Spring 2018

Commuting and Parking Survey Report for West Chester University

Eric K. Foster
MDF Research, LLC

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Spring 2018
Commuting and Parking Survey Report

prepared for
WEST CHESTER UNIVERSITY

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and

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INTRODUCTION

A commuter survey was conducted at West Chester University in the spring of 2018. 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. These data may be used as baselines to gauge the effectiveness of efforts to reduce greenhouse gas emissions and to mitigate parking and traffic congestion.

One out of seven University members were selected randomly by the University to be solicited for participation in the survey. The fraction would provide sufficient statistical precision for the current purposes. In addition, because the same survey may be repeated in the future, we believe that a sample is not only sufficient statistically but also desirable to reduce “survey fatigue” in the population. The cost of sampling, too, is typically lower than attempting to solicit the entire population (a census), and, perhaps counterintuitively, the data and analysis are typically more accurate when a sample is used.

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. 2199 email addresses were supplied. After removing bounced emails and a few other ineligible cases (totaling 52 ineligibles), the total adjusted population was 12,747 eligible students, 994 faculty, and 1,288 staff.

Overall response rate was 40.8%. By strata and substrata, rates were as follows1:

<table>
<thead>
<tr>
<th>Strata</th>
<th>Eligible populations</th>
<th>Sample solicited (1/7)</th>
<th>Response rates</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>total</td>
<td>subsets</td>
<td></td>
</tr>
<tr>
<td>Students</td>
<td>12,747</td>
<td>1,821</td>
<td>653</td>
</tr>
<tr>
<td></td>
<td>fr</td>
<td>2,086</td>
<td>298</td>
</tr>
<tr>
<td></td>
<td>so</td>
<td>2,933</td>
<td>419</td>
</tr>
<tr>
<td></td>
<td>jr</td>
<td>3,388</td>
<td>484</td>
</tr>
<tr>
<td></td>
<td>sr</td>
<td>3,297</td>
<td>471</td>
</tr>
<tr>
<td></td>
<td>sr+</td>
<td>1,043</td>
<td>149</td>
</tr>
<tr>
<td>Faculty</td>
<td>994</td>
<td>142</td>
<td>96</td>
</tr>
<tr>
<td></td>
<td>pt fac</td>
<td>336</td>
<td>48</td>
</tr>
<tr>
<td></td>
<td>ft fac</td>
<td>658</td>
<td>94</td>
</tr>
<tr>
<td>Staff</td>
<td>1,288</td>
<td>184</td>
<td>126</td>
</tr>
<tr>
<td></td>
<td>reg staff</td>
<td>889</td>
<td>127</td>
</tr>
<tr>
<td></td>
<td>USHC</td>
<td>49</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>ARAmark</td>
<td>350</td>
<td>50</td>
</tr>
<tr>
<td>total</td>
<td>15,029</td>
<td>2,147</td>
<td>875</td>
</tr>
</tbody>
</table>

The University indicated that very close to 5,000 students lived on campus, leaving 7,747 to be eligible off-campus students. The on-campus student response rate was 29.8%, and off-campus student response rate was 39.2%. This difference may have occurred because on-campus students did not readily think of themselves as “commuters” and therefore ignored the solicitations in greater numbers (although the texts of the study’s communications attempted to overcome this inference.) Data are analyzed and reported herein for on- and off-campus students as a group, part-time faculty, full-time faculty, and combined staff.

The instrument (a facsimile is appended) was developed in consultation with WCU’s Office of Sustainability and Off Campus and Commuter Services. After the paper version was revised and approved by these offices, MDF Research programmed it for online administration. Pretests were performed with seven volunteers from the University, and a few additional minor revisions were performed.

---

1 The eligible populations were calculated as seven times the sample sizes supplied by WCU.
incorporated into the survey. The survey was launched on May 7, 2018 and remained live until the end of June. Thirteen reminders were sent to non-responders, two weekly through June 14 (for 13 total contacts). The responses to reminders followed a classic “pulse-decay” pattern after each reminder, with successive reminders drawing ever-smaller pulses:

The survey was designed with an emphasis on brevity and ease of completion. Average time to complete the survey was 5.3 minutes for faculty and staff and just 4.1 minutes for all students (on-campus students were presented with fewer questions than off-campus students and faculty and staff). A $5 Amazon gift card incentive was paid to all participants who requested one, usually within 24 hours of completion. Students heavily favored mobile administration (about 88% of their surveys were completed on cell phones), and even a majority of faculty and staff, 56%, also completed the survey 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 can balloon if great precision is required from smaller segments of the target population. Stable and variable multimode commutes are difficult to capture accurately. 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 as many cases. (Data from the current survey, in fact, exceeded these percentages.) Thus, to stay within budget and time constraints, although multimode commuting is still reported, this study relied on the fact that most people have single mode, non-variable commutes on the days they do commute.

Consequently, the survey instrument asked respondents to consider their typical commute when answering questions. 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 data that are accurate enough to measure the effects of future interventions intended to alter commuting behaviors at WCU.

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2 Generally, to get accurate data for multimode commuting, a diary or other medium must be used by respondents to record miles for each leg of their commute. In addition, variable multimode commutes (different each day) also add complexity to observing and recording a small proportion of commuters’ travel. With a $5 incentive and a very short data collection period available, the diary method with its concurrent additional logistical demands was not a feasible protocol.
Because a sample was drawn rather than a census, in some instances, no one may have reported a certain commuting behavior (faculty carpooling as passengers, for example). This does not mean that no faculty are carpool passengers. It only means that in our randomly drawn sample, no one reported being a carpool passenger. For most summary data in this report, it is reasonable to assume most 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.

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 they are usually ignored or found to be confusing. Interested readers may consult the chart in Appendix B showing margins of error for percentages, which are most often reported here. All readers are advised that the point estimates are just that – estimates, based on a sample. Standard errors, calculated from the raw data, may be applied if a follow-up survey is performed to detect any intervention’s statistically significant effects.

Answers to many of the research questions spawning 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 how much the population consumes. 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.

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, leading to over- or under-estimates, rather than randomly affecting the point estimates. It is possible that non-respondents might have responded in a different way from the respondents, leading to an unknown amount of response bias. Even if biases do exist, however, they will be less of a problem if a replication of the survey is conducted with the same instrument under similar conditions and results are compared\(^3\). Presumably, is the goal of collecting these data in the first place.

---

\(^3\) 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, a future WCU intervention designed to affect commuting and parking habits is 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 194 students who indicated they live on campus, about a third (35%) only walked to classes. As expected, many use the WCU shuttle (52%) at least once per week. However, 30% also say they drive at least once per week to commute, though they live on campus. (The mode commute distance is, correspondingly, one mile for on-campus students.)

![On-campus student transportation](image)

Off-campus students, with 458 responding, have a very different transportation profile. The majority report driving (76%), with 45% walking. Only 10% report using the shuttle (probably because they drive directly to the campus where their classes are held), and 9% say they carpool as passengers.

![Off-campus student transportation](image)

Projecting these data to the total student population, almost 7,400 students drive at least once per week. This is an estimate of individual on- and off-campus student cars that are used to commute on or to the campus in a typical week, unadjusted for days commuting (which will be handled below).

Faculty and staff drivers

Predictably, faculty transportation is dominated by driving: 92% of them drive to campus, with just 10% walking. Only 2% or fewer use any other form of transportation.

---

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.”
76% of staff, on the other hand, drive but also utilize public transportation at seven to ten times the rate that faculty do. They also walk and carpool (15% + 8%) at more than twice the rate of faculty:

Projecting these data to the faculty and staff populations, WCU can expect about 1,900 employee cars at least once per week. This is an estimate of the number of individual faculty and staff cars that visit the campus in a typical week, unadjusted for days commuting.

**Total annual WCU commuting fuel use**

A few key variables are required to estimate the fuel use of WCU commuters. If they indicated that they only drive to campus\(^5\), we then 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 projecting it to the entire University community.

Off-campus student\(^6\) one-way driving commutes ranged from just a half mile to 90 miles, but the mode was only a mile, median was 10 miles, and average was 14.18 miles:

---

\(^5\) For purposes of analysis, “single mode” included driving and driving in combination with walking and/or WCU shuttle. The assumption was 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 used.

\(^6\) On-campus students were not included in the fuel consumption calculations. Although 22% of them indicated they do drive a vehicle as 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. An estimate of their total fuel use is nevertheless mentioned in footnote #9 at the end of this section.
Combining individuals’ commuting days, distance (x2 for roundtrip), miles per gallon\(^7\), and weeks per academic year yields the total annual fuel consumption per off-campus student.\(^8\) 73% of respondents reported commuting by driving only, so with 7,747 off-campus students, each averaging 128.12 gallons per academic year, their total fuel consumption would be 724,558 gallons.

Faculty and staff summary data were calculated similarly. Part-time faculty drove an average of 15.35 miles one way in their commutes, 2.62 days per week:

---

\(^7\) Almost a third 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.

\(^8\) For each driving case, days commuting were multiplied by twice the one-way distance to yield miles/week. Miles were then divided by mpg to yield gals/wk, and this figure was multiplied by 32 weeks (about the academic year) to yield total fuel consumed in commuting per year. Figures in the chart display only two digits but are calculated using four.
All part-time faculty respondents (100%) reported driving. With 336 part-time faculty averaging 104.55 gallons per academic year, their total fuel consumption is 35,128 gallons.

Full-time faculty drove 16.43 miles one way in their commutes, 3.85 days per week:

<table>
<thead>
<tr>
<th>days/wk</th>
<th>mi 1-way</th>
<th>miles / wk</th>
<th>mpg</th>
<th>gals/wk</th>
<th>gals/acad yr (32 wks)</th>
</tr>
</thead>
<tbody>
<tr>
<td>mode</td>
<td>3.00</td>
<td>10.00</td>
<td>60.00</td>
<td>23.00</td>
<td>2.73</td>
</tr>
<tr>
<td>median</td>
<td>4.00</td>
<td>12.25</td>
<td>100.00</td>
<td>25.50</td>
<td>3.60</td>
</tr>
<tr>
<td>average</td>
<td>3.85</td>
<td>16.43</td>
<td>120.33</td>
<td>28.68</td>
<td>4.52</td>
</tr>
</tbody>
</table>

86% of 658 full-time faculty commuted only by driving, averaging 144.66 gallons per academic year. Their total fuel consumption is 81,860 gallons. And staff commutes look like this:

<table>
<thead>
<tr>
<th>days/wk</th>
<th>mi 1-way</th>
<th>miles / wk</th>
<th>mpg</th>
<th>gals/wk</th>
<th>gals/acad yr (32 wks)</th>
</tr>
</thead>
<tbody>
<tr>
<td>mode</td>
<td>3.00</td>
<td>10.00</td>
<td>60.00</td>
<td>23.00</td>
<td>2.73</td>
</tr>
<tr>
<td>median</td>
<td>4.00</td>
<td>12.25</td>
<td>100.00</td>
<td>25.50</td>
<td>3.60</td>
</tr>
<tr>
<td>average</td>
<td>3.85</td>
<td>16.43</td>
<td>120.33</td>
<td>28.68</td>
<td>4.52</td>
</tr>
</tbody>
</table>

With 74% of 1,288 staff driving in their commutes, averaging 227.84 gallons per academic year, the total fuel consumption is 217,158 gallons.
Total drive-only fuel consumption, then, for the entire University community is 33,085 gallons per week or 1,058,704 gallons\(^9\) per year. All single-mode drivers accumulate approximately 751,000 miles per week in their commutes, which is over 24 million miles per year.

**Modes of commuting**

Students, faculty, and staff use different means of commuting to campus. All three groups have a very high proportion of using the automobile as a single mode of transportation. 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 463 off-campus students. 84% 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 (66%) of all off-campus students drive alone in their commutes to campus, 14% walk only, and about 1 in 25 off-campus students use all of the remaining modes shown on the right of Chart 1 – these modes are almost negligible.

![Off-campus student modes of commuting](chart1)

Chart 2 below displays commute modes of 96 responding faculty. Fully 97% typically use only one mode of transportation, with percents shown on the left for the small number of remaining multi-modal commutes to campus.

---

\(^9\) On-campus students’ commuting fuel consumption is difficult to calculate from survey responses. It appears that many respondents misinterpreted the commute distance question, as 16 out of 43 respondents said they commuted more than 3 miles (some, as many as 25 miles, in fact). If we assume the one mile distance between North and South Campus as the median and a more representative measure, then the average fuel use is 7.5 gallons per year per on-campus student. This adds about 8,300 gallons to the total, less than 1% of the sum from the other groups above.
The single mode commute is further delineated in the stacked column on the right. As expected, most faculty (90%) drive alone when commuting, 6% walk only, and a negligible number use some other single mode of commuting.

Finally, Chart 3 displays the commute modes of 126 responding staff. 87% 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 is further delineated on the right. Similar to off-campus students, 65% of staff drive alone when commuting, but a much larger proportion than either of the other two groups use public transportation bus (16%). 4% walk only, and a negligible number using some other mode.
Carpooling

Questions about carpooling elicited highly variable, and probably not very reliable, responses. The survey asked about this mode of commute more than once, and responses were not consistent. When asked, “how many people, besides yourself, were usually in the vehicle when you drove to campus?” 41% of the on-campus drivers said they carried at least one passenger, as seen in the chart below.

However, while 41% of on-campus student drivers reported carpooling at least once per week, on-campus passengers from this group report they did so, on average, in only about a quarter (28%) of their commutes to campus. So the figures above may be inflated to the degree that carpooling does not happen with every commute among those who report carpooling. Further, when the survey asked for all forms of commuting transportation, only 12% of on-campus students reported carpooling as one of them (see chart on page 4). There were similar inconsistencies across all groups. Faculty and staff appear to carpool very little, in any event. So while the survey did not capture precise and reliable information about carpooling, it is fair to say that generally, this mode remains a relatively uncommon one for commuters. Because of its infrequency, it may be difficult to measure any effect an intervention may have on carpooling.

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.

22% of on-campus students reported driving in their commute to WCU. But an additional 17% of on-campus students also reported having a vehicle for their use while at WCU, even if they do not use it to commute. Obviously, this segment is not negligible when it comes to parking space availability.10

One goal of the survey was to determine where people park and to estimate how many spaces are required. Commuters and on-campus student non-commuters with cars were asked to identify their preferred parking locations. The columns in the table (next page) show the percentages where the people who drive in their commutes or who have cars on campus – resident students – typically park. The bottom line shows the number of cases that provided these data.

---

10 On-campus students who do not drive to commute still use their cars an average of 3.8 days per week – which is more often than off-campus students use their cars for commuting, on average. 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.
As with overall fuel use, parking spaces required to meet demand can be approximated by weighting to the respective populations and also by days commuting. Here are the relevant data:

<table>
<thead>
<tr>
<th>Surface lots:</th>
<th>on campus</th>
<th>off campus</th>
<th>p/t fac</th>
<th>f/t fac</th>
<th>staff</th>
</tr>
</thead>
<tbody>
<tr>
<td>surface - North</td>
<td>15%</td>
<td>41%</td>
<td>52%</td>
<td>50%</td>
<td>48%</td>
</tr>
<tr>
<td>surface - South</td>
<td>32%</td>
<td>16%</td>
<td>4%</td>
<td>10%</td>
<td>9%</td>
</tr>
<tr>
<td>other</td>
<td>0%</td>
<td>4%</td>
<td>4%</td>
<td>6%</td>
<td>7%</td>
</tr>
<tr>
<td>Garages:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Matlack</td>
<td>4%</td>
<td>6%</td>
<td>8%</td>
<td>5%</td>
<td>4%</td>
</tr>
<tr>
<td>New Street</td>
<td>11%</td>
<td>1%</td>
<td>4%</td>
<td>3%</td>
<td>2%</td>
</tr>
<tr>
<td>Stu Rec Ctr</td>
<td>2%</td>
<td>1%</td>
<td>0%</td>
<td>0%</td>
<td>1%</td>
</tr>
<tr>
<td>Sharpless</td>
<td>4%</td>
<td>7%</td>
<td>8%</td>
<td>6%</td>
<td>8%</td>
</tr>
<tr>
<td>other</td>
<td>1%</td>
<td>1%</td>
<td>0%</td>
<td>2%</td>
<td>0%</td>
</tr>
<tr>
<td>street w/Boro permit</td>
<td>9%</td>
<td>6%</td>
<td>4%</td>
<td>6%</td>
<td>6%</td>
</tr>
<tr>
<td>street, metered</td>
<td>10%</td>
<td>10%</td>
<td>4%</td>
<td>3%</td>
<td>5%</td>
</tr>
<tr>
<td>other</td>
<td>11%</td>
<td>7%</td>
<td>12%</td>
<td>8%</td>
<td>9%</td>
</tr>
<tr>
<td>Counts:</td>
<td>117</td>
<td>347</td>
<td>25</td>
<td>62</td>
<td>110</td>
</tr>
</tbody>
</table>

As with overall fuel use, parking spaces required to meet demand can be approximated by weighting to the respective populations and also by days commuting. Here are the relevant data:

<table>
<thead>
<tr>
<th>response group</th>
<th>on campus</th>
<th>off campus</th>
<th>p/t fac</th>
<th>f/t fac</th>
<th>staff</th>
<th>total spaces required</th>
</tr>
</thead>
<tbody>
<tr>
<td># with cars</td>
<td>117</td>
<td>347</td>
<td>25</td>
<td>62</td>
<td>110</td>
<td></td>
</tr>
<tr>
<td>% with cars</td>
<td>61%</td>
<td>76%</td>
<td>96%</td>
<td>89%</td>
<td>87%</td>
<td></td>
</tr>
<tr>
<td>population count</td>
<td>5,000</td>
<td>7,747</td>
<td>336</td>
<td>658</td>
<td>1,288</td>
<td></td>
</tr>
<tr>
<td>population with cars</td>
<td>3,031</td>
<td>5,869</td>
<td>323</td>
<td>583</td>
<td>1,124</td>
<td></td>
</tr>
<tr>
<td>days on campus</td>
<td>5.00</td>
<td>3.28</td>
<td>2.62</td>
<td>3.85</td>
<td>4.98</td>
<td></td>
</tr>
<tr>
<td>parking spaces req’d</td>
<td>3,031</td>
<td>3,850</td>
<td>169</td>
<td>449</td>
<td>1,120</td>
<td>8,619</td>
</tr>
</tbody>
</table>

Surface lots:
- surface - North: 466, 1,587, 88, 225, 540 = 2,906
- surface - South: 984, 632, 7, 43, 102 = 1,768
- other: - 144, 7, 29, 81 = 261

Garages:
- Matlack: 130, 233, 14, 22, 41 = 440
- New Street: 337, 44, 7, 14, 20 = 422
- Stu Rec Ctr: 52, 33, - , - , 10 = 95
- Sharpless: 130, 266, 14, 29, 92 = 531
- other: 26, 44, - , 7, - = 77
- street w/Boro permit: 259, 222, 7, 29, 71 = 588
- street, metered: 311, 388, 7, 14, 61 = 781
- other: 337, 255, 20, 36, 102 = 750

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 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 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.) The required spaces are then distributed according to reported use, as shown in the chart at the top of this page.

11 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.
For example, 466 (surface lot spaces, North, for on-campus students) is 15% of the 3,031 on-campus student cars; 1,587 is 41% of the 3,850 cars belonging to commuting students, etc. The bold numbers on the right for lot and garage spaces total 6,500 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 of the competition for parking spaces.

There was one segment of off-campus students who indicated that they did not drive “at least once per week in a typical week,” and yet, they indicated having a car for use and where they park, when they do drive. Since their days on campus may be assumed to be less than one, the maximum number of spaces – surface lots and garages combined – that they would require, applying the same algorithm as above, would be a about 65 – a negligible contribution to the overall parking congestion.

The method used here to determine parking demand only 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. There are peaks and valleys in demand for parking, and all cars are never on campus simultaneously. And there is also the necessity for a certain percentage of marginal spaces, as it were, if people are to find spaces 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 reasonable starting points for how parking is distributed.
CONCLUSION

Results

Benchmarks for comparison with future commuting habits and data were obtained in this survey during May-June 2018. 2,147 people were solicited to participate. Overall response rate was 40.8%, varying from 34.3% to 80.0% among personnel strata.

It is not news that Americans are habitual drivers. A suburban campus like West Chester’s draws a large proportion of drive-alone commuters. 66% of off-campus students, 90% of faculty, and 65% of staff drive alone. A fair number of on-campus students report carpooling, but they, of course, have the shortest commute – typically, just a mile – and do not carpool with every commute. Aside from the campus shuttle, only staff make significant use of public transportation (20-24%).

WCU driving commuter fuel consumption per year in gallons is as follows:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>part-time faculty</td>
<td>35,128</td>
</tr>
<tr>
<td>full-time faculty</td>
<td>81,860</td>
</tr>
<tr>
<td>staff</td>
<td>217,158</td>
</tr>
<tr>
<td>off-campus students</td>
<td>724,558</td>
</tr>
<tr>
<td>total</td>
<td>1,058,704</td>
</tr>
</tbody>
</table>

The total approaches two Olympic swimming pools in volume. Single-mode drivers accumulate 24.05 million miles commuting per academic year. These figures assume a 32-week academic year, so they are underestimates that do not include the reduced activity in the summer months.

Multimodal commuting is not very common at WCU. About 17% of off-campus students report using more than one mode in their commutes; only 3% of faculty do; and staff, about 14%. 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. And in most multimodal cases, the distance the vehicle travels is probably less than the alternative transportation mode miles.

Parking data (and verbatim open-ended results) clearly reflect severe competition for spaces. In total, over 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. On-campus student cars consume about a third of the surface lot and garages spaces, and they are presumably on campus more time (virtually every day) of all the groups, with staff cars very close in their proportion of days parking. The maximum number of surface lot and garage spaces for North and South Campuses was estimated to be 6,500. The optimum number, since not all cars are on campus simultaneously, depends upon peak demand, on the one hand (which would be less than 100% of the maximum), and marginal spaces for convenience, on the other (which would increase the space requirement).

One final note on parking is that congestion and scarcity also affect fuel use. Driving for many minutes in stop-and-go traffic to find a parking space obviously consumes fuel over and above what is usually reported as “commuting miles.” A 20-minute commute can easily be extended another 5-10 minutes 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 certainly allude to it.
Technical and logistical notes

The online instrument 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 (only to nonresponders) for very little overhead and more than doubled the 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. About a third of driving respondents did not know the mpg 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, all percentage 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. The database did receive a small number of these anomalous cases, 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 eliminated the possibility of thousands of “robo-cases,” but there is still the possibility of manual mischief.

The response rate was serviceable (and better than expected), but could be improved by several means:

- First and foremost, the timing of the survey should avoid competing with major events in the academic calendar. This is not easy – the academic calendar is always busy. However, launching the same week of final exams was less than optimal, to say the least. Data collection in the month just following Spring Break might be a better time.

- The incentive, though small, was sufficient for the length of the survey and certainly contributed to the response rate. However, doubling it would improve the response by perhaps 15-20% (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 even fewer people, 1/8 or 1/9, for instance.
Appendix A
The Instrument
Facsimile of online version, with programming instructions

You are part of a small random sample selected from the WCU community. For this reason, we appreciate your cooperation 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.

West Chester University • 703 S 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, you will be placed in the screen you last visited.
Please read and answer each question below. Please be as accurate and truthful as possible. All your answers will be confidential.

1. On which WCU campus did you spend most of your time in Spring semester 2018?
   - O₁ North
   - O₂ South
   - O₃ Philadelphia
   - O₄ Nursing Center (Exton)
   - O₅ Graduate Center (Exton)
   - O₆ Online only [display INELIGIBLE CLOSE A]
   - O₇ Other (please specify): ____________________ [display INELIGIBLE CLOSE A]  

2. During the Spring semester 2018 academic semester, how many days per week did you typically come to campus?
   _______ days per week

[q3 appears ONLY to students]
3. a. Did you live on campus in Spring semester 2018?
   - O₁ Yes [q3b,c appear]  
   - O₂ No [go to q4]

   b. On which WCU campus did you live?
   - O₁ North
   - O₂ South

   c. Did you sometimes use any form of transportation to your classes other than walking?
   - O₁ Yes [go to q4]
   - O₂ No [skip to q9]

= = = = =

[appears to ALL Rs (unless q3c = 2)]
4. When you came to campus, about how far did you typically commute to your classes or workplace, ONE WAY (counting all “segments” (parts) of the commute, if more than one)? Your best estimate is OK. If you typically use the WCU intercampus shuttle, enter 1 mile.  
   a. _______ miles commuting one way
   OR
   b. _______ blocks, if less than 1 mile one way [Make only one choice answerable here (gray out other, maybe?)]
Now please think about your typical week of commuting to campus in Spring semester 2018. You might have commuted the same way almost every day or differently depending on the day. You might have used 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 used at least once a week in a typical week of commuting to campus in Spring semester 2018. (Please check all that apply, but do not check forms that you typically use only rarely.)

- Driving a vehicle
- Carpooling (as a passenger)
- WCU shuttle (either on campus or to/from Exton)
- Public transportation bus
- Regional rail line or Amtrak
- Bicycle
- Walk
- Other (please specify): __________________

[For q5a=1]

6. a. In a typical week, about how many days did you drive a car to campus? _______ days per week

b. About how many miles did you drive one way as part of your typical commute to campus? _______ miles driven

c. How many people, besides yourself, were usually in the vehicle when you drove to campus? (Carpooling may include family members or others.)
   - No one else
   - One
   - Two
   - Three or more

d. Where did you most often park your vehicle while you were on campus?
   - A surface lot [q6e appears]
   - A garage [q6f appears]
   - On the street with a Borough permit [go to q6g]
   - On the street at metered spaces [go to q6g]
   - Other (please specify): __________________ [go to q6g]

e. Please indicate which lot you most often parked in:
   - A North campus lot [go to q6g]
   - A South campus lot [go to q6g]
   - Other (please specify): __________________ [go to q6g]

f. Please indicate which garage you most often parked in:
   - Matlack
   - New Street
   - Student Recreation Center
   - Sharpless
   - Other (please specify): __________________
g. What would you say is the average miles per gallon your vehicle gets, approximately?

   q6_mpg ______ mpg [go to q7]

   q6_other O 1 I drive an all-electric vehicle [go to q7]
   O 2 I don't know

h. Please select the type of vehicle you most often used to commute: [dropdown menu]

   O 1 gasoline auto, small
   O 2 gasoline auto, medium
   O 3 gasoline auto, large
   O 4 hybrid automobile
   O 5 diesel automobile
   O 6 gasoline light truck
   O 7 gasoline heavy truck
   O 8 diesel light truck
   O 9 diesel heavy truck
   O 10 motorized scooter
   O 11 motorcycle
   O 12 other

[if q5b=1, else go to q8]

7. a. About how many days in a typical week did you carpool as a passenger in your commute to campus? _______ days per week

b. How many people, besides yourself, were usually in the vehicle when you carpooled to campus?

   O 1 one
   O 2 two
   O 3 three or more

[if q5c,d,e,f,g = 1, populate next item with those selected options; otherwise, go to q9]

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

   a. WCU shuttle (either on campus or to/from Exton) _______ 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

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

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

   O 1 Yes [q9b,c,d appear] O 2 No [go to q10]

b. Please select the type of vehicle you have:

   O 1 automobile
   O 2 S.U.V
   O 3 motorized scooter
   O 4 motorcycle
   O 5 light truck
   O 6 other (please specify): _____________________

   [Note: only students might see q9, because only students see the gateway in q3c or q5.]
c. About how many days per week have you used your vehicle for any purpose during the Spring semester 2018?
   - 1: one day or less
   - 2: 2
   - 3: 3
   - 4: 4
   - 5: 5
   - 6: 6
   - 7: 7

d. Where have you most often parked your vehicle?
   - 1: a surface lot [q9e appears]
   - 2: a garage [q9f appears]
   - 3: on the street with a Borough permit [go to 10]
   - 4: on the street at metered spaces [go to 10]
   - 5: other (please specify): ____________________ [go to q10]

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

1. You are welcome to use the space below to tell us anything about your commute not reflected in your earlier answers. For example, what do you like about your current commute and what do you dislike about it? In addition, feel free to suggest how WCU could improve your commute to and from campus:

   [text box]

2. a. In the future, would you like to commute by means other than driving yourself (that is, by carpooling, taking transit, walking, or bicycling) more often than you did in the Spring 2018 semester?
   - 1: Yes, and I plan to do so. [q11b appears]
   - 2: Yes, but I don’t think I will actually be able to do so. [q11c appears]
   - 3: No, I’m happy with my commute the way it is. [go to q12]

   b. Please describe how you plan to commute by means other than driving yourself in the future:

      [text box]

   c. Please describe what makes it difficult for you to use means other than driving yourself:

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

☑️ Yes [q13 appears] ☐️ No [go to REGULAR CLOSE]

4. Please enter your preferred e-mail to receive your Amazon Gift Card (usually sent within 12-24 hours):

__________
(please be sure to click “NEXT” below to record this e-mail address)

(Note: Please watch your inbox for this gift card. 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**

<table>
<thead>
<tr>
<th>Sample size</th>
<th>Percent result</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>5%</td>
</tr>
<tr>
<td>25</td>
<td>8.7%</td>
</tr>
<tr>
<td>50</td>
<td>6.2%</td>
</tr>
<tr>
<td>75</td>
<td>5.0%</td>
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<tr>
<td>100</td>
<td>4.4%</td>
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<tr>
<td>125</td>
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<td>150</td>
<td>3.6%</td>
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<td>175</td>
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<tr>
<td>675</td>
<td>1.7%</td>
</tr>
<tr>
<td>700</td>
<td>1.6%</td>
</tr>
</tbody>
</table>

**Example:** Using the highlighted cell, if the result of a given variable representing 275 respondents is 15% (or 85%), the margin of error 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%).