2019 CAMPUS TRANSIT RIDERSHIP STUDY

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Executive Summary

This 2019 campus ridership study fulfills the ridership study requirement in Section 10.3 of the current intergovernmental Agreement (FY 2019-2021) between the Champaign-Urbana Mass Transit District (MTD) and the University of Illinois. The main purpose of the study is to better understand transit ridership trends in the university district and to assess how MTD transit services are meeting the needs of university members in the changing local and campus context. It also aims to explore the possible reasons behind the ridership decline since the peak year of 2015.

To achieve these objectives, the current study conducted four main research tasks:

- Task 1: Peer review
- Task 2: Transit ridership and operation performance analysis
- Task 3: Existing and projected environmental factors
- Task 4: Campus travel survey

Task 1. Peer review

A great number of universities, in partnership with local and regional transit agencies, have adopted university pass (U-Pass) programs that provide university students, faculty, and staff with unlimited transit use at deeply discounted rates. Overall, U-Pass programs vary in their design, budget size ($3,150,000 on average), and usage, but both universities and transit agencies feel that the programs have been a success. Common challenges for these programs include the costs of program implementation and physical infrastructure as well as resistance to increases in parking fees.

- Programs are often managed by one of two kinds of partnerships: 1) transit agencies and school administration or 2) transit agencies and student associations.
- Transit agencies improve their services after program implementation—through changes to existing routes, increases in the hours of operation, increases in number of vehicle trips, longer routes during peak hours, and addition of new routes around the university campus.
- Primary benefits reported by the transit agencies include greater transit ridership, creation of lifetime riders, improved marketing, and greater transit revenue.
- Primary benefits reported by participating institutions include reduction in parking demand on campus, reduction in commuting costs for students, and increased affordability of college education.
- Primary reasons for unsuccessful implementation of programs include resistance from university administration, parking revenue loss, opposition to fee increases, lack of

transit on campus, limitation of resources, and inclusion of part-time students in the program.

Task 2. Transit ridership and operation performance analysis

On-campus stations account for a significant proportion of MTD ridership. On-campus stations make up 11% of all stations, but 61% of daily ridership and 43% of annual passenger revenue miles in 2018. Fifty-three percent of the top ten busiest stations are on campus, and these stations include the Illini Union, Transit Plaza, Ikenberry Commons, Gregory at Library, and Pennsylvania Avenue Residences (PAR). The proportion of on-campus stations and ridership have increased from 2016 (9% and 59%, respectively, of the system total) to 2018 (11% and 61%). Even on community routes, 29% of ridership comes from on-campus stops. Between 2016 and 2018, transit ridership fell by 6% at off-campus stops while there was little change at on-campus stops. The Campustown zone between University and Springfield Avenues has seen the most significant ridership increase.

At the agency level, MTD ridership measured by unlinked passenger trips steadily increased between 2007 and 2015, and has since continually declined from the 2015 peak. However, the recent ridership decline is on par with national trends. Average bus trip length (passenger miles traveled per unlinked passenger trip) was significantly lower in 2017 (1.8 miles) than in 2002 (2.7 miles).

Vehicle revenue miles and vehicle revenue hours steadily increased from 2002 to 2017, so service cuts are not a reason for the recent ridership decline. Vehicle operating expenses, operating costs per trip, and operating costs per vehicle revenue mile and hour, even after adjusting for inflation, increased from 2002 to 2017. Total inflation-adjusted fare revenue increased from 2002 to 2017, but fare revenue per trip remained stable at around $.40 (in 2002 dollars). The fare to vehicle operations expenses ratio decreased in the early 2000s and since then has been stable at around 35%.

Route level analysis shows that the bus ridership decline in recent years has been much faster on community routes. While bus ridership on campus weekday routes declined by 8.3% from AY 2014-15 (Sep. 14—Aug. 15) to AY 2017-18, community weekday routes experienced a 16.6% reduction for the same period. The gaps between campus and community routes are even larger when measured by ridership per service level: -13.2% versus -25.2% for passenger trips per vehicle revenue mile and -14.7% versus -27.0% for trips per vehicle revenue hour.

Commute time analysis using Google Maps API reveals that a 20-minute commute by bus is possible only for immediate campus neighborhoods and central locations, while a driving commute takes less than 20 minutes from nearly all locations in the region. The 20-minute bus commute zone extends a bit farther on locations along main arterials such as University and Curtis Avenues. The ratio of commute times between the two modes shows that a bus

commute takes about 1.5 to 2 times as long as driving in central locations and 2 to 4 times as long in outer rings. Estimated bus commute time is also longer than estimated bike commute time in most locations.

Task 3. Existing and projected environmental factors

Student enrollment steadily grew over the past twenty years, and no decline was observed in student population since 2014-2015. However, other factors such as student residential location may have impacted bus ridership. The Campustown and North Lincoln neighborhoods added about 3,000 and 2,000 students, respectively, between 2000 and 2015. These close-in neighborhoods also added about 1,300 rental housing units in the same period, and 783 additional units containing 2,165 bedrooms are expected to go online in 2019 and the following years. As students concentrate in neighborhoods near campus, walking and bicycling are increasingly feasible travel options.

Educational and athletic facilities on campus have also grown to accommodate the increase in student enrollment. Vehicle ownership of young and low-income households has been consistently lower than that of all age and income groups. The proportion of carless households increased around campus due to the concentration of student population. The number of campus parking permits for both students and faculty/staff shows a subtle decline or stable trend in recent years. Bike census data shows large fluctuations over years supposedly because of adverse weather conditions on census days. VeoRide, a bike share program on campus, enjoyed high monthly ridership in the first year, with a small potential impact on bus ridership (a 0.6% reduction in rough estimation). However, the increased ratio of electric bikes to pedal bikes seems to reduce the popularity of VeoRide due to the higher price of electric bikes.

Task 4. Campus travel survey

The research team administered an online campus travel survey to a randomly selected group of 6,000 undergraduate and graduate students and 6,000 faculty and staff in the period of October 22—November 10, 2019. The response rate was 17.6% for faculty/staff (1,057 responses) and 11.2% for students (669 responses). The survey collected information on three main trips the respondent made in the previous day, commute trips in a typical week, MTD bus use and satisfaction, and opinions about general travel and travel choices.

Commute mode

- Faculty and staff were most likely to commute by driving alone (54%), followed by taking the bus (20%). Students were most likely to take the bus (39%) or walk (38%).
- Commute mode choice of both students and faculty/staff was strongly associated with their residential locations. Walking was dominant for students (56%) in zones less than one mile from campus. The bus was the most competitive in one- to two-mile zones for

both students (41-50%) and faculty/staff (22-23%). Outside of two-mile zones, driving was dominant, especially for faculty/staff (77-96%).

Trips Made by Bus

- 20.5% of the reported total 4,178 trips were completed by bus.
- For 97% of bus trips, riders walked to the bus stop and to their destination.
- The average access time to and from, and wait time at the bus stop were 3.85 and 6.2 minutes, respectively.
- 89% of bus riders reported no transfer and 8% transferred once.

MTD Opinions

- Bus riders were generally satisfied with MTD bus service, with average overall satisfaction scores from faculty/staff and students at 4.2 and 3.9 (out of 5), respectively. Faculty and staff were slightly more satisfied than students in general because they are more likely to be riders by choice.
- Friendliness of bus drivers was the highest-ranked attribute, receiving an average of 4.3 from faculty/staff and 4.1 from students.
- Overall, the lowest-ranking attributes were the frequency of bus services, the information presented at stops, and shelters or other physical facilities. For student riders, on-time performance (reliability) of transit services received the lowest average score of 3.3.
- For faculty and staff, the biggest barriers to riding the bus were needing a car during the day for errands, the bus taking too much time, and the bus being too far from home or work.
- For students, the biggest barriers to riding the bus were the bus taking too much time, the bus not running often enough, needing to have a car during the day for errands, and not liking taking the bus.

Parking and Gas

- Eighty percent of student and faculty/staff parking permit holders would consider an alternative way to commute were the on-campus parking permits priced at $900 and $1,100, respectively.
- Eighty percent of student and faculty/staff parking permit holders would consider an alternative way to commute at the gasoline price of $4.50 and $6.00 per gallon, respectively.

Opinions about Travel

- Nearly 65% of respondents liked the idea of using public transit as a means of travel (with 52% feeling this way about driving), and the same number feel safe while waiting for the bus.

- 73% of respondents were aware of environmental problems related to driving. However, environmental concerns affected travel mode choice for only 45%, and only 38% felt obliged to use environmentally-friendly modes.
- Only 30% of respondents report taking the bus habitually, while 51% report driving habitually.

Recommendations

First, efforts to increase MTD bus ridership among faculty and staff would be more effective than efforts targeted to students. Bus commute share among students is already 39%, and walking and biking account for 38% and 8% of student commute trips, respectively. Only 13% of students drive alone or carpool to school. If the trend of increasing student concentration in campus-adjacent neighborhoods persists in coming years, it is likely to further boost active transportation modes—walking and biking. There is more room to improve transit ridership among faculty and staff. Sixty-two percent of faculty and staff drive or carpool, and only 20% take a bus to campus. We suggest that any policy or strategy to promote transit should aim to draw transit riders away from driving, not away from walking and bicycling.

Second, making bus trips faster will be key to improving transit ridership, especially for people who live at a greater distance from campus. A bus trip to campus from most locations outside campus-adjacent neighborhoods takes more than twenty minutes, which is more than twice the driving commute time for the same distance. Many destinations are actually more quickly reachable by bicycle than by bus. Many respondents of the campus travel survey also listed "the bus takes too much time" as a primary barrier to using the MTD bus. Increasing bus ridership among residents outside campus neighborhoods without significantly improving bus travel time seems like a nearly unattainable goal. Improving bus speed may involve redesigning the bus network with more simplified and straight routes and focusing on high demand areas. The top 10% of bus stops account for 85% of all bus trips; therefore, connecting these key destinations with quicker services may be one of the more effective approaches to increasing bus speed and consequently, ridership.

Third, parking pricing can significantly influence commute mode choice among faculty and staff. The campus travel survey shows that more than half of current faculty/staff permit holders would consider an alternative way to commute at a permit price of $900 per year and nearly 80% would consider alternatives at a $1,100 price. Parking on campus is currently underpriced given the high construction and maintenance costs of parking spaces, which in effect subsidizes commuters who drive alone to campus. Therefore, any policy program that mitigates this price distortion would encourage alternative commute modes, including carpool, MTD bus, biking, and walking.

Finally, strategies based on high environmental awareness among campus community members have the potential to significantly influence travel-related decisions. The survey results show that 73% of respondents are aware of environmental problems related to driving, and nearly 65% of respondents like the idea of using public transit. However, only 38% of respondents feel obliged to use environmentally friendly modes, and environmental concerns are affecting the actual travel mode choices of only 45%. Nudge programs to promote pro-environmental behavior without significantly limiting people's choices or altering economic (dis-)incentives are increasingly popular, especially in energy and resource conservation. We suggest that well-designed nudge programs to promote green transportation are likely to bear fruit, considering community members' positive attitude toward alternative transportation modes.

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Introduction

Background

The Champaign-Urbana Mass Transit District (MTD) has been providing university students, faculty and staff with unlimited access to the MTD's transit services, including special campus routes, via the Intergovernmental Agreement with the University of Illinois. A university pass (U-Pass) program is widely known to create benefits to nearly all participants. Transit agencies gain from substantially increased transit ridership, transit capacity utilization during off-peak hours, and increased transit revenue (Yu & Beimborn, 2018). Students enjoy deeply discounted transit services and enhanced mobility options, and universities typically save on the costs of parking facilities provision. MTD has also experienced a dramatic increase in transit ridership and improved fare-box recovery ratios since the formal partnership with the university was initially established in 1989. In addition, transit ridership increased significantly after the campus network redesign in 2009.

More recent years, however, show a decline in transit ridership after the peak years of 2014 and 2015. MTD suspects that the falling ridership is partly due to the disruptions caused by the MCORE projects and the densification of campus neighborhoods. However, to better understand the driving forces behind the trend of transit use requires a more systematic analysis of university members' travel behavior and a careful study of changing campus environments. To address the need for a formal transit ridership study, the current Intergovernmental Agreement (FY 2019-2021) requires a transit ridership study. Section 10.3 specifies that "the Parties intend to cooperate in a ridership study during the term of this Agreement to be conducted by a mutually acceptable third-party consultant." This campus transit ridership study fulfills this requirement.

Objective

The purpose of this campus ridership study is to better understand transit ridership trends in the university district and to assess how MTD transit services are meeting the needs of university members in the changing environment. It requires primary data collection through a formal survey on travel behaviors of university members and an in-depth analysis of the factors that influence the transit use of university students, faculty, and staff. The findings of the travel behavior analysis, along with an analysis of the current transit operational performance and development patterns in the campus town, will offer important insights on improving MTD transit services.

To achieve these objectives, the current study addresses the following research questions:

- Who uses the MTD bus services? How, where, when and for what purposes do university passengers use the bus services?
- What are primary factors that affect transit use of students, faculty, and staff?
- How will expected changes in the campus environment affect the transit demand of university members?
- How do the current MTD bus services meet the transit demand of university members?

Overview of Research Project

To achieve these objectives, the research project conducts four research tasks:

- Task 1: Peer Review
- Task 2: Transit Ridership and Operational Performance Analysis
- Task 3: Existing and Projected Environmental Factors
- Task 4: Campus Travel Survey

Task 1 identifies three case studies of college student transit pass programs in small and medium sized metro areas and compares planning implementation, financing, technology, service improvements, and evaluation across the peer programs. Task 2 analyzes transit ridership by route and major stop, dividing stops into on-campus and off-campus and analyzing the operational performance measures including passenger trips per vehicle revenue hour and vehicle revenue mile; operating cost per vehicle revenue mile, passenger trip, and passenger mile; fare revenue per passenger trip and passenger mile; and fare recovery ratio. Task 3 examines the spatial distribution of the student population using census tract level data from the American Community Survey; the distribution of student housing developments near campus using building permit data; educational and athletic facility changes on campus, car ownership, parking permits, and bike count trends; and emerging mobility options such as bikeshare service. In Task 4, the research team conducts a campus-wide travel survey and reveals travel decisions of students, faculty, and staff. This rider survey asks for trip data, parking data and preferences, attitudes towards MTD's services, and general travel opinions.

1. Peer Review

Universities across the United States are increasingly adopting U-Pass (universal student transit pass) programs to provide unlimited public transit access to their students, staff and faculty. These programs are deeply discounted and are generally prepaid for by the university which pays for the program through student fees, parking fees, and other avenues. Transit Cooperative Research Program (TCRP) Synthesis 131 provides a comprehensive study of U-Pass programs through an extensive literature review, online survey of participating transit agencies and universities, and some case studies (TCRP, 2018). The TCRP report compares planning, implementation, financing, technology, service improvements, and evaluations of various U-Pass programs. This chapter summarizes the main findings of the TCRP report and presents a review of three transit systems in small and medium-sized cities that use U-Pass programs. Overall, findings suggest that U-Pass programs vary in their design and usage, but that both universities and transit agencies feel that the programs have been a success. Common challenges for these programs include cost of the program, buses, and facilities, as well as abusive use of passes. The three case studies covered in this report are:

- Case Study 1: Blacksburg Transit, Virginia
- Case Study 2: Foothill Transit in Los Angeles County, California
- Case Study 3: Milwaukee County Transit System (MCTS), Wisconsin

Case Study 1: Blacksburg Transit, Virginia

a. Overview

Blacksburg is a small college town in southwest Virginia, with a city population of 42,600 in 2010 (U.S. Census Bureau). Virginia Polytechnic Institute and State University, also known as Virginia Tech, has approximately 30,000 students that make up nearly 90 percent of the Blacksburg Transit (BT) ridership. The U-Pass program was implemented in the 1980s to provide transit access to students staying in off-campus housing located at a distance from the university campus. The aim was to reduce parking demands and provide mobility to the community.

b. Planning

Negotiations between the city and university resulted in the implementation of this program. The transit agency signed a three-year agreement with university. At present, the university contributes $3 million towards operating costs and about $250,000 towards capital costs per year. The program was applied without any initial consultation with students. However, the program hired some students as part time drivers after its implementation. The transit agency

actively participates in all student orientation programs. During orientation Blacksburg Transit provides its services to students to reach the orientation site from remote parking facilities. The agency also promotes the program actively through social media.

c. Implementation

Students enrolled in a full-time course load at the university are eligible to use the program. The services are also available to faculty and other university staff without any additional fee. Student fees support the transit program. Hours and service along university-specified routes determines the costs associated with the program. Public riders not associated with the university either pay $0.50 per trip or $8.00 for a monthly pass. Public fares have not changed significantly since the program was implemented in 1980s.

The program uses student IDs for boarding public transit. The drivers push a button every time a student shows an ID and boards the bus. This keeps a record of actual ridership by passenger type. Vehicles are also fitted with automatic passenger counters to keep track of real time boarding for the agency. The agency created a custom app (BT4U) showing bus locations in real time. The app has a “take me home” button that provides directions for students to reach their residences from anywhere else at any time.

Demand for the program depends on university sessions and breaks. The transit agency provides three levels of service according to the university schedule:

- **Full Service:** This service is typically applicable during the fall and spring semesters for all routes and multiple buses operating at peak frequency, every 10 to 15 minutes. Services for the day end slightly before 3 am in the morning.
- **Reduced Service**: This service is applicable during summer, fall, winter, and spring breaks. During this time the frequency of buses falls to 30, 45, or 60 minutes depending on the route. Service does not operate on Sundays.
- **Intermediate Service**: This service is applicable at times when full service is not required and reduced service is inadequate for ridership requirements. It is used during the week before the start of the fall term.

The agency started provision of services with five buses which expanded to the 34 vehicles for regular service and nine additional demand response vehicles in 2013 (National Transit Database). The city zoning department made conscious decisions of locating student housing along the existing transit lines. Linguistically diverse populations of the university may require the transit agency to display information in multiple languages in the future. The agency also runs special services that operate on premium fares for football game days.

d. Evaluation

The program receives strong support both from the university and Blacksburg Transit Agency. It increased the agency's ridership, reduced parking demand, and improved accessibility. During the university sessions, daily ridership varies from 10,000 to 12,000 rides. Monthly online ridership reports record the ridership totals, ridership by route, service levels, and fare type.

Students account for 93.2 percent of Blacksburg Transit ridership, university faculty and staff account for 2.6 percent, and non-university users account for the remaining 4.2 percent ridership (as of February 2017). Ridership peaks at midday, and the agency's service productivity is high with a rate of 46 passengers per revenue hour. Some routes face loading problems during peak hours when more than 70 passengers board per hour. The agency provides additional buses to deal with this issue. Additional vehicles load quickly, indicating latent demand for more vehicles.

Case Study 2: Foothill Transit in Los Angeles County, California

a. Overview

Foothill Transit is the second largest transit agency in Los Angeles County, California. The agency operates 39 express and local routes with 367 buses. It has its own pass system called Class Pass that coordinates with the Los Angeles County Metropolitan Transportation Authority (LACMTA) regional pass. This agency achieved innovation in electric buses and created marketing programs that received recognition nationally. Its U-Pass program was implemented in 2013 with goals to increase off-peak ridership, improve access to colleges, and create transit use habits among students.

b. Planning

All institutions participating in the program sign a formal agreement annually that describes the payment schedule, administration and service charges of the pass. Most participating institutions used student referenda before adopting a fee. The agency invites participation of student government and the Dean of students in deciding the fees for the ridership pass. Foothill Transit works with institutions and uses media, prints, and banners extensively to market the U-Pass program. It also promotes the program at school events and provides information to students regarding lost cards and how to get them replaced.

c. Implementation

All participating institutions have nearly 60,000 students eligible for the pass. However, the policies for usage of pass are different for all institutions. For instance, Mt. San Antonio College provides a free class pass (reusable card with electronic fare) to students who pay their fee in fall or spring semesters. Those who pay fees in the fall are eligible for Class Pass use during the

winter session as well. Similarly, those who pay in the spring are eligible for Class Pass use during the summer session.

Foothill Transit sells Class Passes at lower prices compared to regional passes available to the non-university public. For instance, Citrus College includes the Class Pass cost in the mandatory student fee, and it is $7 per semester for full-time students and $6 per semester for part-time students. In comparison, a regular monthly pass available to the public costs $110 per month, or $440 for four months. A Class Pass, which costs $6-$9 per semester, is clearly only a fraction of the cost of a regular pass. The transit agency bills the institutions based on a per trip basis, charging them 75 cents for each boarding. The institutions also pay a capitalized cost based on total costs to the transit agency each semester.

The program uses smart cards for the Class Pass system. The agency also developed an IT program to keep an updated list of all pass holders to help prevent fraud and to discourage students from having multiple passes. A lost card is replaceable for a fee of $10 by returning to the campus to obtain it. The agency keeps a track of lost cards to deactivate them.

The transit agency makes service improvements as needed including schedule modifications and added evening hours. The agency responds with standby buses to handle large loads on opening days of new services. This often occurs in morning peak hours but not in afternoons.

Foothill Transit runs in partnership with LACMTA at Pasadena College and Rio Hondo College. Students of these colleges have a sticker on their student IDs allowing them to travel through LACMTA as well. The pass technology enables revenues to be distributed among transit agencies by following policies established for fare distribution.

d. Evaluation

The program benefits from smart cards providing extensive usage information. The program's evaluation happens through periodic surveys of pass usage, attitudes as well as before and after studies of ridership. Students account for nearly 7 percent of transit usage. This percentage increased by 18 percent in the second year and 14 percent in the third year of program implementation.

Case Study 3: Milwaukee County Transit System (MCTS), Wisconsin

a. Overview

The Milwaukee County Transit System (MCTS) was created in 1975 and is the largest agency in Wisconsin. It was formed as part of the Milwaukee county government. The transit agency operates with 400 low floor buses on 60 bus routes covering nearly 90 percent of the county and some parts of neighboring counties as well. University of Wisconsin-Milwaukee (UWM)

adopted the U-Pass program in 1994. Later, six more schools joined the program. Investigators derived information about this program through interviews with MCTS and UWM staff.

UWM has a compact campus with limited parking, creating the need for this program. Residents opposed increases in parking and supported transit services. As part of initial efforts to bring transit services to campus, the university bought tickets from the agency and sold them to students at discounted prices. In 1990, MCTS partnered with the university to adopt a U-Pass program paid by student fees.

b. Planning

The U-Pass program was first proposed to the university transit and parking office, student government, and campus administration. Students' vote in favor of the program inspired administration support as well. The agency has an agreement with the university describing payments, service charges, and pass administration. The University guarantees transit revenue neutrality. It conducted studies before and after the program implementation to determine revenue impacts. Implementation of this task took nearly two years.

The eligibility of students in the U-Pass programs differs slightly from institution to institution. The agreements are usually one year except for the Milwaukee Area Technical College, which has a three-year agreement. Good working relations exist between the institutions and the agency.

MCTS sets up information booths at student orientations and distributes passes in the events. It makes extensive use of mail services and social media. The agency makes strong efforts of outreach during campus tours or during orientations in residence halls. These efforts highlight multiple benefits of the program such as ease of use, ease of city exploration, avoiding car purchases, and avoidance of parking charges.

c. Implementation

In 2017, 50 percent of the 50,000 eligible students had passes. UWM established that any student paying the segregated fee, which is an additional fee paid by students for access to student services and facilities, can have the pass, which is charged to all students enrolled for one or more credits. Students in online courses do not pay this fee and thus are not eligible for the pass. The program excludes faculty and staff, but they are eligible to purchase commuter value passes.

The program was implemented with a revenue neutral approach in 1994. Since then, the revenue of the program has inflated with time. The student pass costs $45.10 in spring and fall semesters and $22.10 in summer, compared to a regular adult pass that costs $72 per month. Students eligible for financial aid have the pass treated as any other component of the financial aid package.

The program uses smart card technology (M-Card). To ride transit, students show their I-Cards along with the M-Card which has a unique ID number. The university updates valid pass number information daily for MCTS. In the future, M-Cards and I-Cards will be integrated when the university redesigns the student IDs. The cards can be replaced for a fee of $15 and only one may be replaced per semester. The institutions have managed to avoid fraud by the daily updates on eligible passes to MCTS.

MCTS makes improvements in the program using university inputs. It includes adding and modifying university-oriented routes. Over time following changes have been implemented.

- Addition of routes from remote park and ride lots to campus.
- Addition of shuttle service.
- Extension of existing routes.
- Weekend services for students residing in dorms.
- Different schedules for examination periods.

University shuttles run on routes that may not be covered by MCTS and uses MCTS bus stops. The program provides information about MCTS bus arrival times on monitors in unions and dorms.

d. Evaluation

In 2017, the program accounted for 5 percent of the total MCTS ridership. Student associations and university administration both strongly support the program. The smart cards used for the program provide information about card usage and the expectations regarding use according to time of the day, week, and month of year.

For evaluation of the program, data from October was collected. Direct routes account for 87 percent of all boarding. Some routes operate year-round while others operate only when the university is in session. In 2016, the U-Pass accounted for 1.5 million boardings at UWM.

Key Takeaways

Role of Transit Agencies, Institutions, and Students

- Transit agencies, school administrations, and students all initiate U-Pass Programs.
- Programs are often managed by one of two kinds of partnerships: 1) transit agencies and school administration and 2) transit agencies and student associations.
- Transit agencies plan transit routes, schedules, timetables, user information, data collection, evaluation of the program, fare structures, and fare mechanisms.
- Institutes increase their involvement in U-Pass programs by maintaining a dialogue with transit agencies regarding service issues, via contracts for services and having university representatives on transit board.

- Students play an active role through participation in advisory committees, holding student referenda, involvement in administration and management as well as through research efforts.

Program Design

- Programs vary widely in terms of student status required for participation in U-Pass Programs, and percentage of students using the U-Pass programs also varies greatly.
- U-Pass programs are not available to students after they graduate.
- Programs cover a range of services such as local bus services, light rail systems, regional commuter services, campus shuttle services, paratransit services, on-call services and intercity transportation. Passes differ in their use with regards to time of the day, places and routes of use or even academic semesters of the schools.
- Transit agencies improve their services after program implementation such as changes to existing routes, increase in the hours of operation, increase in number of vehicle trips, longer routes during peak hours as well as addition of new routes around the university campus.
- Nearly 55 percent of transit agencies maintain coordination between U-Pass Programs and other campus transit services.
- Transit passes can be used as student IDs or smart cards only.

Program Financing

- Program budgets varied from $10,000 to $6,000,000 (reported by transit agencies) and $25,000 to $28,600,000 (University of Washington, Seattle, reported by universities). $3,150,000 was the estimated average budget.
- Transit agencies reported student fees, and local, state and federal funds as the major source of funds. The institutions reported student fees and parking fees as primary funding sources for the U-Pass programs.

Benefits and Challenges of the Programs

- Primary benefits as reported by the transit agencies include greater transit ridership to the university campus, greater transit ridership to other locations, creation of lifetime riders and improved marketing, and greater transit revenue.
- Primary benefits as reported by participating institutions include reduction in parking demand on campus, reduction in commuting costs for students, and increased affordability of college education.
- Challenges faced by transit agencies include abusive use of transit passes and costs of additional buses and other facilities.
- Challenges faced by institutions include the costs of U-Pass programs paid by institutions and resistance to increase in parking fee when it is used to fund the program.

Impact Measures of U-Pass Programs

- The most common evaluation measures are ridership data; financial data including subsidies, income from fares, and costs; and results of satisfaction surveys.
- Continuation of growth in passenger trips (in the range of 0.3 percent to 251 percent) annually after implementation of the program.

Satisfaction Levels

- Generally, both responding institutions and agencies were satisfied with the programs.
- Primary reasons for unsuccessful implementation of programs include university administration resistance, parking revenue loss, opposition to fee increase, lack of transit on campus, limitation of resources, and inclusion of part-time students in the program.
- Transit agencies and universities generally have a positive attitude towards the program.
- Institutions tend to consider the attitude of bus drivers as negative and the attitude of university students as slightly negative towards the programs.

Lessons Learned

- Transit agencies suggest working on pass use details to make it more compatible with or integrated with student IDs. They also suggest simplification of the contracting process. The agencies also want to ensure appropriate prices of the pass.
- Responding universities suggest better marketing, improved administration, better communication between agencies, institutions, and students as well as improved anticipation of the program demand.

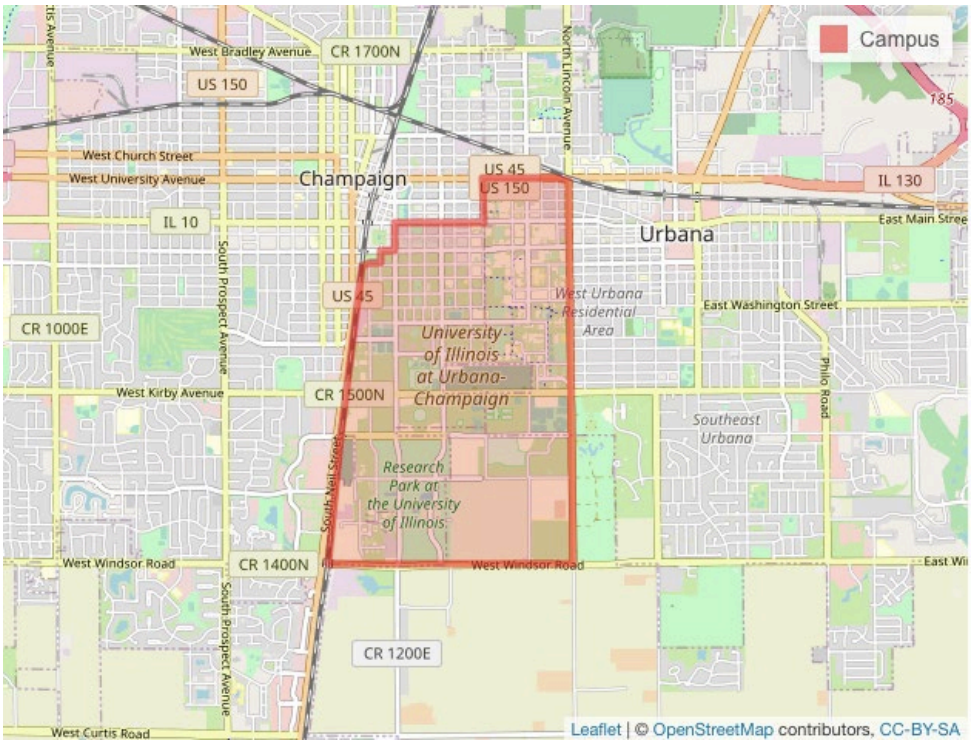
2. Transit Ridership and Operational Performance Analysis

Chapter 2 analyzes transit ridership and operational performance over the 10-year period from 2007-2017 in order to better understand the existing context in which Champaign-Urbana Mass Transit District (MTD) operates, and the potential future developments that will affect transit ridership. The research team analyzed data from MTD, the National Transit Database, the U.S. Census, and the American Community Survey (ACS). Findings indicate that campus stations account for a significant proportion of total ridership; that MTD's ridership has been in decline, but that this mirrors a national trend; and that student population density continues to concentrate along Green Street and decline in Urbana.

Task 2-1. Spatial Analysis of Transit Ridership

This section will analyze transit ridership trends over the 10-year period from 2007-2017 by route and major stops, and by station location (on or off campus). The campus area is defined by Lincoln Avenue on the east, Windsor Avenue on the south, Neil Street on the west, and University Avenue on the north (Figure 2-1).

Figure 2-1: Map of the Campus area



a. Ridership by Station Location

Stations are classified into two main categories: on-campus stations and off-campus stations. In 2018, 11 percent of stations were on campus, up from 9 percent in 2016 (see Table 2-1). Off-campus stations make up 89 percent of the total, down from 91 percent in 2016. Despite the greater number of stations, off-campus stations account for less than half of total daily ridership, and this decreased from 2016 (41 percent) to 2018 (39 percent). On-campus stations provide 61 percent of all ridership in 2018, up from 59 percent in 2016. On campus stations have slightly higher alightings than boardings, and the opposite is true for off campus stations. However, more passenger revenue miles were reported on the off-campus stations.

Table 2-1. Transit ridership by station location, 2016-2018

Station Location	Number of Stations	Daily Total	Daily Board	Daily Alight	Passenger Revenue Miles (millions)
2018					
On-campus	274	46,211	22,921	23,289	133.6
	11%	61%	60%	61%	43%
Off-campus	2,287	30,047	15,129	14,919	173.9
	89%	39%	40%	39%	57%
Total	2,561	76,258	38,050	38,208	307.4
	100%	100%	100%	100%	100%
2016					
On-campus	251	45,891	22,707	23,184	N/A
	9%	59%	58%	59%	
Off-campus	2,425	32,000	16,170	15,830	N/A
	91%	41%	42%	41%	
Total	2,676	77,891	38,877	39,014	N/A
	100%	100%	100%	100%	

b. Ridership by Route Type

Routes are categorized as campus routes if they primarily serve campus or community routes if they primarily serve the community. Campus routes include 1 Yellow Hopper, 10 Gold Hopper, 12 Teal, 13 Silver, 21 Raven, and 22 Illini. Both daytime and evening trips were included in this analysis. Campus routes board and alight most (89 percent) of their ridership on on-campus stops, with only 11 percent coming from off-campus stops (Table 2-2). Community routes board and alight 71 percent of ridership at off-campus stops, while 29 percent of boardings and alightings come from on-campus stops.

Table 2-2. Annual transit ridership by route type and station type, 2018

	On-campus stops	Off-campus stops	Total
Campus Routes (6 Routes)			
Boarding	5,293,764 (89%)	670,743 (11%)	5,964,507 (100%)
Alighting	5,335,253 (89%)	644,338 (11%)	5,979,591 (100%)
Community Routes (15 Routes)			
Boarding	1,588,752 (29%)	3,912,531 (71%)	5,501,283 (100%)
Alighting	1,585,636 (29%)	3,884,969 (71%)	5,470,605 (100%)

c. Top 10 percent Boarding and Alighting Stations

The top 10 percent (256) stations account for 85 percent of daily boarding and alighting in the MTD system. Among these stations, 53 percent (136 stations) are on-campus stations, and the remaining 47 percent are off campus. Figure 2-1 shows the spatial distribution of top the 10 percent daily alighting and boarding stations in 2018. Figure 2-2 focuses on the top stations within the university district.

In general, the top stations include commercial centers such as Walmart stores, Marketplace Mall, and Country Fair; transit centers such as the Illinois Terminal; and college campuses such as Parkland College and many stations at the University of Illinois. Within the University of Illinois, top stations include Illini Union (south side), Transit Plaza (SE and SW sides), Ikenberry Commons (south side), Gregory at the Library (north and south), and PAR (north side). The list of top alighting stations is similar and includes Armory & Wright (south side).

Figure 2-1. Top 10 percent boarding and alighting stations, 2018

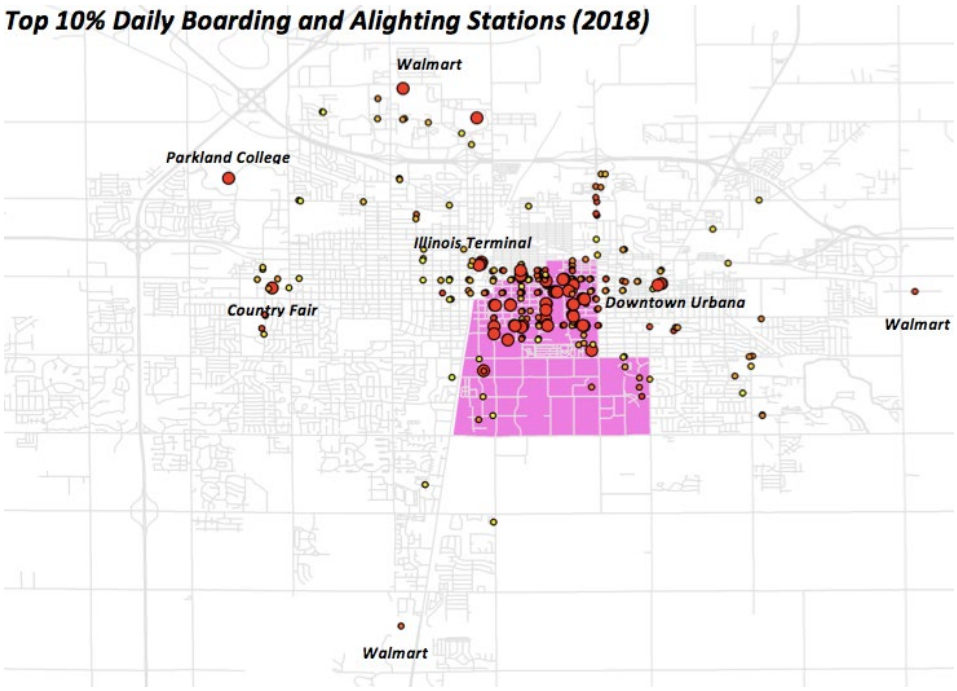
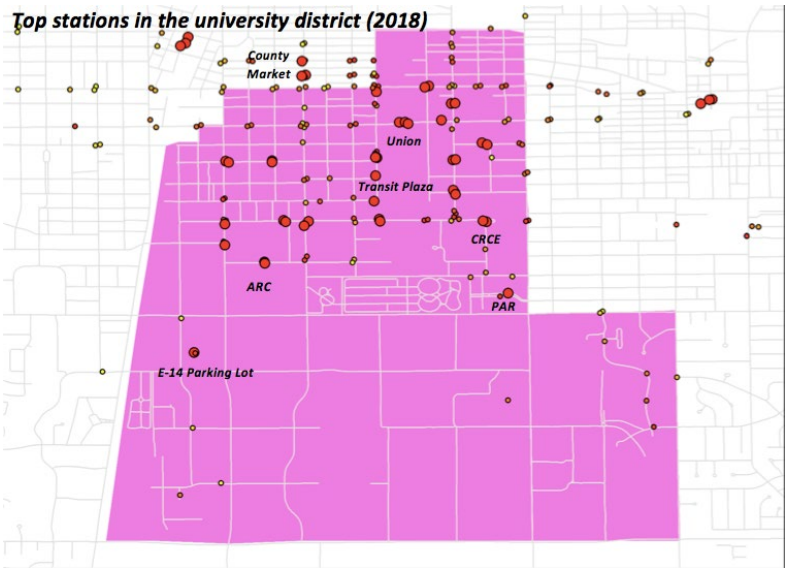


Figure 2-2. Top 10 percent boarding and alighting stations in the university district, 2018



We compare daily transit ridership (boarding and alighting) between 2016 and 2018. Figure 2-3 shows daily transit ridership change in each grid cell (900 square feet) in the university district between 2016 and 2018. Transit ridership along Green Street significantly decreased in this period. This can be explained by adjustment of MTD routes due to the MCORE Project 1. The construction, which occurred from March 2017 until December 2018, significantly affected the decline of transit ridership in this area. On the contrary, transit ridership significantly increased

along Goodwin Avenue, especially near the Materials Research Laboratory. This also can be explained by adjustment of routes caused by the MCORE Project 1. Figure 2-4 shows the same variable in Figure 2-3 but focuses on the entire Champaign-Urbana region.

Figure 2-3. Daily transit boarding and alighting change in the university district between 2016 and 2018 (size of cell: about 900 by 900 feet)

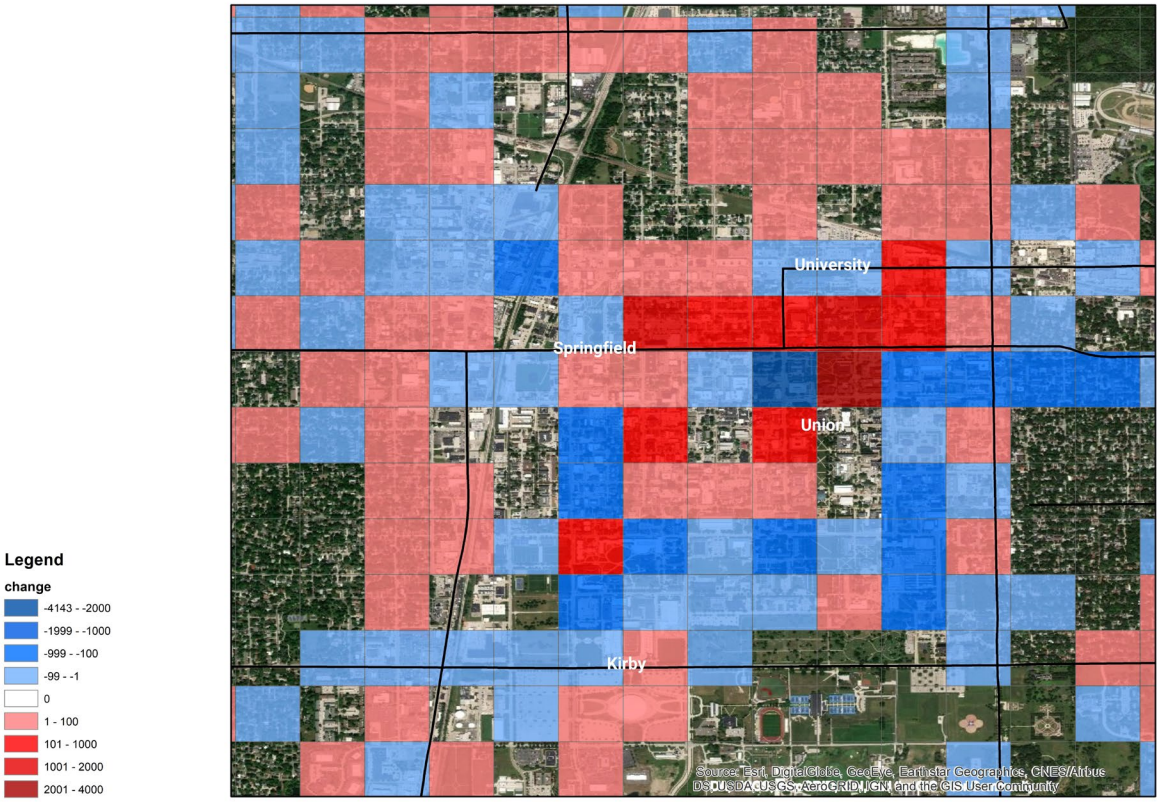
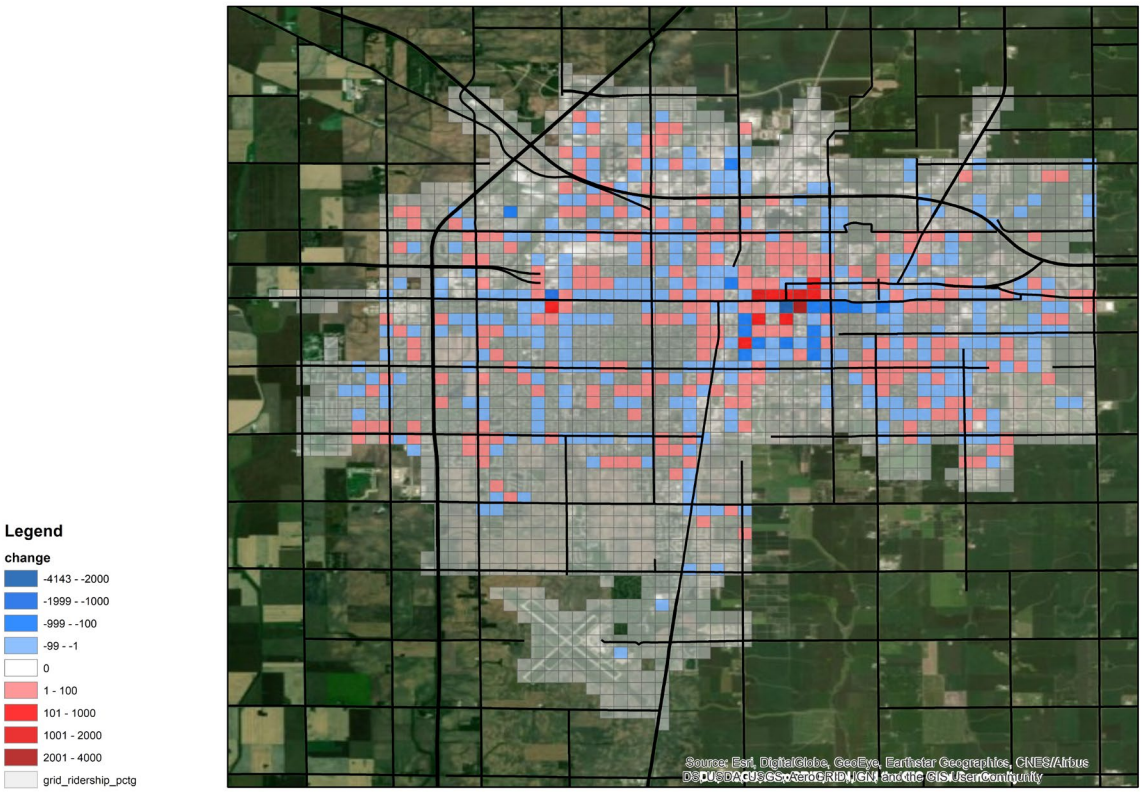


Figure 2-4. Daily transit boarding and alighting change in the Champaign-Urbana area between 2016 and 2018 (size of cell: about 900 by 900 feet)



d. Heatmap Analysis

To examine the density of weekday transit service, we created a heat map (i.e., Kernel density estimation) to show the density of weekday transit service. Figure 2-5 shows the density for a Monday (using Monday, August 27, 2018 as an example), and Figure 2-6 shows the same map, but focused on the university district. Darker red cells indicate that there is more transit service in that area, both in terms of density of station locations and frequent services. Also note that the breakpoints of each color are same in the two maps. This means that people can easily access transit in darker red areas. Figure 2-7 shows the same heat map, but uses Sunday, September 2, 2018 as an example, and Figure 2-8 focuses on the university district.

These maps indicate five major hotspots: Country Fair, Illinois Terminal, Campus (Transit Plaza and Goodwin), Lincoln Square Mall in Urbana's downtown, and Ikenberry. During the weekday, Goodwin Avenue shows the highest service level, which can be explained by the higher number of transit services, and most of those services are frequent.

In both weekday service and weekend service, the Illinois Terminal and the Illini Union are served by higher level of transit services, because these are hubs of the MTD services. In addition, North Lincoln Street shows higher levels in both weekday and weekend service.

Although this area is served only by one route, the 22 Illini, the bus operates every 10 minutes, indicating a high frequency of services. Finally, the results show that weekend service is limited compared to the weekday service.

Figure 2-5. Heat map of transit service level on a Monday, 2018

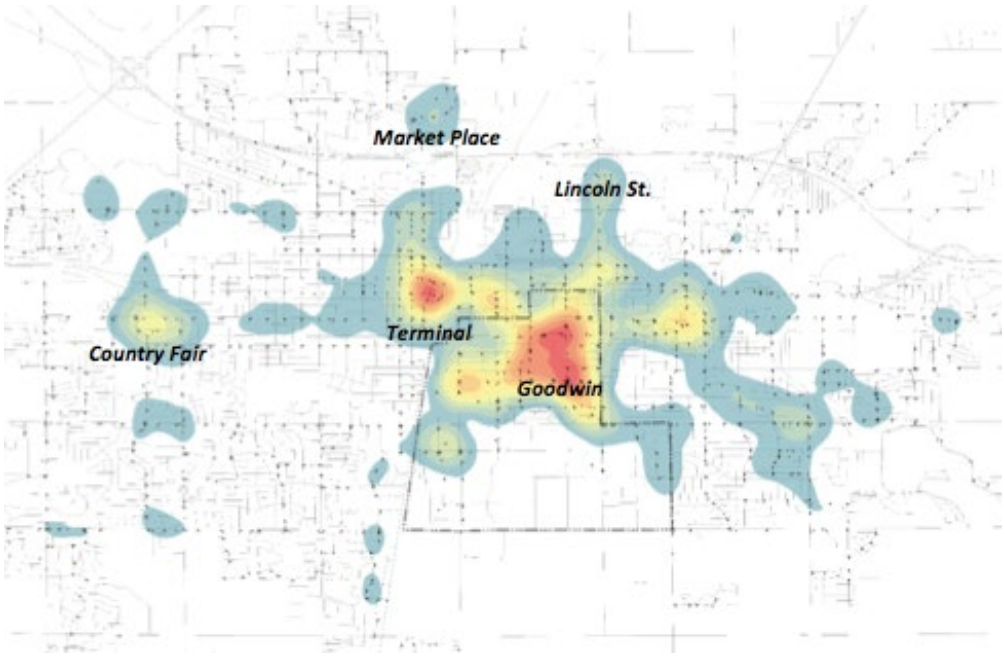


Figure 2-6. Heat map of transit service level on a Monday in the university district, 2018

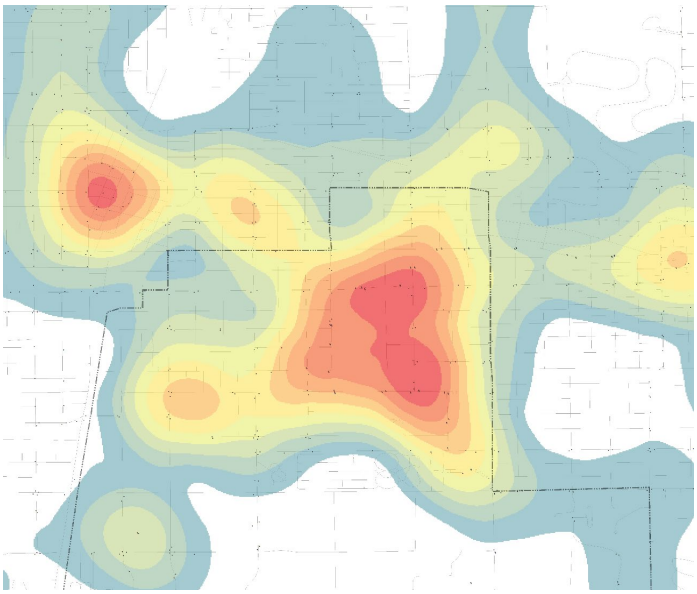


Figure 2-7. Heat map of transit service level on a Sunday, 2018

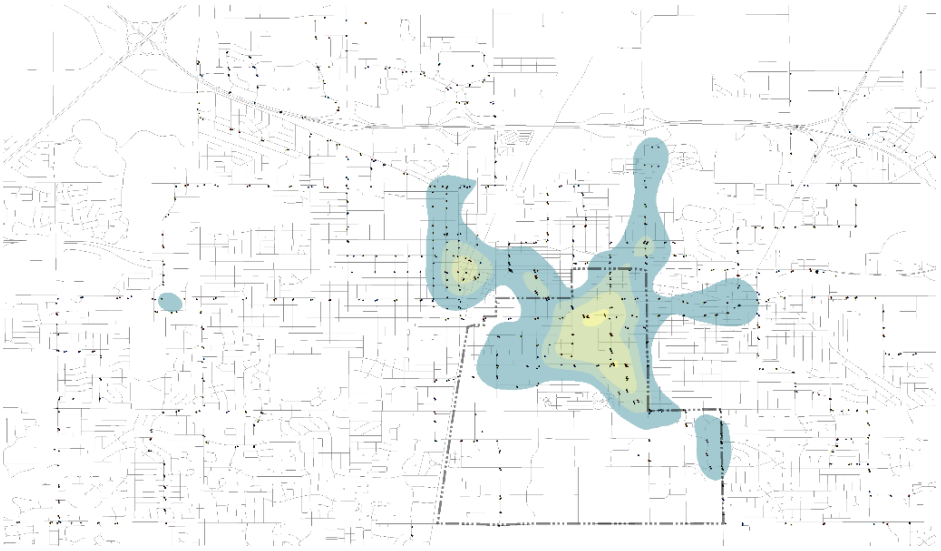
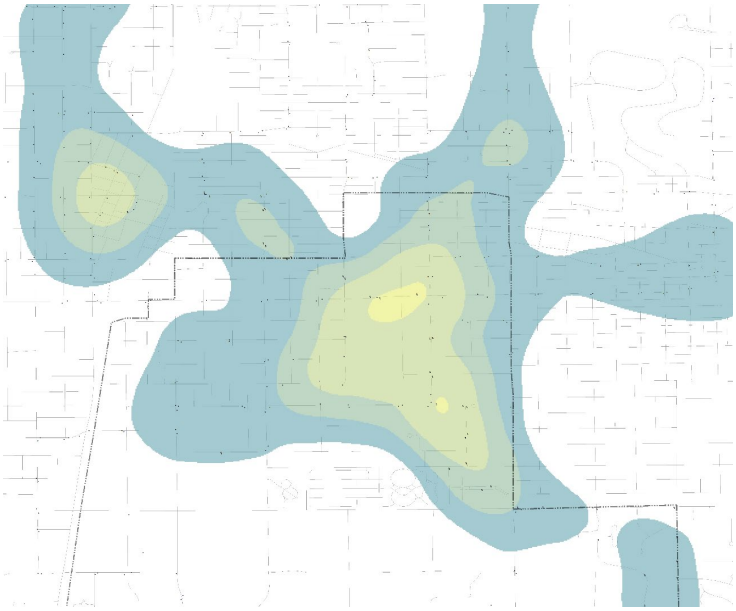


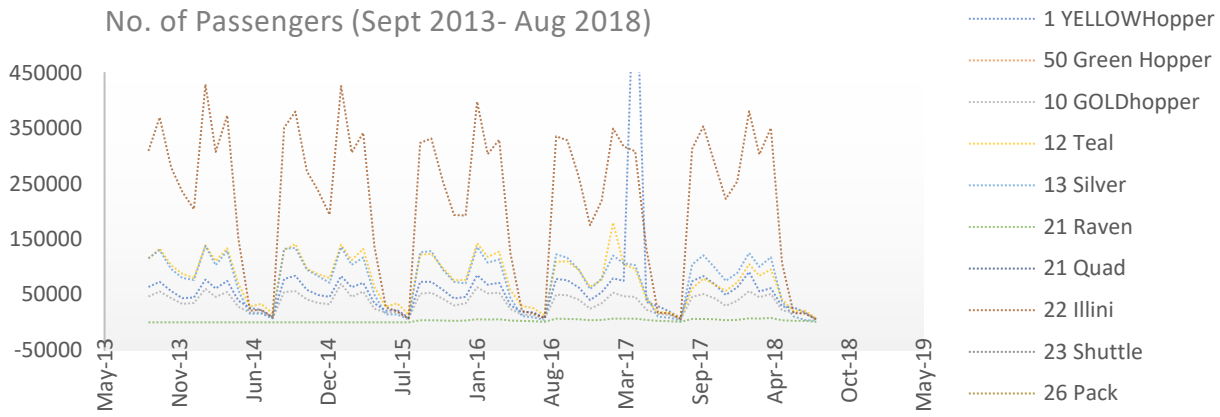
Figure 2-8. Heat map of transit service level on a Sunday in the university district, 2018

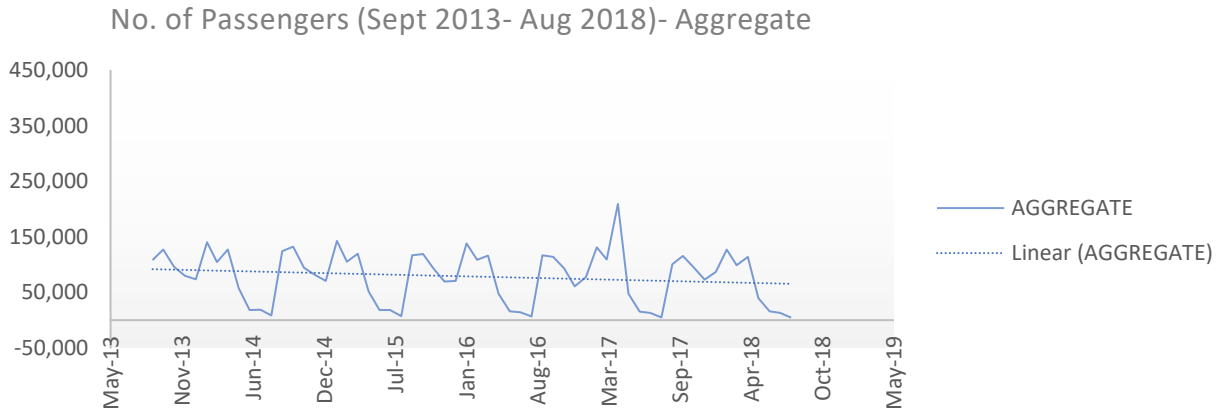


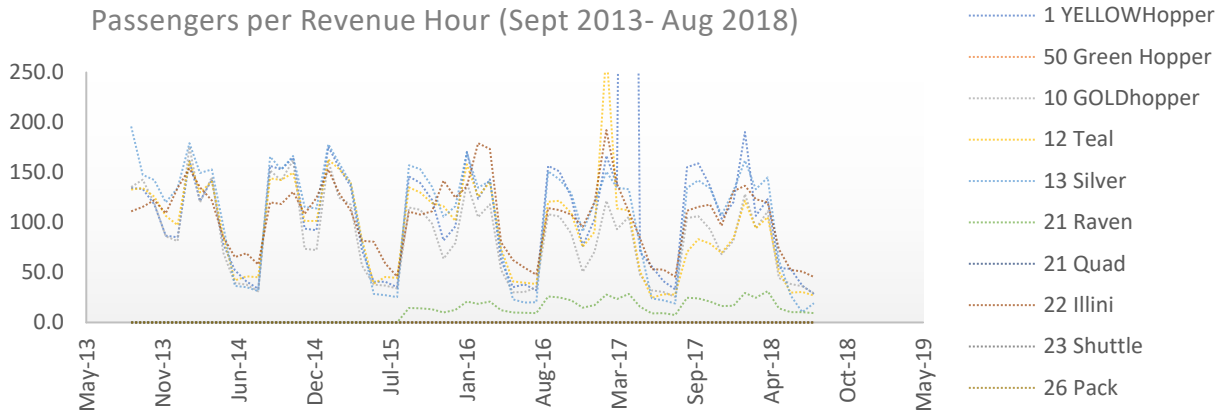
e. Route Performance Analysis

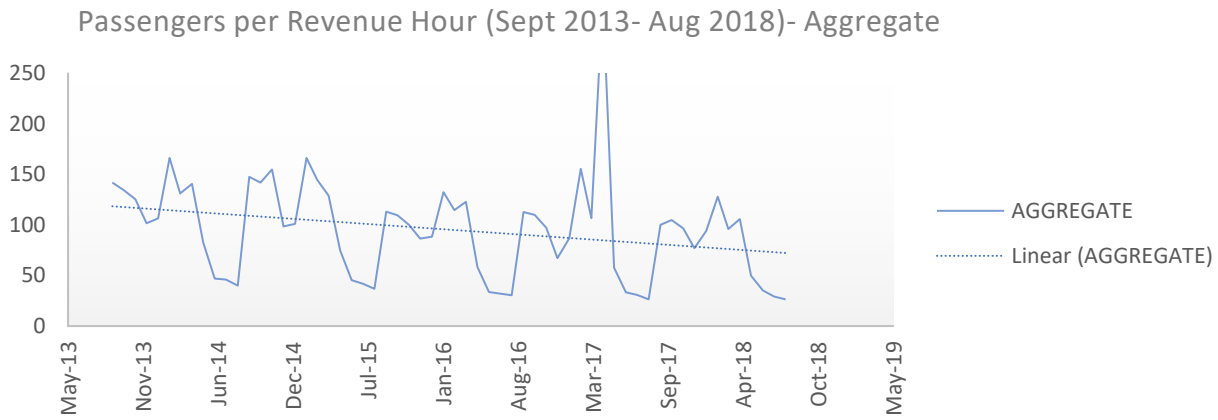
This section analyzes ridership by route, both on-campus and off-campus during weekdays and weekends from September 2013 to August 2018. Route performance is analyzed using three performance indicators: number of passengers, passengers per revenue hour, and passengers per revenue mile by routes.

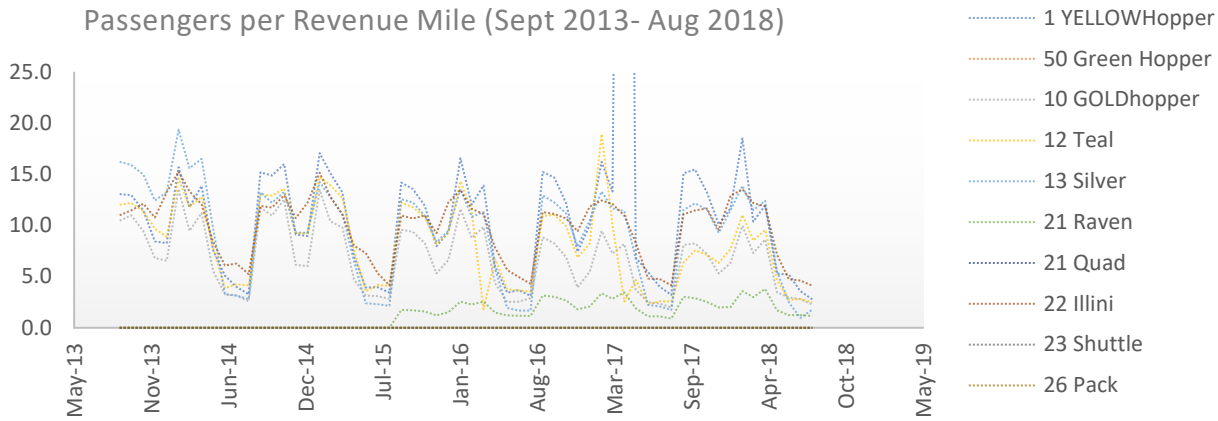
Figure 2-9: Campus Weekday Routes Performance Analysis








Passengers per Revenue Hour (Sept 2013- Aug 2018)- Aggregate
250
200
150
100
50
0
May-13
Nov-13
Jun-14
Dec-14
Jul-15
Jan-16
Aug-16
Mar-17
Sep-17
Apr-18
Oct-18
May-19
AGGREGATE
Linear (AGGREGATE)


Passengers per Revenue Mile (Sept 2013- Aug 2018)
25.0
20.0
15.0
10.0
5.0
0.0
May-13
Nov-13
Jun-14
Dec-14
Jul-15
Jan-16
Aug-16
Mar-17
Sep-17
Apr-18
Oct-18
May-19
1 YELLOWHopper
50 Green Hopper
10 GOLDhopper
12 Teal
13 Silver
21 Raven
21 Quad
22 Illini
23 Shuttle
26 Pack

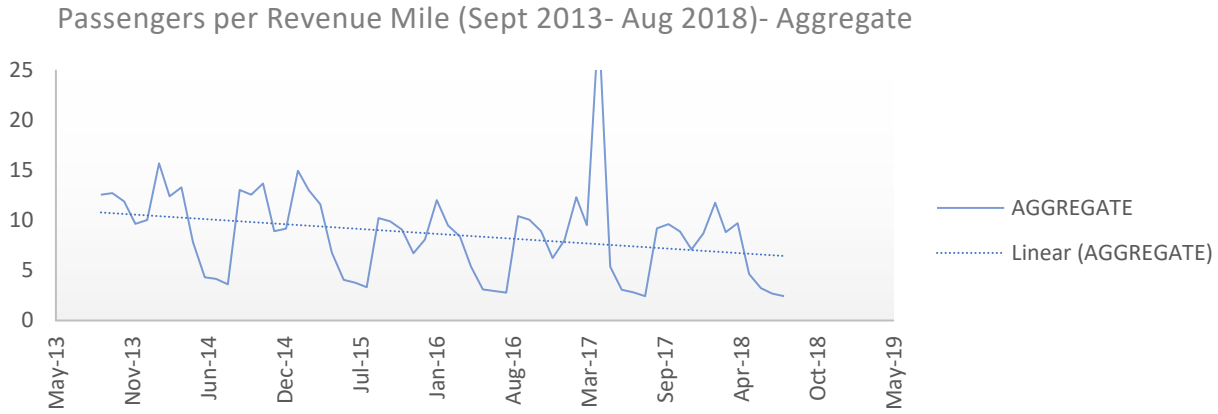
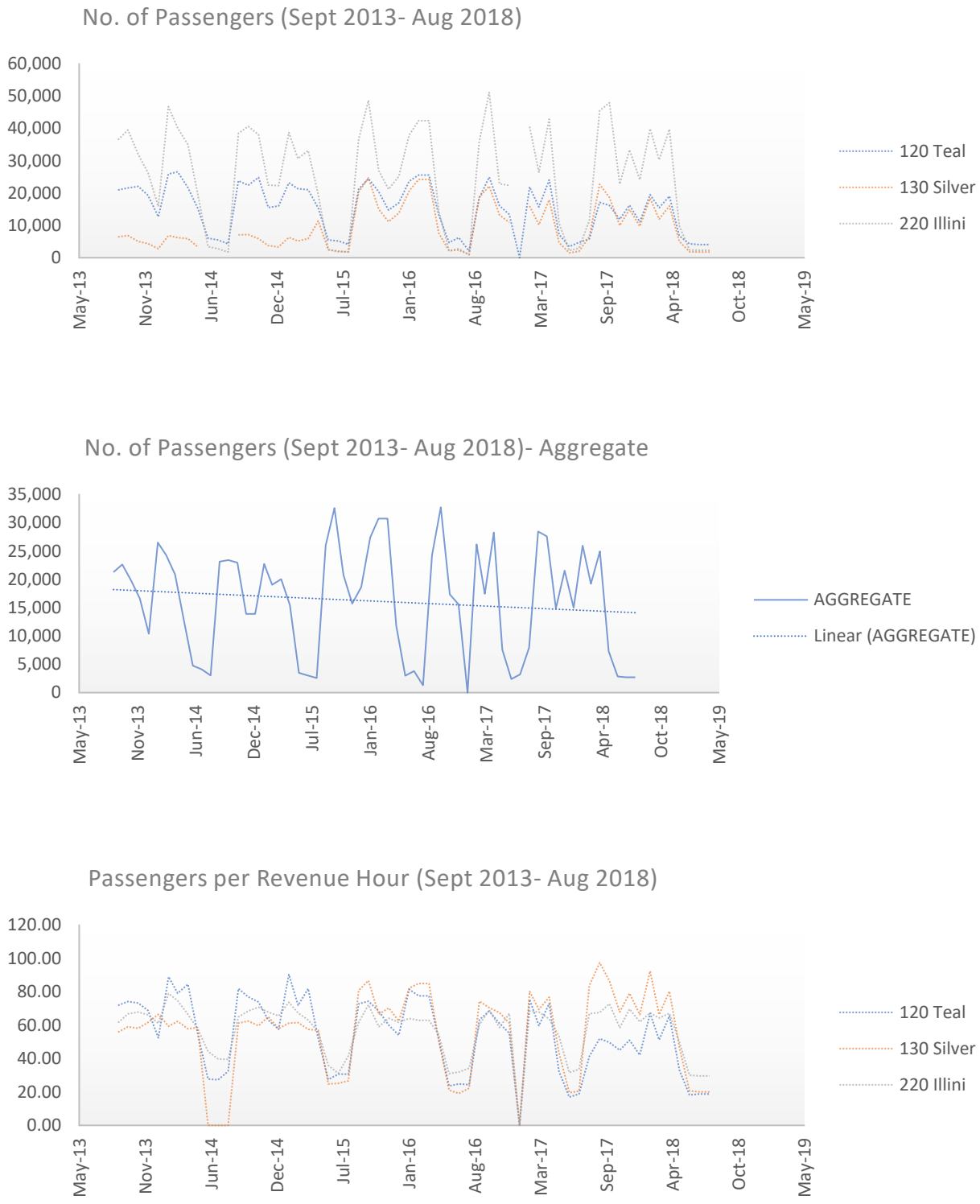
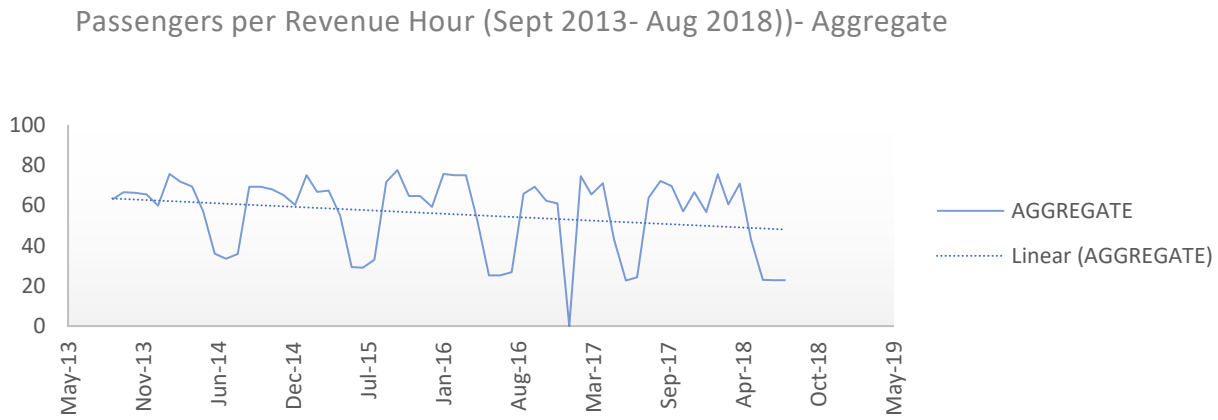
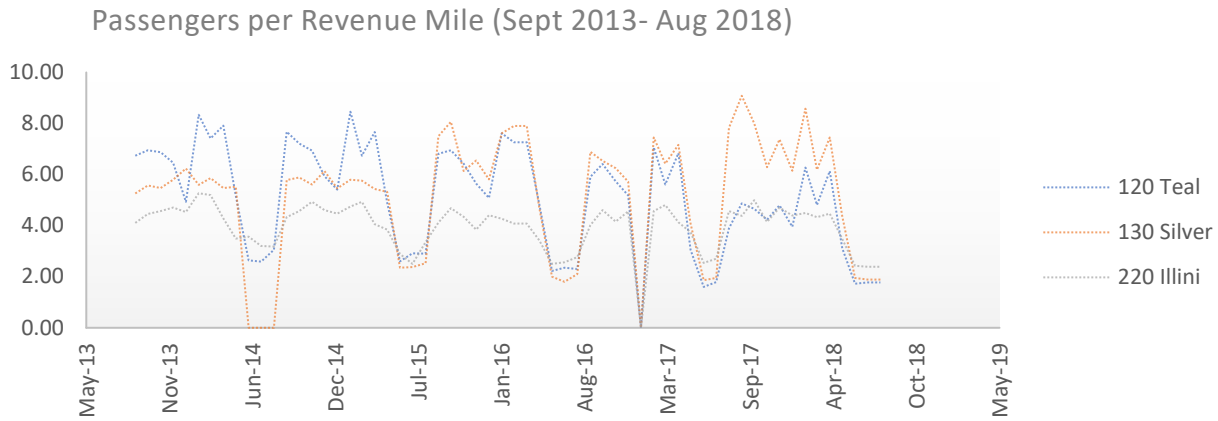

Passengers per Revenue Mile (Sept 2013- Aug 2018)- Aggregate
25
20
15
10
5
0
May-13
Nov-13
Jun-14
Dec-14
Jul-15
Jan-16
Aug-16
Mar-17
Sep-17
Apr-18
Oct-18
May-19
AGGREGATE
Linear (AGGREGATE)

Figure 2-10: Campus Weekend Routes




Passengers per Revenue Hour (Sept 2013- Aug 2018))- Aggregate
100
80
60
40
20
0
May-13
Nov-13
Jun-14
Dec-14
Jul-15
Jan-16
Aug-16
Mar-17
Sep-17
Apr-18
Oct-18
May-19
AGGREGATE
Linear (AGGREGATE)


Passengers per Revenue Mile (Sept 2013- Aug 2018)
10.00
8.00
6.00
4.00
2.00
0.00
May-13
Nov-13
Jun-14
Dec-14
Jul-15
Jan-16
Aug-16
Mar-17
Sep-17
Apr-18
Oct-18
May-19
120 Teal
130 Silver
220 Illini

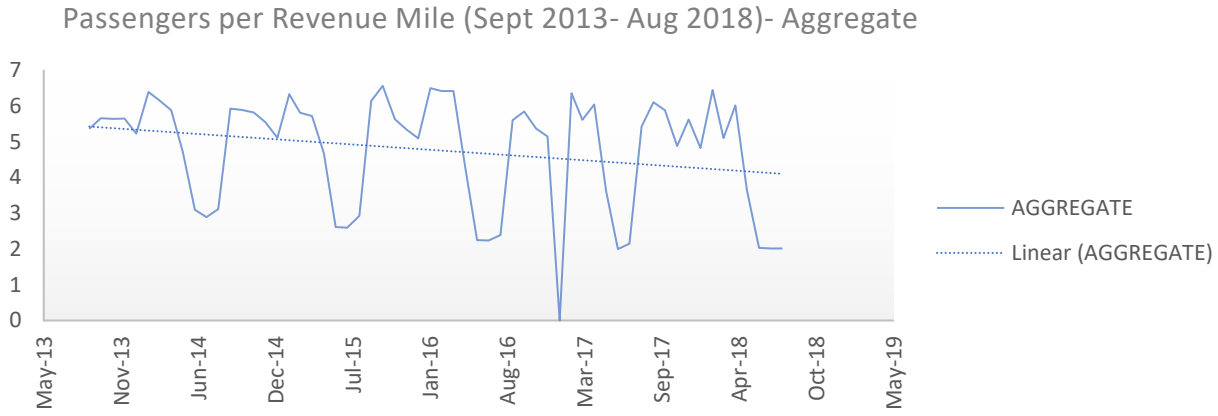
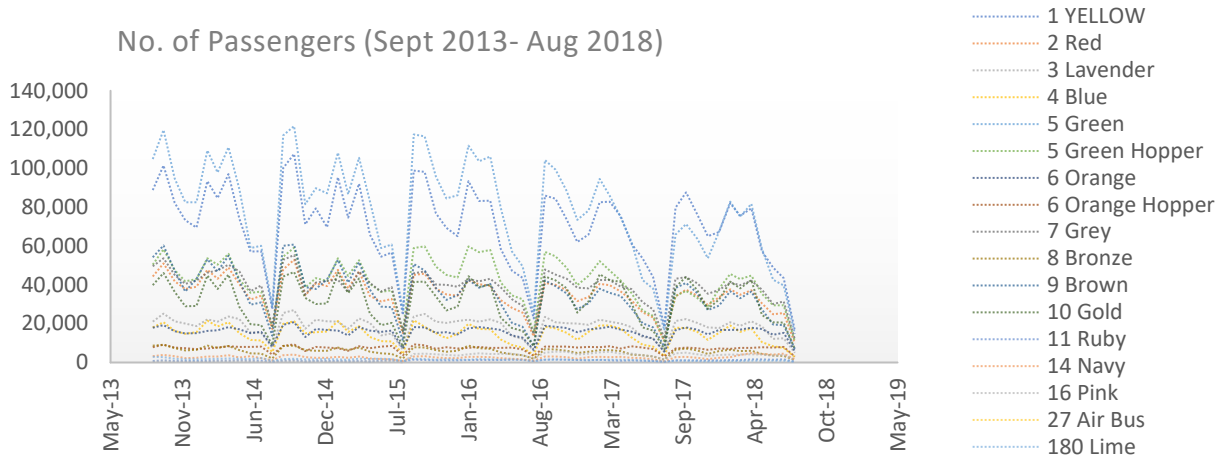
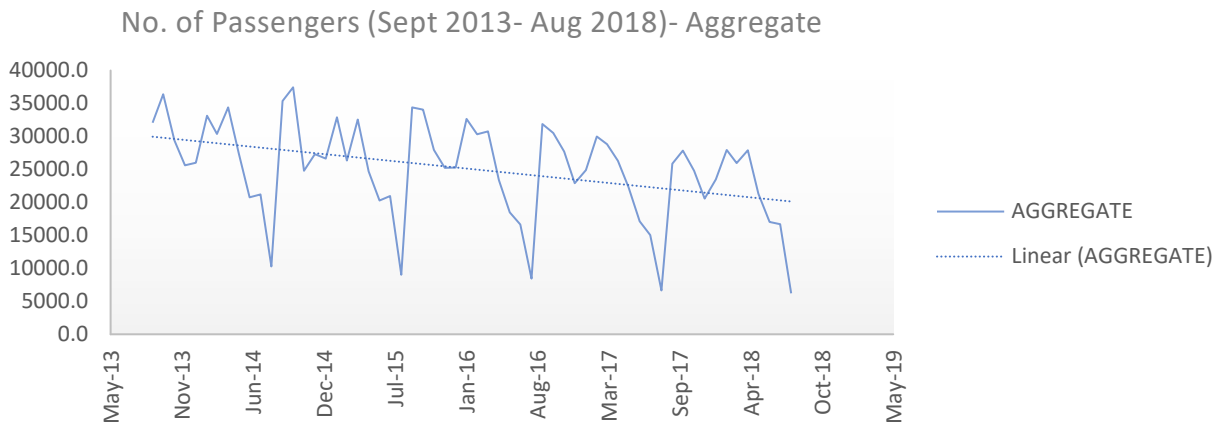
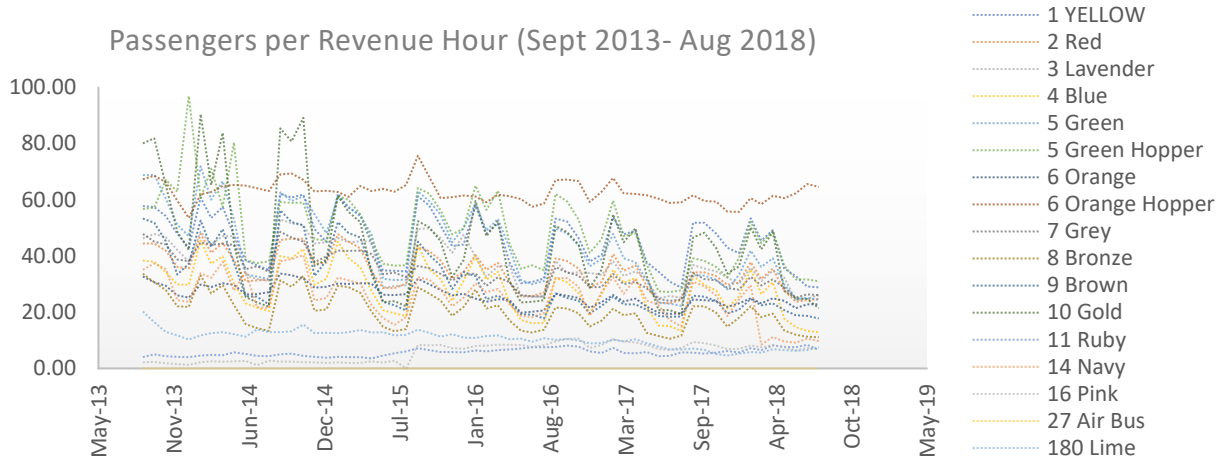
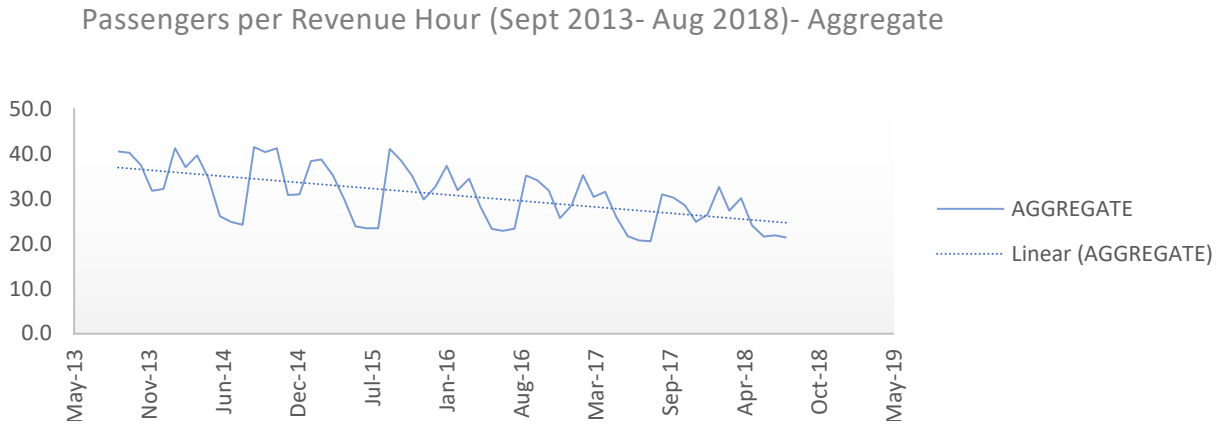

Passengers per Revenue Mile (Sept 2013- Aug 2018)- Aggregate
7
6
5
4
3
2
1
0
May-13
Nov-13
Jun-14
Dec-14
Jul-15
Jan-16
Aug-16
Mar-17
Sep-17
Apr-18
Oct-18
May-19
AGGREGATE
Linear (AGGREGATE)

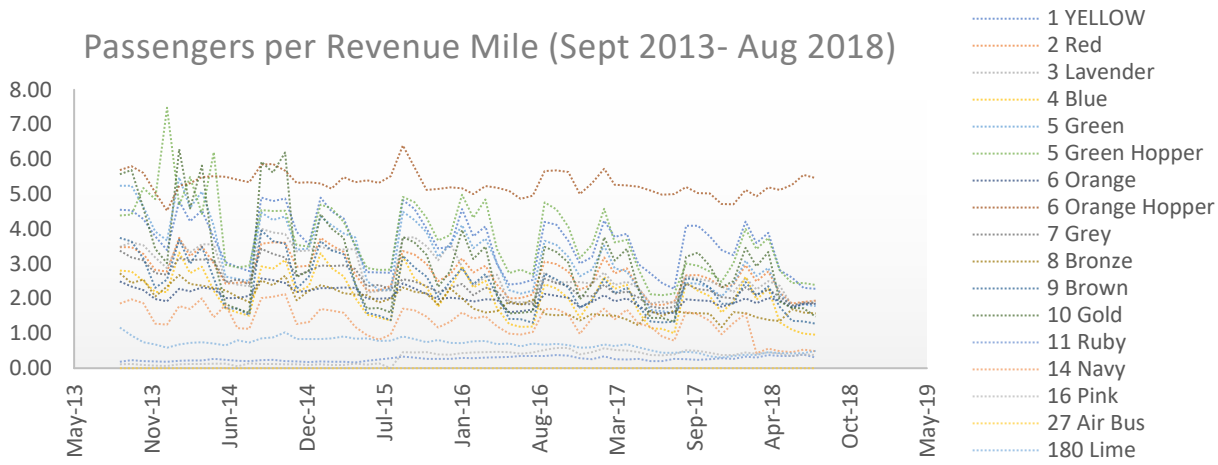
Figure 2-11: Community Weekday Routes








Passengers per Revenue Hour (Sept 2013- Aug 2018)- Aggregate
50.0
40.0
30.0
20.0
10.0
0.0
May-13
Nov-13
Jun-14
Dec-14
Jul-15
Jan-16
Aug-16
Mar-17
Sep-17
Apr-18
Oct-18
May-19
AGGREGATE
Linear (AGGREGATE)


Passengers per Revenue Mile (Sept 2013- Aug 2018)
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
May-13
Nov-13
Jun-14
Dec-14
Jul-15
Jan-16
Aug-16
Mar-17
Sep-17
Apr-18
Oct-18
May-19
1 YELLOW
2 Red
3 Lavender
4 Blue
5 Green
5 Green Hopper
6 Orange
6 Orange Hopper
7 Grey
8 Bronze
9 Brown
10 Gold
11 Ruby
14 Navy
16 Pink
27 Air Bus
180 Lime

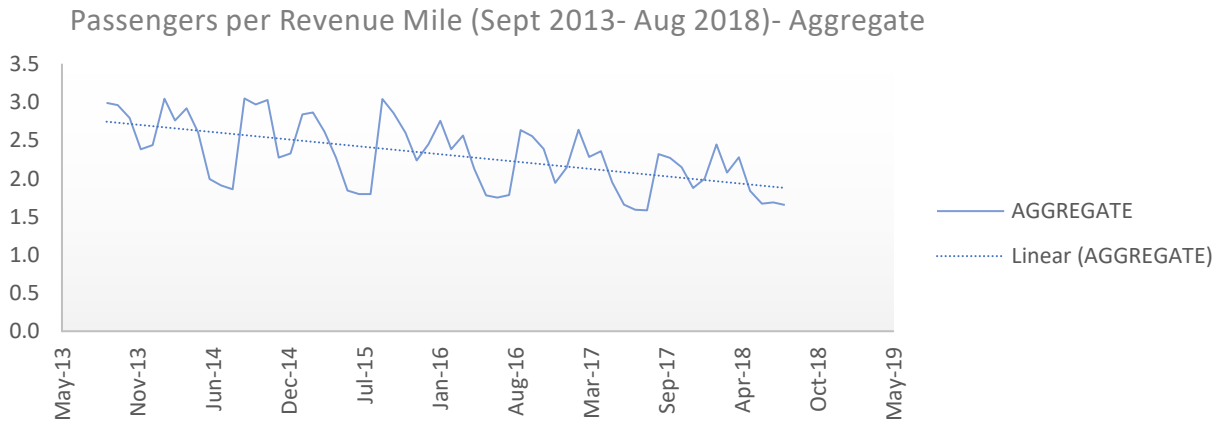
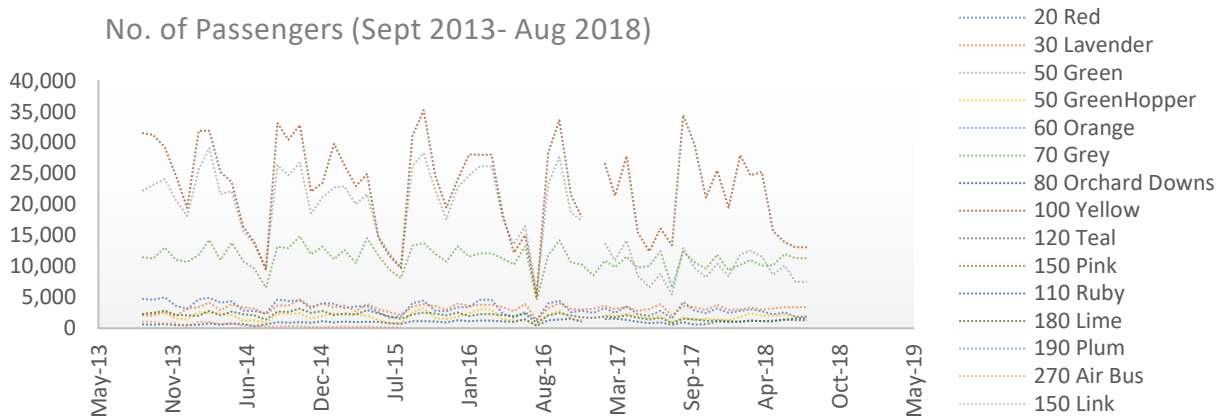
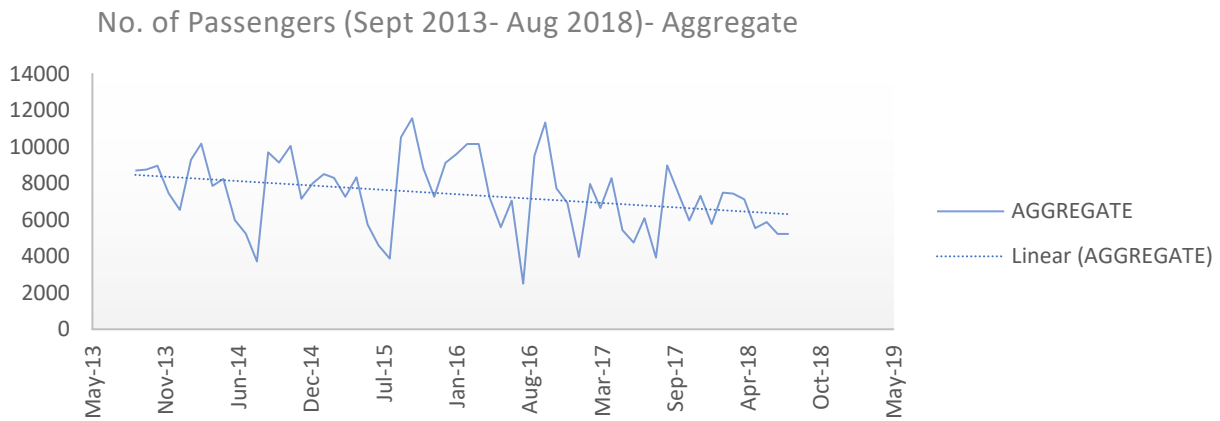
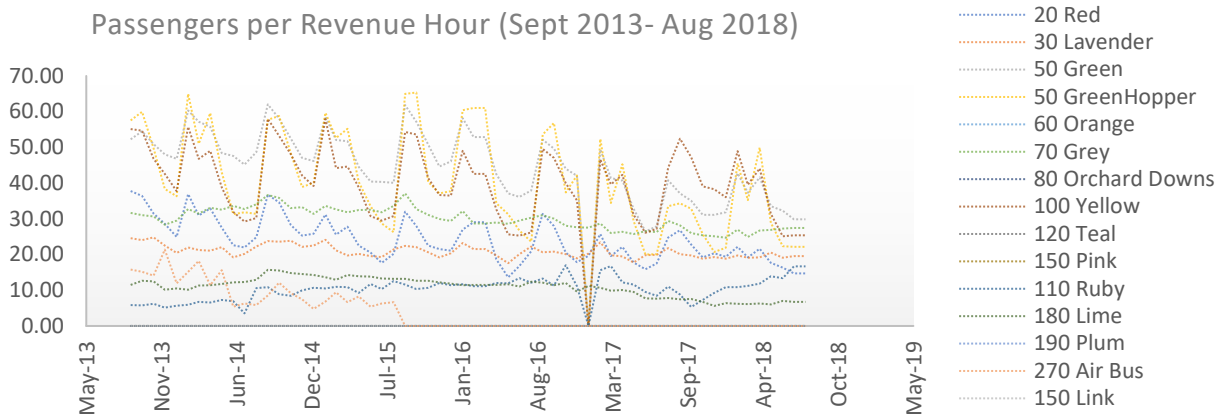
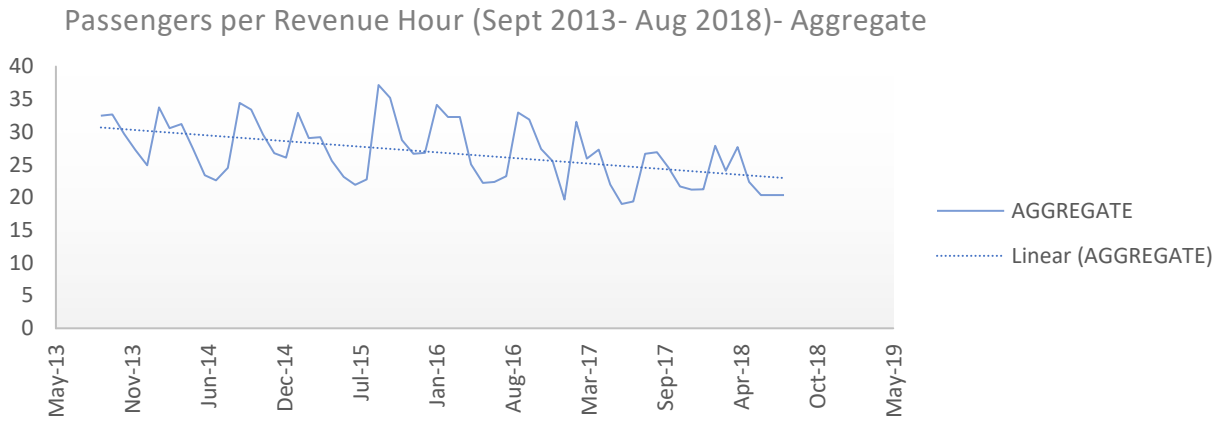

Passengers per Revenue Mile (Sept 2013- Aug 2018)- Aggregate
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
May-13
Nov-13
Jun-14
Dec-14
Jul-15
Jan-16
Aug-16
Mar-17
Sep-17
Apr-18
Oct-18
May-19
AGGREGATE
Linear (AGGREGATE)

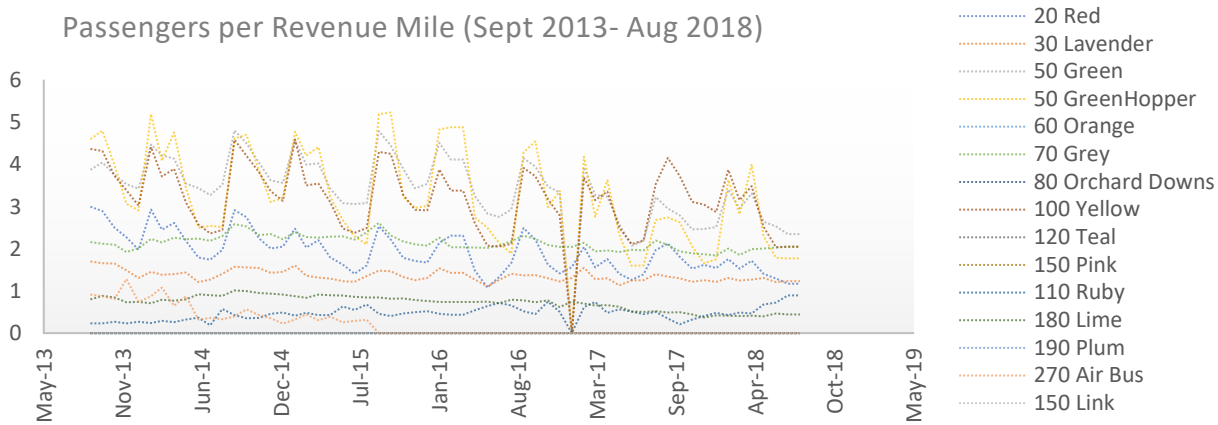
Figure 2-12: Community Weekend Routes

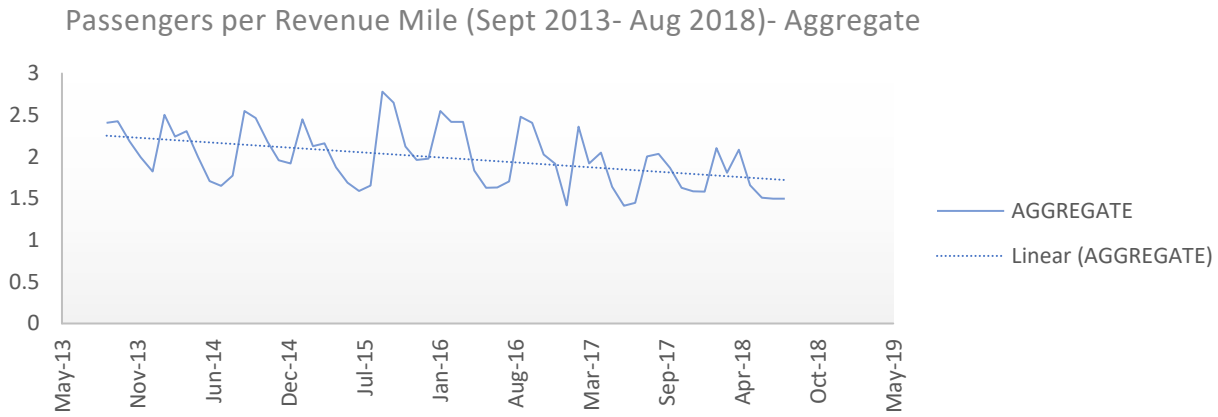












On-campus route performance remains consistent from September 2013 to August 2018. None of the three indicators analyzed show noticeable variation across five years for these routes, either for weekdays or weekends. Off-campus routes, on the other hand, show a steady decline across years in all three variables. This is true for both weekdays and weekend routes. The

figures above indicate no change in ridership for on-campus routes but declining ridership for off-campus routes.

Task 2-2. Operational Performance Measures

By using data from the National Transit Database (NTD) collected and maintained by the Federal Transit Administration (NTA), we examine several important operational performance measures. We focus on data reported between 2002 and 2017.

a. Unlinked Passenger Trips

Unlinked Passenger Trips (UPT) is defined as the number of passengers that board public transportation vehicles. When a transit trip involves transfers, all individual trips are counted. Figure 2-13 shows annual UPT between 2002 and 2018. Transit ridership in the region shows a steady increase since 2007, then began declining after the 2015 peak. Figure 2-14 shows UPT per capita, which illustrates a similar trend.

Figure 2-13. Unlinked Passenger Trips (UPT), 2002-2018

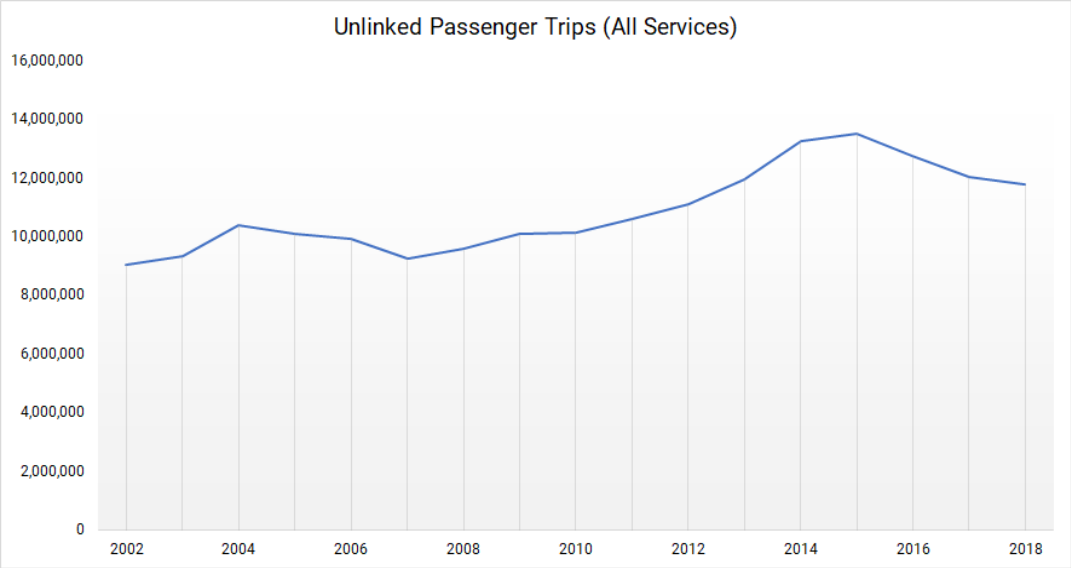
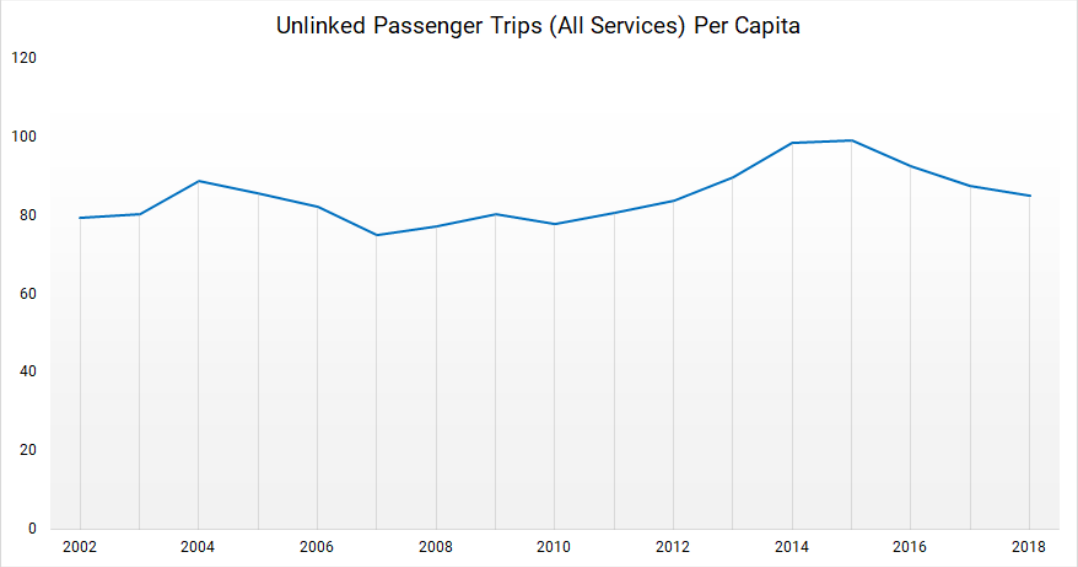


Figure 2-14. Unlinked Passenger Trips Per Capita, 2002-2018

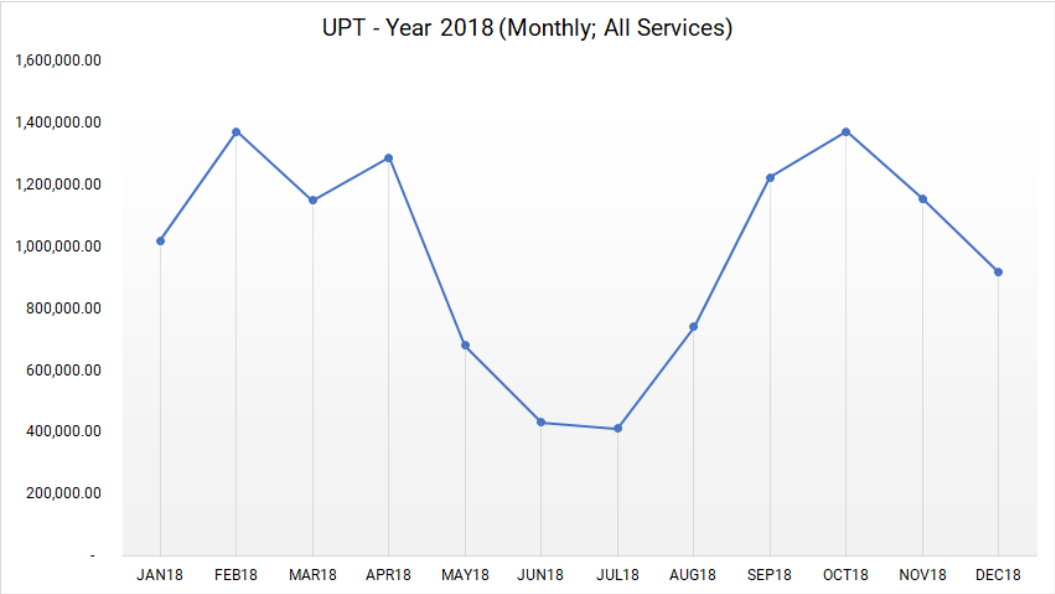


We compare MTD's UPT trend with that of the U.S. in Figure 2-15, using 2002 as the reference point (defined as 1.0). Nationally, transit ridership showed a slow growth in the 2000s and early 2010s, and then started to decline after the 2014 peak. However, the slow ridership growth was largely due to an increase in rail ridership in New York and other large urban areas. Bus ridership decline began in 2009 and started to accelerate from 2015 in most large urban areas. MTD's decline in UPT since 2015 is similar to the U.S. national trend. However, MTD's UPT has grown more over the period from 2002-2018 than the national average (29.8 percent vs. the national average of 6.3 percent).

Figure 2-15. Unlinked Passenger Trips (UPT) of MTD and the nationwide trend, 2002-2018

There is a clear seasonal pattern in transit ridership. Figure 2-16 illustrates UPT in each month in 2018. There are two peaks of UPT in February and October. Both months are the middle of the academic semester and do not include any vacations (e.g., spring break or fall break). In addition, February generally has cold and snowy weather that promotes transit trips rather than other modes such as walking. The lowest UPT months are June and July, which are the middle of summer break when there is the fewest number of people on campus.

Figure 2-16. Monthly Unlinked Passenger Trips (UPT), 2018



b. Passenger Miles Traveled and Average Distance

Figure 2-17 shows the trend of passenger miles traveled (PMT) and Figure 2-18 shows the PMT) per UPT over time. While the PMT variable is unstable, showing an abnormal sharp increase or drop within a very short time period, an overall trend of shortening average bus trip distance is clearly observed. The average distance has decreased from 2.73 miles in 2002 to 1.87 miles in 2017. We believe this is due to an increase of students' share of total bus ridership.

Figure 2-17. Passenger Miles Traveled (PMT), 2002-2017

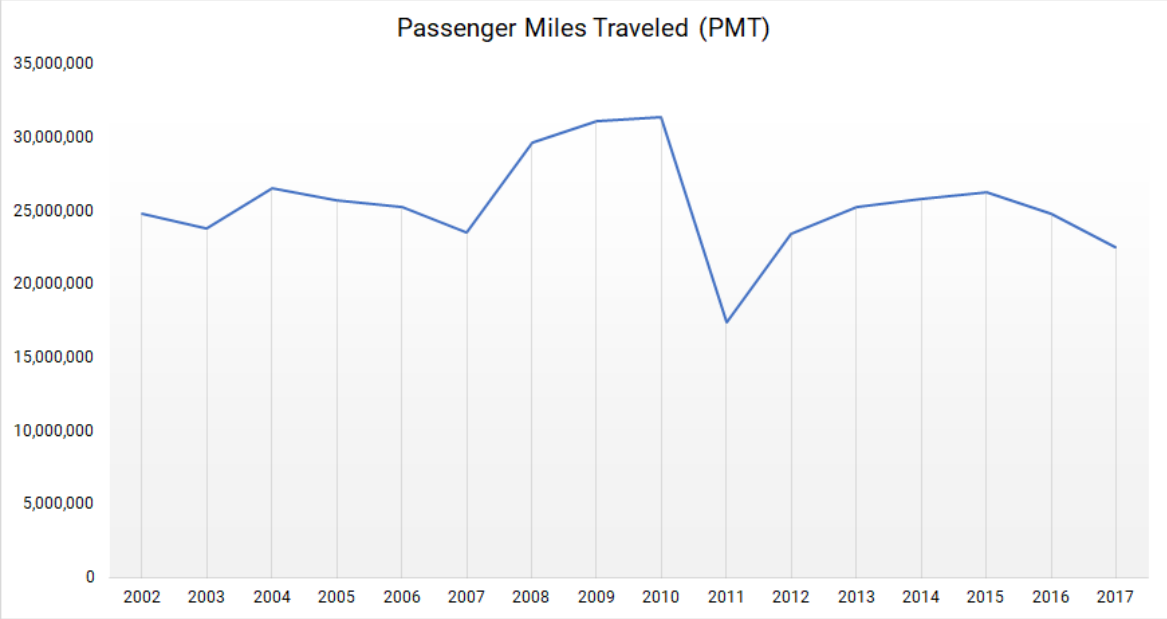


Figure 2-18. Average Distance per Passenger, 2002-2017

c. Vehicle Revenue Miles and Vehicle Revenue Hours

Figure 2-19 and 2-20 show Vehicle Revenue Miles (VRM) and Vehicle Revenue Hours (VRH) from 2002 to 2017 that are important indicators of transit service level. According to the NTD, VRM is defined as the miles that vehicles travel while in revenue service, while VRH is the hours that vehicles travel while in revenue service. Both graphs show a similar trend of gradual increase over the time period. Specifically, VRM and VRH were almost constant until 2006, and then they began to steadily increase. Recent transit ridership decline does not seem to be caused by a service cut.

Figure 2-19. Vehicle Revenue Miles (VRM), 2002-2017

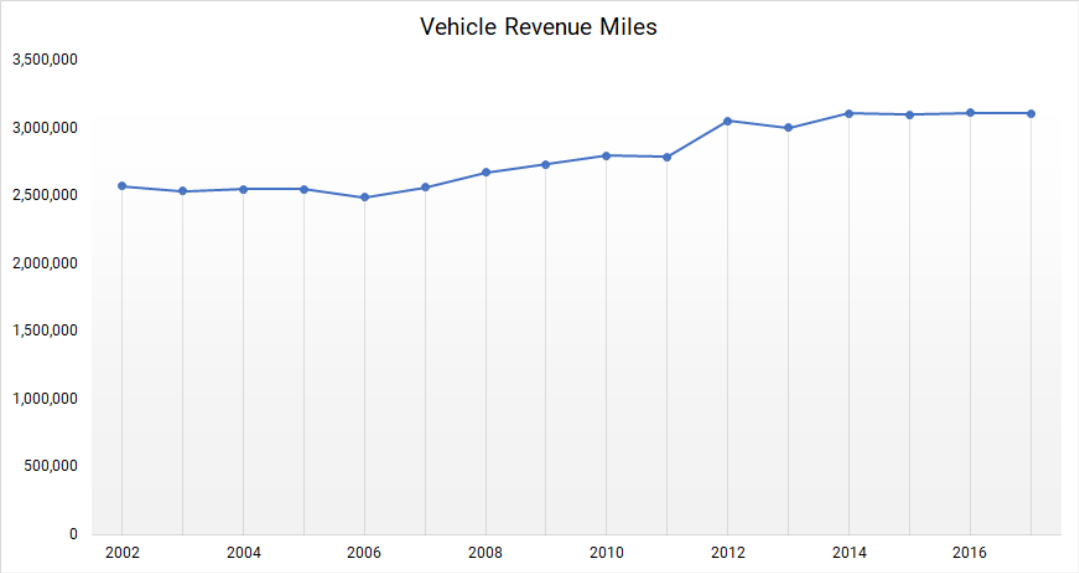
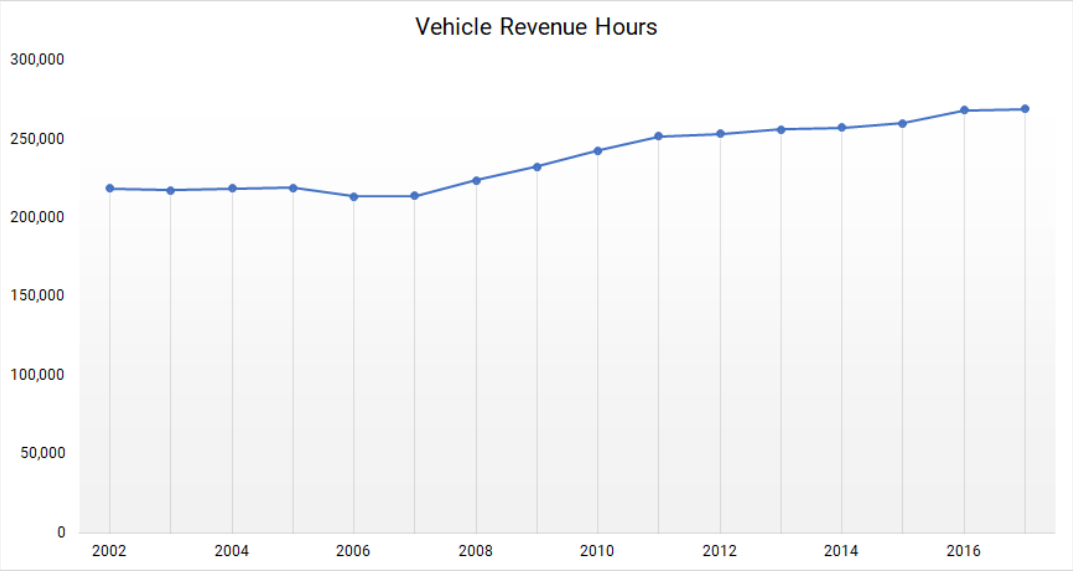


Figure 2-20. Vehicle Revenue Hours (VRH), 2002-2017



d. Operating Expenses

Figure 2-21 illustrates vehicle operations expenses (of all services) between 2002 and 2017 and includes inflation-adjusted vehicle operations expenses (in 2002 dollars). The operating cost has increased since 2002, even after adjusting for inflation. Figure 2-22 illustrates operating costs per unlinked passenger trips (UPT), which have also increased.

Figure 2-21. Vehicle Operations Expenses, 2002-2017

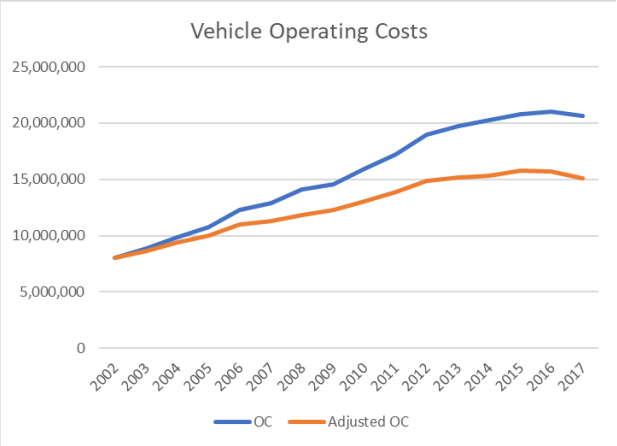


Figure 2-22. Operating Costs per Unlinked Passenger Trip, 2002-2017

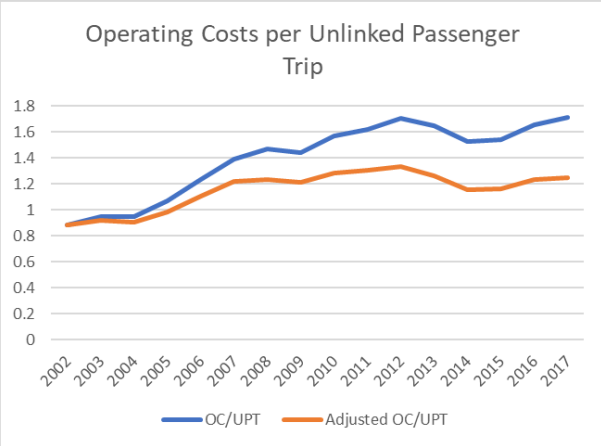


Figure 2-23 illustrates operating costs per vehicle revenue miles (VRM) and Figure 2-24 illustrates operating costs per vehicle revenue hours (VRH). Operating costs have steadily increased since 2002 in each of these metrics. These graphs show that costs slightly increased, even after adjusting for inflation.

Figure 2-23. Operating Costs per Vehicle Revenue Mile, 2002-2017

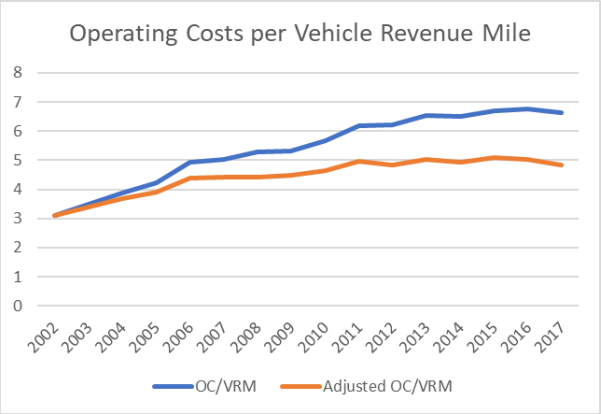
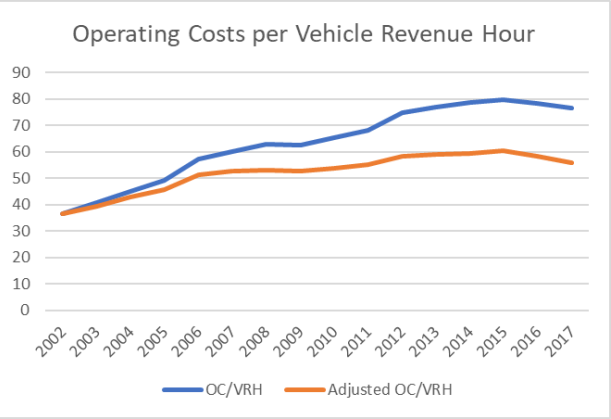


Figure 2-24. Operating Costs per Vehicle Revenue Hour, 2002-2017



e. Fares Revenues Earned

Figure 2-25 illustrates Fare Revenues Earned (FRE) between 2002 and 2017. FRE has gradually increased since 2002. In 2017, reported Fare Revenues Earned was about $7 million. Even after accounting for inflation, FRE continues to increase over this time period. Figure 2-26 illustrates fare revenues earned per unlinked passenger trips (UPT), which shows an increasing trend.

Figure 2-25. Fares Revenue Earned, 2002-2017

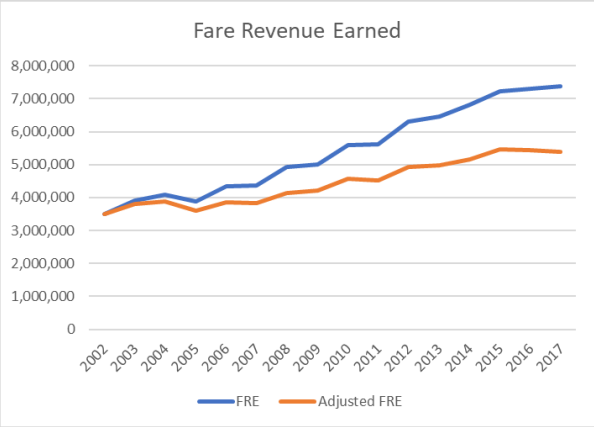
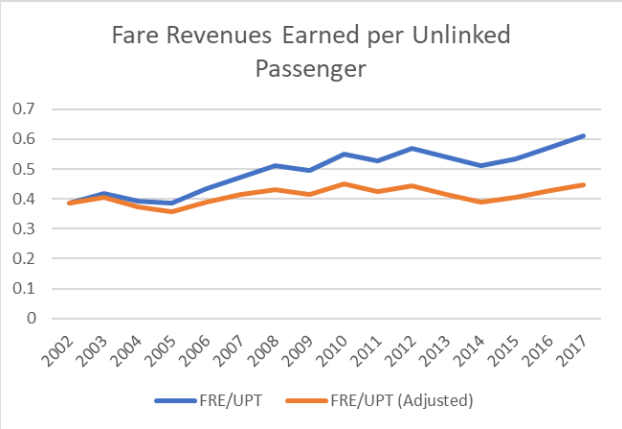


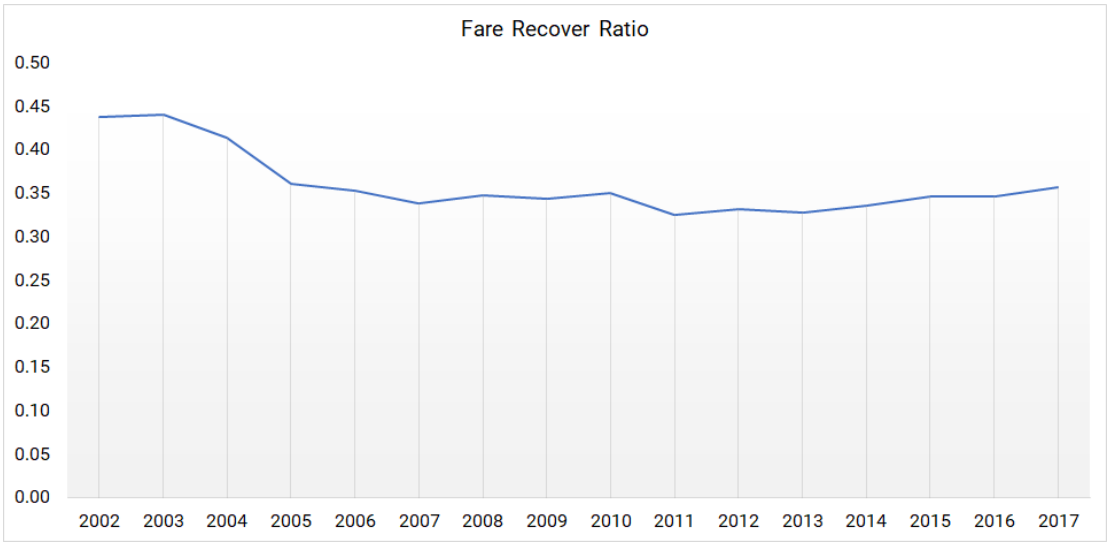
Figure 2-26. Fare Revenues Earned per Unlinked Passenger Trips, 2002-2017



f. Fare Recovery Ratio

Fare Recovery Ratio (FRR) is obtained by dividing fare revenues earned (FRE) by operating costs. It represents how operating cost is covered by fare earned by passenger trips. Figure 2-27 shows change of FRR over time. In general, FRR has slightly decreased since 2002.

Figure 2-27. Fare Recovery Ratio, 2002-2017



Note: Vehicle operations expenses are used as the denominator instead of total operating expenses and, thus, the ratios in the chart are a bit higher than normal fare recovery ratios.

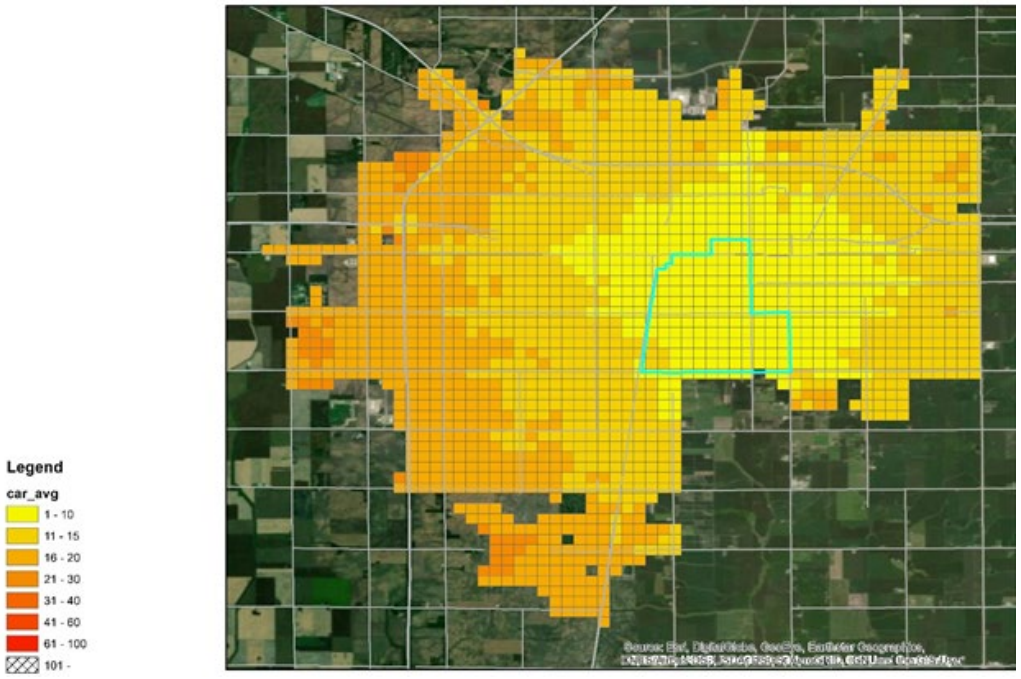
Task 2-3. Regional Travel Time Analysis

In this section, we analyze travel time to campus within the region based on distance and travel mode. To do this, we used Google Maps API to obtain realistic travel time using actual road networks, traffic congestion levels at each road segment, transit schedules, bike paths, and walkways. We divided the region into 900 by 900 feet grid cells and collected the travel time from each grid cell to campus, the center of Main Quad, by each travel mode. We obtained the data by running a Python program on November 22 to capture typical traffic conditions and regular bus routes and schedules during the same period that the 2019 Campus Travel Survey was conducted.

Average commute time from each grid to campus by driving, bus, bike, and walking are shown in Figures 2-28 to 2-32. Not surprisingly, commute time increases with the distance from the campus regardless of transportation mode. At any given distance to the campus, driving takes the shortest travel time, while walking takes the longest travel time.

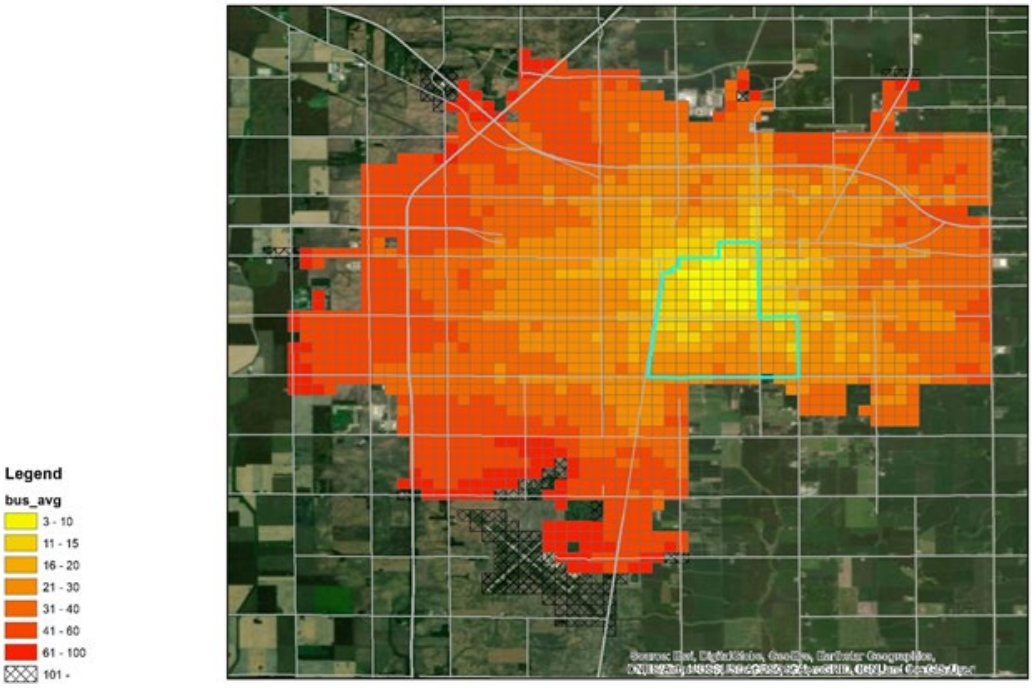
A 20-minute commute by bus is possible only for immediate campus neighborhoods and central locations while a driving commute takes less than twenty minutes from nearly all locations in the Champaign-Urbana region. It should be noted that the 20-minute bus commute zone extends to a bit farther locations along main arterials (bus routes) such as University and Curtis Avenue when estimated by three shortest trip times between 7:00am and 9:50am. The average of three shortest trip times is used as a proxy of the commute time in case when a commuter consults bus schedules.

Figure 2-28: Average Driving Time to Campus



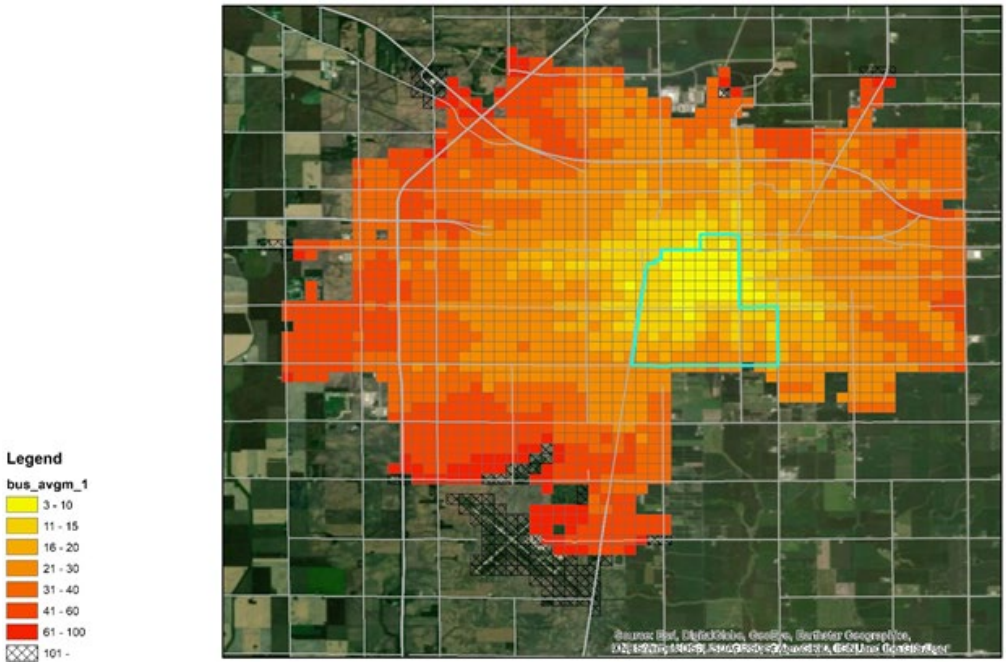
Note: Departure times used include 7am, 8am, and 9am from each grid cell (900 feet by 900 feet)

Figure 2-29: Average bus travel time to campus



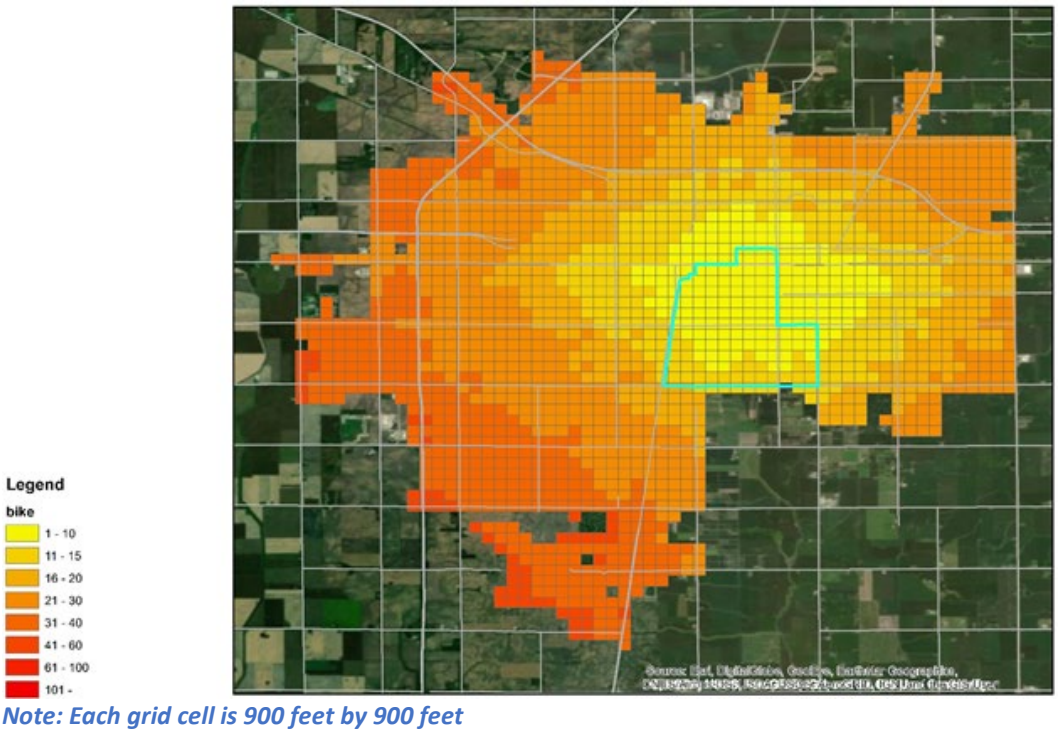
Note: Analysis uses 18 different departure times in a 10-minute interval (7am - 9:50am) from each grid cell (900 feet by 900 feet)

Figure 2-30: Average bus travel time to campus, using the three shortest travel times in a 10-minute interval



Note: Analysis uses average bus travel time of the three shortest travel times in a 10-minute interval (7am - 9:50am) from each grid cell (900 feet by 900 feet) to campus

Figure 2-31: Bike travel time to campus



Note: Each grid cell is 900 feet by 900 feet

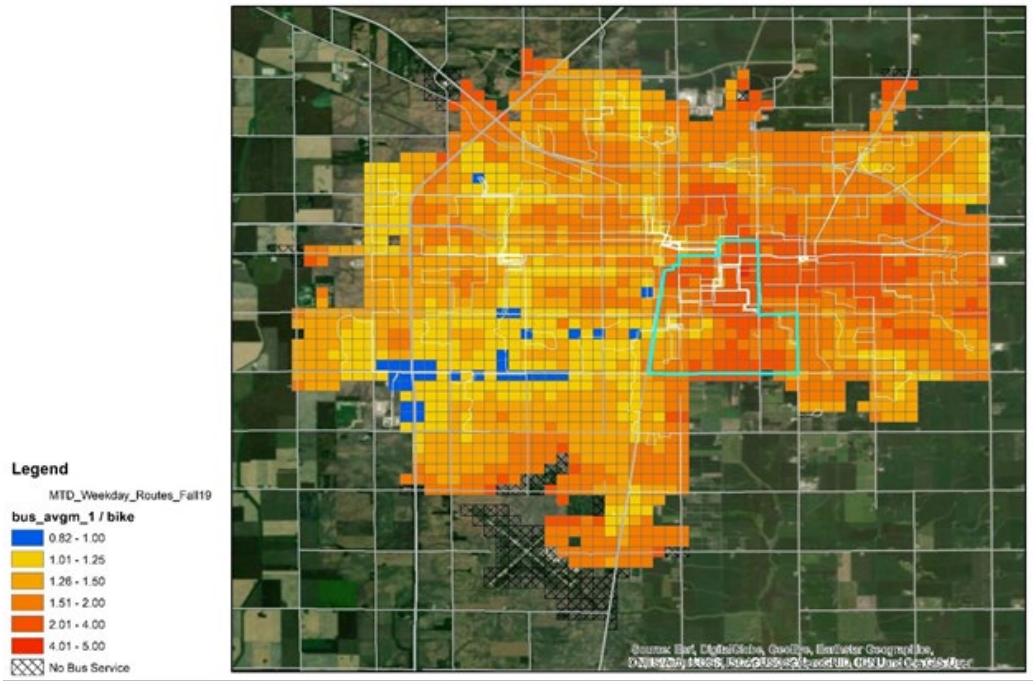
Figure 2-32: Walk travel time to campus

Note: Each grid cell is 900 feet by 900 feet

Next, we calculated the ratio of bus travel time to bike and car travel time (Figures 2-33 – 2-34) to assess travel time advantage or disadvantage of bus transit in the region. We used the average of the three shortest bus travel times to calculate this. Most of the grid cells show that bus travel time is longer than bike travel time, except several areas in southwest Champaign that are far from campus. These areas include Duncan and Windsor, Mattis and Windsor, and Kirby and Mattis. These areas are served by multiple bus routes (Routes 5, 9, 10, 14, 16, and 180) that may provide relatively shorter travel time than biking. However, bike travel time remains shorter than bus travel time in most areas of Champaign-Urbana and especially in close-in neighborhoods.

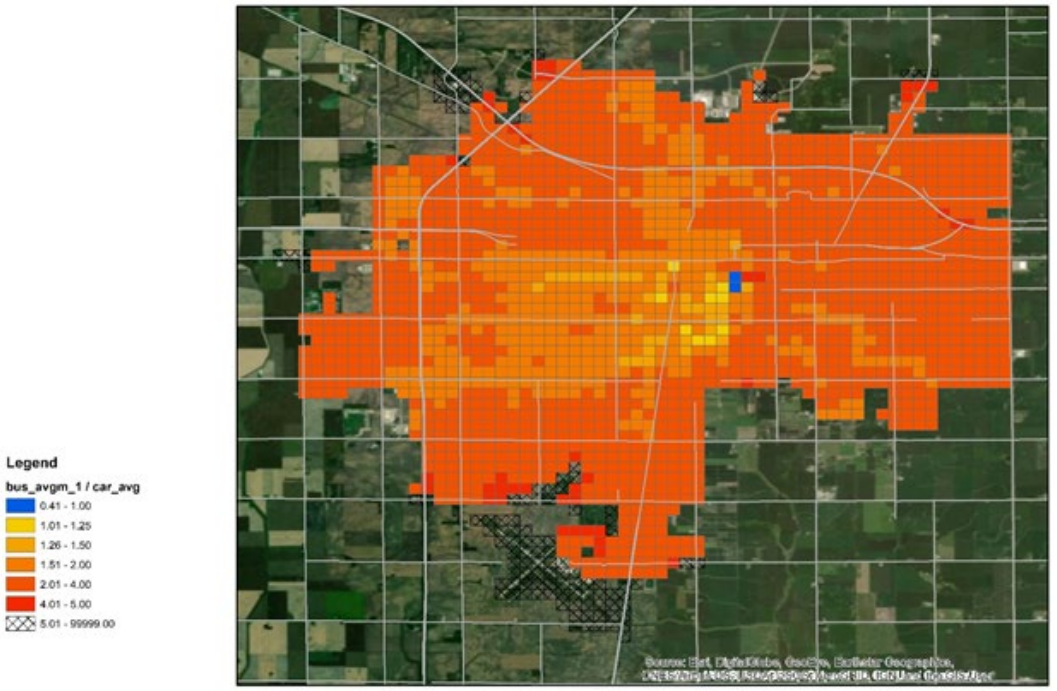
Similarly, most areas in Champaign-Urbana shows that driving time is much shorter than bus travel time (Figure 2-34). Bus commute takes about 1.5 to 2 times as long as driving commute in central locations and 2 to 4 times in outer rings. This suggests that traveling to campus by bus may be less attractive when travel time is a principal motivator. It is important to note that travel time in these examples is estimated rather than actual. In a real travel situation, for example, bicycling could take longer if people take a detour to avoid routes where they feel unsafe.

Figure 2-33: Ratio of bus travel time to bike travel time



Note: Average bus travel time of the three shortest travel time illustrated in Figure 2-30 above is used as the bus travel time in this map.

Figure 2-34: Ratio of bus travel time to car travel time



Note: Average bus travel time of the three shortest travel time illustrated in Figure 2-30 above is used as the bus travel time in this map.

Key Takeaways

On-campus stations play a significant role in sustaining MTD ridership. They account for 61 percent of daily ridership and 43 percent of annual passenger revenue miles in 2018, while only accounting for 11 percent of total number of stations. 53 percent of top 10 stations are on campus, and these stations include the Illini Union, Transit Plaza, Ikenberry Commons, Gregory at Library, and PAR. The number of on-campus stations and ridership have increased from 2016 (9% and 59%) to 2018 (11% and 61%). Even on community routes, 29 percent of ridership is at on-campus stops. Between 2016 and 2018, transit ridership fell by 6% at off-campus stops while there was little change at on-campus stops. The campus town zone between University and Springfield Avenues has seen the most significant ridership increase.

At the agency level, unlinked passenger trips have been declining since 2015, but this in on par with the national trend. Transit patronage has strong seasonality—ridership peaks in October and February and is at its lowest in June and July. Passenger miles traveled is slightly lower in 2017 than in 2002, and passenger miles traveled per unlinked passenger trip is significantly lower in 2017 than in 2002.

Vehicle revenue miles and vehicle revenue hours have steadily increased from 2002 to 2017. Vehicle operating expenses, even after being adjusted for inflation, have increased from 2002 to 2017, although they've dropped slightly from 2016-2017. Fare revenue earned, even after being adjusted for inflation, has increased from 2002 to 2017. The Fare Recovery Ratio has decreased from 2002 to 2017. Student population density has increased near Green Street and has decreased in downtown Urbana.

Route level analysis shows that bus ridership has declined much faster on community routes. While bus ridership on campus weekday routes declined by 8.3% from AY 2014-15 (Sep. 14—Aug. 15) to AY 2017-18, community weekday routes experienced a 16.6% reduction for the same period. The gaps between campus and community routes are larger when measured by passengers per vehicle revenue mile or hour—-13.2% versus -25.2% for passengers per vehicle revenue mile and -14.7% versus -27.0% for passengers per vehicle revenue hour.

In most areas in Champaign-Urbana, driving time is much shorter than bus travel time, with bus trips taking 1.5 to 2 times as long as driving commute in central locations and 2 to 4 times in outer rings. This suggests that traveling to campus by bus may be less attractive when travel time is a principal motivator.

3. Existing and Projected Environmental Factors

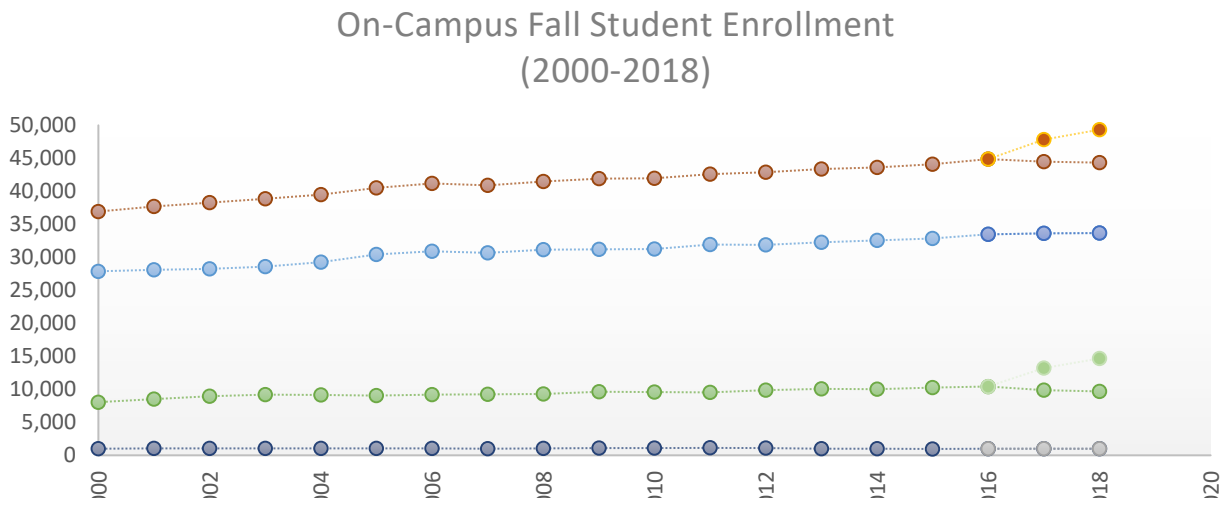
The purpose of Task 3 is to examine the existing and projected environmental factors that affect transit ridership and demand. These factors include the spatial distribution of the student population, annual student enrollment, the spatial distribution of residential units in and around campus town, the addition of educational and athletic facilities on campus to accommodate growing student population, vehicle ownership by age and income, mode share, on-campus parking, on-campus bike count, and emerging mobility options such as VeoRide bikeshare program. Findings indicate that while the student population is not declining, residential location of students closer to campus may negatively impact transit ridership.

Task 3-1. Student Population

a. Annual Student Enrollment

Figure 3-1 shows total on-campus student enrollment for fall terms from 2000-2018. The graph displays a small but steady increase in student enrollment. While the undergraduate student enrollment shows a steady growth throughout the period, graduate student enrollment was constant for the most years until 2016 when it began to increase significantly. However, the growth of graduate enrollment since 2016 seems to be a result of the fast growth of online graduate degree programs such as iMBA and, hence, would not help increase transit ridership.

Figure 3-1: On-Campus Fall Term Student Enrollment (2000-2018)



The Division of Management Information (DMI) data do not report on- and off-campus student enrollment since Fall 2017. Thus, the research team estimated on-campus student enrollment, using online course enrollment information obtained from the Office of Registrar. Estimates for graduate students in Fall 2017 and 2018 are calculated by deducting the number of students enrolled in online courses from the total number of enrolled students (both on-campus and off-campus). For Undergraduate and Professional courses, total number of students are assumed to be all on-campus students since almost all the online programs offered on campus are meant for graduate students. These values can only be estimated as not all students enrolled in online courses are located off-campus. The slow increase in student enrollment does not explain the decline in transit ridership.

b. Spatial Distribution of Student Population

We investigate how student population has changed in the study area since 2000 using the 2000 Decennial Census data, 2005-2009 American Community Survey (ACS) data, and 2013-2017 ACS data. Because ACS estimates represent 5-year averages, the 2005-2009 data represents student population in 2007, and the 2013-2017 data represents student population in 2015. Student population was obtained by summing the number of undergraduate students and the number of graduate students reported in the survey. The unit of analysis is census tract level. A few census tracts in the study area were disaggregated to make the unit boundaries consistent over time.

Figure 3-2 and Figure 3-3 illustrate student population per acre in 2000 and 2015. In each year, higher density of student population is observed in the central campus town area. While the maps are similar, there are a few changes. For example, a census tract bounded by University Avenue, Wright Street, Springfield Street, and Neil Street shows an increase in student population density. In addition, a census tract southeast of the campus also shows an increase in student population density.

Figure 3-2: Student population per acre, 2000 (census tract level)

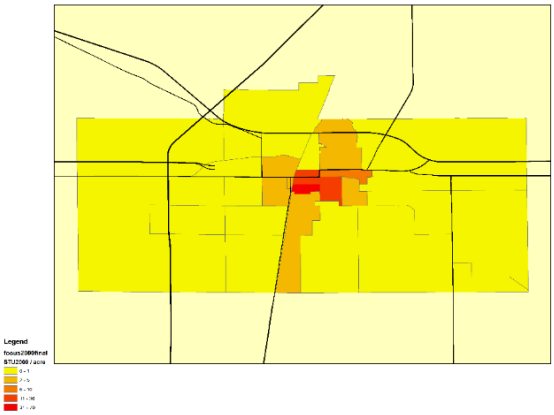


Figure 3-3: Student population per acre, 2015 (census tract level)

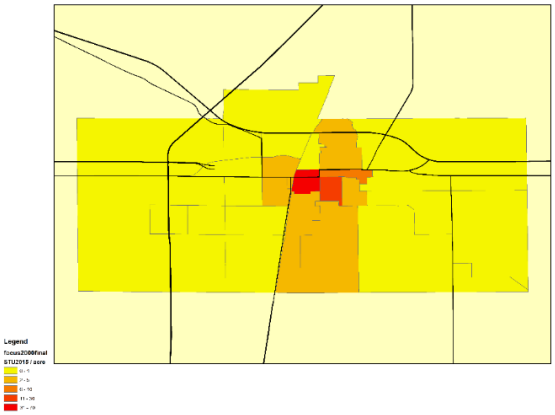


Figure 3-4 and Figure 3-5 also illustrate the student population density in 2000 and 2015 but in a dot density map. Census tracts with more dots indicate areas with higher student population density.

Figure 3-4: Dot density map of student population, 2000 (1 dot = 50 students)

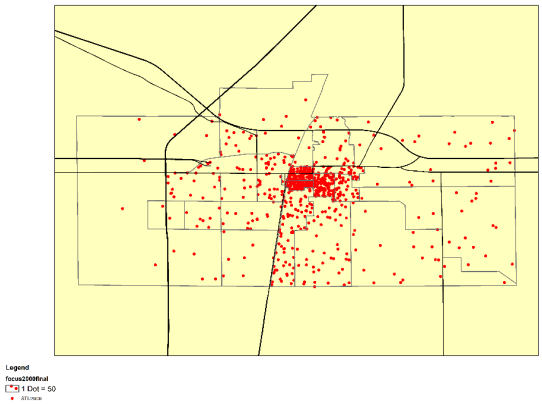
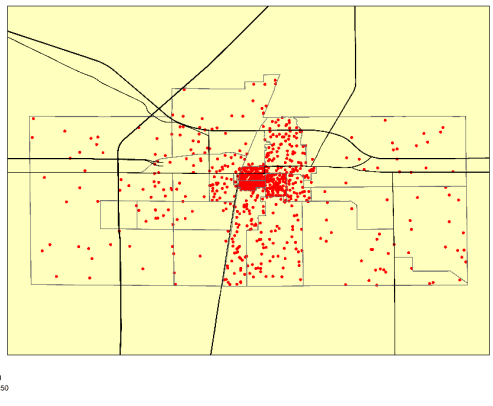


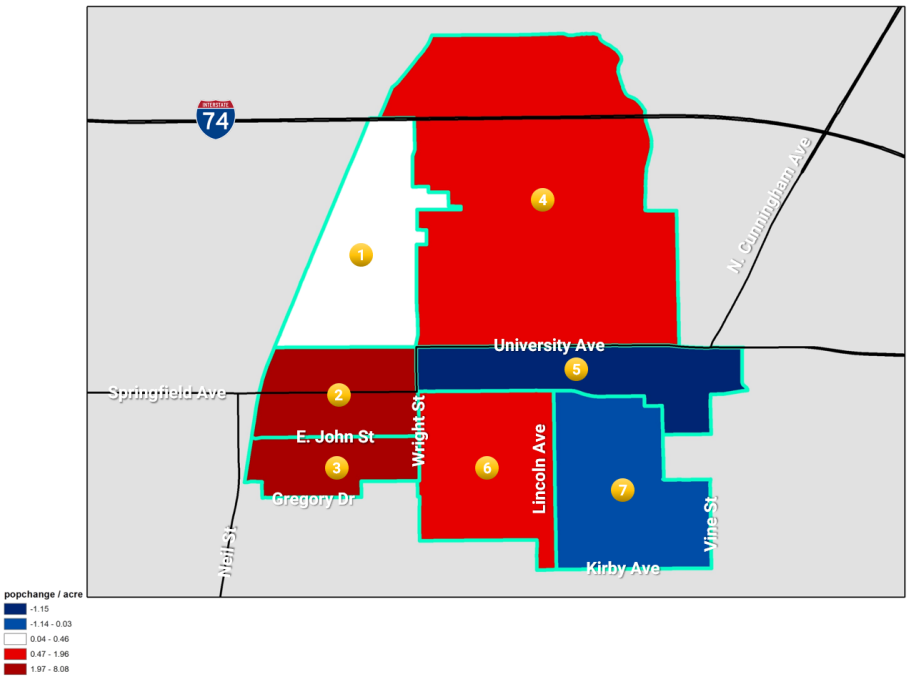
Figure 3-5: Dot density map of student population, 2015 (1 dot = 50 students)



To further examine student population change from 2000 to 2015, we mapped the change in student population density of the campus town area in Figure 3-6. Red values indicate an increase in student population density, blue values indicate a reduced student population density, and white indicates no significant change. Census tracts near Green Street (Tract 2 & Tract 3) show one of the highest increases in student population density in this period, which corroborates our earlier observations. This trend can be explained by active development that has occurred in the area near Green Street. North of the campus area (Tract 4), especially near Lincoln Street, also shows an increase in student population density. This can be explained by the development of new student apartments, such as Capstone Quarters and One-Illinois. Southeast of the campus area, especially in Orchard Downs (Tract 6), shows an increase in student population density. More incoming residents at Orchard Downs can explain this trend. Lastly, the downtown Urbana area (Tract 5) shows a decrease in student population density.

This can be explained by relatively less active new housing development in Urbana, compared to Champaign. Census tract 4 shows the highest increase in student population, while Census Tract 5 shows the biggest decrease in student population. Overall, campus town added about 3,000 more students and 2,000 more were added to the North Lincoln neighborhoods.

Figure 3-6: Change in student population and its density between 2000 and 2015



Student Population by Census Tract

Tract	2000	2015	Change
①	76	145	+69
②	4,913	6,677	+1,764
③	7,972	9,128	+1,156
④	1,242	3,476	+2,234
⑤	1,768	1,461	-307
⑥	5,592	5,912	+320
⑦	1,651	1,572	-79

The changes in student population density can also be observed in satellite images. Figure 3-7 and Figure 3-8 show satellite images from the Champaign County GIS Consortium of the Green Street area, where the student population increased the most, captured in 2002 and 2017. Blue circles in the two satellite images indicate areas that show the significant change. The two satellite images clearly illustrate that more high-rise buildings were built in this area, which leads to an increase in student population. This change is particularly clear along Green Street, where many high-rise buildings are visible in the satellite image captured in 2017 (blue circles in Figure 3-7 and Figure 3-8).

Figure 3-7: A satellite image of Green Street area captured in 2002 (Source: Champaign County GIS Consortium)

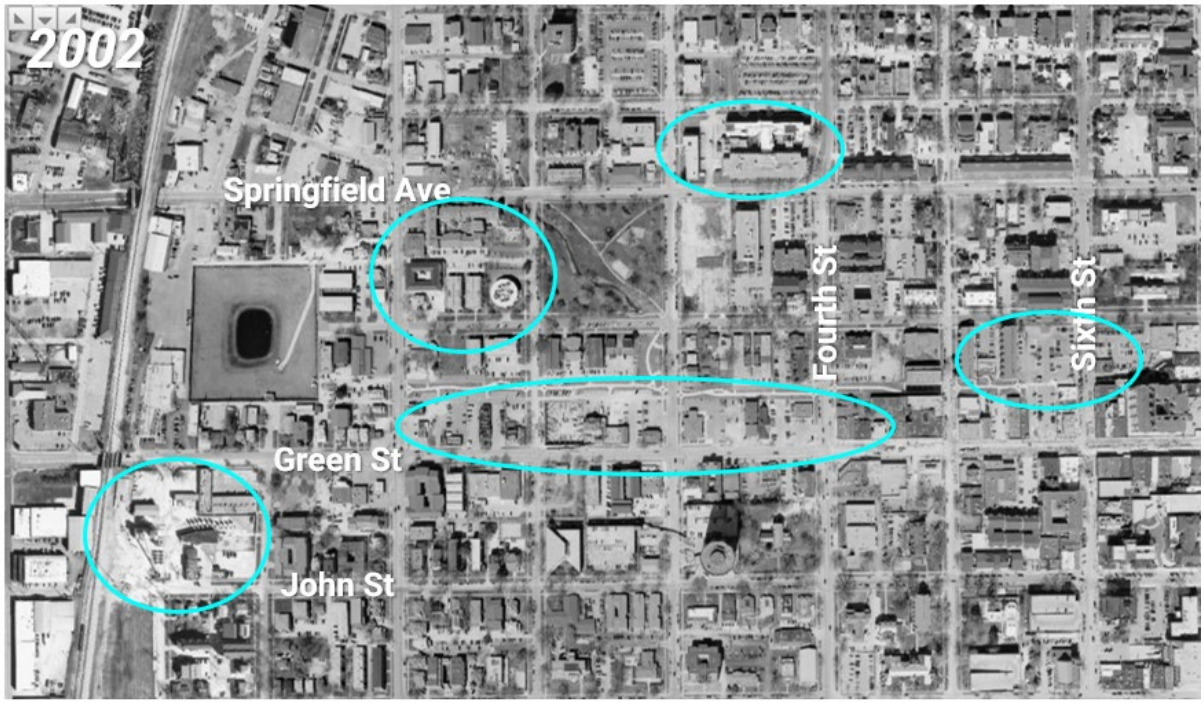
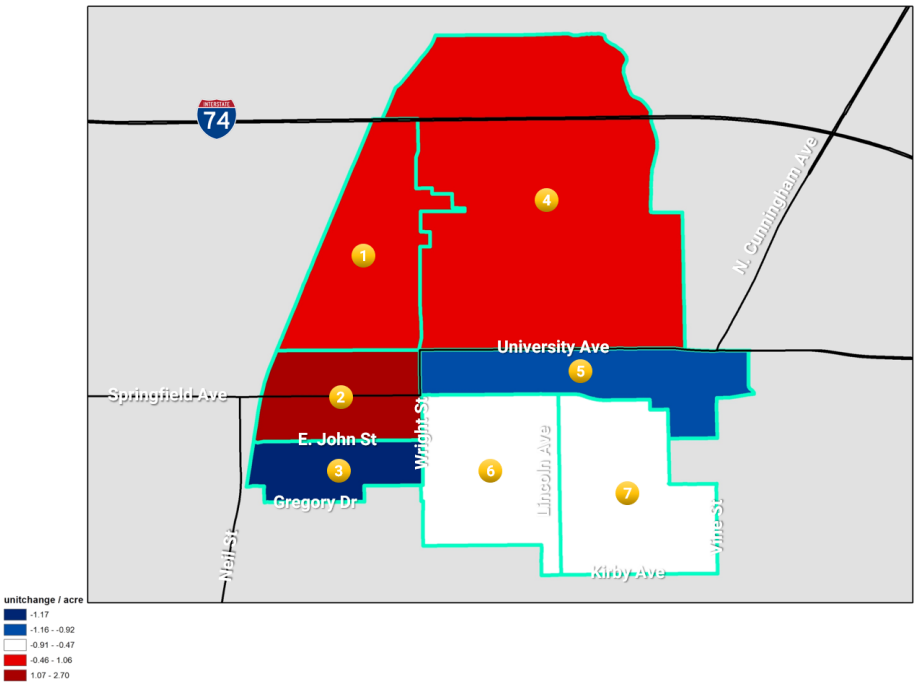


Figure 3-8: A satellite image of Green Street area captured in 2017 (Source: Champaign County GIS Consortium)

Next, we mapped the change in density of rental housing units of the campus town area in Figure 3-8 (number of units per acre). Red values indicate an increase in density of rental housing units, blue values indicate a reduced density of rental housing units, and white indicates no significant change. North of the campus area (Tract 4), especially near Lincoln Street, also shows the highest increase in density of rental housing units. This can be explained by the development of new student apartments, such as Capstone Quarters and One-Illinois. Similar to what we observed earlier in student population density (Figure 3-9), Census Tract 2 near Green Street shows one of the highest increases in density of rental housing units in this period. The downtown Urbana area (Tract 5) shows a decrease in density of rental housing units. This can be explained by relatively less active new housing development in Urbana, compared to Champaign. Campus area and southeast of campus (Tract 6 and 7) show no significant change in density of rental housing units. This is mainly because most of the areas are on-campus housing units, which have not changed significantly in this period. All in all, campus town, downtown, mid-town, and North Lincoln neighborhoods added about 1,300 rental housing units.

Figure 3-9: Change in number of rental housing units and its density between 2000 and 2015



Rental Housing Units by Census Tract

Tract	2000	2015	Change
①	291	512	+221
②	3,011	3,602	+591
③	2,044	1,877	-167
④	783	1,987	+1,204
⑤	1,282	1,035	-247
⑥	1,220	1,070	-150
⑦	919	739	-180

Task 3-2. Spatial Distribution of Housing Development

We investigate the spatial distribution of multifamily housing developments in and around campus town, which may provide insights on transit demand by students. Figure 3-10 shows the number of bedrooms constructed in various residential developments in and around

campus town from 2004 to 2018 and the number of bedrooms under construction in 2019, or those that are likely to be constructed in the next few years. The map depicts dense development around the northern part of campus town in recent years, largely from 2016 to 2018.

Figure 3-10: Multifamily Residential Developments in and around Campus town (2004-2020)

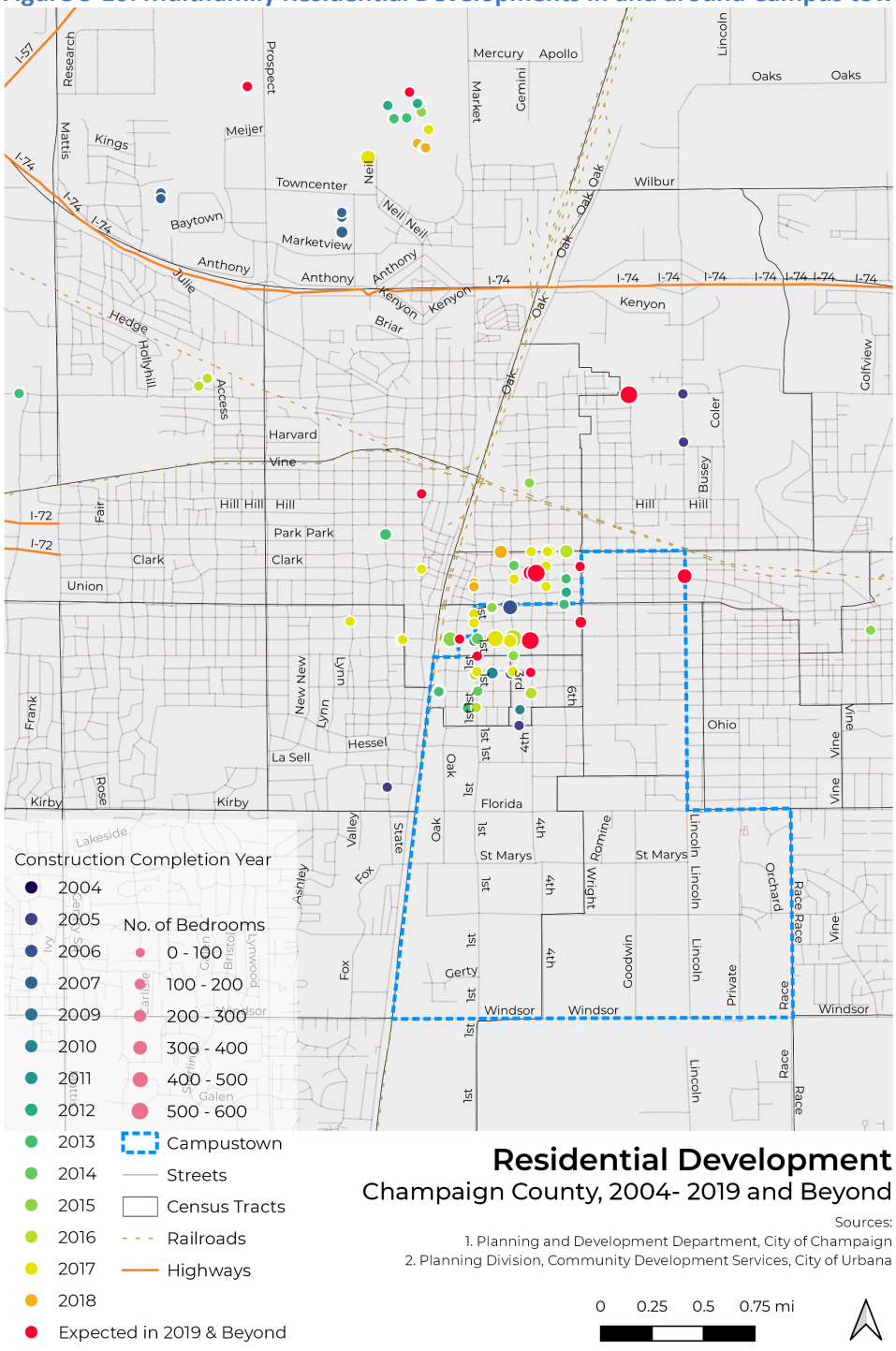


Figure 3-11: Number of Bedrooms constructed or expected to be constructed on/off Campus (2004-2020)

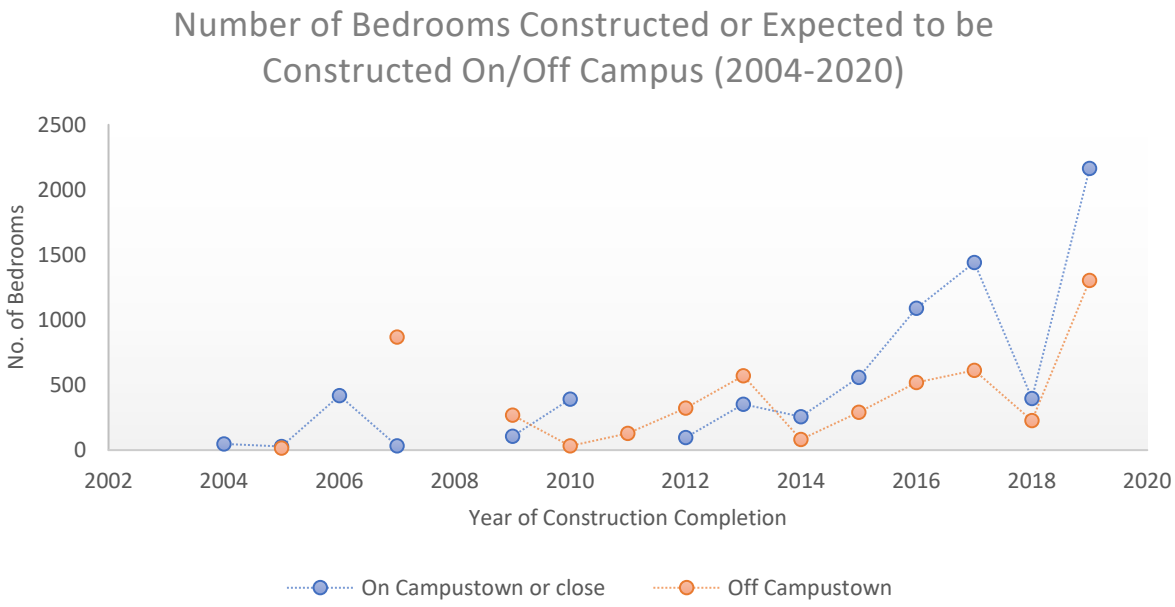


Figure 3-11 below shows the number of bedrooms and units added on and off campus in the past 15 years (2004-2018). Until 2013, the number of bedrooms constructed off campus was mostly greater than the number of bedrooms constructed on campus. However, the trend starts reversing from 2014 onwards. Number of bedrooms on campus increased at a much higher rate as compared to off-campus estimates. In 2015 and 2016, on-campus bedrooms constructed was twice as much as off-campus bedrooms. On campus estimates spiked in 2017 (over 1,400) as opposed to only 612 bedrooms for off campus estimates. Both estimates, however, dropped sharply in 2018.

However, number of bedrooms are expected to spike in 2019 and 2020. Planned developments on-campus include Gather apartments, with 365 estimated bedrooms on the corner Lincoln Road and University Avenue; three major developments on Fourth Street, which will contribute 548, 538 and 332 bedrooms; and multiple other smaller developments are likely to add around 2,165 bedrooms in 738 units in and around campus town in the next few years (see Table 3-1).

Developments are planned in off-campus areas as well, though the total is not as high as on-campus. Three upcoming major off campus developments on West Bradley Avenue in Urbana, Palmer Drive in Champaign, and Interstate Drive in Champaign are likely to add 540, 189 and 128 bedrooms, respectively, in the next few years. Overall, 1,305 bedrooms in 709 units will be constructed off campus.

Such large residential developments in and around campus town are likely to reduce potential MTD bus ridership as the campus is easily accessible from these areas by walking and bicycling.

Thus, higher number of units and bedrooms constructed close to campus town as opposed to off-campus locations is a possible reason for the decline in MTD bus ridership as observed in 2015.

Table 3-1: Number of Bedrooms and Units Constructed or Expected to be Constructed (2014-2020)

	On Campustown or in proximity*		Off Campus	
Year	**Bedrooms**	**Units**	**Bedrooms**	**Units**
2004	48	12	-	-
2005	28	7	16	16
2006	418	160	-	-
2007	32	8	868	280
2008	-	-	-	-
2009	106	29	268	140
2010	392	114	32	8
2011	-	-	128	80
2012	96	24	324	234
2013	352	130	571	399
2014	256	92	82	60
2015	560	180	292	152
2016	1,089	459	519	236
2017	1,443	576	612	335
2018	396	236	228	184
Expected in 2019 & Beyond	2,165	783	1,305	709

Source: Planning and Development Department, City of Champaign, Illinois & Planning Division, Community Development Services, City of Urbana, Illinois

**Campus defined as area bound between south of University Avenue, east of U.S. Highway 45, north of Windsor Road, west of Race Street and Lincoln Avenue and south of Florida Avenue. Off Campus defined as geographic area of Champaign County excluding the previous category.*

Task 3-3. Educational and Athletic Facilities on Campus

This section examines the annual addition of educational and athletic facilities in campus town from 2001 to 2019. Three major constructions across the campus in the past 15 years include the academic facilities for Electrical and Computer Engineering in 2014 (room count of 38), Siebel Center for Computer Science in 2003 (room count of 21) and Business Instructional Facility in 2008 (room count of 20) (see Table 3-2). In addition, the Henry Dale and Betty Smith Football Center constructed in 2019 (124,360 sq. ft.) and Academic Facility of ACES Library, Info. and Alumni Center constructed in 2001 (82,723 sq. ft.) are two major developments on campus since 2001. Overall, 102 rooms of various sizes have been added on campus in the last two decades to accommodate the growing student population.

Table 3-2: Educational and Athletic Facilities constructed in campus town (2001- 2019)

Date Built	Type	Building Name	Gross Square Feet	Count of Room Code
2001	Academic	ACES Library, Info. & Alumni Center	82,723	5
	Academic	Police Training Institute - Tactical Range 2	2,250	1
	Other	PTI - Control Booth	51	1
2002	Academic	Early Child Development Lab	23,182	1
2003	Academic	Siebel Center for Computer Science	266,825	21
2004	Academic	FSI - South Storage Building	1,448	1
2006	Academic	Christopher Hall	25,792	3
2008	Academic	FSI - Fire Apparatus Storage Building	3,600	1
	Academic	Business Instructional Facility	166,457	20
2012	Academic	FSI - Learning Resource Research Center	21,659	5
2014	Academic	Electrical and Computer Engineering	238,390	38
2015	Other	Center for Wounded Veterans in Higher Education	30,638	2
2017	Academic	Integrated Bioprocessing Research Laboratory	39,746	1
2019	Academic	Bruce D. Nesbitt African American Cultural Center	8,253	1
	Other	Henry Dale and Betty Smith Football Center	124,360	1
Total				**102**

Source: Facilities and Services, University of Illinois, Urbana Champaign

Figure 3-12 shows the spatial distribution of all educational and athletic facilities across Campus town constructed since 2001 until 2019.

Figure 3-12: Location of Educational and Athletic Facilities construction in Camps town (2001- 2019)

Task 3-4. Transportation Trends

This section analyzes vehicle ownership for campus town census tracts over time and vehicle ownership in the Champaign-Urbana public use microdata area (PUMA) by age and poverty status. In addition, this section examines trends in on-campus parking permits and bicycle ridership.

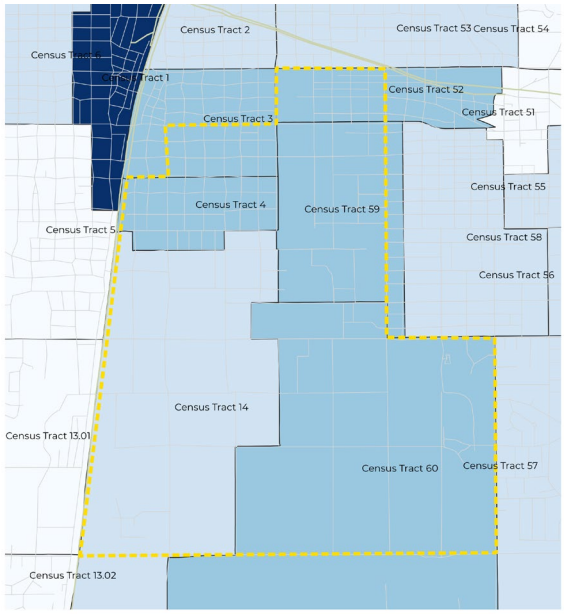
a. Vehicle Ownership

Percentage of Households Without a Vehicle (2007-2015)

Figure 3-13 shows the percentage of households with no vehicle by census tract in Champaign County over four years, 2007, 2010, 2013, and 2015. These estimates are extracted from American Community Survey 5-year estimates.

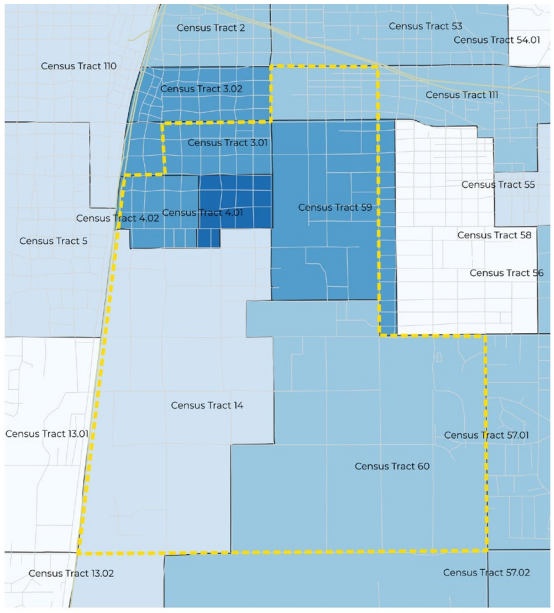
In 2007, most of campus town has a concentration of 20-30 percent households with no vehicles, except for census tract 14 that has even lower concentration (10-20 percent) of such households. In 2010, this concentration grew in the northern part of the campus town in census tracts 3.01, 4.01, 4.02 and 59. It is important to note that census tract boundaries for Champaign County changed from 2007 to 2010. The high concentration of households with no vehicles in census tract 6 (downtown) in 2007 was diluted due to merging of census tracts in 2010. The concentration of households without a vehicle grew to 50-60 percent by 2015 north of campus town. For a large part of the campus, the percentage remains between 30 and 50 percent. This pattern is consistent with the high concentration of rental housing developments and student population in census tract 3.02, 3.01, 4.01, 4.02, and 59.

Figure 3-13: Percentage of Vehicle- less Households in Champaign County (2007-2015)



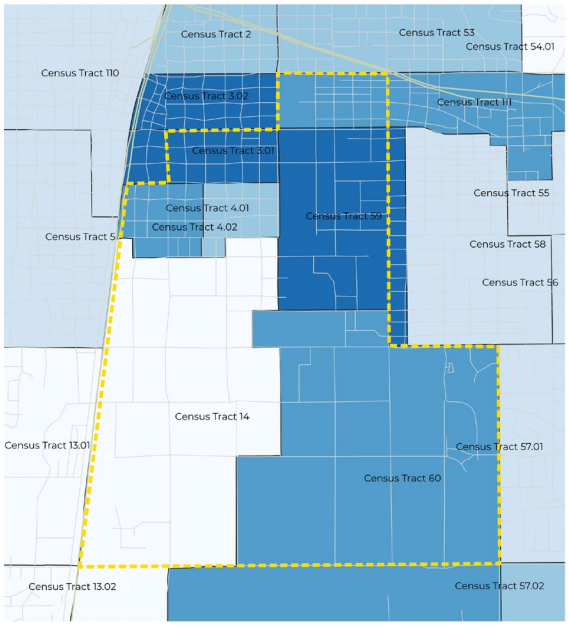
Percentage of Households with No Vehicles
Champaign County, 2005- 2009

Source: American Community Survey,
5- year Estimates, 2005- 2009



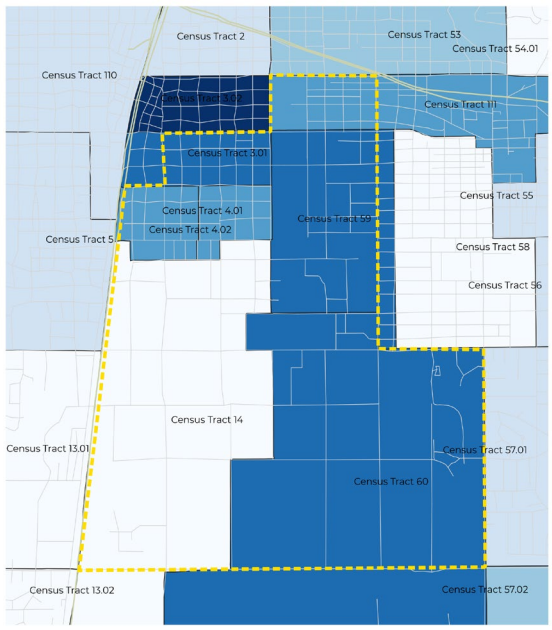
Percentage of Households with No Vehicles
Champaign County, 2008- 2012

Source: American Community Survey,
5- year Estimates, 2008- 2012



Percentage of Households with No Vehicles
Champaign County, 2011- 2015

Source: American Community Survey,
5- year Estimates, 2011- 2015



Percentage of Households with No Vehicles
Champaign County, 2013- 2017

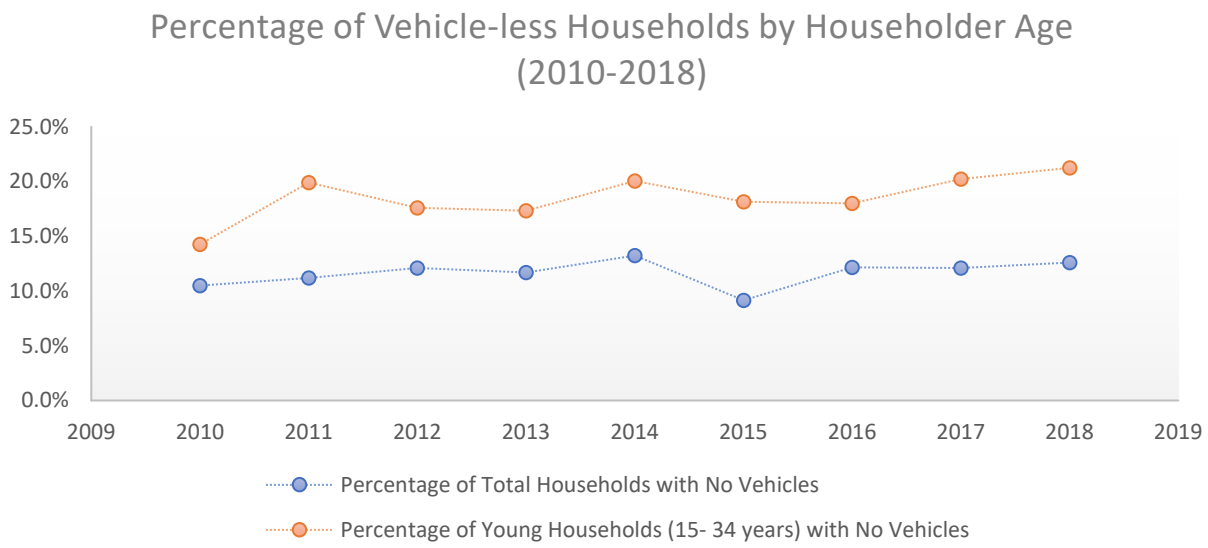
Source: American Community Survey,
5- year Estimates, 2013- 2017

Vehicle Ownership among Young (15-34 years) Households, 2010- 2018

To examine vehicle ownership further, we explore vehicle ownership of young households (15-34 years old) in Champaign County, which helps us understand vehicle ownership in the population that is most likely to consist of students. Figure 3-14 represents the percentage of households without a vehicle for all age groups and compares with young households.

The estimates for all age groups indicate that the percentage of households with no vehicle slightly increased from 10.5 percent in 2010 to 12.6 percent in 2018. However, this range is much higher for young households. It has increased from about 14.3 percent in 2010 to 21.3% in 2018. Overall, the percentage of young households in possession of no vehicles has increased from 2010 to 2018 (14.3 percent to 21.3 percent).

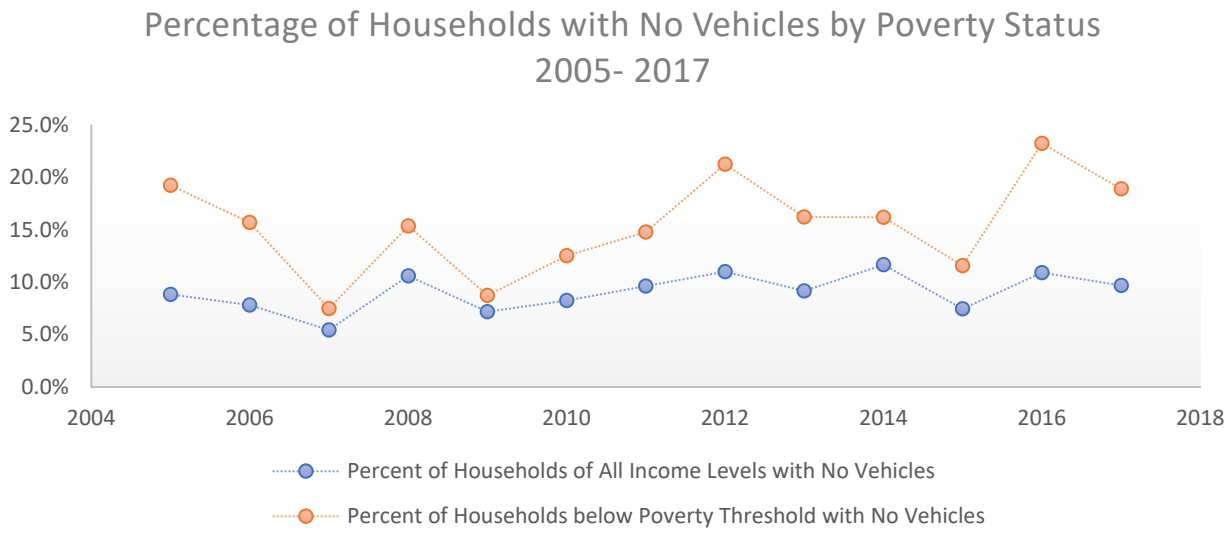
Figure 3-14: Percentage of Vehicle-less Households by Householder Age (2015-2018)



Vehicle Ownership among Low Income Households, 2005- 2017

We also examined vehicle ownership for low-income households, where householder's income is below poverty threshold, in Champaign County. Figure 3-15 represents the percentage of households with no vehicles for all income groups and draws a comparison with households below poverty threshold. The estimates for all income groups indicate that the percentage of households with no vehicle varied between 7-12 percent from 2010 to 2018. However, this range is much higher for low income households, where it is between 7-24 percent. Overall, the percentage of low-income households in possession of no vehicles has increased from 2010 to 2018 (14.3 percent to 21.3 percent). In sum, car ownership does not seem to be a reason behind the declining ridership in the late 2010s.

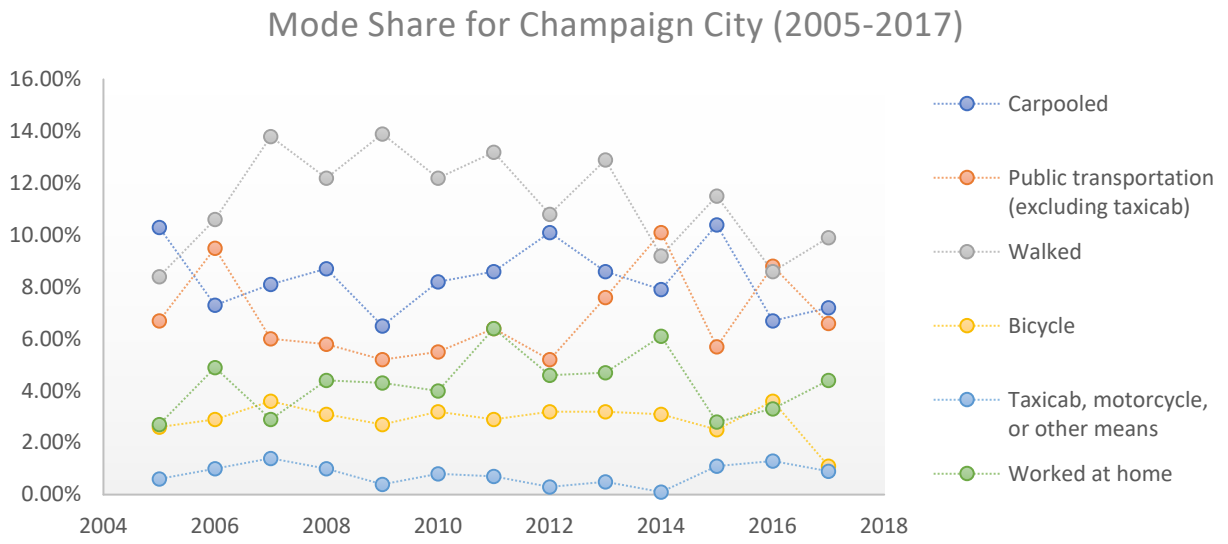
Figure 3-15: Percentage of Households with No Vehicles by Poverty Status (2005-2017)



b. Commute Mode Share

Figure 3-16 shows transportation mode share for the City of Champaign from 2005 to 2017. Walking shows an overall declining trend from 14 percent in 2007 to 10 percent in 2017. Public transportation shows a sudden rise of nearly 5 percent from 2012 to 2014, then declining afterwards. Excluding the noise in 2014, the ACS transit commute share data are consistent with MTD transit ridership data. However, bike and walking commute mode did not take over the declining transit commute share.

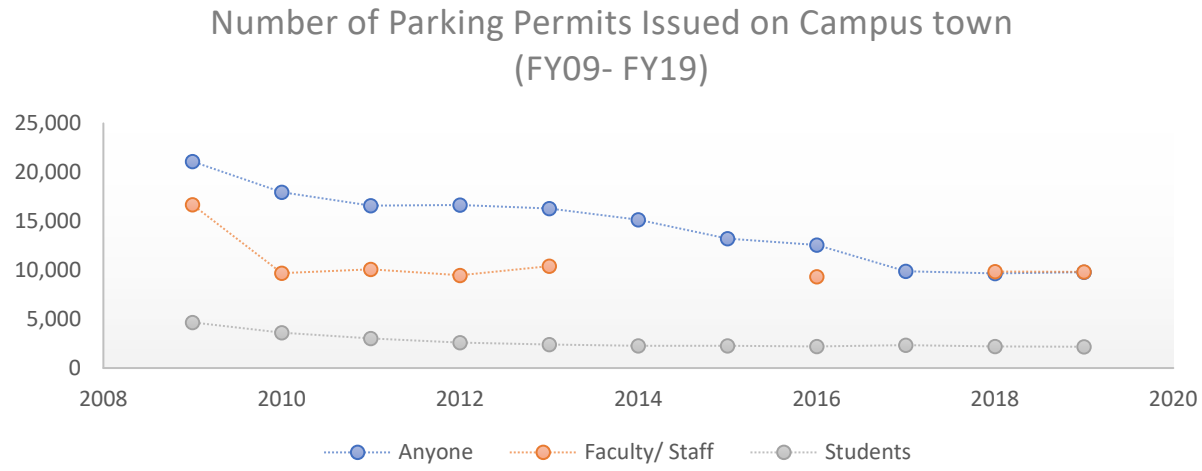
Figure 3-16: Mode Share, City of Champaign (2005-2017)



c. Campus Parking Permits

This section explores the number of parking permits issued on campus to faculty or staff, students and others in financial years 2009 to 2019. Figure 3-17 shows the number of parking permits issued by each category of parking users. The graphs show a nearly consistent trend for Faculty/Staff from FY10 to FY19 with approximately 10,000 parking permits issued each year. The number of parking permits issued to students declined steadily from FY09 (4,664 permits) to FY14 (2,280 permits). The estimates, however, became stable after FY15 and remained so until FY18 with nearly 2,200 permits issued to students each year.

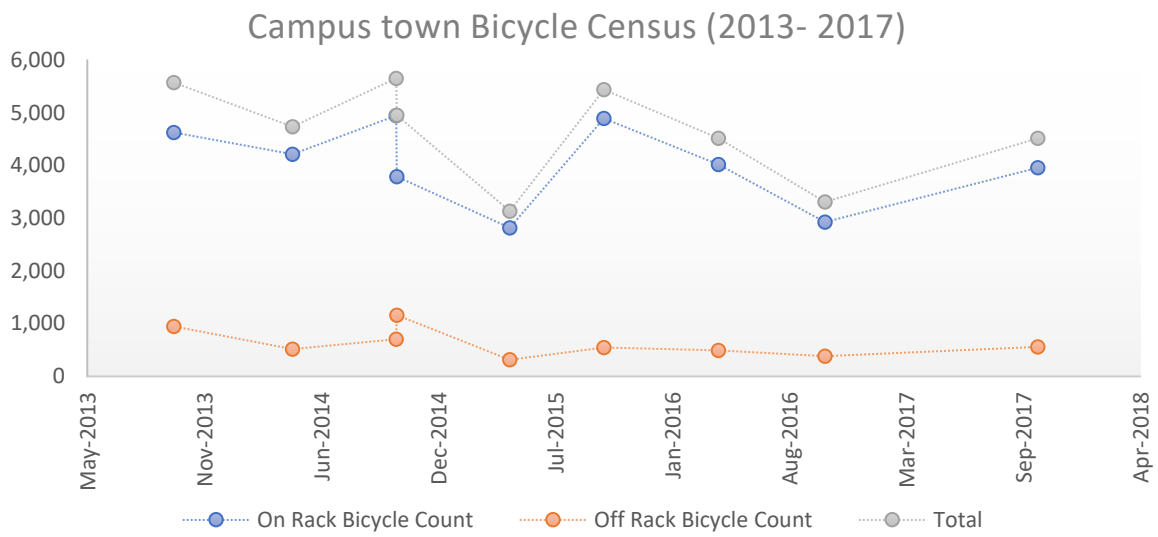
Figure 3-17: Number of Parking Permits issued on Campus town (FY09- FY19)



d. Bike and Bikeshare Trends

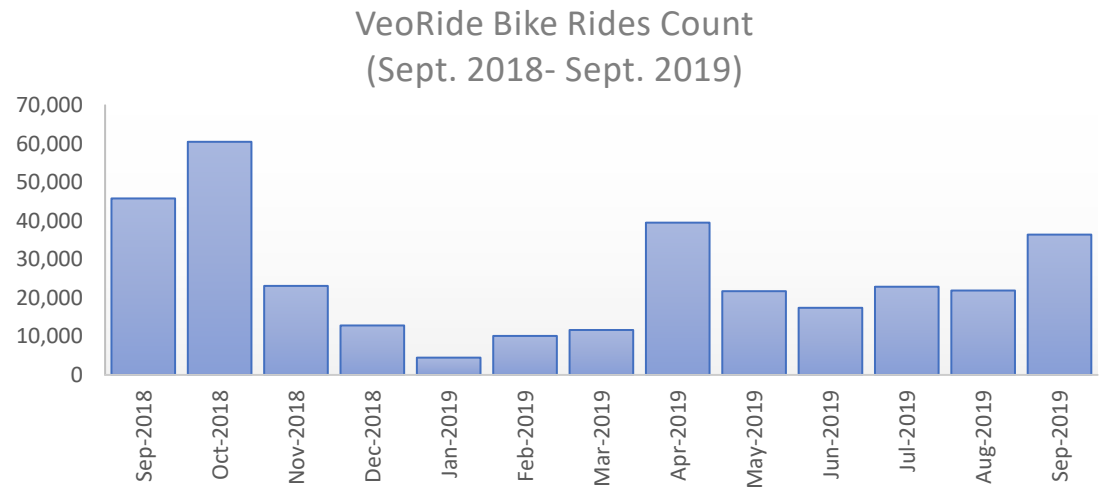
The Facilities and Services Department at University of Illinois Urbana Champaign conducted bicycle counts from 2013 to 2017 in April and October of each year. These counts were conducted to better understand the need for bicycle infrastructure on campus. These counts took note of all the bicycles present in the quadrants at a given time both on and off racks. There is a sharp decline in April of 2015 and another decline in October of 2016. The large variability in these counts may be due to sampling error.

Figure 3-18: Campus town Bicycle Census (2013- 2017)



Bike share programs are a system of sharing bicycles for short terms. VeoRide began its dockless bikesharing program on campus in Fall 2018. Figure 3-19 shows the number of bike rides recorded monthly for VeoRide service on campus since its inception in September 2018. September and October saw the highest ridership at 46,000 and 60,500, respectively. Ridership is much lower over the winter months. Beginning in April 2019, VeoRide began replacing its pedal bike fleet with electric bikes. The first year VeoRide ridership between September 2018 and August 2019, 292,040, is about 2.5 percent of bus ridership in 2018, 11.5 million. A survey conducted by an Urban Planning graduate student shows that VeoRide is substituting walking trips (50 percent) more than bus rides (23 percent) (Graves, 2018). A rough estimate is that VeoRide has the potential of reducing bus ridership by 0.6 percent.

Figure 3-19: VeoRide Rides Count (2018- 2019)



Key Takeaways

Student enrollment steadily grew in the past twenty years and no decline was observed in student population since 2014-2015. However, other factors such as their residential location may have had an impact on bus ridership. Many rental housing units were added in proximity to the campus and student population increased significantly in campus town and North Lincoln neighborhoods, making walking and bicycling feasible options of travel. This trend is expected to persist in coming years.

Educational and athletic facilities on campus have also increased to accommodate the growth in student enrollment. Vehicle ownership of young and low-income households has been consistently lower than that of all age and income groups. Percent carless households increased around campus due to the concentration of student population. The number of campus parking permits for both students and faculty/staff shows a subtle decline or stable trend in recent years. Bike census data shows much fluctuation in numbers. Some of the apparent reasons for this could be adverse weather conditions on census day. VeoRide seems a promising travel option given high monthly ridership in the first year, with a small impact on transit ridership. However, the ratio of e-bikes to pedal bikes may become a factor in the dropping numbers of this ridership.

4. Survey Analysis

The purpose of Task 4 was to conduct and analyze a campus travel survey, representative of both students and faculty/staff on campus. This will help us understand the existing commute and travel context in which MTD operates. To complete this task, we wrote, deployed, and analyzed a campus-wide survey asking questions about travel choices and MTD bus services. This report will cover the survey design methodology and results, including analysis of respondents, regular commute behavior, opinions about MTD, and trip choices. Overall, we found that 20 percent of trips made were by bus, and 70 percent of respondents felt safe using the bus and know how to use the schedule. However, only 30 percent of respondents take the bus regularly and feel that they can get to their destinations easily using the bus.

Survey Design

We drafted the survey and received IRB approval. We contracted with Division of Management Information (DMI) to obtain an email list for our survey, which included email addresses for 6,000 undergraduate and graduate students and 6,000 faculty and staff at UIUC.

We sent the first email invite on Tuesday, October 22, 2019. We sent reminder emails on Thursday, October 31, 2019; Sunday, November 3, 2019; and Sunday, November 10, 2019. We chose days of the week strategically for our emails, since we ask respondents to fill out travel information for the trips that they took yesterday, and because most respondents who fill out the survey will fill it out on the same day they receive the email. We closed the survey on Monday, November 11, 2019.

Part 1: Survey Respondents

We received a total of 2,523 responses to the survey; however, some of these were incomplete responses that were not used in the survey analysis. We removed respondents who did not make it through the first page of the survey and those who lived outside of the Champaign-Urbana urbanized area, which left us with 1,726 respondents in our sample. The sample includes 1,057 faculty/staff with response rate of 17.6% and 669 students with response rate 11.2%. Margin of errors is ±3% and ±4%, respectively, at 95% confidence level.

Table 4-1 below shows the respondents by type as compared to campus population. Sixty-one percent of respondents were faculty or staff, while only 38.8 percent were students. This means that faculty and staff were overrepresented in our survey in comparison to actual campus representation, and students were underrepresented. Therefore, we analyze survey results for the two groups separately in most cases.

Table 4-1: Survey Respondents by Type

	Survey Respondents		Campus Population[1]	
	Number	Percent	Number	Percent
Freshman	139	8.1	6,613	10.6
Sophomore	93	5.4	7,631	12.3
Junior	96	5.6	8,057	13.0
Senior	107	6.2	10,766	17.3
Graduate Student	234	13.6	17,346	27.9
Total Students	**669**	**38.8**	**51,196**	**82.3**
Faculty	291	16.9	2,765	4.4
Staff	766	44.4	8,209	13.2
Total Faculty/Staff	**1,057**	**61.2**	**10,974**	**17.7**
Total	**1,726**	**100.0**	**62,170**	**100.0**

[1] Source: DMI (http://www.dmi.illinois.edu/stuenr/class/enrfa19.htm) & https://illinois.edu/about/facts.html

a. Home Locations

Of the 2,175 survey participants who provided their geo-masked home location in the survey, we focus on 1,726 (about 80 percent) people who live in the Champaign-Urbana urbanized area. We exclude the twenty percent of people who commute to campus from outside of the Champaign-Urbana area (e.g., Rantoul, Mahomet, Danville, etc.). We focus on the participants living in the Champaign-Urbana area because the primary objective of this project is to understand travel behavior of the campus members in terms of transportation mode.

Figure 4-1 and Figure 4-2 show the spatial distribution of the faculty/staff and student participants. To fully protect the survey participant's locational privacy, we present the number of survey participants aggregated at a 900 by 900 feet cell in the study area (even though the home addresses we collected were already geo-masked). First, the maps show that our survey samples are evenly drawn from the Champaign-Urbana urbanized area. Second, and not surprisingly, the maps show that students live much closer to the campus, compared to faculty and staff.

Figure 4-1: Home Locations of Faculty/Staff by Grid

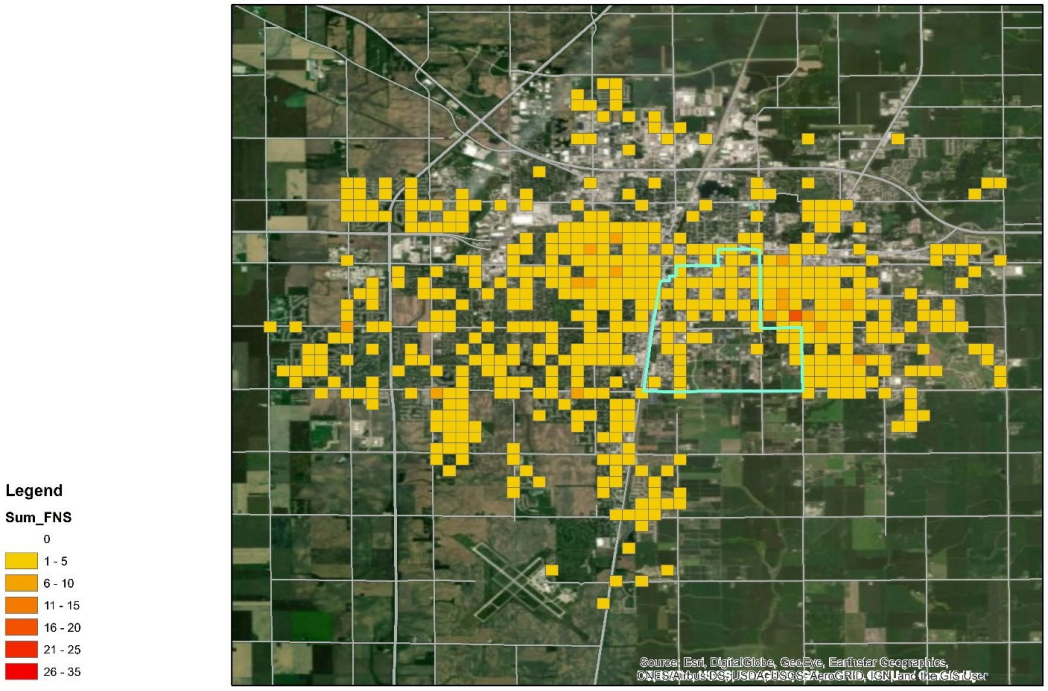
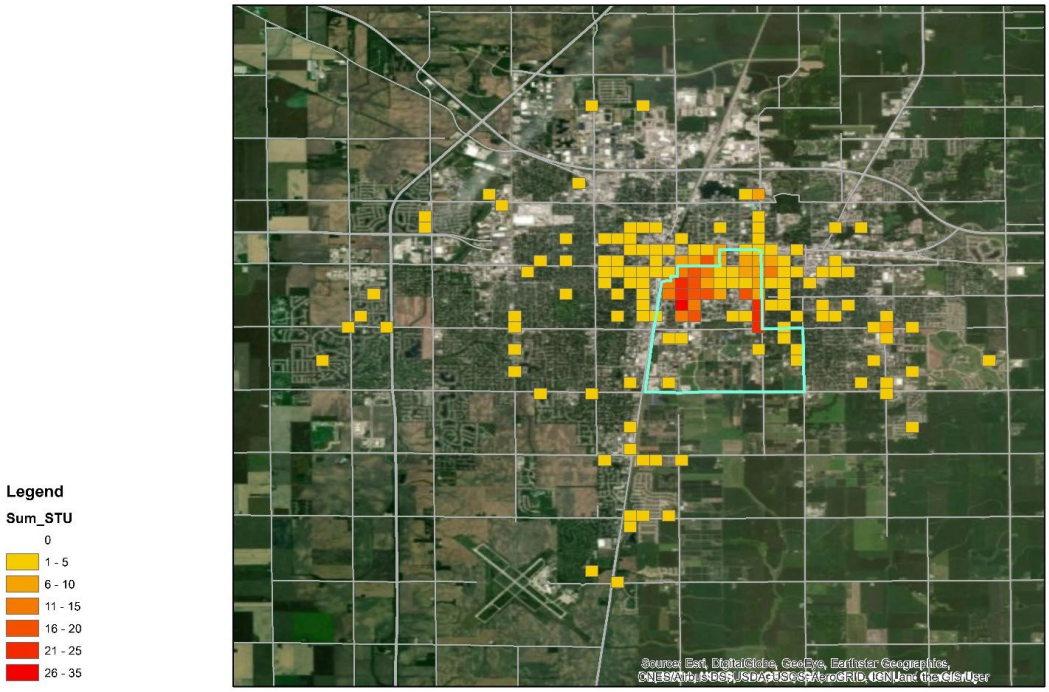


Figure 4-2: Home Locations of Students by Grid



Part 2: Trip Analysis

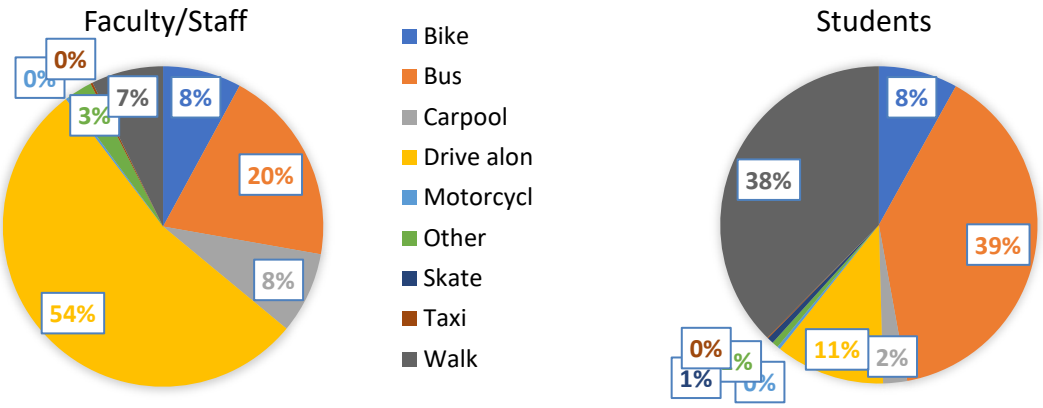
A total of 4,178 trips were reported, with each respondent reporting 2.4 trips on average (out of three possible). Most of these trips (3,717 of them) happened on weekdays, and 461 happened on the weekends.

a. Mode Choice

Driving alone was the most common mode choice, representing 41 percent of the reported trips. Walking and bus were the second and third most common mode choice, each accounting for 20 percent of the trips. Carpooling trips represented eight percent of trips, while biking represented six percent.

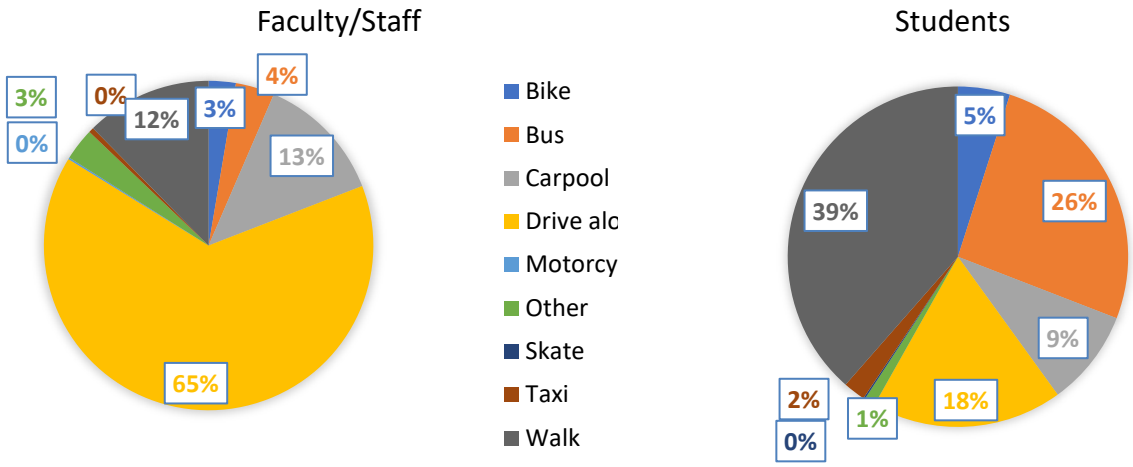
Faculty and staff were most likely to commute by driving alone (54 percent), followed by taking the bus (20 percent) (Figure 4-3). Students, however, were most like to take the bus (39 percent) or walk (38 percent).

Figure 4-3: Mode Choice for Commuting Trips



For non-commuting trips, faculty and staff were more likely to drive alone (65 percent) or carpool (13 percent) and were significantly less likely to take the bus (4 percent) (Figure 4-4). Students were still likely to walk (39 percent) or take the bus (26 percent).

Figure 4-4: Mode Choice for Non-Commuting Trips



We also analyzed the primary commute mode based on home location (Figure 4-5 and Figure 4-6). First, we calculated the probability of choosing each travel mode. In this case, "car" includes both driving alone and carpooling. Then, we calculated the average probability value at each grid cell by each mode of travel. The travel mode that has the highest average value is selected as the primary mode at each cell. Faculty and staff are much more likely to live in farther grids and drive, while students are more likely to live closer and walk.

Figure 4-5: Primary Commute Mode at Each Grid Cell (Faculty & Staff)

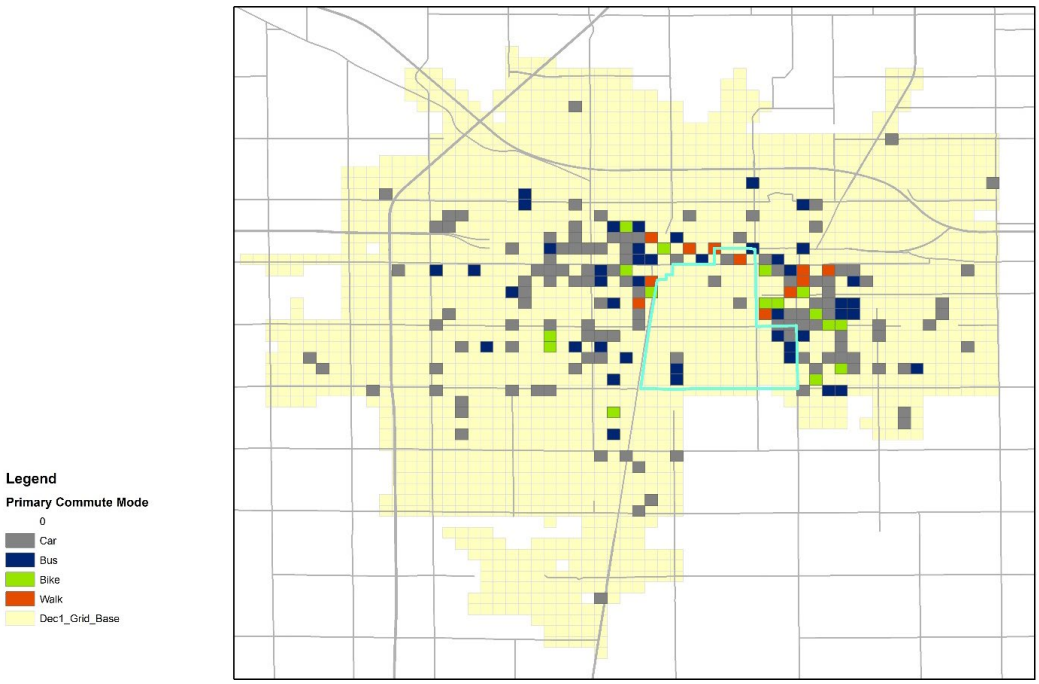
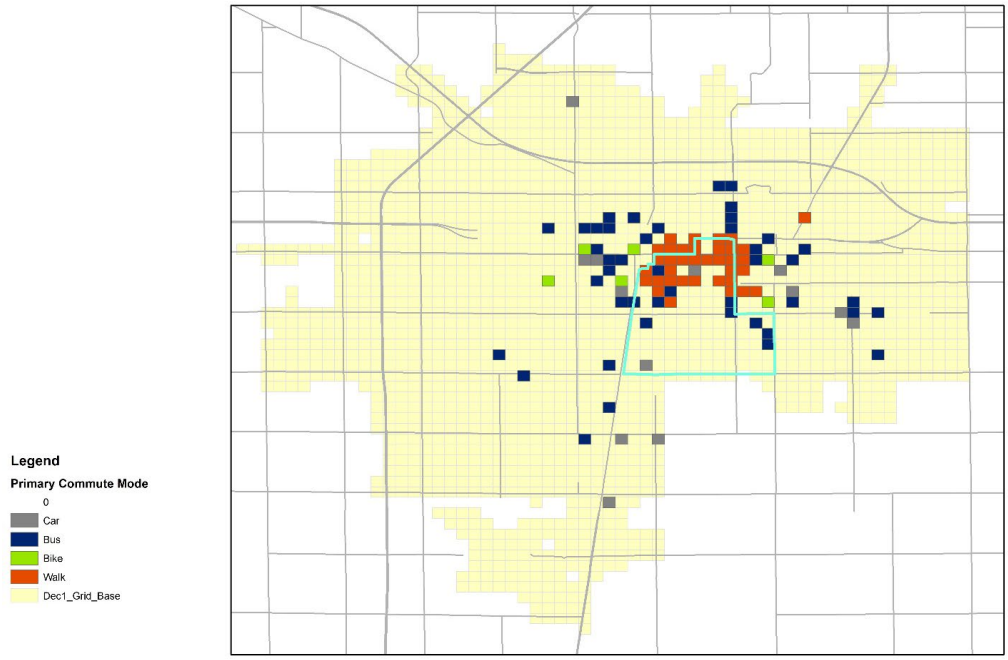


Figure 4-6: Primary Commute Mode Choice at Each Grid Cell (Students)



Next, we calculated the probability of riding the bus in each cell (Figure 4-7 and Figure 4-8). The height of the box indicates the probability of riding the bus in each grid cell. The deeper blue indicates a higher probability. These figures show a bird's eye view from the southeast of Champaign.

Figure 4-7: Probability of Transit Ridership for Commuting (Faculty & Staff)

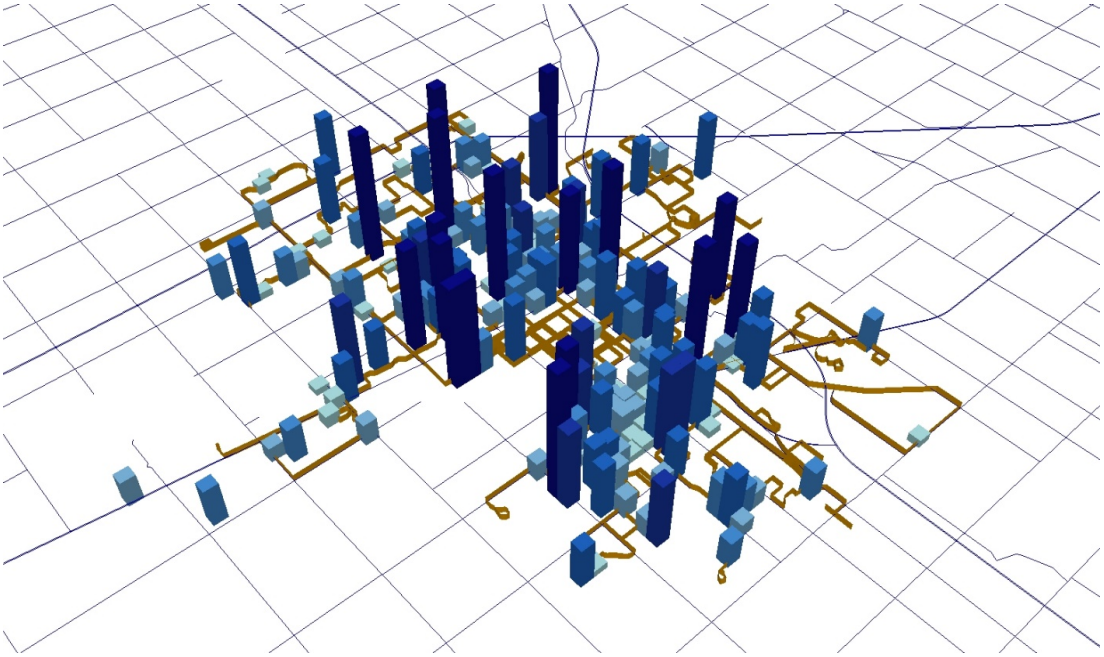
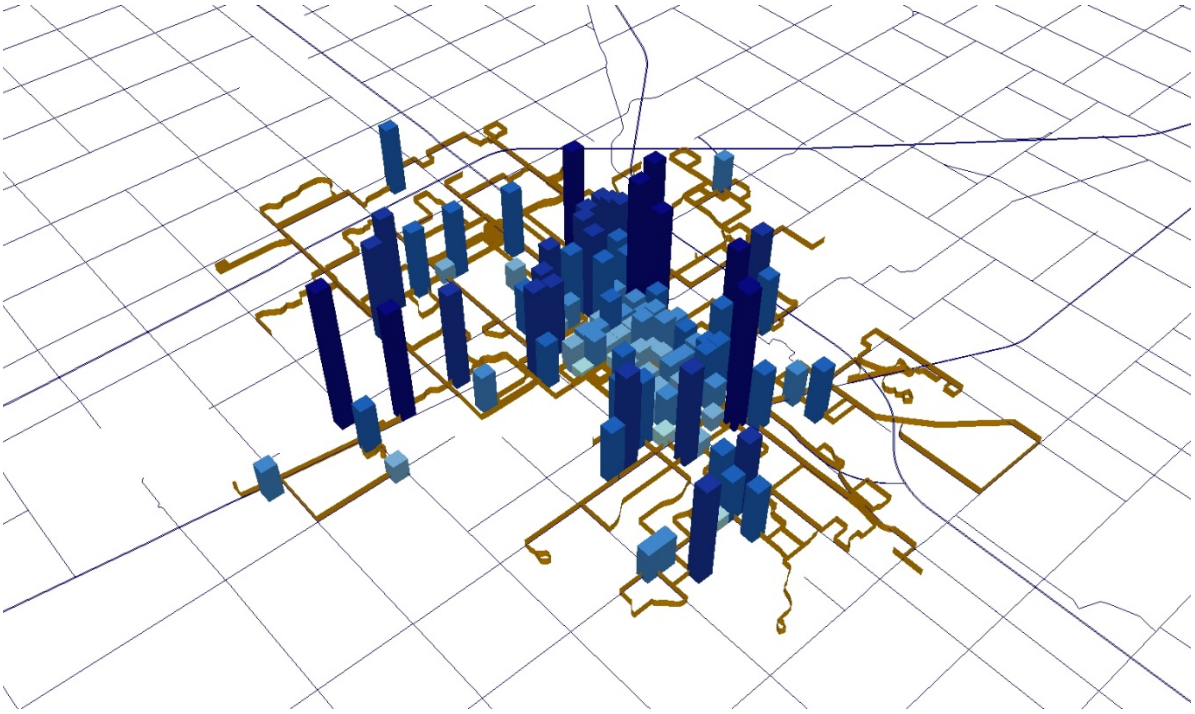


Figure 4-8: Probability of Transit Ridership by Grid Cell (Students)



Finally, we calculated the commute mode share by distance to campus (Figure 4-9 and Figure 4-10). Students are more likely to choose to walk, while faculty and staff are more likely to drive.

Figure 4-9: Commute Mode Share by Distance to Campus (Faculty & Staff)

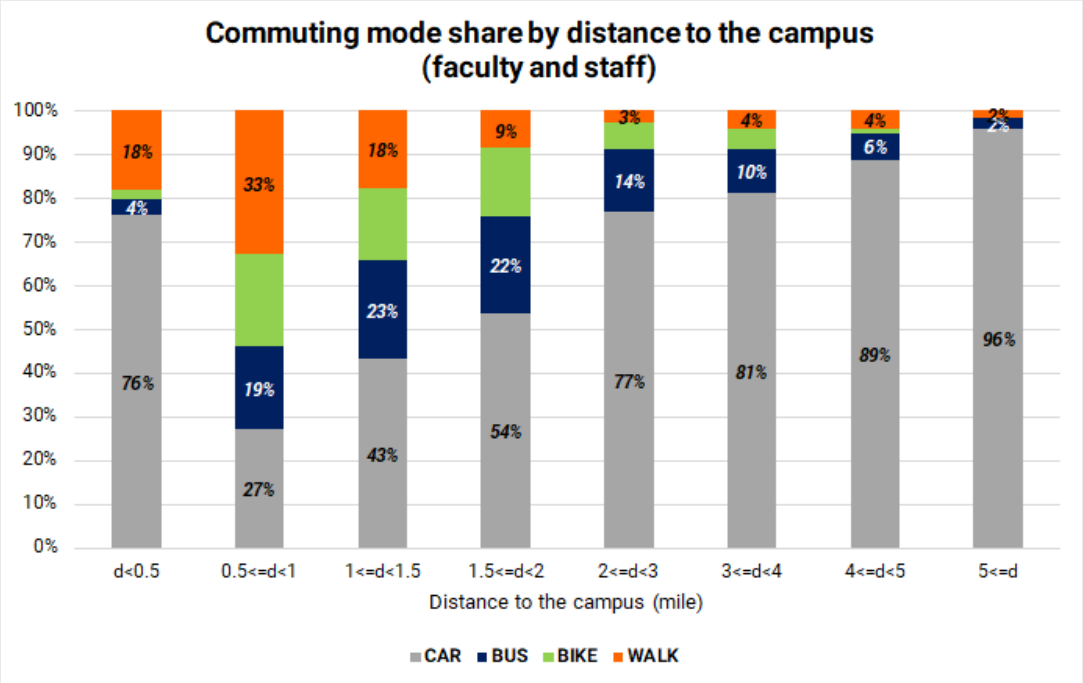
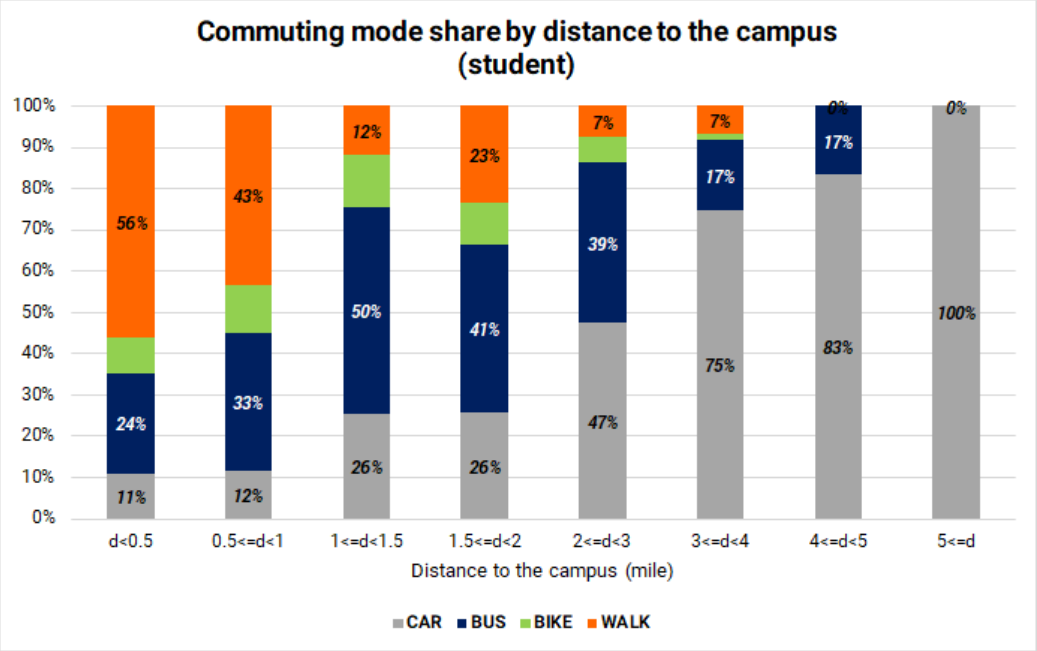


Figure 4-10: Commute Mode Share by Distance to Campus (Students)

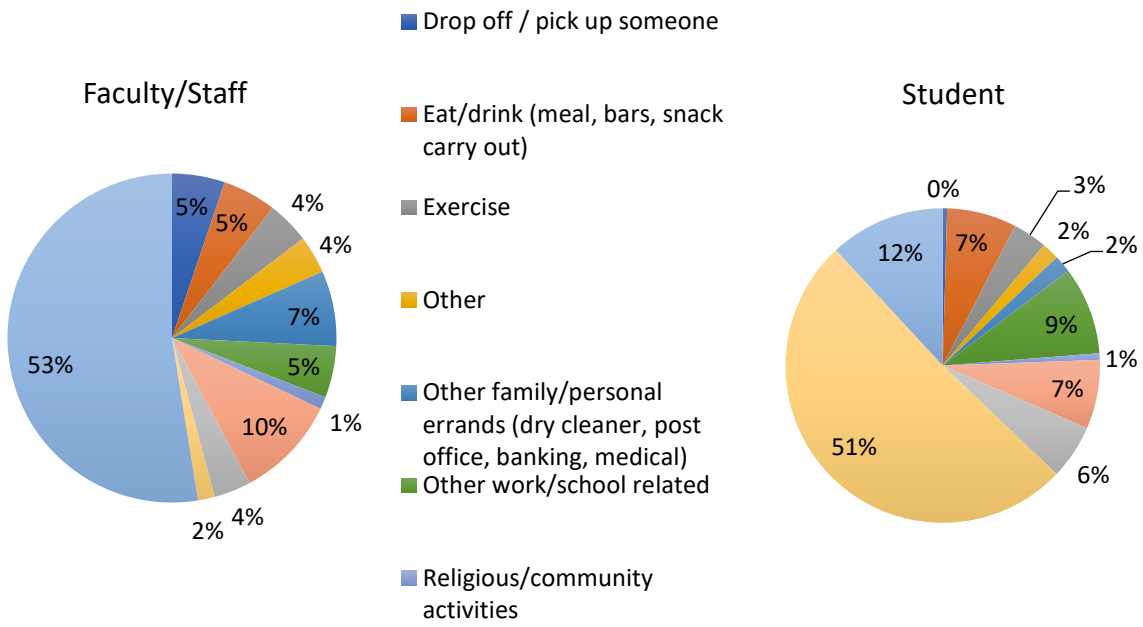


b. Trip Purpose

Thirty-six percent of all trips were to and from work, and represented the most common trip purpose. Nineteen percent of all trips were to and from school. Shopping was the third most common trip type, representing 9.5 percent of all trips.

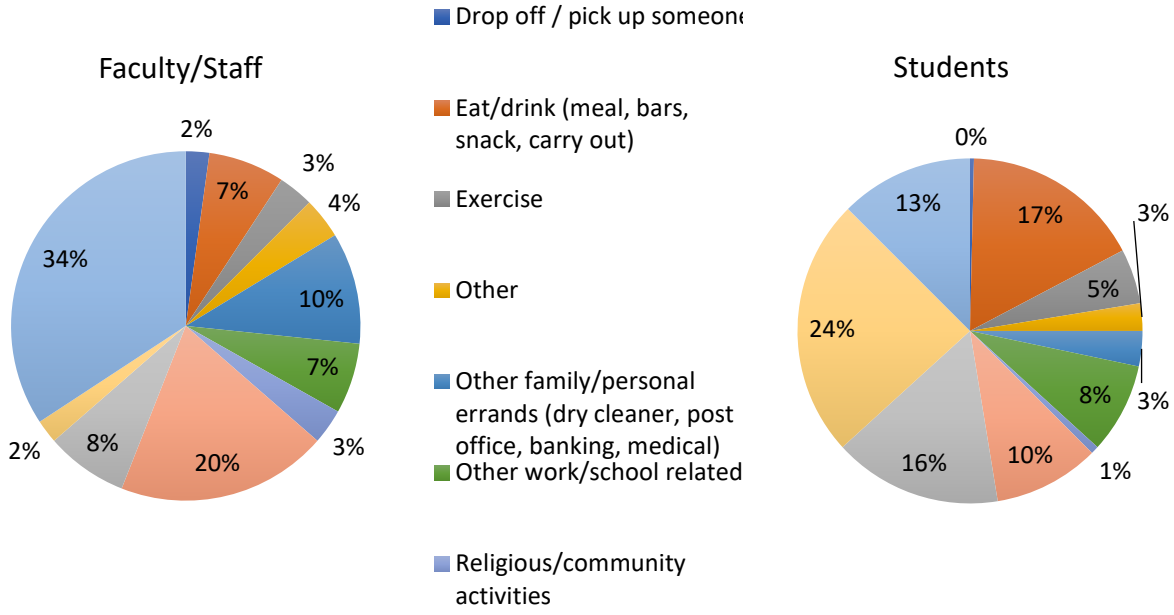
During the week, traveling to and from work represented 53 percent of faculty and staff trips, while going to and from school represented 51 percent of student trips (Figure 4-11). Students were also likely to travel to and from work (12 percent) or travel to other work and school related activities (9 percent). Faculty and staff were most likely to travel for shopping (10 percent).

Figure 4-11: Weekday Trip Purposes



On the weekends, faculty and staff were most likely to travel for religious or community activities (34 percent) or shopping (20 percent). Students, on the other hand, were most likely to travel to and from school (24 percent), to eat or drink (17 percent), or social and recreational purposes (16 percent).

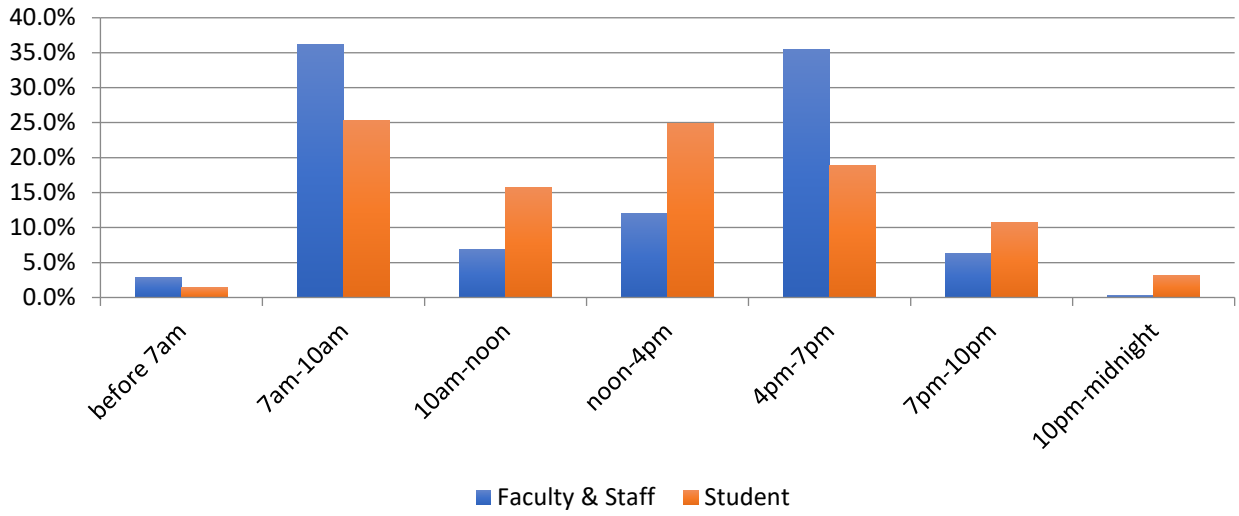
Figure 4-12: Weekend Trip Purposes



c. Time of Day

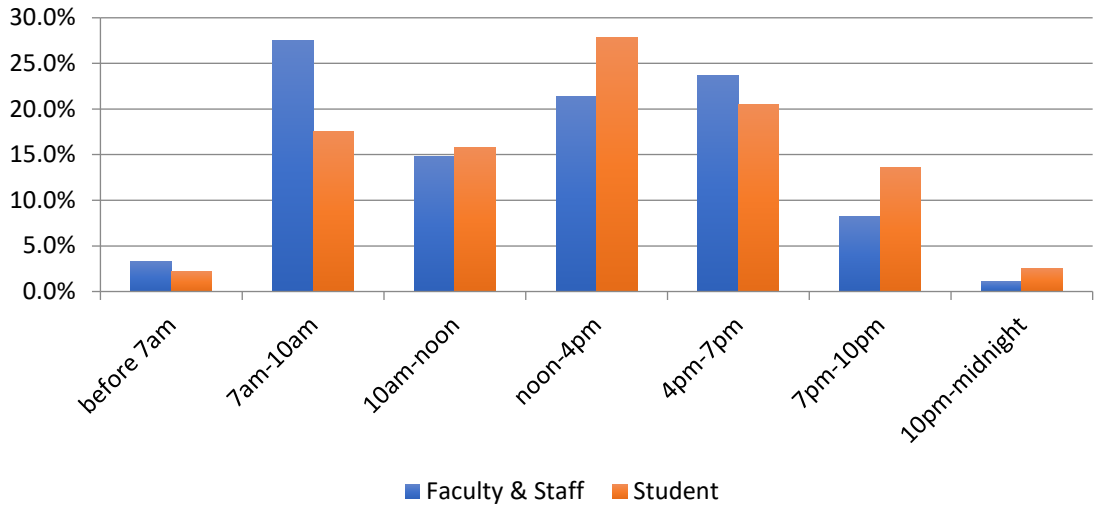
During the week, faculty and staff are most likely to travel between 7am and 10am, as well as 4pm to 7pm (Figure 4-13). This matches expected peak hour times. Students also travel frequently between 7am and 10am but are also more likely to travel during the noon to 4pm time period.

Figure 4-13: Time of Day of Trips, Weekday Trips



On weekends, faculty and staff are still most likely to travel from 7am to 10am and 4pm to 7pm, but there is also a significant amount of trips from noon to 4pm (Figure 4-14). Students are most likely to travel from noon to 4pm and are more likely than faculty and staff to travel in the evening.

Figure 4-14: Time of Day of Trips, Weekend Trips



d. Travel Time

The average length of all trips was 18.4 minutes. By mode, the longest trips were made by bus (an average of 21.7 minutes long), carpool (20.7 minutes), and driving (17.4 minutes). The shortest trips were made by bike (13.4 minutes), taxi (14.6 minutes) and walking (15.6 minutes). Weekday trips tended to be shorter for both faculty/staff and students. On weekdays, faculty and staff trips were 18.5 minutes on average, and student trips were 16.3 minutes long. On weekends, faculty and staff trips were on average 28.6 minutes long, and student trips were 20.2 minutes long.

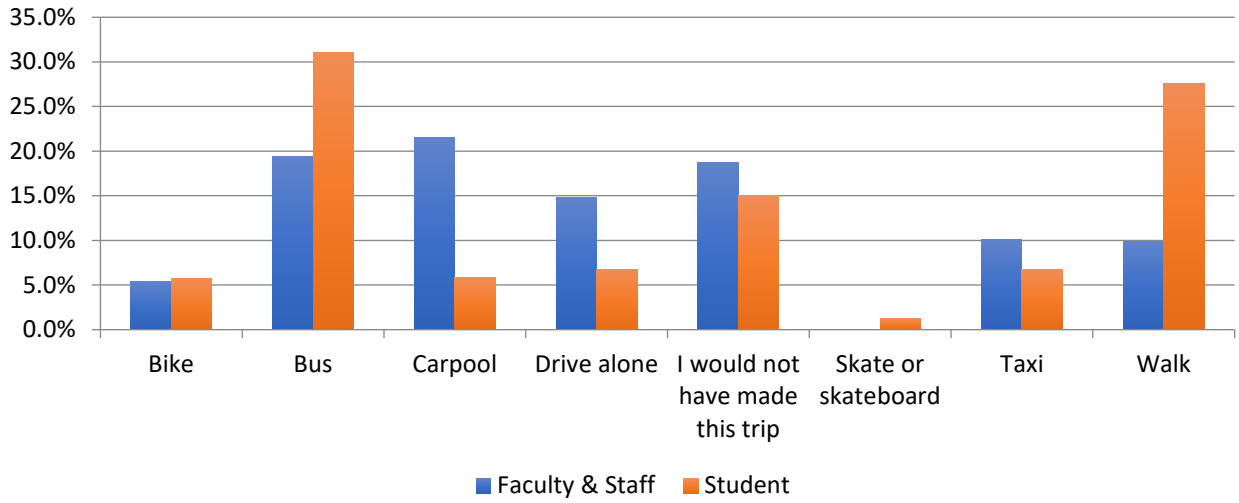
e. Bus Trips

Of the 4,178 trips reported in the survey, 20.5 percent of them were completed by bus. Nearly all respondents (97 percent) walked to the bus stop rather than using another mode, and the average respondent took 3.85 minutes to get to the bus stop. Again, 97 percent of respondents walked to their destination after getting off the bus, and this took an average of 3.9 minutes. People who took the bus waited an average of 6.2 minutes at the bus stop. Eighty-nine percent of respondents did not transfer, and eight percent of people transferred once.

f. Alternatives

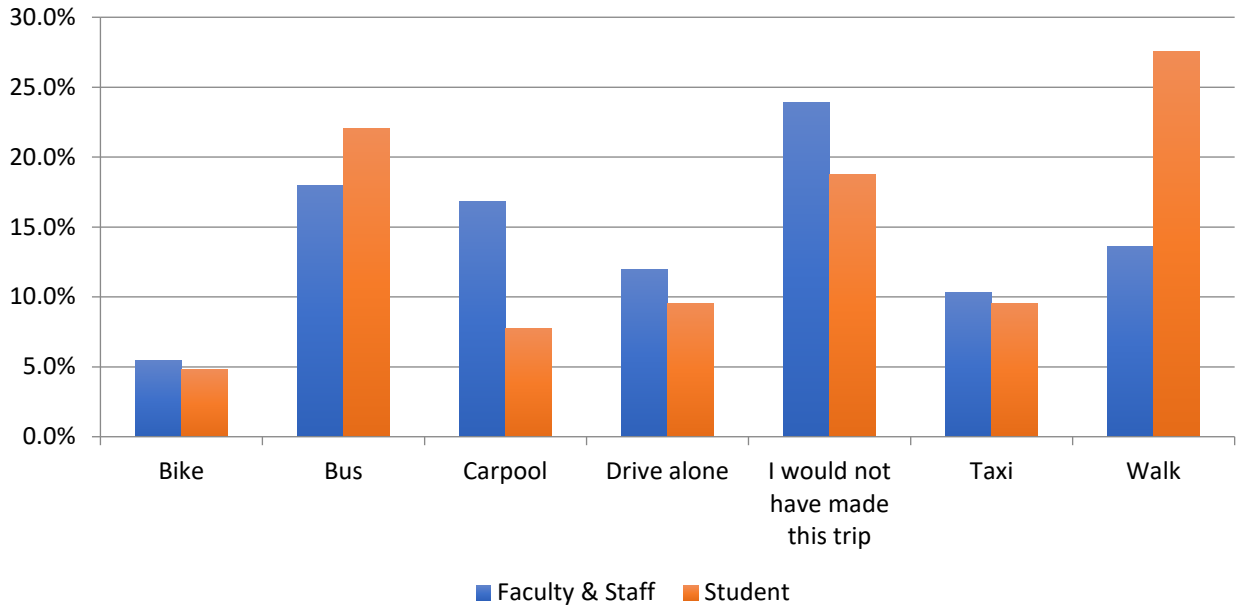
We asked respondents how they would have made their trip if the mode they used had not been available. Taking the bus was the most common response (22 percent), followed by not making the trip (17 percent), walking (16 percent), carpooling (15 percent), and driving alone (11 percent). On weekdays, taking the bus or walking are the most common alternatives for students (Figure 4-15). For faculty and staff, carpooling, taking the bus, or skipping the trip are the most common.

Figure 4-15: Weekday Alternatives



On the weekends, students are still most likely to walk or take the bus as a common alternative (Figure 4-16). Faculty and staff are most likely to skip their trip.

Figure 4-16: Weekend Alternatives



We also calculated the alternatives based on the original mode choice of the trip (Table 4-2). For this analysis, we focused on the 1,094 participants who live off-campus and reported commuting trips (e.g., trip to the campus) on weekdays. Among the 1,094 participants, the majority made trips between 7am and 10 am, and their average commute time is 17 minutes. In terms of commuting mode reported, 51 percent of them drive to the campus (including carpooling), 24 percent of the people take a bus, 22 percent of them walk/bike, and 3 percent of them choose other modes (e.g., taxicab, Uber/Lyft, etc.). The differing mode choices from earlier in the document is due to a slightly different sample selection.

From this analysis, we find that respondents who originally drove a car for commuting mostly do not change their travel mode: 42 percent of them still drive to the campus by either driving another vehicle or carpooling. However, other than driving, the bus shows the highest proportion as the alternative commuting mode. This trend can be explained by the spatial distribution of people who drive for commuting. Most of them live far away from the campus or live areas where the buses do not effectively serve. Therefore, for them, even under the circumstance where their car is not available, they still need to drive other cars (or by carpooling) to come to the campus.

Second, people who originally ride a bus for commuting mostly change to walking or biking to campus (40 percent). This observation can be explained by where bus commuter live. Most of

the bus commuters live in the zone where the distance to the campus is between one and three miles. Considering this relatively shorter distance, people can easily switch to walking or bicycling as alternative travel modes. Similarly, people who originally walk or bike to campus largely consider the bus as an alternative option. Among 243 people who reported that they walked or biked to the campus, 44 percent of them switched to the bus. This observation can also be explained by the fact that bus and walking/biking are a good alternative to one another.

Lastly, by comparing the overall mode split in the original case with that in the alternative (changed) case, we observe that other modes – mainly ride-sharing services – have a drastic increase (Figure 4-17). In the original case, only 3 percent of people choose ridesharing, but it increases to 12 percent (almost 4 times higher) in the alternative case. This observation suggests that although people do not mainly choose the ride-sharing services for their regular commuting trips, people largely consider it as a good alternative travel mode when their original mode is not available.

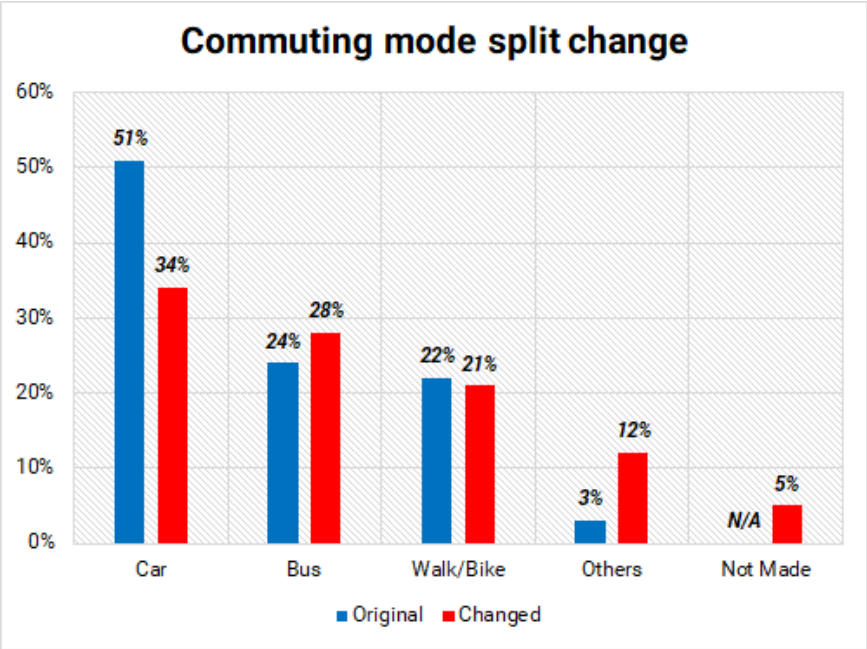
Table 4-2: Alternatives by Mode Choice

	Alternative Chosen					
	Car	**Bus**	**Walk/Bike**	**Others**	**Not made this trip**	**Total**
Car[1]	236 (42%)	166 (30%)	58 (10%)	76 (14%)	20 (4%)	556 (100%)
Bus	83 (32%)	15 (6%)	101 (39%)	37 (14%)	21 (8%)	257 (100%)
Walk/Bike	48 (20%)	108 (44%)	59 (24%)	12 (5%)	16 (7%)	243 (100%)
Others[2]	8 (22%)	15 (42%)	6 (17%)	4 (11%)	3 (8%)	36 (100%)
Total	375	304	224	129	60	1092

[1] *Car includes driving alone and carpooling*

[2] *Includes Taxi, Uber, and Lyft*

Figure 4-17: Commuting Mode Split Change

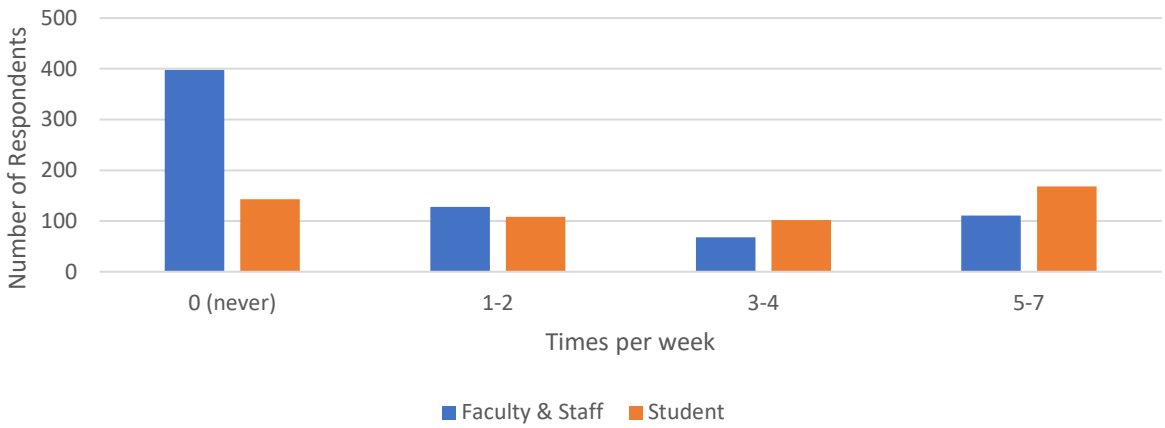


Part 3: Typical Commute Behavior

a. Regular Commute Behavior

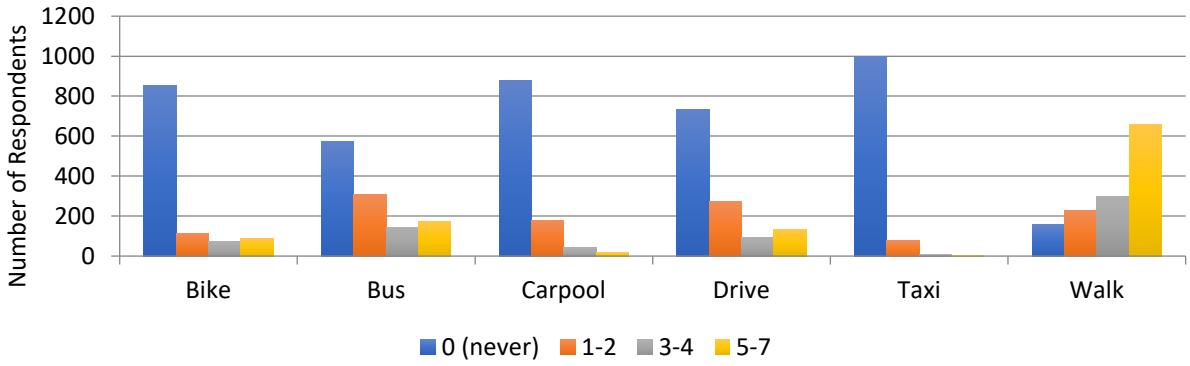
We asked respondents how often they use the bus in one week. Faculty and staff are most likely not to use the bus, while students are most likely to use the bus 5-7 times per week (Figure 4-18).

Figure 4-18: Bus Mode Frequency



We also asked respondents how they generally travel between on-campus destinations. Most respondents walk (Figure 4-19), and bus rides are the second-most common way to travel between on-campus destinations.

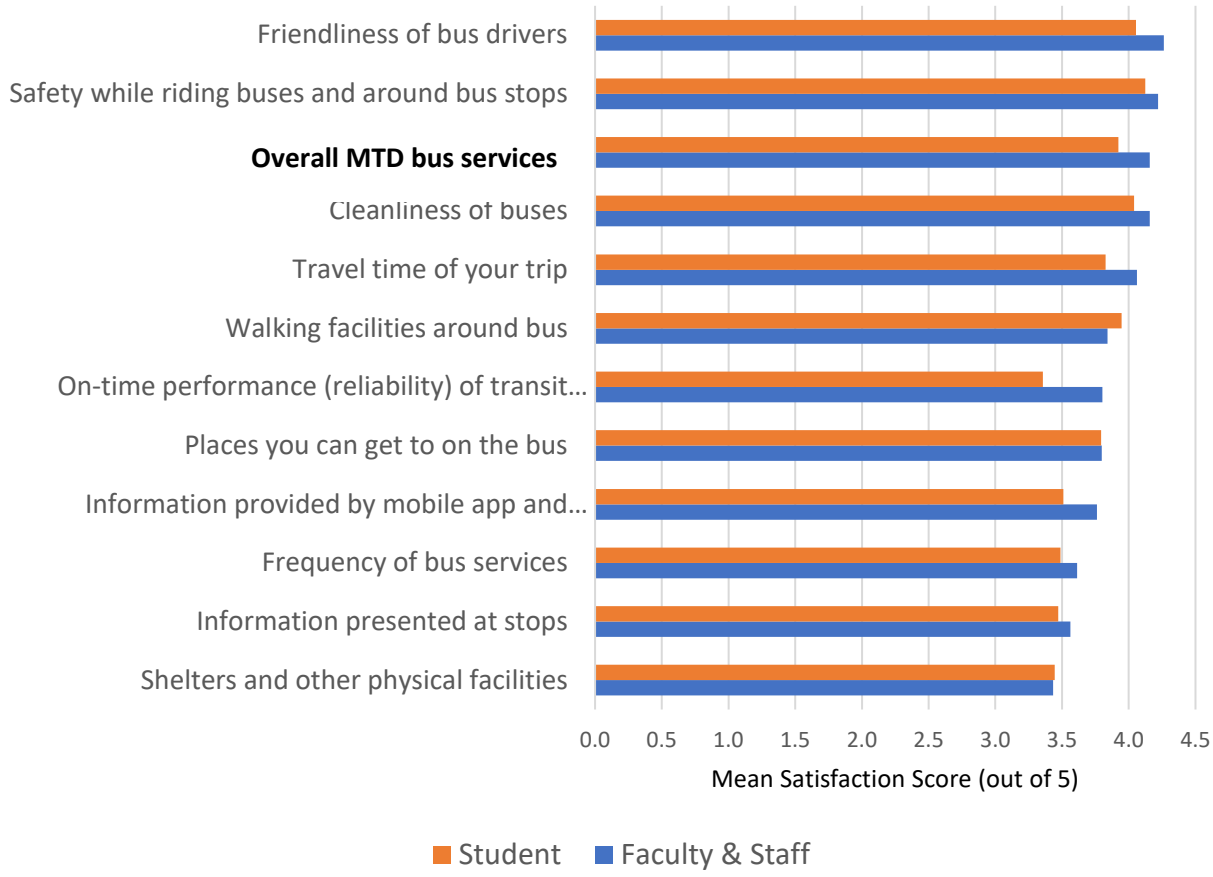
Figure 4-19: Mode Between On-Campus Destinations



b. Opinions about MTD

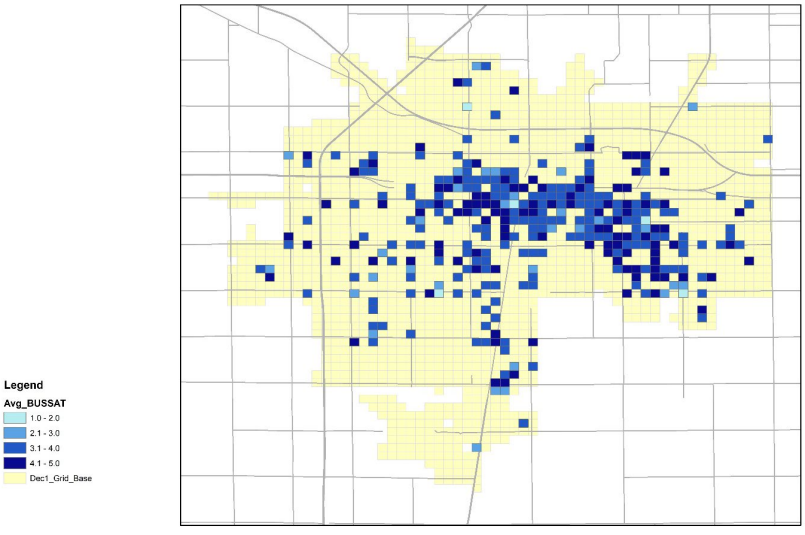
For respondents who answered that they have used the bus within the past week, we asked them to rate a variety of characteristics (Figure 4-20). Overall, respondents were fairly positive about MTD characteristics. Friendliness of bus drivers was the highest-ranked attribute, receiving an average of 4.3 by faculty and 4.1 by students (out of 5). Overall MTD bus service was also ranked highly. The lowest-ranking attributes were the frequency of bus services, information presented at stops, and shelters or other physical facilities. These each received an average of 3.5.

Figure 4-20: Satisfaction with MTD Services



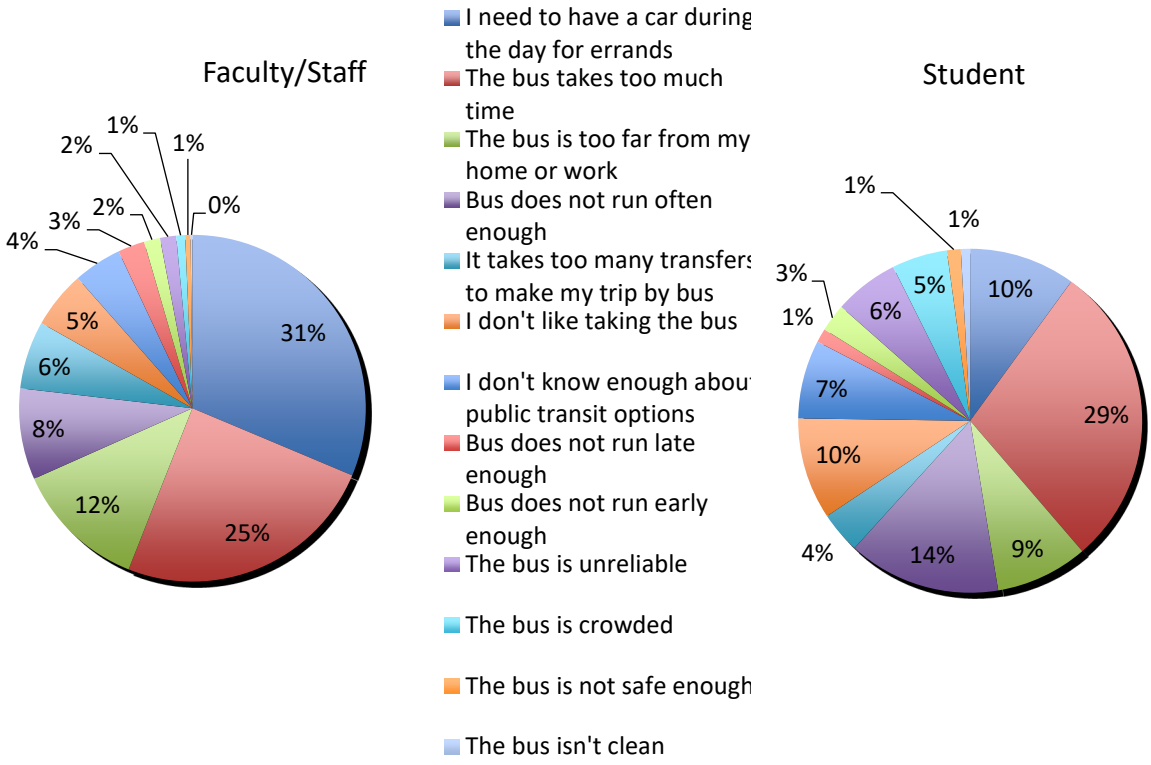
We also analyzed overall satisfaction spatially (Figure 4-21). There are pockets of high-satisfaction grids close to campus.

Figure 4-21: Spatial Pattern of Bus Satisfaction



We asked respondents who had not ridden the bus in the past week why they did not ride. For faculty and staff, the most important reasons were needing a car during the day for errands, the bus taking too much time, and the bus being too far from home or work (Figure 4-22). For students, the top reasons were the bus taking too much time, the bus not running often enough, needing to have a car during the day for errands, and not liking taking the bus.

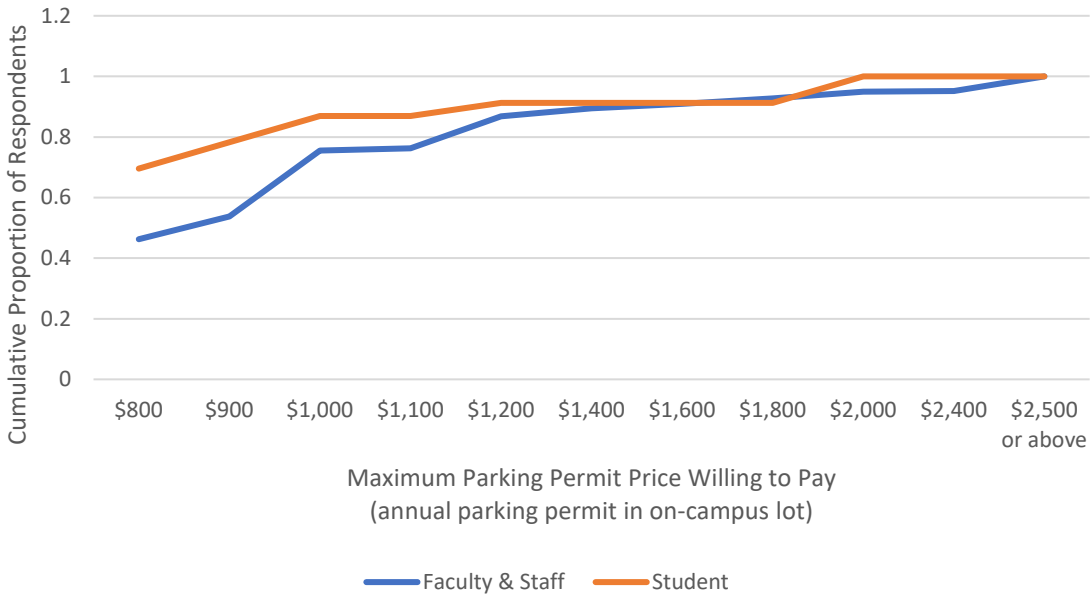
Figure 4-22: Reasons for Not Riding the Bus



c. Parking Behavior and Preference

If respondents drove to campus, we asked where they parked. Faculty and staff are most likely to have a parking permit in an on-campus lot (66 percent) or park at the meter (18 percent). Students were most likely to park at a meter (56 percent) or somewhere off campus (17 percent). For those with parking permits in on-campus lots, we asked the maximum they would be willing to pay for this permit. Figure 4-23 shows the cumulative proportion of respondents at each price point. Eighty percent of students would not be willing to pay more than $900 for this permit, while eighty percent of faculty and staff would not be willing to pay more than $1,000.

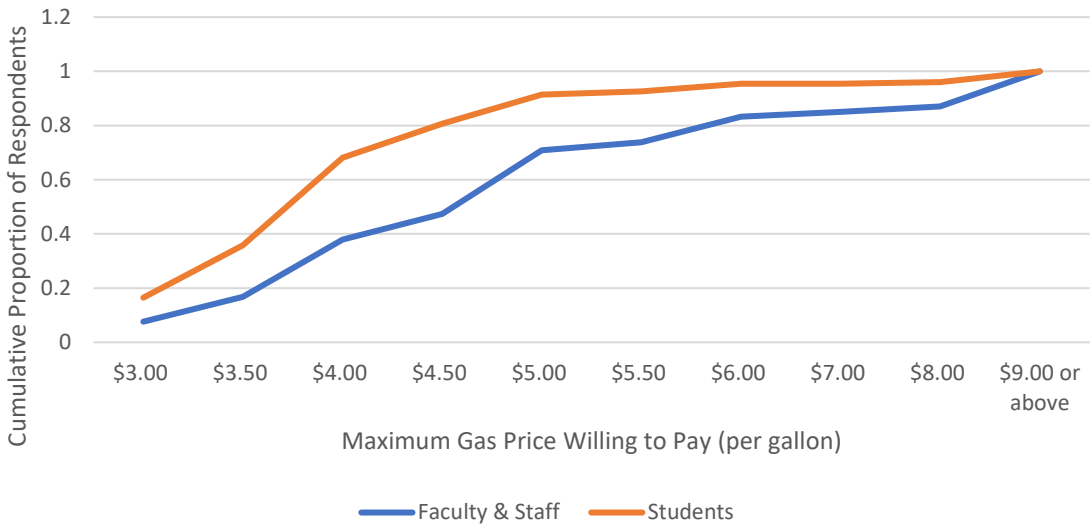
Figure 4-23: Parking Price Sensitivity



d. Gas Price Preference

We also asked those who drove how much they would be willing to pay for gas. Specifically, we asked them at which gas price they would stop driving and choose a different mode of transportation. 80 percent of students would not pay more than $4.50 for gas, while 80 percent of faculty and staff would not pay more than $6.00.

Figure 4-24: Gas Price Sensitivity

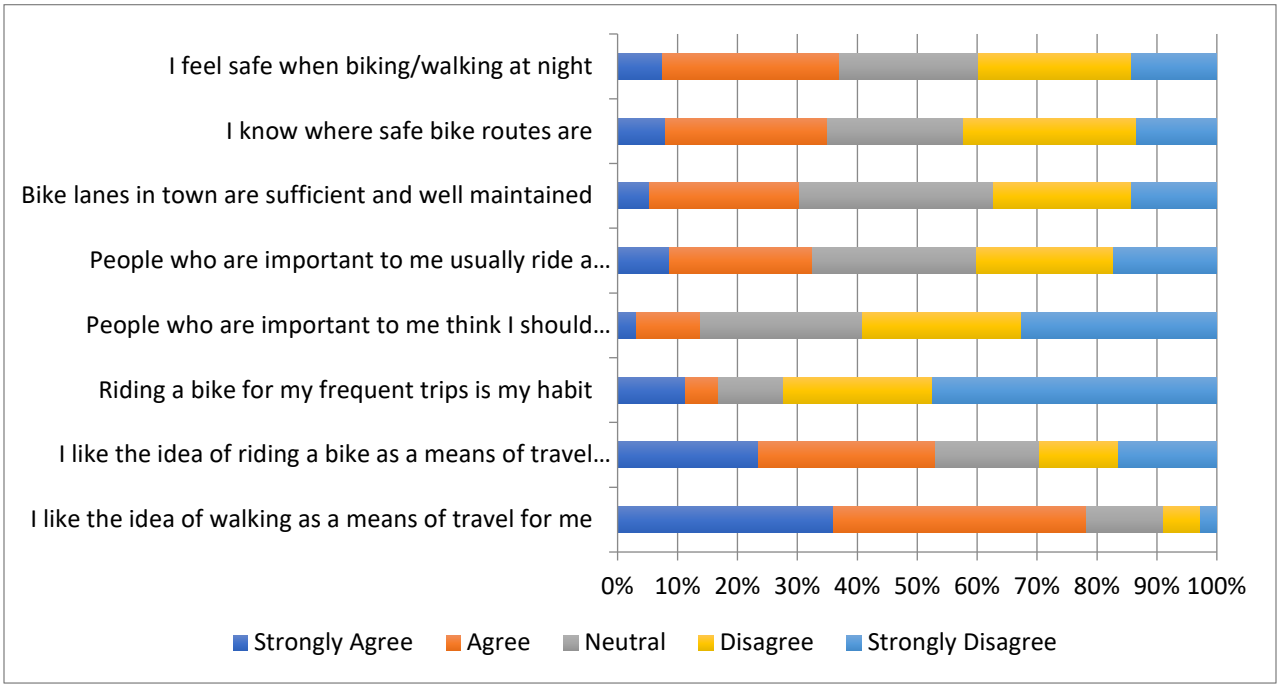


Part 4: Opinions About Travel

We asked a variety of questions to understand respondents' general attitudes towards travel. We ask these questions to try to better understand which habits or beliefs form the basis of their travel decisions. We asked respondents a variety of questions relating to walking and biking, riding the bus, driving, environmental concerns, and health concerns.

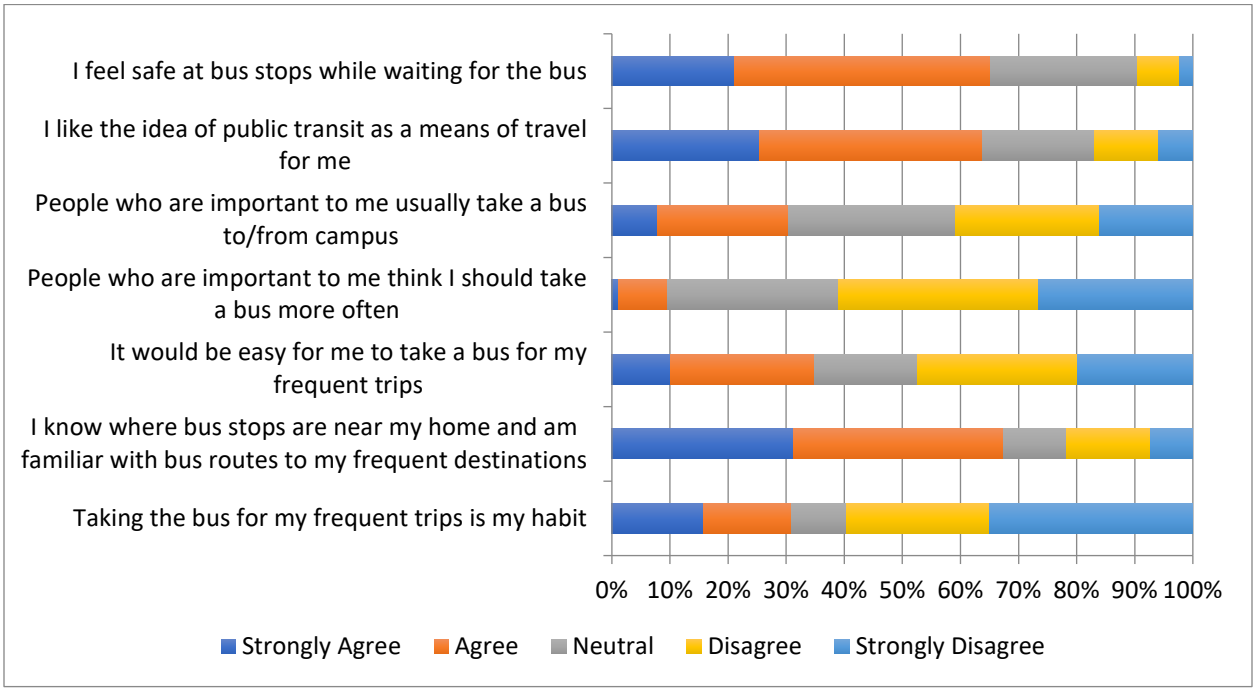
Perhaps the statement that respondents were most likely to agree with was "I like the idea of walking as a means of travel for me" (Figure 4-25). Nearly 80 percent of respondents agreed with this statement. Slightly over half of respondents agreed with a similar statement about biking. However, only 38 percent of respondents felt safe walking or biking at night, and only 17 percent of people stated that riding a bike for frequent trips was a habit.

Figure 4-25: Opinion Questions Related to Walking & Biking



Nearly 65 percent of respondents like the idea of using pubic transportation as a means of travel, and the same number feel safe while waiting for the bus. Nearly 70 percent of respondents knew the bus stops and routes near their homes and frequent destinations. However, only 35 percent of respondents thought it would be easy to take the bus to their frequent destinations, and only 30 percent of respondents report taking the bus habitually. Taking the bus, however, is unlikely to be important to other important people in a respondents' life; only 10 percent of respondents thought that important people thought they should use the bus more often, and 60 percent disagreed with the sentiment.

Figure 4-26: Opinion Questions Related to Transit



About half of respondents liked the idea of driving as a means of travel, and the same number drive habitually, although 40 percent of respondents reported not driving habitually (Figure 4-27). A little more than 50 percent thought that owning a car was a symbol of freedom. Interestingly, over 70 percent of respondents reported that driving a car leads to environmental problems, including climate change. Forty-five percent of respondents agreed that environmental concerns affect the choices that they make about their daily travel.

Figure 4-27: Opinion Questions Related to Driving

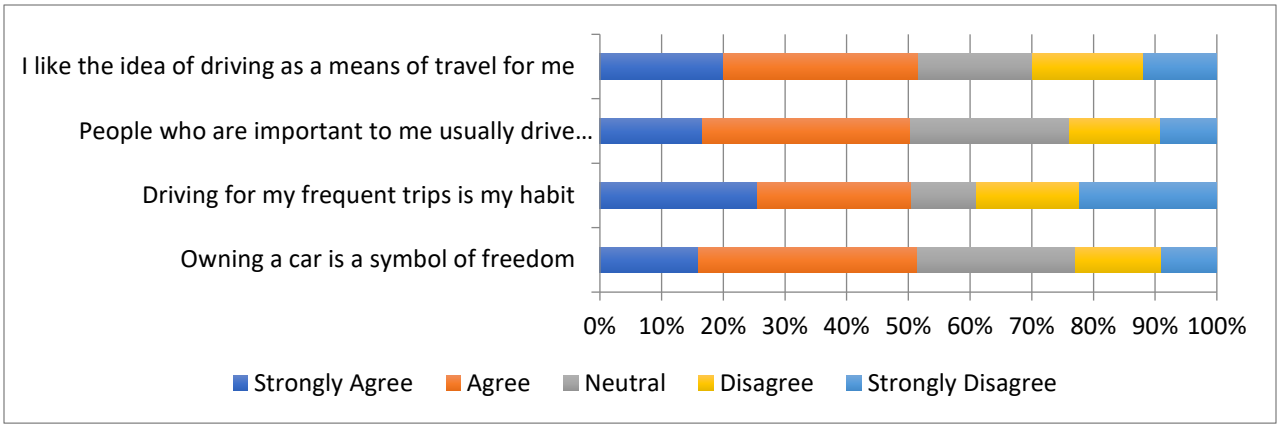
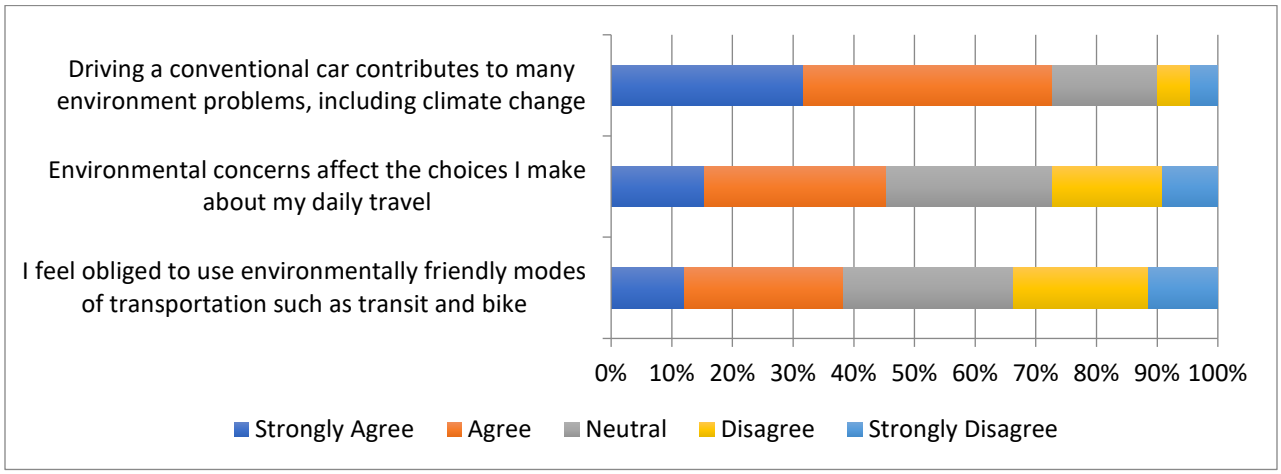
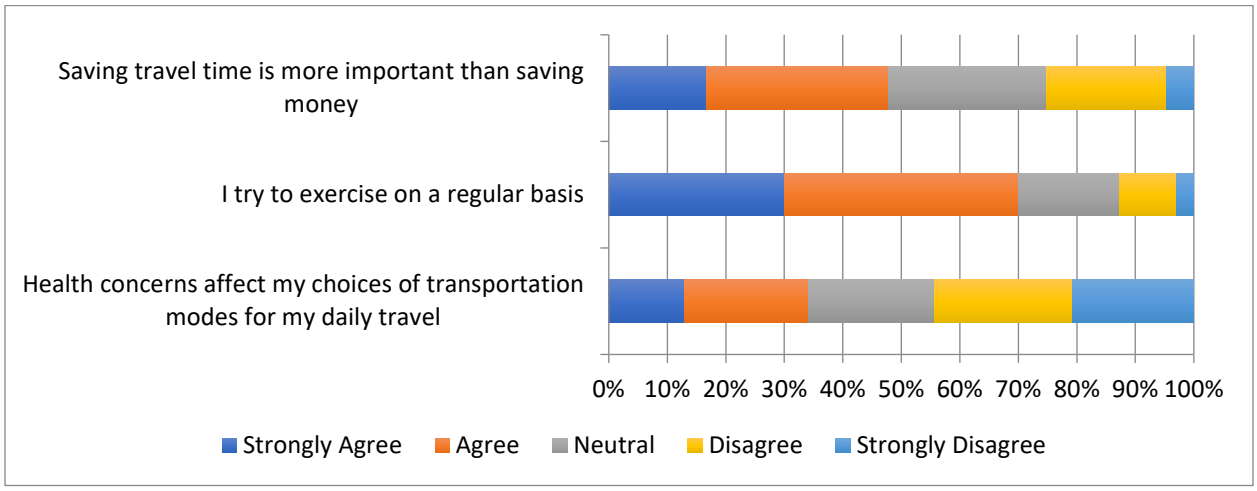


Figure 4-28: Opinion Questions about Environmental Concerns



One-third of respondents reported that health concerns affect their daily travel decisions, and 70 percent of respondents exercise on a regular basis. Nearly 50 percent of respondents reported that saving travel time is more important to them than saving money, while 25 percent disagreed and 25 percent reported no preference.

Figure 4-29: Opinion Questions about Health



Part 5: Demographics

a. Age, Gender, and Race

We asked a variety of demographic questions from our respondents. The average student age was 22.4, while the average faculty and staff age was 43.8. More females than males responded for both faculty/staff and students (Table 4-3).

Table 4-3: Gender of Respondents (Percent of total respondents)

	Faculty	Staff	Graduate Student	Senior	Junior	Sophomore	Freshman
Female	8.7	28.8	6.7	4.2	3.4	3.2	3.3
Male	7.7	17.7	6.6	2.0	1.6	1.8	3.0
Other	0.1	0.7	0.1	0.1	NA	NA	0.1

Sixty-two percent of student respondents are domestic students, while 14.3 percent are international students. Most student respondents are white (48.1 percent), Asian (28.9 percent), or Hispanic (13.9 percent). Most faculty respondents are white (74.9 percent), Asian (9.8 percent), and Black (5.1 percent).

Table 4-4: Race of Respondents (Percentage of Total Respondents)

Race	Faculty	Staff	Graduate Student	Senior	Junior	Sophomore	Freshman
Asian	1.3	3.9	4.0	1.3	1.5	0.9	1.6
Black	0.5	2.3	0.4	0.1	0.1	0.2	0.5
Hispanic	0.8	1.8	1.5	0.5	0.5	0.9	1.0
Native American	0.1	0.2	0.1	0.0	0.0	0.0	0.1
White	10.7	29.8	5.0	3.3	2.1	2.1	2.8
Other	0.1	0.6	0.3	0.1	0.0	0.2	0.0
No Answer	0.6	1.3	0.5	0.2	0.2	0.1	0.1

b. Income and Employment

Most students in the sample hold at least one job. Nearly half of students work on campus, while only 12 percent hold jobs off campus and 39 percent do not hold jobs. Ninety percent of faculty and staff hold only one job, and faculty and staff work on average 44 hours per week. Thirty-five percent of students report earning $499 or less per month (Figure 4-30). Twenty percent of faculty and staff earn between $50,000 and $75,000 (Figure 4-31).

Figure 4-30: Monthly Student Income

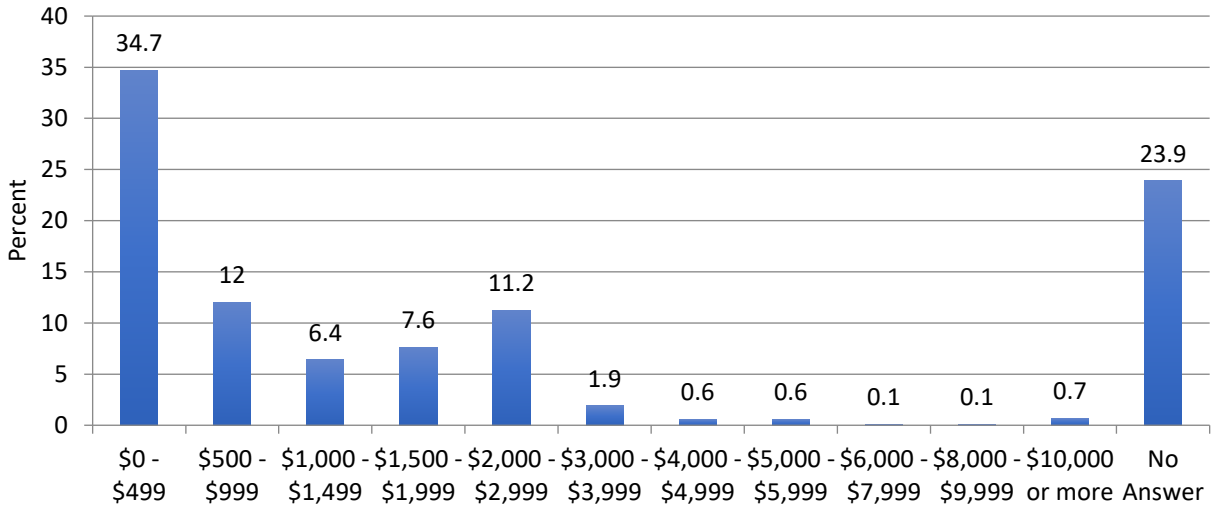
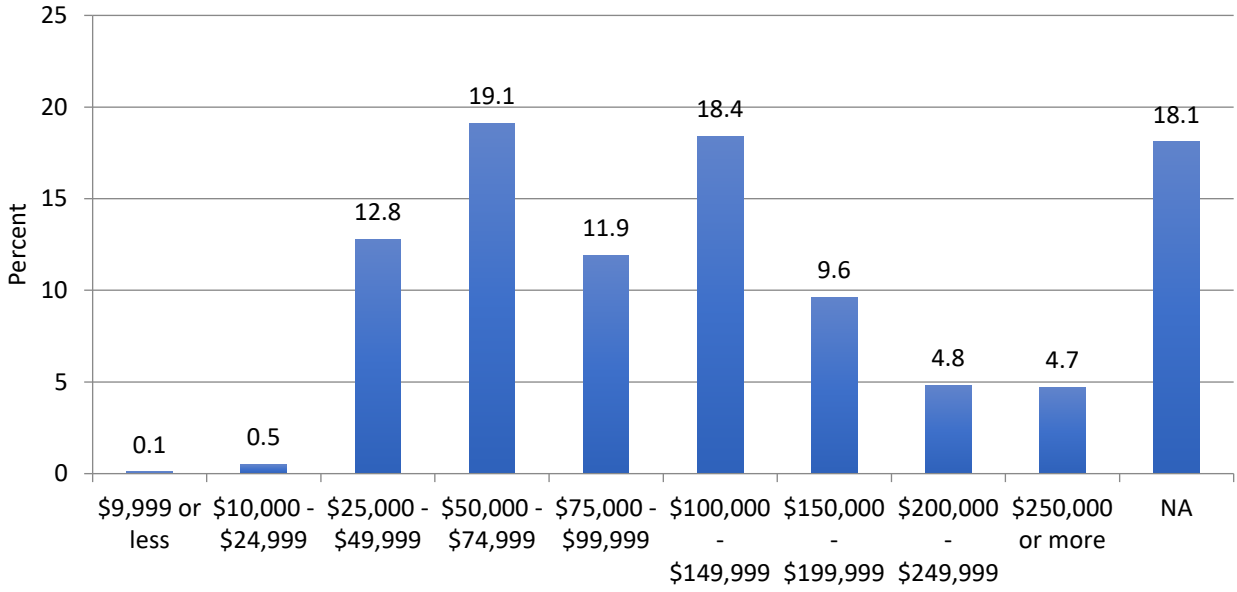


Figure 4-31: Faculty/Staff Annual Income



c. Housing

Forty-eight percent of students live off-campus, 46 percent live on-campus, and seven percent live in sororities and fraternities. Most students (53 percent) live with roommates, while 18 percent live by themselves. Students' top three reasons for choosing housing include the cost, proximity to work or school, and the size and characteristics of the home or dorm.

At 72 percent, the majority of faculty and staff live in a single-family detached home, and 70 percent of respondents own their home. Home size and characteristics was the most important

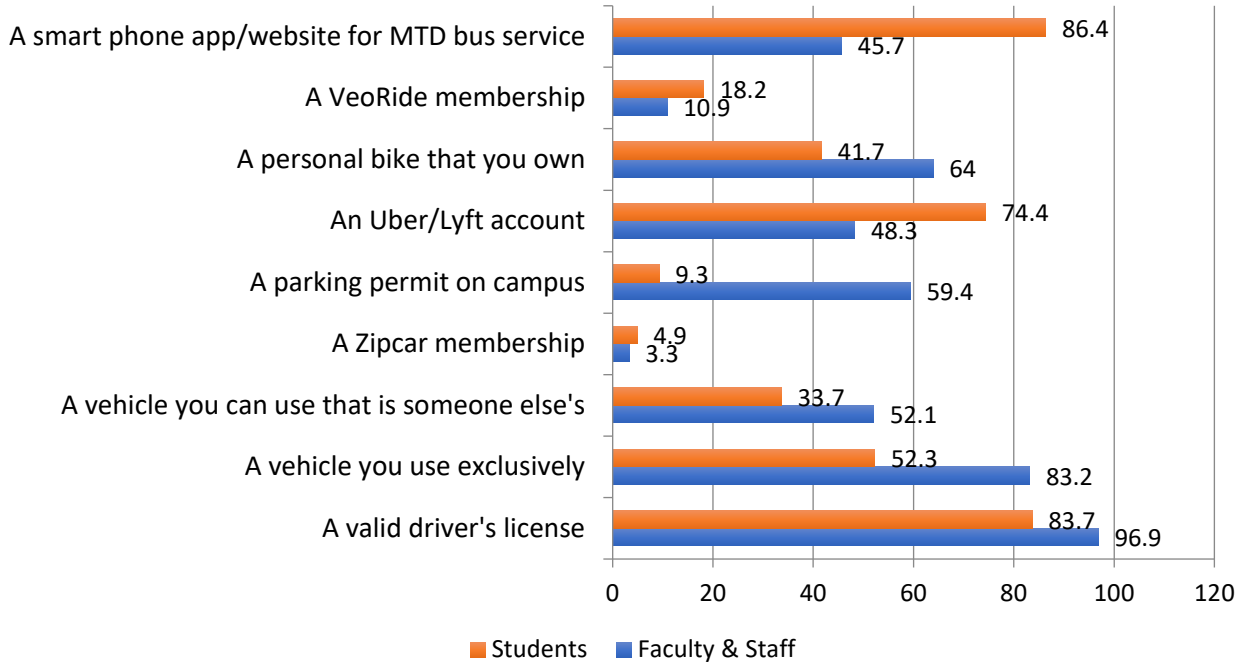
determine of housing choice for faculty and staff, while the cost and living in a quiet neighborhood were also important. Proximity to work was the #4 reason for housing choice.

d. Other Characteristics

Of all respondents, 7.1 percent reported having a disability that prevents them from biking, 6.3 percent have a disability that prevents them from walking, 2.9 percent have a disability that prevents them from using public transit, and 1.6 percent have a disability that prevents them from driving.

Students are far more likely that faculty and staff to have a smart phone app for MTD bus service, at 86.4 percent of students and 45.7 percent of faculty and staff (Figure 4-32). Nearly 20 percent of students have a VeoRide membership, compared with 10 percent of faculty and staff. Nearly all faculty and staff have a driver's license, at 96.9 percent, compared with 83.7 percent of students. Sixty percent of faculty and staff have a parking permit on campus, compared with only 9.3 percent of students. On average, faculty and staff own 1.7 cars per household.

Figure 4-32: Memberships, vehicles, and license



Key Takeaways

Travel Mode

- Faculty and staff were most likely to commute by driving alone (54 percent), followed by taking the bus (20 percent).
- Students were most likely to take the bus (39 percent) or walk (38 percent).
- Commute mode choice of both students and faculty/staff was strongly associated with their residential locations. Walking is dominant for students for < 1 mile zones. Bus was the most competitive in 1-2 mile zones from campus for both students and faculty/staff. Outside 2 mile zones, driving is dominant especially for faculty/staff.

Travel Purpose

- Thirty-six percent of all trips were to and from work, and represented the most common trip purpose.
- Nineteen percent of all trips were to and from school.
- Shopping was the third most common trip type, representing 9.5 percent of all trips.

Travel Time

- The average length of all trips was 18.4 minutes.
- By mode, the longest trips were made by bus (an average of 21.7 minutes long), carpool (20.7 minutes), and driving (17.4 minutes).

Trips Made by Bus

- Of the 4,178 trips reported in the survey, 20.5 percent of them were completed by bus.
- Nearly all respondents (97 percent) walked to the bus stop and to their destination from the bus stop.
- The average respondent took 3.85 minutes to get to the bus stop.
- People who took the bus waited an average of 6.2 minutes at the bus stop.
- Eighty-nine percent of respondents did not transfer, and eight percent of people transferred once.
- Taking the bus was the most common alternative mode listed (22 percent) on the day when the current mode is not available.

MTD Opinions

- Bus riders were generally satisfied with MTD bus service, with average overall satisfaction scores being 4.2 and 3.9 (out of 5) for faculty/staff and students, respectively. Faculty and staff are slightly more satisfied than students in general because they are more likely to be choice riders than captive riders.
- Friendliness of bus drivers was the highest-ranked attribute, receiving an average of 4.3 by faculty and 4.1 by students.

- Overall, lowest-ranking attributes were the frequency of bus services, information presented at stops, and shelters or other physical facilities. For student riders, on-time performance (reliability) of transit services received the lowest average score of 3.3.
- For faculty and staff, the biggest barriers to riding the bus were needing a car during the day for errands, the bus taking too much time, and the bus being too far from home or work.
- For students, the biggest barriers to riding the bus were the bus taking too much time, the bus not running often enough, needing to have a car during the day for errands, and not liking taking the bus.

Parking and Gas

- Eighty percent of student parking holders would not be willing to pay more than $900 for a parking permit on campus and would consider an alternative way to commute.
- Eighty percent of faculty and staff would not be willing to pay more than $1,100 for a parking permit on campus.
- 80 percent of students would not pay more than $4.50 per gallon for gas.
- 80 percent of faculty and staff would not pay more than $6.00 per gallon for gas.

Opinions About Travel

- Nearly 65 (52) percent of respondents like the idea of using public transportation (driving) as a means of travel, and the same number feel safe while waiting for the bus.
- Nearly 70 percent of respondents knew the bus stops and routes near their homes and frequent destinations.
- 73 percent of respondents are aware of environmental problems related to driving; Environmental concerns affect travel mode choice only for 45 percent and only 38 percent feel obliged to use environmentally friendly modes.
- Only 35 percent of respondents thought it would be easy to take the bus to their frequent destinations.
- Only 30 (51) percent of respondents report taking the bus (driving) habitually.
- Taking the bus is unlikely to be important to other important people in a respondents' life; only 10 percent of respondents thought that important people thought they should use the bus more often, and 60 percent disagreed with the sentiment.

Other Characteristics

- Students value proximity to work/school more highly than faculty/staff do.
- 86 percent of students use the MTD website or app to get bus information.
- 45 percent of faculty and staff use the MTD website or app to get bus information.

5. Conclusions

Summary of Findings

On-campus stations account for a significant proportion of MTD bus ridership and performed better than off-campus stations in recent years. On-campus stations account for 11% of all of stations, but 61% of daily ridership and 43% of annual passenger revenue miles in 2018. While bus ridership fell by 6% at off-campus stops between 2016 and 2018, there was little change at on-campus stops.

At the agency level, MTD ridership steadily increased from 2007 to 2015, then has declined since the 2015 peak at a pace similar to national transit ridership trends. Bus ridership decline has been much faster on community routes (a 16.6% reduction from 2014 to 2017) than on campus routes (-8.3%).

The recent ridership decline is not due to an MTD bus service cut, because vehicle revenue miles and hours steadily increased from 2002 to 2017. Student enrollment also steadily grew for the same period and did not decline in recent years. In addition, other changes to the campus environment— including car ownership, the location of educational and athletic facilities, the number of parking permits, and bicycle ownership—do not seem to have contributed to declining bus ridership.

A bike share program on campus, VeoRide, appears to have replaced a small fraction of bus ridership (about .6%) in its first year of operation. The ongoing MCORE project in Campustown is also likely to have negatively impacted ridership by disrupting and rerouting existing bus routes since 2017. However, this does not explain the ridership decline in 2016. Increasing student concentration near campus may have also led to a ridership reduction. Recent years have seen substantial increases in student population and new rental housing units in close-in neighborhoods, and this trend is expected to continue in the near future. As students concentrate in areas near campus, walking and bicycling are increasingly feasible travel options. Ride-hailing services such as Uber and Lyft may also have affected MTD bus ridership during this period but were not studied due to data limitations.

From the survey, we learned that students were most likely to take the bus or walk to complete their trips, while faculty and staff were most likely to commute by driving alone or taking the bus. Commute mode choice of both students and faculty/staff was strongly associated with their residential location, and the bus was the most competitive in one- to two-mile zones from the campus for both students and faculty/staff. Outside of two miles, bus commuting takes two to four times the driving commute time, and bus commute share falls substantially.

Twenty percent of all reported trips were made by bus. People who rode the bus took on average 3.8 minutes to get to the bus stop and waited an average of 6.2 minutes at the bus stop. Eighty-nine percent of respondents did not transfer buses.

Overall, MTD bus service was highly ranked for satisfaction, with the friendliness of bus drivers as the highest-ranked attribute. The lowest-ranking attributes were the frequency of bus services and the information presented at stops. For faculty and staff, the biggest barriers to riding the bus were the need for a car during the day for errands, the bus taking too much time, and the bus being too far from home or work. For students, the biggest barriers to riding the bus were the bus taking too much time, the bus not running often enough, needing to have a car during the day for errands, and not liking taking the bus.

A high portion of respondents like the idea of using the bus, feel safe while waiting for the bus, and know the bus stops near their home (65-70%). However, environmental concerns affected travel mode choice for only 45% of respondents, and only 38% felt obliged to use environmentally friendly modes. In addition, only 30% report taking the bus habitually and only 35% thought it would be easy to take the bus to their frequent destinations.

Recommendations

The findings from various transit ridership analyses and the travel survey offer many important insights and policy implications. Because a rigorous analysis of specific policy measures is beyond the scope of this study, here we suggest general policy directions in four main areas that can be further developed in future studies.

First, efforts to increase MTD bus ridership among faculty and staff would be more effective than efforts targeted to students. Bus commute share among students is already 39%, and walking and biking account for 38% and 8% of student commute trips, respectively. Only 13% of students drive alone or carpool to school. If the trend of increasing student concentration in campus-adjacent neighborhoods persists in coming years, it is likely to further boost active transportation modes—walking and biking. There is more room to improve transit ridership among faculty and staff. Sixty-two percent of faculty and staff drive or carpool, and only 20% take a bus to campus. We suggest that any policy or strategy to promote transit should aim to draw transit riders away from driving, not away from walking and bicycling.

Second, making bus trips faster will be key to improving transit ridership, especially for people who live at a greater distance from campus. A bus trip to campus from most locations outside campus-adjacent neighborhoods takes more than twenty minutes, which is more than twice the driving commute time for the same distance. Many destinations are actually more quickly reachable by bicycle than by bus. Many respondents of the campus travel survey also listed “the bus takes too much time” as a primary barrier to using the MTD bus. Increasing bus

ridership among residents outside campus neighborhoods without significantly improving bus travel time seems like a nearly unattainable goal. Improving bus speed may involve redesigning the bus network with more simplified and straight routes and focusing on high demand areas. The top 10% of bus stops account for 85% of all bus trips; therefore, connecting these key destinations with quicker services may be one of the more effective approaches to increasing bus speed and consequently, ridership.

Third, parking pricing can significantly influence commute mode choice among faculty and staff. The campus travel survey shows that more than half of current faculty/staff permit holders would consider an alternative way to commute at a permit price of $900 per year and nearly 80% would consider alternatives at a $1,100 price. Parking on campus is currently underpriced given the high construction and maintenance costs of parking spaces, which in effect subsidizes commuters who drive alone to campus. Therefore, any policy program that mitigates this price distortion would encourage alternative commute modes, including carpool, MTD bus, biking, and walking.

Finally, strategies based on high environmental awareness among campus community members have the potential to significantly influence travel-related decisions. The survey results show that 73% of respondents are aware of environmental problems related to driving, and nearly 65% of respondents like the idea of using public transit. However, only 38% of respondents feel obliged to use environmentally friendly modes, and environmental concerns are affecting the actual travel mode choices of only 45%. Nudge programs to promote pro-environmental behavior without significantly limiting people's choices or altering economic (dis-)incentives are increasingly popular, especially in energy and resource conservation. We suggest that well-designed nudge programs to promote green transportation are likely to bear fruit, considering community members' positive attitude toward alternative transportation modes.

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