

Project No. NCDOT 3205

# TRIP MAKING PATTERNS OF NC'S UNIVERSITY STUDENTS

## **FINAL REPORT**

### **Technical Report A: Survey Documentation**

Prepared for

North Carolina Department of Transportation

Institute for Transportation Research and Education, NCSU

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## I. Executive Summary

This technical report documents all aspects of the six surveys conducted on university campuses across North Carolina during 2013 and 2014. It describes the survey design, sampling plan, conduct of the survey, and summarizes the results.

In developing a survey to obtain planning data for college student travel behaviors, key survey dimensions and associated data were determined based on studies undertaken for universities in other states as well as utilizing existing data made available by University Planning and Analysis (UPA) at NCSU. Through reviewing the literature and discussing technical issues, a survey was initially drafted in early January of 2013.

Several criteria were used for designing the questionnaire. It was expected that the fully voluntary nature of the survey would require a simple short questionnaire requiring little time to complete. It was also anticipated that it would be easier for respondents to pin locations on a map than to type address text. These two overall criteria led the team to develop a web based tool that could capture information quickly and easily. A map was embedded in the survey instrument so that respondents could easily click on the places their activities took place. Both the questions and map together provided a complete description for activities and travel between locations without requiring a lot of time for respondents.

A sampling plan was prepared for the surveys based on the literature review and the characteristics of the campuses to be surveyed. It was determined that a critical dimension for the sampling plan would be students living on and off campus. A sampling plan was prepared for conducting the surveys at NCSU and UNCG during the first year of the survey. This called for obtaining approximately 370 samples each from on campus and off campus students to achieve a five percent confidence interval with ninety five percent confidence in the final results. The number of students to contact was based on a ten percent response rate. This ten percent response rate was not achieved during the first year surveys at NCSU and UNCG, so during the second year, it was recommended to send survey invitations to all enrolled students for whom email addresses could be obtained.

Concurrent with the development of a sampling plan, the survey was pilot-tested by distributing it to the Institute of Transportation Engineers (ITE) Student Chapter at NC State University in order to test survey language and respondent burden. Fourteen students completed the survey with an overall response rate of 24.5 percent. Completion of the pilot showed promise for success in the scheduled distribution of the actual survey.

The survey was deployed at six campuses of the UNC system over a period of two years. In order to maintain consistency, the same deployment process was used at each campus surveyed. The process is described in detail below for NCSU. A total of 6,021 students across the six campuses started the survey and 3,779 completed it.

After North Carolina State University (NCSU) and University of North Carolina at Greensboro (UNCG) were surveyed in the first year of the project, four universities were surveyed in the second year. They were:

Appalachian State University (ASU), Fayetteville State University (FSU), University of North Carolina at Wilmington (UNCW) and University of North Carolina at Charlotte (UNCC). This technical report documents the compilation of the survey data sets, as well as the data analysis results.

The university student surveys were conducted using the online survey platform, Qualtrics. After the surveys were closed, raw data were downloaded, and for each university, three files were created: person file, place file and trip file. The person file contains each respondent's demographic and trip rate information, the place file records the coordinates and place types of all places each respondent visited on his/her travel day, and the trip file stores all the trip related information, such as trip duration and trip mode. These three files can be linked through Person ID or Place ID.

Great efforts have been made to review the data entries and retain as many useful samples as possible in the final cleaned data sets. The data sets have been cleaned to improve data quality and remove obvious errors. The data cleaning work includes cleaning trip purposes, place types, home coordinate, and removing the inconsistency between place type and coordinate. Weights were then developed based on three characteristics that impact university students' travel behaviors: residence locations (on-campus vs. off-campus), credit hours (full-time vs. part-time) and class status (undergraduate vs. graduate).

The final cleaned person files include 336, 383, 266, 224, 838 and 1,350 person records from NCSU, UNCG, ASU, FSU, UNCW and UNCC, respectively. They account for 36% to 52% of the students who started the surveys. The final cleaned trip files include 1,978, 2,022, 1,520, 1,074, 4,585 and 6,284 trip records from NCSU, UNCG, ASU, FSU, UNCW and UNCC, respectively. They account for 84% to 91% of the trip records in the raw data sets.

The cleaned data sets are analyzed, and the major observations are summarized below:

- 1) Demographic characteristics
  - a. The percent of students living on campus varies from about 20% to 35% across the six surveyed universities.
  - b. NCSU, UNCG and UNCC have relatively higher shares of graduate students (around 20%), whereas only about 6% of students at ASU are graduate students. The shares of part-time students at UNCG, FSU and UNCC are high (23% to 30%), the shares are around 15% for NCSU and UNCW, but only 4% for ASU.
  - c. More off-campus students can access vehicles (varies from 86% to 95%) than on-campus students (varies from 36% to 71%). However, the percent of students owning on-campus parking permits does not differ much for off-campus students and on-campus students.
  - d. More on-campus students are unemployed than off-campus students (varies from 57% to 67% for on-campus students vs. 29% to 41% for off-campus students). For employed students, off-campus students are more likely to work off campus, and on-campus students are more likely to work on campus.
  - e. In general, the off-campus students from UNCG, UNCC and FSU live farther away than those from NCSU and UNCW, who live farther away than off-campus students from ASU. This is consistent with the shares of part-time students: the more part-time students, the farther students live away from campus.

## 2) Trip rate

- a. On-campus students in general make more trips than off-campus students. The range of total trip rate for off-campus students is 4.62 to 5.31 across the six surveyed universities, and it is 4.51 to 7.46 for on-campus students. These trip rates were compared to those collected from other surveys and found to be consistent.
- b. Most of the trips made by on-campus students are within the university. On the contrary, within the university trips only account for a small portion of total trips made by off-campus students. Therefore, off-campus students impose more impacts on the surrounding road system.
- c. Off-campus students make more trips crossing the university boundary than on-campus students. The trip rate varies from 1.84 to 2.63 for off-campus students and from 0.84 to 1.34 for on-campus students (except that it is 2.38 for ASU).
- d. Off-campus students make many more trips outside of the university than on-campus students. The trip rate varies from 1.57 to 2.61 for off-campus students and from 0.21 to 0.44 for on-campus students.

## 3) Trip distribution

- a. In general off-campus students travel farther than on-campus students. The average trip distance varies from 2.08 miles to 7.41 miles for off-campus students across the six universities, and it is from 0.62 miles to 2.59 miles for on-campus students.
- b. Due to the differences in the land use around campus and the differences in the campus size, the average trip distances for the six surveyed universities are quite different. ASU has the shortest average trip distance at 0.62 miles for on-campus students and 2.08 miles for off-campus students. On the contrary, UNCC has the longest average trip distance at 2.47 miles and 7.41 miles for on-campus and off-campus students, respectively.
- c. The average trip distances for trips outside of the university are close to trips crossing the university boundary, and they are both much longer than the trips within the university.

## 4) Mode share

- a. The dominant mode for on-campus students is walk, which accounts for 55% to 80% of total trips. However, the share of walk for off-campus students is only 6% to 27%. Drive alone takes the biggest share of the off-campus student trips (varies from 39% to 78%). As a comparison, it only varies from 3% to 16% for on-campus students.
- b. Trips within the university boundary are mostly made by walk, trips outside of the university are dominated by auto (drive alone plus shared ride), and trips crossing the university boundary are between the other two trip classifications.

## II. Introduction

This report documents the surveys conducted on six university campuses across North Carolina during 2013 and 2014. It describes the sampling plan, survey design, survey deployment, and summarizes the results of the surveys. The surveys were intended to collect data to be used for developing models of university student travel. Models developed as part of this project are described in Technical Report B: Model Development.

### **III. Sampling Plan**

The objective of the university student travel surveys was to provide a data set representative of the university students' population and travel patterns. The sampling plan was designed to achieve this objective. Based on the literature review, the following sampling plan was suggested.

#### **(1) Sampling frame**

The sampling frame (or the data base from which a sample is drawn) consists of all students who enroll in the university and attend classes on campus. Students who take courses solely via distance learning sites and do not attend classes on campus are excluded from the sampling frame.

#### **(2) Sampling method**

Stratified sampling is a commonly used method. A stratum is a subset of the population that shares at least one common characteristic. For stratified sampling, the relevant strata are identified, and random sampling is then used to select a sufficient number of subjects from each stratum. Stratified sampling is superior to random sampling because it reduces sampling error. It was suggested to use stratified sampling in the project.

#### **(3) Sample size**

For stratified sampling, a sufficient number of samples should be collected from each stratum to ensure the survey data set is representative. Sample size by stratum is determined based on the population in each stratum, and the desired confidence interval and confidence level. In plain language, confidence interval is the plus-or-minus figure usually reported in opinion poll results, and confidence level is how sure one can be about the survey results. For example, if a survey showed that the percentage of choosing answer A is 70% at confidence interval of 5% and confidence level of 95%, one can say that it is 95% sure that the true percentage of choosing answer A for the entire population is between 65% and 75%.

#### **(4) Stratification of students**

The literature review showed that many characteristics could impact university students' travel behaviors, including but not limited to, residence location (living on-campus vs. off-campus), education status (undergraduate vs. graduate), enrollment status (full-time vs. part-time), whether they work, and whether they have vehicles or parking permits. However, it is not practical to stratify the university students based on all of these characteristics, because many more completed samples are needed if more strata are defined. Based on the literature review and the practice of travel demand modeling, residence location is the most important characteristic to stratify university students. Therefore, it was suggested to define two strata for the university student travel surveys: on-campus students and off-campus students.

### **A. Sampling Plan for North Carolina State University**

The sample size required for the North Carolina State University (NCSU) survey is shown in Table 1. It shows how many completed samples are needed using a desired confidence interval of 5% at a 95% confidence level. The sample size calculation is based on a Sample Size Calculator by Creative Research Systems (<http://www.surveysystem.com/sscalc.htm#one>).

**Table 1 Sample size for North Carolina State University**

	Population	Completed samples required for 5% confidence interval and 95% confidence level	The number of students to recruit if the response rate is 10%	Percent of recruited students
On-campus	8,568 <sup>1</sup>	368	3,680	43%
Off-campus	22,548	378	3,780	17%
Sum	31,116 <sup>2</sup>	746	7,460	24%

Table 1 also shows how many students should be recruited in the survey to achieve the needed number of completed samples. The calculation is based on the assumption that the response rate is 10%. The review of some previous university student surveys shows that the response rate varies from 3.4% to 29.4%, with most response rates between 10% and 15%. The project team used different strategies to encourage survey participation, including lowering the survey burden, improving the survey questionnaire, and enhancing the survey advertisement. The project team studied the possibility to provide incentives to survey participants, since the literature review shows that incentive is a very important factor for a higher response rate.

Table 1 shows that to obtain 368 completed samples for on-campus students, 43% of the population of on-campus students should be recruited for the survey. Any further stratification of the on-campus students would require recruiting more students, which is practically very difficult since NCSU only allowed the project team to survey part of the students due to the time conflict with other surveys.

The suggested sample size shown in Table 1 is close to that for the NCSU student survey conducted in the spring semester of 2001. In that survey, 4,000 on-campus students and 4,000 off-campus students were recruited, and it collected 843 completed samples, 429 from on-campus students and 414 from the off-campus students.

## **B. Sampling Plan for University of North Carolina at Greensboro**

Following the same method as the North Carolina State University, the sample size required for the University of North Carolina at Greensboro (UNCG) survey is shown in Table 2.

<sup>1</sup> It is assumed that all on-campus housing facilities are fully occupied, so the number of on-campus students is equal to the on-campus housing capacity, which is obtained from this link: <http://www.ncsu.edu/housing/fastfacts.php>. The exact number of on-campus students only has very limited impact on the calculation of required sample size.

<sup>2</sup> The total number of student population is based on the 2012 fall semester enrollment from the NCSU website (<http://www2.acs.ncsu.edu/upa/enrollmentdata/f12enrol/index.htm>). It does not include distance education students.

Table 2 Sample size for University of North Carolina at Greensboro

	Population	Completed samples required for 5% confidence interval and 95% confidence level	The number of students to recruit if the response rate is 10%	Percent of recruited students
On-campus	4,250 <sup>3</sup>	352	3,520	83%
Off-campus	12,676	373	3,730	29%
Sum	16,926 <sup>4</sup>	725	7,250	43%

### C. Sampling Plan for Campuses to Survey during Year 2

While surveying NCSU and UNCG during year one, it was found that response rates to the initial invitation to participate in the survey were very low: 4.6% to 5.3%. Two strategies were recommended by the research team to address low numbers of completed surveys: sending invitations to as many students as possible up to all enrolled students, and providing survey incentives. When the offices of institutional research were contacted at each of the four universities to be surveyed during year two, they were asked to provide as many student addresses as possible. It was also recommended to offer fifteen thirty dollar gift cards at each campus for students that completed the survey.

## IV. Survey Design

In developing a survey to obtain planning data for collegiate student travel behaviors, key survey dimensions and associated data were determined based on studies undertaken for universities in other states and existing data made available by University Planning and Analysis (UPA) at NCSU. Through reviewing the literature and discussing technical issues, a survey was initially drafted in early January of 2013.

Several criteria were used for designing the questionnaire. It was expected that the fully voluntary nature of the survey would require a simple short questionnaire requiring little time to complete. It was also anticipated that it would be easier for respondents to pin locations on a map than to type address text. These two overall criteria led the team to develop a web based tool that could capture information quickly and easily. A map was embedded in the survey instrument so that respondents could easily click on the

<sup>3</sup> It is assumed that all on-campus housing facilities are fully occupied, so the number of on-campus students is equal to the on-campus housing capacity. In 2009, the actual on-campus housing capacity at UNCG is 4250 beds in 24 buildings: [http://hrl.uncg.edu/about\\_us/pdfs/housing\\_plan\\_2020.pdf](http://hrl.uncg.edu/about_us/pdfs/housing_plan_2020.pdf). The exact number of on-campus students only has very limited impact on the calculation of required sample size.

<sup>4</sup> The total number of student population is based on the 2012 fall semester enrollment from the NCSU website (<http://ire.uncg.edu/pages/factbook/2012-13/PDFs/history/2012Profile.PDF>). It does not include distance education students.

places their activities took place. Both the questions and map together provided a complete description for activities and travel between locations without requiring a lot of time for respondents.

Concurrent with the development of a sampling plan, the testing and revising of the draft survey produced multiple iterations of the survey. A final draft survey was sent in both printed version and a link to the survey to the NCDOT Steering and Implementation committee for review. Following the review, the draft survey was finalized to be deployed as a pilot on the Institute of Transportation Engineers (ITE) Student Chapter at NCSU. This survey pilot test is described next.

## **V. Survey Pilot Test**

A pilot survey was distributed to the Institute of Transportation Engineers (ITE) Student Chapter at NC State University in order to test survey language and respondent burden. The student organization's roster and contact information was provided by the student president. There were a total of 57 potential pilot participants. In addition to having names and email addresses, the database also contained corresponding data such as academic program and expected completion year. This embedded data could be readily transferred into the Qualtrics surveying tool. Furthermore, the file provided by the ITE Student Chapter was directly uploaded as a comma-separated values (CSV) text file into the web-based surveying tool.

Prior to sending the pilot survey to participants, the student chapter was notified that they would be receiving a unique survey link to participate and was asked to provide input and comments after completing it. The pilot survey was administered on Tuesday, March 12, 2013 in two phases. Phase 1 took place at 11 AM and was sent to the first half of the student organization, while Phase 2 was administered at 4PM for the remaining potential participants. Due to the time constraint of distributing the actual survey, the time allotted for completion and feedback pertaining to the pilot survey was limited to one week. Accordingly, an accelerated reminder was sent two days after the initial request.

Out of the 57 potential pilot participants, 14 completed the survey, but none provided direct feedback on their survey experience as had been requested. Excluding the survey responses that took exceedingly long periods of time (over 4 hours), the time for completing the survey ranged from a minimum of 4 minutes and 38 seconds to a maximum of 21 minutes and 43 seconds. The median time for completion was between 8 and 10 minutes. The recorded responses also determined that most responses occurred during early business hours (8AM – 9AM) and in the afternoon (past 2PM). A student participant came forward to provide verbal feedback, and confirmed that the survey flow was intuitive and expressed minor concerns that were subsequently addressed. Overall, the response rate of 24.5 percent and completion of the pilot showed promise for success in the scheduled distribution of the actual survey samples of the student populations at NCSU and UNC-Greensboro.

## **VI. Survey Deployment**

This section describes how the surveys were deployed at all six university campuses. This includes information on the ways students were selected to be surveyed, how the students were invited to

participate, the dates the survey was open for responses, incentives provided and basic information about the number of responding students.

### **A. North Carolina State University**

Prior to deployment, the survey was submitted to the Institutional Review Board (IRB) at NCSU on February 20, 2013 for review. IRB approval of the survey was received on February 27, 2013. The University Planning and Analysis group on campus was selected to provide a sample of students to survey, because they have experience conducting surveys on campus and have access to enrollment records for students. This enables them to select a sample of students without needing to share student records and thus compromising confidentiality for students. The NCSU survey also was required to avoid surveying student populations already being surveyed to avoid excess survey burden. Students were selected from freshman, junior, and Master's level students taking at least one class in the spring semester of the survey. A total of 12,395 NC State students matched these criteria. Of this group, 3,680 residing on campus and 3,780 residing off campus students were selected for the sample pool.

The survey was deployed starting on March 19, 2013 with 7,460 potential student participants. The sampling pool was divided into five equal panels of 1,492 randomized students with individual survey deliveries for each group Tuesday through Saturday (the survey requested information about activities on the day prior to receiving the invitation to participate). Students selected were sent an email message inviting them to participate in the survey with a link to the survey (text of message shown in Appendix C). One to two weeks after the initial request for participation, a reminder email was sent on a different day of the week for each panel. The survey was closed on April 15, 2013 so as not to conflict with class evaluations and senior surveys conducted by other university offices. A total of 904 responses were recorded as surveys started with 396 surveys completed, yielding response and completion rates of 12.1% and 5.3%, respectively. This 5.3% rate of completion was lower than the hoped for 10% on which the sampling plan was designed.

### **B. University of North Carolina – Greensboro**

The final survey used at NCSU was modified to specifically be deployed at University of North Carolina - Greensboro (UNCG). 9,543 students were identified as potential participants by the Bryan School of Business and Economics. Similar to the survey scheduling protocol used for the NCSU student sample, the pool at UNCG was divided into five panels for survey deployment on different days of the week. The survey was deployed and initial requests for participation were sent the week of Tuesday, April 9, 2013. Again, periodic reminders were sent within the two weeks following. Although the closing date of the survey was May 11, 2013, the responses recorded correspond with travel dates up until the last day of classes, April 30. In addition to soliciting voluntary participation, incentives in the form of gift cards were offered to encourage students to take the survey. There were a total of 15 \$30 Amazon.com gift cards obtained through UNCG's Associate Dean's Indirect Cost Recovery Fund/Overhead Account. The prizes were awarded at random to the students that provided contact information, and were electronically delivered two to three weeks after notification. Of the sample, 841 participants started the survey and 442 completed it, yielding response and completion rates of 8.8% and 4.6%, respectively. This 4.6% rate of completion was lower than the hoped for 10% on which the sampling plan was designed.

### **C. University of North Carolina at Charlotte**

A total of 24,114 students, essentially the entire student population enrolled in spring semester 2014, were contacted as survey participants starting on February 25, 2014. In addition to soliciting voluntary participation, incentives in the form of 15 \$30 Amazon.com gift cards were offered to encourage students to take the survey. The survey was closed on May 5, 2014. 2,860 students started the survey and 1,492 completed it, yielding response and completion rates of 11.9% and 6.2% respectively.

### **D. University of North Carolina at Wilmington**

A total of 13,064 students, essentially the entire student population enrolled in spring semester 2014, were contacted as survey participants starting on February 25, 2014. In addition to soliciting voluntary participation, incentives in the form of 15 \$30 Amazon.com gift cards were offered to encourage students to take the survey. The survey was closed on April 21, 2014. 1,612 students started the survey and 917 completed it, yielding response and completion rates of 12.3% and 7% respectively.

### **E. Fayetteville State University**

A total of 5,636 students, essentially the entire student population enrolled in spring semester 2014, were contacted as survey participants starting on February 25, 2014. In addition to soliciting voluntary participation, incentives in the form of 15 \$30 Amazon.com gift cards were offered to encourage students to take the survey. The survey was closed on April 14, 2014. 539 students started the survey and 266 completed it, yielding response and completion rates of 9.6% and 4.7% respectively.

### **F. Appalachian State University**

A total of 10,000 students were contacted as survey participants starting on March 18, 2014. The number of students contacted was slightly more than half the total student population at this university by the request of university officials. In addition to soliciting voluntary participation, incentives in the form of 15 \$30 Amazon.com gift cards were offered to encourage students to take the survey. The survey was closed on April 27, 2014. 633 students started the survey and 266 completed it, yielding response and completion rates of 6.3 % and 3.3 % respectively. Thus, Appalachian State University had the smallest percentage of survey participants who started the survey and completed it.

### **G. Incentives Procedures**

During year one incentives were tested at UNC-Greensboro, and were determined to result in more completed surveys for students that started the survey. It was recommended to provide at each campus surveyed a chance to win one of fifteen thirty dollar gift cards from Amazon. The approach used was the following. After the internet based survey was closed for responses, respondents that completed the survey (the survey platform Qualtrics sets a flag to true if a respondent finished the survey), were asked to provide their contact information. From all the respondents who entered their contact information, fifteen were chosen at random to receive a \$30 gift card from Amazon.com. The gift cards were electronic and the respondents were instructed in how to pick them up via email. Records were kept for each gift card showing the recipient email address contacted and confirming the gift card was picked up.

## VII. Survey Response Compilation

### A. Creation of Data Sets

After the surveys were closed at each campus, data were downloaded from Qualtrics as a CSV file. This file contains the responses to all survey questions and had hundreds of columns (e.g. 839 columns for the UNCC data set). Each record stored the demographic information of a respondent, as well as all the trips he/she made on his/her travel day. Eighteen students participated in the NCSU pilot survey, and their responses were included in the files for NCSU, with a field “From\_pilot\_survey” to differentiate them from the students participating in the NCSU full survey. To facilitate the data analysis, the CSV file was disaggregated into three files and some new variables were created. The three files are person file, place file, and trip file. The person file contains each respondent’s demographic and trip rate information, the place file records the coordinates and place types of all places each respondent visited on his/her travel day, and the trip file stores all the trip related information, such as trip duration and trip mode. These three files can be linked through Person ID or Place ID, and each file has a manageable number of fields. The major fields in these three files are listed in Tables 1 to 3, as well as the descriptions and sources. These fields were either generated by Qualtrics, or were obtained from the respondents’ answers to the survey questions, or derived. Please notice that Table 3 to Table 5 do not list all fields in the three files. For details, please refer to the dictionary worksheets provided along with the final cleaned data sets.

Table 3 Major Fields in the Person Table

Field Name	Description	Source
Pearson_ID	Person sample ID (unique identifier)	N/A
From_pilot_survey	Whether this sample is from the pilot survey. 0 = No; 1 = Yes	N/A
Survey_start_time	The time when the respondent started taking the survey	Qualtrics
Survey_end_time	The time when the respondent ended the survey	Qualtrics
Survey_duration	Calculated as "Survey_end_time - Survey_start_time". The unit is minute. Respondents are allowed to leave the survey without finishing it and return back to continue, so the survey duration could be very long.	Derived
Finished	Whether the respondent reached the end of the survey. 0 = No; 1 = Yes	Qualtrics
Class_status	The respondent's grade (or in which program)	Question Q2
Credit_hours	Number of credit hours in the spring semester of 2013. Twenty means 20+.	Question Q3
On_campus	Whether the respondent lives on campus. 0 = No; 1 = Yes. Note: fraternity and sorority houses are not counted as on campus residence.	Question Q5
Travel_date	The day on which the respondent made the trips that are reported in the survey	Question Q10
Number_of_places	The number of places that the respondent went on his/her travel day. Is the answer to the question "Referring to the example above, how many places did you go on your selected travel day?...".	Question Q11
Stated_trip_rate	The number of trips made on the travel day based on the "Number_of_places". Calculated as "Number_of_places - 1"	Derived
Derived_trip_rate	The number of trips made on the travel day derived from the detailed place information reported in the survey. If a respondent did not report any of his/her places, derived_trip_rate=-999.	Derived
Derived_minus_Stated	Calculated as "Derived_trip_rate - Stated_trip_rate"	Derived
Graduate	Whether the respondent is a graduate based on "Class_status"	Derived
Full_time	Whether the respondent is a full time student based on "Class_status" and "Credit_hours". A student is considered as a full time student if he/she is an undergraduate and takes $\geq 12$ credit hours or a graduate and takes $\geq 9$ credit hours.	Derived
Weight	Person weight for the final remaining person records. Developed based on residence locations (on-campus vs. off-campus), credit hours (full-time vs. part-time) and class status (undergraduate vs. graduate).	Derived

Table 4 Major Fields in the Place Table

Field Name	Description	Source
Person_ID	Person sample ID, which can be used to link to the records in the person table	Person table
Place_ID	Place ID, in the format of Person_ID followed by three digits. The place ID of the first place for a person (suppose his/her Person ID is xxx) is xxx000, the second is xxx001 and so forth. A place, such as home, could have several different IDs if it is visited by the respondent several times.	N/A
Place_type	Place type. The possible values are home, campus, off-campus workplace and other.	Question Q12, Q18 or Q29
Place_Lat	Latitude of the place	Question Q13, Q19 or Q30
Place_Long	Longitude of the place	Question Q13, Q19 or Q30

Table 5 Major Fields in the Trip Table

Field Name	Description	Source
Person_ID	Person sample ID, which can be used to link to the records in the person table	Person table
Start_PlaceID	Place ID of the start place, which can be used to link to the records in the place table	Place table
Start_PlaceType	Place type of the start place	Question Q12, Q18, or Q29
Start_Lat	Latitude of the start place	Question Q13, Q19 or Q30
Start_Long	Longitude of the start place	Question Q13, Q19 or Q30
Time_leave_StartPlace	Time when the respondent left the start place	Question Q15, Q17, Q26, Q28, Q37, Q39
End_PlaceID	Place ID of the end place, which can be used to link to the records in the place table	Place table
End_PlaceType	Place type of the end place	Question Q18 or Q29
End_Lat	Latitude of the end place	Question Q19 or Q30
End_Long	Longitude of the end place	Question Q19 or Q30
Time_leave_EndPlace	Time when the respondent left the end place	Question Q26, Q28, Q37 or Q39
Purpose	The main purpose for traveling to each of the places	Question Q20 or Q31
Mode 1, Mode 2, Mode 3	Transportation mode used to complete the trip. A respondent might use more than one mode in a trip.	Question Q21 or Q32
Mode_model	Transportation mode that will be used for data analysis. It is derived based on Mode_1.	Derived
Total_traveler	Including the respondent, the total number of people traveling together for the auto-driver and auto-passenger mode	Question Q22 or Q33
Bus_system	Which bus system the respondent used for the bus mode	Question Q23 or Q34
Trip_duration	Estimate of the trip duration from the start place to the end place	Question Q24 or Q35
Weight	Trip weight, which is equal to the person weight from the person table based on the person ID.	Person table
Trip_type	Trip type, defined based on the traveler's residence status and the place type of the trip's start and end place. The possible values are On-1, On-2, On-3, On-4, On-5, Off-1, Off-2, Off-3, Off-4 and Off-5.	Derived
Trip_classification	Trip classification, defined based on whether the trip is within, crossing or outside of the university boundary.	Derived
Trip_purpose	Trip purpose. The possible values are HBU, HBO, UBNH and NHNU.	Derived

## B. Defining Complete and Valid Samples

In the university student surveys, some students started the survey, but quit without completing it; most probably by simply closing the web browser and not coming back to continue the survey. They did not reach the end of the survey, and were flagged as “incomplete” by Qualtrics (“Finished = 0” in Table 1). Table 6 provides an insight on how many and when students quit the surveys. The numbers in parentheses in Table 6 are the percentages of students among the students who started the survey.

**Table 6 When and How Many Students Quit the Surveys**

	NCSU	UNCG	ASU	FSU	UNC W	UNCC
Number of students who started the survey	922	841	633	539	1,612	2,861
Number of students who quit before answering whether they lived on campus (Q5)	34 (4%)	24 (3%)	9 (1%)	17 (3%)	22 (1%)	72 (3%)
Number of students who quit before answering how many places they visited on their travel days (Q11)	115 (12%)	75 (9%)	31 (5%)	28 (5%)	58 (4%)	173 (6%)
Number of students who quit before providing any place information (Q12 and the following questions)	328 (36%)	236 (28%)	180 (28%)	154 (29%)	367 (23%)	830 (29%)
Number of students who quit before reaching the end of the survey (flagged as “incomplete” by Qualtrics)	507 (55%)	399 (47%)	308 (49%)	273 (51%)	695 (43%)	1,369 (48%)

Table 6 shows about 1% to 4% of students quit the survey before Q5, which asked them whether they lived on campus or off campus. Q5 is a critical question since it will be used to classify students as on-campus and off-campus students. In Q11, students were asked to look at an example diagram and recall how many places they visited on their travel days. It is expected that most students will answer Q11 and the answers will be relatively accurate since the example diagram is shown on the same webpage. It is also expected that many students would quit the survey after Q11 due to the increasing survey burden. Results in Table 6 are consistent with the expectations: 4% to 12% of students quit the survey before Q11, but 23% to 36% of students quit the survey before Q12. In other words, 19% to 24% of students quit the survey after they saw the webpage containing Q12.

Starting from Q12, students were asked to input the places they visited, one by one, until they did not leave the place on their travel day. During this iterating, some students might decide not to continue the survey and intentionally claim a place as their last place of the day so that they can terminate iterating earlier. Since they ended the survey in a logical manner, they were flagged as “complete” by Qualtrics. However, such samples are invalid, and they only provided a subset of the places. Question 11 (Q11) in the questionnaire is designed to identify such invalid samples.

As shown in Table 3, the answers to Q11 are “Number\_of\_places” in the person file, and “Number\_of\_places” minus one yields “Stated\_trip\_rate”. Another trip rate can be obtained by counting the number of places a student reported in the survey from Q12 to the end of the survey, and it is called

“Derived\_trip\_rate” in Table 3. If students did not intentionally provide incorrect answers to terminate the iteration questions earlier, “Derived\_trip\_rate” should be close to “Stated\_trip\_rate”. To compare these two trip rates, a new field “Derived\_minus\_Stated” is introduced in the person file. Table 7 summarizes its value for the complete samples (“Finished = 1” in Table 3).

**Table 7 Summary of Derived Trip Rate minus Stated Trip Rate**

	$\leq -2$	-1	0	1	$\geq 2$	Other <sup>5</sup>	Total
NCSU	72	58	188	54	36	7	415
UNCG	59	51	212	69	45	6	442
ASU	65	18	158	61	20	3	325
FSU	49	29	114	44	25	5	266
UNCW	109	89	472	158	87	2	917
UNCC	185	148	788	236	119	16	1,492

When “Derived\_trip\_rate” is far less than “Stated\_trip\_rate”, it is very likely that students intentionally provided incorrect answers to terminate the iteration questions earlier, so such samples are invalid. A threshold of -2 for “Derived\_minus\_Stated” was selected to identify the invalid samples. When “Derived\_minus\_Stated” is equal to -1, “Derived\_trip\_rate” is only one less than “Stated\_trip\_rate”. For such samples, students had already reported most of the places, so it is less likely that students intentionally terminated the iteration questions earlier. A more possible reason for such a discrepancy is that students incorrectly counted one more place for “Stated\_trip\_rate”, or missed a place when they reported the places one by one. When “Derived\_minus\_Stated” is positive, students actually reported more places than what they claimed in Question 11 (Q11), which might be due to unintentional errors or a misunderstanding of Q11. In summary, the samples with “Derived\_minus\_Stated $\geq$ -1” are regarded as valid samples.

The samples that meet the condition of “Finished = 1 and Derived\_minus\_Stated  $\geq$  -1” are called complete and valid samples. They have much better data quality and they were further cleaned based on the procedures described in section C. Data Cleaning and Processing. Some complete and valid samples were dropped from the final cleaned data sets after careful review due to various reasons: for example, the reported travel day was on weekend or the reported trips do not make sense.

Efforts were made to manually review the incomplete or invalid samples in order to retain as many useful samples as possible. Some incomplete or invalid samples are included in the final cleaned data sets after careful review. For example, some samples are flagged as “incomplete” by Qualtrics since the students did not reach the last page of the survey. However, they reported the places they visited and their “Derived\_trip\_rate” is equal to or larger than the “Stated\_trip\_rate”. In such cases, it is more likely that

<sup>5</sup> Q11 (the number of places visited on the travel day) is not set to be a mandatory question, so “Stated\_trip\_rate” could be null. For such samples, “Derived\_minus\_Stated” is set to be “other”, and these samples are reviewed one by one to determine whether they should be included in the cleaned data set. It is also possible that the student disagreed to take the survey at Q1 and Qualtrics takes this situation as complete since the student quitted the survey logically.

the students completed all the places they visited but simply closed the webpage when they saw the webpage asking for contact information for gift card drawing. Although some incomplete or invalid samples are included in the final cleaned data sets, the complete and valid samples are the majority.

Table 3 compares the number of all samples collected in the surveys and the number of samples retained in the final cleaned data set, as well as the trip records for these samples.

**Table 8 Comparison of Collected Samples and Retained Samples**

	Persons			Trips		
	Number of collected samples (person records)	Number of retained samples (person records)	Percent of retained samples	Number of collected trip records	Number of trip records from the retained person records	Percent of trip records from the retained records
NCSU	922	336	36%	2,354	1,978	84%
UNCG	841	383	46%	2,304	2,022	88%
ASU	633	266	42%	1,770	1,520	86%
FSU	539	224	42%	1,246	1,074	86%
UNCW	1,612	838	52%	5,055	4,585	91%
UNCC	2,861	1,350	47%	7,029	6,248	89%

Table 8 shows that the “Percent of retained samples” for NCSU is as low as 36%, and it varies from 42% to 52% for other universities. The possible reason is that the NCSU survey is the only survey that did not offer any incentives. As a comparison, the surveys for the other five universities offered a drawing for one of fifteen \$30 gift cards. The incentive information was listed clearly in the invitation email, and students can only enter their contact information for the gift card drawing after they reported their trips. So once a student started the survey, more students would carefully complete the survey so that they can be entered into the drawing.

Table 8 also lists the number of trip records from all the collected samples and from the retained samples. It shows that most (84% to 91%) of the trip records collected in the surveys are retained.

## C. Data Cleaning and Processing

The purpose of this step was to improve data quality and clean some obvious errors in the survey data sets.

### 1. Cleaning Purposes

In the student survey, students were asked for the main purpose for traveling to each of the places, and six possible answers were provided to choose from: go home, attend classes/study/research, work, dining/shopping, recreational/social/community service/personal and other (students can enter text descriptions when they choose this option). Some trips had the trip purpose of “other”, but based on the descriptions, they can actually choose one of the first five possible answers. For example, “other –

internship” is “work”, and “other – appointment with professor” is “classes/study/research”. The trips with trip purpose of “other” were reviewed and modified when necessary.

In some cases, the trip purposes were modified to match the end place types. For example, if the end place was “home”, but the trip purpose was “study”, the trip purpose was then modified to be “go home”.

## **2. Processing Trip Modes**

In the student survey, the questions on trip mode (Questions 21 and 32) are multiple choice questions. The raw data showed that no students selected more than three trip modes for a trip, so three fields were created in the trip file to record the trip modes: “Mode\_1”, “Mode\_2” and “Mode\_3”, as shown in Table 3. The trip modes were prioritized and they were put in “Mode\_1” to “Mode\_3” based on their priorities. The priority of a trip mode is shown below.

- (1) Public Bus / Private Shuttle
- (2) Car Pool (either as driver or as passenger) - Auto / Van / Truck
- (3) Driver - Auto / Van / Truck
- (4) Motorcycle / Motorized Moped or Scooter
- (5) Bicycle
- (6) Walk
- (7) Other

To be consistent with the trip modes usually used in travel demand modeling, another field, “Mode\_model”, was created based on “Mode\_1”. In detail, “Car Pool (either as driver or as passenger) - Auto / Van / Truck” and “Driver - Auto / Van / Truck” in “Mode\_1” were renamed as “Shared Ride” and “Drive Alone” in “Mode\_model”.

## **3. Cleaning Place Types**

Students needed to classify each of the places they visited to one of the four place types: home, campus, off-campus workplace, and other. Some trips had a trip purpose of “go home,” but the end place types were not “home.” These end place types were changed to “home” to be consistent. Similarly, the end place types for some trips with trip purpose of “attend classes / study / research” were modified to be “campus.”

## **4. Cleaning Home Coordinate**

In the student survey, students were asked to click the places they visited on a Google map, then the coordinates were recorded. Usually a student would go to his/her home more than once. Each time a student went home, he/she needed to click on the Google map to obtain the coordinate of home. These coordinates are not necessarily identical but should be close. Based on this rule, the home coordinates were checked and cleaned using the following procedure.

For each of the students, the home coordinates were pooled together, and the distances among them were calculated. If the maximum distance is more than 0.1 miles, the student was marked and all his/her trips were reviewed to identify the issues, by plotting all the places this student visited on a map, or checking trip purpose, place type and the student’s residence status (living on-campus or off-campus).

The possible issues include claiming a non-home place as home, and taking parents' home or out-of-town home as home. These issues can be solved by modifying the place type or trip purpose. After these modifications, the coordinate of the first home location was used as the coordinate of this student's home.

### **5. Removing the Inconsistency between Place Type and Coordinate**

When a student entered a place, he/she needed to identify the type of this place (home, campus, off-campus workplace or other), and point out where the place was by clicking on a Google map. Several logic checks were conducted to see whether the place types are consistent with the coordinates provided by students. The logic checks are:

- (1) If a student identifies himself/herself as an on-campus student, his/her home should be located on campus.
- (2) If a student identifies himself/herself as an off-campus student, his/her home should be located off campus.
- (3) Places with place type of "campus" should be located on campus.
- (4) Places with place type of "off-campus workplace" should be located off campus.
- (5) Places with place type of "other" should be located off campus.

When a place's place type is not consistent with its coordinate, the student's responses were reviewed manually to understand what could possibly be wrong, and modifications were made. Possible modifications include changing the student's residence status (living on campus or off campus), changing the place type, changing the coordinate (for example, assigning an on-campus coordinate if the trip purpose is "attend classes/study/research"), or removing this student as a sample in the final data set if his/her trips are hard to understand.

### **D. Data Weighting**

Although the sample was randomly selected, not all sampled students agreed to participate, nor did all students that agreed to participate actually complete the study, which resulted in a non-response bias in the data set. Therefore, weights were developed to adjust for the non-response bias. These weights also factored (expanded) the survey data to represent all students in the surveyed university.

The first step of the weighting process is to determine what characteristics should be considered. The literature review shows that many characteristics could impact university students' travel behaviors, including but not limited to, residence location (living on-campus vs. off-campus), education status (undergraduate vs. graduate), enrollment status (full-time vs. part-time), whether they work, and whether they have vehicles. However, not all of these characteristics can be used in the weighting process, since it is difficult to collect the total number of students for some of these characteristics. It is relatively easy to collect the total number of students who live on campus, who are undergraduates and who are enrolled full-time, but it is difficult to collect the total number of students who work, and who have vehicles. So, the following weighting process considered three characteristics: residence location, education status, and enrollment status. It is worth mentioning that the literature review shows that most university student surveys only considered one characteristic, i.e., residence location, for weighting.

The second step of the weighting process is to collect the total number of students by the weighting characteristics. Table 9 shows the numbers for ASU.

**Table 9 Total Number of Students by the Weighting Characteristics for ASU**

	Undergraduate		Graduate		Total
	Part-time	Full-time	Part-time	Full-time	
On-campus	0	5,675	11	41	5,727
Off-campus	506	9,240	177	774	10,697
Total	506	14,915	188	815	16,424

The total number of students by education status and enrollment status, i.e., the last row in Table 9, is the 2013 fall enrollment from the ASU website<sup>6</sup>. The total number of students by residence location, i.e., the last column in Table 9, is also obtained from the ASU website<sup>7</sup> but adjusted to match the 2013 fall enrollment. Unfortunately, the total number of students by all three characteristics, i.e., the unshaded cells in Table 9, is not available. Iterative Proportionate Fitting (IPF) was then used to derive the number of students by all three characteristics, based on the marginal vectors (the shaded cells in Table 9). This process is similar to Fratar Balancing. The seed matrix (with dimension of 2×4) is the number of surveyed students from the raw survey data set in each category. For example, the first cell of the seed matrix shows the number of surveyed students who are part-time undergraduates living on campus in the raw survey data set. After the IPF process, the number of students by all three characteristics is obtained and shown in the unshaded cells of Table 9.

The third step of the weighting process is to summarize the number of students by the weighting characteristics in the final cleaned data set. Table 10 shows the numbers for ASU.

**Table 10 Number of Students in the Final Cleaned Data Set for ASU**

	Undergraduate		Graduate		Total
	Part-time	Full-time	Part-time	Full-time	
On-campus	0	82	0	1	83
Off-campus	5	132	9	37	183
Total	5	214	9	38	266

<sup>6</sup> [http://irap.appstate.edu/sites/irap.appstate.edu/files/FB20132014\\_S8demographics.pdf](http://irap.appstate.edu/sites/irap.appstate.edu/files/FB20132014_S8demographics.pdf)

<sup>7</sup> [http://irap.appstate.edu/sites/irap.appstate.edu/files/FB20132014\\_s56res\\_halls\\_studenthoused.pdf](http://irap.appstate.edu/sites/irap.appstate.edu/files/FB20132014_s56res_halls_studenthoused.pdf)

The weights are calculated as the population matrix (Table 9) divided by the sample matrix (Table 10) cell by cell. Since no part-time undergraduates living on-campus remained in the final cleaned survey data set, they were grouped with the full-time undergraduates living on-campus. Similarly, part-time graduates living on-campus were grouped with full-time graduates living on-campus. The weights for ASU are shown in Table 11.

**Table 11 Weights for ASU**

	Undergraduate		Graduate	
	Part-time	Full-time	Part-time	Full-time
On-campus	69.2104		51.7493	
Off-campus	101.2074	69.9973	19.6469	20.9322

Table 12 to Table 20 are similar to Table 9 to Table 11 respectively, and they show the numbers for FSU, UNCW and UNCC.

**Table 12 Total Number of Students by the Weighting Characteristics for FSU**

	Undergraduate		Graduate		Total
	Part-time	Full-time	Part-time	Full-time	
On-campus	77	1,715	0	0	1,792
Off-campus	1,362	2,256	415	354	4,387
Total	1,439	3,971	415	354	6,179

**Table 13 Number of Students in the Final Cleaned Data Set for FSU**

	Undergraduate		Graduate		Total
	Part-time	Full-time	Part-time	Full-time	
On-campus	1	35	0	0	36
Off-campus	35	122	16	15	188
Total	36	157	16	15	224

Table 14 Weights for FSU

	Undergraduate		Graduate	
	Part-time	Full-time	Part-time	Full-time
On-campus	76.6352	49.0079	N/A	
Off-campus	38.9231	18.4915	25.9313	23.5943

Table 15 Total Number of Students by the Weighting Characteristics for UNCW

	Undergraduate		Graduate		Total
	Part-time	Full-time	Part-time	Full-time	
On-campus	60	4,117	0	21	4,199
Off-campus	925	5,905	749	431	8,010
Total	985	10,023	749	452	12,209

Table 16 Number of Students in the Final Cleaned Data Set for UNCW

	Undergraduate		Graduate		Total
	Part-time	Full-time	Part-time	Full-time	
On-campus	3	272	0	1	276
Off-campus	59	375	73	55	562
Total	62	647	73	56	838

Table 17 Weights for UNCW

	Undergraduate		Graduate	
	Part-time	Full-time	Part-time	Full-time
On-campus	20.0100	15.1371	21.2562	
Off-campus	15.6791	15.7479	10.2615	7.8325

Table 18 Total Number of Students by the Weighting Characteristics for UNCC

	Undergraduate		Graduate		Total
	Part-time	Full-time	Part-time	Full-time	
On-campus	151	5,090	8	15	5,264
Off-campus	3,043	13,219	2,933	2,112	21,307
Total	3,194	18,309	2,941	2,127	26,571

Table 19 Number of Students in the Final Cleaned Data Set for UNCC

	Undergraduate		Graduate		Total
	Part-time	Full-time	Part-time	Full-time	
On-campus	7	216	2	3	228
Off-campus	139	599	162	222	1,122
Total	146	815	164	225	1,350

Table 20 Weights for UNCC

	Undergraduate		Graduate	
	Part-time	Full-time	Part-time	Full-time
On-campus	21.5877	23.5654	3.7569	5.1621
Off-campus	21.8913	22.0682	18.1079	9.5113

## VIII. Survey Response Analysis

### A. Demographic Characteristics

In this section, the demographic characteristics of the students are presented. All results are weighted, unless otherwise noted.

#### 1. Number of Students by Residence Location

The surveys were weighted based on three characteristics: residence location (living on-campus vs. off-campus), education status (undergraduate vs. graduate), and enrollment status (full-time vs. part-time). Therefore, the shares of these three characteristics obtained from the survey samples match the population. The results are shown in Tables 19 and 20, and Figures 1 and 2. For comparison purposes, the two universities surveyed in the first year of the project were also presented (NCSU and UNCG).

Table 21 and Figure 1 show that the percent of students living on campus varies from about 20% to 35%.

Table 21 Survey Results: Number of Students by Residence Location

Student	NCSU			UNCG		
	Number of Samples	Sum of Weights	Weighted Share	Number of Samples	Sum of Weights	Weighted Share
Off-campus	192	20,552	70.6%	295	12,767	75.0%
On-campus	144	8,568	29.4%	88	4,253	25.0%
Total	336	29,120	100.0%	383	17,020	100.0%
Student	ASU			FSU		
	Number of Samples	Sum of Weights	Weighted Share	Number of Samples	Sum of Weights	Weighted Share
Off-campus	183	10,697	65.1%	188	4,387	71.0%
On-campus	83	5,727	34.9%	36	1,792	29.0%
Total	266	16,424	100.0%	224	6,179	100.0%
Student	UNCW			UNCC		
	Number of Samples	Sum of Weights	Weighted Share	Number of Samples	Sum of Weights	Weighted Share
Off-campus	562	8,010	65.6%	1,122	21,307	80.2%
On-campus	276	4,199	34.4%	228	5,264	19.8%
Total	838	12,209	100.0%	1,350	26,571	100.0%

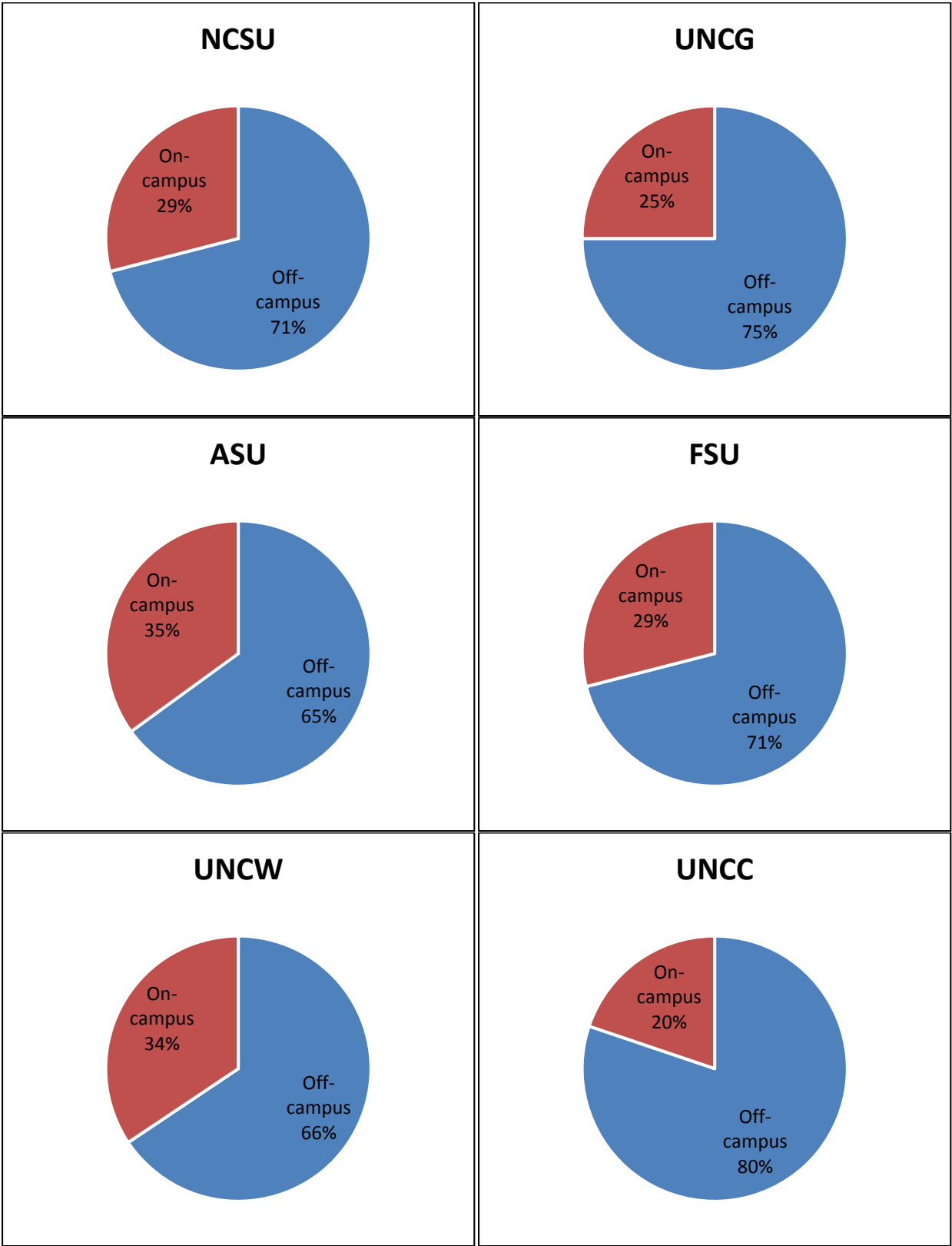


Figure 1 Survey Results: Number of Students by Residence Location

## **2. Number of Students by Education Status and Enrollment Status**

Table 22 and Figure 2 show that the six surveyed universities are different in terms of number of students by education status and enrollment status. NCSU, UNCG and UNCC have relatively higher shares of graduates (around 20%), whereas only about 6% of students at ASU are graduates. The shares of part-time students at UNCG, FSU and UNCC are high (23% to 30%), and they are around 15% for NCSU and UNCW, but only 4% for ASU.

Table 22 Survey Results: Number of Students by Education Status and Enrollment Status

Student	NCSU			UNCG		
	Number of Samples	Sum of Weights	Weighted Share	Number of Samples	Sum of Weights	Weighted Share
Full-time Undergraduate	201	20,438	70.2%	261	11,907	70.0%
Part-time Undergraduate	3	1,707	5.9%	24	1,764	10.4%
Full-time Graduate	92	4,386	15.1%	51	1,195	7.0%
Part-time Graduate	40	2,589	8.9%	47	2,154	12.7%
Total	336	29,120	100.0%	383	17,020	100.0%
Student	ASU			FSU		
	Number of Samples	Sum of Weights	Weighted Share	Number of Samples	Sum of Weights	Weighted Share
Full-time Undergraduate	214	14,915	90.8%	157	3,971	64.3%
Part-time Undergraduate	5	506	3.1%	36	1,439	23.3%
Full-time Graduate	38	826	5.0%	15	354	5.7%
Part-time Graduate	9	177	1.1%	16	415	6.7%
Total	266	16,424	100.0%	224	6,179	100.0%
Student	UNCW			UNCC		
	Number of Samples	Sum of Weights	Weighted Share	Number of Samples	Sum of Weights	Weighted Share
Full-time Undergraduate	647	10,023	82.1%	815	18,309	68.9%
Part-time Undergraduate	62	985	8.1%	146	3,194	12.0%
Full-time Graduate	56	452	3.7%	225	2,127	8.0%
Part-time Graduate	73	749	6.1%	164	2,941	11.1%
Total	838	12,209	100.0%	1,350	26,571	100.0%

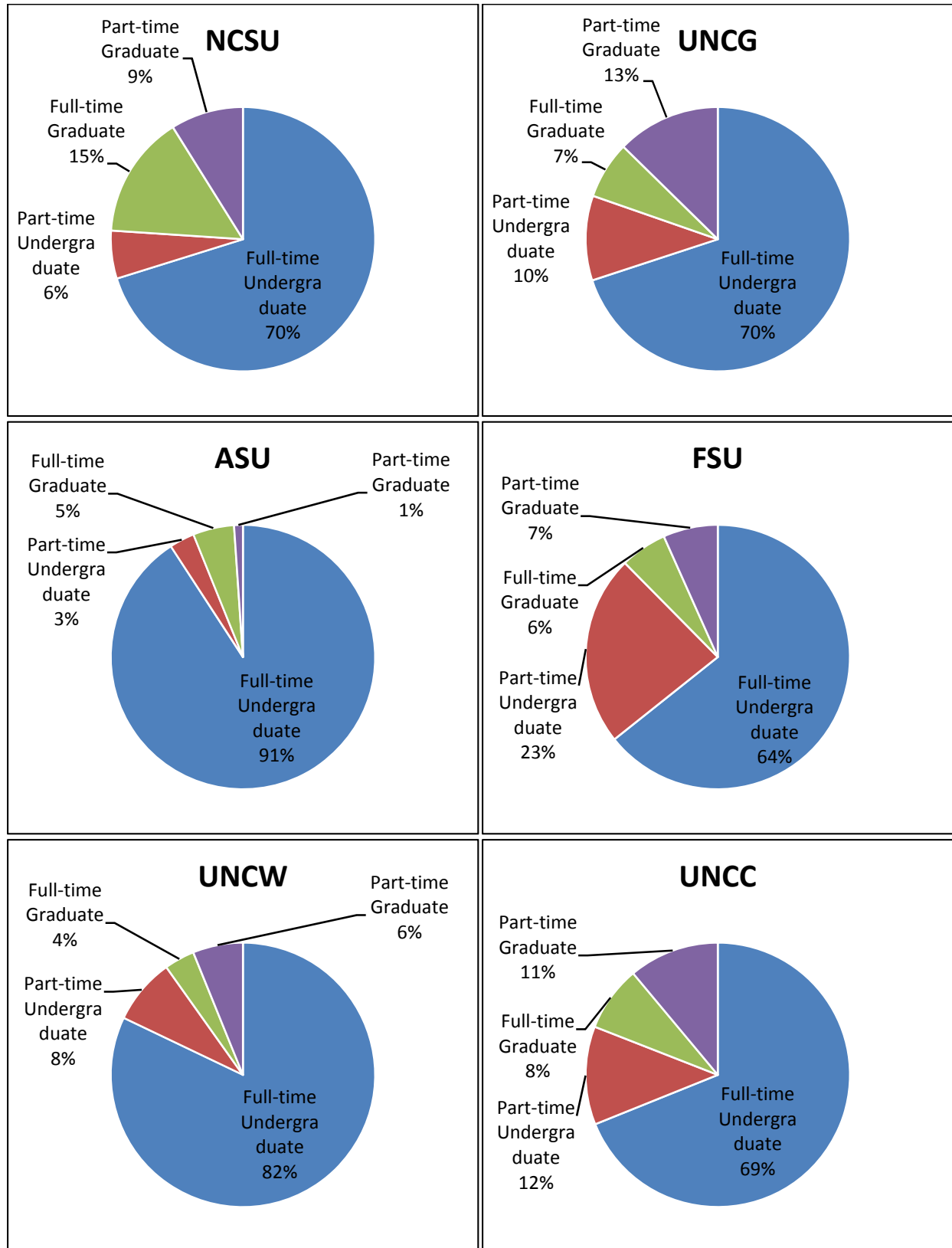


Figure 2 Survey Results: Number of Students by Education Status and Enrollment Status

### 3. The Number of Weekdays a Student Goes to Campus

Table 23 summarizes the number of weekdays a student goes to campus. It shows that except UNCC, more than 90% of on-campus students go to campus five days a week. Such percentages are much smaller for off-campus students (around 60% for NCSU and ASU, only 34% for UNCC, and around 45% for the rest). Among the off-campus students, around 14% of NCSU and ASU students go to campus less than or equal to twice a week, and around 31% for UNCG and FSU.

**Table 23 Survey Results: How Many Weekdays a Student Goes to Campus**

Student	How many weekdays does a student go to campus?	NCSU		UNCG	
		Number of Samples	Weighted Share	Number of Samples	Weighted Share
Off-campus	0	5	4.6%	33	12.5%
	1	5	1.5%	16	5.9%
	2	23	8.5%	33	12.3%
	3	15	11.3%	27	9.6%
	4	30	13.8%	46	14.0%
	5	114	60.4%	140	45.7%
	Total	192	100.0%	295	100.0%
On-campus	0	2	1.5%	0	0.0%
	1	0	0.0%	0	0.0%
	2	3	1.0%	1	1.1%
	3	2	0.9%	1	1.1%
	4	6	2.8%	6	6.8%
	5	131	93.9%	80	90.9%
	Total	144	100.0%	88	100.0%
Student	How many weekdays does a student go to campus?	ASU		FSU	
		Number of Samples	Weighted Share	Number of Samples	Weighted Share
Off-campus	0	4	2.6%	25	16.0%
	1	4	1.7%	8	4.6%
	2	17	9.3%	19	11.5%
	3	12	3.2%	19	10.1%
	4	40	22.8%	29	16.5%
	5	106	60.4%	88	41.2%
	Total	183	100.0%	188	100.0%
On-campus	0	0	0.0%	0	0.0%
	1	0	0.0%	0	0.0%
	2	0	0.0%	0	0.0%
	3	0	0.0%	0	0.0%
	4	4	4.8%	2	5.5%
	5	79	95.2%	34	94.5%
	Total	83	100.0%	36	100.0%

Student	How many weekdays does a student go to campus?	UNCW		UNCC	
		Number of Samples	Weighted Share	Number of Samples	Weighted Share
Off-campus	0	49	8.4%	22	2.0%
	1	15	2.0%	50	4.2%
	2	56	9.5%	179	16.0%
	3	72	12.9%	175	15.2%
	4	102	17.7%	311	28.7%
	5	268	49.4%	385	33.9%
	Total	562	100.0%	1,122	100.0%
On-campus	0	3	1.1%	1	0.1%
	1	0	0.0%	0	0.0%
	2	1	0.4%	3	1.3%
	3	3	1.1%	2	0.9%
	4	9	3.2%	36	16.1%
	5	260	94.2%	186	81.7%
	Total	276	100.0%	228	100.0%

#### 4. Car Ownership

Table 24 summarizes how many students have vehicles to use. As expected, more off-campus students can access vehicles (varies from 86% to 95%) than on-campus students (varies from 36% to 71%). It is worth noticing that although on-campus parking facilities are limited, still about 47% of on-campus students at NCSU, UNCG and ASU have vehicles to use, and it is as high as about 71% for UNCW and UNCC.

Table 24 Survey Results: Car Ownership

Student	“Do you have a vehicle to use?”	NCSU		UNCG	
		Number of Samples	Weighted Share	Number of Samples	Weighted Share
Off-campus	Yes	161	85.6%	271	92.0%
	No	31	14.4%	24	8.0%
	Total	192	100.0%	295	100.0%
On-campus	Yes	69	46.8%	40	45.5%
	No	75	53.2%	48	54.5%
	Total	144	100.0%	88	100.0%
Student	“Do you have a vehicle to use?”	ASU		FSU	
		Number of Samples	Weighted Share	Number of Samples	Weighted Share
Off-campus	Yes	165	88.7%	174	94.1%
	No	18	11.3%	14	5.9%
	Total	183	100.0%	188	100.0%
On-campus	Yes	39	47.1%	13	35.6%
	No	44	52.9%	23	64.4%
	Total	83	100.0%	36	100.0%
Student	“Do you have a vehicle to use?”	UNCW		UNCC	
		Number of Samples	Weighted Share	Number of Samples	Weighted Share
Off-campus	Yes	534	94.9%	1,040	93.7%
	No	28	5.1%	82	6.3%
	Total	562	100.0%	1,122	100.0%
On-campus	Yes	196	71.0%	160	70.3%
	No	80	29.0%	68	29.7%
	Total	276	100.0%	228	100.0%

## 5. Parking Permit Ownership

Table 25 summarizes parking permit information. Although more off-campus students can access vehicles, Table 25 shows that the percent of students owning on-campus parking permits does not differ much for off-campus students and on-campus students (except FSU, which is probably because of the small sample size). A further analysis shows that among the students who have vehicles to use, on-campus students are more likely to have on-campus parking permits (varies from 72% to 99% vs. 28% to 79% for off-campus students).

**Table 25 Survey Results: Parking Permit Ownership**

Student	“Do you have a permit to park on campus”	NCSU		UNCG	
		Number of Samples	Weighted Share	Number of Samples	Weighted Share
Off-campus	Yes	76	42.1%	105	33.6%
	No	116	57.9%	190	66.4%
	Total	192	100.0%	295	100.0%
On-campus	Yes	54	35.6%	33	37.5%
	No	90	64.4%	55	62.5%
	Total	144	100.0%	88	100.0%
Student	“Do you have a permit to park on campus”	ASU		FSU	
		Number of Samples	Weighted Share	Number of Samples	Weighted Share
Off-campus	Yes	47	20.9%	137	72.1%
	No	136	79.1%	51	27.9%
	Total	183	100.0%	188	100.0%
On-campus	Yes	28	33.8%	11	30.1%
	No	55	66.2%	25	69.9%
	Total	83	100.0%	36	100.0%
Student	“Do you have a permit to park on campus”	UNCW		UNCC	
		Number of Samples	Weighted Share	Number of Samples	Weighted Share
Off-campus	Yes	351	61.6%	732	66.0%
	No	211	38.4%	390	34.0%
	Total	562	100.0%	1,122	100.0%
On-campus	Yes	194	70.3%	140	61.4%
	No	82	29.7%	88	38.6%
	Total	276	100.0%	228	100.0%

## 6. Employment Information

Table 26 summarizes student employment information. As expected, more on-campus students are unemployed than off-campus students (varies from 57% to 67% for on-campus students vs. 29% to 41% for off-campus students). For employed students, off-campus students are more likely to work off campus, and on-campus students are more likely to work on campus.

Table 26 Survey Results: Employment Information

Student	“Are you currently employed?”	NCSU		UNCG	
		Number of Samples	Weighted Share	Number of Samples	Weighted Share
Off-campus	No	51	33.8%	100	34.3%
	Yes, on and off campus	10	3.2%	12	3.9%
	Yes, off campus	54	35.6%	120	42.9%
	Yes, on campus	77	27.4%	63	18.9%
	Total	192	100.0%	295	100.0%
On-campus	No	93	67.1%	56	63.6%
	Yes, on and off campus	4	3.0%	4	4.5%
	Yes, off campus	13	9.7%	14	15.9%
	Yes, on campus	34	20.2%	14	15.9%
	Total	144	100.0%	88	100.0%
Student	“Are you currently employed?”	ASU		FSU	
		Number of Samples	Weighted Share	Number of Samples	Weighted Share
Off-campus	No	65	40.8%	75	38.1%
	Yes, on and off campus	9	4.1%	8	3.8%
	Yes, off campus	45	26.0%	88	49.1%
	Yes, on campus	64	29.1%	17	9.0%
	Total	183	100.0%	188	100.0%
On-campus	No	48	57.7%	21	57.4%
	Yes, on and off campus	1	1.2%	1	2.7%
	Yes, off campus	13	15.7%	4	10.9%
	Yes, on campus	21	25.4%	10	28.9%
	Total	83	100.0%	36	100.0%
Student	“Are you currently employed?”	UNCW		UNCC	
		Number of Samples	Weighted Share	Number of Samples	Weighted Share
Off-campus	No	168	32.0%	307	28.8%
	Yes, on and off campus	34	5.1%	60	5.1%
	Yes, off campus	256	46.9%	519	49.6%
	Yes, on campus	104	16.0%	236	16.5%
	Total	562	100.0%	1,122	100.0%
On-campus	No	161	58.4%	132	57.8%
	Yes, on and off campus	11	4.0%	9	4.0%
	Yes, off campus	51	18.4%	42	18.8%
	Yes, on campus	53	19.3%	45	19.4%
	Total	276	100.0%	228	100.0%

## 7. The Distance between Home and Campus for Off-campus Students

The distance between home and campus for off-campus students is analyzed. This distance is calculated as the shortest straight line distance from an off-campus student’s home to any campus boundaries.

Table 27 shows the percentages of off-campus students who live 1, 2, 5, 10 and 20 miles away from campus. Based on Table 27, the distances between home and campus for off-campus students are quite different for the six surveyed universities. For example, about 70% of ASU off-campus students live less than 2 miles away from campus, whereas it is only 14% for FSU.

**Table 27 Percent of Off-campus Students who Live 1, 2, 5, 10 and 20 Miles away from Campus**

	NCSU	UNCG	ASU	FSU	UNCW	UNCC
Below 1 mile	41%	32%	32%	4%	40%	29%
Below 2 miles	60%	37%	70%	14%	54%	37%
Below 5 miles	70%	59%	86%	31%	75%	49%
Below 10 miles	88%	67%	89%	60%	81%	67%
Below 20 miles	96%	80%	91%	78%	87%	89%

Figure 3 shows the cumulative distribution curve of the distance between home and campus for each of the six surveyed universities. It provides more details than Table 27. The curves can be grouped into three groups based on the similarity: UNCG, UNCC and FSU as the first group, NCSU and UNCW as the second group, and ASU as the third group. In general, the off-campus students from the first group live farther than the second group, who live farther than the third group. This is consistent with the shares of part-time students: the more part-time students, the farther students live away from campus. As shown in Section VIII.A.2, the shares of part-time students at UNCG, FSU and UNCC are high (23% to 30%), and they are around 15% for NCSU and UNCW, but only 4% for ASU.

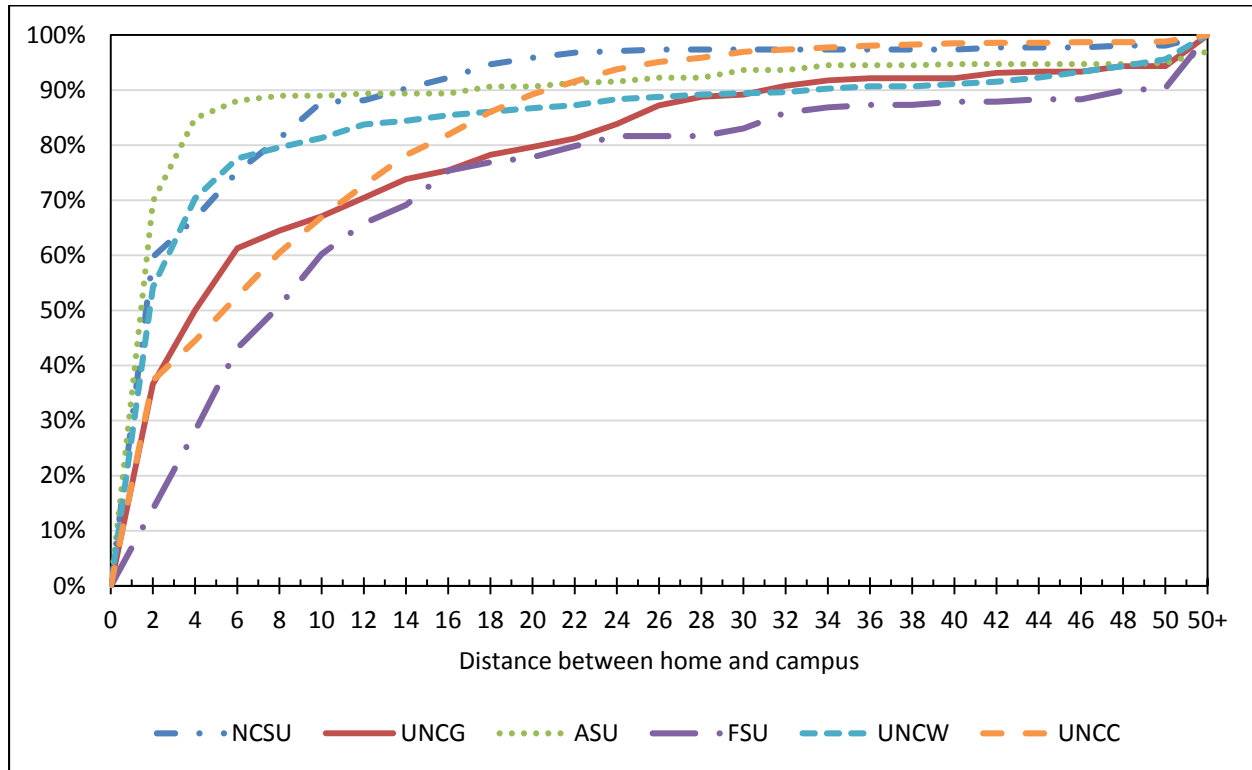


Figure 3 Cumulative Distribution Curve of the Distance between Home and Campus

## B. Travel Behavior Characteristics

### 1. Review of Trip Type, Trip Classification and Trip Purpose

In the technical report for Task 3 Model Design, ten trip types, three trip classifications and four trip purposes were defined. They are used to summarize the travel behavior characteristics collected from the surveys. Their definitions are reviewed in this section to help understand the results in the following sections.

Figure 4 shows ten types of trips university students could make, five trip types for on-campus students (On-1 to On-5) and five trip types for off-campus students (Off-1 to Off-5).

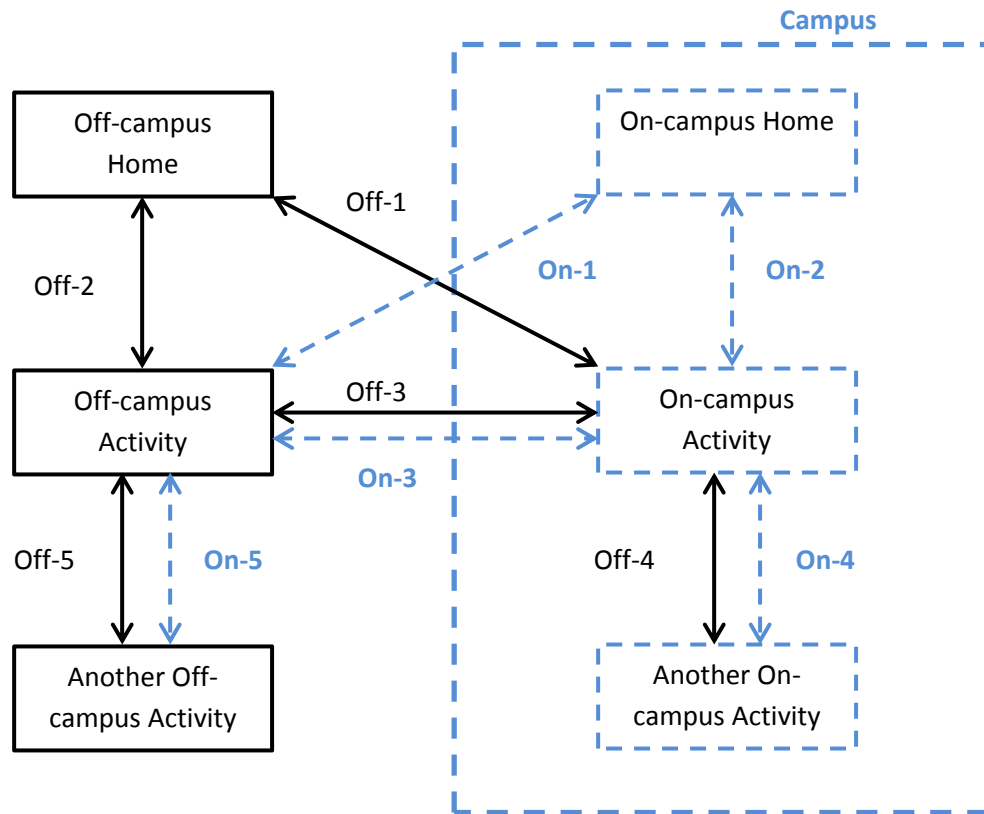


Figure 4 Illustration of Trip Types

In Figure 4, trip ends are represented as boxes: boxes with solid black borders for off-campus trip ends, and boxes with blue dashed line borders for on-campus trip ends. The lines linking these boxes represent the trips between these trip ends. The trips made by off-campus students are represented in solid black lines and on-campus students in dashed blue lines. Trips are numbered as Off-1 to Off-5, and On-1 to On-5 in Figure 4. These numbers are used to differentiate trips, and they do not indicate trip sequences. Although not all possible trips are shown in Figure 4, Figure 4 covers all types of trips. These trips are summarized in Table 28.

**Table 28 Summary of Trip Types**

Student Type	ID	Description	Characteristics
Off-campus Student	Off-1	Between home and university	Crossing the university boundary
	Off-2	Between home and non-university	Outside of the university
	Off-3	Between university and non-university	Crossing the university boundary
	Off-4	Within university	Within the university
	Off-5	No trip end is home or university	Outside of the university
On-campus Student	On-1	Between home and non-university	Crossing the university boundary
	On-2	Between home and university	Within the university
	On-3	Between university and non-university	Crossing the university boundary
	On-4	Within university	Within the university
	On-5	No trip end is home or university	Outside of the university

Table 28 shows that there are ten types of trips, but they can be classified into three groups: trips crossing the university boundary; trips within the university; and trips outside of the university. Table 29 summarizes how these trips are grouped.

**Table 29 Summary of Trip Classifications**

ID	Trip Classifications	Off-campus Student	On-campus Student
1	Crossing the university boundary	Off-1, Off-3	On-1, On-3
2	Within the university	Off-4	On-2, On-4
3	Outside of the university	Off-2, Off-5	On-5

Following the traditional way to group trips based on trip purpose, four trip purposes were defined for university students, as shown in Table 30.

**Table 30 Summary of Trip Purposes**

ID	Trip Purpose	Off-campus Student	On-campus Student
1	HBU (Home Based University)	Off-1	On-2
2	HBO (Home Based Other)	Off-2	On-1
3	UBNH (University Based Non-home)	Off-3, Off-4	On-3, On-4
4	NHNU (Non-home Non-university)	Off-5	On-5

In the kickoff meeting held on October 11, 2012, NCDOT indicated that university student trips that most affect the surrounding road system were of most interest. Therefore, the university student travel model will focus on modeling “crossing the university boundary” trips and “outside of the university” trips.

## 2. Trip Rate

Table 31 lists the trip rates for off-campus and on-campus students.

Table 31 Survey Results: Trip Rate by Residence Location

Student	NCSU			UNCG		
	Number of Samples	Number of Trips	Weighted Trip Rate	Number of Samples	Number of Trips	Weighted Trip Rate
Off-campus	192	976	5.28	295	1,478	4.95
On-campus	144	1,002	7.07	88	544	6.18
Total	336	1,978	5.80	383	2,022	5.26
Student	ASU			FSU		
	Number of Samples	Number of Trips	Weighted Trip Rate	Number of Samples	Number of Trips	Weighted Trip Rate
Off-campus	183	976	5.31	188	909	4.80
On-campus	83	544	6.56	36	165	4.51
Total	266	1,520	5.74	224	1,074	4.72
Student	UNCW			UNCC		
	Number of Samples	Number of Trips	Weighted Trip Rate	Number of Samples	Number of Trips	Weighted Trip Rate
Off-campus	562	2,926	5.28	1,122	5,112	4.62
On-campus	276	1,659	6.01	228	1,136	4.99
Total	838	4,585	5.53	1,350	6,248	4.70

Table 31 shows that on-campus students make more trips than off-campus students (except FSU, which is probably because of the small sample size). These trip rates are compared to the trip rates collected by other surveys, and the results are listed in Table 32 and plotted in Figure 5.

Table 32 Comparison of Trip Rates

University	Year	Abbreviation	Off-Campus Student Trip Rate	On-Campus Student Trip Rate	All Student Trip Rate
North Carolina State University	2001	NCSU-2001	5.69	7.46	6.35
Old Dominion University	2009	ODU-2009	4.42	5.25	4.59
Virginia Commonwealth University	2009	VCU-2009	4.66	6.20	4.85
University of Virginia	2009	UVA-2009	4.38	5.82	4.87
Virginia Tech	2009	VT-2009	4.28	4.83	4.41
Old Dominion University	2010	ODU-2010	5.00	6.20	5.30
Virginia Tech	2010	VT-2010	5.20	6.70	5.60
North Carolina State University	2013	NCSU-2013	5.28	7.07	5.80
University of North Carolina - Greensboro	2013	UNCG-2013	4.95	6.18	5.26
Appalachian State University	2014	ASU-2014	5.31	6.56	5.74
Fayetteville State University	2014	FSU-2014	4.80	4.51	4.72
University of North Carolina - Wilmington	2014	UNCW-2014	5.28	6.01	5.53
University of North Carolina - Charlotte	2014	UNCC-2014	4.62	4.99	4.70

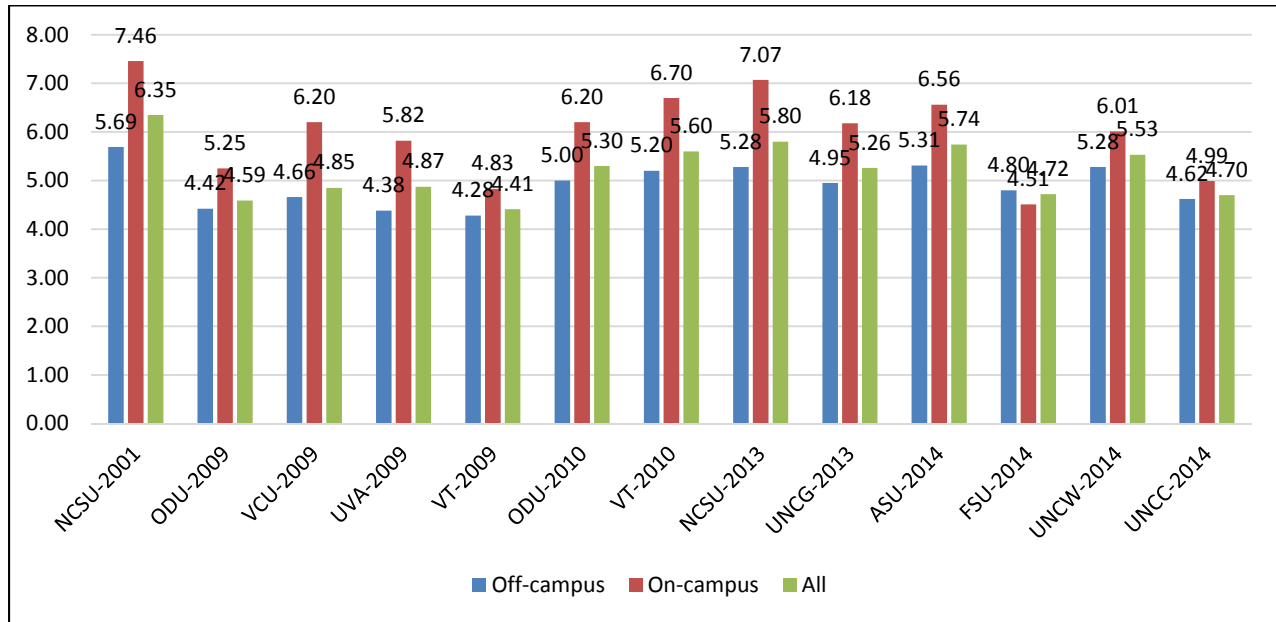


Figure 5 Comparison of Trip Rates

Not all trip rates collected in the literature review are used in the comparison, because some surveys did not collect all trips made by students. For example, the Indiana University – Bloomington survey conducted in 1998 only collected inter-zonal trips, and the Arizona State University survey conducted in 2007 only collected trips to and from the campus.

Table 32 and Figure 5 show that based on the six surveys in the NCDOT project, the range of trip rate for off-campus students is 4.62 to 5.31, which is within the range collected from other surveys (4.28 to 5.69). It is the same for the trip rate for on-campus students (4.99 to 7.07 from the NCDOT project vs. 4.83 to 7.46 from other surveys) if the FSU-2014 results are excluded. Only 36 on-campus student samples are collected in the FSU-2014 survey, and they account for 2% of the on-campus students. The small sample size leads to a less robust average trip rate.

The trip rates are also summarized by residence location and trip type, which are shown in Table 33.

Table 33 Survey Results: Trip Rate by Residence Location and Trip Type

Student	Trip Type	NCSU		UNCG	
		Number of Trips	Weighted Trip Rate	Number of Trips	Weighted Trip Rate
Off-campus	Off-1	341	1.83	391	1.27
	Off-2	222	1.20	465	1.60
	Off-3	134	0.74	203	0.68
	Off-4	198	1.13	192	0.63
	Off-5	81	0.38	227	0.75
	Total	976	5.28	1,478	4.95
On-campus	On-1	67	0.44	62	0.70
	On-2	392	2.75	205	2.33
	On-3	62	0.40	56	0.64
	On-4	448	3.25	182	2.07
	On-5	33	0.24	39	0.44
	Total	1,002	7.07	544	6.18
Student	Trip Type	ASU		FSU	
		Number of Trips	Weighted Trip Rate	Number of Trips	Weighted Trip Rate
Off-campus	Off-1	327	1.89	216	1.06
	Off-2	246	1.31	314	1.74
	Off-3	146	0.74	153	0.78
	Off-4	153	0.84	66	0.35
	Off-5	104	0.54	160	0.87
	Total	976	5.31	909	4.80
On-campus	On-1	165	1.99	17	0.46
	On-2	119	1.44	61	1.67
	On-3	32	0.39	21	0.57
	On-4	211	2.54	57	1.56
	On-5	17	0.21	9	0.25
	Total	544	6.56	165	4.51
Student	Trip Type	UNCW		UNCC	
		Number of Trips	Weighted Trip Rate	Number of Trips	Weighted Trip Rate
Off-campus	Off-1	216	1.65	1,534	1.39
	Off-2	314	1.59	1,612	1.45
	Off-3	153	0.61	678	0.61
	Off-4	66	0.82	642	0.60
	Off-5	160	0.61	646	0.58
	Total	909	5.28	5,112	4.62
On-campus	On-1	17	0.78	170	0.73
	On-2	61	2.70	471	2.08
	On-3	21	0.40	67	0.29
	On-4	57	1.89	369	1.64
	On-5	9	0.24	59	0.25
	Total	165	6.01	1,136	4.99

Table 33 shows that the top two trip types (in terms of trip rate) for off-campus students are Off-1 (between home and on-campus activity) and Off-2 (between home and off-campus activity). The top two trip types for on-campus students are On-2 (between home and on-campus activity) and On-4 (between on-campus activity and another on-campus activity).

Table 34 shows the trip rate by residence location and trip classification. It is obvious from Table 34 that most of the trips made by on-campus students are within the university. On the contrary, within the university trips only account for a small portion of total trips made by off-campus students. Therefore, off-campus students impose more impacts on the surrounding road system. Off-campus students make more trips crossing the university boundary than on-campus students. The trip rate varies from 1.84 to 2.63 for off-campus students and from 0.84 to 1.34 for on-campus students (except that it is 2.38 for ASU). Off-campus students also make much more trips outside of the university than on-campus students. The trip rate varies from 1.57 to 2.61 for off-campus students and from 0.21 to 0.44 for on-campus students.

Table 34 Survey Results: Trip Rate by Residence Location and Trip Classification

Student	Trip Classification	NCSU		UNCG	
		Number of Trips	Weighted Trip Rate	Number of Trips	Weighted Trip Rate
Off-campus	Crossing the university boundary	475	2.57	594	1.96
	Within the university	198	1.13	192	0.63
	Outside of the university	303	1.57	692	2.35
	Total	976	5.28	1,478	4.95
On-campus	Crossing the university boundary	129	0.84	118	1.34
	Within the university	840	5.99	387	4.40
	Outside of the university	33	0.24	39	0.44
	Total	1,002	7.07	544	6.18
Student	Trip Classification	ASU		FSU	
		Number of Trips	Weighted Trip Rate	Number of Trips	Weighted Trip Rate
Off-campus	Crossing the university boundary	473	2.63	369	1.84
	Within the university	153	0.84	66	0.35
	Outside of the university	350	1.84	474	2.61
	Total	976	5.31	909	4.80
On-campus	Crossing the university boundary	197	2.38	38	1.04
	Within the university	330	3.97	118	3.23
	Outside of the university	17	0.21	9	0.25
	Total	544	6.56	165	4.51
Student	Trip Classification	UNCW		UNCC	
		Number of Trips	Weighted Trip Rate	Number of Trips	Weighted Trip Rate
Off-campus	Crossing the university boundary	1,255	2.27	2,212	2.00
	Within the university	447	0.82	642	0.60
	Outside of the university	1,224	2.19	2,258	2.03
	Total	2,926	5.28	5,112	4.62
On-campus	Crossing the university boundary	326	1.18	237	1.02
	Within the university	1,266	4.59	840	3.73
	Outside of the university	67	0.24	59	0.25
	Total	1,659	6.01	1,136	4.99

Table 35 shows the trip rate by residence location and trip purpose. The NHNU trips made by off-campus students, and the NHNU and HBO trips made by on-campus students seem to have low trip rates.

Table 35 Survey Results: Trip Rate by Residence Location and Trip Purpose

Student	Trip Purpose	NCSU		UNCG	
		Number of Trips	Weighted Trip Rate	Number of Trips	Weighted Trip Rate
Off-campus	HBU	341	1.83	391	1.27
	HBO	222	1.20	465	1.60
	UBNH	332	1.87	395	1.32
	NHNU	81	0.38	227	0.75
	Total	976	5.28	1,478	4.95
On-campus	HBU	392	2.75	205	2.33
	HBO	67	0.44	62	0.70
	UBNH	510	3.65	238	2.70
	NHNU	33	0.24	39	0.44
	Total	1,002	7.07	544	6.18
Student	Trip Purpose	ASU		FSU	
		Number of Trips	Weighted Trip Rate	Number of Trips	Weighted Trip Rate
Off-campus	HBU	327	1.89	216	1.06
	HBO	246	1.31	314	1.74
	UBNH	299	1.58	219	1.12
	NHNU	104	0.54	160	0.87
	Total	976	5.31	909	4.80
On-campus	HBU	119	1.44	61	1.67
	HBO	165	1.99	17	0.46
	UBNH	243	2.92	78	2.13
	NHNU	17	0.21	9	0.25
	Total	544	6.56	165	4.51
Student	Trip Purpose	UNCW		UNCC	
		Number of Trips	Weighted Trip Rate	Number of Trips	Weighted Trip Rate
Off-campus	HBU	909	1.65	1,534	1.39
	HBO	891	1.59	1,612	1.45
	UBNH	793	1.43	1,320	1.20
	NHNU	333	0.61	646	0.58
	Total	2,926	5.28	5,112	4.62
On-campus	HBU	746	2.70	471	2.08
	HBO	215	0.78	170	0.73
	UBNH	631	2.29	436	1.93
	NHNU	67	0.24	59	0.25
	Total	1,659	6.01	1,136	4.99

### 3. Trip Distribution

The highway network distance, instead of straight line distance, is used to summarize the characteristics of trip distribution since it represents the actual trip distance better. To obtain the highway network

distance, six travel demand models were collected from each of the regions in which the surveyed universities are located. The TAZ files in the travel demand models are then used to determine to which TAZ a trip end belongs according to the trip ends coordinate. The highway network distance is then the distance from the start trip end's TAZ to the end trip end's TAZ. The distance between a pair of TAZs is from the skim matrices that are created based on the highway network and traffic assignment results provided by the travel demand models.

Table 36 lists the average trip distances for off-campus and on-campus students. It shows that in general off-campus students travel farther than on-campus students. The average trip distance varies from 2.08 miles to 7.41 miles for off-campus students across the six universities, and it is from 0.62 miles to 2.59 miles for on-campus students.

Due to the differences in the land use around campus and the differences in the campus size, the average trip distances for the six surveyed universities are quite different. ASU has the shortest average trip distance at 0.62 miles for on-campus students and 2.08 miles for off-campus students. On the contrary, UNCC has the longest average trip distance at 2.47 miles and 7.41 miles for on-campus and off-campus students, respectively.

**Table 36 Survey Results: Average Trip Distance by Residence Location**

Student	NCSU			UNCG		
	Number of Samples	Number of Trips	Weighted Trip Distance (mile)	Number of Samples	Number of Trips	Weighted Trip Distance (mile)
Off-campus	192	976	4.51	295	1,478	5.68
On-campus	144	1,002	1.12	88	544	1.89
Total	336	1,978	3.30	383	2,022	4.57
Student	ASU			FSU		
	Number of Samples	Number of Trips	Weighted Trip Distance (mile)	Number of Samples	Number of Trips	Weighted Trip Distance (mile)
Off-campus	183	976	2.08	188	909	7.20
On-campus	83	544	0.62	36	165	2.59
Total	266	1,520	1.50	224	1,074	5.92
Student	UNCW			UNCC		
	Number of Samples	Number of Trips	Weighted Trip Distance (mile)	Number of Samples	Number of Trips	Weighted Trip Distance (mile)
Off-campus	562	2,926	3.83	1122	5,112	7.41
On-campus	276	1,659	1.26	228	1,136	2.47
Total	838	4,585	2.87	1,350	6,248	6.37

Table 37 lists the weighted average trip distance by residence location and trip type. It provides many details, but is not easy to read. Table 38 and Table 39 aggregate the trip types, and reveal the trends clearly.

Table 37 Survey Results: Average Trip Distance by Residence Location and Trip Type

Student	Trip Type	NCSU		UNCG	
		Number of Trips	Weighted Trip Distance (mile)	Number of Trips	Weighted Trip Distance (mile)
Off-campus	Off-1	341	5.21	391	7.22
	Off-2	222	7.01	465	6.24
	Off-3	134	4.95	203	5.70
	Off-4	198	0.73	192	0.45
	Off-5	81	3.69	227	6.26
	Total	976	4.51	1,481	5.68
On-campus	On-1	67	4.18	62	5.40
	On-2	392	0.74	205	0.45
	On-3	62	2.96	56	5.69
	On-4	448	0.60	182	0.46
	On-5	33	4.03	39	5.11
	Total	1,002	1.12	544	1.89
Student	Trip Type	ASU		FSU	
		Number of Trips	Weighted Trip Distance (mile)	Number of Trips	Weighted Trip Distance (mile)
Off-campus	Off-1	327	2.23	216	11.59
	Off-2	246	3.03	314	6.94
	Off-3	146	2.31	153	7.46
	Off-4	153	0.25	66	0.83
	Off-5	104	1.81	160	4.65
	Total	976	2.08	909	7.20
On-campus	On-1	165	1.00	17	6.78
	On-2	119	0.26	61	0.78
	On-3	32	1.82	21	8.65
	On-4	211	0.25	57	0.72
	On-5	17	1.59	9	4.59
	Total	544	0.62	165	2.59
Student	Trip Type	UNCW		UNCC	
		Number of Trips	Weighted Trip Distance (mile)	Number of Trips	Weighted Trip Distance (mile)
Off-campus	Off-1	909	4.17	1,534	9.30
	Off-2	891	4.94	1,612	8.03
	Off-3	346	4.42	678	8.49
	Off-4	447	0.44	642	0.66
	Off-5	333	3.96	646	7.18
	Total	2,926	3.83	5,112	7.41
On-campus	On-1	215	3.36	170	8.05
	On-2	746	0.60	471	0.72
	On-3	111	3.62	67	7.21
	On-4	520	0.47	369	0.70
	On-5	67	4.23	59	6.81
	Total	1,659	1.26	1,136	2.47

Table 38 summarizes the average trip distance by residence location and trip classification. It shows that the average trip distances for trips outside of the university are close to trips crossing the university boundary, and they are both much longer than the trips within the university, which is controlled by the campus size.

**Table 38 Survey Results: Average Trip Distance by Residence Location and Trip Classification**

Student	Trip Classification	NCSU		UNCG	
		Number of Trips	Weighted Trip Dist.	Number of Trips	Weighted Trip Dist.
Off-campus	Crossing the university boundary	475	5.14	594	6.69
	Within the university	198	0.73	192	0.45
	Outside of the university	303	6.22	692	6.25
	Total	976	4.51	1,481	5.68
On-campus	Crossing the university boundary	129	3.60	118	5.54
	Within the university	840	0.66	387	0.46
	Outside of the university	33	4.03	39	5.11
	Total	1,002	1.12	544	1.89
Student	Trip Classification	ASU		FSU	
		Number of Trips	Weighted Trip Dist.	Number of Trips	Weighted Trip Dist.
Off-campus	Crossing the university boundary	473	2.25	369	9.84
	Within the university	153	0.25	66	0.83
	Outside of the university	350	2.67	474	6.18
	Total	976	2.08	909	7.20
On-campus	Crossing the university boundary	197	1.14	38	7.81
	Within the university	330	0.25	118	0.75
	Outside of the university	17	1.59	9	4.59
	Total	544	0.62	165	2.59
Student	Trip Classification	UNCW		UNCC	
		Number of Trips	Weighted Trip Dist.	Number of Trips	Weighted Trip Dist.
Off-campus	Crossing the university boundary	1,255	4.24	2,212	9.05
	Within the university	447	0.44	642	0.66
	Outside of the university	1,224	4.67	2,258	7.78
	Total	2,926	3.83	5,112	7.41
On-campus	Crossing the university boundary	326	3.45	237	7.81
	Within the university	1,266	0.55	840	0.71
	Outside of the university	67	4.23	59	6.81
	Total	1,659	1.26	1,136	2.47

Table 39 summarizes the average trip distance by residence location and trip purpose. It shows that off-campus students usually travel much farther than the on-campus students for HBU trips, farther for UBNH and HBO trips, and about the same for NHNU trips.

Table 39 Survey Results: Average Trip Distance by Residence Location and Trip Purpose

Student	Trip Purpose	NCSU		UNCG	
		Number of Trips	Weighted Trip Distance (mile)	Number of Trips	Weighted Trip Distance (mile)
Off-campus	HBU	341	5.21	391	7.22
	HBO	222	7.01	465	6.24
	UBNH	332	2.39	395	3.18
	NHNU	81	3.69	227	6.26
	Total	976	4.51	1,481	5.68
On-campus	HBU	392	0.74	205	0.45
	HBO	67	4.18	62	5.40
	UBNH	510	0.86	238	1.69
	NHNU	33	4.03	39	5.11
	Total	1,002	1.12	544	1.89
Student	Trip Purpose	ASU		FSU	
		Number of Trips	Weighted Trip Distance (mile)	Number of Trips	Weighted Trip Distance (mile)
Off-campus	HBU	327	2.23	216	11.59
	HBO	246	3.03	314	6.94
	UBNH	299	1.22	219	5.43
	NHNU	104	1.81	160	4.65
	Total	976	2.08	909	7.20
On-campus	HBU	119	0.26	61	0.78
	HBO	165	1.00	17	6.78
	UBNH	243	0.46	78	2.85
	NHNU	17	1.59	9	4.59
	Total	544	0.62	165	2.59
Student	Trip Purpose	UNCW		UNCC	
		Number of Trips	Weighted Trip Distance (mile)	Number of Trips	Weighted Trip Distance (mile)
Off-campus	HBU	909	4.17	1,534	9.30
	HBO	891	4.94	1,612	8.03
	UBNH	793	2.14	1,320	4.60
	NHNU	333	3.96	646	7.18
	Total	2,926	3.83	5,112	7.41
On-campus	HBU	746	0.60	471	0.72
	HBO	215	3.36	170	8.05
	UBNH	631	1.02	436	1.69
	NHNU	67	4.23	59	6.81
	Total	1,659	1.26	1,136	2.47

#### 4. Mode Share

Table 40 lists the mode shares for off-campus and on-campus students. The results are also plotted in Figure 6. Please note that trip mode “Other” in Table 40 and Figure 6 includes motorcycles, motorized mopeds and scooters.

**Table 40 Survey Results: Mode Share by Residence Location**

Student	Trip Mode	NCSU		UNCG	
		Number of Trips	Weighted Mode Share	Number of Trips	Weighted Mode Share
Off-campus	Walk	258	26.7%	325	21.7%
	Bicycle	21	1.6%	16	1.0%
	Drive Alone	435	43.7%	705	48.2%
	Shared Ride	100	10.5%	353	24.0%
	Transit	155	16.9%	59	3.9%
	Other	7	0.6%	20	1.2%
	<b>Total</b>	<b>976</b>	<b>100.0%</b>	<b>1,478</b>	<b>100.0%</b>
On-campus	Walk	690	71.2%	425	78.1%
	Bicycle	38	4.0%	3	0.6%
	Drive Alone	66	4.8%	59	10.9%
	Shared Ride	92	8.9%	47	8.7%
	Transit	115	10.9%	9	1.6%
	Other	1	0.1%	1	0.2%
	<b>Total</b>	<b>1,002</b>	<b>100.0%</b>	<b>544</b>	<b>100.0%</b>
Student	Trip Mode	ASU		FSU	
		Number of Trips	Weighted Mode Share	Number of Trips	Weighted Mode Share
Off-campus	Walk	263	27.0%	57	6.3%
	Bicycle	3	0.4%	0	0.0%
	Drive Alone	398	39.1%	704	78.4%
	Shared Ride	161	15.5%	129	13.6%
	Transit	143	17.0%	14	1.2%
	Other	8	1.0%	5	0.5%
	<b>Total</b>	<b>976</b>	<b>100.00%</b>	<b>909</b>	<b>100.0%</b>
On-campus	Walk	433	79.5%	107	64.8%
	Bicycle	0	0.00%	0	0.0%
	Drive Alone	17	3.1%	27	16.4%
	Shared Ride	59	10.9%	24	14.5%
	Transit	35	6.5%	5	3.0%
	Other	0	0.0%	2	1.2%
	<b>Total</b>	<b>544</b>	<b>100.00%</b>	<b>165</b>	<b>100.0%</b>

Student	Trip Mode	UNCW		UNCC	
		Number of Trips	Weighted Mode Share	Number of Trips	Weighted Mode Share
Off-campus	Walk	480	16.9%	831	16.4%
	Bicycle	184	6.4%	113	2.4%
	Drive Alone	1,662	56.0%	3,259	63.6%
	Shared Ride	458	15.4%	748	15.0%
	Transit	128	4.8%	142	2.3%
	Other	14	0.5%	19	0.3%
	<b>Total</b>	<b>2,926</b>	<b>100.0%</b>	<b>5,112</b>	<b>100.0%</b>
On-campus	Walk	913	55.2%	738	65.4%
	Bicycle	258	15.5%	31	2.8%
	Drive Alone	231	13.9%	179	15.7%
	Shared Ride	246	14.8%	142	12.1%
	Transit	11	0.7%	45	3.9%
	Other	0	0.0%	1	0.1%
	<b>Total</b>	<b>1,659</b>	<b>100.0%</b>	<b>1,136</b>	<b>100.0%</b>

Table 40 and Figure 6 show that off-campus students and on-campus students have quite different mode share patterns. The dominant mode for on-campus students is walk, which accounts for 55% to 80% of total trips. However, the share of walk for off-campus students is only 6% to 27%. Drive alone takes the biggest share of the off-campus student trips (varies from 39% to 78%). As a comparison, it only varies from 3% to 16% for on-campus students.

The transit share for off-campus students is in general higher than on-campus students. Among the six universities, NCSU and ASU have relatively higher transit shares, probably because of more transit routes, bigger campus, and/or less on-campus parking spaces.

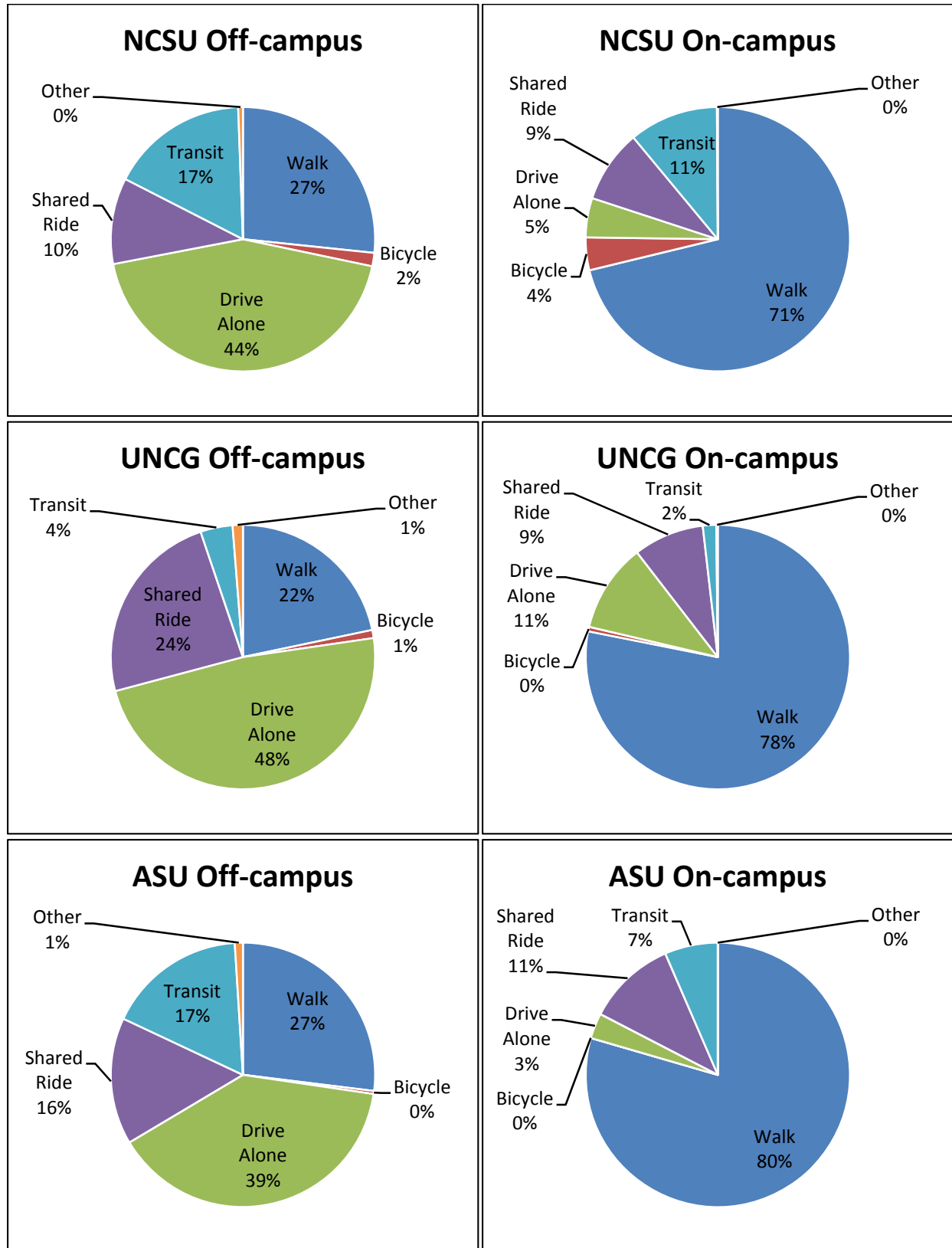


Figure 6 Survey Results: Mode Share by Residence Location (Part I)

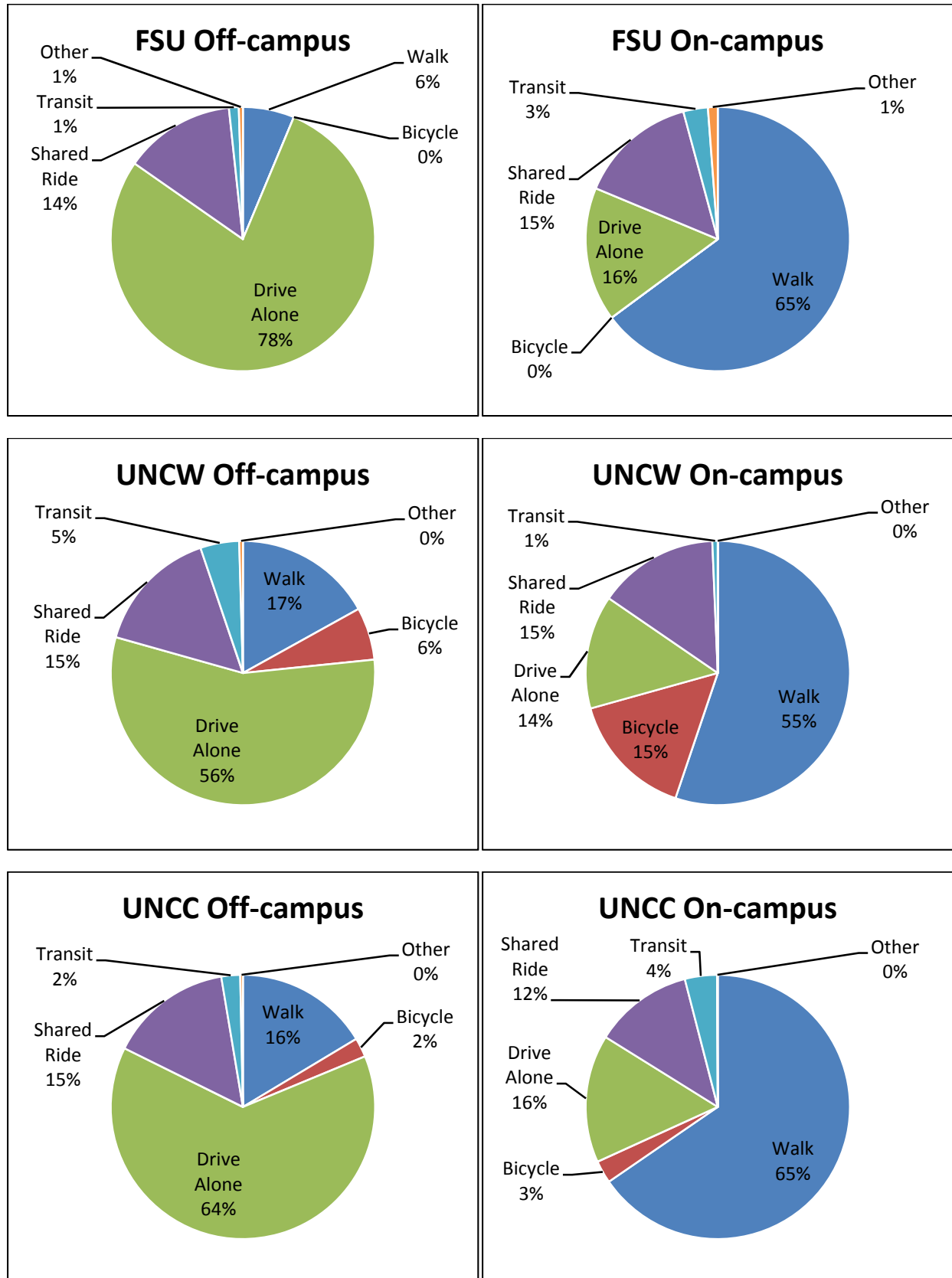


Figure 6 Survey Results: Mode Share by Residence Location (Part II)

Figures 7 to 12 show more details of the mode share for ASU: Figures 7 to 8 show the mode share by trip type, Figures 9 to 10 by trip classification, and Figures 11 to 12 by trip purpose. The same figures for FSU, UNCW, UNCC, NCSU and UNCG were also plotted, and they are attached in Appendix A.

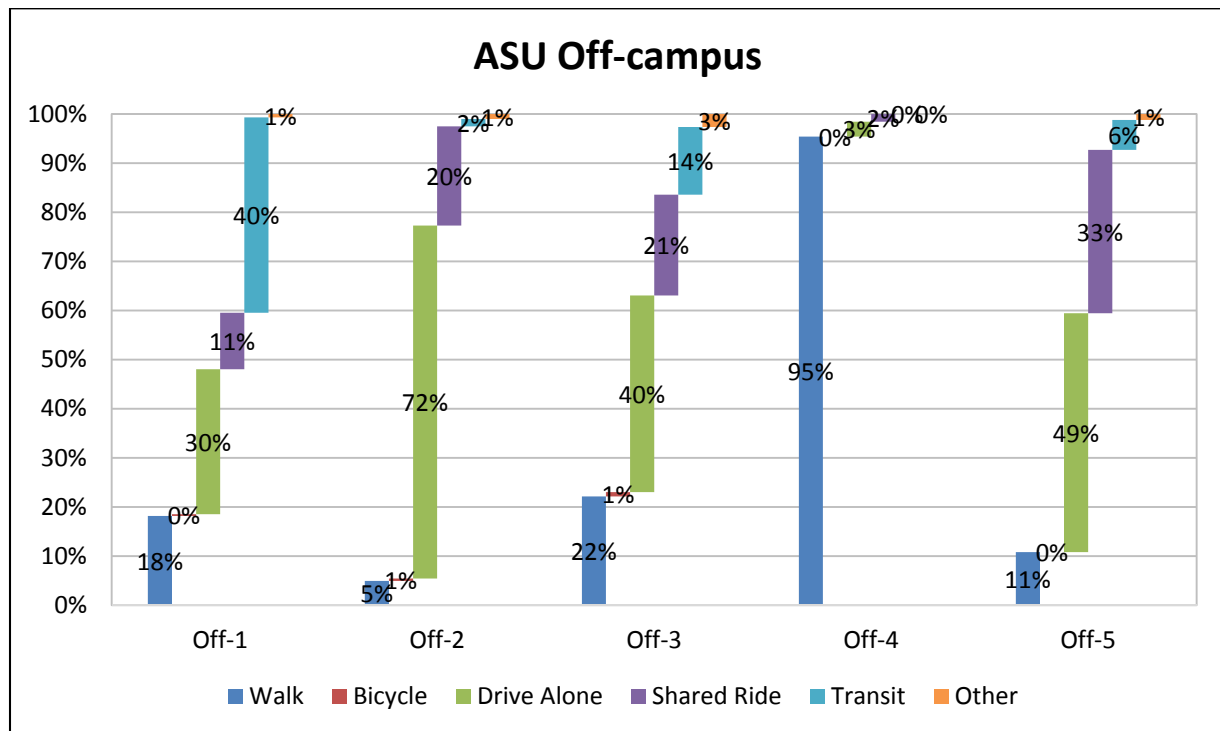


Figure 7 Mode Share by Residence Location and Trip Type: ASU Off-campus

Figure 7 shows the mode shares of ASU off-campus students by trip type. Off-1 trips in Figure 7 are trips made by off-campus students between home and on-campus activity. They have the highest transit share among all five trip types. Their mode shares are relatively similar to those for Off-3, trips between on-campus activity and off-campus activity (Off-3 has the second largest transit share at 14%). Both trip types are classified as “crossing the university boundary” trips, and the aggregated mode share is shown in Figure 9 as “Crossing.” Off-2 are between off-campus home and off-campus activity, and they have much higher auto share (the mode share for drive alone plus shared ride) at 92%, similar to Off-5, which are between off-campus activities. Both trip types are classified as “outside of the university” trips, and the aggregated mode share is shown in Figure 9 as “Outside.” Off-4 trips are trips made by off-campus students between on-campus activities. They are usually short trips (according to Table 37), so walk is the dominant mode (at 95%). Off-4 is classified as “within the university trips” and it is the same as the “Within” in Figure 9.

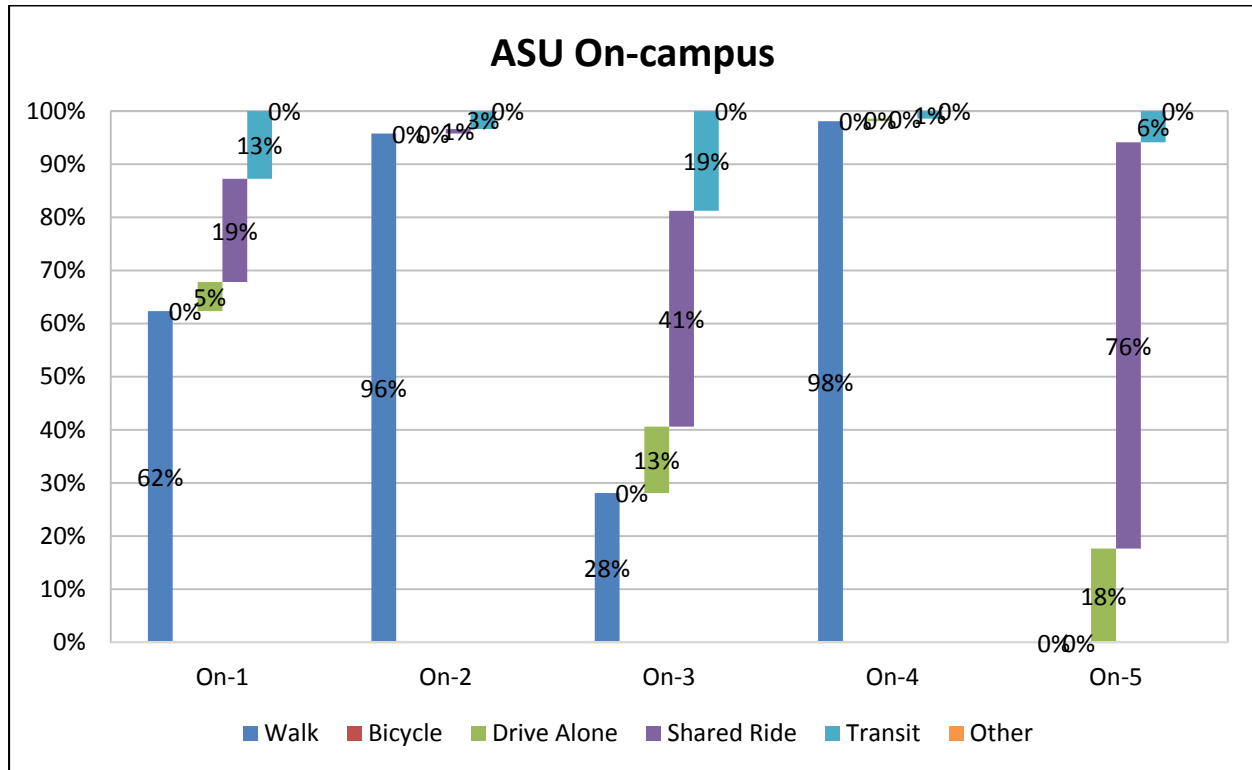


Figure 8 Mode Share by Residence Location and Trip Type: ASU On-campus

Figure 8 shows the mode shares of ASU on-campus students by trip type. On-1 trips in Figure 8 are trips made by on-campus students between home and off-campus activity. Walk takes the biggest share (62%), followed by shared ride (19%) and transit (13%). On the contrary, drive alone only takes 5%. These numbers reflect the low auto ownership by on-campus students (as shown in Table 24). Similar to On-1 trips, On-3 trips (trips between on-campus activity and off-campus activity) cross the university boundary, and the aggregated mode share is shown in Figure 10 as “Crossing.” Both On-2 trips and On-4 trips are trips within the university, and they have walk as the dominant mode. The aggregated mode share for On-2 and On-4 is shown in Figure 10 as “Within.” On-5 trips are trips between off-campus activities. Figure 8 shows that auto (drive alone plus shared ride) is the dominant mode at 94% for On-5 trips.

Figures 7 and 8 show that trips in the same trip classification have similar mode shares, such as Off-2 and Off-5 for off-campus students, and On-2 and On-4 for on-campus students. So Figures 9 and 10 plot the mode shares of ASU students by trip classification. They indicate that trips within the university boundary are mostly made by walk, trips outside of the university are dominated by auto (drive alone plus shared ride), and trips crossing the university boundary are between the other two trip classifications.

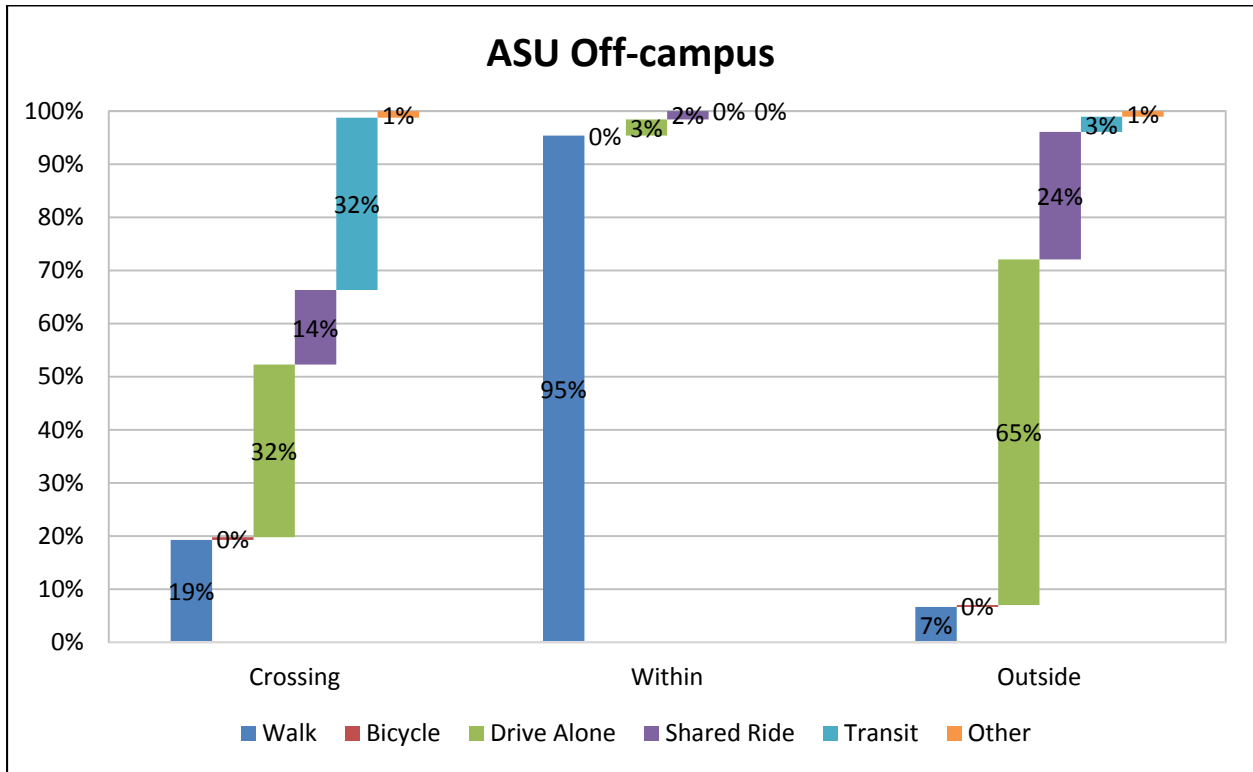


Figure 9 Mode Share by Residence Location and Trip Classification: ASU Off-campus

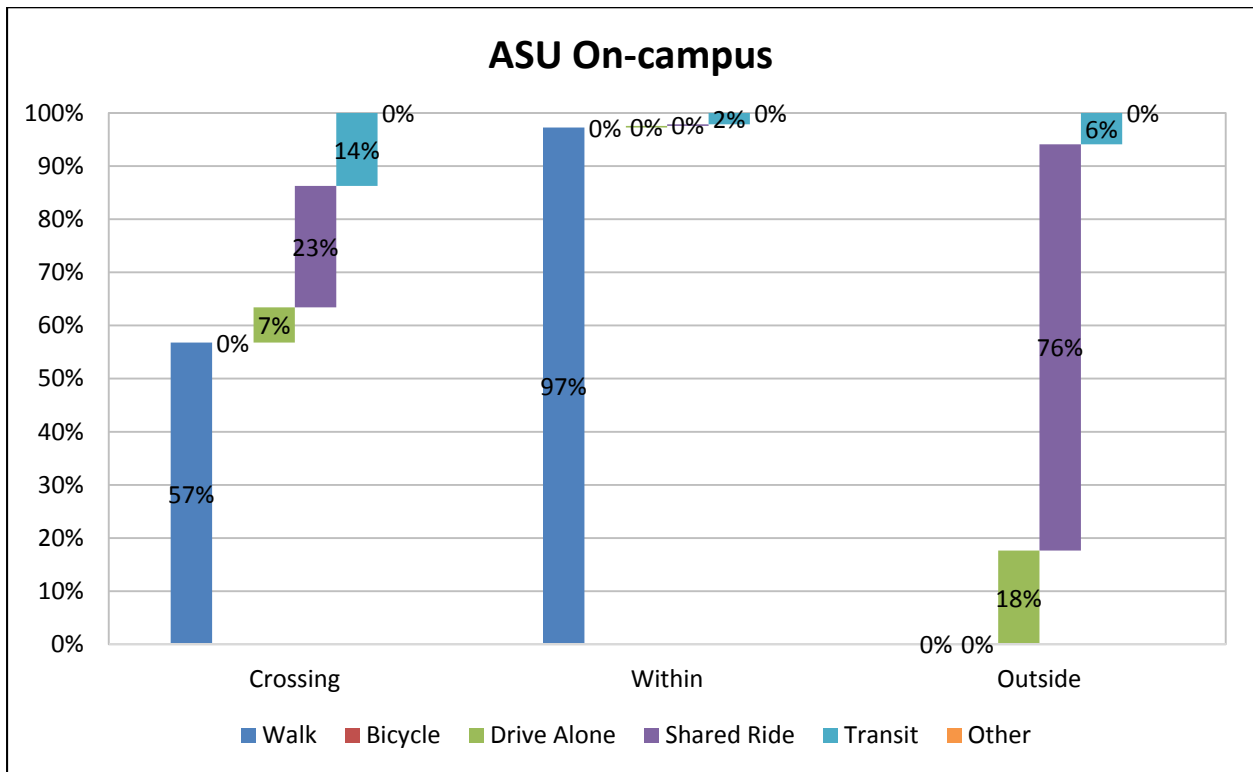


Figure 10 Mode Share by Residence Location and Trip Classification: ASU On-campus

Figure 11 shows the mode shares of ASU off-campus students by trip purpose. Based on Table 30, HBU is Off-1, HBO is Off-2, UBNH is Off-3 and Off-4, and NHNU is Off-5. So UBNH trips include trips within the university and trips crossing the university boundary, and they have walk as the top mode (61%), followed by drive alone (20%) and shared ride (6%).

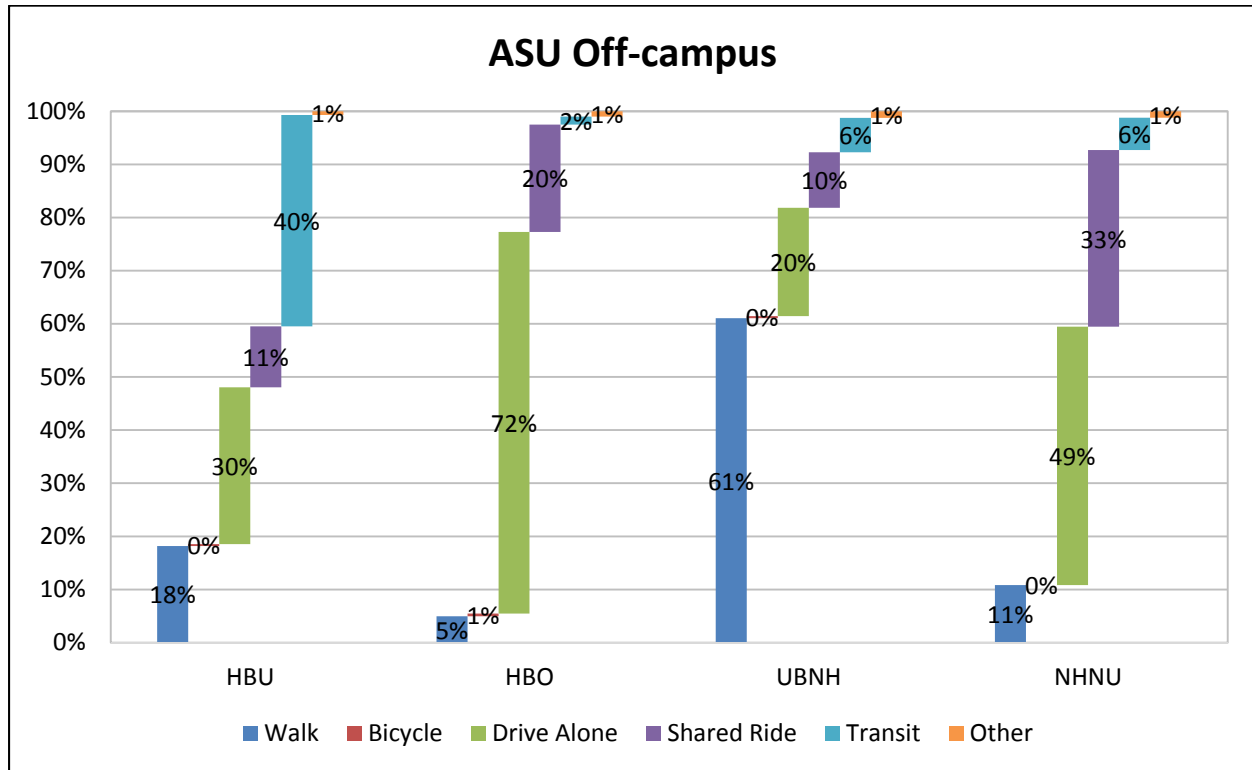


Figure 11 Mode Share by Residence Location and Trip Purpose: ASU Off-campus

Figure 12 shows the mode shares of ASU on-campus students by trip purpose. Based on Table 28, HBU is On-2, HBO is On-1, UBNH is On-3 and On-4, and NHNU is On-5. So UBNH trips include trips within the university and trips crossing the university boundary, and walk is the dominant mode (89%).

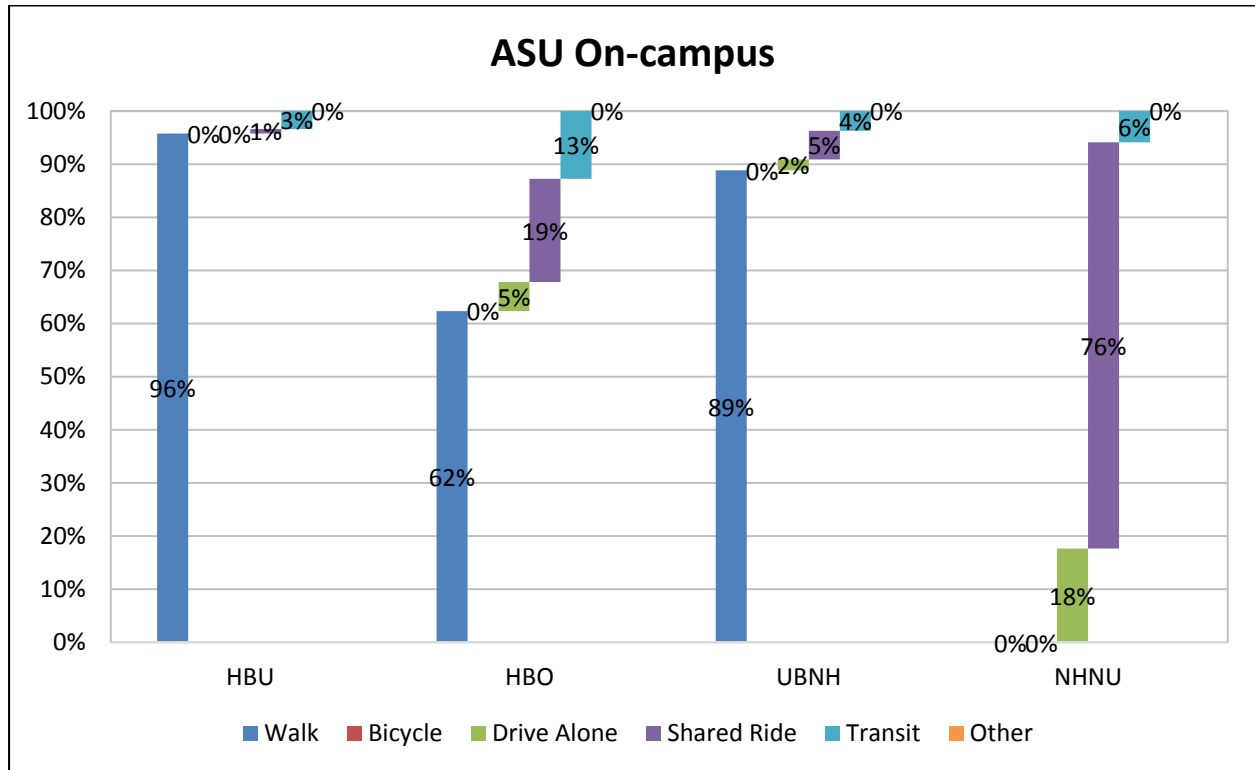


Figure 12 Mode Share by Residence Location and Trip Purpose: ASU On-campus

## Appendix A. Mode Share Plots for FSU, UNCW, UNCC, NCSU and UNCG

Appendix A presents the mode share plots for FSU, UNCW, UNCC, NCSU, and UNCG. They are similar to Figures 7 to 12, which are for ASU.

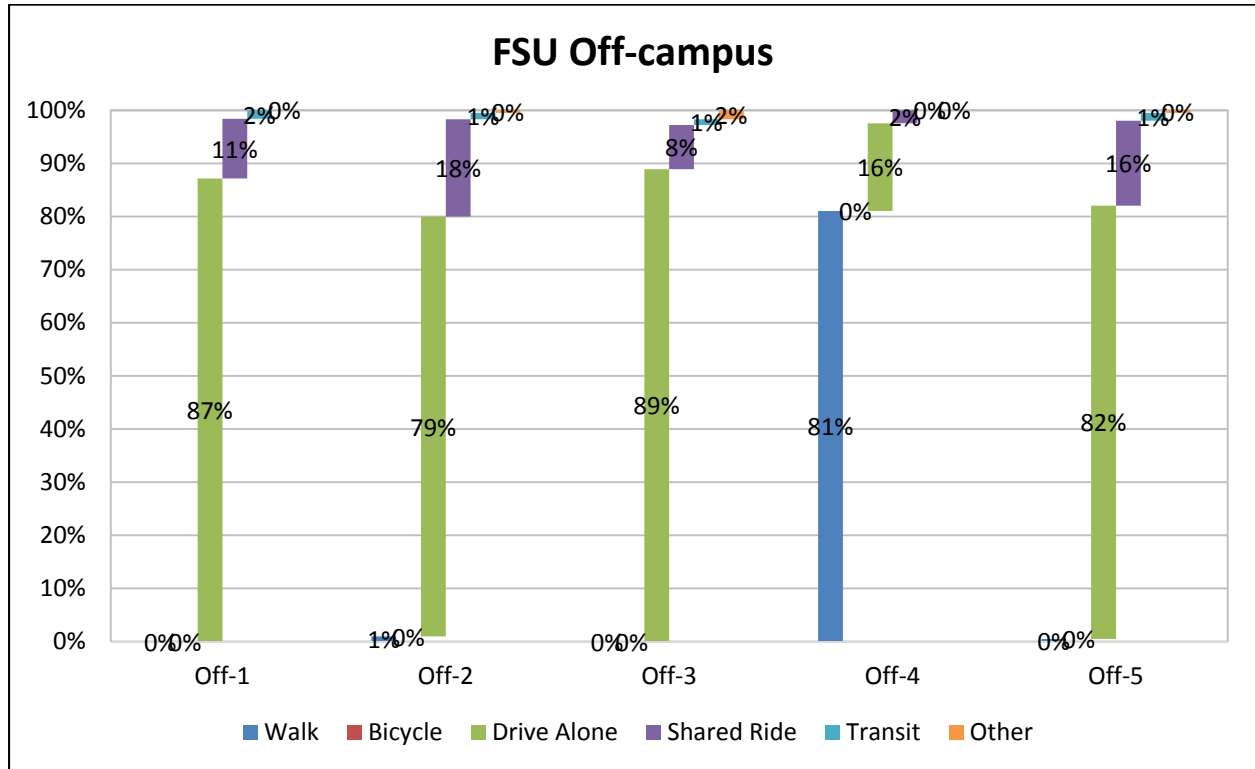


Figure A-1 Mode Share by Residence Location and Trip Type: FSU Off-campus

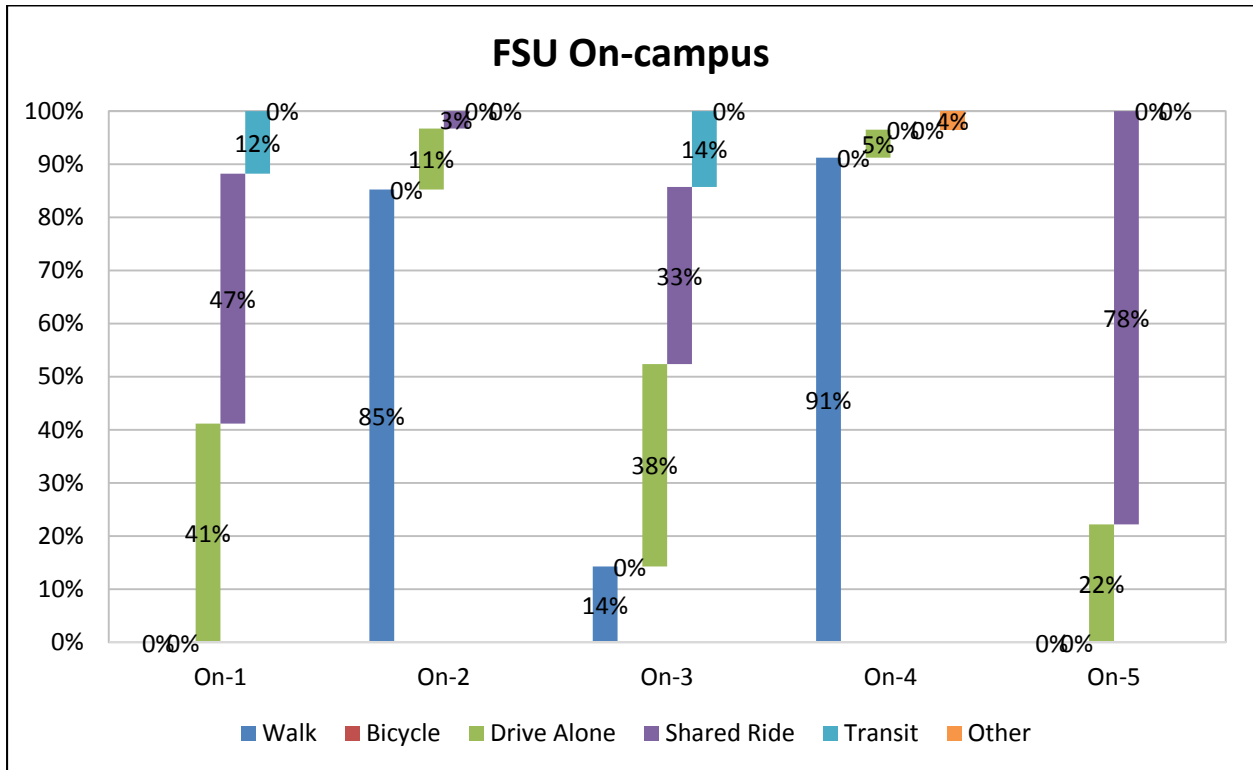


Figure A-2 Mode Share by Residence Location and Trip Type: FSU On-campus

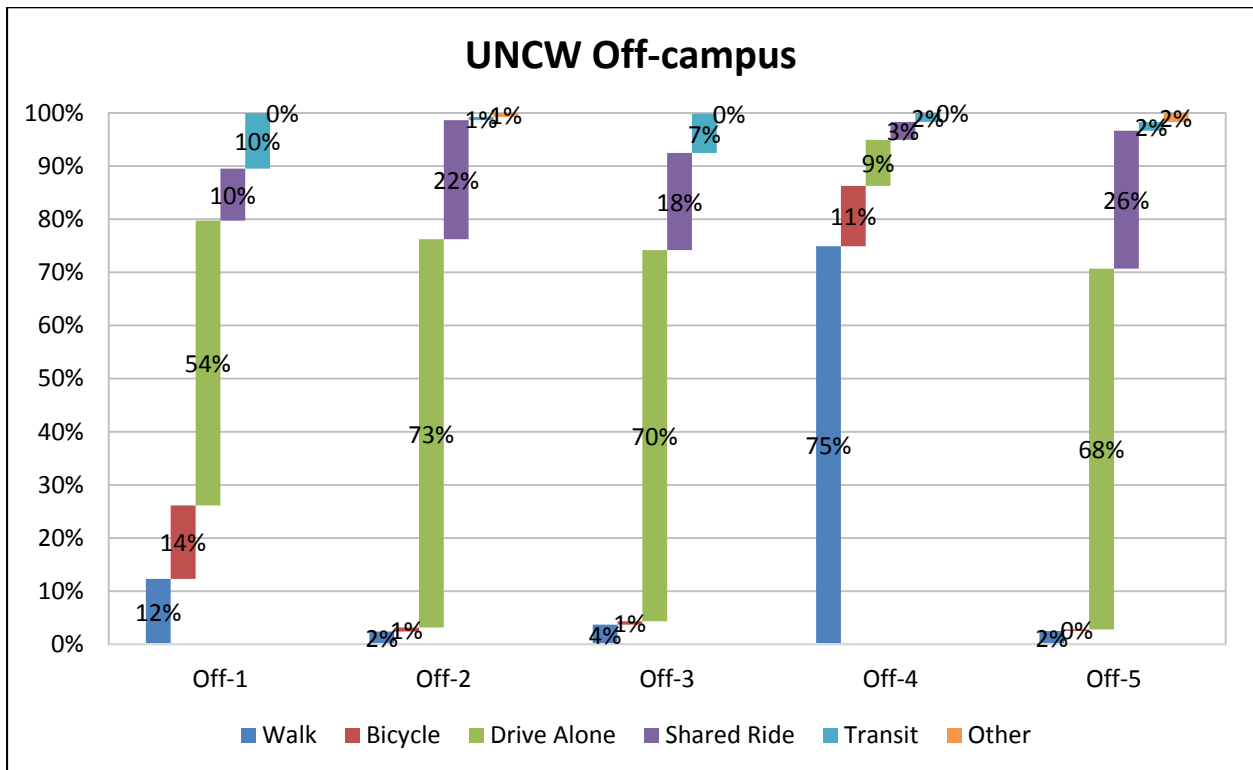


Figure A-3 Mode Share by Residence Location and Trip Type: UNCW Off-campus

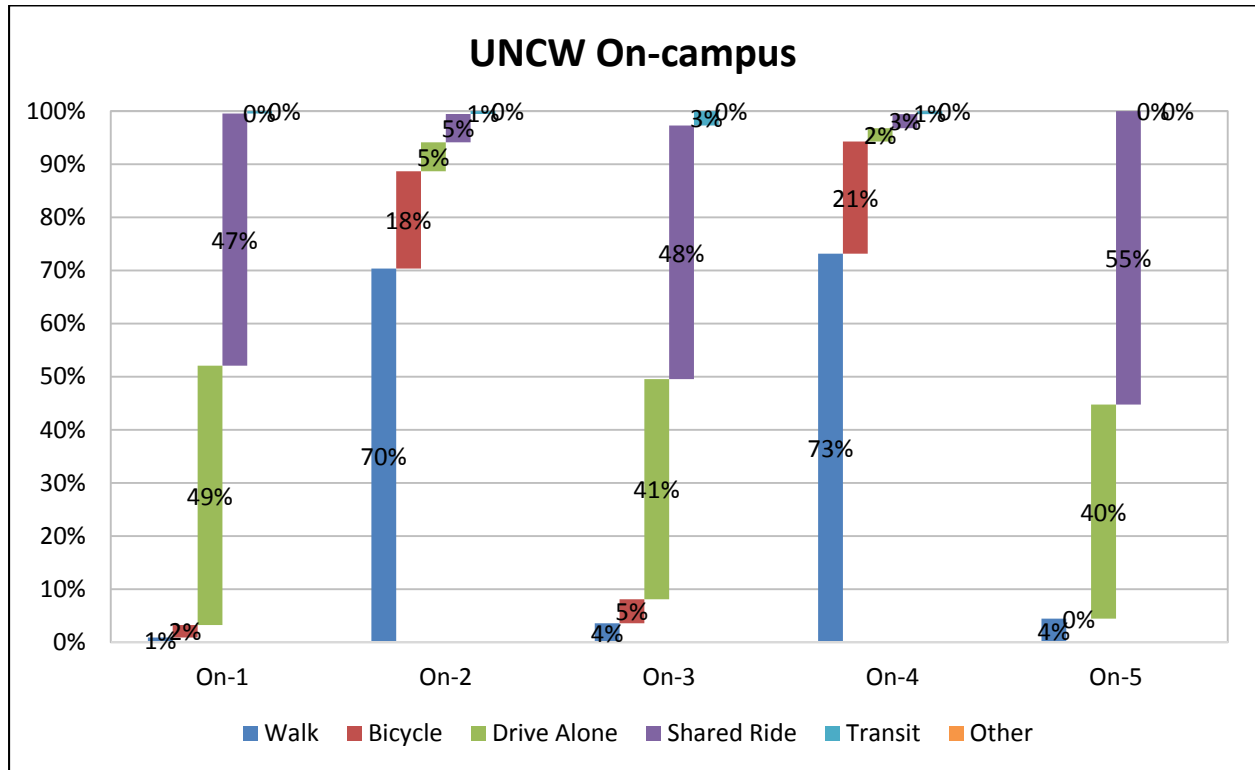


Figure A-4 Mode Share by Residence Location and Trip Type: UNCW On-campus

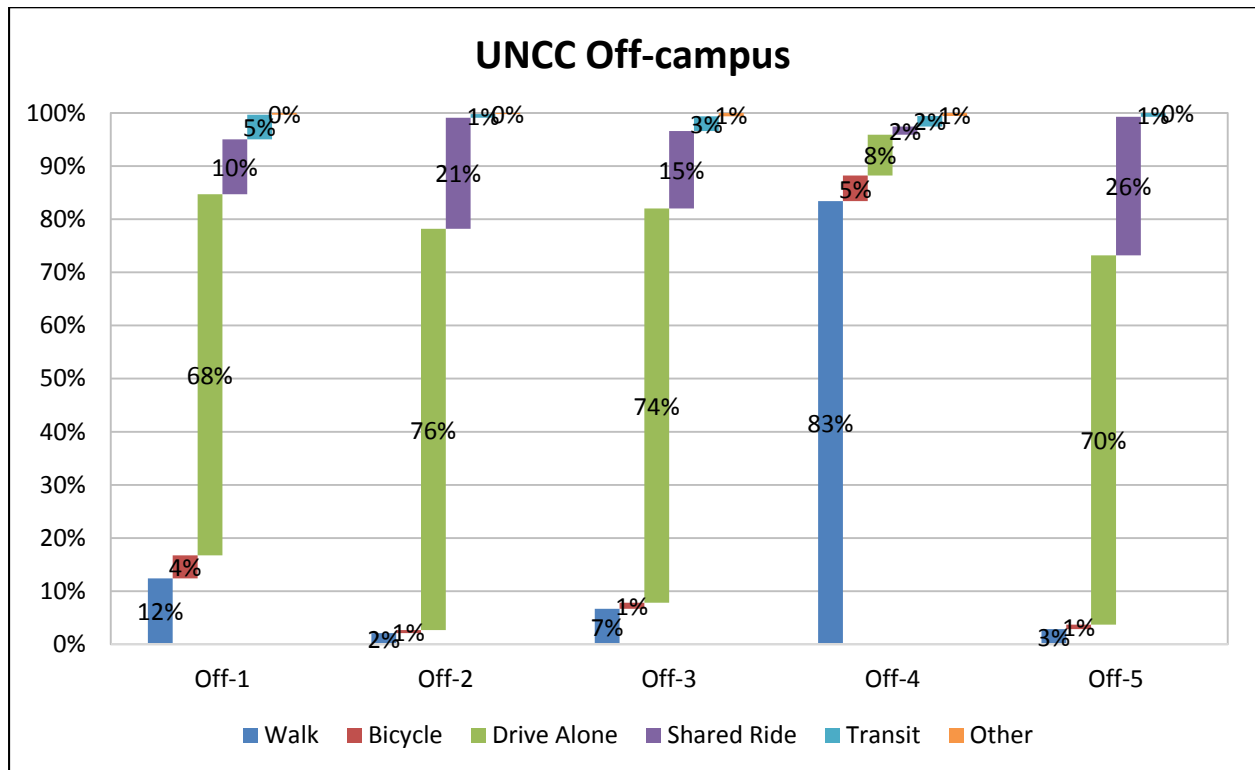


Figure A-5 Mode Share by Residence Location and Trip Type: UNCC Off-campus

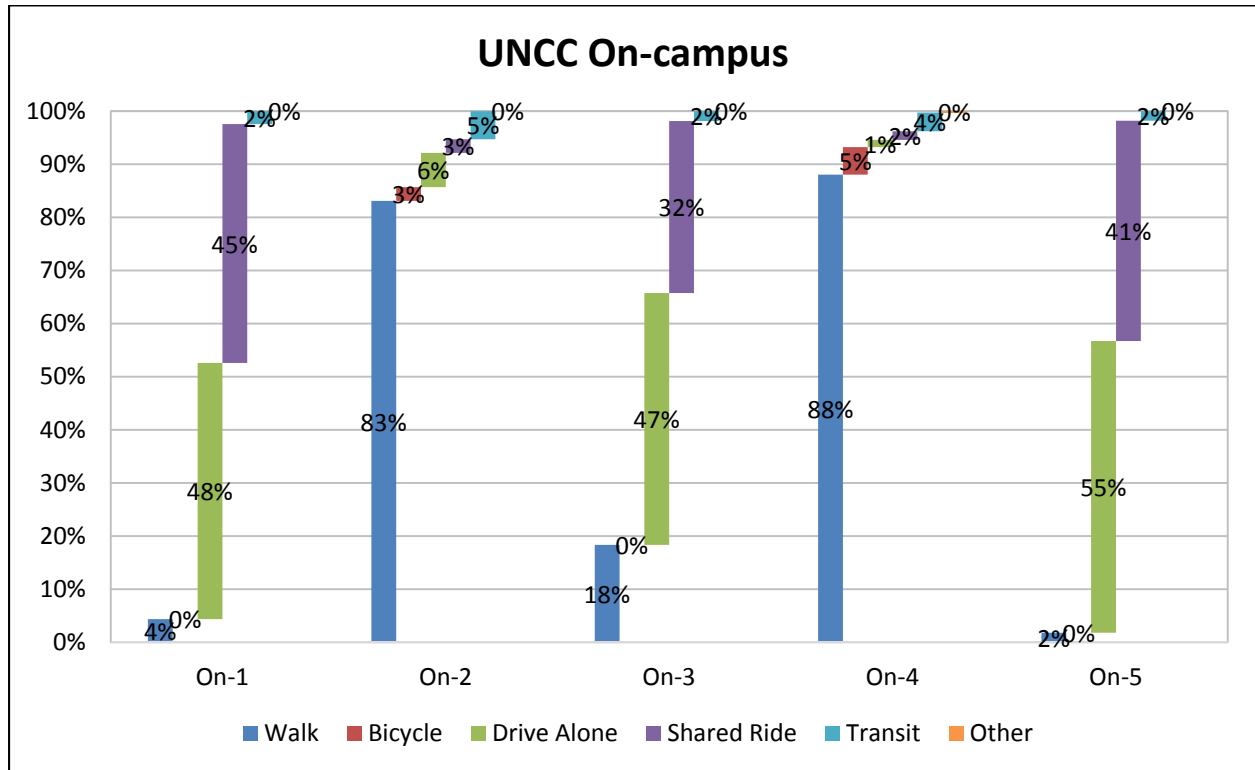


Figure A-6 Mode Share by Residence Location and Trip Type: UNCC On-campus

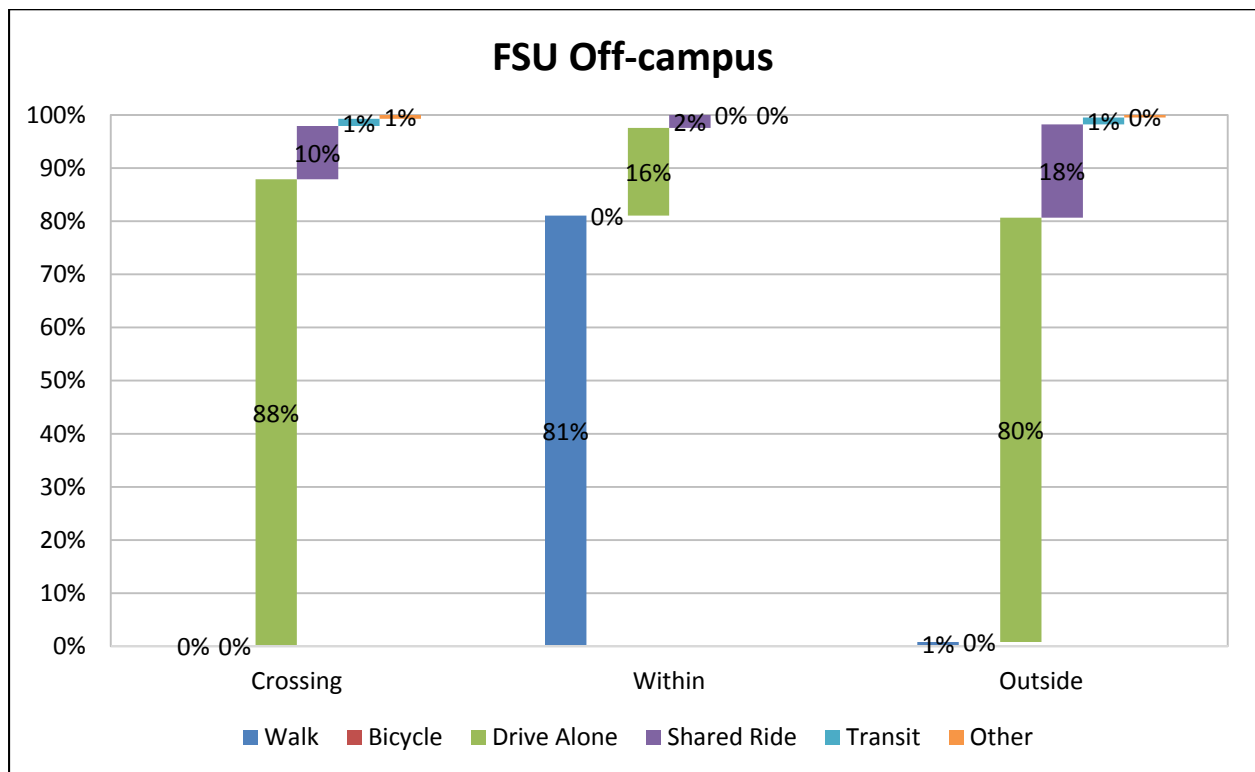


Figure A-7 Mode Share by Residence Location and Trip Classification: FSU Off-campus

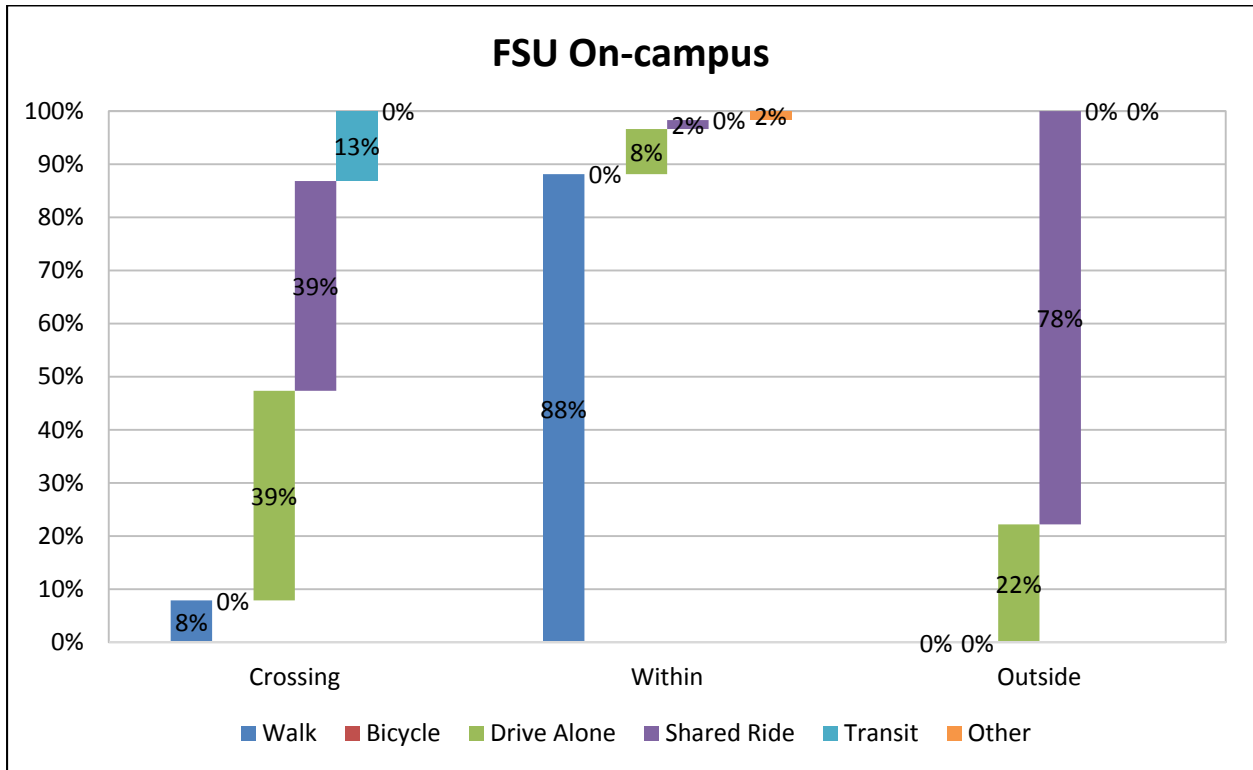


Figure A-8 Mode Share by Residence Location and Trip Classification: ASU On-campus

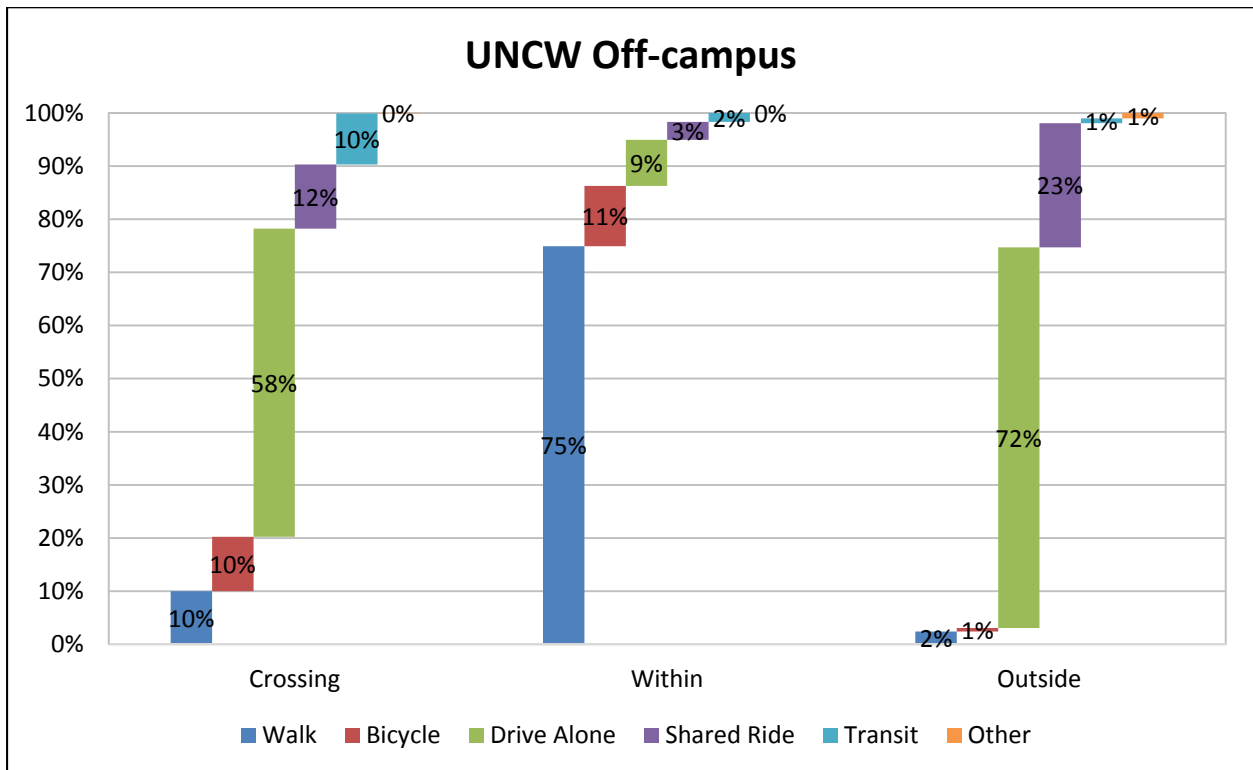


Figure A-9 Mode Share by Residence Location and Trip Classification: UNCW Off-campus

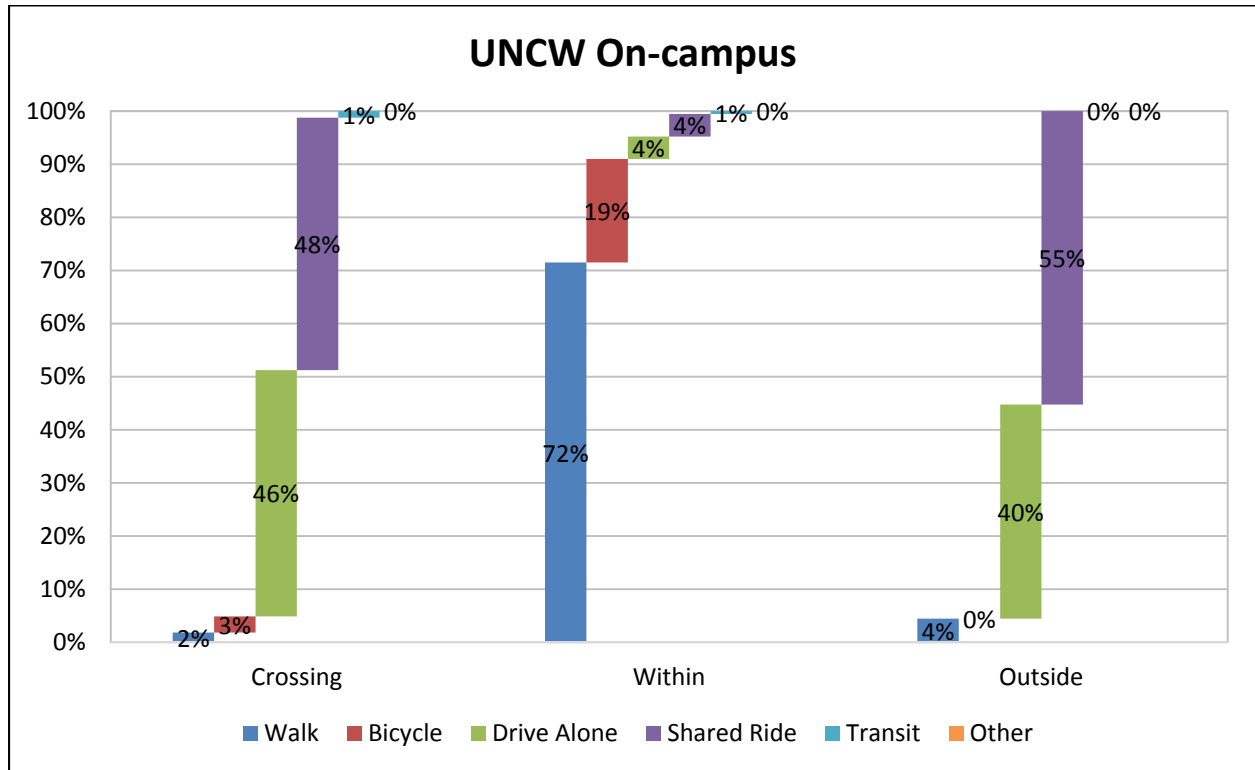


Figure A-10 Mode Share by Residence Location and Trip Classification: UNCW On-campus

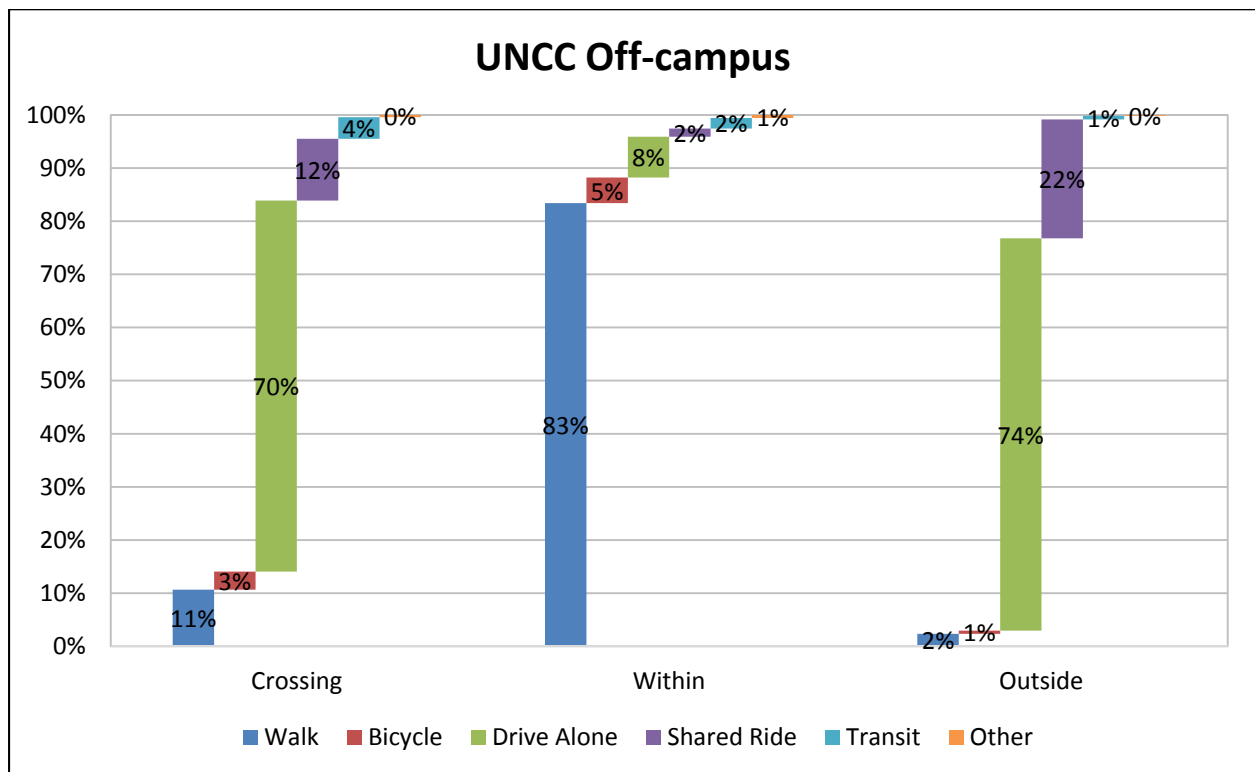


Figure A-11 Mode Share by Residence Location and Trip Classification: UNCC Off-campus

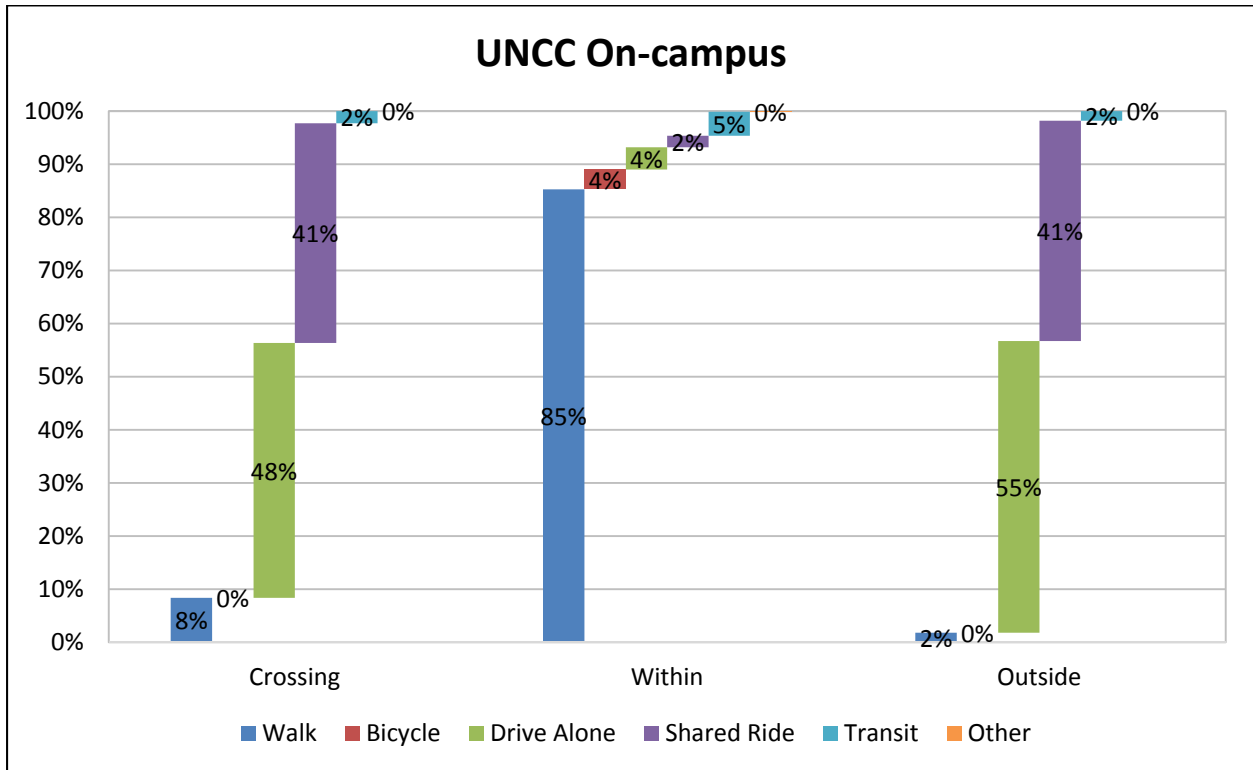


Figure A-12 Mode Share by Residence Location and Trip Classification: UNCC On-campus

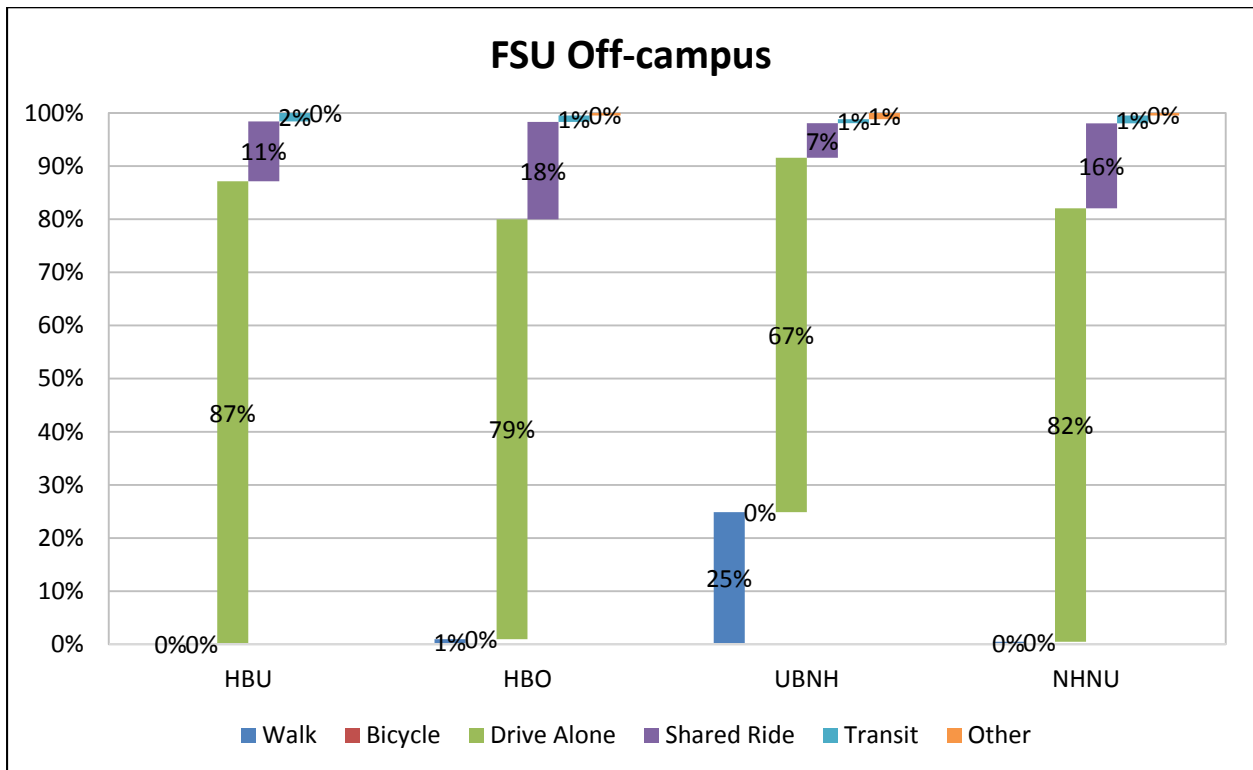


Figure A-13 Mode Share by Residence Location and Trip Purpose: FSU Off-campus

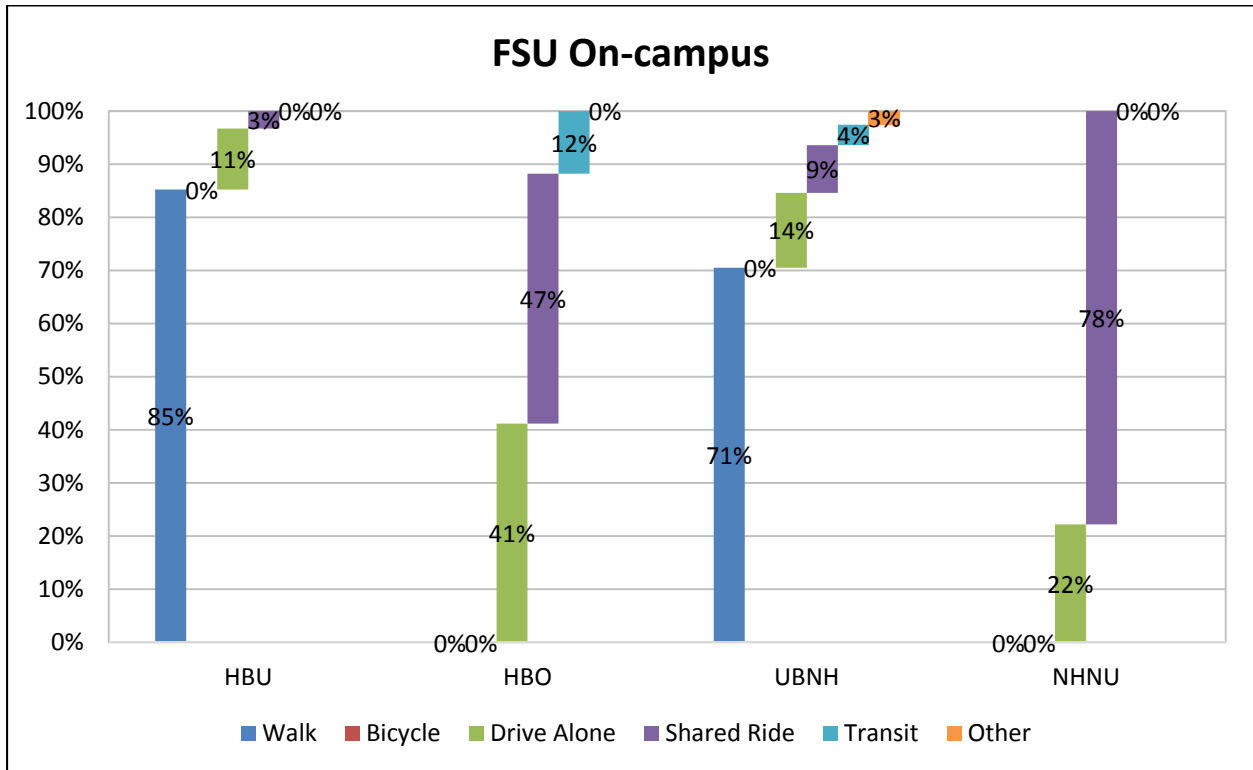


Figure A-14 Mode Share by Residence Location and Trip Purpose: FSU On-campus

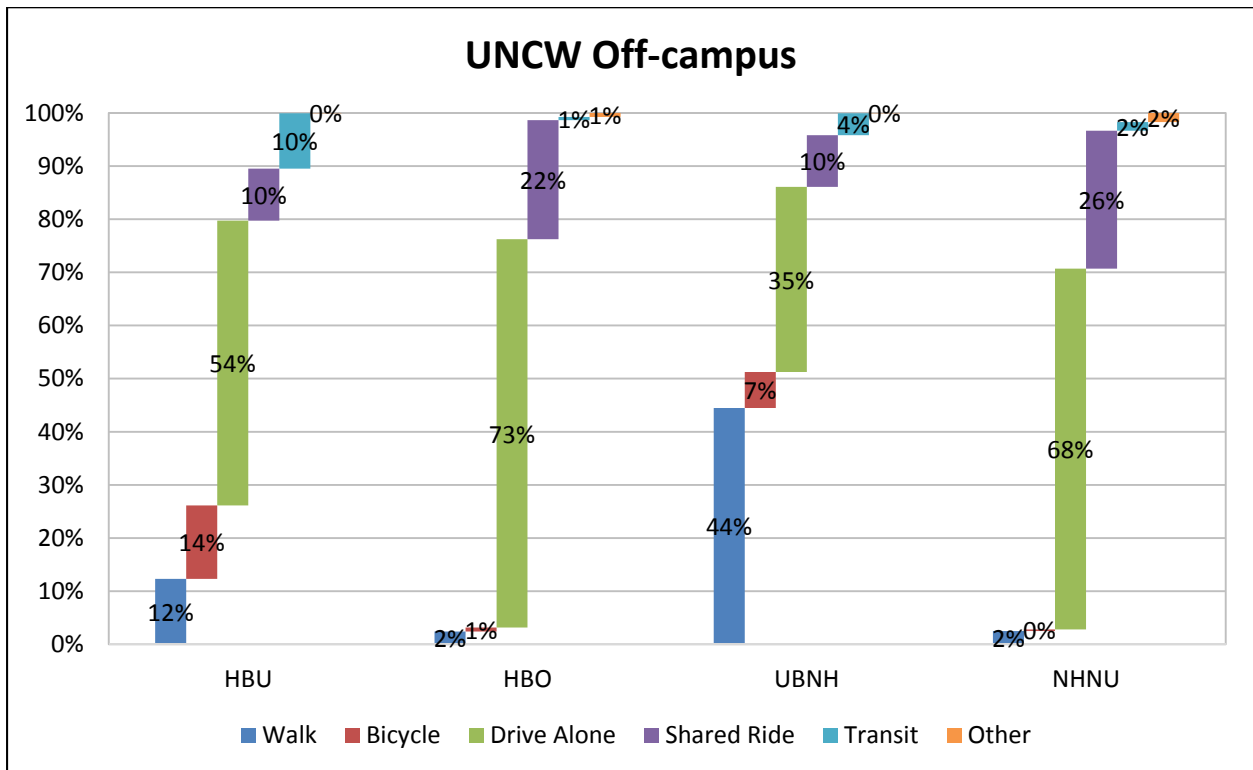


Figure A-15 Mode Share by Residence Location and Trip Purpose: UNCW Off-campus

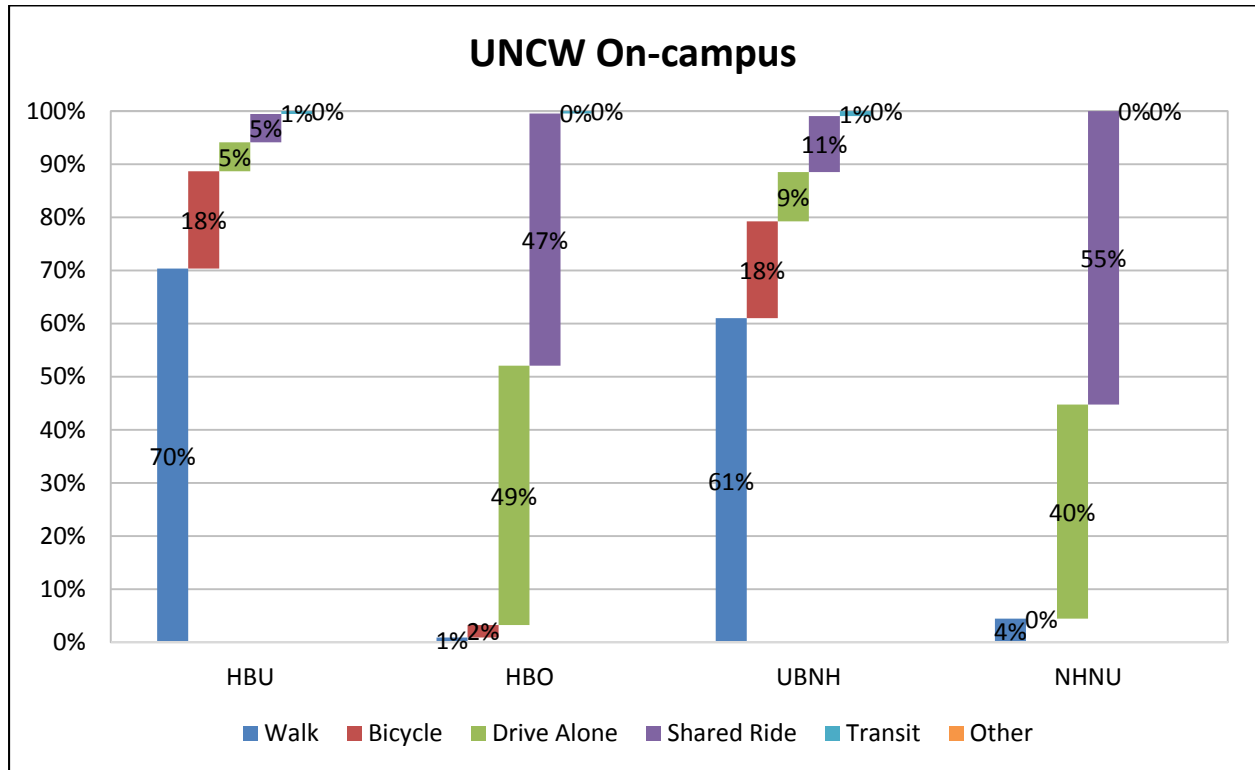


Figure A-16 Mode Share by Residence Location and Trip Purpose: UNCW On-campus

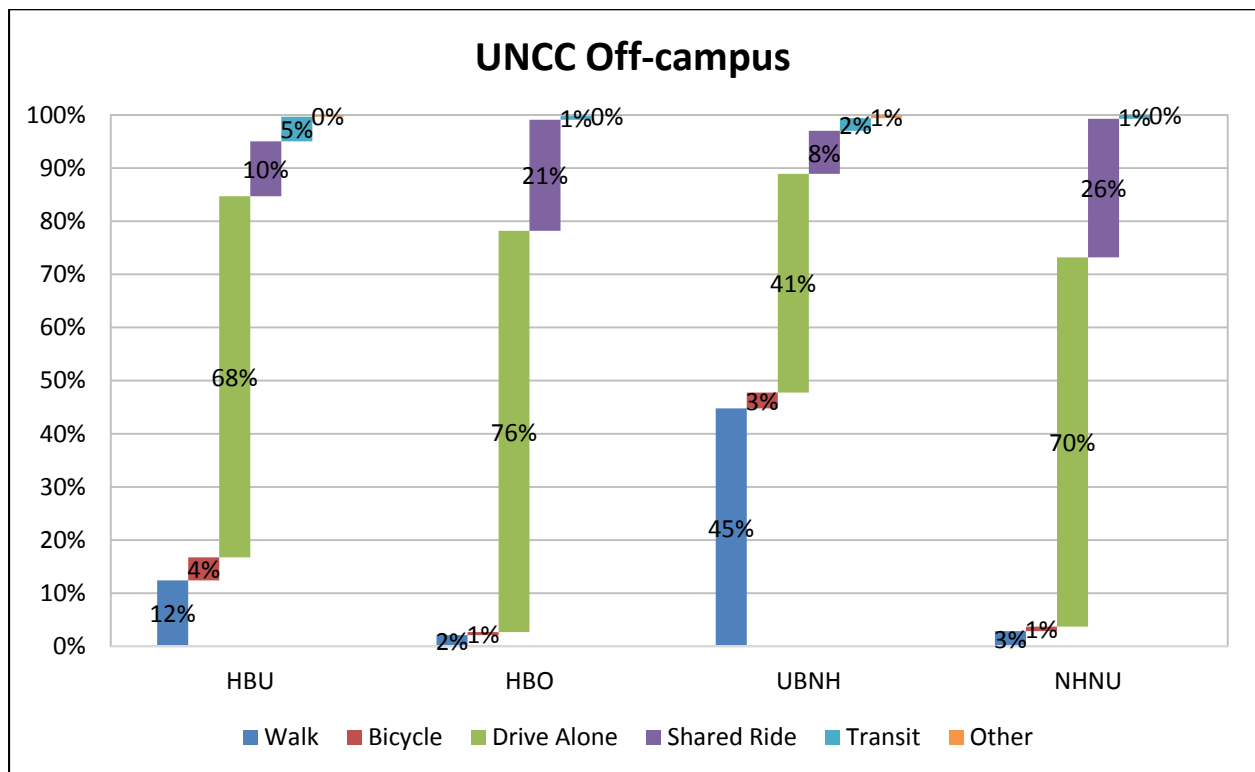


Figure A-17 Mode Share by Residence Location and Trip Purpose: UNCC Off-campus

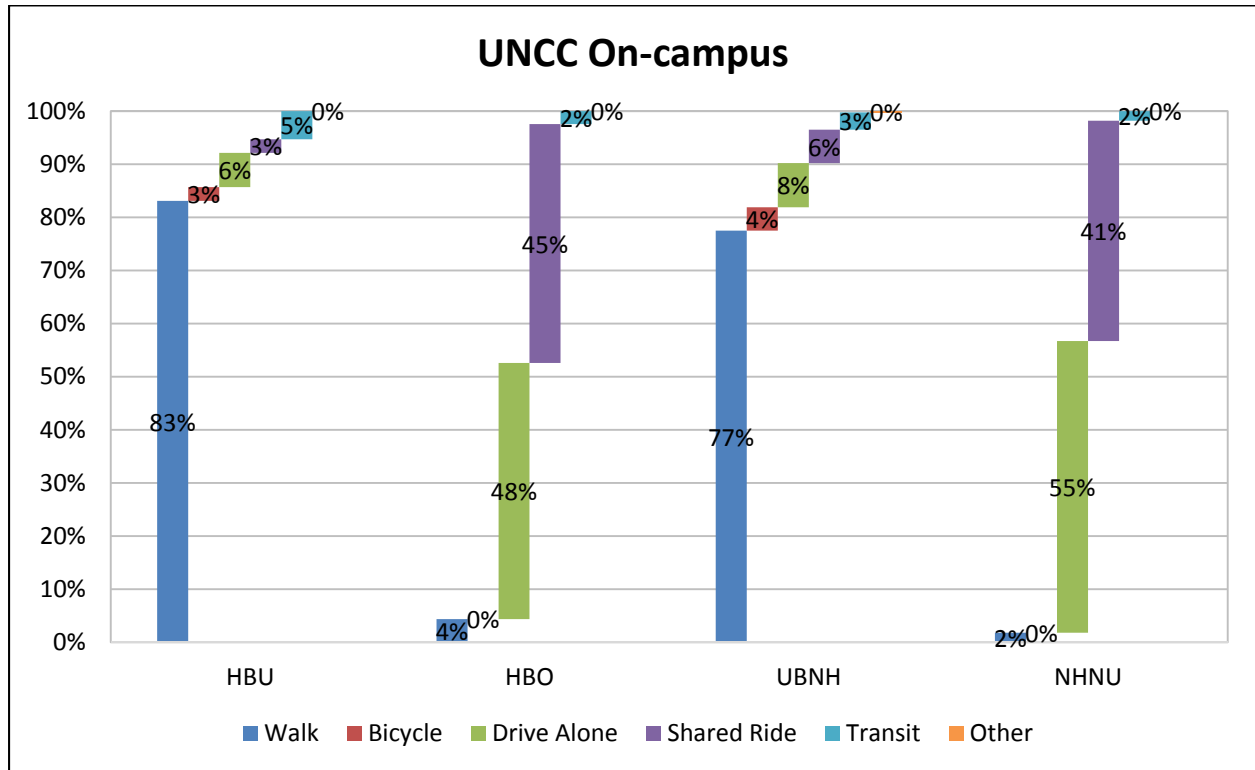


Figure A-18 Mode Share by Residence Location and Trip Purpose: UNCC On-campus

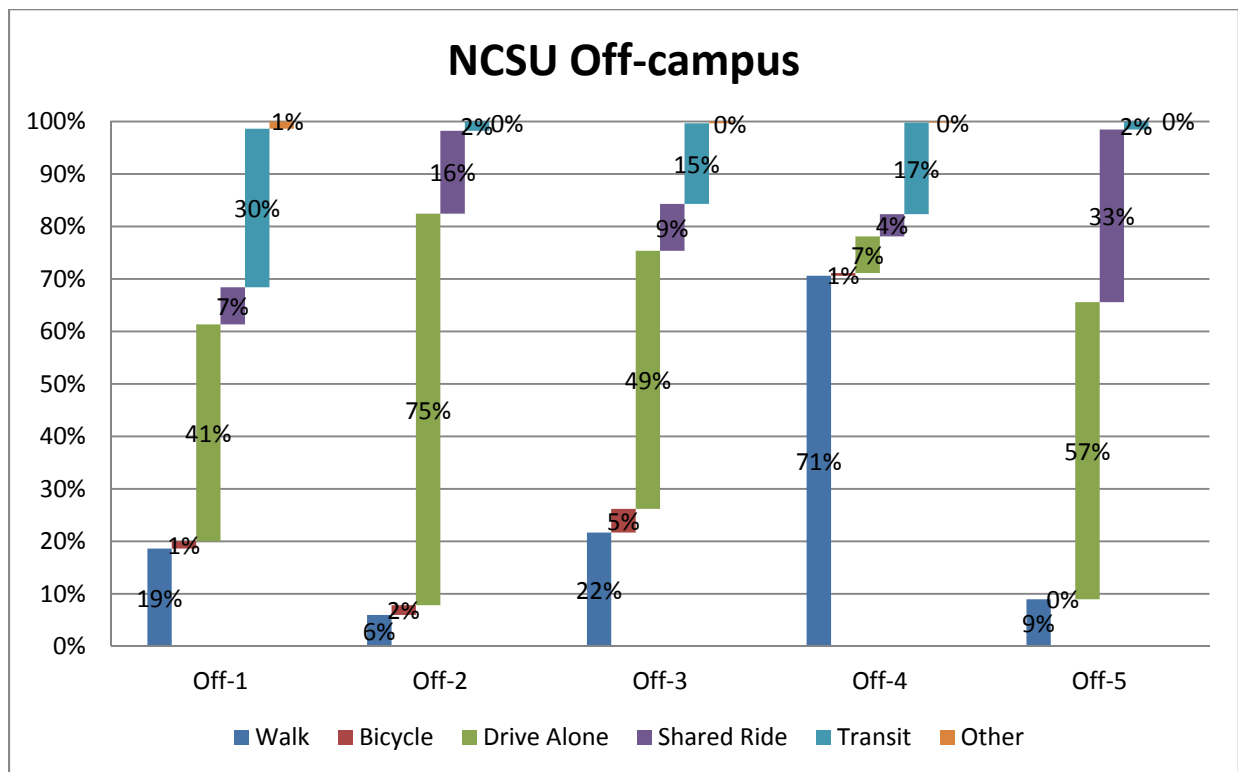


Figure A-19 Mode Share by Residence Location and Trip Type: NCSU Off-campus

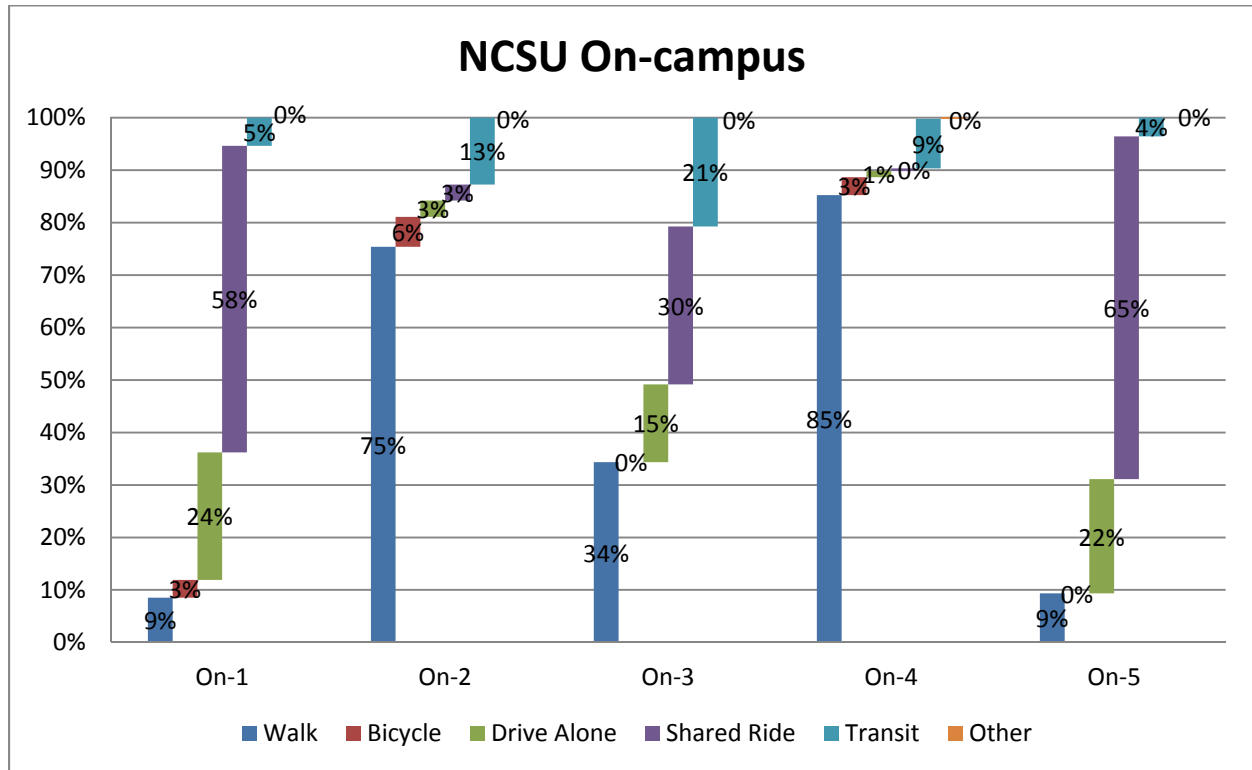


Figure A-20 Mode Share by Residence Location and Trip Type: NCSU On-campus

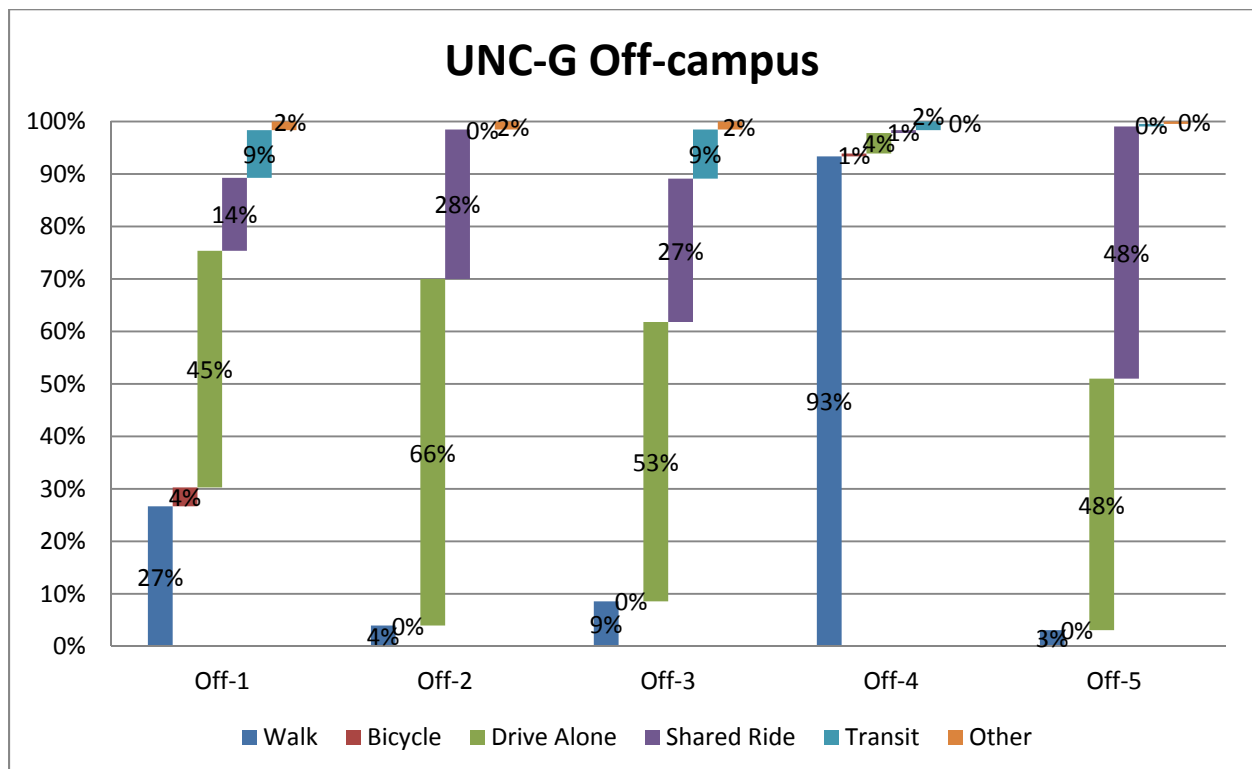


Figure A-21 Mode Share by Residence Location and Trip Type: UNC-G Off-campus

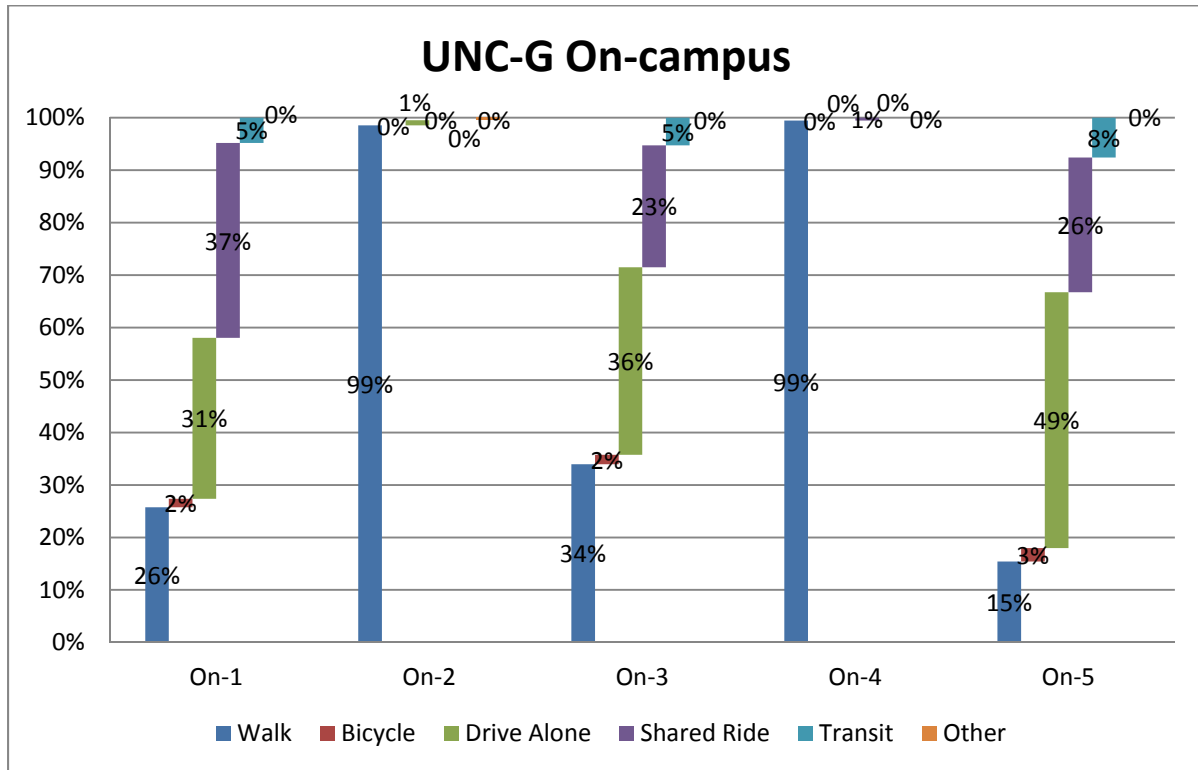


Figure A-22 Mode Share by Residence Location and Trip Type: UNC-G On-campus

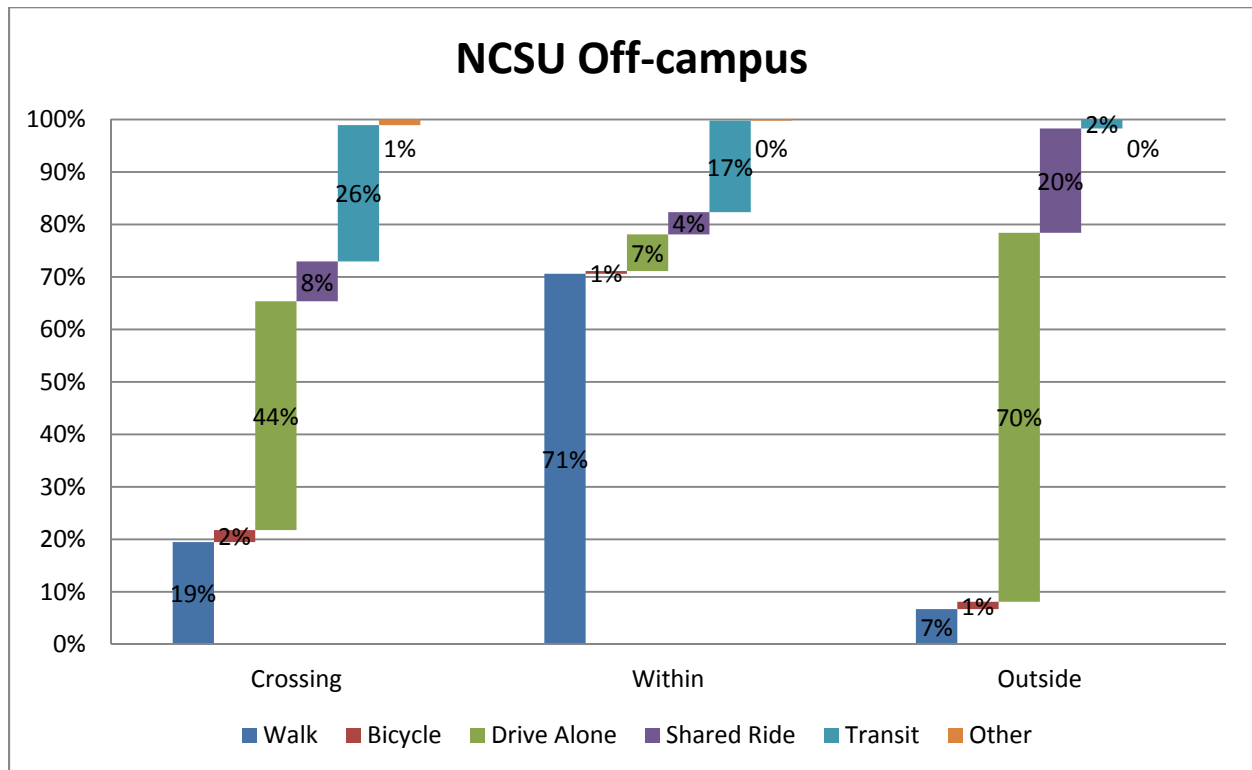


Figure A-23 Mode Share by Residence Location and Trip Classification: NCSU Off-campus

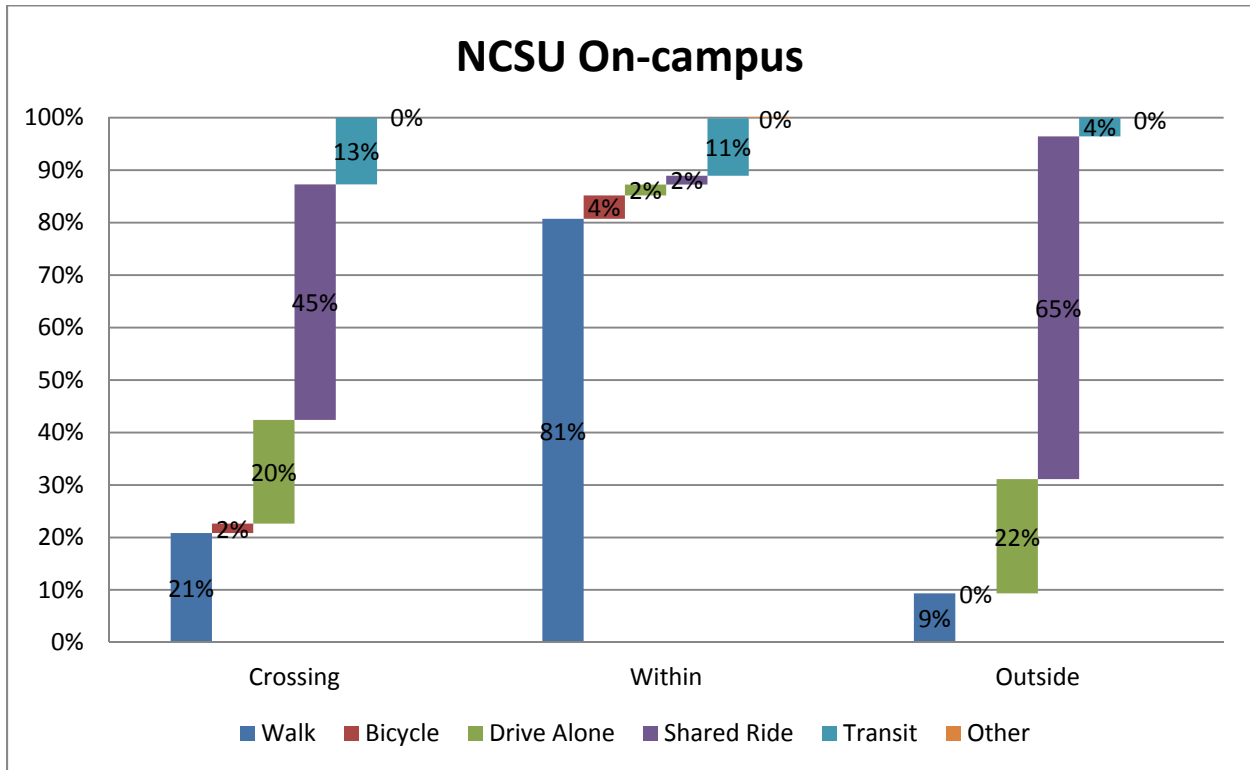


Figure A-24 Mode Share by Residence Location and Trip Classification: NCSU On-campus

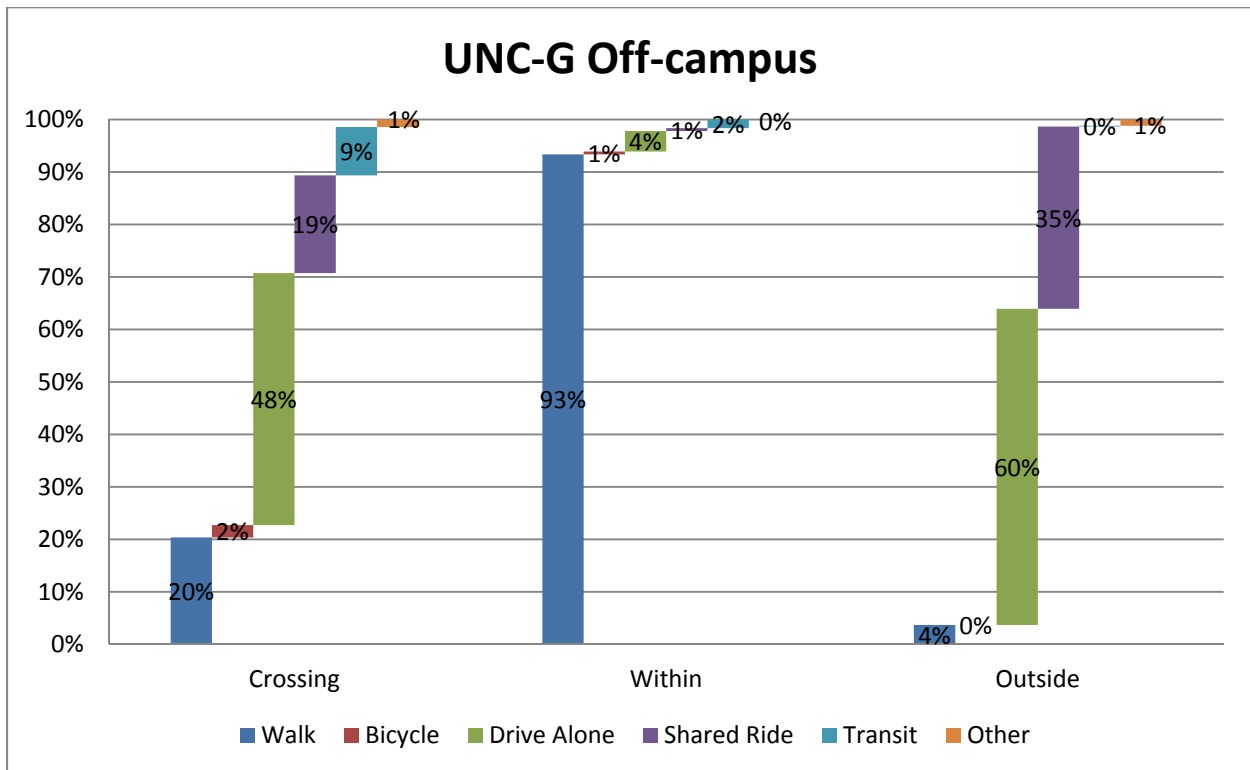


Figure A-25 Mode Share by Residence Location and Trip Classification: UNC-G Off-campus

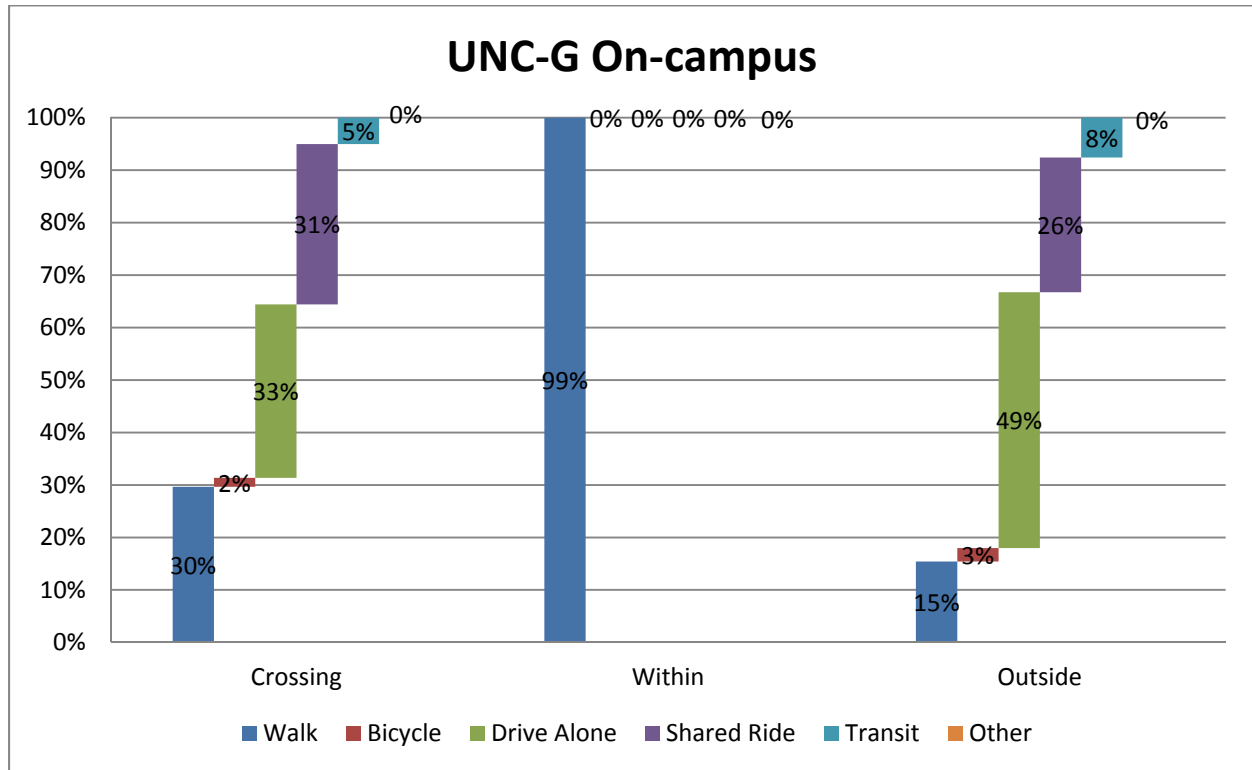


Figure A-26 Mode Share by Residence Location and Trip Classification: UNC-G On-campus

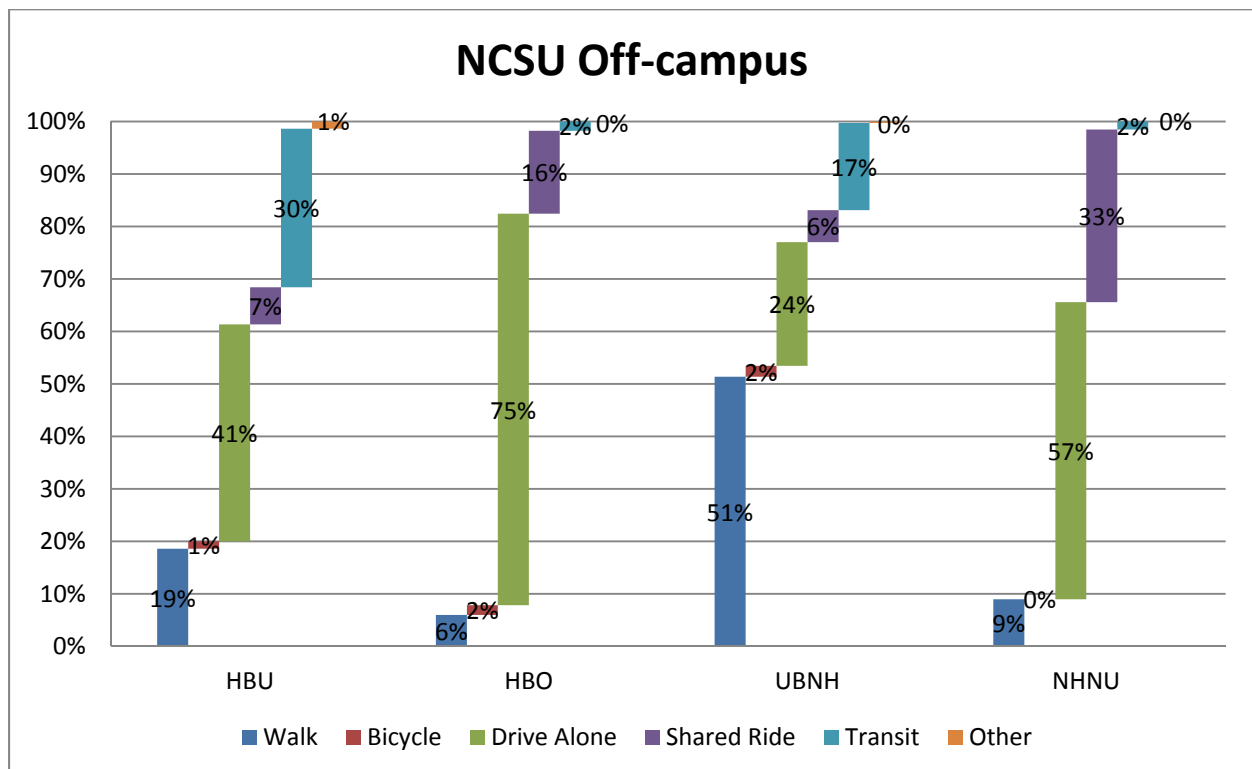


Figure A-27 Mode Share by Residence Location and Trip Purpose: NCSU Off-campus

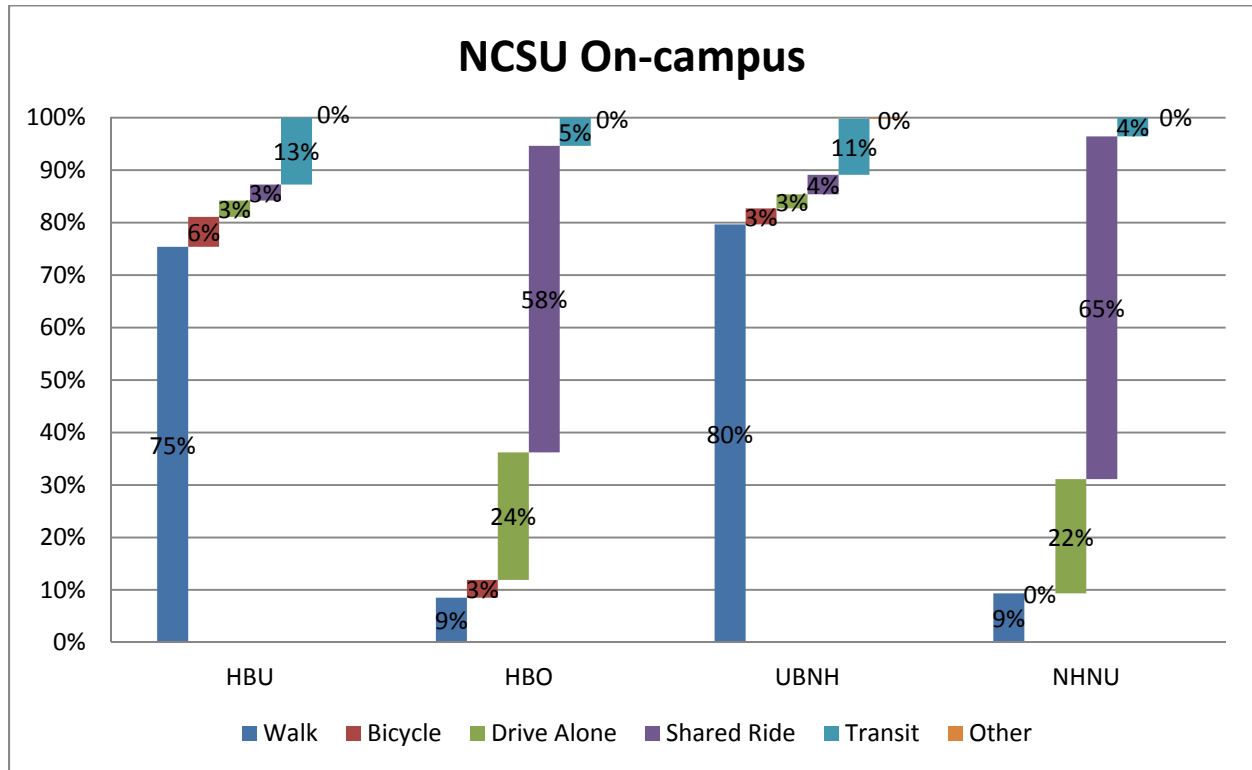


Figure A-28 Mode Share by Residence Location and Trip Purpose: NCSU On-campus

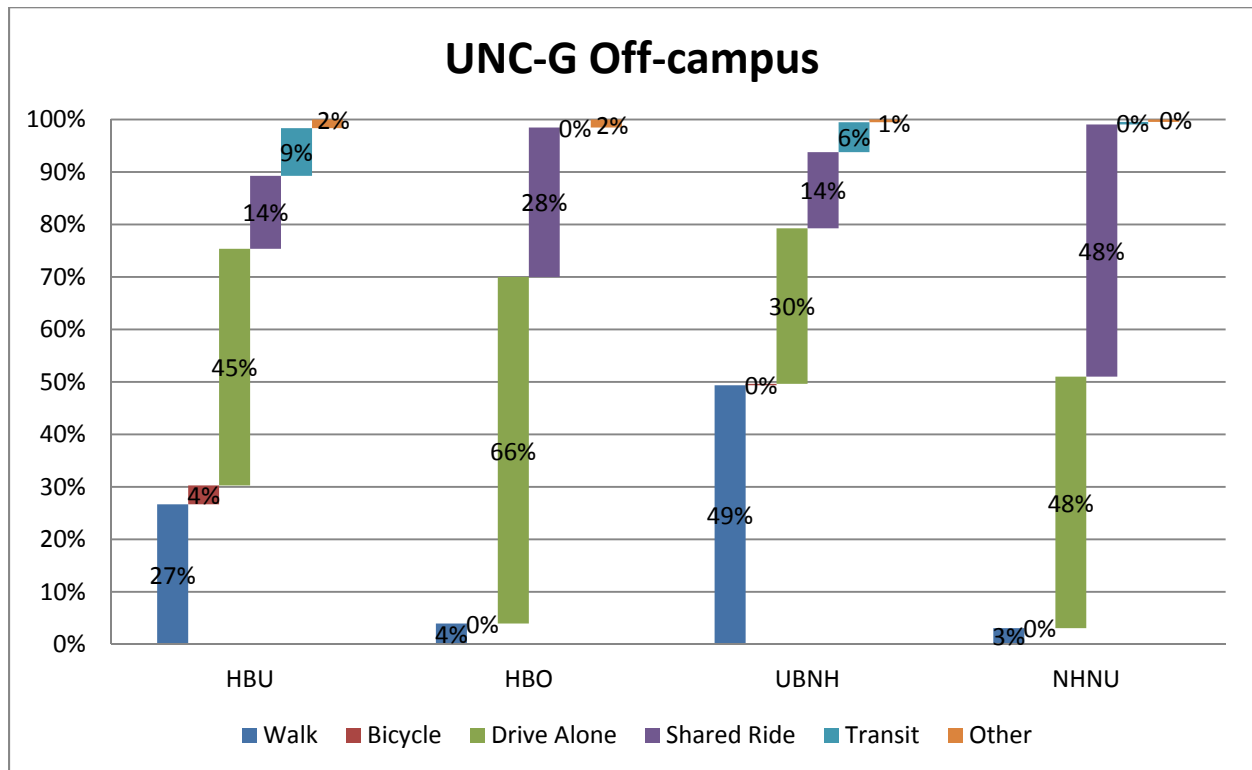


Figure A-29 Mode Share by Residence Location and Trip Purpose: UNC-G Off-campus

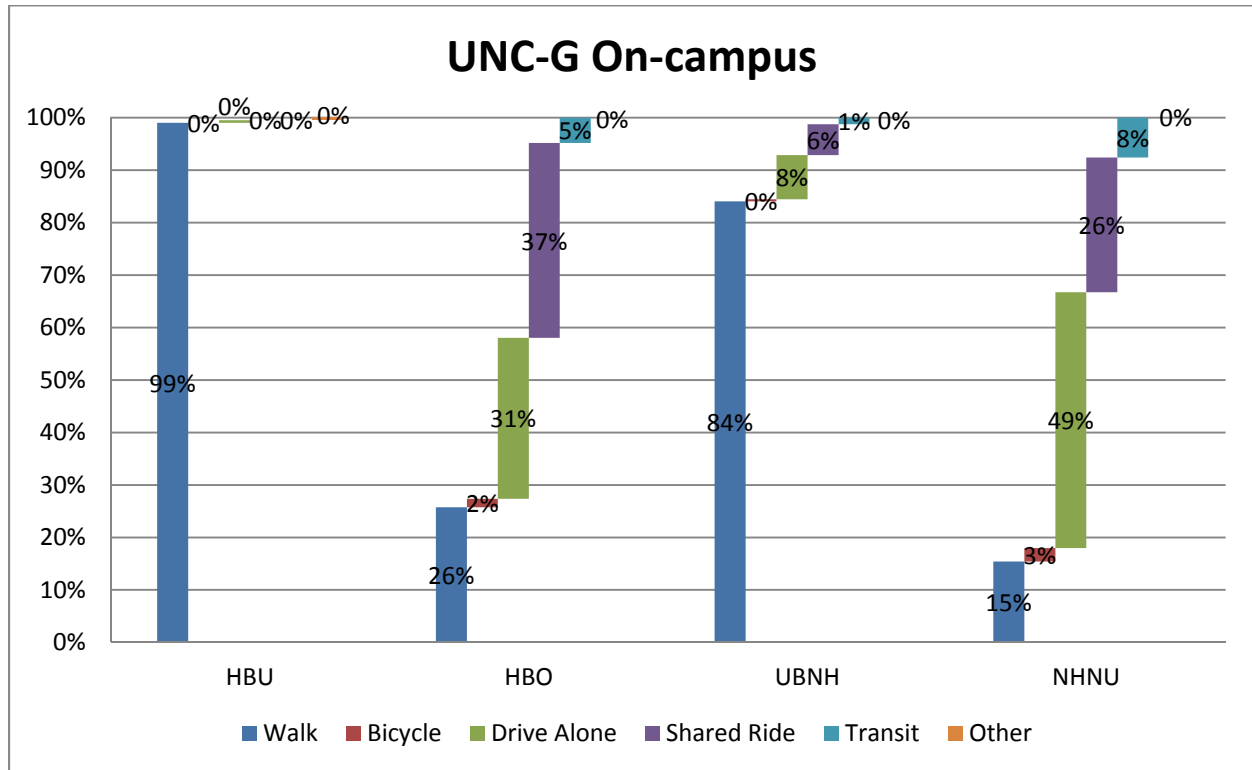


Figure A-30 Mode Share by Residence Location and Trip Purpose: UNC-G On-campus

## Appendix B. Questionnaire of the University Student Travel Survey – UNC at Charlotte



Q1 (Force Response) The Institute for Transportation Research and Education at NC State University has been tasked by the North Carolina Department of Transportation to conduct a travel survey of UNC-Charlotte students. This survey should take approximately 10 minutes to complete. The answers you provide will be summarized so that your identity and specific information remains anonymous and undisclosed.

We hope that you can assist us with this survey, and if you are so inclined to do so, please agree to participate with the option to withdraw at any given point or reason.

Please contact Joe Huegy (JBHuegy@ncsu.edu) for any questions or comments.

- ☐ I Agree (1)
- ☐ I Disagree (2)

If I Agree is not selected, skip to End of Survey

Q2 (Force Response) What is your class status?

- ☐ Freshman (1)
- ☐ Sophomore (2)
- ☐ Junior (3)
- ☐ Senior (4)
- ☐ In a Master Program (5)
- ☐ In a PhD Program (6)
- ☐ Non-Degree Seeking (7)
- ☐ Co-op / Intern (8)
- ☐ Other (9) \_\_\_\_\_

Q3 (Force Response) How many credit hours are you enrolled in this spring semester?

- ☐ 0 (1)
- ☐ 1 (2)
- ☐ 2 (3)
- ☐ 3 (4)
- ☐ 4 (5)
- ☐ 5 (6)
- ☐ 6 (7)
- ☐ 7 (8)
- ☐ 8 (9)
- ☐ 9 (10)
- ☐ 10 (11)
- ☐ 11 (12)
- ☐ 12 (13)
- ☐ 13 (14)
- ☐ 14 (15)
- ☐ 15 (16)
- ☐ 16 (17)
- ☐ 17 (18)
- ☐ 18 (19)
- ☐ 19 (20)
- ☐ 20+ (21)

Q4 What days are you typically on campus (select all that apply)?

- ☐ Monday (1)
- ☐ Tuesday (2)
- ☐ Wednesday (3)
- ☐ Thursday (4)
- ☐ Friday (5)
- ☐ I typically do not go to campus on weekdays (6)

Q5 (Force Response) Are you currently living on campus (i.e. residence halls, university apartments, and Greek Village)?

- ☐ Yes (1)
- ☐ No (2)

Q6 (Force Response) Are you currently employed?

- ☐ Yes, on campus (1)
- ☐ Yes, off campus (2)
- ☐ Yes, both on and off campus (3)
- ☐ No (4)

Q43 Are you married or in a civil union / engaged?

- ☐ Yes (1)
- ☐ No (2)

Q44 Do you have children?

- ☐ No (3)
- ☐ Yes, under the age of 16 (1)
- ☐ Yes, age of 16+ (2)
- ☐ Yes, of all ages (4)

Q7 (Force Response) Do you have a vehicle to use (e.g. car, motorcycle, and other motorized/electric vehicles)?

- ☐ Yes (1)
- ☐ No (2)

Q8 (Force Response) Do you have a permit to park on campus or in university lots?

- ☐ Yes (1)
- ☐ No (2)

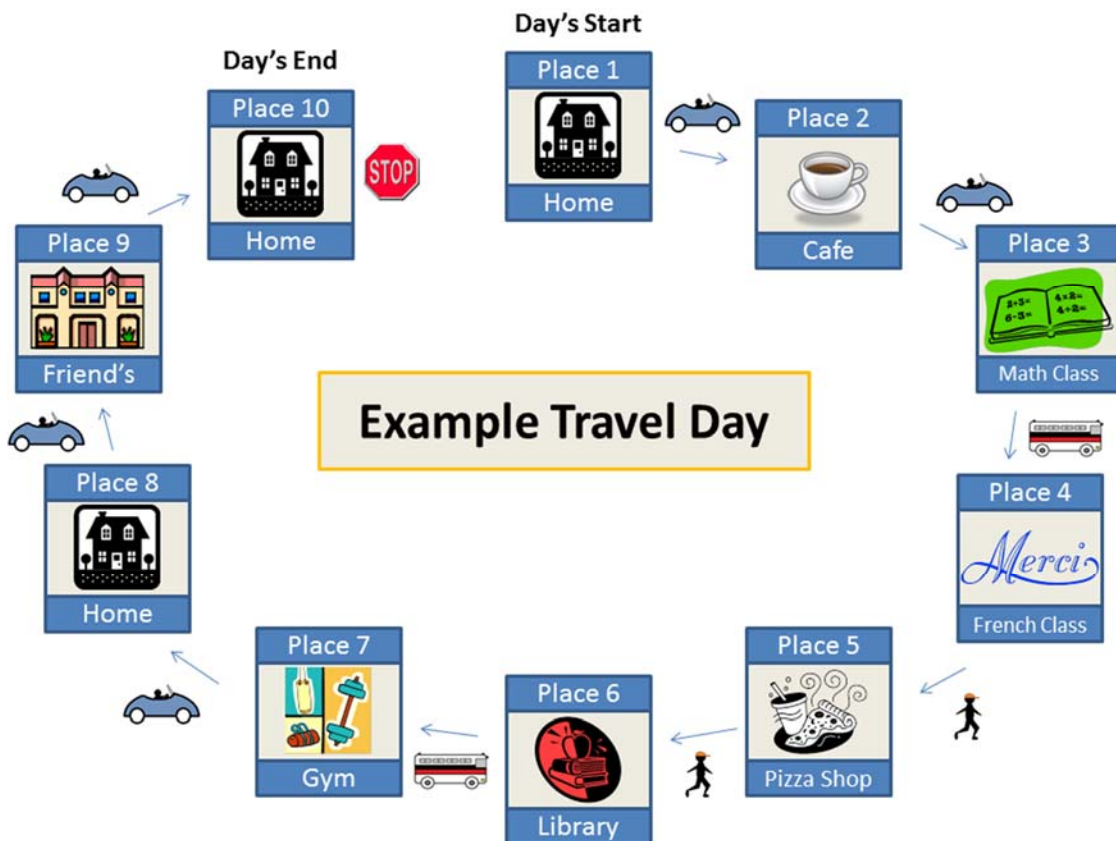
If Yes is selected for Q8, display Q45.

Q45 What type of parking permit do you have?

- ☐ Resident (R) (3)
- ☐ Greek (G) (2)
- ☐ Commuter (C) (1)
- ☐ Night (N1, N2, N3, N4) (8)
- ☐ Two day (CMW, CTT) (18)
- ☐ 6A (19)
- ☐ Lot 27 walk-in (L27) (20)
- ☐ Faculty/Staff (F/S) (21)
- ☐ Other (17) \_\_\_\_\_

Q9 For the final part of the survey, please chronologically recall all the places you went yesterday. If yesterday was over the weekend, please use your most recent weekday. Places can be defined as (1) your starting location, (2) the destinations you traveled to, and (3) your ending location.

If you need to change or add any previous responses, please feel free to do so as your answers are saved. To back track, use the back feature at the bottom of each survey page as opposed to your browser's navigation button.



Q10 (Force Response) Please select the date you wish to describe.

March 2014						
Su	Mo	Tu	We	Th	Fr	Sa
23	24	25	26	27	28	1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31	1	2	3	4	5

Q11 Referring to the example above, how many places did you go on your selected travel day? Please be sure to include your start and end places for the day; in the example above, there are 10. If you went to a location twice, it is counted as two places.

- ☐ 1 (1)
- ☐ 2 (2)
- ☐ 3 (3)
- ☐ 4 (4)
- ☐ 5 (5)
- ☐ 6 (6)
- ☐ 7 (7)
- ☐ 8 (8)
- ☐ 9 (9)
- ☐ 10 (10)
- ☐ 11 (11)
- ☐ 12 (12)
- ☐ 13 (13)
- ☐ 14 (14)
- ☐ 15 (15)
- ☐ 16 (16)
- ☐ 17 (17)

- ☐ 18 (18)
- ☐ 19 (19)
- ☐ 20+ (20)

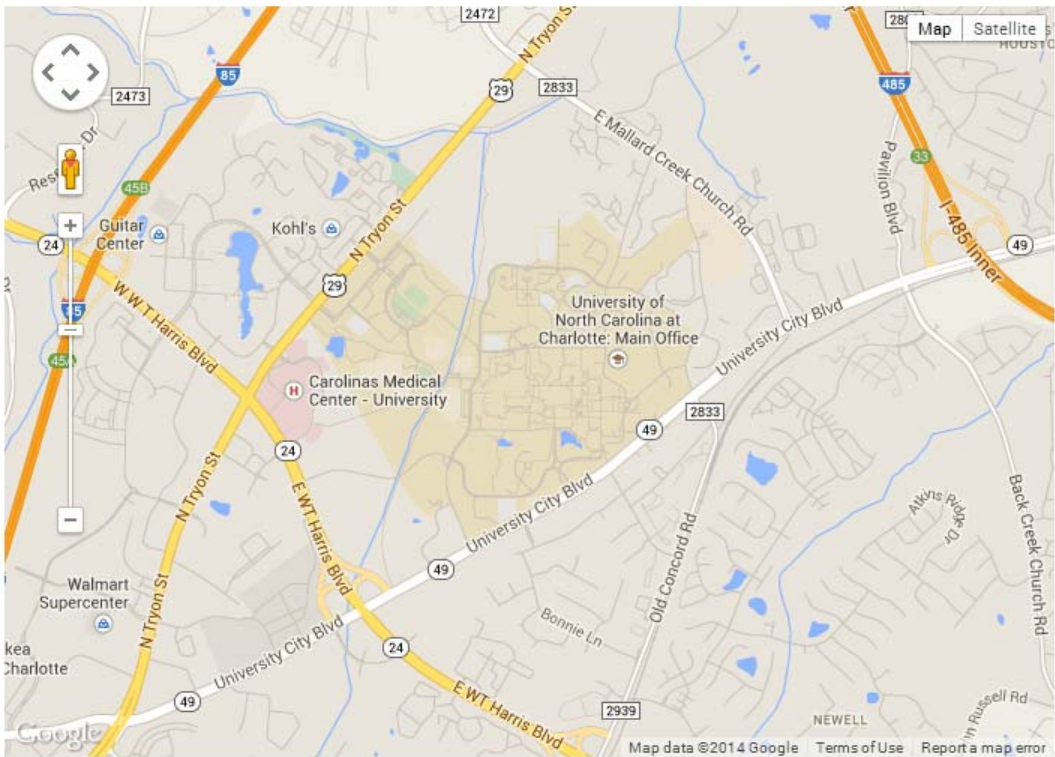
Q12 (Force Response) Where did you begin on {Selected date from Q10}?

- ☐ Home (1)
- ☐ UNC-Charlotte Campus (2)
- ☐ Off-campus Workplace (3)
- ☐ Other (4)

Q13 (Force Response) Where is this place? Please click it on the map shown below. You can zoom in, zoom out, and use the search box to help you find your place. Your click is successfully recorded when you see a blue circle. If it did not show up, click a nearby place.

Atkins Library, Charlotte, NC

Find my Place



	Latitude	Longitude
Coordinates	<input type="text"/>	<input type="text"/>

Q14 (Force Response) Did you leave this place on {Selected date from Q10}?

- ☐ Yes (1)
- ☐ No (2)

If Yes is selected for Q14, display Q15; if No is selected for Q14, display Q16.

Q15 What time did you leave this place? A rough estimate is OK.

Hour	<input type="text"/>
Minute	<input type="text"/>
AM / PM	<input type="text"/>

Q16 Please confirm you did not leave this place on your travel day. Select "No" will end this survey. Select "Yes" and click "Next" will continue this survey.

- ☐ Yes, I left this place and I want to record more of my trips. (1)
- ☐ No, I did not leave this place. Please exit the survey. (2)

If No is selected for Q16, skip to End of Survey

If Yes is selected for Q16, display Q17.

Q17 What time did you leave this place? A rough estimate is OK.

Hour	<input type="text"/>
Minute	<input type="text"/>
AM / PM	<input type="text"/>

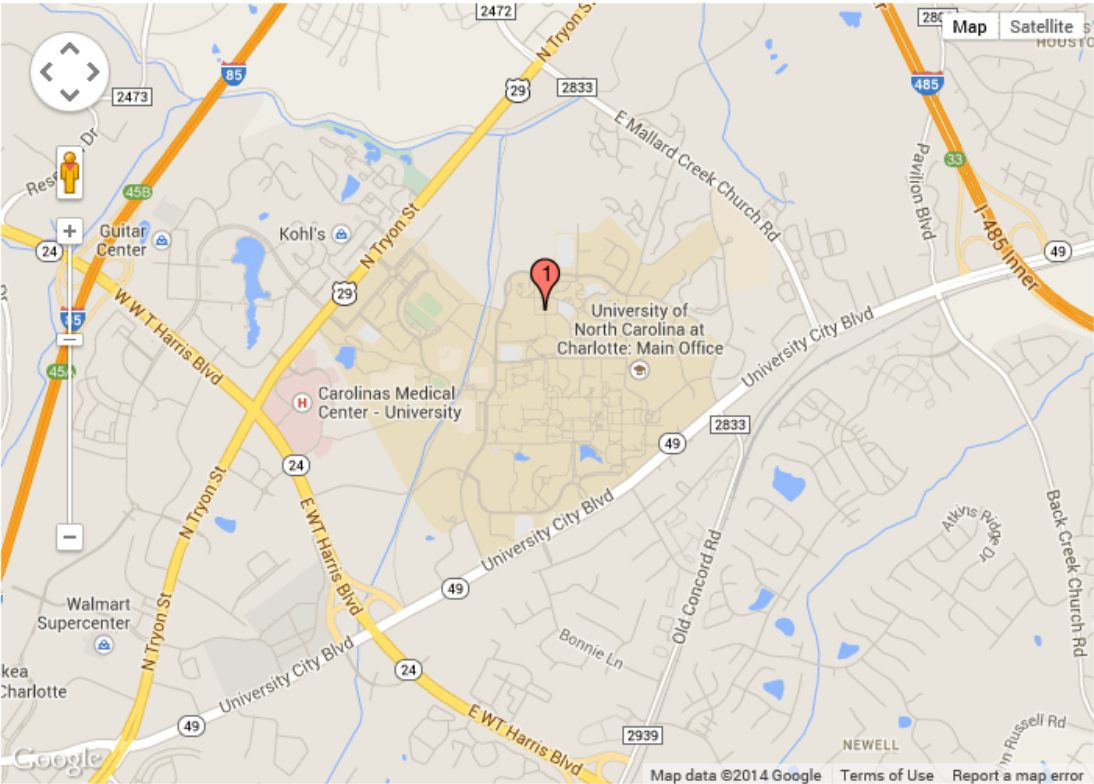
Q18 (Force Response) Where did you go next (the 2nd place of the day)?

- ☐ Home (1)
- ☐ UNC-Charlotte Campus (2)
- ☐ Off-campus Workplace (3)
- ☐ Other (4)

Q19 (Force Response) Where is this place? Please point it out on the map shown below. You can zoom in, zoom out, and use the search box to help you find your place. Your first place has been marked on the map. Your click is successfully recorded when you see a blue circle. If it did not show up, click a nearby place.

Atkins Library, Charlotte, NC

Find my Place



	Latitude	Longitude
Coordinates	35.2899	-80.7322

Q20 (Force Response) What was your main purpose for traveling here (select one)?

- ☐ Go home (1)
- ☐ Attend Classes / Study / Research (2)
- ☐ Work (3)
- ☐ Dining / Shopping (4)
- ☐ Recreational / Social / Community Service / Personal (5)
- ☐ Other (10) \_\_\_\_\_

Q21 (Force Response) How did you get to this place (select all that you used)?

- ☐ Drive Alone (Auto / Van / Truck) (1)
- ☐ Car Pool (either as driver or as passenger - Auto / Van / Truck) (2)
- ☐ Motorcycle / Motorized Moped or Scooter (3)
- ☐ Public Bus / Private Shuttle (4)
- ☐ Bicycle (6)
- ☐ Walk (7)
- ☐ Other (8) \_\_\_\_\_

If "Car Pool (either as driver or as passenger - Auto / Van / Truck)" is selected for Q21, display Q22. If "Public Bus / Private Shuttle" is selected for Q21, display Q23.

Q22 Including yourself, how many people were traveling in the vehicle?

- ☐ 1 (1)
- ☐ 2 (2)
- ☐ 3 (3)
- ☐ 4 (4)
- ☐ 5 (5)
- ☐ 6 (6)
- ☐ 7 (7)
- ☐ 8+ (8)

Q23 Which bus(es) did you take? Please select all that you used.

- ☐ Campus Shuttle (1)
- ☐ CATS (4)
- ☐ Other (3)

Q24 (Force Response) How many minutes did you take to get here? A rough estimate is OK.

Q25 (Force Response) Did you leave this place on {Selected date from Q10}?

- ☐ Yes (1)
- ☐ No (2)

If Yes is selected for Q25, display Q26; if No is selected for Q25, display Q27.

Q26 What time did you leave this place? A rough estimate is OK.

Hour	<input type="text"/>
Minute	<input type="text"/>
AM / PM	<input type="text"/>

Q27 Please confirm you did not leave this place on your travel day. Select "No" will end this survey. Select "Yes" and click "Next" will continue this survey.

- ☐ Yes, I left this place and I want to record more of my trips. (1)
- ☐ No, I did not leave this place. Please exit the survey. (2)

If No is selected for Q27, skip to End of Survey.

If Yes is selected for Q27, display Q28.

Q28 What time did you leave this place? A rough estimate is OK.

Hour	<input type="text"/>
Minute	<input type="text"/>
AM / PM	<input type="text"/>

Q29 (Force Response) Where did you go next {Your Place n<sup>8</sup>}?

- ☐ Home (1)
- ☐ UNC-Charlotte Campus (2)
- ☐ Off-campus Workplace (3)
- ☐ Other (4)

Q30 (Force Response) Where is this place? Please click it on the map shown below. You can zoom in, zoom out, and use the search box to help you find your place. Your first two places have been marked

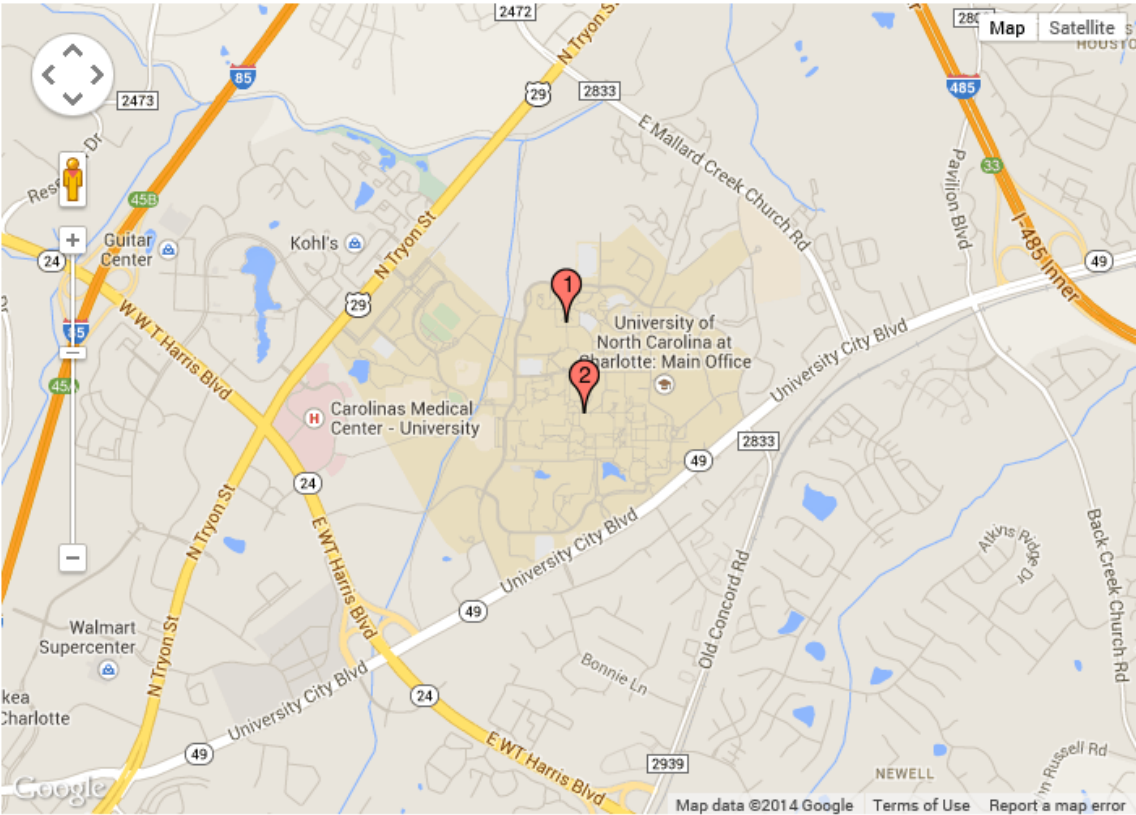
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<sup>8</sup> n is used to track the number of places a respondent is reporting. Since the respondent has reported two places when he/she reaches Q29, n is equal to 3 when Q29 is displayed for the first time. Q29 to Q39 will be displayed over and over again, until the respondent selects “No” for Q36 and Q38, or they have reported 26 places. When Q29 is displayed for the second time, n is equal to 4, and so on. The maximum number of n will be 26.

on the map. Your click is successfully recorded when you see a blue circle. If it did not show up, click a nearby place.

Atkins Library, Charlotte, NC

Find my Place



	Latitude	Longitude
Coordinates	36.0678	-79.8007

Q31 (Force Response) What was your main purpose for traveling here (select one)?

- ☐ Go home (1)
- ☐ Attend Classes / Study / Research (2)
- ☐ Work (3)
- ☐ Dining / Shopping (4)
- ☐ Recreational / Social / Community Service / Personal (5)
- ☐ Other (10) \_\_\_\_\_

Q32 (Force Response) How did you get to this place (select all modes you used)?

- ☐ Drive Alone (Auto / Van / Truck) (1)
- ☐ Car Pool (either as driver or as passenger - Auto / Van / Truck) (2)
- ☐ Motorcycle / Motorized Moped or Scooter (3)
- ☐ Public Bus / Private Shuttle (4)
- ☐ Bicycle (6)
- ☐ Walk (7)
- ☐ Other (8) \_\_\_\_\_

If “Car Pool (either as driver or as passenger - Auto / Van / Truck)” is selected for Q32, display Q33. If “Public Bus / Private Shuttle” is selected for Q32, display Q34.

Q33 Including yourself, how many people were traveling in the vehicle?

- ☐ 1 (1)
- ☐ 2 (2)
- ☐ 3 (3)
- ☐ 4 (4)
- ☐ 5 (5)
- ☐ 6 (6)
- ☐ 7 (7)
- ☐ 8+ (8)

Q34 Which bus(es) did you take? Please select all that you used.

- ☐ Campus Shuttle (1)  
☐ CATS (4)  
☐ Other (3) \_\_\_\_\_

Q35 (Force Response) How many minutes did you take to get here? A rough estimate is OK.

Q36 (Force Response) Did you leave this place on {Selected date from Q10}?

- ☐ Yes (1)  
☐ No (2)

If Yes is selected for Q36, display Q37; if No is selected for Q36, display Q38.

Q37 What time did you leave this place? A rough estimate is OK.

Hour	<input type="text"/>
Minute	<input type="text"/>
AM / PM	<input type="text"/>

Q38 Please confirm you did not leave this place on your travel day. Select "No" will end this survey. Select "Yes" and click "Next" will continue this survey.

- ☐ Yes, I left this place and I want to record more of my trips. (1)  
☐ No, I did not leave this place. Please exit the survey. (2)

If No is selected for Q38, skip to End of Survey.

If Yes is selected for Q38, display Q39.

Q39 What time did you leave this place? A rough estimate is OK.

Hour

▼

Minute

▼

AM / PM

▼

Q29 to Q39 will be displayed over and over again, until the respondent selects “No” for Q36 and Q38, or they have reported 26 places.

Q43 If you want to enter for the drawing of a \$30 gift card, please leave your contact information below.  
Note: The email address you provide must be a valid UNC-Charlotte email address.

Name

Phone Number

Email Address

Home Street Address

City, State and Postal Code

## End of Survey

This is the end of the survey. Your responses have been recorded. We really appreciate your effort in participating in this survey. Thanks!



## Appendix C. Survey Notification at NCSU and UNCG

The following message was sent to NCSU students inviting them to participate in the survey.

*Students of NC State, greetings!*

*The Institute for Transportation Research & Education (ITRE) on Centennial Campus is conducting a study about the daily travels of our state's university and college students. We would like to ask you to help us complete the following survey. Your answers will be anonymous and data will be summarized so as to keep the information you provide undisclosed. Please assist us by filling out a brief questionnaire through the link provided below. Our project aims to provide the NC Department of Transportation with more accurate planning models in order to better serve your transportation needs and improve the community's transportation network!*

*[insert link]*

*If you have any questions regarding our work, please feel free to contact Joe Huegy at [JBHuegy@ncsu.edu](mailto:JBHuegy@ncsu.edu). Thank you for your interest and consideration!*

*Best,*

*The Team at ITRE*