Spring 2019

Commuting and Parking Survey

Report

prepared for

WEST CHESTER
U N I V E R S I T Y

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INTRODUCTION

A second annual commuter survey was conducted at West Chester University in the spring of 2019. The purpose of the survey was to measure community members' current commuting and parking habits and to informally investigate their willingness to participate in alternate forms of transportation. Data from the previous year's survey is compared to 2018 survey data.

As in 2018, for several reasons, one out of seven University members was selected randomly for participation in the survey. The fraction was estimated to provide sufficient statistical precision for the year-over-year comparison. The cost of sampling is typically lower than attempting to solicit the entire population (a census). In addition, because the survey is being repeated, a sample is desirable to reduce "survey fatigue" in the population. There was a 6% overlap of the student sample selected the previous year, and 17% of the faculty and staff also overlapped the previous year's sample.

The sample was drawn from ten strata: four student levels and seniors with 120+ credit hours; full and part-time faculty; regular staff; USHC employees; and ARAmark employees. In most analyses in this report, the strata examined are on-campus students, off-campus students, full-time faculty, part-time faculty, and a combined three groups of staff. 2,297 email addresses were supplied. After removing bounced emails and a few other ineligible cases (totaling just 22 ineligibles), the total adjusted population was 13,545 eligible students, 959 faculty, and 1,421 staff being represented.
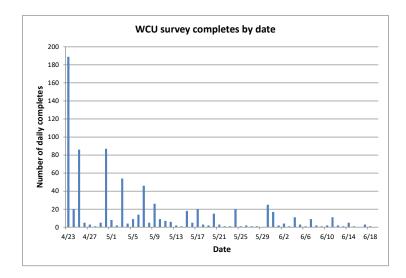
Overall response rate was 34.9%. By strata and substrata, rates were as follows[1]:

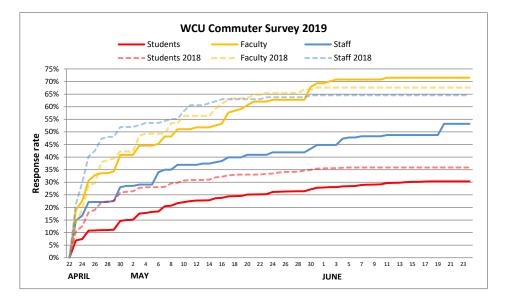|	Eligible populations		Sample solicited (1/7)		Response rates		
Strata	total	subsets	sample	subsets	count	rate	last year
Students	13,545		1,935		587	**30.3%**	35.9%
fr		2,814		402	106	26.4%	34.6%
so		3,255		465	138	29.7%	39.1%
jr		3,157		451	148	32.8%	34.3%
sr		3,262		466	142	30.5%	35.0%
sr+		1,057		151	53	35.1%	36.9%
Faculty	959		137		98	**71.5%**	67.6%
pt fac		336		48	26	54.2%	54.2%
ft fac		623		89	72	80.9%	74.5%
Staff	1,421		203		108	**53.2%**	68.5%
reg staff		1,050		150	87	58.0%	64.6%
USHC		21		3	6	200.0%	57.1%
ARAmark		350		50	15	30.0%	80.0%
total	**15,925**		**2,275**		**793**	**34.9%**	40.8%

The instrument (a facsimile is appended) was developed in consultation with WCU's Office of Sustainability and Off Campus and Commuter Services. The instrument was designed with an emphasis on brevity and ease of completion. All questions from the previous year's survey were included, and items #10 through #18, regarding knowledge and attitudes about alternate forms of transportation, were appended. After programming for online administration, MDF Research performed pretests with six volunteers from the University resulting in a few minor revisions.

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[1] The eligible populations were calculated as seven times the sample sizes supplied by WCU, after deleting ineligible cases.

The survey was launched on April 22, 2019 and remained live until June 23. Sixteen reminders were sent to non-responders during this period. The response to reminders followed the typical "pulse-decay" pattern, with successive reminders drawing ever-smaller pulses:

WCU survey completes by date

Number of daily completes (y-axis, 0 to 200)
Date (x-axis, 4/23 to 6/18)

Cumulative survey completions were also tracked and compared to the previous year's:

WCU Commuter Survey 2019

Legend: Students, Faculty, Staff, Students 2018, Faculty 2018, Staff 2018

Response rate (y-axis, 0% to 75%)
APRIL, MAY, JUNE (x-axis, 22 to 23)

92% of respondents completing the survey logged in only once; 8% logged in more than once to complete. Average time to complete the survey was 7.6 minutes for faculty and staff and 6.4 minutes for all students. (Both times were about 2 minutes longer than last year's survey, due to the additional items about alternative transportation.) A $5 Amazon gift card incentive was paid, usually within 24 hours, to all participants who requested one. Mobile administration was up slightly from last year: students heavily favored their mobiles, with over 90% completing on cell phones, and about 60% of faculty and staff completed on mobile devices.

Assumptions about respondents and data

Capturing and recording the commuting behavior of large groups of people can become an enormously complex enterprise. Budget, time, and effort (both respondent and researcher) can balloon if great precision is required from smaller segments of the target population. Consistent and varying multimode commutes are difficult to capture accurately[2]. However, previous studies indicated that about 85% of commuters do travel nearly the same way every day and that "to" and "from" commutes were also identical in most cases. Data from the current survey, in fact, confirmed (and exceeded) the percentage of these habits, as did last year's data. Thus, to stay within budget and time constraints, although multimode commuting is still reported, this study relied on the fact that *most* people (85%+) have single mode, non-variable commutes on the days they do commute.

Consequently, the survey instrument asked respondents to consider and describe their *typical* commute. We asked what mode of transportation was used *at least once per week*, and then, in analysis, we assumed that this mode was used on all the days respondents said they commuted. These simplifying assumptions allowed for a cost-effective data collection, an instrument that was not burdensome for respondents, and, we hoped, data that would be accurate enough to detect the effects of future interventions intended to alter commuting behaviors at WCU.

Because a sample was drawn rather than a census, in some instances, no one may have reported a certain commuting behavior (off-campus students using regional rail, for example). This does not mean that no off-campus students use regional rail. It only means that in our randomly drawn sample, no one in this group reported it. For most summary percentage data in this report, it is reasonable to assume they are *accurate* to within roughly +/-4%, but the response may not be *precise* enough to capture very small groups of people in some behavioral categories. Statistically, the more extreme the percentages (i.e., when they are closer to 100% or to 0%), the *lower* the margin of error. For percentages closer to the middle range (i.e., around 50%), the margin of error is larger. But this pattern is also contingent on size of sample, with smaller ones having larger margins of error. Interested readers may consult the chart in Appendix B showing margins of error for percentage data.

Relatedly, confidence intervals (that is, the margin of error on either side of reported point estimates) are not displayed in the body of this report because readers usually ignore them or find them confusing when processing the point estimates. All readers are advised that the point estimates are just that – estimates, based on a sample. Standard errors, calculated from the raw data, are applied in the Conclusion section to detect statistically significant changes in fuel use from the previous year.

Answers to most of the research questions in this study required projecting survey results to the whole WCU population. This is a relatively simple calculation of weighting the data "up" to population size. For example, if 100 randomly sampled people respond from a population of 1,000, we can sum a given variable and then multiply by 10 to arrive at a reasonable estimate of the variable at the population level. Weighting of this kind is done routinely for national economic and labor estimates, for instance, because censuses are rarely performed. But because a sample was taken, there is necessarily a confidence interval, a degree of uncertainty, that must be allowed for around the point estimate. This is the margin of error referred to above.

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[2] Generally, to get accurate data for multimode commuting, respondents must know and record miles for each leg of their commute. *Variable* multimode commutes (different each day) add complexity to observing and recording (using a diary or other medium) this small proportion of all commuting. With a $5 incentive and a short data collection period available, the diary method with its concurrent additional logistical demands was not a feasible protocol. In addition, matching the protocol to the previous year's was also advantageous ("apples to apples").

In addition to sampling error, there are also unknown non-sampling errors that all surveys reports should declare and which contribute to variation from the true values in the population. These errors may or may not be biased, that is, lead to over- or under-estimates, rather than randomly affecting the point estimates. Among the non-sampling errors is response bias, that non-respondents might have responded in a different way from the respondents. Even if biases do exist, however, they will be less of a problem when results are compared to a replication of the survey using the same instrument under similar conditions[3].

In any case, broad population estimates are best measured and understood over time with as many data points (sets) as possible. As expected, figures in the present report vary from last year's report (although not greatly), due to sampling, non-sampling, and other natural variation factors. While these factors can never be eliminated, data from each successive year can increase our confidence that the survey results are closer to the reality of the WCU community's commuting profile.
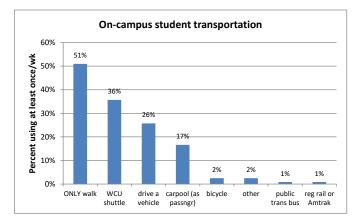
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[3] To understand why bias is less problematic when a replication is performed, consider a weight loss program. Suppose the scale is biased by adding 3 additional pounds to the clients. One weighs in at 210 at the beginning of the program – but the true weight is 207. At the end of the program, the reported weight is 185 (it's a great program!), but the true weight is 182. The key statistic, accurately captured, is *the loss* of 25 pounds, which is unaffected by the bias in the scale.

In the current situation, WCU interventions designed to affect commuting and parking habits are the equivalent of the weight loss program, and the survey is the scale. The degree to which the intervention is effective is unaffected by any bias, provided the same instrument is administered under similar conditions.
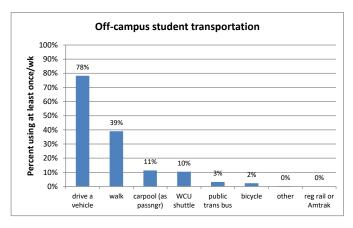
RESULTS

Student drivers

Of the 241 students who indicated they live on campus, 124 (51%) indicated they *only* walked to classes, and 86 (36%) use the WCU shuttle at least once per week. However, 62 (26%)[4] also say they drive at least once per week to commute, though they live on campus. (This mode's default commute distance was set as one mile for on-campus students.)

On-campus student transportation

Percent using at least once/wk

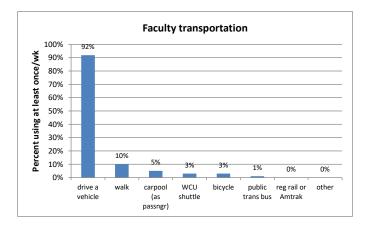| ONLY walk	WCU shuttle	drive a vehicle	carpool (as passngr)	bicycle	other	public trans bus	reg rail or Amtrak
51%	36%	26%	17%	2%	2%	1%	1%

As expected, off-campus students, with 345 responding, have a very different transportation profile. The majority (78%) report driving, with 39% walking (14% *only* walk). 11% say they carpool as passengers, and 10% report using the shuttle.

Off-campus student transportation

Percent using at least once/wk

drive a vehicle	walk	carpool (as passngr)	WCU shuttle	public trans bus	bicycle	other	reg rail or Amtrak
78%	39%	11%	10%	3%	2%	0%	0%

Faculty and staff drivers

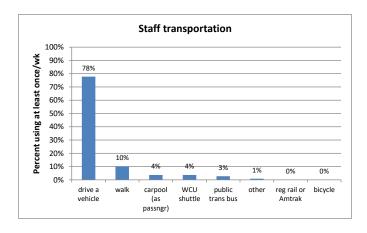Predictably, faculty transportation is dominated by driving: 92% of them drive to campus, with just 10% walking. 5% report carpooling as passengers, and only 3% or fewer use any other form of transportation.

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[4] Percents here will exceed 100% because people can report multiple modes of commuting in the same day. Single and multiple modes are discussed in more detail below, under "Modes of commuting."

Faculty transportation

78% of staff drive but use public transportation and other modes at about the same rates as faculty[5]:

Staff transportation

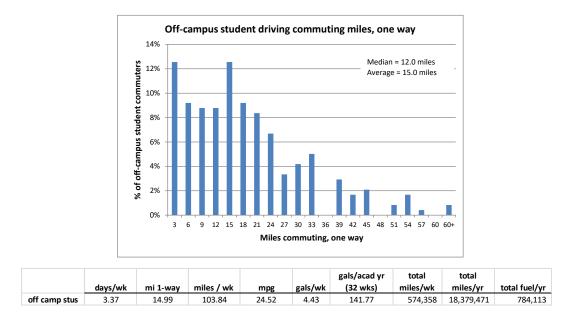## Total annual WCU commuting fuel use

A few variables are required to estimate the fuel use of WCU commuters. If they indicated that they only drive to campus[6], the survey asked a) how many days they typically drive to campus, b) how far they commuted, and c) the miles per gallon rating of their vehicle. This would allow calculating an estimate of commuting fuel use for individual respondents' cases and a projection to the University community.

Off-campus student[7] one-way driving commutes ranged from blocks to 63 miles. The median was 12.0 miles and average, 15.0 miles:

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[5] Public transportation use among staff was about 21% last year. The lower rate this year may be due to logistical obstacles resulting in fewer ARAmark employees completing the survey.

[6] For purposes of analysis, "single mode" driving included driving and driving in combination with walking and/or WCU shuttle. The assumptions were that driving in these cases was by far the dominant mode in terms of miles, and that when these cases' commuting distances were reported, only the driving distances were considered.

[7] On-campus students were not included in the fuel consumption calculations. Although 17% of them indicated they do drive a vehicle for at least part of their commute, the mode and median distance was just one mile, which suggests most of the driving is only between North and South campuses. Cases where driving for on-campus students was greater than one mile were likely instances of off-campus work or personal commuting (which fall outside the purview of this study). An estimate of their total fuel use is nevertheless mentioned in footnote #10 at the end of this section.

Off-campus student driving commuting miles, one way

Median = 12.0 miles
Average = 15.0 miles

	days/wk	mi 1-way	miles / wk	mpg	gals/wk	gals/acad yr (32 wks)	total miles/wk	total miles/yr	total fuel/yr
off camp stus	3.37	14.99	103.84	24.52	4.43	141.77	574,358	18,379,471	784,113

Combining individuals' commuting days, distance (x2 for roundtrip), miles per gallon[8], and weeks per academic year (32) yields the total annual fuel consumption per off-campus student.[9] 69% of off-campus students reported driving only commutes. So with 5,531 off-campus driving-only students, averaging 141.77 gallons per academic year per student, their total fuel consumption would be 784,113 gallons.
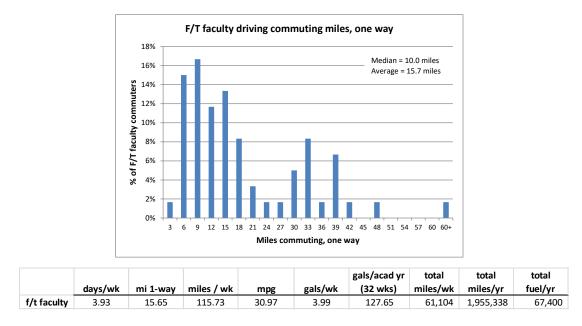
Faculty summary data were calculated in the same manner. Part-time faculty drove an average of 23.28 miles one way in their commutes, 2.52 days per week:

P/T faculty driving commuting miles, one way

Median = 14.0 miles
Average = 23.3 miles

	days/wk	mi 1-way	miles / wk	mpg	gals/wk	gals/acad yr (32 wks)	total miles/wk	total miles/yr	total fuel/yr
p/t faculty	2.52	23.28	120.09	19.43	4.96	158.80	37,107	1,187,420	49,069

92% of part-time faculty respondents reported driving-only commuting. With 336 part-time faculty averaging 158.8 gallons per academic year, their total fuel consumption is 49,069 gallons.

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[8] 26% of the respondents did not know the miles per gallon of their vehicles, but virtually all of these people reported that they used a medium sized gasoline automobile. A standard statistic from the US EPA for this type of vehicle of 23 mpg was entered in these cases.
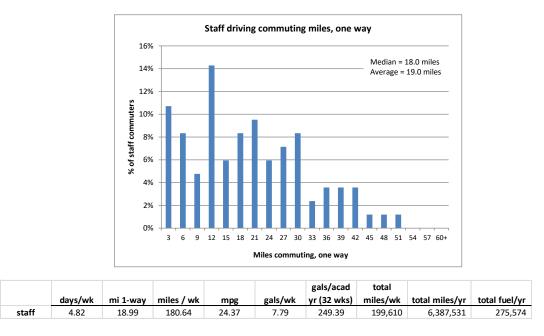
[9] For each driving case, days commuting were multiplied by twice the one-way distance to yield miles/week. Mi/wk were then divided by mi/gal to yield gals/wk, and this figure was multiplied by 32 weeks (about an academic year) to yield total fuel consumed in commuting per year. (Figures in the table display two digits but are calculated using four.)

Full-time faculty drove 15.65 miles one way in their commutes, 3.93 days per week:

F/T faculty driving commuting miles, one way

Median = 10.0 miles
Average = 15.7 miles

	days/wk	mi 1-way	miles / wk	mpg	gals/wk	gals/acad yr (32 wks)	total miles/wk	total miles/yr	total fuel/yr
f/t faculty	3.93	15.65	115.73	30.97	3.99	127.65	61,104	1,955,338	67,400

85% of 623 full-time faculty commuted only by driving, averaging 127.65 gallons per academic year. Their total fuel consumption is 67,400 gallons.

And staff commuting distances looked like this:

Staff driving commuting miles, one way

Median = 18.0 miles
Average = 19.0 miles

	days/wk	mi 1-way	miles / wk	mpg	gals/wk	gals/acad yr (32 wks)	total miles/wk	total miles/yr	total fuel/yr
staff	4.82	18.99	180.64	24.37	7.79	249.39	199,610	6,387,531	275,574

With 78% of 1,421 staff driving in their commutes, averaging 249.39 gallons per academic year, the total fuel consumption is 275,574 gallons.
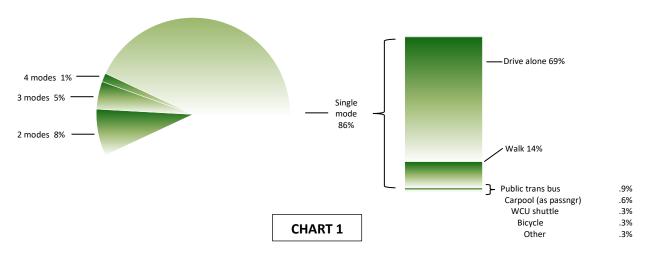
Total drive-only fuel consumption, then, for off-campus students, faculty, and staff at the University is 36,923 gallons per week or 1,176,156 gallons per year[10], equivalent to the volume of nearly two Olympic swimming pools. All single-mode drivers accumulate approximately 872,180 miles per week in their commutes, which is nearly 28 million miles per year.

Modes of commuting

Students, faculty, and staff vary in commuting to campus, although all three groups have a very high proportion of driving cars as their single mode of transportation[11]. There are a few other modes ("alternative" modes) that are used in much smaller degree and in various combinations, as shown in the following charts.

Chart 1 displays commute modes of 345 off-campus students. 86% typically use only one mode of transportation, with percents shown on the left for multi-modal commutes to campus, that is, more than one mode in various combinations of driving, carpooling, busing, walking, training, or cycling.

As the single mode commute is most common, it is further delineated in the stacked column on the right. Two-thirds (69%) of all single-mode off-campus students drive alone in their commutes to campus, 14% walk only, and about 1 in 40 off-campus students comprise all of the nearly negligible remaining modes shown on the right of Chart 1.
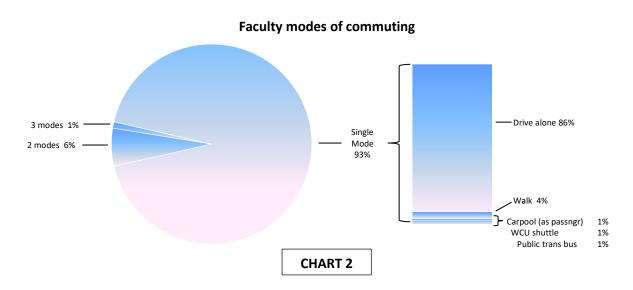
Off-campus student modes of commuting

4 modes 1%
3 modes 5%
2 modes 8%

Single mode 86%

Drive alone 69%

Walk 14%

Public trans bus   .9%
Carpool (as passngr)   .6%
WCU shuttle   .3%
Bicycle   .3%
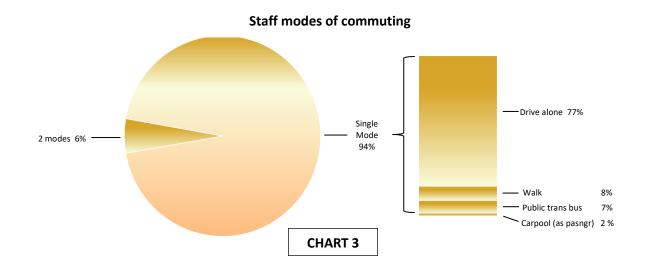Other   .3%

CHART 1

Chart 2 below displays commute modes of 84 responding faculty (full- and part-time combined). 93% of them typically use only one mode of transportation, with a few percents shown on the left for the small number of remaining multi-modal commutes to campus.

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[10] Some on-campus student respondents misinterpreted the commute distance question, as 9 out of 40 said they commuted 3 miles or more (one said 70 miles, in fact). With one mile between North and South Campus as a more representative measure of on-campus student commuting, then their average fuel use is 5.8 gallons per year per student. This adds 5,358 gallons to the total, or less than 0.5% of the sum from all the other groups combined.

[11] As mentioned in the introduction, this fact is important to the design of the survey, as we assumed that most people commute by one mode and do so fairly consistently.

Faculty modes of commuting

3 modes 1%
2 modes 6%
Single Mode 93%

Drive alone 86%
Walk 4%
Carpool (as passngr) 1%
WCU shuttle 1%
Public trans bus 1%

CHART 2

The single mode commute is further delineated in the stacked column on the right. As expected, most faculty (86%) drive alone when commuting, 4% walk only, and a negligible number use an alternate single mode of commuting.

Staff modes of commuting

2 modes 6%
Single Mode 94%

Drive alone 77%
Walk 8%
Public trans bus 7%
Carpool (as pasngr) 2 %

CHART 3

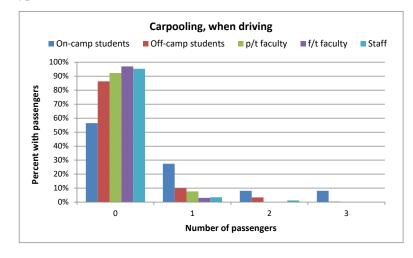Finally, Chart 3 displays the commute modes of 108 responding staff. 94% typically use only one mode of transportation, with percents shown on the left for the remaining multi-modal commutes to campus.
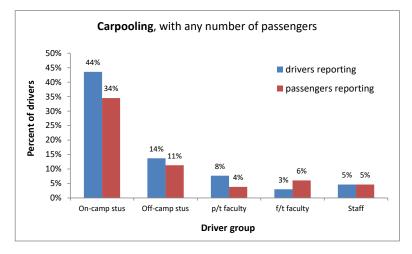
The single mode commute delineated on the right is a profile similar to faculty, with 77% of staff driving alone, 8% walking, 7% using public transportation bus, and a small number reporting carpooling.

Carpooling

The survey asked, "How many people, *besides yourself*, were usually in the vehicle when you drove to campus?" As demonstrated above, most commuters drive alone, but when carpooling occurrs, a single passenger is most typical:

Carpooling, when driving

Drivers differed slightly from passengers when reporting carpooling (with passengers more likely to report less carpooling). But overall, only on-campus student drivers carpooled in significant amounts (and, of course, they have the shortest commuting distance):

Carpooling, with any number of passengers

Generally, carpooling remains a relatively uncommon commuting mode for commuters.

Parking

Parking is clearly at a premium for the WCU community, as reflected in both data and in comments about parking availability, captured in an open-ended item in the survey. (Those verbatim results are under separate cover.)

This year, 53% of on-campus students reported driving in their commute to WCU, and an additional 12% reported *having* a vehicle for their use while at WCU, even if they do not use it to commute[12]. While on-campus student commuting contributes little to fuel use, this segment clearly is significant when considering competition for parking spaces[13].

One goal of the survey was to determine where people park and to estimate how many spaces may be required in those locations. All respondents with cars were asked to identify their preferred parking locations. The columns in the table below show the percentages where people who commute by driving or who have cars on campus – resident students – typically park. The bottom line shows the number of cases that provided these data.

Where People Park

	on campus	off campus	p/t fac	f/t fac	staff
Surface lots:					
surface - North	16%	39%	30%	44%	58%
surface - South	36%	22%	17%	5%	8%
other	1%	2%	4%	3%	4%
Garages:					
Matlack	7%	10%	9%	13%	2%
New Street	8%	3%	0%	0%	0%
Stu Rec Ctr	1%	0%	4%	8%	5%
Sharpless	0%	3%	17%	20%	13%
other	0%	0%	0%	0%	0%
street w/Boro permit	5%	6%	4%	0%	2%
street, metered	22%	12%	13%	5%	0%
other	4%	3%	0%	2%	7%
Counts:	76	239	23	61	84

As with overall University fuel use, the number of parking spaces required to meet demand in these locations can be approximated by weighting to the respective populations and also by days commuting[14]. The relevant data are on the next page.

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[12] Last year, 30% of on-campus students reported driving in their commute and an additional 31% reported having a vehicle. The reason for these differences is not known, but the total on-campus students reporting cars is similar between years: 61% last year and 65% this year.

[13] On-campus students who do not drive to commute still *use* their cars an average of 3.75 days per week, which is more days than off-campus students use their cars for commuting (3.37 days). These non-commuting uses are not included in the commuting and fuel figures of the WCU community reported in this report, but they have a significant impact on parking availability.

[14] In the case of resident students who own a vehicle, the full week is weighted, that is, they are assumed to have their vehicles in a space all five days of the week.

Parking Projections

	on campus	off campus	p/t fac	f/t fac	staff	
response count	117	345	26	72	108	
# with cars	76	239	23	61	84	
% with cars	65%	69%	88%	85%	78%	
pop. count	5,561	7,984	336	623	1,421	
proj. pop. cars	3,612	5,531	297	528	1,105	
days on campus	5.00	3.37	2.52	3.93	4.82	
proj. pkng. spaces req'd	3,612	3,730	150	415	1,066	
University parking spaces req'd - projected						
Surface lots:						
surface - North	570	1,451	46	184	622	**2,873**
surface - South	1,283	827	26	20	89	**2,245**
other	48	62	7	14	38	**169**
Garages:						
Matlack	238	359	13	54	25	**689**
New Street	285	109	-	-	-	**394**
Stu Rec Ctr	48	-	7	34	51	**140**
Sharpless	-	125	26	82	140	**373**
other	-	-	-	-	-	**-**
Total:	2,472	2,933	125	388	965	**6,883**
Non-University parking spaces req'd - projected						
street w/Boro permit	190	234	7	-	25	456
street, metered	808	437	20	20	-	1,285
other	143	125	-	7	76	351
Total:	1,141	796	27	27	101	2,092

To determine the *maximum* number of parking spaces required by group and location, the percentage of people who commute by driving (or, in the case of resident students, the percentage who have cars for their use while at WCU) is first multiplied by the total population of each group. This approximates the *maximum* number of driving commuters and students with cars on campus. The ratio of average commuting days per week is then multiplied to arrive at the number of spaces required. For example, if the group commutes an average of 2 out of 5 days, then the cars requiring spaces are weighted by two-fifths, or 40%. The required spaces are then distributed according to reported use (the percents in the chart on the previous page) to arrive at the total count.

For example[15], 570 North surface lot spaces for on-campus students is 16% of the 3,612 on-campus student cars; 1,451 is 39% of the 3,730 cars belonging to commuting off-campus students, and so on. The bold numbers on the right for lot and garage spaces total 6,883 on the two main WCU campuses. On-campus students, while they contribute little to the commuting fuel consumption of the WCU community, contribute over a third (2,472 / 6,883 = 36%) of the competition for parking spaces.

An important caveat to reiterate is that the method used to determine parking requirements calculates the *maximum* number of spaces required if all commuters were on campus at the same time. Obviously, this is not the case in reality and figures here are therefore inflated. There are peaks and valleys in demand for parking, and all cars are never on campus simultaneously. On the other hand, a certain percentage of marginal spaces are necessary if people are to locate spots in a reasonable amount of time.

Exactly how these forces are balanced is beyond the purview of this report. Professional parking consultants may very well have more sophisticated formulas for estimating the optimum number and distribution of spaces for the WCU community. The raw data above at least provide empirical starting points for how parking demand is distributed.

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[15] Numbers are approximate in the examples due to additional decimal places, not shown, used in the charts.

Knowledge and attitudes about alternative transportation

The survey asked about awareness, use, and attitudes about six alternate forms of economical transportation. Awareness varied considerably both across groups and the forms of transportation. Use was generally low to moderately low, except for the two bus routes, which saw moderate use among several groups. The summary data are presented in the table below. Comments on how these services could be improved (which, of course, came mostly from people who have used the services) are under separate cover.

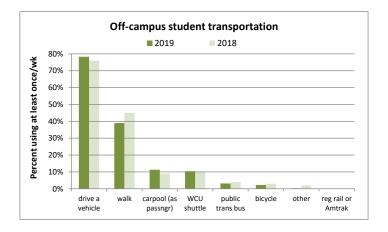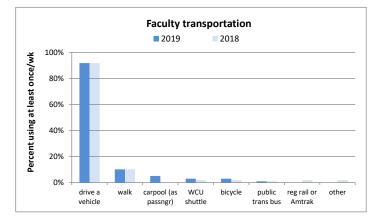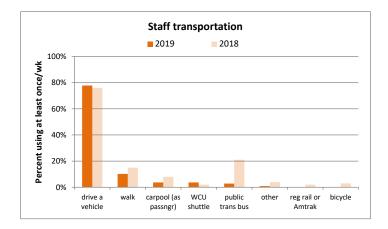| Zagster Bikeshare	On-camp students	Off-camp students	P/T faculty	F/T faculty	Staff
Aware of service	86%	72%	43%	75%	88%
Used the service	23%	6%	0%	9%	4%
Value (1=high; 4=low)	2.11	3.00	--	2.00	2.67
# saying improvable	11/23	2/10	--	2/4	0/3
RideAmigos					
Aware of service	17%	25%	0%	43%	30%
Used the service	5%	3%	0%	15%	12%
Value (1=high; 4=low)	1.00	3.00	--	3.00	2.67
# saying improvable	0/1	1/3	--	2/4	0/3
Rideshare Parking Spaces					
Aware of service	26%	41%	35%	56%	40%
Used the service	10%	15%	0%	18%	19%
Value (1=high; 4=low)	1.00	2.64	--	2.17	2.33
# saying improvable	0/3	2/15	--	1/6	1/9
Uptown Loop Shuttle Bus Route					
Aware of service	78%	62%	30%	72%	75%
Used the service	34%	16%	0%	16%	24%
Value (1=high; 4=low)	1.48	2.00	--	1.50	1.92
# saying improvable	9/31	2/24	--	1/7	5/15
Exton Train Station Shuttle Bus Route					
Aware of service	55%	37%	35%	77%	65%
Used the service	28%	15%	25%	28%	11%
Value (1=high; 4=low)	1.75	2.25	2.50	0.12	2.17
# saying improvable	3/18	2/13	0/2	6/13	0/6
Zipcar carshare vehicles					
Aware of service	44%	41%	35%	52%	57%
Used the service	17%	3%	0%	3%	6%
Value (1=high; 4=low)	2.00	3.00	--	1.00	2.00
# saying improvable	1/9	1/3	--	0/1	0/3

CONCLUSION

Comparing 2018 and 2019 results

With about a 40% response rate last year and 35% this year, a reasonable question to ask is how close are the two survey results? If they are fairly close, we can have some assurance that response bias, at least, has not greatly changed the data. But as with any complex phenomena, multiple data points help us to zero in on the reality of the variables, and trend lines are especially helpful in this regard. So two data points not only supply confidence in the instrument and survey methods (where results are close), but they also begin the process of establishing trends that contribute to understanding the phenomena under scrutiny. To this end, key survey results from both years are compared in the following tables.

Modes used

Virtually all mode reporting for students, faculty, and staff were very similar between years. The rankings of the modes are almost identical, if not the precise percentages. Alternative transportation modes remained in single digits for both years, and the small changes between years are well within the margins of error. The West Chester community remains primarily solitary drivers disinclined to carpooling and public transportation. Only off-campus students walk in significant numbers.

Staff transportation

The sudden drop in staff use of buses may be due to an anomaly in respondent bias. There was more difficulty in 2019 obtaining responses from this hard-to-reach group (specifically, ARAmark employees) than in 2018.

A slightly larger number of on-campus students reported carpooling (not shown above). But they, of course, have the shortest commute – typically, just a mile – and do not carpool with every commute. Undergraduate cohorts sharing living quarters and other activities probably accounts for this mode choice exception.

Fuel use statistically unchanged from 2018 to 2019

Total 2019 fuel use by WCU commuters came to 1,176,156 gallons, about an 11% increase over 2018's 1,058,704 gallons. Statistical tests, however, show that the differences in average WCU fuel consumption of the commuter groups may only be due to chance variation in the samples. While there were apparent increases in three of the four groups below, these differences are well within what can be explained by chance variation in the data[16]:

	gals/acad yr			
	2019	**2018**	**change**	**p value**
staff	249.39	227.84	21.55	.51
off camp stus	141.77	128.12	13.65	.25
F/T faculty	127.65	144.66	-17.01	.45
P/T faculty	158.80	104.55	54.25	.26

Multimodes

As in 2018, multimodal commuting is not very common at WCU. About 14% of off-campus students report using more than one mode in their commutes; only 7% of faculty do; and staff, about 6%. This is good for ease of measurement. With the instrument used in this survey, it would be guesswork to assign vehicle miles (and therefore, fuel consumption) to these multimode commutes, but their small proportions suggest that they would not change the point estimates too significantly.

---

[16] The statistical tests were performed on fuel use of individual respondents within each group. Conventionally, the probability of a result as or more extreme than the sample differences would have to be less than 5% (i.e., $p < .05$) to conclude that there is likely a difference in the two year's populations. Therefore, the difference between years cannot confidently be attributed to anything other than chance variation in the samples. This is true even in the part-time faculty sample because the variance was so large. *P* values are two-tailed.

Parking

As in 2018, close to 9,000 individual cars either are on or commute to the campuses each week. They are not on campus all at once, of course, and not all of them use campus parking facilities – nearly 7,000 do.

In both years, on-campus students' cars consumed slightly more than a third of the surface lot and garage space requirements, partly because they are on campus more time (virtually every day) than other groups. Off-campus students' cars required the most spaces, 43% this year and 46% last year. Also in 2018 and 2019, the percentage demand for parking spaces of part-time, full-time, and staff remained the same at 2%, 6% and 14%, respectively.

The *maximum* number of surface lot and garage spaces for North and South Campuses was estimated to be 6,500 in 2018 and 6,883 in 2019. (Again, the difference here may just be random.) The *optimum* number, since not all cars are on campus simultaneously, depends upon the variance from maximum demand, on the one hand (which would reduce the space requirement), and marginal spaces for convenience, on the other (which would increase the requirement).

One final note on fuel consumption and parking is that vehicle congestion and space scarcity increase fuel use. Driving for many minutes in stop-and-go traffic to find a parking space obviously adds mileage and consumes fuel over and above what is usually reported for "commuting miles." A 20-minute commute can easily be extended significantly in the search for a space. The instrument, however, did not attempt to quantify this aspect of WCU commuting experience directly, although some open-ended remarks alluded to it both years.

Technical and logistical notes

The online instrument again worked perfectly. No technological impediments were encountered. The web mode served the aims of the study well, gathering a large amount of data in a short period of time. (One small segment – ARA staff – were solicited personally rather than by email at a central location but still completed online.) Electronic administration also allowed numerous reminders to nonresponders and more than doubled the initial response. Programming logic minimized respondent burden, and data checks resulted in minimal missing or out of range data.

Most of the simplifying assumptions about commuting behavior mentioned at the beginning of this report were borne out by the data. Most people use a single mode of transportation and, of these, most of them drive alone. Most people also commute in a consistent pattern across commuting days.

Little imputation of data was required. 26% of driving respondents did not know the miles per gallon of their vehicles, but a follow up question in these cases successfully captured the kind of vehicle they drove. With this information, standard EPA information supplied reasonable estimates of vehicle mpg.

Though there is certainly measurement error in how precisely people report commuting driving distances, previous commuter studies demonstrate that there is little bias in this statistic. Consequently, coupled with mpg and days commuting, the estimate of annual fuel use by the entire community is relatively robust. Nevertheless, summary data in this report, because of the sampling method, have confidence intervals around them that can be easily calculated or interpolated using the appended margin of error chart.

During the data collection period, the survey database must be regularly monitored for hacking and inadmissible cases. This is just a reality of the digital world today. This year did not experience any such cases, but last year, the database did receive a small number, which were caught the day they were recorded and promptly removed. Professional surveyors can usually spot and remedy such problems quickly. The "captcha" mechanism at login virtually eliminates the possibility of thousands of "robo-cases," but there is still the possibility of manual mischief.

The response rate was serviceable, but could be improved. Though small, the incentive seemed sufficient for the length of the survey and certainly contributed favorably to the response rate. However, increasing it to $8 or $10 would improve the response by perhaps 10-20 percentage points, particularly among students, the lowest responding group. In turn, this would, for statistical reasons, make future changes in key variables easier to detect. The costs could be offset by soliciting fewer people, 1/8 or 1/9, for instance. Incentives and sample fraction are, of course, contingent on budget. The 2019 survey launch date was earlier than in 2018 to avoid conflict with final exams. It was assumed that the 2018 response rate may have been depressed due to this conflict. Nevertheless, the rate *decreased* in 2019. We still recommend avoiding finals and any other events that may inordinately compete for the community's awareness and time.

= =
WCU COMMUTING SURVEY

4.16.19h

WEST CHESTER
U N I V E R S I T Y

You are part of <u>a small random sample</u> selected from the WCU community. For this reason, we greatly appreciate your help in completing this brief survey of commuting information and habits.

For your time – just a few minutes – we will send you **a $5 Amazon gift card** upon completion.

While you may not have exact answers to all the survey items, we hope you will answer to the best of your ability and be entirely candid in your responses.

Your responses are completely CONFIDENTIAL. An outside research firm has been enlisted to collect the data. You will not be identified in any results. Your participation is voluntary, and completing the survey indicates your consent.

We thank you again for contributing to this important research.

[login etc.]

[survey screen footer]

West Chester University ⬩ 703 South High St., Rm 101 ⬩ West Chester, PA 19383 ⬩ 610-436-2053

= = = = =

You are about to enter the survey. To go back a page, please use the

survey's red "Back" button, not your browser's back button.

Your answers will be saved each time you click "Next."

You may leave the survey and return multiple times. If you do return,

after entering your login code again, you will be placed in the screen you last visited.

= = = = =

Please read and answer each question below. Please be as accurate as possible. All your answers will be confidential.

1. On which WCU campus do you spend *most* of your time this Spring semester 2019?
   - O_1 North
   - O_2 South
   - O_3 Philadelphia
   - O_4 Nursing Center (Exton)
   - O_5 Graduate Center (Exton)
   - O_6 Online only [display INELIGIBLE CLOSE A]
   - O_7 Other *(please specify)*: _____ [display INELIGIBLE CLOSE A]

[Note: question numbers and answer option numbers/letters will not appear on live instrument.]

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2. During the Spring semester 2019 academic semester, how many days per week do you *typically* come to campus?
   _____ days per week

[q3 appears ONLY to students]

3. a. Do you live on campus this Spring semester 2019?

   - O_1 Yes [q3b,c appear] O_2 No [go to q4]

   b. On which WCU campus do you live?

   - O_1 North
   - O_2 South

   c. Other than walking, do you sometimes use other ways of getting to your classes this semester?

   - O_1 Yes [go to q4] O_2 No [skip to q9]

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[appears to ALL Rs (unless q3c = 2)]

4. When you commute to campus, about how far do you *typically* commute *ONE WAY,* counting all segments/parts of the commute, if more than one? Your best estimate is OK.
   (If you *typically* use only the WCU intercampus shuttle, enter 1 mile.)

   a. _____ mile(s) commuting one way

   OR

   b. _____ blocks, *if less than 1 mile one way*

   [Only one choice answerable here (gray out other)]

= = = = = = =
Now please think about your typical week of commuting to campus this Spring semester 2019. You might commute the same way almost every day or differently depending on the day. You might use only one form of transportation or more than one form on multiple segments of a commute.

The following questions ask about these aspects of your commuting habits.

5. From the following list, please check the forms of transportation that you use <u>at least once a week</u> in a *typical* week of commuting to campus this Spring semester 2019. *(Check all that apply, but do not check forms that you <u>typically</u> use only rarely.)*

    ❑_a driving a vehicle
    ❑_b carpooling (as a passenger)
    ❑_c WCU shuttle bus (on campus, to/from Exton, or to/from West Chester Borough)
    ❑_d public transportation bus
    ❑_e regional rail line or Amtrak   [For q5, if checked, enter "1";
    ❑_f bicycle   if not checked, enter "0."]
    ❑_g walk
    ❑_h other *(please specify)*: _____

= = = = = = =
[if q5a=1]
6. a. In a *typical* week, about how many days do you drive a car to campus?   _____ day(s) per week

    b. About how many miles do you drive *one way* as part of your *typical* commute to campus?
        _____ mile(s) driven

    c. How many people, <u>besides yourself</u>, are usually in the vehicle when you drive to campus? *(Carpooling may include family members or others.)*
        ◯₁ No one else
        ◯₂ One
        ◯₃ Two
        ◯₄ Three or more

    d. Where do you *most often* park your vehicle while you are on campus?
        ◯₁ a WCU surface lot [q6e appears]
        ◯₂ a WCU garage   [q6f appears]
        ◯₃ on the street with a Borough (or other local) permit [go to q6g]
        ◯₄ on the street at metered spaces [go to q6g]
        ◯₅ other *(please specify)*: _____   [go to q6g]

    e. Please indicate which lot you *most often* park in:
        ◯₁ a North campus lot [go to q6g]
        ◯₂ a South campus lot [go to q6g]
        ◯₃ other *(please specify)*: _____   [go to q6g]

    f. Please indicate which garage you *most often* park in:
        ◯₁ Matlack
        ◯₂ New Street
        ◯₃ Student Recreation Center
        ◯₄ Sharpless
        ◯₅ other *(please specify)*: _____

= = = = =

    g. What would you say is the average miles per gallon (MPG) your vehicle gets, approximately?

q6g_mpg _____ mpg <mark>[go to q7]</mark>

q6g_other $\bigcirc_1$ I drive an all-electric vehicle <mark>[go to q7]</mark>
$\bigcirc_2$ I don't know

    h. Please select the type of vehicle you <u>most often</u> use to commute: <mark>[dropdown menu]</mark>

$\bigcirc_1$ gasoline auto, small	$\bigcirc_7$ gasoline heavy truck
$\bigcirc_2$ gasoline auto, medium	$\bigcirc_8$ diesel light truck
$\bigcirc_3$ gasoline auto, large	$\bigcirc_9$ diesel heavy truck
$\bigcirc_4$ hybrid automobile	$\bigcirc_{10}$ motorized scooter
$\bigcirc_5$ diesel automobile	$\bigcirc_{11}$ motorcycle
$\bigcirc_6$ gasoline light truck	$\bigcirc_{12}$ other

= = = = =

<mark>[only if q5b=1; otherwise, go to q8]</mark>

7. a. About how many days in a *typical* week do you carpool as a passenger in your commute to campus?

    _____ day(s) per week

    b. How many people, <u>besides yourself</u>, are usually in the vehicle when you carpool to campus?

    $\bigcirc_1$ One
    $\bigcirc_2$ Two
    $\bigcirc_3$ Three or more

<mark>[If q5c,d,e,f,g = 1, populate next item with those selected options; otherwise, go to q9]</mark>

8. About how many days in a *typical* week do you take the following transportation to commute to campus?

    a. WCU shuttle bus (on campus, to/from Exton,
       or to/from West Chester Borough)   _____ days per week
    b. Public transportation bus   _____ days per week
    c. Regional rail line or Amtrak   _____ days per week
    d. Biking   _____ days per week
    e. Walking   _____ days per week

<mark>[if (Student AND q5a=1) OR if (non-student), skip to q10; otherwise, continue]</mark>

9. a. Do you currently have a personal vehicle for use while you are at WCU?

    $\bigcirc_1$ Yes <mark>[q9b,c,d appear]</mark> $\bigcirc_2$ No <mark>[go to q10]</mark>

    b. Please select the type of vehicle you have:
    $\bigcirc_1$ automobile
    $\bigcirc_2$ S.U.V
    $\bigcirc_3$ motorized scooter
    $\bigcirc_4$ motorcycle
    $\bigcirc_5$ light truck
    $\bigcirc_6$ other *(please specify)*: _____

<mark>[Note: only students <u>might</u> see q9, because only students see the gateway in q3c or q5.]</mark>

    c. About *how many days per week* have you used your vehicle for *any purpose* during the Spring semester 2019?
    _____ days per week

d. Where have you *most often* parked your vehicle?
   - ◯₁ a WCU surface lot [q9e appears]
   - ◯₂ a WCU garage   [q9f appears]
   - ◯₃ on the street with a Borough (or other local) permit [go to 10]
   - ◯₄ on the street at metered spaces [go to 10]
   - ◯₅ in a private driveway or property [go to 10]
   - ◯₆ other *(please specify)*: _____   [go to q10]

e. Please indicate which WCU surface lot you *most often* parked in:
   - ◯₁ a North campus lot [go to q10]
   - ◯₂ a South campus lot [go to q10]
   - ◯₃ other *(please specify)*: _____   [go to q10]

f. Please indicate which WCU garage you *most often* parked in:
   - ◯₁ Matlack
   - ◯₂ New Street
   - ◯₃ Student Recreation Center
   - ◯₄ Sharpless
   - ◯₅ other *(please specify)*: _____

= = = = =
Just a few more questions, please, regarding alternate transportation.

West Chester University has implemented programs in the past year to give our students, faculty, and staff more options for traveling to, from, and on campus. Your answers to the following questions will help WCU more effectively support the commuting choices of students, faculty, and staff.

10. a. Do you know that WCU has a bikeshare program, **Zagster Bikeshare,** that any student, faculty member, or staff person can join and that gives access to 15 bicycles from three stations on campus?

   ◯₁ Yes [b appears]   ◯₂ No [go to q12]

b. Have you ever used, or considered using, Zagster Bikeshare?

   ◯₁ Yes [c,d appear]   ◯₂ No [go to q12]

c. How valuable is it to you?
   - ◯₁ Very valuable
   - ◯₂ Somewhat valuable
   - ◯₃ Not very valuable
   - ◯₄ Not valuable at all
   - ◯₅ Uncertain or don't know

d. Could WCU's Bikeshare program be improved so that it would be more useful to you?

   ◯₁ Yes, there are things that would make WCU's Bikeshare program more useful to me. [e appears]

   ◯₂ No, there is nothing that would make WCU's Bikeshare program more useful to me. [go to q12]

   ◯₃ Uncertain / I don't know what would make the Bikeshare program useful to me. [go to q12]

e. Please tell us how it could be more useful to you:

<div style="border:1px solid black; padding:40px; text-align:center;">[text box]</div>

= = = = =

11. a. Do you know that WCU provides free access for all students and employees to **RideAmigos**, a smartphone and PC-accessible commute management service that:

a) provides detailed information on the most direct and time-saving driving routes, public transit options, safe bicycling routes, and walking routes, and

b) helps users find other students or employees to carpool with?

◯₁ Yes [b appears]   ◯₂ No [go to q13]
[repeat b, c, d, and e above]

= = = = =

12. a. Do you know that WCU provides 17 **Rideshare Parking Spaces** in premium locations in five campus surface lots for students and employees who carpool together?

◯₁ Yes [b appears]   ◯₂ No [go to q14]
[repeat b, c, d, and e above]

= = = = =

13. a. Do you know that WCU offers a free **Uptown Loop Shuttle Bus Route** that connects North Campus to West Chester Borough? Stops include the Chester County Hospital, Walnut Street and Miner Street, and the Bradford Plaza Shopping Center (where Giant, Walgreens, and other retailers are located).

◯₁ Yes [b appears]   ◯₂ No [go to q15]
[repeat b, c, d, and e above]

= = = = =

14. a. Do you know that WCU offers a free **Exton Train Station Shuttle Bus Route** that connects North Campus to the Exton Amtrak and SEPTA Regional Rail train station?

◯₁ Yes [b appears]   ◯₂ No [go to q16]
[repeat b, c, d, and e above]

= = = = =

15. a. Do you know that there are two **Zipcar carshare vehicles** on campus (behind Sykes Student Union) that are available for short-term rental by WCU employees and students, aged 18 years and older?

◯₁ Yes [q6b appears]   ◯₂ No [go to q17]
[repeat b, c, d, and e above]

= = = = =

16. If you were able to purchase monthly and semester **SEPTA passes at a 10% discount** over the typical price, would you do so?

  $\bigcirc_1$ Yes $\bigcirc_2$ No $\bigcirc_3$ Maybe, if I knew more about the program
  [all students skip to q20]

= = = = =

[q17 and q18 appear only to non-students]

17. Do you know that payments for semester and annual parking permits for the New Street, Sharpless, and Student Recreation Center garages can be made via **pre-tax salary deductions**?

  $\bigcirc_1$ Yes $\bigcirc_2$ No

18. Would you like to be able to purchase monthly and semester SEPTA passes using **pre-tax salary deductions**?

  $\bigcirc_1$ Yes $\bigcirc_2$ No $\bigcirc_3$ Maybe, if I knew more about the program

= = = = =

19. Please use the space below to tell us anything about your commute not reflected in your earlier answers. For example, what do you like or dislike about your current commute? How WCU could improve your commute to and from campus?

[text box]

= = = = =

20. We greatly appreciate your contributing to this survey. For your time, would you like to receive a $5 Amazon Gift Card, redeemable online?

  $\bigcirc_1$ Yes [q21 appears] $\bigcirc_2$ No [go to REGULAR CLOSE]

21. Please enter your *preferred* e-mail to receive your Amazon Gift Card:

  _____ *(be sure to click "NEXT" below to record this email address)*

(Note: Watch your inbox for this gift card (usually sent within 12-24 hours).
It will be sent DIRECTLY FROM AMAZON but may also be placed into
your "spam" or "bulk mail" folder.)

[NEXT]

[go to REGULAR CLOSE]

= = = = = = = = = = = = = =
REGULAR CLOSE

Thank you again for helping us understand commuting at WCU.

= = = = = = = = = = = = = =
INELIGIBLE CLOSE A for display above q1 [if q1 = 6 OR 7]

Most people selected for this survey attend one of the WCU campuses listed.
Are you sure of your selection?

○ Yes, I'm sure. [go to INELIGIBLE CLOSE B below]

○ No, I meant to select another campus, so I want to go back. [return to q1]

[SUBMIT]

= = = = = = = = = = = = = =
INELIGIBLE CLOSE B

People who do not commute to a WCU campus are not eligible for this survey.

Thank you anyway for choosing to respond to WCU's Commuter Survey.

= = = = = = = = = = = = = =
ERROR IF AN ANSWER IS LEFT BLANK:

Unanswered items are shown in red.
Please select:
○ go back to answer
○ continue without answering

Appendix B
Margin of error chart: confidence intervals around percent results

Sample size		Percent result									
		95%	90%	85%	80%	75%	70%	65%	60%	55%	50%
		5%	10%	15%	20%	25%	30%	35%	40%	45%	50%
	25	8.7%	12.0%	14.3%	16.0%	17.3%	18.3%	19.1%	19.6%	19.9%	20.0%
	50	6.2%	8.5%	10.1%	11.3%	12.2%	13.0%	13.5%	13.9%	14.1%	14.1%
	75	5.0%	6.9%	8.2%	9.2%	10.0%	10.6%	11.0%	11.3%	11.5%	11.5%
	100	4.4%	6.0%	7.1%	8.0%	8.7%	9.2%	9.5%	9.8%	9.9%	10.0%
	125	3.9%	5.4%	6.4%	7.2%	7.7%	8.2%	8.5%	8.8%	8.9%	8.9%
	150	3.6%	4.9%	5.8%	6.5%	7.1%	7.5%	7.8%	8.0%	8.1%	8.2%
	175	3.3%	4.5%	5.4%	6.0%	6.5%	6.9%	7.2%	7.4%	7.5%	7.6%
	200	3.1%	4.2%	5.0%	5.7%	6.1%	6.5%	6.7%	6.9%	7.0%	7.1%
	225	2.9%	4.0%	4.8%	5.3%	5.8%	6.1%	6.4%	6.5%	6.6%	6.7%
	250	2.8%	3.8%	4.5%	5.1%	5.5%	5.8%	6.0%	6.2%	6.3%	6.3%
	275	2.6%	3.6%	4.3%	4.8%	5.2%	5.5%	5.8%	5.9%	6.0%	6.0%
	300	2.5%	3.5%	4.1%	4.6%	5.0%	5.3%	5.5%	5.7%	5.7%	5.8%
	325	2.4%	3.3%	4.0%	4.4%	4.8%	5.1%	5.3%	5.4%	5.5%	5.5%
Sample size	350	2.3%	3.2%	3.8%	4.3%	4.6%	4.9%	5.1%	5.2%	5.3%	5.3%
	375	2.3%	3.1%	3.7%	4.1%	4.5%	4.7%	4.9%	5.1%	5.1%	5.2%
	400	2.2%	3.0%	3.6%	4.0%	4.3%	4.6%	4.8%	4.9%	5.0%	5.0%
	425	2.1%	2.9%	3.5%	3.9%	4.2%	4.4%	4.6%	4.8%	4.8%	4.9%
	450	2.1%	2.8%	3.4%	3.8%	4.1%	4.3%	4.5%	4.6%	4.7%	4.7%
	475	2.0%	2.8%	3.3%	3.7%	4.0%	4.2%	4.4%	4.5%	4.6%	4.6%
	500	1.9%	2.7%	3.2%	3.6%	3.9%	4.1%	4.3%	4.4%	4.4%	4.5%
	525	1.9%	2.6%	3.1%	3.5%	3.8%	4.0%	4.2%	4.3%	4.3%	4.4%
	550	1.9%	2.6%	3.0%	3.4%	3.7%	3.9%	4.1%	4.2%	4.2%	4.3%
	575	1.8%	2.5%	3.0%	3.3%	3.6%	3.8%	4.0%	4.1%	4.1%	4.2%
	600	1.8%	2.4%	2.9%	3.3%	3.5%	3.7%	3.9%	4.0%	4.1%	4.1%
	625	1.7%	2.4%	2.9%	3.2%	3.5%	3.7%	3.8%	3.9%	4.0%	4.0%
	650	1.7%	2.4%	2.8%	3.1%	3.4%	3.6%	3.7%	3.8%	3.9%	3.9%
	675	1.7%	2.3%	2.7%	3.1%	3.3%	3.5%	3.7%	3.8%	3.8%	3.8%
	700	1.6%	2.3%	2.7%	3.0%	3.3%	3.5%	3.6%	3.7%	3.8%	3.8%

Example: Using the highlighted cell, if the result of a given variable representing 275 respondents is 15% (or 85%) the margin of error of is +/- 4.3%. That is, in 95% of a large number of samples of the same size, the result will land between 10.7% and 19.3% (or 80.7% and 89.3%).