

The high importance and positive score of "Bus operator courtesy/helpfulness" illustrates the power of interpersonal interactions in the overall rating of a service.

THE LOWER RIGHT QUADRANT: THIS SERVICE IS GOOD, BUT IMPROVEMENT WOULD BE WELCOME

At the lower right are two service elements with high favorable ratings relative to other services, but that under current service configurations are relatively unimportant in influencing overall satisfaction. They are the fare media options and the usefulness of printed information. The Triangle Region's systems do well on these and need to maintain that level of satisfaction, but efforts to improve either of these would have minimal impact on the rating of service *overall.*

Lower left quadrant: It would be nice to improve these elements, but doing so would not affect the rating of Triangle Region transit service overall by much.

Seven elements of service appear in this quadrant. Five of these are operating services that are used by fewer riders (95% at most). They include hours and frequency of Saturday and Sunday service and ease of transferring between systems. In addition, ease of transferring within the system appears here as well. Finally, two elements of the overall travel environment fall into this area, the quality of WiFi service and the usefulness of telephone operators.

Appendix A: Questionnaire

Note. The questionnaires for GoDurham, GoTriangle and GoCary are identical. The 2018 questionnaire for GoRaleigh differs in part in that it has more questions and the survey sample was larger to support a route level survey. (In 2019 the longer form will be used for GoTriangle and GoCary, and in 2020 for GoDurham.) However, core questions and response options are identical, thus making it possible to merge the data from the four surveys.

In the data file, the question numbering used is from the shorter form survey. For this reason only the short form of the survey is shown in the appendix. Since the questionnaires are identical, only one, in this case GoTriangle is shown here.

Please tell us about how you use GoTriangle

El cuestionario en español se encuentra en la parte posterior

In the past 30 days, how would you rate GoTriangle on the following services...
(Circle a rating for each question or check the box indicating that it does not apply to you)

	Excellent			Neutral			Very poor	Not applicable to me
1. Buses running on-time	7	6	5	4	3	2	1	☐
2. Frequency of service on weekdays *(Mon-Fri)*	7	6	5	4	3	2	1	☐
3. Frequency of service on Saturday	7	6	5	4	3	2	1	☐
4. Frequency of service on Sunday	7	6	5	4	3	2	1	☐
5. Hours the buses operate weekdays *(Mon-Fri)*	7	6	5	4	3	2	1	☐
6. Hours the buses operate Saturday	7	6	5	4	3	2	1	☐
7. Hours the buses operate Sunday	7	6	5	4	3	2	1	☐
8. Total time required to make your usual trip	7	6	5	4	3	2	1	☐
9. Availability of service to all destinations you want to get to	7	6	5	4	3	2	1	☐
10. Ease of transferring within GoTriangle system	7	6	5	4	3	2	1	☐
11. Ease of transferring between GoTriangle and other area bus transit systems	7	6	5	4	3	2	1	☐
12. Cleanliness of the bus interiors	7	6	5	4	3	2	1	☐
13. Cleanliness of the bus shelters and transit center	7	6	5	4	3	2	1	☐
14. Your sense of personal safety from other passengers on the buses	7	6	5	4	3	2	1	☐
15. Courtesy and helpfulness of bus operators	7	6	5	4	3	2	1	☐
16. Usefulness of information from 485-RIDE telephone operators	7	6	5	4	3	2	1	☐
17. Usefulness of printed information such as schedules or brochures	7	6	5	4	3	2	1	☐
18. Available ways for you to pay your bus fare	7	6	5	4	3	2	1	☐
19. Quality of wireless internet *(WIFI)* service	7	6	5	4	3	2	1	☐
20. The quality of GoTriangle services overall	7	6	5	4	3	2	1	

21. Of the services in questions 1 – 19 above, please list the three most important to improve?
___ Most important ____ 2nd most ___ 3rd most

22. On how many days in a typical week do you use GoTriangle? *(Circle only one)*
1 2 3 4 5 6 7

23. What is the ONE main purpose for which you most often use the GoTriangle buses? Is it to go to or from... *(Check only one)*
1 ☐ Work 2 ☐ School/college 3 ☐ Shopping
4 ☐ Medical/dental 5 ☐ Recreation/event 6 ☐ Other _____

24. Compared to one year ago, do you currently ride GoTriangle... *(Check only one)*
1 ☐ More often 2 ☐ The same 3 ☐ Less often 4 ☐ Did not ride a year ago

25. For your fare on the first GoTriangle bus you boarded during this trip, did you... *(Check only one)*
1 ☐ ...pay cash fare for this trip only 2 ☐ ...buy a day pass on the bus
3 ☐ ...use a day pass bought ahead of time 4 ☐ ...use a 7 or 31 day pass
5 ☐ ...use a university or other ID 6 ☐ ...use a GoPass

26. How did you get to the stop where you got on this GoTriangle bus? *(Check only one)*
1 ☐ Walked 2 ☐ Biked 3 ☐ Drove
4 ☐ Uber or Lyft 5 ☐ Was dropped off by family/friend 6 ☐ Other GoTriangle bus
7 ☐ Bus other than GoTriangle 8 ☐ Other: _____

27. In a typical week, which, bus systems do you usually use? *(Check all that apply)*
1 ☐ GoRaleigh/GoRaleigh Access 2 ☐ GoTriangle/GoTriangle Access
3 ☐ GoDurham/GoDurham Access 4 ☐ GoCary/GoCary Door-to-Door
5 ☐ Chapel Hill Transit 6 ☐ Duke Transit 7 ☐ Wolfline

28. If you use a cell-phone, do you use a mobile app for local transit on it? *(Check only one)*
1 ☐ Yes 2 ☐ No 3 ☐ Do not use a cell phone

29. In the past 30 days, how often have you used Uber or Lyft or a similar ridesharing company?
(Check only one) ☐ 0 times ☐ 1 time ☐ 2 times ☐ 3 times ☐ 4 or more times

If you used Uber, Lyft, or a similar ridesharing service... *(Check only one)*
Did you use it in combination with a bus trip on GoTriangle? 1 ☐ Yes 2 ☐ No 3 ☐ Not applicable
Did you use it to replace a bus trip on GoTriangle? 1 ☐ Yes 2 ☐ No 3 ☐ Not applicable

30. How old are you? _____ Years old

31. Please mark all of the following that apply to you. Are you: *(Check all that apply)*
1 ☐ Employed full time 2 ☐ Employed part time 3 ☐ Unemployed and seeking work
4 ☐ Homemaker 5 ☐ Student 6 ☐ Retired
7 ☐ Volunteer position

32. Do you have a valid driver's license? *(Check only one)* 1 ☐ Yes 2 ☐ No

33. How many cars or other vehicles are available for your use? *(Circle only one)*
0 1 2 3 or more

34. Do you identify as... 1 ☐ Male 2 ☐ Female 3 ☐ Prefer not to answer

35. Do you consider yourself to be... *(Please Check all that apply to you)*
1 ☐ African American/Black 2 ☐ Asian 3 ☐ Caucasian/White
4 ☐ Hispanic 5 ☐ Native American Indian 6 ☐ Other: _____

36. What language do you most often speak at home? *(Check only one)*
1 ☐ English 2 ☐ Spanish 3 ☐ Other: _____

37. What is your total annual household income? *(Check only one)*
1 ☐ Less than $10,000 2 ☐ $10,000 to $14,999 3 ☐ $15,000 to $19,999
4 ☐ $20,000 to $24,999 5 ☐ $25,000 to $34,999 6 ☐ $35,000 to $49,999
7 ☐ $50,000 to $74,999 8 ☐ $75,000 to $100,000 9 ☐ More than $100,000

Comments: _____

20000

Por favor, díganos sobre cómo utiliza GoTriangle

En los últimos 30 días, Cómo calificaría a GoTriangle en los siguientes servicios...
(Circule una calificación para cada pregunta o marque la casilla que indica que no se aplica a usted)

	Excelente			Neutral			My mal	No se aplica a mí
1. Autobuses transitan a tiempo	7	6	5	4	3	2	1	☐
2. Frecuencia de servicio entre semana *(Lun-Vie)*	7	6	5	4	3	2	1	☐
3. Frecuencia de servicio el sábado	7	6	5	4	3	2	1	☐
4. Frecuencia de servicio el domingo	7	6	5	4	3	2	1	☐
5. Horas que autobuses operan entre semana *(Lun-Vie)*	7	6	5	4	3	2	1	☐
6. Horas que autobuses operan el sábado	7	6	5	4	3	2	1	☐
7. Horas que autobuses operan el domingo	7	6	5	4	3	2	1	☐
8. Tiempo total requerido para hacer su viaje regular	7	6	5	4	3	2	1	☐
9. Disponibilidad del servicio a todos los destinos que desea llegar	7	6	5	4	3	2	1	☐
10. Facilidad de transferir dentro del sistema GoTriangle	7	6	5	4	3	2	1	☐
11. Facilidad de transferir entre GoTriangle y otros sistemas de tránsito de autobuses del área	7	6	5	4	3	2	1	☐
12. Limpieza del interior del autobús	7	6	5	4	3	2	1	☐
13. Limpieza de los albergues de autobús y de centros de tránsito	7	6	5	4	3	2	1	☐
14. Su seguridad personal de otros pasajeros en los autobuses	7	6	5	4	3	2	1	☐
15. Cortesía y amabilidad de operadores de autobús	7	6	5	4	3	2	1	☐
16. Utilidad de la información de los operadores de 485-RIDE	7	6	5	4	3	2	1	☐
17. Utilidad de la información impresa tal como horarios o folletos	7	6	5	4	3	2	1	☐
18. Formas disponibles para que pagues tu tarifa de autobús	7	6	5	4	3	2	1	☐
19. Calidad del servicio de internet inalámbrico *(WIFI)*	7	6	5	4	3	2	1	☐
20. Calidad de los servicios de GoTriangle en general	7	6	5	4	3	2	1	

21. De los servicios en las preguntas 1 a 19 anteriores, ¿por favor enumera los tres más importantes para mejorar? ___ Lo más importante ___ 2º más ___ 3º más

22. ¿Cuántos días en una semana típica usas GoTriangle? *(Circule sólo uno)*
1 2 3 4 5 6 7

23. ¿Cuál es el ÚNICO propósito principal para el que usas los autobuses de GoTriangle más seguido? Es ir hacia o desde... *(Marque sólo una)*
1 ☐ Trabajo 2 ☐ Escuela/colegio 3 ☐ Compras
4 ☐ Médico/dental 5 ☐ Recreación/evento 6 ☐ Otro _____

24. Comparado con hace un año, ¿actualmente usas GoTriangle... *(Marque sólo una)*
1 ☐ Más a menudo 2 ☐ Lo mismo 3 ☐ Menos 4 ☐ No lo usaba hace un año

25. Para su tarifa en el primer autobús GoTriangle que abordó en este viaje, usted... *(Marque sólo una)*
1 ☐ ...pago tarifa en efectivo solo por este viaje 2 ☐ ...compro el pase de 1-Día en el autobús
3 ☐ ...compro el pase de 1-Día con anticipación 4 ☐ ...uso un pase de 7 o 31-Días
5 ☐ ...uso identificación de universidad u otra 6 ☐ ...uso un GoPass

26. ¿Cómo llegaste a la parada donde subiste a este autobús de GoTriangle? *(Marque sólo una)*
1 ☐ Caminado 2 ☐ Bicicleta 3 ☐ Condujo
4 ☐ Uber o Lyft 5 ☐ Lo llevo familia/amistad 6 ☐ Otro autobús de GoTriangle
7 ☐ Autobús que no sea de GoTriangle 8 ☐ Otro: _____

27. En una semana típica, ¿que sistemas de autobús sueles usar? *(Marque todo lo que corresponda)*
1 ☐ GoRaleigh/GoRaleigh Access 2 ☐ GoTriangle/GoTriangle Access
3 ☐ GoDurham/GoDurham Access 4 ☐ GoCary/GoCary Door-to-Door
5 ☐ Chapel Hill Transit 6 ☐ Duke Transit 7 ☐ Wolfline

28. Si usa un teléfono celular, ¿usa una aplicación móvil de tránsito local en él? *(Marque sólo una)*
1 ☐ Sí 2 ☐ No 3 ☐ No uso teléfono celular

29. En los últimos 30 días, ¿con qué frecuencia usó Uber o Lyft o una compañía de viaje compartido similar? *(Marque sólo una)* ☐ 0 veces ☐ 1 vez ☐ 2 veces ☐ 3 veces ☐ 4 o más veces

Si usó Uber, Lyft o un servicio de viaje compartido similar... *(Marque sólo una)*
¿Lo usaste en combinación con un viaje en autobús en GoTriangle? 1 ☐ Sí 2 ☐ No 3 ☐ No aplica
¿Lo usaste para reemplazar un viaje en autobús en GoTriangle? 1 ☐ Sí 2 ☐ No 3 ☐ No aplica

30. ¿Cuantos años tienes? _____ Años

31. Marque todo lo siguiente que se aplique a usted. Eres tú: *(Marque todo lo que corresponda)*
1 ☐ Empleado tiempo completo 2 ☐ Empleado medio tiempo 3 ☐ Desempleado y buscando trabajo
4 ☐ Ama/o de casa 5 ☐ Estudiante 6 ☐ Jubilado
7 ☐ Puesto de voluntario

32. ¿Tiene una licencia de conducir válida? *(Marque sólo una)* 1 ☐ Sí 2 ☐ No

33. ¿Cuántos automóviles u otros vehículos hay disponibles para su uso? *(Circule sólo uno)*
0 1 2 3 o más

34. ¿Te identificas como... 1 ☐ Masculino 2 ☐ Femenino 3 ☐ Prefiero no responder

35. ¿Te consideras ser... *(Por favor marque todo lo que aplica a usted)*
1 ☐ Afroamericano/Negro 2 ☐ Asiático 3 ☐ Caucásico/Blanco
4 ☐ Hispano 5 ☐ Indio Nativo Americano 6 ☐ Otro: _____

36. ¿Qué idioma habla más a menudo en casa? *(Marque sólo una)*
1 ☐ Inglés 2 ☐ Español 3 ☐ Otro: _____

37. ¿Cuál es su ingreso familiar anual en total? *(Marque sólo una)*
1 ☐ Menos de $10,000 2 ☐ $10,000 a $14,999 3 ☐ $15,000 a $19,999
4 ☐ $20,000 a $24,999 5 ☐ $25,000 a $34,999 6 ☐ $35,000 a $49,999
7 ☐ $50,000 a $74,999 8 ☐ $75,000 a $100,000 9 ☐ Más de $100,000

Comentario: _____