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Understanding Commuter Patterns and Behavior: An Analysis to Recommend Policies Aimed at Reducing Vehicle Use

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UNDERSTANDING COMMUTER PATTERNS AND BEHAVIOR: AN ANALYSIS TO RECOMMEND POLICIES AIMED AT REDUCING VEHICLE USE

Final Report

Prepared for

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EXECUTIVE SUMMARY

In an effort to decrease greenhouse gas emissions and develop a model for others to follow, the University at Albany has undertaken an extensive examination of transportation use by its employees and students and those of the employees at the nearby Harriman state campus. The goal is to make alternative transportation a more viable option for the commuting population by identifying solutions and collaborations and recommending policies aimed at reducing vehicle miles travelled.

Addressing the use of transportation is a vital part of achieving carbon reductions. However, there exist institutional constraints towards tapping into this potential which manifest themselves in the lack of awareness and availability to feasible solutions. The analyses included in this research comprises of a review of the existing alternative transportation options in the Capital Region, a Geographic Information Systems (GIS) study of where the commuting population lives and their proximity to CDTA bus routes, a GPS on-time performance study of the main student transit lines, and a survey and focus group discussion on commuting behaviors and preferences. The results look to address the reliance on single occupancy vehicles (SOV), a transportation issue that is common at both the state and national level. The techniques developed by this analysis provide a framework that could be reproduced throughout the state to develop transportation policies and impact a significant amount of the population.

The study revealed an array of existing transportation options available throughout the region. CDTA has developed an elaborate bus system that offers several routes with direct access to the SUNY and Harriman Campuses. Other commuter bus lines, either sponsored by a local government entity or an independent transportation company, do exist but only some have stops at the SUNY and Harriman Campuses. The success of these lines to date has been limited since the majority of commuters need greater flexibility than the schedules currently offered. It also appears that the majority of commuters are not aware of the cost savings benefits that are involved with taking public transportation. The CDTC has taken steps to improve the commuter bus system, along with their car and vanpool networks, by a establishing a clearinghouse for information on finding bus schedules, car pool partners and park and ride locations with the iPool2 website.

The central theme developed from the GIS analysis is that geographic access to transit is not the reason why the majority of commuters don't utilize mass transit. The frequency and convenience of the bus routes bear a larger role in commuting decisions. The GIS results can be used to guide marketing efforts by the UAlbany and Harriman Campus in an effort to support car and vanpooling programs and assist transportation authorities by identifying locations that could benefit from rerouting bus lines and/or reconfiguring bus stops. Our results suggest that there are specific areas with a large density of SUNY and Harriman commuters, namely postal codes representing the City of Albany, Clifton Park, and Delmar.

These results suggest that the existing CDTA routes should be analyzed to determine if these communities are being serviced efficiently and properly with direct routes to the UAlbany and Harriman Campus.

During the process of developing a methodology for conducting an on-time performance analysis, there were several lessons learned. The most prominent lesson is that the use of handheld GPS units is not efficient and becomes a very expensive and time intensive process. This could be greatly improved if transit agencies made use of an automated vehicle location (AVL) system. For smaller transit providers, such as UAlbany, installing a GPS based tracking technology system, like the iTrak system, could be an inexpensive way to monitor and manage shuttle fleets. GPS based technology can also benefit the transit user as these provide a real-time shuttle tracker application which can be accessed on a smart phone or via the web so that transit users can look up where the bus is located and when it will arrive at the stop. The use of this technology would greatly improve the user friendliness of transit and help to make transit a viable alternative to SOV commuting to campus. The research team strongly recommends that the CDTA use an AVL system and the University at Albany implements the iTrak fleet manager system as a means to improve the effectiveness and reliability of mass transit as well as campus safety. With these established, it would be possible for a regional transit website to be created that displays a map of bus locations in real-time throughout the Capital District.

The transportation survey produced a substantial set of data and findings regarding UAlbany commuter preferences. The study focused on three main topics: the extent to which respondents use a car to regularly commute to school, the main limitations of alternative transportation systems on campus, and supported solutions. The data in the student and employee surveys show that driving is the dominant form of commuting (40% daily-use students; 73% daily-use employees), mainly because of the "convenience" factor along with the need to "travel from other places to and from work/school". While students used the bus rather frequently, all other modes were far less commonly used. Both groups found major limitations in transit due to frequency, length of trip, and unavailable routes. Carpooling was hindered by the lack of social networks. Bicycling suffered from safety concerns and walking was limited due to the distance of travelling from home. While both groups agreed on many of the same solutions for transit improvements certain solutions, such as telecommuting and monetary rewards or penalties, were likely to work best with only one population.

The focus groups revealed additional reasons for not using alternative transportations not identified in the survey along with clarification on rewards that might entice usage. General alternative transportation concerns such as distrust of bus reliability during high stress periods, (i.e. tests) and potential solutions, such as parking garages, parking lot shuttles, expanded on-campus daycare, graduate housing, and dormitory-led bus-education programs were also reported during the course of the meetings.

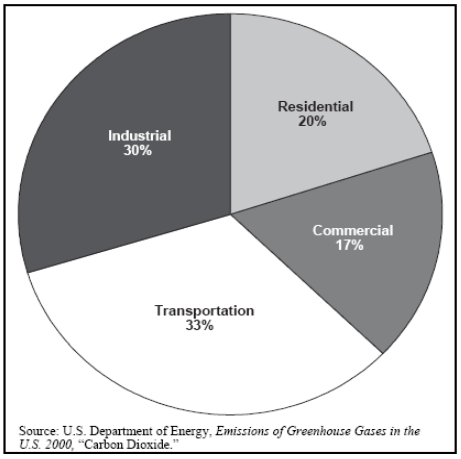
The project has generated a list of recommended actions based on findings specific to the University at Albany and Harriman Campus along with the ones that can be generalized to all institutions as highlighted in the TCRP's 82 case studies. Additionally, a handbook describing the methodology used to gather and analyze data has been created for other institutions to follow.

PROJECT HISTORY

BACKGROUND ON GHG EMISSIONS AND TRANSPORTATION

In the United States GHG emissions is a major environmental concern that requires policies and programs to limit and reduce the amount of greenhouse gases that are emitted into the atmosphere in an attempt to prevent serious and irreversible environmental degradation. The United States Department of Energy (USDOE) monitors the consumption of fossil fuels and GHG emissions in the United States by sector of the nation's economy. According to the USDOE, the transportation sector of the nation's economy is responsible for emitting one third of the nation's GHG emissions (TCRP Report 93, 2003). By economic sector, transportation emits the most greenhouse gases compared to other sectors of the nation's economy and therefore has been targeted for policies and programs to reduce the sector's level of greenhouse gas emissions. The call for policies and programs requires government action in order to achieve this objective. Figure 1-1 provides a pie chart that illustrates the transportation sector's share of GHG emissions relative to the other major sectors of the United States economy.

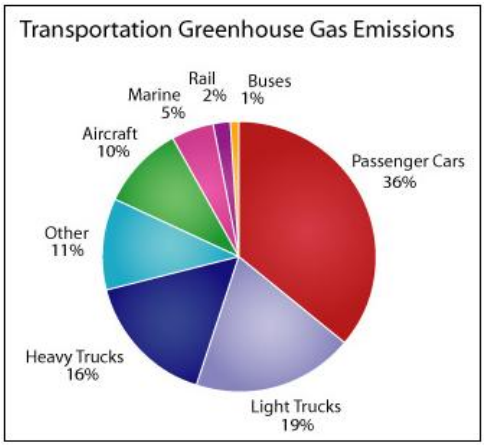
Figure 1-1: Greenhouse Gas Emissions by Economic Sector



Source: TCRP Report 93

Figure 1-2 provides a pie chart that illustrates the share of GHG emissions by form of transportation which illustrates that passenger cars and light trucks account for over half of the GHG emissions from the transportation sector. The fact that personal vehicles represent 55% of the GHG emissions from the transportation sector is an environmental issue that needs to be addressed. Data on commuting patterns in the United States by mode reveal that approximately 90% of Americans commute to work using a car, light truck, or van (Commuting in America, 2006).

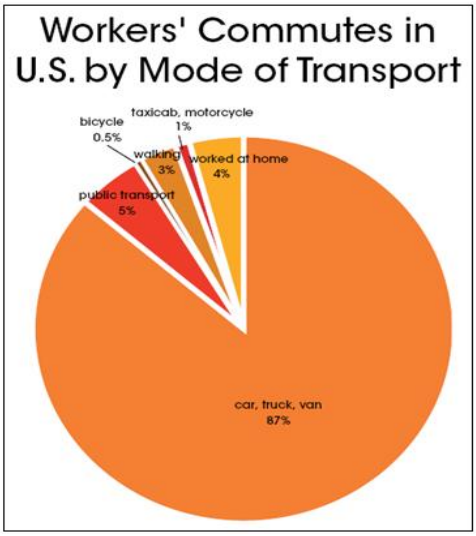
Figure 1-2: Greenhouse Gas Emissions by Transportation Form



Source: TCRP Report 93

Of the remaining 10% about 5% use public transportation and the other 5% use various other modes of transportation including bicycling, walking, taxi cabs, motorcycles and telecommuting (Commuting in America, 2006). Figure 1-3 provides a pie chart that illustrates the modal split of commuting in the United States by mode of transportation.

Figure 1-3: Commuting by Mode of Transportation

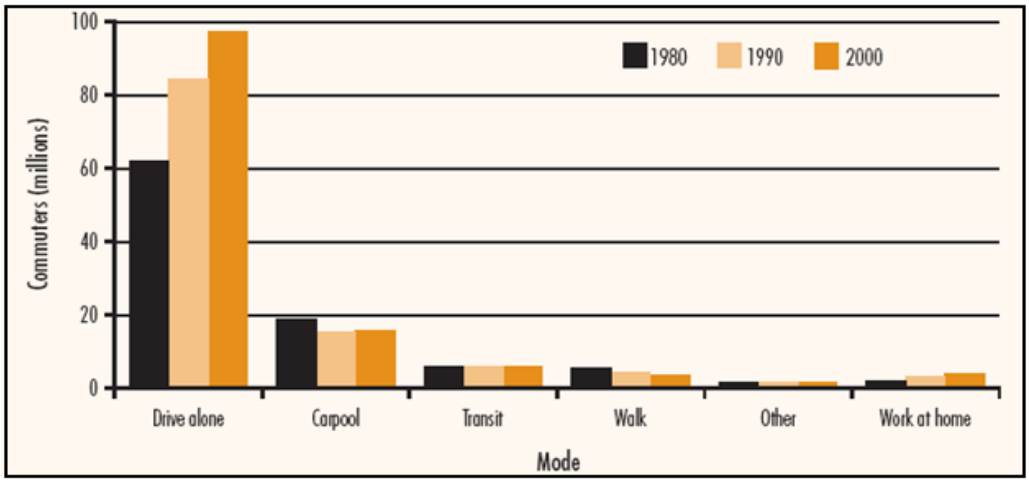


Source: Commuting in America III

The pattern of land use determines to a large extent the mode in which Americans commute to work. In urbanized areas, there is a significantly higher mode share for public transportation, bicycling and walking while in suburban and rural places with a decentralized pattern of land use there is a much higher mode

share for commuting to work in personal vehicles. Temporal trends of commuting patterns in the United States indicate that there has been a steady increase in the percentage of Americans that commute to work alone in SOV's. Analysis of longitudinal data on commuting in America reveals that SOV commuting has increased the most while all other modes of commuting have decreased with the exception of telecommuting (Commuting in America III, 2006). Figure 1-4 provides a graph that illustrates temporal trends in commuting by mode of transportation.

Figure 1-4: Temporal Trends in Commuting by Mode



Source: Commuting in America III

In addition, temporal trends of VMT relative to population growth indicate that Americans are driving more. The temporal analysis of commuting by mode share and VMT indicates that Americans are commuting more in SOVs and thus the VMT has increased which results in higher levels of GHG emissions. The significant increase in the rate of SOV commuting poses a serious environmental problem due to the fact that it now accounts for over half of the GHG emissions from the transportation sector.

PROJECT HISTORY

In an attempt to address this issue, the University at Albany formed a research team to take a comprehensive look at their transportation system and recommend effective policies and programs to reduce SOV use and the resulting GHG emissions. This study began effective February 9th, 2009. The purpose of the proposed 18 month project was to analyze the current transportation offerings available to commuters of the UAlbany and the New York State's office campus, known as the Harriman Campus. To complete this task, the team sought to evaluate the effectiveness of the current bus routes while also examining consumer attitudes towards using mass transit with an eye towards developing policies that would improve transportation offerings for commuters. The funding for the project was agreed to be

shared by; the New York State Department of Transportation (NYSDOT), the New York State Energy Research and Development Authority (NYSERDA), and the contractor, The Research Foundation of SUNY, University at Albany, through the Office of Environmental Sustainability and Department of Geography and Planning.

The official kick off meeting was held on April 28, 2009. Joseph Tario, NYSERDA, and Paul Hoole, NYSDOT served as case managers. The first step of the project included the formation of a Technical Advisory Committee (TAC). The TAC, in accordance with NYSERDA's request, included a representative from Capital District Transportation Authority (CDTA), the Office of General Services (OGS), and from Capital District Transportation Committee (CDTC). The following individuals agreed to be the members of the (TAC) to supervise the project: Ross Farrell, CDTA; Mila Vega, CDTA, Alison Pingelski, OGS and Jennifer Ceponis, CDTC. As the project progressed, Carrie Ward replaced Mila Vega, William Hill replaced Alison Pingelski, Robert Ancar replaced Paul Hoole and Deborah Mooney, NYSDOT, joined the review team.

During this preliminary planning period, a set of techniques were established to study the UAlbany commuter patterns and behavior. Those techniques included the use of GIS to map the home base of current employees and student commuters. Additionally, GIS mapping techniques were engaged to identify how the current CDTA bus routes aligned with the home base of the commuter population. A comprehensive transportation survey was also planned, which was to be followed by supplementary focus groups, to gauge commuter concerns and desires. Lastly,GPS was to be used to assess the on time performance of the existing UAlbany shuttles and CDTA routes 11 and 12, the two most heavily frequented routes that the campus community had access to use at no cost.

A prior study funded by CDTC, completed by Nelson/Nygaard Consulting Associates during the time period of 2006-2007, analyzed the commuting behavior at the neighboring Harriman Campus. This study served as a desirable data resource that the research team sought access to in hopes of creating transportation strategies to serve both the Harriman and UAlbany Campuses. Having access to this data would allow the research team to build GIS maps to identify commonalities that existed between the two groups of commuters. It was the hope of the research team to combine the data from the Harriman Campus study with the data collected at the UAlbany Campus, to determine if the current transportation offerings successfully served the commuter population of both campuses, or if any changes could be made to improve the mass transit options.

During the kick off meeting on April 28, 2009 a preliminary survey regarding commuting habits was distributed to the TAC. This survey was similar to that which was distributed by CDTA during the Harriman Campus study. The research team received suggestions from the TAC throughout the summer

on ways to improve the survey. The suggestions were incorporated into a series of drafts that were subject to the approval of the TAC before the final distribution to the campus community, scheduled for early fall in accordance with the agreed upon time table.

To formulate the GIS analysis the team was required to obtain data from the Director of Parking and Mass Transit for UAlbany. The data included the zip code and the user type (staff, faculty, or student) of each permit that was distributed by the Department of Parking and Mass Transit for the fall of 2008. By May 2009, this data was gathered and recoded into an Excel spreadsheet for further sorting. With access to the 2008 parking permit data, a GIS analysis was completed analyzing the density of the permits, distributed by driver type. Following this preliminary analysis it was recognized that by further delineating the data, a more comprehensive analysis could be performed. It was decided by the research team to expand this part of the project to include street level data that could be obtained through the Director of Parking and Mass Transit.

Also during May of 2009, the research team began to assess the mass transit and carpooling alternatives that already existed for those whom commuted to the UAlbany campus. This information assisted the GIS technicians as they established the CDTA routes for the mapping exercise. The research focused on three different elements. The researchers compiled a list of all alternative forms of transportation available in the Capital Region. From this list a preliminary analysis was conducted on the feasibility of the existing alternatives for UAlbany commuters. The research team also examined if the existing alternatives were practical for the state workers at the Harriman Campus. It was concluded that the gathering of data would need to be continued throughout the summer of 2009 to fully understand whether; the existing mass transit options were compatible with commuter needs, if there could be more effective mass transit routes, if possible park and ride locations could be formed, or if any collaboration of transportation efforts would be successful between UAlbany and the Harriman Campus.

Lastly during May 2009, GPS techniques for the fall 2009 on time performance analysis were created. A detailed tutorial was generated that offered a set of instructions for the use of the GPS equipment. The tutorial included an outline of the technical issues that may occur while the research team attempts to collect the data. The tutorial defined how to; properly set the parameters on the GPS equipment, download the data, post-process the captured data and begin the analysis. The research team tested the various types of GPS models available for use, including the solar powered GPS units and the new i-blue 747 a+. It was found that the new units offered more advanced software features however would require some changes to the older training instructions. Throughout the month the research team continued to work on developing a GPS/GIS interface, planned out routes for the GPS analysis, and recruited volunteers for the GPS project. The GPS system continued to be evaluated for effectiveness and reliability throughout the summer months. In July, Catherine Lawson made a presentation at the 2009 Transportation Research Board Joint Summer

Meeting, in Seattle, that included a demonstration of the use of GPS for local transit planning. The session provided information on the application of data visualization techniques to help agencies improve the way they do business and/or conduct research in time of constrained or reduced resources. Following the presentation, the research team reconvened to continue to plan for the GPS analysis, scheduled for the fall of 2009.

Between May 31, 2009 and July 31, 2009 progress was continued on the various tasks. The data provided on the permits, which was distributed by the UAlbany Department of Parking and Mass Transit, was developed into street level data in the zip codes where there was found to be a high density of commuters. This data was then used to create a GIS map incorporated with Google Earth software to illustrate commuter points by street level. The effort to obtain more street level data for the area delineated the "second tier" (the area that wasn't the highest concentrated) continued through this time period. A meeting was also held with OGS where it was agreed upon that the data from the Harriman survey would be available to the research team. While the evaluation of the current state of mass transit and carpooling alternatives for the UAlbany community continued, a meeting was held between UAlbany officials and a VPSI representative to discuss the possibility of instituting a vanpool system. UAlbany also completed the administrative requirements to set up an employer module on IPool2 during this time period. These initiatives were planned to be aggressively marketed by the campus, including a first Sustainable Transportation Day at the University, which was planned for September 22nd, 2009 at the University.

Also during the summer of 2009, the TAC council responded to the first draft with critiques to enhance the survey. A second draft was sent to the TAC taking into account the comments offered by the committee. The research team followed with a third draft further responding to the TAC's concerns and suggestions. Lastly, a fourth draft was compiled and distributed to the TAC in August 2009. The fourth draft was accepted by the TAC as a final copy and it was determined that distribution of the survey would be administered in October 2009.

By August 2009, the research team was able to begin the GPS techniques to evaluate effectiveness and reliability of the current mass transit available. To prepare the GPS/GIS interface methodology for the fall semester project involving the CDTA busses, a summer project was conducted evaluating the current level of service that University shuttles provide to students. With the assistance of the Department of Parking and Mass Transit Supervisor, along with the Transportation Supervisor and the University's Bus Operators, the research team was able to formulate two route alterations that provide students with a better mass transit service. The project used GPS technology and GIS to map out the proposed routes. The technology allowed the team to conduct time trials on the suggested routes to create the new transit schedules. The two new routes involved changes to the East Campus Route, which was re-routed to travel through an area of

the city that contains a high population of students, along with modifications to the university shopping shuttle, which effectively provided students with more shopping options available via mass transit.

In September 2009 the research team encountered an unexpected delay acquiring the data from the Harriman campus survey. The web-link sent by OGS did not allow our team to access the data. A second issue arose as the TAC representative from OGS had left OGS during this time period. OGS continued to work with the research team to make the data from the prior study available, and also to fill the vacancy that resulted on the TAC.

Also during September 2009, the research team was able to complete the literature review on on-time performance studies. A deployment plan for the GPS study was prepared for four routes that service the University and the surrounding areas. The hiring of undergraduate recruits was completed to assist in the data collection phase of the project. The training for these recruits was scheduled for mid-October.

Additionally in September 2009, details were finalized for the surveying task, while the focus group project began to be formalized. The research team met with the Deans of Business and Arts and Science to identify professors to take part in the focus groups. The goal was to have individuals identified and a general meeting conducted by late October. Also in late September, the scheduled Sustainable Transportation Day, entitled "Destination Green", took place on the University's uptown campus. Extensive publicity for the event was generated throughout the campus community. The event was also covered by local media. Chancellor Nancy Zimpher and President George Philip capped off the event with a ceremonial bike ride from University Hall to the transportation exhibitors. Attendance was positive with many staff, faculty and students dropping by the exhibits and learning more about their alternative transportation options.

By October 2009 the data requested from the Harriman Campus project was available to the research team. The data was displayed in a GIS map that visualized the home bases of the Harriman commuters. At this point the research team began to collect the permit data for the fall of 2009 from the University's Department of Parking and Mass Transit to continue to identify areas where mass transit needs were under met. By the end of October 2009, it was believed that all data for the study was complete and the team was in the process of comparing the 2008 and 2009 data set. GIS mapping had taken place for the fall 2008 data and was underway for the fall 2009 data. This data was to be examined to identify any changes in patterns. The team also worked to create a protocol on the GIS methodology for future analysis that may work from this study.

October 2009 also represented the commencement of the GPS data collection along the four CDTA routes. The collection of the data was to occur throughout October and into November. The team found many of

their projects to be in good time although the final draft of the survey experienced delay due to the IRB (institutional review board) process. Later in the month of October, the survey did receive approval for distribution. With the approval, the final distribution was planned to begin in November of 2009, to allow analysis throughout December. The focus group work also took a step forward with the assistance of the University's Marketing Department. Insight and guidelines were offered by the Marketing Department, which aided the team in structuring the focus groups. Lastly, during the month of October, Mary Ellen Mallia presented a report on this study at the Northeast Campus Sustainability Consortium conference, held at the University of Vermont.

By November 2009 the GIS maps for the fall of 2008 and 2009 which chartered the UAlbany commuters, were complete. This allowed the team to determine where there were deficiencies in the existing mass transit. The protocol for the GIS methodology continued to be defined during this period. The team also began to analyze the data for any significant changes that may have occurred in commuting patterns from 2008 to 2009.

Also in November, GPS data collection continued along the bus routes selected. The data generated was compared to the existing route schedule to determine how timely the buses ran. The research team continued to collect the survey data from the campus-wide distribution. Analysis of the results were planned to continue through December. The research team had completed planning for the focus group project, as potential participants had been identified. In November, the team worked to clear select graduate students through the IRB to conduct the focus groups. The training for those students was planned for January and February of 2010, with the actual study being held during March of 2010.
By December 2009, the research team made an observation that there was a significant decrease in the number of student parking permits issued in 2009 compared to the 2008 data. It was subsequently discover that 2008 data spanned from September to May while the 2009 data spanned only from September to November. Since there are numerous students who transfer to UAlbany in the spring, it was decided to wait until after the spring semester had begun to pull together the 2009 data. Despite the setback the team was able to continue to develop the GIS maps and make preliminary conclusions on how well the current mass transit was serving the campus community.

By December the team had completed the GPS data collection and planned to begin the analysis of the data during the spring semester. Also during December, the survey data that had been collected was inputted into the SPSS software for analysis that was planned for January and February 2010. Armed with an exploratory knowledge of the survey results, the focus group team was able to begin to design the questions and to finalize the schedule for the discussions. Lastly, the research team began to compile preliminary findings for a planned presentation of the project's progress to representatives of NYSERDA and NYSDOT, scheduled for March 1st 2010.

Following the presentation of findings, a series of suggestions were offered to the research team. Those suggestions led to the following work to be completed during March 2010. The team set out to gather the refined version of the 2009 parking permit data for students, which included the recent applications from students entering the University during the spring semester. The team also furthered their research into the reasons why there had been an apparent decline in employee permits. While still preparing the focus groups, scheduled for late March 2010, the team continued their assessment of the GIS, GPS, and survey data. As per the suggestions offered at the March 1st presentation, the team set out to review marketing opportunities for the vanpool and carpooling programs that the University planned to sponsor.

During March 2010 student permit data based on their campus residences was gathered. While completing this study, a difficulty was encountered when the research team attempted to create a map of the student's based on their campus address. The research team found that there did not appear to be a clean database of where the students actually reside during the school year. Many of the students have recorded the academic offices in which they work as their campus address. Additionally, locations within the city of Albany as well as other parts of the state have come up in the query for campus addresses, which clearly are not where the students are residing. The research team believed that there was clearly an error in either the query or human error when inputting the information on the permit application. An employee in Institutional Research was assigned to look into whether a viable database could be generated for student campus addresses, to allow the research team the opportunity to create new GIS maps.

Also in March, the U-Commute Focus Group Research Team completed six very successful sessions. On March 15, 17th, 19th, 22nd, 23rd, and 24th the focus group moderator, with direction from Principal Investigator Lawson, led groups of on-campus undergraduates, faculty, staff, graduate students, and off-campus undergraduates. With a modest turnout in the first session, participation quickly grew to optimal capacity of 6-8 members for many of the following sessions, even peaking at 12 participants for the staff session on the 19th. Discussions generally ran about 70 minutes, with some sessions running over due to the number of participants. Topics included: parking preferences, carpooling, transit successes and challenges, bicycling, modal connectivity, and other commuting issues. By the end of March, following the completion of the focus groups, the notes and recordings from each session were combined to provide a format that allowed the research team to generate a series of conclusions. Our findings demonstrated that much of the knowledge generated by the focus group exercise tended to mirror and verify the opinions expressed in the survey. The similar results that were produced during the focus group exercise created greater validity to the conclusions that were made following the survey efforts.

By the end of April 2010 data collection had been completed on all other tasks and the process of analyzing and writing the final reports had commenced. With the survey data complete, the research team was able to

offer a "public-use" version of the transportation survey data to the University's Geography and Planning Department for use in a Statistical Methods course. The data was used to train the students on the use of several statistical techniques, including visualization of nominal and ordinal data, and chi-square analyses. Three of the students used the dataset for their final project. The students communicated that the data was an ideal platform which offered them the opportunity to test their skills at recoding and reclassifying data. The students were able to develop unique ways to analyze the data, including a series of special analyses by mode of travel, by the starting time, by the first and last class period; combinations of questions (e.g., do you drive alone to campus and do you find traffic congestion a problem?); attitudes towards barriers to mode use by frequency of mode use, and other interesting data combinations. The students' recommendations for analyses were planned to be tested in the final statistical data analysis conducted during the summer of 2010, during the final phase of the project. The successful use and level of interest in using this dataset for learning was impressive. It will become one of the standard datasets for future use in the Statistical Methods course.

Through the spring and into the summer months of June and July the team worked together to share the data from the various tasks completed. The GIS maps were officially completed by July 2010. The GPS data continued to be analyzed throughout May into July. An additional research assistant was hired in June to assist the team in preparing the final reports, including this document. During the writing process the research team revisited the discrepancy discovered in the 2008 and 2009 permit data. The team concluded that comparisons should not be made between 2008 permit data and the 2009 data as there are too many questions pertaining to how that data had been administered. However, this provided an opportunity to offer additional recommendations to improve future data collection and retention efforts.

A final presentation to NYSERDA, NYSDOT and the TAC is scheduled to cumulate this project in September 2010. The team anticipates offering recommendations towards improving awareness and marketing of alternative transportation options by providing insight into what would entice commuters to use alternate forms of transportation while also detailing what commuters dislike about current transportation options. The team also plans to offer a series of suggestions, based on our process that will improve future studies with similar goals.

ALTERNATIVE FORMS OF TRANSPORTATION WITHIN THE CAPITAL REGION

OVERVIEW

This chapter will explore what alternative transportation options are available to UAlbany and Harriman commuters in order to identify substitutes to SOVs and reduce VMT. The mass transit options that will be explored include the various public and private bus services, the iPool2 website which connects people who are interested in carpooling or forming a vanpool network, the ability to commute to campus by bicycle and the walk-ability to and from the SUNY and Harriman campuses. Through an analysis of the existing alternative transportation options, the research team will attempt to demonstrate the existing viability of the alternative and highlight improvements that can be made to increase the feasibility of these alternatives.

CAPITAL DISTRICT TRANSPORTATION AUTHORITY

The Capital District Transportation Authority (CDTA), which services Albany, Rensselaer, Schenectady, and Saratoga counties, is the leading bus service within the region. According to the CDTA's Operational Summary, the Authority's services approximately 2,300 square miles and a population of over 790,000 people. CDTA highlights that "50.6% of this population lives within a 1/4 mile of bus service" (CDTA, 2010). With a 2010-2011 operating budget of $73.5 million, CDTA has a 306 vehicle fleet with 234 of those along fixed routes (CDTA, 2010). CDTA has a base free of $1.50 per ride while also offering different long term pay options.

Recently, CDTA has worked to make their buses more accessible to those who generally wouldn't ride the bus. One of their efforts has been to install bike racks on the front of all CDTA buses to accommodate bikers who wish to use the bus for part of their trip (CDTA, 2010). The CDTA website provides information on how to safely load and unload a bike from the bus. The website also provides additional bike information such as a bike rack map for the Capital Region, and a link to Capitalcoexist.org, a local website that educates bicyclist and motorist on how to coexist while using the region's roadways.

An additional effort that will specifically affect UAlbany commuters this fall is the inception of universal access to CDTA buses. This means that current members of the UAlbany community (students/faculty/staff) will have free access to all CDTA buses with exception of the Northway Express (run by Upstate Transit) and Star buses. Prior to this announcement, only six select routes were free to the campus community. Now UAlbany's 20,000-plus students, faculty, and staff will have free access to

CDTA's seventy routes covering Albany, Rensselaer, Schenectady and Saratoga County, with only a simple swipe of their campus ID.

COMMUTER BUS OPTIONS AND PARK AND RIDES

The viability of the commuter bus services and other alternative forms of transportation, such as car or vanpooling, relies on establishing meeting points where many commuters can gather at convenient locations. Due to the low density environment of the rural and suburban communities surrounding the city of Albany, it has been imperative to develop meeting places accessible by SOV's. The development of park-and-ride lots, which offers free parking for commuters, has been vital to the success of the commuter bus systems. Incorporating meet up places allows the commuter buses to make limited stops before reaching final destinations. This creates a commute that is comparable in length to actually driving a SOV vehicle to an urban location. Using a commuter bus can significantly decrease the cost of commuting by eliminating the expense of gasoline, the wear and tear on a vehicle from long commutes, and parking fees that may exist near high demand employment centers. The park and ride lots can also make commutes more convenient as they allow commuters to know their vehicles have been left in a safe location. Commuters can find information on the local park and rides as well as transit options through the iPool2 website which is maintained by Capital District Transportation Committee (CDTC). The site includes a map which highlights thirty-seven different park and ride locations within eight area counties. These park and ride centers are highly utilized within the commuter bus systems, and are employed as meeting areas for potential car and vanpool programs.

While the CDTA operates a majority of the buses that service the population within the immediate Capital Region, the commuter-shed of the SUNY and Harriman campuses covers a much larger area. Private bus services have attempted to capitalize from these commuter markets by offering fixed routes during peak commuting times. These companies include Upstate Transit, Brown Coach, Yankee Trails, and Coxsackie Transport Inc. In Schoharie County, the local public transportation service contracted with a transit company to develop a similar commuter bus route. In Schenectady County, commuters are serviced from commuter bus lines from counties further west, and also from two express commuter lines run by CDTA. Each of these routes distributes passengers at central locations within downtown Albany, where people work or where they can link up to a CDTA bus to arrive at a final destination. All of these commuter buses will be depicted below by their routes, by the frequency of travel, and by the ease of commuting to the UAlbany and Harriman campuses.

The first commuter bus line to be examined is the Northway Express (NX). Due to the continued growth in population of Saratoga County, the NX, operated by Upstate Transit, should be highlighted as one of the key alternatives for commuters from Saratoga County to the UAlbany and Harriman campuses. According

to CDTA's statistics from the 2008-2009 calendar year, the NX had a ridership of 231,000 commuters. The NX operates five days a week, from Monday to Friday with routes that stop at strategic locations within downtown Albany. The route that pertains to our study is run number C2. This route provides service to the Uptown UAlbany Campus, with a stop along the campus' Collins Circle. This route then continues on to the Harriman Campus where it makes stops at State Office Buildings 12 and 8. The morning route begins at 6:07am with pick-ups at the Upstate Transit facility in Ballston Spa, NY, followed by a 6:09am pick-up at the Milton Town Hall. By 6:11am the commuter bus is planned to arrive in Saratoga Springs for a pick-up at the corner of Hathorn Blvd and Geyser Rd. The C2 run makes seven stops within Saratoga including the Saratoga Amtrak station and at the Exit 15 park and ride. Two more scheduled stops are made at park and ride location going south down I-87. These are at exit 11- Mechanicville (7:00am) and at exit 9- Clifton Park/Halfmoon (7:10am). By 7:33am the C2 arrives at SUNY's Collins Circle, subsequently followed by the two stops at the Harriman Campus. The estimated trip time between the first stop in Saratoga Springs and Collins Circle is one hour and twenty six minutes. The C2 route is completed in reverse starting at 4:05pm weekdays leaving SUNY's Collins Circle. The route makes the same stops excluding the first stop in Saratoga Springs (Hathorn Blvd and Geyser Rd) and the Upstate Transit facility. The final stop at the Saratoga Amtrak station is at 5:40pm. This adds up to be an estimated trip from Collins Circle to the Amtrak station of one hour and thirty five minutes.

In Montgomery and western Schenectady County, the Brown Coach transit company provides the State Plaza Line Run service, a commuter line that services many key locations within downtown Albany. The Early State Plaza Line Run begins at 6:10am at Fonda Corner, Park St. and South Broadway Montgomery, NY, roughly forty-five miles north-west of Downtown Albany. The Brown Coach continues to make two subsequent stops at the Amsterdam Mall- Church St. Bus Shelter at 6:30am, followed by a stop at the Exit 26 Park and Ride at 6:45am. Drop offs within Downtown Albany begin at 7:15am, first at the Empire State Plaza. The next stop would be the closest stop to the Uptown and Harriman Campus, at the corner of Washington St. and Swan St. This stop is roughly four miles from the Uptown Campus. The corner is on a CDTA bus line, allowing for an easy transfer up to the Harriman and SUNY campuses. The remaining Albany stops that the Brown Coach makes is further downtown at the corner of State St. and North Pearl St., and lastly at the Department of Environmental Conservation, at 625 Broadway at 7:23am. The final stop along the route is in Menands at Bell Atlantic. The afternoon run makes the same stops as the morning run, arriving at the Empire State Plaza at 4:00pm followed by a stop at the corner of Washington St. and Swan St. at 4:02pm, before the bus heads further downtown. The bus is expected to arrive back at the Exit 26 Park and Ride is at 4:50pm, the Amsterdam Mall at 5:05pm, and the Fonda Corner in Montgomery at 5:20pm. The schedule indicates that the full route should take one hour and twenty minutes. It is important to note that while this commuter-run does provide a fairly direct route into the City of Albany, it does not provide convenient access to the Uptown SUNY or Harriman Campus. Based on the drop off points within

the City, commuters would most likely need to utilize a CDTA bus to complete their journey to the Uptown or Harriman Campus, which would add time on to the bus commute.

Schenectady County is also serviced by two CDTA commuter express lines with stops in the city. The 55 X line offers weekday service from downtown Schenectady to multiple locations within the City of Albany. Nine runs are made throughout the morning, eight starting at the corner of State Street and Washington Street, in downtown Schenectady, with the other route being run from the Rotterdam Square Mall. The 55 X's closest stop to the SUNY and Harriman Campus commuters would be the Empire State Plaza stop. All nine runs make this stop, ranging in morning drop off times from as early as 6:52am till 8:25 am. Returning trips begin from Empire State Plaza as early as 3:40pm and last till 5:40pm. Local service continues throughout the day when the 55X is not in service. The estimated travel time from State Street and Washington Street to the drop-off point at Empire State Plaza is forty-two minutes.

The other weekday express service offered by CDTA in Schenectady County is the 56 X. The 56X runs only once a day beginning service at the corner of State Street and Washington Street in downtown Schenectady, at 6:55am. This run does make direct stops at the SUNY and Harriman Campuses. These stops occur first at Collins Circle (SUNY) at 7:32am followed by building eight on the Harriman Campus at 7:40am. The night route leaves Collins Circle at 4:15pm and the Harriman Campus at 4:20pm, making the same limited stops before arriving back at the corner of State Street and Washington Street at 5:03pm. The estimated travel time from the State Street and Washington Street to the drop-off point at SUNY Albany is thirty-seven minutes.

In Rensselaer County, Yankee Trails offers the Hoosick Falls Line Run Monday through Friday. This run begins in Hoosick Falls, NY, at 6:45am, roughly thirty-five miles north-east of downtown Albany. The morning run makes eleven scheduled stops through Rensselaer County, including the Troy Terminal, and through Menands, until the commuter bus arrives at Empire State Plaza at 8:05am. Following the stop at the Plaza, the Yankee Trails bus will stop at the Albany Greyhound station at 8:10am, before reversing the trip back to Hoosick Falls, this time continuing to Bennington, Vermont. The afternoon trip from Albany begins at 5:15pm at the Albany Greyhound station. The bus then makes a stop at the State Plaza, before the return journey takes them back through Menands, Troy, and north through Rensselaer County for a planned arrival at Hoosick Falls at 6:40pm. The bus continues through Hoosick Falls to make a stop at Hoosick, Old Bennington, and a final stop at 7:20pm in Bennington, Vermont. In total, the Hoosick Falls Line makes two round trips (four runs in total) from Hoosick Falls to Albany. Every trip except the early morning run into Albany includes Bennington, Vermont in the route. The only stops in downtown Albany are at the Greyhound terminal and at Empire State Plaza, neither being within walking distance of the Uptown or Harriman Campus. Commuters would most likely have to board a CDTA bus to finish their

journey. The total travel time from Hoosick Falls to the Empire State Plaza is estimated to take one hour and twenty-two minutes by commuter bus.

Columbia County is also serviced with a commuter bus line, run by Coxsackie Transport Inc., that completes four runs (A,B,C,D) to and from Albany, Monday through Friday. The first run of the day (A) begins in Hudson, NY at 6:15am, over thirty miles away from downtown Albany. Following the Hudson stop, Run A makes stops in Greenport (6:25am), Columbiaville (6:30am), Kinderhook (6:40am), and Valatie (6:45am), before arriving at the Harriman State Office Campus (Building 8) at 7:15am. The Harriman Campus stop is the stop within the closest proximity to the UAlbany Uptown Campus. Following the Harriman stop, the route continues to downtown Albany making four more stops along the way. The route from Hudson to the Harriman State Office Campus is expected to take one hour. SUNY Albany commuters would have a slightly longer commute to continue their journey from the Harriman Office Campus to SUNY.

Columbia County offers a second Run C in the morning hours, for those who don't need as early a start as Run A offers. This run begins in Germantown at 6:45am before arriving in Hudson at 7:00am. From Hudson, Run C makes the same stops as Run A, except it does not make a stop at the State Office Campus. Instead, the first Albany stop is at the Empire State Plaza at 8:00am, followed by a stop at the corner of Washington St. and Swan St., and at State St. and Pearl St. Without a stop at the State Office Campus, commuters to UAlbany and the Harriman Campus would most likely need to utilize CDTA to arrive at their final destinations. The final two runs (B) and (D) run into Albany run in the afternoon; Run B leaving Hudson at 2:30pm, and Run D leaving Germantown at 3:45pm. Neither B nor D makes a stop at the State Office Campus. Both runs make three Albany stops (Empire State Plaza, Washington St. and Swan St., and State St. and Pearl St.). The expected commute is to be a little over one hour (more if leaving from Germantown). With no direct link to the SUNY Albany or Harriman Campus, commuters would need more time and an additional transportation option to arrive at their final destinations.

The Columbia County commuter bus system offers four returning routes from Albany back to the City of Hudson. The afternoon returning runs (B and D) leave from the corner of Washington and Swan St. respectively at 4:32pm and 5:10pm. The other two pick-ups within Albany are from the corner of State St. and Pearl St. and the Broadway stop at the old Trailways terminal. Runs B and D make five stops within Columbia County in Valatie, Kinderhook, Columbiaville, Greenport, and a last stop back in Hudson. Run B's estimated arrival back in Hudson is at 5:50pm while Run D has an expected arrival at 6:10pm.

The last commuter bus to be discussed is offered by Schoharie County Public Transportation. Schoharie offers two weekday services to Albany, named Route 21 and Route 22. Route 21 begins at the Price Chopper Plaza in Cobleskill NY, at 5:30 am. Cobleskill is roughly forty miles west of the city of Albany.

Following the initial pick up at the Price Chopper Plaza, Route 21 follows Route-7 southwest, in the opposite direction of the City of Albany, until arriving in Richmondville, over six miles away from Cobleskill. Route 21 makes two stops in Richmondville before retracing the same path back to Cobleskill. Route 21 then makes a stop at the corner of Main Street and Center Street at 6:00 am. This stop is only .4 miles from the first stop made at the Price Chopper Plaza. After leaving Cobleskill, Route 21 makes five additional stops, three of which are designated as park and rides, and two others in the town of Rotterdam, in Schenectady County. Route 21's first stop in the City of Albany is at SUNY Albany at 7:00am. Following the SUNY Albany stops, the run continues to the State Campus Office, before making a final stop on Wolf Road in Colonie. These same stops are completed in the afternoon, although in a slightly different order. Beginning at 3:15pm, the Route 21 run makes a pick up at SUNY Albany. The second pick up is at the State Campus Office (Harriman Campus), followed by a 3:50pm pick up on Wolf Road in Colonie. Route 21 then continues to make the same stops in Schenectady County, along with the three park and ride locations. Unlike the morning route, which stops in Cobleskill before and after stopping in Richmondville; during the afternoon Route 21 continues through Cobleskill to Richmondville for the two scheduled stops (5:00pm, 5:05pm). The bus then reverses direction, back to Cobleskill for the stops at the corner of Main Street and Center Street (5:15pm), and the Price Chopper Plaza in Richmondville (5:20pm). A one way commute from Cobleskill to SUNY is expected to take one hour if the commuter gets on the bus during the second stop in Cobleskill. The afternoon commute is expected to take almost two hours due to the change of order of the Albany pick-ups and the fact that the bus goes past Cobleskill to Richmondville, before returning to make the scheduled stops.

Although Route 22 doesn't provide direct access to the SUNY Uptown Campus or the Harriman State Offices, it does allow commuters to easily access locations within the City of Albany where a CDTA bus could be utilized. Route 22 makes identical stops to Route 21 throughout Schoharie and Schenectady County, performing the same loop from Cobleskill to Richmondville. The morning route begins at 5:40am at the Price Chopper Plaza, ten minutes after Route 21 leaves. Once arriving in Albany, Route 22 has scheduled stops at the Empire State Plaza (7:08am), the Corner of Washington St. and Swan St. (7:11am), the corner of State St. and Broadway (7:15am), along with the Corporate Woods Office Complex (7:25am) and Bryant and Stratton on Central Ave (7:35am). The afternoon Route 22 route begins at Bryant and Stratton at 3:45pm and makes the same stops as the morning route. Pick up at Empire State Plaza is at 4:05pm, followed by Washington St. and Swan St. at 4:10pm, and State St. and Broadway at 4:15pm. The afternoon route completes six scheduled stops, three being park and ride locations, before reaching the final destination, the Price Chopper Plaza in Richmondville at 5:35pm. Unlike Route 21, Route 22's return route does make a stop on Main Street in Cobleskill before heading to Richmondville. If one is to get off at this stop they will be back in Cobleskill by 5:15pm compared to 5:35pm if they were to wait for the bus to return to the Price Chopper Plaza. However, the first stop is at the corner of Main Street and Union Street, which is .9 miles away from the Price Chopper Plaza. If one was to decide to save themselves twenty

minutes by getting off at the first Cobleskill stop, they would have to find a way back to the Price Chopper Plaza if they had left a car there in the morning. This may be difficult for some to walk or find other transportation for that distance.

While the commuter bus system does provide adequate and relatively timely commutes into the city of Albany, obvious shortfalls do exist. It is important to point out that while many of the outlining counties do provide commuter bus services, commuters from Greene County, Washington County and Fulton County do not have a commuter bus option. For employees and students who live in any of these three counties, driving a car, either by themselves or in a carpool, is the only way to get to the campus. Of the commuter buses that are offered, many have very few routes which are scheduled in a way that do not coincide with the schedules of the majority of the staff, faculty and students at SUNY Albany. With some of these services, it is clear that many commuters would have to create a workday outside of the usual 9am-5pm or 8am-4pm schedule. Students who rely on a commuter bus would be forced to only take classes that are offered before the last afternoon commuter bus heads back to their home county. Flexibility would need to be granted by employers to allow for those who use the commuter buses to leave earlier than the normal workday. Due to a limited number of routes, commuters give up the ability to stay late, if need be, from class or work. For some, the flexibility to choose when to leave is a necessity in their activities. This would also be an issue for those whom regularly partake in after work activities in downtown. Individuals who rely on public transportation would find themselves handcuffed by the schedule of the buses.

For those whom already complain that there isn't enough time in a day, the idea of elongating the time of their commute may seem unmanageable. Figure 2-1 below displays the expected time each commuter would face if they were to take a bus as opposed to driving. This comparison is made from the earliest main pick-up location on the bus route until the arrival on campus, or the closest stop to campus. This depiction is purely for comparison purposes and does not take into account daily occurrences like stops for gas, time it takes to park, traffic, or any other occurrence that may change the expected travel time. The driving travel time is calculated using the fastest routes, according to Google Maps. The approximate trip time by bus states the official amount of time the schedule says it will take for the first morning bus run to reach the drop-off location. While some of the commuter buses make multiple runs, the scheduled trip time appears to be either consistent or within a few minutes. This comparison is to show the information that is available to the commuter when they make a decision based on the time a commute will take.

Table 2-1: Commuter Bus Route Expected Time Table Compared to SOV Travel

Bus Route	AM Departure	Arrival*	Approximate Trip Time by Bus**	Trip Time by SOV***
Northway Express (C2)	Amtrak Station, Saratoga Springs	Collins Circle-SUNY Campus	1hour 22 minutes	35 minutes
Brown Coach - Plaza Line	Park St and S. Broadway, Fonda	Corner of Washington and Swan	1 hour 8 minutes	44 minutes
55 X (Run by CDTA)	State Street and Washington Street, Schenectady	Empire State Plaza	42 minutes	21 minutes
56 X (Run by CDTA)	State Street and Washington Street, Schenectady	Collins Circle-SUNY Campus	37 minutes	15 minutes
Hoosick Falls Line	24 Main Street, Hoosick Falls	Empire State Plaza	1 hour 22 minutes	54 minutes
Columbia County (A)	Front and Warren Street, Hudson	Harriman Campus	1 hour	53 minutes
Columbia County (C)	Front and Warren Street, Hudson	Corner of Washington and Swan	1 hour 5 minutes	49 minutes
Schoharie County (21)	Main St and Center Street, Cobleskill (2nd Cobleskill stop)	Collins Circle-SUNY Campus	1 hour	41 minutes
Schoharie County (22)	Main St and Center Street, Cobleskill (2nd Cobleskill stop)	Corner of Washington and Swan	1 hour 1 minute	46 minutes

*- Closest bus drop-off point to Uptown SUNY Albany

** - Time from the first major pick up point on the route till the bus is planned to arrive at the Uptown SUNY Albany Campus or the closest bus drop-off point.

** - Expected travel time, according to the route chosen by Google Maps, from the same pick up point to the drop off point.

Clearly it is unlikely that some people will be able to utilize the commuter lines on a daily basis due to their need or desire to have flexibility in their schedule. However, access to information about alternative transportation options has been greatly improved through partnerships between CDTC, CDTA and employers. The development of the iPool2 program has provided a clearinghouse where commuters can get information about park and ride locations as well as transit options at the website, www.IPool2.org. Additionally, this site has made car/vanpooling much more accessible, by allowing commuters to register

to find carpool matches and express an interest in forming vanpools. One notable innovation is the development of the Guaranteed Ride Home program (GRH), a strategy to provide mass transit users more flexibility when circumstances force their commuting patterns to change. The GRH is just one step that the mass transit community has taken to ease the worry of having to stay late for work or class. This program guarantees a free ride home to any individual in the event of an emergency such as, family or personal illness at work or school, if the individual missed the last scheduled bus, if there was unscheduled overtime at work, or any other valid emergency. The GRH program is available to any commuter who takes the bus, bikes, or walks to work on a two days per week average. This option is free of charge after completing an iPool2 GRH registration. The GRH program can be used six times per year, limited to two days in one month. The program reimburses a taxi expense up to seventy dollar per ride, with a two-hundred dollar annual cap. It is apparent that the GRH program can't be used as a regular strategy, but for those that find themselves concerned about not having transportation due to an emergency, this brings an added sense of security that they won't be left stranded and helps to encourage the use of alternative transportation.

Another concern is that many of the commuter buses don't offer access to major work centers on a regular basis. For example, SUNY Albany commuters who take the Yankee Trails Hoosick Falls Line, or the Brown Coach State Plaza Line Run will not have direct access to the campus. CDTA and the private commuter buses have done their best to address these concerns by developing the Link program. The Link program offers free rides on connecting CDTA routes for those passengers that ride a commuter line. This, for example, would make it more accessible for someone who took a commuter line bus to the corner of Washington St. and Swan St. to transfer to a CDTA bus, that can drop them off at the center of campus. The Link program is available to any person who took the commuter bus and is not subject to being a resident of any specific county.

CARPOOL AND VANPOOL NETWORKS

The development of the park and ride locations along with the iPool2's website has offered Capital Region commuters new resources to make it less complicated to carpool or form a vanpool. Park and ride locations allow for a centralized location where those who live in rural locations can leave their cars without paying for parking. This allows multiple people to be able to share an automobile without having to burden the carpool driver with individual pick-ups or having parking issues from multiple cars being parked at one individual home. The iPool2 website has successfully generated a forum that commuters can use to discover individuals whom have similar work schedules and who may live in nearby locations. The website is free to use, instantly displays personal matches based on commuting destination, home location, and work schedule, and presents the user with local park and ride locations based on convenience. The website also offers the ability to keep information private, only displaying the information that the user provides (i.e. telephone, email, etc). IPool2 also serves as an educational tool, establishing the many

benefits that may be created from car or vanpooling. The website describes the cost savings that can be incurred from lower parking, vehicle wear and tear, and fuel costs, as well as the environmental benefits of fewer vehicles and cleaner air. The GRH program, described previously, gives greater comfort to those worried about not having a car available in the case of an emergency and provides incentive to form a car or vanpool.

The development and the marketing of the iPool2 website at SUNY Albany was led by the Office of Environmental Sustainability. The director of the program, Mary Ellen Mallia, discovered the predecessor of iPool2, the Commuter Register, which was sponsored by the CDTC. During the spring and early summer of 2008, as regional gas prices broke the four dollar a gallon barrier, staff began to contact the Office of Environmental Sustainability about carpooling programs. In response the university actively began to market the Commuter Register, which offered the service of connecting possible carpoolers at no cost. When the CDTC chose to switch over to the iPool2 program, UAlbany sought to create a component within the site. Since the development of this page, the university has increased their marketing efforts to create awareness of the website and the various commuting options. These efforts have included providing links and information on iPool2 on the University's Sustainability Green Scene website and electronic bulletin and also on the website of the Office of Parking and Mass Transit. The Environmental Sustainability Office has also sponsored a "Brown Lunch and Learn" through the Employee Assistance Program that highlighted the iPool2 website and the car/vanpooling options available. Over twenty employees were able to take part in the event. The largest marketing event to make the campus community more aware of the iPool2 website was the fall 2009 "Destination Green" sustainable transportation day. The ceremony, which involved the Chancellor of SUNY and the UAlbany President, brought attention to the alternative transportation options that are available to students, staff, and faculty. Additionally, information on the transportation systems are obtainable at resource tables during orientation, opening weekend events, the annual employee wellness fair and Earth Day.

The iPool2 program also offers users the ability to indicate interest in forming a vanpool. Vanpool efforts are most successful for longer commutes (at least fifteen miles), with the number of participants ranging between five and fifteen. Individuals may also seek to be part of a vanpool when employment locations charge high parking fees. When an individual on the iPool2 website notates that he/she is interested in being a member of a vanpool, the individual will be given contact information for others within the same region with the same interest. Once a vanpool group is organized, they are provided with the contact information of VPSI Inc., a company with over thirty years of experience leasing vans for this purpose. While to this point few vanpools have been organized, having the framework in place to promote the venture and connect interested parties has been seen as a successful foundation.

Despite the hard work of CDTC, CDTA and other transit providers to meet the needs of commuters, many in the Capital Region lack awareness of these transit options and the associated programs (i.e. Link, GRH). Attempts to advertise the available programs have had mixed success and it has proven difficult to convince people that they can alter their schedules to use public transportation. The survey portion of this project looks to shed light on the reasons behind the lack of awareness and/or interest in using the commuter lines.

BIKING AND WALKING

The renewed interest in being able to walk and bike around Albany has sparked city and SUNY officials into developing a safer environment for bikers and pedestrians. Participants in our transportation survey expressed their concerns about safety while walking and/or biking to the Uptown campus. According to the survey results, people who have either walked to the Uptown SUNY campus, or have considered walking, have a real concern for personal safety. Adequate lighting, safe sidewalks, safe intersections, and a police presence are all issues that are continually being addressed by city and university officials. While the university's main campus is located within the boundaries of the city, the campus is not integrated within the existing urban fabric. In the past few years the University's Geography and Planning Department has sponsored many graduate projects focusing on improving the walkability and the bikeability between the city and the uptown campus. These projects have focused on creating links between the city and the various SUNY campuses.

In the fall of 2009, Geography and Planning Professor Jeff Olsen focused a graduate Planning Studio class on developing a comprehensive bike parking plan that will support future increased bike usage. Past projects during 2005 and 2006 led to additional planned improvement, such as the concept of the "Purple Path" which is a multi-use pedestrian and activity path planned around Perimeter Road. The first phase of the "Purple Path" has been completed and phase two is scheduled to begin pending funding appropriations. The path has been included in the UAlbany's Office of Facilities Management's Master Plan as one of the projects to be undertaken in the next few years. The "Purple Path", along with the connecting "Golden Grid", will offer pedestrian networks that will improve safety for walkers and riders, reduce the need to drive to and park on campus, and increase the options for outdoor activities. It is important to note that to date the path network has yet to be completed. This has resulted in a continued dependency on the automobile due to poor pedestrian and bike networks.

The City Of Albany has also acknowledged that residents are demanding a walkable environment, and a safer and more complete bicycle network. In late 2009 the city, in partnership with the CDTC, released the final draft of Albany's Bicycle Master Plan. The plan, created by harnessing public input, identified a network of bicycle routes throughout the city that will progress cycling as a viable mode of transportation.

The plan embraces the concept of a "Bikeway Network", using existing routes while also proposing new routes that can link together desirable locations within the city. The project, which involves a time frame of twenty years, has led to some immediate improvements. These advancements have included an identified hierarchy of bikeways that require signage or infrastructure advancements. Improvements to date include new signs and painting along select routes including portions of Washington Avenue, which leads to the uptown SUNY campus. Other improvements have included additional bike parking, encouraged bike friendly development, and more bicycle awareness and safety programs. Progress is expected to continue over several years so that bicycling can be seen as a real option for many seeking an alternative form of transportation.

SUMMARY

While the majority of Capital Region residents do utilize their SOV for commuting purposes, other options are available throughout the region. CDTA has developed an elaborate bus system that offers timely service throughout the core counties. Many of CDTA's routes offer direct access to the SUNY and Harriman Campuses. The SUNY campus community has had access to some of these routes free of charge in an effort to persuade more people out of their SOVs to alleviate congestion and parking concerns. With the start of the fall 2010 semester, all CDTA routes will be made available free of charge to the campus community. As some people begin to recognize this program by making the move to use CDTA, one could assume that this would create momentum; which could lead to more awareness and increased ridership as more people become comfortable with bus service.

The commuter bus services that do exist provide alternative transportation to commuters who live outside of CDTA's territory. The region has taken steps to improve the commuter bus system, along with their car and vanpool networks by creating park and ride locations in strategic areas. These park and rides are listed for public access at the iPool2 website. These commuter bus lines are either sponsored by a local government entity or run by an independent transportation company. They offer direct routes into downtown Albany, some directly to the SUNY and Harriman Campuses, with only a few fixed stops. The success of these lines to date has been limited at the SUNY and Harriman Campuses. The majority of commuters need greater flexibility than the schedules currently offered. It also appears that the majority of commuters are not aware of the cost savings benefits that are involved with taking public transportation. As was depicted in Figure 1-1, many people will choose to use a SOV as it appears to be the most time efficient and convenient option available.

Lastly, the region has also taken steps to improve walkability and bike routes. These enhancements are either relatively recent, or may still be in the implementation stage. These improvements have been sponsored by the University, the City of Albany, the CDTC and CDTA along with other government

entities, to make the region friendlier to pedestrians. While these improvements are bound to help, the Uptown SUNY campus and the Harriman Campus are located in environments that are extremely SOV-friendly. The highway access surrounding these locations is impeccable. This, in-return, limits any efforts that can be made to better unite the campuses with the urban environment. Due in part to the mass suburbanization around the City of Albany, along with location of the campuses, few efforts to date have been able to develop a transportation mode that is as convenient as the automobile.

Future plans to reduce SOV use at both the SUNY and Harriman campuses will have to include added benefits such as savings in cost, time, or an improvement in quality of life. The available options don't appear to offer these advantages. Even though the perceived cost per mile to use a SOV is probably lower than what it really is; due to the low cost and easily accessible parking at both locations, very little incentives exist for one to change their mode of transportation. Unless the cost of operating an automobile is to increase significantly, future public transportation efforts will have to offer significant and obvious cost savings without incurring a large increase in travel time to entice people away from their automobiles. Current alternative transportation options have lacked the flexibility needed for the modern day commuter and have failed to offer or market any significant cost savings that could be gained by using alternative transportation.

ALTERNATIVE TRANSPORTATION BULLET POINTS

- CDTA services approximately 2,300 square miles and a population of over 790,000 people
    - 50.6% of this population lives within a 1/4 mile of bus service"
    - CDTA will kick off "Universal Access" to the bus service for the UAlbany community in the fall of 2010 (exception of Northway Express).
    - CDTA buses include bike racks to accommodate bikers.
- Commuter Buses are offered in: Saratoga, Montgomery, Schenectady, Rensselaer, Columbia and Schoharie County.
    - While the commuter buses offer a valuable service there are some issues with the service including:
        - Inconvenient schedules
        - Too few routes scheduled
        - Some do not offer direct access to .Harriman or the UAlbany Campus
        - The expected travel time by bus is significantly higher than the expected travel time by SOV.
- Carpool and Vanpool networks are being developed on campus.
    - Online resources such as IPool2 exist to connect interested parties.
    - Interest in programs sparks during times when gas prices increase significantly.
    - To date, few have made the change to car/vanpooling.

- The Uptown UAlbany Campus offers limited biking and walking opportunities for local residents.
    - Efforts by the University, including the "Purple Path", have been made to increase accessibility for pedestrians and bikers.
        - Progress in constructing the "Purple Path" has been slow.
        - The City of Albany has acknowledged the need to create a more bike friendly environment with the creation of the 2009 Bicycle Master Plan.

WORKS CITED

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GIS ANALYSIS

BACKGROUND

Providing alternative transportation options alone will fail to address the needs of commuters if the transportation offered does not service the locations where the highest percentages of commuters reside. In the previous chapter, the research team highlighted the various transportation options that exist throughout the Capital Region commuter-shed, with a detailed analysis of the schedules and the places that they serve. The next step involves exploring whether the existing transit is servicing the commuter population at the UAlbany and Harriman Campus. Using data contributed by the University at Albany's Parking and Mass Transit Services (PMTS) on the parking permits distributed, along with the data extracted from the Harriman Campus study by the Office of General Services, GIS maps were created to display the home location of the commuter base. The GIS study results, broken down by categories of staff, faculty and students, sheds light on the needs of the existing commuting population. This compound study provides a multi-level picture that can be used to enhance current mass-transit offerings, position future projects, and identify commonalities that may exist between the large commuting population at UAlbany and the Harriman Campus.

METHODOLOGY

The GIS analysis performed on University at Albany commuters consisted of two segments: 1) density of commuters by postal boundary (zip code), and 2) geocode of commuter permanent addresses in relation to Capital District Transportation Authority (CDTA) bus routes. Data was contributed by the University at Albany Parking and Mass Transit Services (PMTS) and GIS layers were obtained from these listed sources:

- National Atlas
  - URL: http://www.nationalatlas.gov/maplayers.html?openChapters=#chpbound
  - Data: State Boundaries
- New York State Office of Cyber Security and Critical Infrastructure Coordination
  - URL: http://www.nysgis.state.ny.us/gisdata/inventories/member.cfm?organizationID=522
  - Data: NYS County Boundaries – 1:24,000, NYS Civil Boundaries, NYS Zip Codes, NYS Streets
- Capital District Transportation Authority
  - URL: http://www.nysgis.state.ny.us/gisdata/inventories/member.cfm?organizationID=98
  - Data: CDTA Bus Routes (October 2009), CDTA Bus Stops (November 2009)

GIS data was managed in shapefile format, and ESRI ArcGIS 9.3 software was utilized to perform geospatial analysis. University commuter data was extracted from PMTS and additional filtering occurred in Microsoft Excel 2007. All GIS data was projected in UTM NAD 1983 Zone 18 using the ArcGIS Project tool. Four commuter groups were identified and analyzed: University at Albany faculty, staff, and students; and Harriman State Campus commuters.

Density by Postal Boundary

Cross-tabulations were made for each of the commuter groups by postal boundary and count. Postal codes with extensions (e.g. 12202-1123) were truncated to five digits. A dBASE table consisting of the cross-tab results was exported from Microsoft Excel 2007 and added to the ArcMap project. The dBASE table was joined to the New York postal boundary shapefile based on the 5 digit postal value (unique identifier). All values from the dBASE table were joined with 0% omitted from the dataset. The joined shapefile was exported and then re-inserted into the project. Symbology was created to illustrate the various density values of each New York State postal boundary. This process was replicated for each commuter group, and symbology remained consistent (modified Natural Breaks: 1-10, 11-50, 51-100, 101-300, 301 <). An additional analysis was performed for addresses within a sixty-mile scope of the uptown campus, which focused on the highest density postal boundaries.

Geocode of Commuter Permanent Addresses

The process of geocoding is defined as assigning spatial locations to data that are in tabular form (data) but have fields that describe their locations. Data provided by PMTS was reviewed and filtered for consistency. Permits with addresses not registered in New York State were originally omitted from the dataset due to the small number of commuters from out-of-state. These values were subsequently added to the database as per the suggestions received at the interim project presentation. Included in the final sixty-mile radius boundary analysis are portions of Vermont and Massachusetts.

A dBASE table was created with the following attributes: *postal code*, *address 1*, *address 2*, *city*, and *state*. An Address Locator was developed using the ArcCatalog with the NYS Streets shapefile. A formatted spreadsheet was imported into the Address Locator to geocode the permit data. The match results for each University at Albany group type are illustrated below (Table 3-1):

Table 3-1: Geocode Results (2008)

Permit Type	Matched	Tied	Unmatched	*Total*
Staff '08	2,101 (80%)	65 (2%)	454 (17%)	2,620 (100%)
Faculty '08	1,250 (82%)	37 (2%)	236 (15%)	1,523 (100%)
Students '08	8,134 (81%)	299 (3%)	1,557 (16%)	9,990 (100%)
Total	11,485 (81%)	401 (3%)	2,247 (16%)	14,133 (100%)

A single re-match was performed to identify additional matches, returning results that remained unchanged. All tied values were matched with an appropriate candidate along the street segment that was most common.

CDTA BUS STOPS AND ROUTES

CDTA GIS data obtained from the NYS GIS Clearinghouse was used to analyze individuals that are serviced by public transportation in the Capital District. The bus stop shapefile was imported into the ArcMap project and a 0.25 mile radius buffer was created for each. Transportation studies have suggested that 0.25 miles is an ideal distance for an individual to walk in order to reach a bus stop; and thus it was used for this analysis (Fairfax County Plannying Commission). Table 3-2 indicates the standards for distance from a bus stop that other municipalities have upheld in previous studies.

Table 3-2: Tolerable Walking Distance from Bus Stop by Region/Government Entity

[Maryland] Mass Transit Administration	1500 ft. (0.28 mi.)
[Kansas City, Missouri] Mid-America Regional Council	1500 ft. (0.28 mi.)
[New Jersey] New Jersey Transit	0.25 – 0.5 mi.
[Ontario, Canada] Ontario Ministry of Transportation	0.25 mi.
[NY, CT, NJ, Tri-metro] Regional Plan Association	1000 ft. (0.19 mi.)
[Snohomish City, Washington] Snohomish County Transportation Authority	1000 ft (0.19 mi.)

Source: http://www.fairfaxcounty.gov/planning/tod_docs/walking_distance_abstracts.pdf

Albany, Rensselaer, Saratoga, and Schenectady Counties, which will be recognized as the "core" Capital region counties, were the geospatial limits of this investigation due to the overwhelming majority of registered permits in these regions and represent the main scope of CDTA's services. Permits registered

outside the four county boundaries were excluded from the bus stop portion of the study. Addresses plotted within a buffer polygon were selected and recorded in tabular form.

COUNTY LEVEL RESULTS

The analysis of the GIS data resulted in a series of maps highlighting the living patterns of the different University at Albany groups, students, faculty, and staff. The Harriman Campus employee data was also analyzed independently. The individual fields were combined into new fields to illustrate specific cluster patterns. The maps used color to indicate the levels of density in each postal code. The light red colors represent postal codes with a low density of commuters. The darker the red colors symbolized postal codes with higher density of commuters. A postal code polygon void of color represents that no commuters live within the boundaries of that area.

Maps were created in various scales including a set of maps that covered the majority of New York State and the surrounding out of state communities. Other sets included maps depicting the sixty-mile radius and a set of maps focusing on the ten mile radius level. Figures 3-1, 3- 2, and 3-3 illustrate the three types of scale maps that were developed. Figure 3-1 projects the majority of New York State and some out of state communities; Figure 3-2 represents the sixty-mile radius of communities surrounding UAlbany, Figure 3-3 is a ten-mile radius view of communities surrounding UAlbany. All of the maps created during the research period are included in the appendix for further review.

Figure 3-1: GIS Map representing Faculty, Staff and Student Permits (2008)

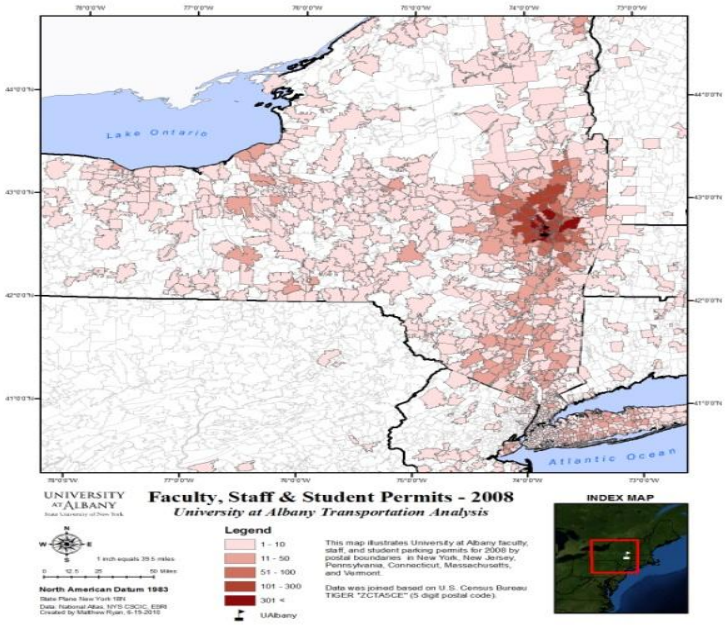


Figure 3-2: GIS Map representing the Harriman Staff and the UAlbany Staff Permits (2008) at the Sixty-mile Radius

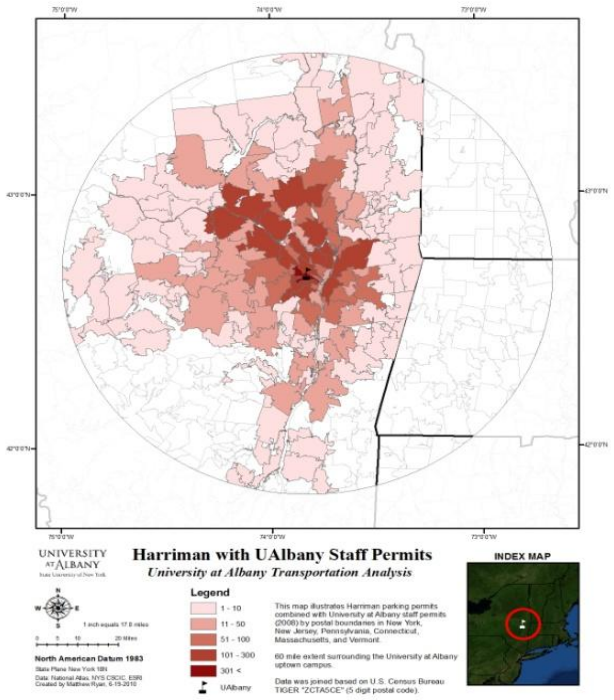
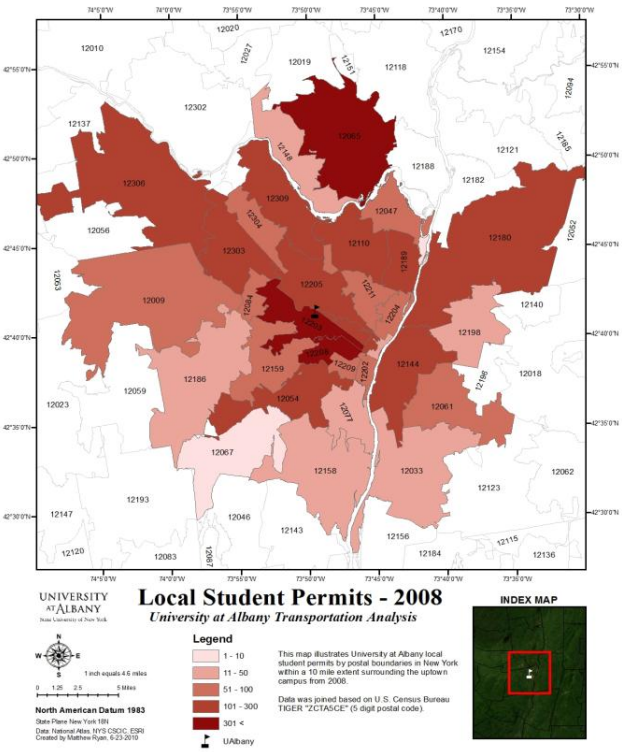


Figure 3-3: GIS Map representing the Local Student Permit data (2008) at the Ten-mile Radius



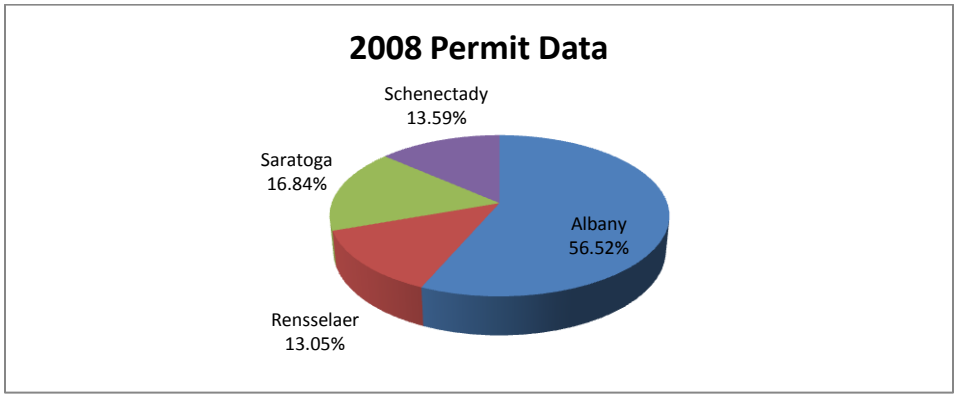
A series of conclusions can be made from the GIS analyses performed on the 2008 data. The team successfully identified clusters of commuting populations throughout the region by category (faculty, staff, and students). These results were tabulated separately as each population has been found to have diverse commuting schedules. Much of the analysis focused on the four counties, Albany, Rensselaer, Saratoga, and Schenectady as the majority of commuters resided in these counties. Table 3-3 illustrates the number of registered permits for faculty, staff, and students in 2008 for these four "core" Capital Region counties.

Table 3-3: Permits by Classification and County

Permits in "Core" Counties (2008)				
	Faculty	Staff	Students	**Total**
Albany	842	1,172	2,407	**4,421**
Rensselaer	84	272	665	**1,021**
Saratoga	130	298	889	**1,317**
Schenectady	126	270	667	**1,063**
Total Permits	1,182	2,012	4,628	**7,822**

The research team collected data for the 2008 and 2009 year in hopes to provide some comparison between the two data sets. During the data analysis phase, it was found that the data indicated a significant drop in the number of permits distributed in 2009, compared to the previous year. Upon further research, it was determined that the system data was not capable of providing reliable data, sufficient for making longitudinal comparisons from year to year. Additionally, since the 2008 data aligned numerically with the number of parking permits issued and was the only year in which Harriman data was available, this year was used as the focal point for creating the GIS maps.

Figure 3-4: Total Commuter Base (Faculty, Staff, and Student) based on Permit Data within "Core" Counties (2008)



POSTAL CODE LEVEL

Results from our geocoding exercise allow us to break down the commuter results even further. Analysis was completed by postal code to identify areas where a high concentration of commuters exists. Our analysis focuses on a sixty-mile radius surrounding the University at Albany campus. This sixty-mile radius consisted of eighty-two different postal codes. The results are broken down into different categories of commuters (faculty, staff, and students) for the 2008 year. Select categories were then combined to explore zones where a high density of commuters with similar commuting patterns may exist. The total number of permits per postal code identifies UAlbany and Harriman Campuses' largest commuter zones within the Capital Region. The data is further broken down by focusing on the postal codes where more than 100 and more than 10 commuters reside. The rational for highlighting the postal codes with over 100 commuters is to emphasize areas where public transportation may want to be either implemented or refined. The research team also chose to highlight postal codes with at least 10 commuters as potential areas where transportation officials may want to focus marketing and advertising campaigns for car and vanpooling programs. The number of permits distributed by the category of commuter is listed below in Table 3-4.

Table 3-4: Categories of Groups Studied Within a Sixty-Mile Radius of UAlbany

Commuter Group	Permits Distributed
Harriman Parking Permits	3,072
Harriman and UAlbany Staff Parking Permits	5,615
Harriman, UAlbany Staff, UAlbany Faculty Parking Permits	7,062
UAlbany Student Parking Permits 2008	6,373
UAlbany Staff Parking Permits 2008	2,510
UAlbany Faculty Parking Permits 2008	1,424
UAlbany Faculty and Staff Parking Permits 2008	3,934
UAlbany Faculty, Staff, and Student Parking Permits 2008	10,307

Harriman Campus and Combined Results

The data provided to the research team on the Harriman Campus parking permits shows that the 3,072 commuters live within 162 different postal codes throughout the region. Seven different postal code areas have over 100 people commuting from that location to the Harriman Campus. These results are depicted in Table 3-5 below. In total, Harriman Campus has at least 10 commuters within 56 different postal code areas.

Table 3-5: Postal Codes with at least 100 Harriman Campus Permits (2008)

Location	Postal Code	Permits
Clifton Park	12065	169
Albany	12205	160
Albany	12203	159
Troy	12180	130
Schenectady	12306	124
Schenectady	12303	123
Latham	12110	105

The Harriman Campus permit data was added with the UAlbany data to form combined commuter categories. The research team produced a category including the Harriman Campus employees and the UAlbany Staff (excluding faculty) because it was found that the majority of the SUNY staff work schedules that align with the work hours of the majority of employees at the Harriman Campus. Faculty was then included in a separate group with the Harriman and UAlbany staff, even though faculty tends to have different work schedules than staff and the Harriman Campus employees.

In total the combined group of Harriman employees and UAlbany staff account for 5,615 parking permits in 2008. Eighteen different postal codes were shown to have at least 100 permits registered. Sixty-five different postal codes had at least 10 permits registered to homes within their postal code area. Adding UAlbany faculty to those figures the number of permits rises to 7,062. With the additional faculty permits, the number of postal codes with at least 100 permits changes from 17 to 25. Seventy different postal codes now have at least 10 permits within their boundaries. Table 3-6 includes the results for the postal codes with over 100 permits for both the Harriman employees and UAlbany staff permits, and the Harriman employees, UAlbany staff and faculty permits.

Table 3-6: Postal Codes with at least 100 Permits for Combined Groups Including Harriman and UAlbany Employees (2008)

Location	Postal Code	Permits (Harriman and UAlbany Staff)	Permits (Harriman, Staff and Faculty)
Albany	12203	435	635
Albany	12205	290	321
Clifton Park	12065	282	333
Schenectady	12303	225	280
Troy	12180	206	233
Schenectady	12306	200	209
Albany	12208	197	293
Latham	12110	178	211
Delmar	12054	167	319
Rensselaer	12144	151	163
Ballston Spa	12020	145	154
Schenectady	12309	144	238
Slingerlands	12159	114	117
Amsterdam	12010	114	173
Schenectady	12302	113	126
Watervliet	12189	107	112
Cohoes	12047	102	115
Voorheesville	12186	(97)	139
Schenectady	12304	(96)	100
Albany	12211	(90)	126
Albany	12206	(88)	108
Altamont	12009	(85)	112
Ballston Lake	12019	(74)	101
Saratoga Springs	12866	(69)	102
Guilderland	12084	(54)	103

(Figures are included for postal codes with below 100 permits if one category was over 100 permits)

Student Results

Student permit data suggests that in 2008, 9,816 permits were distributed to the student population. Of those permits 65% (6,373 permits) recorded an address that was within a sixty-mile radius of the campus. The student permit data from 2008 suggests that this population is relatively spread out throughout the Capital Region. A total of 262 postal codes are represented in this student data within the sixty-mile radius. Eighty-three of those postal codes are locations where at least ten students have indicated their home address. Table 3-7 lists the eighteen postal codes where over 100 students live during the 2008 school year. Despite only listing these eighteen postal codes with over 100 students, the research team found many other postal codes represented a high concentration of students.

Table 3-7: Postal Codes with over 100 Students (2008)

Location	Postal Code	Permits 2008
Albany	12203	498
Clifton Park	12065	338
Albany	12208	333
Troy	12180	270
Albany	12205	236
Schenectady	12309	224
Latham	12110	182
Schenectady	12303	171
Schenectady	12302	137
Delmar	12054	136
Albany	12210	132
Saratoga Springs	12866	128
Schenectady	12306	125
Ballston Spa	12020	122
Rensselaer	12144	120
Albany	12206	118
Watervliet	12189	109
Albany	12211	101

UAlbany Staff Results

In 2008 PMTS distributed 2,548 parking permits to UAlbany staff. Almost all of those permits, 2,510, were distributed to employees who lived within a sixty-mile radius of campus. 138 different postal codes were recognized as areas within the sixty-mile radius where UAlbany staff resided. Forty-seven postal codes housed at least ten permit holders. The top three postal codes with the highest density of UAlbany staff members in 2008 all were within the City of Albany. Only one other postal code, within the town of

Clifton Park, had over 100 UAlbany staff members. Table 3-8 highlights these four postal codes with over 100 staff members for 2008.

Table 3-8: Postal Codes with at least 100 UAlbany Staff Members (2008)

Location	Postal Code	Permits 2008
Albany	12203	270
Albany	12205	128
Albany	12208	115
Clifton Park	12065	112

UAlbany Faculty Results

UAlbany faculty parking permit data for 2008 indicates that 1,498 permits were distributed with 95% (1,424 permits) to commuters within the sixty-mile radius. The 2008 faculty that lived within a sixty-mile radius could be found within 103 different postal codes. Twenty-nine of those postal codes had at least ten faculty members. The postal codes with over 100 permits included Albany (12203) and Delmar (12054).

Table 3-9: Postal Codes with over 100 Faculty Permits (2008)

Location	Postal Code	Permits 2008
Albany	12203	193
Delmar	12054	149

UAlbany Combined Results

The final categories analyzed included various combinations of UAlbany faculty, staff and students to examine where the entirety of the Universities commuting population is living. The combination of UAlbany staff and faculty indicates that ten different postal codes have at least 100 permits registered. These ten communities account for 46% of all the staff and faculty permits distributed in 2008.

Table 3-10: Postal codes with at least 100 Faculty and Staff Permits (2008)

Location	Postal Code	Permits 2008
Albany	12203	463
Delmar	12054	246
Albany	12208	207
Schenectady	12309	158
Albany	12205	158
Clifton Park	12065	156
Schenectady	12303	144
Slingerlands	12159	132
Latham	12110	105
Troy	12180	100

The total number of permits distributed by PMTS to all students, faculty, and staff in 2008 was 13,862. In 2008, there were thirty postal codes that had over 100 permits registered. These thirty communities combine to be 53.5% of all the permits distributed by PMTS in 2008. Table 3-11 highlights the communities in 2008 that had over 100 permits.

Table 3-11: Postal Codes with at least 100 Faculty, Staff and Students (2008)

Location	Postal Code	Permits 2008
Albany	12203	961
Albany	12208	540
Clifton Park	12065	494
Albany	12205	394
Delmar	12054	382
Schenectady	12309	382
Troy	12180	370
Schenectady	12303	315
Latham	12110	287
Slingerlands	12159	228
Schenectady	12306	207
Ballston Spa	12020	206
Saratoga Springs	12866	197
Schenectady	12302	194
Rensselaer	12144	193
Albany	12206	192
Albany	12210	191
Albany	12211	176
Guilderland	12084	145
Watervliet	12189	145
Cohoes	12047	144
Altamont	12009	141
Ballston Lake	12019	136
Voorheesville	12186	125
Albany	12209	124
Schenectady	12304	124
Glenmont	12077	111
Waterford	12188	109
East Greenbush	12061	108
Albany	12204	101

BUS STOP STUDY

GIS maps were also produced to include CDTA bus routes. The bus routes were incorporated into the maps with a .25 mile buffer surrounding the route within the four "core" counties. The results depicting the percentage of the 2008 commuting population that lives within the .25 mile buffer of a bus stop can be found in Table 2-13. Our results indicate that between 45%-50% of all SUNY campus commuters live

within .25 miles of a CDTA bus stop. Of the four counties included in the study, the commuters living in Albany County have the greatest percentage of the population tested (those whom have parking permits) living within the .25 mile threshold of a bus stop. Results indicate that in 2008, 56% of faculty living in Albany County live within the threshold. For staff, the percentage living near a bus stop decreases to 53%. SUNY students are the most likely out of the SUNY commuting population to live near a bus stop in Albany. The results indicate that 64% of the student population in 2008 lived within a reasonable distance (.25 miles) of a CDTA bus stop.

Table 3-12: Commuter Access to Bus Service in "Core" Counties (2008)

Faculty

County	Permits in County	Permits within 0.25 miles from bus stop	Percentage Served
Albany	842	470	56%
Rensselaer	84	30	36%
Saratoga	130	25	19%
Schenectady	126	56	44%
Total	1,182	581	49%

Staff

County	Permits in County	Permits within 0.25 miles from bus stop	Percentage Served
Albany	1,172	627	53%
Rensselaer	272	131	48%
Saratoga	298	23	8%
Schenectady	270	133	49%
Total	2,012	914	45%

Students

County	Permits in County	Permits within 0.25 miles from bus stop	Percentage Served
Albany	2,407	1,530	64%
Rensselaer	665	343	52%
Saratoga	889	102	11%
Schenectady	667	321	48%
Total	4,628	2,296	50%

The other three counties, Rensselaer, Saratoga, and Schenectady tend to have a lower percentage of commuters who live within .25 miles of a bus stop. The 2008 results depict the following about access to

CDTA in Rensselaer County. A total of 36% of faculty lived within the threshold of a bus stop. University at Albany staff was found to have a greater percentage of commuters living near a bus stop than faculty. Our study indicates that 48% of staff living in Rensselaer lived within the .25mile threshold in 2008. The student population, similar to the results in Albany County, proved to be the most likely to live close to a bus stop in 2008, with 52% living within .25 miles of a stop.

Schenectady County's 2008 results were similar to those of Rensselaer County, indicating that roughly 50% of all commuters within Schenectady County live within .25 miles of a bus line. Of the faculty living within Schenectady County, 44% lived within our threshold during the 2008 test period. Staff proved again to have a greater percentage of people living near a bus line than faculty with in Schenectady County. The results indicate that in 2008, 49% of staff lived within .25 miles of a bus stop. Students in Schenectady County have similar figures to staff in 2008, with 48% living within our threshold. These results indicate that students living in Schenectady and Rensselaer County will be roughly 12-16% less likely than students living in Albany County to be within walking distance of a bus stop.

Based on our results, the only county in 2008 with an extremely low percentage of commuters served by a bus stop was Saratoga. Although Saratoga County represents 16% of all of SUNY's commuters, few lived within a walking distance of a bus stop in 2008. Of the faculty commuting from Saratoga County, 19% in 2008 were provided with an accessible bus stop. While staff in the other three focus counties were significantly more likely to live near a bus line than faculty, in Saratoga, this trend is reversed. In 2008, staff was less likely to live within .25 miles of a bus line than faculty living within the county. The results indicate that 8% of staff in Saratoga was served by a bus line in 2008. The results for students, while slightly higher than staff, told a similar story. In 2008, 11% of students lived within the threshold of a CDTA bus line. While at first it appears that the result of this analysis is due to a low level of bus service in Saratoga County, other factors should be considered. Due to the rural nature of much of the county, it will be important to analyze the county in further depth at the postal code level to find areas where significant dense pockets of commuters could support a bus stop or bus line. Also, the bus stop study doesn't take in to account the commuter bus option from Saratoga County through Upstate Transit which runs the Northway Express. The spread out built environment, which in places lacks walking infrastructure, may be better served with additional commuter bus options over traditional bus routes.

SUMMARY

The GIS study offers a wealth of information on the existing commuting patterns of the diverse groups that commute to campus. The results can be used to guide marketing efforts by UAlbany and Harriman Campus in an effort to support car and vanpooling programs. These results can also assist transportation authorities by providing information on areas that could benefit from rerouting bus lines and, or

reconfiguring bus stops. The following inferences can be made based on what we have learned from the GIS portion of the study.

Our GIS exercise helped to identify highly concentrated commuting areas. Our results suggest that while the SUNY and Harriman Campuses' commuting population is coming from many different locations, there are postal codes areas that house a large number of commuters. In 2008, postal codes representing the City of Albany, Clifton Park, and Delmar (town of Bethlehem) appear as areas where there is a high density of commuters. These results suggest that the existing CDTA routes must be analyzed to determine if these communities are being serviced efficiently and properly with direct routes to UAlbany and Harriman Campus.

The results should also be used by SUNY and Harriman campus to highlight focus areas where car and vanpooling options should be marketed. However, caution should be brought before generalizing solutions based on these results. Just because an area has a high density of commuters, that doesn't mean commuters will be willing to change their transportation habits. Many programs exist that must be considered as independent or joint initiatives if either institution expects to alter transportation decisions to decrease SOV usage.

While many programs exist that can decrease SOV usage, there are limitations that exist due to the built environment. As discussed during our analysis of Saratoga County, certain areas are more or less dense and walkable than others. For example, the .25 mile walking threshold used for our study does not take into account the walkability of these locations. A .50 mile walk down a paved sidewalk, with marked crosswalks through intersections, may be much more walkable than a .25 mile walk across a highway interchange. The results of these exercise provides information on where potential opportunities exist to offer commuters who rely on the SOV an opportunity to use alternative transportation. Attention must be given to determine if these areas currently provide the infrastructure to support the different transportation options.

While we found that the overwhelming majority of the commuting population (faculty, staff, or students) rely on SOVs to commute to campus, the CDTA bus system is providing a large number of commuters within our "core" counties the choice to use alternative transportation by successfully placing bus stops located near their residence. The results suggest that the reason that a large majority of commuters within our "core" counties are not using mass transit is beyond having geographic access. Based on what we learned about the schedules of the bus services in our review of the existing alternative transportation, it appears that the frequency and convenience of the bus routes bears a larger role in commuting decisions than access to the bus system. In 2008, a majority of commuters within Albany, Schenectady, and Rensselaer Counties lived within walking distance of a CDTA bus stop. Saratoga County lags behind,

offering a much lower percentage of all the commuters a bus stop within walking distance of their homes. The remaining sections of this project, including the on-time performance study along with the survey and focus group exercises, will further explore why, despite many having the physical option to take mass transit, so many chose to rely on the single occupancy vehicle.

GIS STUDY BULLET POINTS

- In 2008, of the four "Core" counties, Albany County has the largest commuter base with 56.52% of the permits distributed listing an Albany County address.
- The Harriman Campus results indicate that commuters are relatively spread throughout the Capital Region.
    - 3,072 Harriman Campus commuters live within 162 different postal codes.
        - Seven of those postal codes have over 100 permits registered within the boundaries.
    - Clifton Park (12065) and two Albany communities (12205, 12203) have the highest concentration of commuters.
- UAlbany students live throughout the Capital Region with 262 postal codes represented within the sixty-mile radius of campus.
    - The highest density of students is within two Albany communities (12203, 12208) and Clifton Park (12065).
- UAlbany staff lives in 138 different postal code areas within the sixty-mile radius of campus.
    - Albany (12203, 12205, 12208) include the highest density of staff commuters.
- UAlbany faculty is spread out in 103 different postal codes within the sixty-mile radius.
    - Albany (12203) and Delmar (12504) have the highest density of faculty.
- Combined permit data GIS maps highlight that there are various communities within the Capital Region where mass transit services must be reconsidered or focused.

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METHODOLOGY FOR CONDUCTION ON-TIME PERFORMANCE ANALYSIS

A common thread in campus sustainability programs is the goal of reducing the number of students, faculty and staff that commute to campus in SOVs. A significant component of a university's carbon footprint can come from the institution's commuters. At the University, commuting accounted for approximately 14% of it footprint. As a result, universities have created Transportation Demand Management plans with mass transit as a centerpiece of many campus TDM programs. Given the positive attributes of mass transit, the use of transit has been promoted at the University at Albany as a sustainable alternative to SOV commuting in an attempt to reduce the University's carbon footprint and become more environmentally sustainable. The fact that transit is being promoted as a means to travel to campus warrants an examination of the reliability and effectiveness of transit that serves the main campus of the University. To accomplish this objective the on-time performance of bus routes that serve the campus will be evaluated by using GPS technology. This study seeks to evaluate the on-time performance of CDTA bus routes 11 and 12 and the UAlbany bus routes that serve Western Avenue and Madison Avenue.

Data Needs and Acquisition

The necessary data needed to conduct this study will require the consultation of secondary data sources as well as primary data collection. The secondary data utilized in this study will be obtained from bus schedules from the CDTA and the UAlbany Department of Parking and Mass Transit. These secondary data sources are necessary given that this study is evaluating on-time performance as a measure of schedule adherence. As such, the bus schedules of routes that serve the campus will be needed to evaluate schedule adherence.

The primary data needed to conduct this study will be obtained from GPS data loggers that will be deployed on bus routes to collect on-time performance data by means of conducting a ride check and evaluating schedule adherence at posted time points along each respective route. The GPS units are equipped with an automatic polling feature and a manual push-button feature for data collection. As such, the push-button will be depressed when the bus departs from a time point to evaluate schedule adherence against the departure time posted in the schedule for the timing points along each route. In addition to the manual push-button, the GPS unit automatically logs points. The interval at which the unit records data can be calibrated. Based on the conventions set in the literature (see appendix for literature review) regarding

the calibration of polling intervals and database storage constraints, a five second polling rate was selected for this study (Bullock et al., 2005).

The sampling methodology for the primary data collection effort involves the development of an appropriate sample size. In consulting the literature on this topic it is was found that most on-time performance studies for transit are conducted using automated vehicle location (AVL) data. As such, the discussion on sample size is often in regards to limiting the number of samples in a study given that an AVL system is capable of collecting excessive data for the purpose of an analysis of this nature. While the use of an AVL system for conducting on-time performance analysis is ideal, this study uses GPS data loggers for the purpose of primary data collection. In scanning the body of existing literature on conducting an on-time performance analysis it was found that there is not a recommended best practice in developing a sample size strategy due to the fact that this study was unable to use the AVL system. The fact that this study requires primary data collection that will be gathered by conducting ride checks on the transit routes that serve the University makes it difficult to collect a large sample of data. To accommodate for this, the study will be deployed for a period of nearly 12 hours a day for three weeks. Deploying the study in this manner will allow for primary data collection during peak commuting times as well as during non-peak times on different days of the week, different weeks of the month, different months and under different weather and traffic conditions. A deployment of this nature is anticipated to produce a sample of data that is representative of the typical conditions experienced by the ridership from both transit agencies under investigation.

Analysis Techniques

This study seeks to evaluate the on-time performance of transit routes that serve the main campus of the University at Albany. In order to achieve the study's objective it is necessary to analyze the schedule adherence of CDTA bus routes 11 and 12 and the UAlbany bus routes on Western Avenue and Madison Avenue. The performance metric of schedule adherence was selected for evaluating on-time performance based on conventions set in the literature which specify that if headways are greater than ten minutes the appropriate measure of on-time performance is schedule adherence (FDOT, 2008). Both the CDTA and the UAlbany buses operate routes with headways greater than ten minutes. In analyzing schedule adherence this study will measure departure time as opposed to arrival time. The times posted in the schedules are departure times; therefore it is necessary to evaluate when the bus departs from the stop. In addition, the literature states that departure times are a more accurate measure of schedule adherence and overall on-time performance than arrival times because departure times do not include dwell times or the time it takes for boarding and alighting (Nakanishi, 1997).

In order to determine schedule adherence the scheduled departure time for posted time points along the route will be compared with the actual departure time from the posted time points. For each departure at a time point it will be necessary to determine if the bus is early, on-time, or late. The body of current literature on conducting an on-time performance analysis is in agreement on what constitutes an early, on-time, and late bus departure. According to the literature, an early bus is when the actual departure time occurred before the scheduled departure time. An on-time bus is when the actual departure time is 0 – 5 minutes after the scheduled departure time. A late bus is defined as any actual departure time over 5 minutes from the scheduled departure time. It is important to note that the literature reports that an early bus is considered to be worse than a late bus. A bus running ahead of schedule is considered to be worse than a bus running late because a transit rider that arrives at the stop at the scheduled time must wait the duration of an entire headway before another bus will arrive because the bus departed from the stop early.

Based on the definitions of early, on-time and late it is possible to calculate the on-time performance of the bus route. The literature that was consulted on the topic is in agreement on how to calculate on-time performance. To calculate on-time performance the number of on-time departures is divided by the total number of departures and multiplied by 100. This gives the on-time percentage which is indicative of the level of service provided by the transit agency. The on-time percentage can be calculated and reported for various time periods; both short term, as in different times of day such as morning and evening, and long term such as weekly, monthly, or yearly.

In conducting an operational analysis of transit systems it is important to note that there are two methods of evaluation that can be conducted. The two methods of conducting schedule adherence include point checks and ride checks. This study will use the ride check method of analysis where evaluators ride on the bus for the duration of the route and record on-time performance based on schedule adherence at time points located at en route locations. By measuring departure times at en route locations it will be possible to control for dwell times and to see where potential problems are occurring along the transit route.

In relating this study's objectives to the body of theory presented in the literature review (available in the appendix) it is possible to anticipate the outcome of this research. The objective of this study is to evaluate the effectiveness and reliability of mass transit that serves the University at Albany's main uptown campus. In carrying out this research it will be possible to report the on-time performance measured in terms of schedule adherence of buses that serve the main uptown campus. The results of the on-time performance analysis will allow for a determination of the level of service that the current transit agencies provide to students, faculty and staff. It is important to note that on-time performance and the level of service for the transit agencies can only be reported in terms of servicing the main campus. As documented in the literature review, the current literature on conducting operational analysis indicates that it is not possible to determine system wide on-time performance based on an assessment of a select few routes that serve a

certain area. If this study attempted to report on system wide service for either transit agency under investigation in this service evaluation study, doing so would introduce bias and aggregation error into the study and would not yield meaningful results (TCRP Report 47, 1999). Therefore, the nature of this research is to evaluate transit performance at a route specific level focusing on the segment of the transit system that serves the main uptown campus of the University at Albany.

IMPLEMENTATION OF ON-TIME PERFORMANCE ANALYSIS

The implementation of the GPS based on-time performance study to evaluate the effectiveness and reliability of both transit agencies that operate transit routes that serve the main campus of the University at Albany was planned during the summer of 2009 and implemented during the fall of 2009. In planning for the deployment of the study to collect primary data on the on-time performance of the mass transit operators that serve the University a comprehensive literature review was conducted on the best practices of conducting an on-time performance analysis. It was also during this time that several GPS units were field tested for suitability in conducting an on-time performance analysis. From the literature review, research and field testing of hand held GPS units, a list of best practices was compiled on conducting an on-time performance analysis using a handheld GPS unit. In addition, a tutorial was created to provide detailed directions on how to operate the GPS unit in the field for the purpose of collecting primary on-time performance data. Once the literature review was finalized and the best practices from were incorporated into the tutorial for operating the GPS unit, a methodology was created to outline in detail how the study would be carried out. The methodology detailed how the GPS units would be used to collect on-time performance data and the analysis techniques that would be used evaluate the on-time performance of the selected transit routes that serve the main campus of the University at Albany. The completion of the methodology and tutorial for collecting on-time performance data for the study was ready for deployment in the fall of 2009.

The implementation of the on-time performance analysis study called for the collection of primary GPS data from a total of four transit routes simultaneously. In order to collect data on multiple transit routes at the same time a team of data collectors was needed. In order to train the workforce on how to collect primary GPS data on on-time performance, a total of three training sessions were held to train workers how to operate the GPS unit and collect on-time performance data. In addition, the training sessions taught the workers how to read the transit schedule to identify time points and included a bus ride to practice reading the schedule, identifying time points and collecting on-time performance data with the handheld GPS unit. A total of 21 workers were trained to use a GPS to collect on-time performance data. With a team of workers trained to collect primary data using a GPS unit, the next step in the study involved the creation of route specific schedules for the trained workforce to follow. The bus schedules posted by the transit

agencies were broken into three shifts of approximately four hours each in such a way that it would be possible to collect approximately twelve hours of on-time performance data per day during the period of time in which the study was deployed. In this way, workers signed up for the shifts that they were able to work and at the end of their shift they handed off the GPS unit to their replacement worker. This allowed the GPS to remain on and collect data for the entire day. The three shifts included a morning, mid-day, and evening shift. In this way, each shift contains a peak travel time as the morning shift collected on-time performance data during the morning rush hour, the mid-day shift collects data during the lunch hour, and the evening shift collects data during the evening rush hour.

The implementation process of the study presented some challenges in the form of controlling the student workers data collection efforts from the introduction of bias and human error and the resultant flawed data that occurred from the introduction of error. While the student workers underwent training to learn how to operate the GPS unit, read bus schedules, identify timing points along each route and how to collect on-time performance data, human error occurred in the form of students boarding the wrong bus, missing timing points along the route, not collecting an entire shift's worth of data, or missing the next student worker to whom they were supposed to hand off the GPS unit. The introduction of human error is difficult to overcome when primary data collection is being conducted. Overall, the student workers did a good job collecting primary data on the on-time performance of the transit routes that serve the main campus of the University.

The study was deployed during the fall of 2009, from October to December. The deployment of the study occurred for a total of four weeks with one week in October, two weeks, in November and a week in December. The deployment of the study investigated a total of four transit routes: CDTA 11, CDTA 12, and the UAlbany Shuttles that serve Western Avenue and Madison Avenue. Of the four transit routes under investigation, a total of 41 buses were tracked and analyzed. A larger sample size of buses was tracked; however, some of the data was found to be invalid and had to be discarded due to human error during data collection as discussed above.

ON-TIME PERFORMANCE ANALYSIS FINDINGS

On-time performance analysis was conducted on the GPS data collected on the four transit routes under investigation in this study. The on-time performance analysis was conducted by calculating the on-time percentage or the number of times the bus departed the bus stop "on-time". The on-time percentage was calculated for each bus in the sample population of the on-time performance data set. The on-time percentage values that were calculated from the GPS data set were entered into a statistical software package called the Statistical Package for the Social Sciences (SPSS) to run basic descriptive statistics on the data set.

The basic statistics that were run on the data set include both measures of central tendency and dispersion. The measures of central tendency that were calculated from the on-time performance data set include the mean, median and mode. The measure of dispersion that was calculated includes the standard deviation, range, minimum and maximum. The mean on-time performance was highlighted in the literature as being the conventional method of reporting on-time performance for a transit operation. This analysis also includes the median and mode as additional measures of central tendency. This study also examines the dispersion of the on-time performance values to gain a better understanding of the variability of the on-time performance values from the mean. The minimum and maximum values are reported to show the lowest and highest on-time performance values in the sample population of on-time performance data. The range is reported to show the difference between the maximum or highest and minimum or lowest on-time performance values. It provides another indication of data dispersion and variability. The standard deviation is also reported as a measure of variability from the mean. A low standard deviation indicates that the on-time percentage values tend to be very close to the mean while a high standard deviation indicates that the on-time percentage values are spread out over a large range of values. The standard deviation is a useful indicator of how reliable and effective the transit agency is regarding on-time performance. A low standard deviation in the percentage of on-time departures indicates that the transit agency is providing a consistent service and is thus reliable. Conversely, a high standard deviation in the percentage of on-time departures indicates that the transit agency is providing inconsistent and unreliable service. With an understanding of the statistical analysis used to evaluate on-time performance of transit operations in this study, it is now possible to examine the descriptive statistics of each transit route under investigation.

The transit routes under investigation include all transit routes that serve the main Uptown campus of the University at Albany. The results of the statistical analysis on all of these routes are included in Table 3-1 below. CDTA route 11 is the first route under analysis as it serves the campus from the Western Avenue corridor. Route 11 was found to have a mean on-time performance value of 71.5 percent. The median on-time performance for route 11 is 71.4%. In measuring the dispersion of the percentage of on-time departures, route 11 has a standard deviation of 8.9. The range is 32.6 with a minimum on-time performance value of 57.1 and a maximum value of 89.7. Overall, based on a fairly low standard deviation value, CDTA route 11 is providing a fairly consistent service.

The next transit route examined is CDTA route 12 that serves the main campus of the University at Albany via the Washington Avenue corridor. CDTA route 12 was found to have a mean on-time performance of 65.8%. The median on-time performance for CDTA route 12 is 64.7. The dispersion of the on-time performance values is such that the standard deviation for route 12 is 17.2. The range of on-time performance values is 53.5 with a minimum value of 40.9 and a maximum value of 94.4. The measures of

dispersion for the on-time performance of CDTA route 12 indicate that the routes on-time performance varies considerably based upon a fairly high standard deviation value and a range of over 50. Based on these findings the variability of on-time performance for CDTA route 12 should be addressed to improve the routes effectiveness and reliability.

The University at Albany also provides mass transit to its students, faculty and staff as a means to travel to campus from the surrounding community and also as a means to travel around campus. The two UAlbany transit routes that connect the campus with the surrounding community are evaluated next to quantify the level of service that is being provided to students, faculty and staff. The UAlbany Shuttle that serves the Madison Avenue corridor was found to have a mean on-time performance of 64.8 and a median on-time performance of 63.6. The dispersion of the on-time performance values was fairly low with a standard deviation of 9.9. The range of the on-time performance values is 33.6 with a minimum value of 55.2 and a maximum value of 88.8. Given that the measures of dispersion are fairly low it can be concluded that the UAlbany Shuttle that serves Madison Avenue is providing a fairly reliable service.

The UAlbany Shuttle that serves Western Avenue, a corridor that contains a high concentration of University students, is analyzed next. The UAlbany shuttle that serves Western Avenue was found to have a mean on-time performance of 60.2 and median on-time performance of 60.7. In terms of the dispersion of these values the route has a standard deviation value of 7.9. The range is 19.4 with a minimum value of 50 and a maximum value of 69.4. The fact that the standard deviation value is low indicates that the transit route is providing fairly reliable service.

Table 4-1: Statistical Analysis of the Routes Servicing Uptown UAlbany

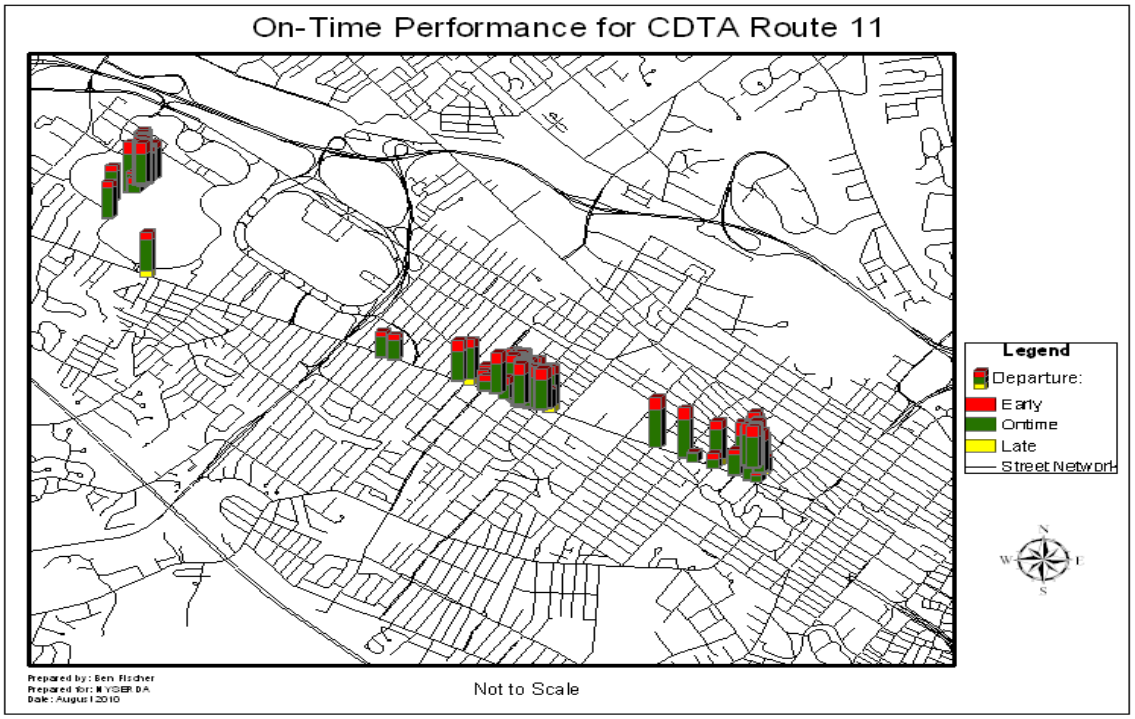
	Mean	Median	Stand. Dev.	Range	Min/Max
CDTA Route 11	71.5%	71.4%	8.90	32.6	57.1%/89.7%
CDTA Route 12	65.8%	64.7%	17.20	53.5	40.9%/94.4%
UAlbany- Madison	64.8%	63.6%	9.90	33.6	55.2%/88.8%
UAlbany- Western	60.2%	60.7%	7.90	19.4	50.0%/69.4%

Now that the on-time performance for each transit route has been reported with a basic statistical analysis, it is necessary to visualize the data in order to gain a better understanding of the on-time performance of each transit route. The on-time performance data is visualized using ArcGIS version 9.3.1 to allow for spatial analysis of each of the transit routes under review in this study. The use of data visualization techniques is a powerful tool because it visually illustrates on-time performance along the transit corridor. This level of detail and analysis is not possible with statistical analysis alone. As such, the next section presents the findings from the GIS analysis of the on-time performance data for each transit route that serves the main campus of the University at Albany.

GIS AND SPATIAL ANALYSIS OF ON-TIME PERFORMACE ANALYSIS FINDINGS

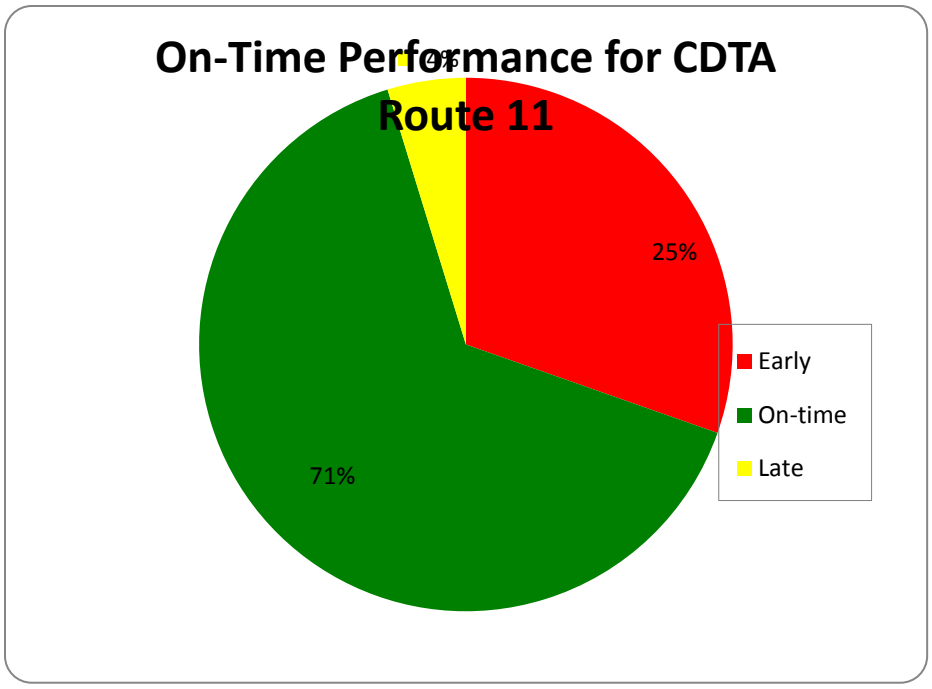
The use of ArcGIS 9.3.1 was employed in this study to visualize the on-time performance data of each transit route that serves the main Uptown campus of the University at Albany. The visualization of the on-time performance data collected by the GPS units allows for a greater level of analysis of on-time performance for each transit route. By visualizing the on-time performance data it is possible to conduct spatial analysis of each transit route at any location along the route. This level of detail easily and very effectively visually illustrates the on-time performance of the bus at each timing point along the route. The first transit route to be visually analyzed is CDTA Route 11. Figure 4-1 provides a map that illustrates the visualization of the on-time performance data collected with GPS units for CDTA Route 11.

Figure 4-1: Map of On-Time Performance for CDTA Route 11



Inspection of the map for the On-Time Performance of CDTA Route 11 reveals that this transit route has a considerable problem with early departures as indicated by the amount of red found on the stacked bar charts at all of the timing points on the route. The map indicates that the majority of the departures for CDTA Route 11 are on-time and it is important to note that late departures are not much of a problem. Figure 4-2 provides a pie chart that illustrates the percentage of early, on-time and late departures for CDTA Route 11.

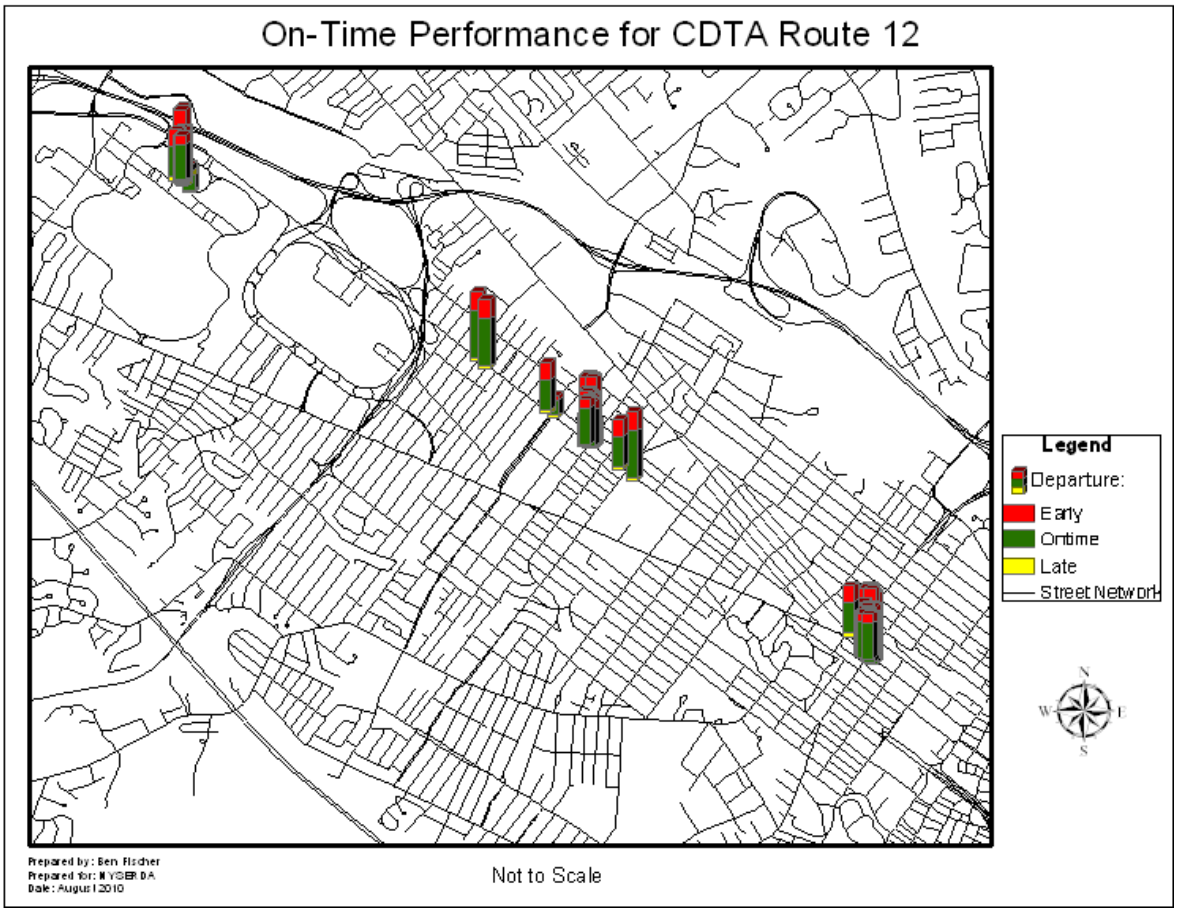
Figure 4-2: On-Time Performance for CDTA Route 11



The pie chart illustrates that the majority of departures for CDTA Route 11 are on-time at 71%. It is import to note that 25% of the departures for CDTA Route 11 are early. This means that one out of four departures leaves the stop early before the scheduled time posted in the bus schedule. This is a considerable problem because early departures are the worst type due to the fact that a transit rider that arrives at the bus stop on-time will miss the bus and be forced to wait the duration of an entire headway to ride the next bus. As illustrated in the pie chart above, late departures are not a significant problem at only 4%.

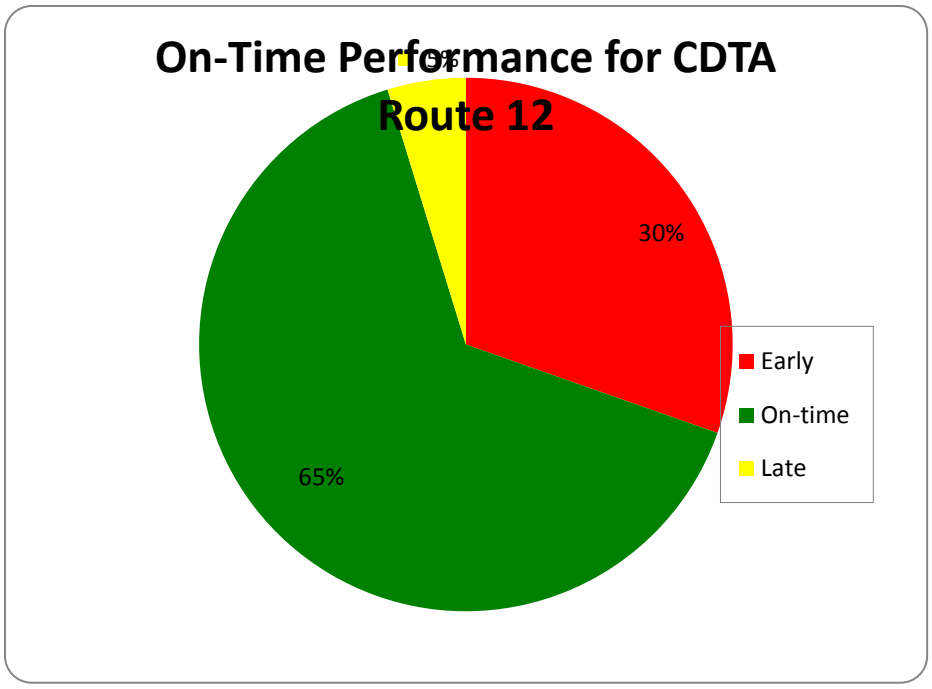
The next transit route under review is CDTA Route 12. The on-time performance data collected with GPS units was post-processed and mapped in GIS. Figure 4-3 provides a map that illustrates the on-time performance for CDTA Route 12.

Figure 4-3: On-Time Performance for CDTA Route 12



The map of on-time performance for CDTA Route 12 visually illustrates the on-time performance data at each time point along the transit route. Similarly to CDTA Route 11, it is evident that CDTA Route 12 has a considerable problem with early departures. This finding is illustrated by the red portions of the stacked bar charts which illustrate early departures. The majority of the departures for CDTA Route 12 are on-time and it appears that there is not much of an issue with late departures. Figure 4-4 provides a pie chart to quantify the percentage of early, on-time and late departures for CDTA Route 12.

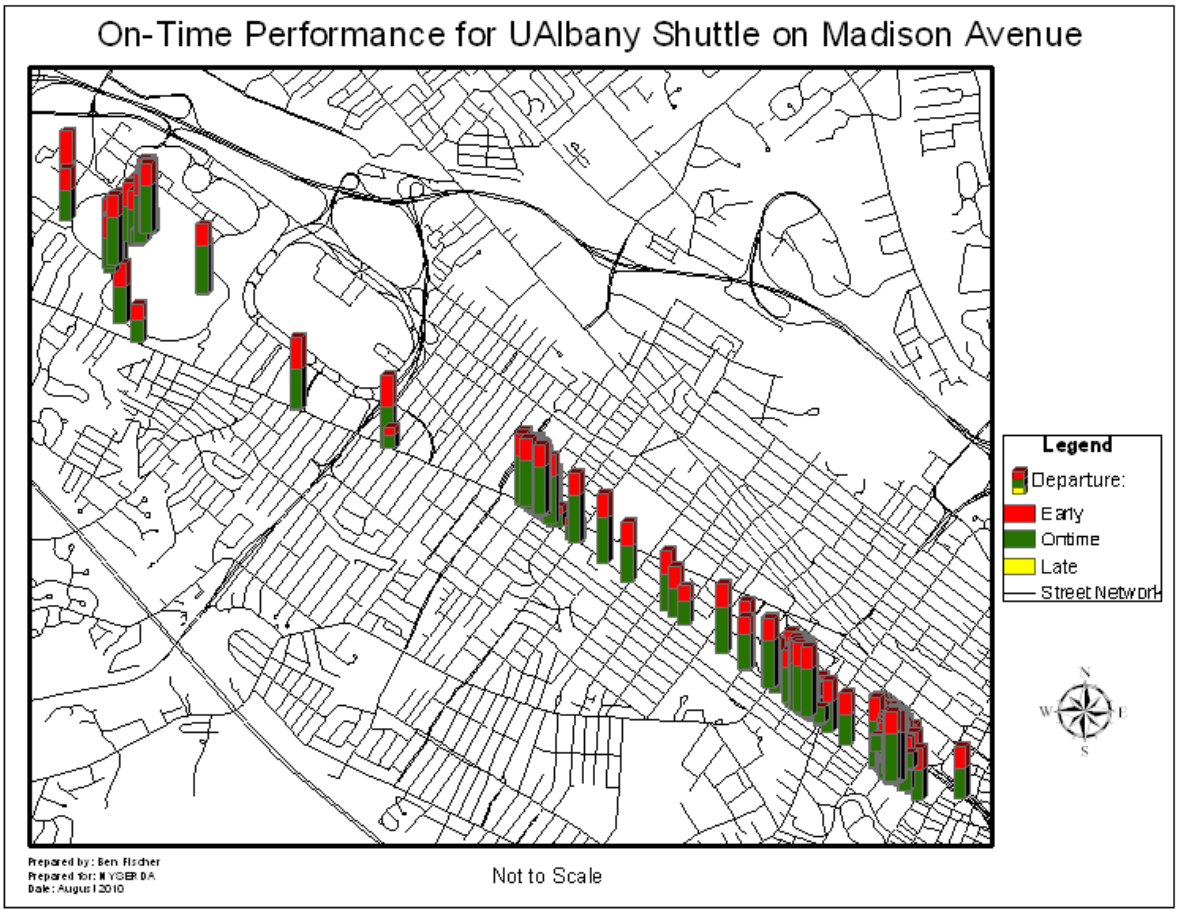
Figure 4-4: On-Time Performance for CDTA Route 12



The pie chart illustrates that the majority of departures for CDTA Route 12 are on-time at 65%. However, CDTA Route 12 has a significant problem with early departures with 30% of departures occurring early. This is problematic and means that nearly one out of every three departures is early. In terms of late departures, CDTA Route 12 was found to have 5% of its departures late. The late departures value is rather low, however; there is room for improvement.

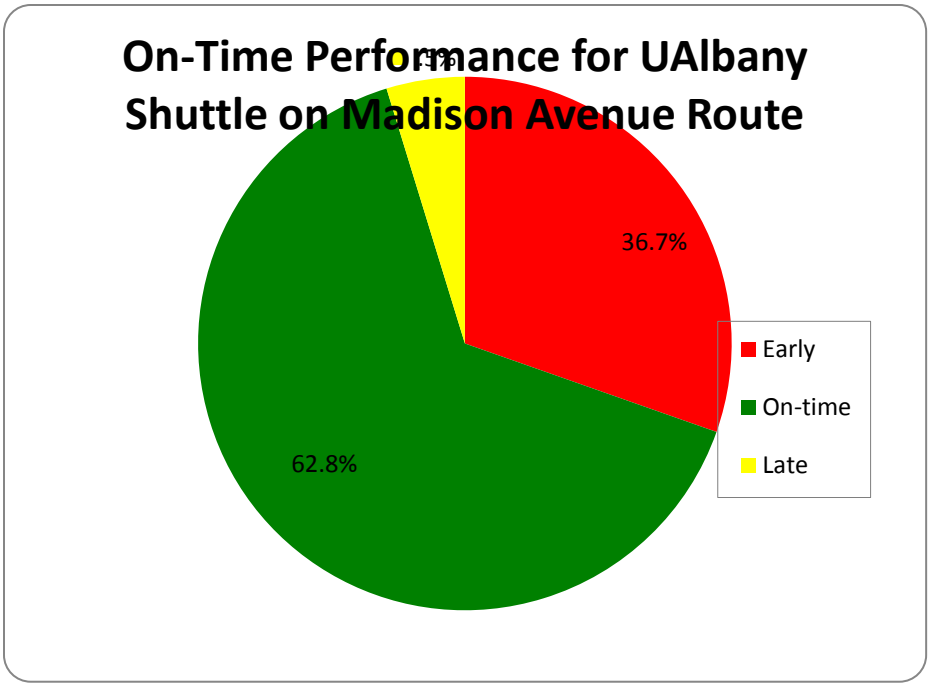
The next transit route under investigation is the UAlbany Shuttle that serves the Madison Avenue Corridor. Figure 4-5 provides a map of the on-time performance data for the UAlbany Shuttle that operates on the Madison Avenue Corridor. Inspection of the map of on-time performance for the UAlbany Shuttle that serves Madison Avenue illustrates that the transit corridor has a considerable amount of early departures. The amount of early departures is illustrated by the red portions of the stacked bar charts.

Figure 4-5: On-Time Performance for UAlbany Shuttle on Madison Avenue



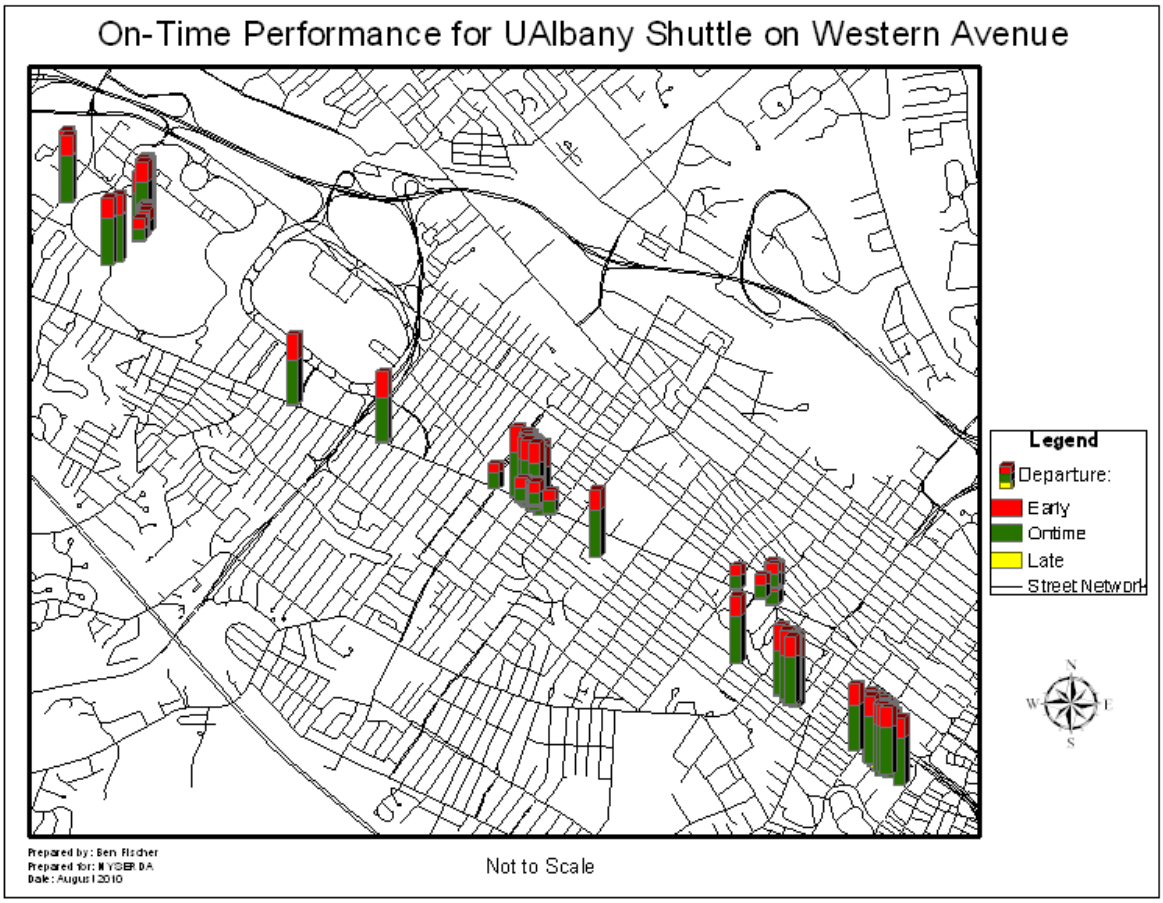
Inspection of the map also reveals that the route has a considerable amount of on-time departures as illustrated by the green portion of the stacked bar chart. It is worth noting that there are no noticeable late departures on the map. To further quantify the early, on-time and late departures Figure 4-6 provides a pie chart of the on-time performance for the UAlbany Shuttle that serves the Madison Avenue Corridor. The pie chart of on-time performance for the UAlbany Shuttle that operates on the Madison Avenue Corridor illustrates that the majority of departures at the timing points along the route are on-time. To be exact 62.8% of the departures at timing points along the UAlbany Shuttle route on the Madison Avenue route are on-time. The UAlbany Shuttle does have a considerable amount of early departures along the Madison Avenue Corridor at 36.7%. Late departures are not an issue with the UAlbany Shuttle that serves the Madison Avenue Corridor given that a negligible .5% of departures were late.

Figure 4-6: On-Time Performance for UAlbany Shuttle on Madison Avenue Route



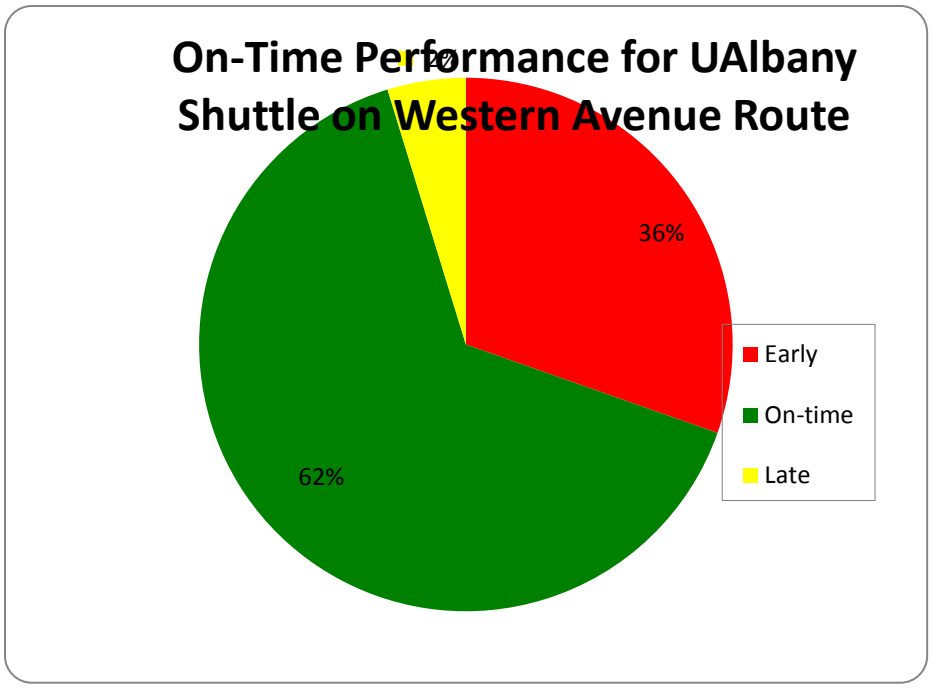
The next transit route under investigation is the UAlbany Shuttle that serves the Western Avenue corridor. The Western Avenue corridor runs through an area of the City of Albany that contains a high concentration of college students. As such, this is one of the transit routes that serves the student enclave and is important in transporting students to and from the main campus of the University at Albany. Figure 4-7 provides a map of on-time performance for the UAlbany Shuttle that operates on the Western Avenue corridor. The map of on-time performance for the UAlbany Shuttle on Western Avenue is quite similar to the maps of the other transit routes in that the number of early departures is quite visible.

Figure 4-7: On-Time Performance for UAlbany Shuttle on Western Avenue



As in the previous maps of other transit routes, the number of early departures is quite visible due to red portions of the stacked bar charts. According to the map, the majority of departures are on-time and there are no visible late departures. The pie chart in Figure 4-8 illustrates the exact percentage of early, on-time and late departures for the UAlbany Shuttle that serves the Western Avenue corridor.

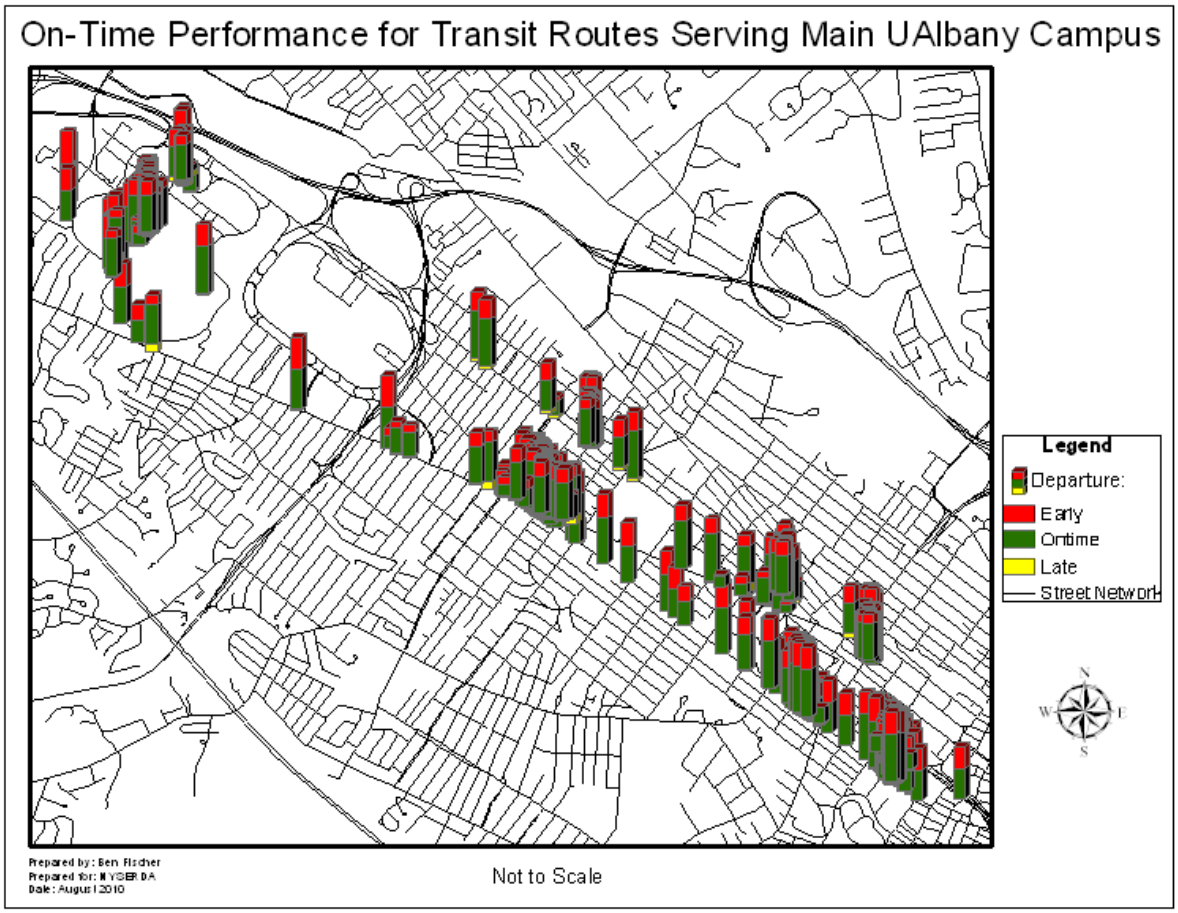
Figure 4-8: On-Time Performance for UAlbany Shuttle on Western Avenue Route



Inspection of the pie chart for the on-time performance of the UAlbany Shuttle that operates on the Western Avenue corridor illustrates that the majority of the departures are on-time. To be precise, 62% of the departures for the UAlbany Shuttle that runs on Western Avenue are on-time. There are considerable early departures on this route. The UAlbany Shuttle that serves the Western Avenue corridor was found to depart the timing points along the route early 36% of the time. The amount of late departures at timing points along the route was found to be negligible at only 2%.

In comparing the on-time performance of all the transit routes under review it is interesting to note that all the routes were found to be approximately the same in terms of the percentage of early, on-time and late departures. All the routes had an on-time departure percentage in the 60's and an early departure percentage in the 30's. It is also interesting to note that all the transit routes under review had a minimal percentage of late departures. Figure 4-9 provides a map of the on-time performance for both transit agencies on all routes under review that serve the main campus of the University at Albany.

Figure 4-9: On-Time Performance for Transit Routes Serving Main UAlbany Campus



As illustrated in the map above of both transit agencies routes that serve the main campus at the University at Albany, the rate of early departures is a considerable problem and one that is occurring from both transit agencies under review. The problem of early departures should be addressed by both transit agencies in order to provide a better level of service. There is a need for future research to investigate why and when the early departures are occurring. Research of this nature should attempt to determine if the early departures are occurring systematically such as only during certain times of the day or if they are occurring randomly. There is a need for further research to determine and isolate the time period if any when the early departures are occurring in order to make the use of mass transit more reliable as a means for students, faculty and staff to commute to campus.

LESSONS LEARNED

In developing a methodology for conducting an on-time performance analysis based on a literature review of the best practices of carrying out a handheld GPS based on-time performance analysis, there were several lessons learned in the process. The most prominent lesson learned in carrying out this study is that

conducting an on-time performance analysis by conducting ride checks with handheld GPS units is not efficient as it is a very expensive and time intensive process. The efficiency of conducting an on-time performance analysis in terms of both fiscal and time efficiency could be greatly improved if both transit agencies under review in this study made use of an automated vehicle location (AVL) system. The Capital District Transportation Authority (CDTA) should use its AVL system to monitor its on-time performance on an on-going basis and use the findings to improve the transit planning process to provide a better level of service to its ridership. Along similar lines, the Department of Parking and Mass Transit at the University at Albany should adopt some form of an AVL system to improve the level of service it provides to its students, faculty and staff. The iTrak Corporation provides various GPS based tracking technologies that can be installed on a bus fleet for a minimal cost. This technology can be used to monitor and manage the fleet and to compile on-time performance reports which can be used to improve the level of service provided by the UAlbany Shuttles. In addition, the iTrak system has the capability of providing a real-time shuttle tracker application which can be accessed on a smart phone or via a website so that transit users can look up where the bus is located and when it will arrive at the stop. The use of this technology would greatly improve the user friendliness of transit and help to make transit a viable alternative to SOV commuting to campus.

Based on all the benefits that an AVL system provides to both the users and providers of transit service, it is strongly recommended that the CDTA use the AVL system and the University at Albany install and use the iTrak fleet manager GPS tracking system as a means to improve the effectiveness and reliability of mass transit as well as campus safety. If both transit agencies adopt the use of an AVL system it would be possible for a regional transit website to be created that displays a map of bus locations in real-time throughout the capital district. This technology is both feasible and cost effective and would make transit use a more viable transportation alternative to SOV travel in the capital region.

ON-TIME PEFORMANCE KEY FINDINGS BULLET POINTS

- The on-time performance of both transit operators was found to be very similar
- Both transit operators were found to have approximately 65 percent of departures on-time
- The percentage of late departures was found to be minimal and not problematic
- Approximately 33 percent of departures for both transit operators were found to be early
- Both transit agencies need to address the high percentage of early departures in order to provide a higher level of service
- Conducting an on-time performance analysis using handheld GPS units is a very time and cost intensive process
- The use of an Automatic Vehicle Location (AVL) system is the recommended method of conducting future on-time performance studies

- It is recommended that both transit agencies implement the use of AVL systems into their transit operations and use the data for the purpose of transit planning and to provide a more reliable and effective service

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SURVEY ANALYSIS

SURVEY CREATION

Successful transportation planning at the University at Albany has long been a challenge to both administrators and planners alike. With traditional issues such as "traffic flow" and "parking availability" to confront, recent environmental concerns, particularly rising carbon dioxide levels from the transportation sector, have added a new dimension to the transportation system planning at the University. In an attempt to analyze the traditional and rising issues in transportation at the University, a survey was created to develop a comprehensive picture of the travel behaviors and preferences of the commuting population. This survey was based on and administered to faculty, staff, and students in the fall of 2009. The survey provides insight on commuting patterns, preferences, and which solutions would most likely succeed if implemented.

The survey process was conducted in a similar manner to the 2006-2007 study completed by Nelson/Nygaard Consulting Associates, analyzing the commuting behavior at the neighboring Harriman Campus. The survey highlighted many of the same questions as the Harriman campus survey, while additional questions were added that are specifically tailored to the UAlbany population. The student survey, along with the survey that was distributed to faculty and staff, experienced many drafts before finally receiving approval from the Technical Advisory Council and the Institutional Review Board at the University for final distribution. The Office of Institutional Research at the University administered the on line survey during the fall of 2009 to the campus community.

STUDENT SURVEY RESULTS

The section below highlights the *student* portion of the survey.

Background Demographic Data

A total of 1,185 students filled out transportation surveys, providing a good representation of the more than 18,000 student body. The class level distributions are also largely representative, comprising 14% Freshmen, 15% Sophomores, 19% Juniors, 17% Seniors, 19% Graduate students, and 13% Doctoral students. While racial distributions largely mirror that of the total population, the gender split within the survey is slightly less representative. The University's student population is comprised of 53% female and

47% male. Our survey population incorporates more females, with 62% of the survey respondents indicating they are female. Overall, with a completion rate of 89% among survey-takers, the student survey presents an overall broad and rich set of data for analysis.

Commuting Destinations and Limitations

The predominant commuting destination of students is school with 87% of the sample population being full-time students. Among the different school campuses, the vast majority of students, "regularly attend class" or "spend time" on the uptown campus, with far fewer attending at either the downtown or East campuses. Monday through Thursday, students most commonly have their first class, and aim to arrive at school, between the hours of 8am and 12pm, and have their last class generally between 4pm and 6pm. Although Friday classes differ slightly from this trend, commuting patterns on this day are slightly less important since far fewer students have Friday classes. Along with school, work and volunteer responsibilities are also substantial sources of students' commuting needs. Of the 65% of students who work during the semester, the most common quantity of hours worked is between 16-20 hours per week.

An issue limiting students' ability to commute to these destinations is the current housing patterns. Over half of UAlbany students live off campus, with nearly 35% living between two to five miles from campus. Although three quarters of UAlbany students live within 15 miles, nearly 10% of students, representing about 1,000 commuters, live more than 20 miles from campus. If the University is committed to decreasing long SOV commutes, the University must market alternative transportation options, such as carpooling or vanpooling to this population of students. While some of these long commutes may be due to students whom for reasons unrelated to commuting can't change their home-base; survey results indicate that when students have the opportunity to choose their housing, either future or current, nearly 65% do so in consideration of commuting.

Current Commuting Patterns

As a result of these commuting needs and limitations, students have specific preferences for, and against, certain modes of transportation. A majority of students report generally using a car to commute to campus either daily (39%) or a few times a week (21%). Of those, only 19% of students indicated that they "regularly" have more than one occupant in their vehicle. 32% of students claim that they would drive regardless of any price increase in gasoline.

One of the more substantial problems with SOV's is the impact on the environment. For every vehicle mile driven, it is estimated that almost one pound of carbon dioxide is released into the atmosphere (Savecarbon.org, 2010). Given the results of the survey data, in 2008 UAlbany student commuters travelled between a low end of 8,888,400 to a high end of 11,010,300 miles a year to and from campus. This equates to employees consuming between 390,699 and 483,969 gallons of gas per year assuming a miles per gallon of 22.75. (Environmental Protection Agency, 2010) (National Highway Traffic Safety Administration, 2010). The annual metric tons of carbon dioxide produced from student commuting is anywhere between 3,465 and 4,293 metric tons.

Students' appetite for alternative transportation currently appears to be mixed. Students' preference for carpooling, is extremely low, as between 63-72% of students never carpool during the entire semester, with only a handful doing so weekly. Among all alternative transportation modes, mass transit is the most commonly used. Over one-half of students (53%) use CDTA at least a few times a semester, and about one quarter do so daily. A nearly equal amount (49%) uses the UAlbany shuttle at least a few times during the semester with 18% taking the shuttle daily. Commuting by bicycle or walking is an option that is utilized less frequently among students than other modes of transportation. Only 9% of students use their bicycles to commute to campus at any time during the semester, while only 16% report walking daily to campus. The population of students whom indicated that they walk as a form of commuting is most likely the on-campus students furthering the supposition that walking is not a regular mode choice for off campus students. The methods in which students commute to campus also varies little between semesters, with 78% reporting no or little variation. This indicates that if policies are developed that entice students to use alternative transportation options, those students will likely stick with their new mode of transportation.

Reasons Behind Modal Preference

There are several reasons behind students' commuting preferences, leading them to choose SOV's for commuting, over alternative methods. Students most commonly commute via SOV because of the "convenience of driving". The "convenience of driving" appears to include the ability to make additional stops during their commute. Our results indicate that, "the need to make other stops on stops on the way *to* and *from* school" is certainly related to, and may be the cause behind this needed "convenience".

Students appear to have some core concerns with the alternatives to the SOV. Students' principal concerns with carpooling are the lack of information and networks. Forty-four percent of students do not have, or know, a person with whom they can carpool. 89% are uncertain where to find resources on this practice. Students' major concerns with the transit system include the infrequency/availability of service, problems finding information on bus scheduling and routes, and prohibitive costs to transit. Of the students reporting these issues 49%, 38%, and 34% indicate that these issues are *somewhat* to *severe* problems. A

new development since this survey was completed is the free and universal access to the CDTA system for the UAlbany community. Now nearly all routes on CDTA buses are free of charge to SUNY members. Among bicycle concerns, nearly half of students report the length of commute, the lack of bike lanes, and bike safety, to be the major factors limiting use of this mode. Length of commute, and safety are also the two most frequently cited pedestrian concerns, as 68% and 45% of students indicate that those issues "prevent them from using alternative transportation". Both modes appear to suffer from the lack of a source to distribute information on these alternatives. Only 24% of students reported "knowing where to find information on bicycle and pedestrian commuting."

Solutions to SOV Use

A number of patterns and potential solutions exist. The first involves using the drawbacks to automobile use, namely parking availability and costs associated with car ownership, to better position alternative transportation options. 74% of students reported parking as *somewhat* to *a severe* problem. This lack of availability may work to deter many students from using SOV's. Driving costs are also quite prohibitive. Students commonly spend $3,500 to as much as $7,100 or more a year on car expenses, most of which they pay themselves.

The results of the survey do indicate that over a third of UAlbany students are not car dependent. 36% of students state that they do not use a car to commute regularly to campus. 29% of students most likely do not own a car as they indicate *never* driving alone during the semester. Nearly 40% of students surveyed report that they would seriously consider switching from SOV's in the event that gasoline price increase to $4/gallon or if the price increased more than $1 in a week. In an indication that incentives may assist in the move away from SOV's and towards carpooling, students expressed support for programs that use preferred parking for carpoolers, carpooling, ride-sharing, and assistance in finding carpool partners, with 55%, 48%, 46%, and 43% reporting a *somewhat* to *definite* likelihood to use these programs.

Among students surveyed, the most appealing improvements are those that would be made to the transit system. Of solutions that have not yet been implemented, an increase in frequency of bus service tops the list with 58% of students reporting *high* to *definite* likeliness of service use, and 63% of students listing it among their top three most desired improvements. Shorter ride times, closer access to bus stops, and rewards for using alternative transportation also place high among students' wishes with 54%, 49% and 46% reporting *high* to *definite* likelihood of using the service. Another desire among students, although not weighted against other improvements, is increased access to infrequent or currently unavailable locations by bus. Colonie Center and the Rensselaer train station lead these desired destinations, at 43% and 32% of students voting in their favor. (Downtown Albany and Crossgates Mall are actually the top two most

frequently listed destinations, but as a majority of bus lines already serve these destinations, increasing access would be quite difficult.)

While improvements to transit tested well among students, other infrastructure improvements did not test well. Students are generally less interested in bicycle and pedestrian improvements compared to other modes. Bike amenities and bike sharing, for example, show only 33% and 28% of students likely to use these programs. Other improvements such as car sharing, and preferred parking for hybrids, were unappealing as well, with only 35% and 39% of student indicating a high likeliness of use. It should be noted that the results of the survey indicate student preferences and are not indicative that these policies or improvements would significantly affect actual student behavior.

Student Summary

The findings from this report indicate there is continuity in student commuting behaviors over time, the preferences students demonstrate for transit improvements, interest in rewards, and the problem of information distribution. This information should greatly assist in improving the overall transportation system at the University. As future surveys on transportation patterns and preferences add to the rich data collected sofar, planners should, over time, be able to make major inroads into both of these complex issues and, ideally, allow the University to serve as a model to other college and communities seeking improvement in their own transportation system.

Student Bullet Points

Significant Facts:

- 36% of students live on campus
- 25% of students live within 2 miles of campus
- 46% of students are in favor of rewards for using alternative transportation
- 60% of students live within 5 miles of campus; 75% of students live within 10 miles of campus
- 25% of students use transit to commute daily; over 40% use transit at least a few times a month
- The majority of classes begin between 8am -12pm, and end between 4pm – 6pm, Monday through Thursday
- 89% of students do not know where to find information on carpooling; 76% do not know where to find information on bicycling or walking
- 29% of students likely do not own a car, as they “never” drive one during the semester
- 40% of students would seriously consider alternatives to SOV’s if gas reached $4/gallon
- 34% of students would drive despite any price increase in gas

- 78% of students do not change their commuting patterns much between semesters

Suggested Measures:

- Rewards for using alternative transportation
- Improvements to bicycle, pedestrian safety, and bicycle lanes
- Increased student housing on, and near uptown campus
- Transit improvements, including: free rides on all routes, faster bus trips, higher frequency of trips, and bus stops closer to students' housing
- Bicycle, pedestrian, carpooling, and transit education campaigns
- Decrease available parking

EMPLOYEE SURVEY RESULTS

Following the direction of the Harriman Campus survey, a UAlbany employee survey was developed to partner with the student survey. In order to have proper context on commuting patterns and preferences reported by employees in this survey, it is useful to know the general demographics of the survey sample compared to the employee population at large to determine if the sample accurately reflects the employee campus population as a whole. Based on the demographic information available, this survey is largely representative of the employee population in multiple categories including sample size, ethnicity, and faculty/staff distribution. With 815 respondents out of 2,737 employees contacted, and a total population of 4,197 employees on campus, both the employee representation and response rates are high (19%, 29%). Based on the available demographic information, the determination is made that the ratio of faculty to staff and the ethnicity distribution in our sample is also representative of the overall employee population on campus. Similar to the student survey efforts, women represent a larger percentage of our survey than the percentage of women who make up the employee populations. Although women represent only 41% of faculty, they represent 57% of those surveyed. The research team found that, across the board, women were more likely to participate in the online survey efforts. Further demographic statistics collected in this survey include; average age (49 years); marital status (60% married, 38% single); and number of years worked at the University (most commonly 5-19 years).

Commuting Demands, Limitations, and Results on Modal Preference

University at Albany employees have a variety of commuting demands and limitations which result in strong preferences for specific modes of transportation. Both faculty and staff do the overwhelming majority of their work on the uptown campus (91%). This is true not only during the semester, but also

during the summer and over breaks, with employees commuting to campus "five days a week or more" 89%, 70%, and 62% of the time during these three periods, respectively. 40% of employees live between 5-15 miles from campus and 25% beyond 15 miles. The vast majority of University faculty and staff drive to work alone daily or a few times a week (89%), and that the most prominent reasons for doing so are "convenience" and "having to travel to other places to and from work", with 82% and 65% reporting these answers, respectively. All other alternative transportation modes, including carpooling, transit via CDTA or UAlbany shuttle, bicycle, and foot, are seldom used; practiced regularly only 14%, 13%, 7%, 5%, and 6% of the time, respectively.

As with the student population, the use of SOV's can significantly impact on the environment and even more so in the case of UAlbany employees because even though they are smaller in size than student commuters, they travel from longer distances. Given the results of the 2008 survey data, employee (faculty and staff) commuters travelled between a low end of 9,474,488 to a high end of 23,102,175 miles a year to and from campus. This equates to employees consuming between 416,461 and 1,015,480 gallons of gas per year assuming a miles per gallon of 22.75. (Environmental Protection Agency, 2010) (National Highway Traffic Safety Administration, 2010). The annual metric tons of carbon dioxide produced from employee commuting is anywhere between 3,694 to 9,008 metric tons.

The preference for single occupancy vehicles takes its toll in other ways as well, including high costs. While work-related driving may not be the exclusive purpose of car-ownership among employees, it is very costly. 14.5% of survey respondents report spending between $30-$100 a week to commute, and as much as $3,960-$7,377+ annually for all car-related expenses. An abundance of cars also create access problems. Parking, congestion, and safety when driving, were each identified as significant issues by UAlbany employees.

Favored Alternative Transportation Solutions

Through the survey, faculty and staff expressed having a significant interest in a variety of alternative transportation programs and services that could cut the level of SOV commuting. Employees are very interested in reducing the number of trips to campus per week. Out of 15 alternative transportation programs proposed, the two most popular choices are "the ability to work from home" and "a compressed work week", gaining the interest of 65% and 51% of employees, respectively. Although not every job can be conducted through telecommuting, there are opportunities available for some employees to perform their job duties, on occasion, from home. These solutions could lead to a small reduction in the number of daily or weekly commutes to the University, lessening the University's carbon footprint.

Employee survey results indicate that improvements to the transit system will also persuade a large percentage of faculty and staff to use alternative transportation. For employees, the length of commute by bus is certainly one of the biggest drawbacks from using the transit system. Several obstacles keep employees from using transit on a regular basis including; schedule demands, having to walk long distances to catch a bus from housing, waiting lengthy periods between buses, and enduring long rides. If transit was improved to; perform on a time frame that reflects what it takes to travel by car, increase the frequency of buses (particularly between the 6am-10am and 4pm-6pm hours), and create/realign bus stops closer to housing, 40%-50% of employees report that they will be likely to use the CDTA or UAlbany shuttle networks. Feelings of insecurity due to the potential for emergencies also hinder bus use among employees. If taxicabs were available to transport employees in case of such an emergency (Guaranteed Ride Home Programs), 37% report that they would be likely to use the service.

Other programs, such as bicycle infrastructure improvements, and alternative transportation-based "rewards" show a high likelihood of success among faculty and staff. Bicycling safety is the *top* concern, out of all transportation issues, with 73% of employees reporting it as a "somewhat" to a "severe" issue. Another proposed option: receiving rewards for using alternative transportation, is popular with a third of UAlbany employees. Further research on the type of rewards that would both entice employees into using alternative modes needs to be conducted to develop a proposal for implementation.

Less-Favored Solutions and Modes

Some alternative transportation modes and proposed solutions were revealed to have a much lower chance of success among employees. While 36% of employees report that "lack of carpooling networks" prevent them from commuting by carpool, only 20%-22% of employees show any significant interest in carpooling programs. Programs to help locate carpoolers or other related services such as; ride-sharing, preferred parking for carpoolers, preferred parking for hybrid of fuel efficient vehicles, van-pooling, or car-sharing all surveyed poorly. A significant increase in the number of commuters who choose to walk to campus appears doubtful as well due to the current housing-pattern. If programs or improvements to promote walking were implemented they would most likely not be successful unless there is a vast increase in the number of employees living closer to campus. This is exemplified by the survey results that "safety while walking" is responsible for 33% of employees not using this mode, with the lion's share (77%), choosing not to walk due to the factor of "distance".

Alternative Solutions and Additional Research Topics

Even as some of our survey results show that there are many commuting decisions that cannot be effected by University policy, opportunities do exist to influence employees' decisions. If assistance was given to help new employees find housing close to campus, or better yet, incentives given for locating, or building housing that is in close proximity to campus, it is likely that, over time, a much higher percentage of employees could decide to locate closer to campus. This type of program, coupled with rewards for using alternative modes, could increase the number of people who regularly commute to campus by foot or bicycle. Additional research, including determining the types of locations to which employees commute by car "on their way to and from work", would also aid in cutting the number of vehicle miles travelled.

Employee Bullet Points

Significant Facts:

- 75% of employees live within 15 miles of campus
- Most employees commute to campus a majority of the year (88% 5 days a week during semester, 70% during summer, 62% over breaks)
- Most employees frequently drive alone (87%). Do so because "most convenient".
- Only 20-22% will likely take part in carpooling programs
- Most employees live too far to walk, many live too far to bike
- 6am – 10am, and 4pm – 6pm are most common commuting periods

Suggested Measures:

- Reduce initial need to commute
    - Increase employees' "ability to work from home"
    - Implement a "compressed work-week" where possible
- Make transit faster & more convenient to use
    - Decrease length of bus trip, closer to that of car
    - Decrease waiting time in between buses particularly during peak travel periods
    - Align bus schedules to match schedules of employees
    - Lessen distance between bus stops and employee housing
    - Create taxi "backup" system for employees in case of emergencies
- Make cycling safer
    - Improve security for cyclists through bike lanes & other measures
- Use incentives
    - Give rewards for using alternative transportation

- Give incentives for choosing, or building, housing close to campus

- Improve information distribution
  - Create education and networking programs for transit, carpooling, bicycling, and walking to campus

STUDENT AND EMPLOYEE COMPARISON

This section will combine the individual preferences, patterns, and favored solutions of both students and employees detailed above, and unite them into a single narrative. Also, comparisons will be made to understand each individual population. Through analysis of the survey data it is evident that there are areas of overlap between these two groups as well as important differences relating to commuting distance, levels of transit use, importance of bicycles, and individualized solutions to the reduction of SOV's.

Response Rate, Representation Level, and General Demographics

Both surveys are largely representative of their respective populations both in size as well as demographics. The response rate is significant for an email survey (15% of students and 29% of employees) and therefore represents a sizable portion of the overall population (7% students, 19% employees). Although females are somewhat overrepresented in this survey compared to the general population, other demographics, such as ethnic and class year/length of employment distributions, are each within one percentage point of the actual population.

Difference in Housing Distance and Centrality of Commuting

Distinctions in housing distance play a key role understanding the student-employee contrast. Students tend to both live closer to campus and consider commuting more often when deciding on housing. 25% of students live within two miles from campus versus 10% of employees. Students most commonly live between 2-5 miles (36%) and employees most commonly live between 5-15 miles (40%). Students' most common travel length for commuting is 11-15 minutes (29%) vs. employees 20-30 minutes (25%). Students were also somewhat more likely to consider commuting when making their original housing decision than were employees, (64% students versus 50% employees) and are more likely to consider commuting when thinking about their next housing selection as well (65% students versus 52% employees).

Comparison of Travel Demands

Both students and employees have heavy commuting demands throughout the year. Each group was found to be most likely to commute to the uptown campus above any other location (91% employees and 90% students). Employees, more than students, are likely to travel to other campuses besides the uptown campus. Both groups also spend the majority of the year commuting to campus (87% of students who took the survey were full-time as well as 89% of employees). The employees who responded to our survey indicate that they commute to campus a considerable portion of the time during the summer (70% "5 days a week or more"). This is in contrast to the student population, where the majority chooses not to take summer classes (24% taking summer classes).

Peak periods of employees' and students' weekly commute generally follow similar patterns. Some slight differences exist in when the populations arrive on campus. The bulk of employees tend to be at work by 10am (92% between 6am–10am), while just over half of students arrive on campus by this time (55%). The most common arrival timeslot for both groups is between 8am-10am, as 35% of students and 50% of employees commute during this range. The most likely departure time from campus for both populations is 4pm to 6pm, which accounts for 69% employees and 31% of students.

Similarities and Differences in Modal Preference

While both groups use the automobile as their mode of choice, employees tend to use a car much more so than students. Not only are employees 30% more likely to use a car, they also are the most likely to drive *between* campuses (89% employees verses 46% students). Carpooling is not used with great frequency by either group. Neither group reports either being a rider or driver more than 20% of the time regularly (*a few times a month* to *daily*). 72% of both populations responded that they are *never* the driver of a carpool.

The usage of CDTA and UAlbany shuttle varies greatly between the two populations. Students responded that they use one of these two systems *a "few times a month"* to "*daily"* 44% and 38% of the time. This compares to the employees results, which indicated that employees use the two modes a *"few times a month"* to "*daily"* just 13% and 7% of the time. Students are also more likely to use these systems for inter-campus commuting, riding the two systems 49% and 43% of the time compared to employees' 11% and 14%. More students choose to walk to work than employees. 22% of students report walking "*a few times a month"* to "*daily"* while only 6% of employees report walking with the same frequency. Out of those who travel between campuses, both employees and students share around the same likelihood of walking: 11% of employees and 14% of students.

Challenges to Alternative Transportation

The "convenience" of driving is the number one and two reasons given by employees and students, respectively, for "being kept from alternative transportation". This convenience likely relates to employees and students' other main reason for driving: the need to "travel from other places to and from work/school", which was the number three reason for each group. Regarding various weaknesses in the alternative transportation system, "infrequent or untimely bus service", "length of trip by bus", and "information distribution on bus schedules and routes" are the three biggest concerns, with between 31%-48% of students and employees reporting these issues as limiting their use of alternative transportation.

The "lack of bicycle lanes" and "bicycle safety" rank as quite significant for both populations and stands as a major deterrent from using this form of alternative transportation for employees and students. Information distribution is perceived as a problem as well, as nearly 75% of both groups reporting that there is a lack of accessible "information on commuting to campus via bicycle." Carpooling tends to be most troubled by the lack of a social network. This issue keeps 36% and 44% of faculty and students from using this method, respectively, and a large majority (79% and 89%) have no knowledge of where to find further information on this subject. Pedestrian concerns are limiting as well: safety issues keep 38% of employees and 33% of students from using alternative transportation; ranking as the 5th most important issue for each group.

Bicycle infrastructure issues, while ranking high for both groups, are substantially more problematic for employees than students. Concerning availability of bike racks, 52% of faculty report this issue as a problem compared with just 31% of students; a twenty point differential between the two groups. The location of bus stops and bus routes is also more problematic for employees than students, as well. While "no runs between home and work" is the 6th most commonly reported answer limiting employees' use of alternative transportation, at 46% of employee responses, it is only the 11th for students, at 29%.

Comparison of Alternative Transportation Solutions

Of all common solutions, those focusing on the transit improvements are among the most promising. Rides being "similar in length to that by car", "higher frequency of buses", "closer bus stops", "more direct service", and "emergency transportation" are all popular with both groups, and are likely to entice 51%, 40%, 38%, 35%, and 37% of employees, and 54%, 58%, 49%, 24%, and 37% of students into riding transit, or using the service if offered. Other improvements are also popular with both groups as well. "Rewards for using alternative transportation" is likely to be used by 46% of students and 34% of employees and "preferred parking for carpoolers" is likely to be used by 34% of students and 22% of employees. Gas prices could influence students and employees to use alternative transportation, if gas prices rose to either $4/gallon or increased at least $1 in a week (40% students and 26-27% employees).

"Free access to all CDTA bus routes" is students' #1 choice for improvements, with 57% of students *very* or *definitely* likely to use the service if available. The program is not received as highly by employees, ranking as their #5 choice, with just 30% *very* or *definitely* likely to use the service. There are other transportation solutions that are more favored by employees. The number one, two, and three most favored alternative transportation improvements ("working from home", a "compressed work-week", and "free taxi-cabs in case of emergency"), were designated only to the employees survey since the ability of the University to implement these programs would only be applicable to that group.

Non-Issues

Other potential solutions or proposed issues did not appeal to either group. Programs focusing on "carpooling", "ride sharing", "preferred parking for hybrid or fuel efficient vehicles", "assistance finding carpool partners", "van-pooling", "car-sharing", "bicycle amenities", and "bike-sharing" are all likely to be used by a quarter or less of employees and students. Features such as "better and larger waiting shelters", "better security", "more comfortable buses", "better ADA accessibility", and a "more appealing look" were not shown to entice a high percentage of people to use mass transit.

Student and Employee Summary

Comparison of student and employee responses show that the top four solutions to reducing SOV use for all groups include transit improvements, bicycle improvements, work place or schedule changes, and pricing changes. Continuing research should focus on how to improve users' understanding of transportation options, how to include suitable rewards for each group, ways to improve the bicycle infrastructure, and realistic methods to upgrade the transit system.

Student-Employee Bullet Points

Common Themes:

- Both groups on campus a large portion of the year (full time status: 87% students, 89% employees)
- Most common departure time is 4pm-6pm (31% of students, 69% of employees)
- Driving is overwhelming modal choice for commute (94% employees, 64% students)
- Carpooling, commuting by bicycle rarely used (4%-17% of time on regular basis)

Joint Concerns:

- Both groups live too far to walk or bike regularly (46%-77%)
- Infrequency of buses, length of trip are biggest transit concerns (31%-48%)

Joint Solutions:

- Favored transit improvements:
    - Faster trips
    - Higher frequency of buses
    - Closer bus stops to housing
    - More direct service

Employee-Student Differences:

- Employees live further away, on average, than students (under two miles: 25% students vs. 10% employees)
- Students peak commute time later than employees (8am-12pm vs. 6am-10am)
- Students more likely to use CDTA and UAlbany Shuttle (~40% vs. ~10%)

Separate Issues:

- Bike safety and infrastructure much greater problem for employees (ex. "bicycle lanes" 73% employees vs. 47% students)

Individualized Solutions:

- Price more of a deterrent and an incentive for students:
    - Gas price increases
    - Alternative transportation rewards
    - Free transit access to all routes

- Solutions most likely to work for employees overall:
    - Telecommuting
    - Compressed work-week
    - Free taxis in case of emergency

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FOCUS GROUP ANALYSIS

BACKGROUND AND DEVELOPMENT OF FOCUS GROUPS

Summary of Survey Findings

The fall 2009 student and employee transportation surveys produced a substantial set of data and findings. Seeking to improve the campus' general transportation system, and reduce its environmental impact due to commuting, the study focused on three main topics: the extent to which respondents use a car to regularly commute to school, the main limitations of alternative transportation systems on campus, and supported solutions among the two survey groups.

The data in both surveys indicates that driving is the dominant form of commuting for employees (73% daily SOV use) and for a large number of students (40% daily SOV use), mainly because of the "convenience" factor. All other modes are far less commonly used, with the exception of the student use of the CDTA and UAlbany shuttles, which is utilized rather frequently. Both surveys express that using transit would require individual sacrifice due to the frequency, length of trip, and availability of routes. The surveys also indicate that people chose not to carpool because there is a lack of social networks to build carpooling relationships. It appears that bicycling does not factor as an option for alternative transportation due to safety concerns. The length of travel prevents many students and employees from walking to campus. While both groups agree on many of the same solutions for transit improvements; certain solutions such as telecommuting and monetary rewards or penalties, appear likely to work best for only one population.

Quantitative Survey Limitations

While the survey covered a wide array of transportation problems and solutions, there are several remaining questions including:

- What kinds of "rewards" would most likely entice employees and faculty into using alternative transportation?
- How exactly can biking be made safer, where are bike lanes most needed, and what kinds of amenities are most desired by respondents?
- Are there other reasons besides "lack of potential carpool partners" that keep students and employees from using carpools?

- What locations do respondents need to "make trips to and from campus", for which their car is more "convenient"?
- What is this "other" that keeps 27% of faculty from using alternative transportation?
- Are there any other alternative transportation problems or solutions that respondents wish to have expressed but were not able to due to the closed answer-system of quantitative surveys?

The Case for Focus Groups

As it is not possible to answer detailed questions through a traditional quantitative method, a qualitative supplement must be included, specifically in the form of open-ended interviews. The most efficient method of an open-ended interview, a method that facilitates obtaining answers from many subjects at a time, and one that allows for deep exploration of a topic, is the focus group. (Spitze, 2010). Originally developed during the late 1930's to counteract the presence of interviewer bias, focus groups often generate greater topic depth because of the non-directive involvement of the moderator in the group and a homogenous environment that takes away pressure to provide answers that are often socially unacceptable (Krueger 2000).

Stakeholder Group Selection

When creating focus groups it is important to produce comfortable homogenous groups of people in order to share experiences and viewpoints. This environment is most likely to promote full discourse of the topic at hand. The first focus group efforts divided the participants into discussion groups by the type of commuter: student, faculty or staff. Students are by far the most populous group on campus. However, not all students share the same commuting patterns and transportation needs, as some students live on campus and some off campus. Accounting for the fact that the student population displays diverse commuting behaviors, the research team created distinct focus groups for off-campus and on-campus students.

Other focus group efforts included dividing the student participants into age-based groups, specifically the off campus group was further split into graduate and undergraduate sections. The role of gender was also considered. Because gender does affect group participation of adolescents into early college age; the research team created a focus group that divided the off-campus undergraduates by gender. Therefore, a total of six focus groups were formed with an average of six stakeholders attending each session. Specifically, the groups were broken down in the following manner: one on-campus undergraduate, one off- campus undergraduate male, one off-campus undergraduate female, one off-campus graduate, one faculty group and one staff group.

Focus Group Question Development

The development of concentrated questions for each focus group was of vital importance in the success of the meeting. The original set of survey questions generally serve as the central component of the meeting, including: how well the University's transportation system functions in general: to what extend the participant uses a car to commute, what the biggest limitations to using alternative transportation are, and what solutions would be most likely to entice participants into taking various alternative transportation modes. The goal of the group interviews is to answer as many questions as possible, such as: the convenience issue, bike safety; and determining any topics that were not available for selection in the survey.

Other questions can also be asked that relate to specific patterns or characteristics that affect the groups' transportation choices. For example, as faculty and upper level administrative staff generally have the highest income, they are most able to afford hybrids. Similarly, as students are most affected by pricing changes, it is useful to include questions on the threshold of affordability for parking and other fees for these groups. The general outline for faculty and staff focus group discussions includes: parking, carpooling, preferred parking, bus use, bicycle use, and other related ideas. For students the list consists of: car use, parking, bus use, carpooling, bicycle use, end-of-year shuttles, and improved life on campus. The full list of focus group questions is included in the appendix.

STUDENT FINDINGS

The information provided below reflects the seventeen students who attended the four student-oriented, transportation focus groups held between March 15th and March 24th, 2010. Data should be viewed as a complete unit rather than compared individually, as some questions were only given to certain student groups.

Automobile Use and Parking

The first set of questions discussed in many of the student focus groups related to automobile use and functionality of the overall system. Many students (8 out of 17) reported using their car to commute to campus regularly. This rate is similar to that which is found in the survey (40% daily). Of those that regularly commuted by car, (mostly female and male off-campus undergraduates) the consensus was that the system works reasonably well. These two groups gave the examples of parking being adequate in Empire Commons because of designated spaces; and the University having low overall parking density compared to some colleges, such as Hudson Valley, where space can "only be found on the grass".

Some participants felt that the parking situation did not work very well. This view is more reflective of the beliefs expressed within the survey, where students listed parking as the number one problem on campus. Students depicted parking as a general problem ("very congested", "over capacity"); difficult in particular locations or times of day ("Colonial...always full during the night", "parking…particularly bad on Indian", "can only be found early in the day"); and spatially limiting ("too far away from school", "scattered", "inconvenient"). Additional concerns expressed by some students as "major threats" include: vehicle safety both on and off the campus, the potential for vandalism downtown, and the high number of reckless drivers on the uptown campus.

Nearly every student group suggested various ways to improve the driving experience. At least two groups mentioned the idea of a parking garage, (one of the ideas shared with employees), and others proposed preferential parking that favors TA's, RA's, 5-Quad residents, or is based on a credit/year system. Still others advocated for the importance of improved signage: "to better designate faculty spots so as to prevent tickets", and "painting letter and numbered spots on the ground…to find your parking spot".

Single Occupancy Vehicle Reduction

While many students indicate that it is "tolerable" and sometimes "preferable" not to use a car, the general belief is that there are many occasions when students feel that they need to use a car. Reasons why include: "Amtrak is very expensive", "need cars during breaks", "car is the only way to get to Westgate Plaza, Colonie, and Crossgates conveniently". Several focus group members suggested methods to discourage single occupancy driving, such as raising parking fees from $20/year to $100 or more, as long as the money "goes towards maintenance", and reducing parking availability ("a lottery", "difficulty…would make them consider carpooling").

Transit

Nearly half of students in the focus groups reported regularly using the bus to commute to campus, which is slightly higher than the survey average. Students in each group reported enjoying a variety of aspects offered by bus ridership; including the ease of scheduling and routes ("bus works when you have a set schedule and can mesh it with the bus"). The group showed a preference for taking the bus as it eliminates the need to: park, is safer, eliminates the concerns of driving during poor weather conditions, and has a lower cost. Participants also reported having no stigma attached to bus use primarily because of "the large population size".

Despite acknowledging that there are times when riding the bus is more convenient, students listed several explanations why they choose not to ride the bus. Many of the comments repeated what was already

known from the survey, such as: infrequency of routes, time inconsistency, length of trip, wrong hours available, unavailability due to distance, and confusion in schedules. Several bus limitations not indicated through the survey were discovered during the focus groups such as: buses being "too full", distrust in schedule reliability during "special occasions such as test periods or bad weather", and the feeling of "loss of control" versus car ownership.

Focus group members also proposed or expressed interest in a variety of transit improvements including: better signage/advertising of schedules, free bus routes, increased frequency and a greater carrying capacity during peak periods (particularly late Thursday and Friday), improved safety and order at bus shelters; as well as shuttle services for Wal-Mart, local malls, large social events, other transportation hubs, and major cities during summer or holiday periods. Not included in the survey was one suggestion that could be influential in getting new students to begin using the bus early in their college career. The suggestion was that a "beginning of the year bus education program" should be developed. As one participant described the idea:

> "The best way wouldn't be reading about it. Students need to use the bus to know it. (It) might be best to have an orientation for new students (where) an RA can explain it to them…Students can be encouraged to travel in groups."

Other transit-related solutions that were proposed by the researchers were met with varying responses. One such proposal, real-time bus schedule updates using GPS, available on smartphones or mounted in central locations, was very popular with all student groups. Suggestions such as hybrid buses, and buses with internet, received only mixed support.

Carpooling

Although students reported being only moderately interested in carpooling in many survey questions, focus group members were largely supportive of the concept. Focus group participants stressed that in order for carpooling to be successful, a system must be created that exhibits certain standards. A model system suggested by participants would include a well-organized registration system that has the ability to combine people with like interests, while defining specified standards for involvement. Participants prefer this system to be online. The system would offer a general level of convenience, offering waivers and potential rewards or stipends for participation.

The focus group participants also discussed their current participation in carpools. Students from the male group described "regularly carpooling with fellow classmates to class, the mall, and shopping", preferring it "when taking long trips or attending social events". Males exclaimed that carpooling is usually "a good

time". Students from the other groups frequently take part in "ride-shares with family, friends, or Craigslist members", and one female participant mentioned that it is a good "campus community-building and assimilation tool". Several members reported notable limitations to carpooling, however, including flexibility ("problems arise when timing is off and carpoolers have to wait"), and safety ("carpooling is a safety issue", "weary of strangers"). Overall, student focus group members were generally not as dissuaded from using the system, as were faculty and staff.

Reflecting the survey results, the students in the focus group had a rather mixed opinion on car sharing, short-term rentals, and "Zip Cars" programs. The ideas were exclaimed to be "great ideas" but possibly "too expensive". Others expressed the desire of "owning a car [so one knows] how it is being driven". The concept of subsidized hybrids rose "affordability" concerns. Additionally, although members are generally in favor of preferred parking for carpoolers ("a good idea"), they are largely unsupportive of preferred parking for hybrids or high-mileage vehicles ("unfair", "privileged").

Cycling

As depicted in the survey results, few student focus group members reported regularly biking to campus. All four groups listed a variety of reasons why they generally choose not to bike. While many reasons listed were similar to those in the survey, the focus groups gave students the chance to provide specific details on the most problematic areas. Respondents reported that: "biking on Washington Avenue has been frightening", "the roads to bike on Western and Washington are not very safe for bikers", and that they are also "hesitant to bike around downtown Albany/Quail Street area, because of safety". Members described other bike-related travel concerns as well, including: narrow or unavailable lanes, bicycle-use not allowed on certain roads, low bicycle storage facilities on campus and some buses, and weather limitations.

Contrary to the student survey, focus group students seemed interested in improving the bicycle situation. Solutions to improve safety and lane concerns included: additional lane separation ("sharrows"), wider bike lanes ("about five feet on each side of the street"), and the elimination of "physical barriers or rails that confine bikers". The participants also would like to see specific, mapped-out routes though the "state office campus", "Western", and "safer neighborhood streets". Other suggested improvements include an education campaign where students are instructed on "bike rules and safety", amenities such as safe bicycle storage near the podium, showers, and easy connections to transit ("large heated bus stops", "park and ride"). Although participants are generally interested in a bike share ("good to get around campus"), concerns were expressed such as "program responsibility" and "liability".

Other Solutions

Focus group members are interested in several other programs that would eliminate the need to commute. Programs that improve quality of life on campus: such as entertainment (movie theater, pool hall, or bar), dining options (on campus grocery store), and increased campus housing (particularly for graduate students) were all seen as solutions. Student participants also noted that there needed to be pedestrian improvements within the city (concern with safety of downtown neighborhoods such as Washington Avenue and Quail). The group offered a variety of suggestions for potential rewards to promote alternative transportation, such as food certificates and podium money, but expressed caution that certain times of day should not be included as the potential for abuse is high.

FACULTY & STAFF FINDINGS

Nineteen faculty and staff members attended the two focus group meetings held on March 17th and 19th 2010. Similar to the format for the reporting of the employee survey, the similarities of the faculty and staff will be discussed, with attention being brought to the occurrences when faculty and staff have opposing opinions.

Parking on Campus

The faculty and staff survey indicated that a large majority of the population use a SOV for commuting purposes. To dive a little deeper into the reasons why the automobile is so prevalent, the opening questions for both faculty and staff centered around the driving experience on campus and their opinions about parking. Although faculty reported less difficulty parking on the uptown campus ("finding parking on campus is not difficult"), the feeling was not shared by staff. Staff reported many problems during the discussion of parking on campus. Of the complaints expressed, those most echoed include: overall parking availability during "peak hours" and the "proximate" parking at the Uptown campus. Other issues include: problems with "CESTM", and trouble parking at the Downtown campus after 9am. There were also concerns that those with special needs weren't being serviced appropriately in certain areas like the "low handicapped spaces in athletic facilities". The overall maintenance of the parking grounds is also a concern as there were complaints about broken meters and poor snow removal. Faculty were much more concerned with visitors lot problems ("confusing system", lack of "vending machines"), than were staff. Staff was the only critic of administrative response to problems ("appeals are not handled", "changes in parking regulations without real notification").

To improve upon this system, the two groups suggested three techniques: a parking garage both Uptown and in CESTM; "continuous shuttle service from parking lots", and parking restrictions for on-campus

students. One solution introduced strictly for these focus groups was "valet parking". The concept was largely unsupported by both groups with concerns on "cost", "hours of operation", and potential for "damage" or "breaches of privacy".

Single Occupancy Vehicle Reduction

Some of the most informative discourse arose during the segment on barriers to alternative transportation and how to decrease SOV use. "Convenience" was indicated as the overwhelming explanation why the respondents were not using alternative transportation. The universality of this concern was displayed when one staff member mentioned the need to have "daycare pickup and flexibility". This comment was resonated by many in the room, as it provoked many to nod their heads in agreement. A high percentage of UAlbany employee have school-age or younger children. The ability to reach the child at a moment's notice seemed to be a core sentiment in the room.

Nearly as significant an obstacle as children-access is the admission in the faculty group, that respondents prefer to drive alone because "private driving gives a sense of anonymity and can be a personal time". This factor directly impacts the rate of carpooling as commuters appear to enjoy this time by themselves. The direct social setting which arises with carpooling may be one of the reasons, beyond the "lack of knowing a potential carpooler", that employees choose not to carpool.

Both groups indicate that other programs/policies could alter commuting behavior. For example, certain carbon reduction methods, such as programs in which commuters can purchase hybrids and other high mileage cars at subsidized rates, tested well during the focus groups. Other programs, such as incentives in the form of giving greater access to environmentally friendly SOVs; such as preferred parking for hybrids, or making parking less available to all, did not test well due to equity concerns.

Transit

According to the survey, both groups seldom use the bus. To explore why employee bus usage is so infrequent, questions were asked about: the low rate of use, the limitations of the transit system, and if any changes could be made to the system that would increase the likelihood of using transit. Only the faculty group explored these issues in depth. The faculty participants pointed out several benefits to using the bus, such as: the "anonymity", that it can be "personal time", the "convenience between the two campuses", and the cost savings due to "free service". The faculty participants also highlighted many limitations to the service that echo the student response. These limitations include: the inconvenient times ("can't leave past 4:30"), the issue of full buses, the length of the trip or the number of transfers ("(the bus) make(s) too many

stops to be convenient enough to use"), security issues, and the cost ("expensive to take Northway Express"). One pattern from the employee survey that was dissimilar from the student response was a concern with the "lack of routes" currently offered by the bus services. The participants noted that this problem was magnified for those who live northwest or south of the campus as cross-town routes are limited.

The participants were interested in certain improvements that also tested well during the survey effort. Both faculty and staff support a higher frequency of buses ("quicker access to Central Avenue, Colonie"), and free routes ("free bus passes on all routes would definitely be an incentive and have high ridership"). Other proposed solutions that had a mixed or low response rate include having buses with "internet access", and "hybrid buses". It was observed that the focus group participants were less likely to come up with transit improvements without a "primer"; a list of ideas similar to the transit solutions that were offered in the survey. In particular, faculty was found to be less likely to suggest improvements to the transit system, and may not have been as supportive of actual solutions as was indicated in the survey.

Carpooling

Based on the survey results, one would be led to believe that the lack of carpool networks is the primary reason behind the irregularity of carpooling by employees. Several additional reasons were discovered in the focus groups including: "having to go out of the way to pickup/drop-off passengers", "having to count on regularity with a schedule that is "not set in stone", and not wanting to sacrifice "quiet time alone" in the car. This additional information provides a detailed view into the differences that participants highlight between carpooling and driving alone.

Solutions to the carpooling situation were mixed. While a few staff members indicate that they support preferred parking for carpoolers, others regard it as a potential source for inequity among the campus community because of potential family or disability restrictions. Both groups report that in order for a system to work, the system would need to have among other items: cooperation from managers, a "credit" system, an allocated drop-off area, and a significant education program.

Cycling

In contrast to the survey results, neither faculty nor staff emphasize bicycling as a top objective in improving the University's transportation system. Both groups briefly mentioned a small number of benefits that could be made to the system including the "continued inclusion of bike racks on buses", and completing the improvements to "perimeter biking" (The Purple Path). Far fewer problems were listed, although "safety" and "weather" were discussed. Both groups did offer several of the same suggestions for

improvements as the student focus group, such as: “designated lanes” and “routes”, a “need for education about legal riding on campus”, and the addition of bicycle “amenities”. The faculty and staff groups took contrasting positions when discussing a “bike share” program. Staff typically agreed with the need for a “bike share”, while faculty tended to oppose the idea.

Pedestrian Concerns

Faculty and staff focus groups briefly touched on pedestrian concerns and potential improvements. Staff pedestrian concerns included downtown and uptown safety issues and maintenance issues of ice and sidewalks during the winter. Faculty concerns centered more on the car-pedestrian separation (“pedestrians have to use the same road as cars with no sidewalk in front of Arts and Sciences”) and “access” to locations such as CESTM and the Health Center.

Other Solutions

One of the most powerful proposals that came out of the two meetings was the need to expand childcare services on campus, so that staff, in particular, could use the bus or carpool. Currently childcare is “very limited and tends to favor children of students”, indicated several staff focus group members. Similar to the survey, staff also reasserted their interest in telecommuting and a condensed work-week, although VPN, access point issues, and “top-down support” would have to be addressed for successful implementation. Staff also had several specific ideas for alternative transportation rewards, including: discounted or free bicycles, comprehensive fee discounts for logging high mileage on bicycles, and gift certificates for using transit.

SUMMARY

Focus groups are powerful data collection instruments that can serve both as independent objects, or as supplements to quantitative surveys. In general, the focus group results followed the patterns indicated in the survey. However, a number of transportation improvements were suggested by participants throughout the course of these meetings including implementing: daycare services on-campus, transportation rewards, on-campus graduate housing, dormitory-led bus-education programs, real-time bus tracking, and expanded on-campus entertainment and dining options. Complex issues were also discussed such as the social experience of carpooling and the need for personal/alone time. Through the continued research of these issues, along with the implementation of the focus group and survey suggestions, transportation on campus will continue to become a safer and better functioning system.

FOCUS GROUP BULLET POINTS

- The Focus Groups addressed questions that still remained after the surveys on topics such as: parking, commuting, SOV reduction, mass transit services, carpooling, biking, and walking.
- Main points taken from the faculty/staff focus groups include:
    - Faculty/staff are generally positive about current parking options at Uptown campus.
        - Peak hour parking is a concern at Uptown
        - Parking at Downtown campus is a concern after 9am
    - Solutions to parking concerns by faculty/staff included a parking garage, parking shuttle, and student parking restrictions.
        - Valet parking, additional costs for parking, preferred parking for certain vehicles all disliked by faculty/staff.
    - Bus service is unavailable in certain locations, inconvenient, often full, and has security concerns.
        - Northway Express option is considered to be "expensive".
    - Improvement to bus service should include:
        - Higher frequency, free routes (advertise).
        - Internet on buses and hybrid buses didn't test well in terms of lowering SOV use
    - Carpooling efforts must include more incentives if it is to outweigh the negatives (loss of "alone time", inconvenient, less dependable)
    - Biking is not as important of a concern to faculty/staff as indicated on survey.
    - General improvements offered included: telecommuting, improved access to daycare on campus, rewards for transportation behavior, rail.
- Main points taken from the student focus groups include:
    - Students have parking concerns at Uptown Campus.
    - Suggestions to improvement parking include: oarking garage, better signage, preferential parking.
        - Cost and convenience major disincentives to using alternative transportation.
    - Bus service generally liked.
        - Problems listed: too many stops, frequency, consistency, schedule confusion, bus service doesn't exist where students live, buses are too full.
        - Improvement offered: Updates available by phone, better signage, better service to certain locations (mall, train station, airport, etc), improve safety at bus stops.
        - Internet on bus, rewards, and hybrid buses mixed reception by students.
    - The idea of carpooling is liked by students although flexibility, safety, logistical concerns were expressed.
        - Ideas to improve carpooling include: website, rewards, and standards.
        - Preferred parking, car sharing, and subsidized hybrids didn't test well.

- Biking improvements offered: additional storage, racks on all CDTA and Ushuttles, better roads for biking including bike lanes, bike maps, and education campaigns.
    - Reasons why students don't bike: weather, lack of amenities (storage, showers), location of campus in relation to home.
- Additional suggestions: offer more on-campus entertainment, shopping options, graduate housing, improve safety around neighborhoods for walking and biking.

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SUGGESTIONS AND RECOMMENDATIONS FOR FUTURE RESEARCH and POLICY

The research team set out to accomplish two distinctive goals during this project. The first goal is to provide information that can be used to determine what type of transportation strategies may assist UAlbany and the Harriman Campus in their efforts to decrease SOV use and VMT. The second goal is to provide a framework for transportation studies. Below are suggestions for future analyses. Our observations are also related to the findings within the recently released 2010 Transportation Cooperative Research Program's Chapter 19; *Employer and Institutional TDM Strategies.*

SUGGESTIONS FOR FUTURE RESEARCH

Recognizing that the transportation issues that exist at UAlbany and the Harriman Campus are not unique to the Capital Region, this analysis hopes to spark additional interest throughout the state and country to utilize similar techniques and develop improved policies that can provide better transportation options while advancing environmental sustainability. Throughout our research process, the team encountered some challenges due to the design of the study. The research team was also challenged with issues relating to the data that was available, in particular how that data was being administered. The suggestions are provided by the category in which we encountered the issue. It is hoped that research efforts will seek to remedy these issues.

GIS Suggestions

One of the desired outcomes of the GIS study was to compare the 2008 and 2009 permit data to distinguish any shifts that have occurred between the years. During the data analysis phase, it was discovered that there was a large decline in permits distributed in 2009 compared to 2008. Upon further research it was determined that the drop in permits could not be adequately explained by the decrease in enrollment and staff and was most likely due to the reliability of the 2009 data. As a result, the research team was not able to conduct a longitudinal comparison. A primary suggestion for future research for the university is examine the way data is collected, explore historical trends and design a system that formats permit data in a way that allows for year to year comparisons.

Specifically the permit data collection system must:

- Provide a baseline of the current population with accurate data
- Allow for continuity of data formatting from year to year
    - Allow updating of data to allow for changes in commuter classification (i.e. faculty to staff, student to staff)
    - Flag households where multiple vehicles are registered to one commuter
    - Format should allow:
        - Breakdown by type of commuter
        - Breakdown data by type of vehicle to allow for a fleet mix study
- Student address database must include the primary local address based on residence, not work address

GPS Analysis Suggestions

During the process of developing a methodology for conducting an on-time performance analysis, the literature review of the best practices of carrying out a handheld GPS based on-time performance analysis, revealed several lessons. The most prominent being that on-time performance analyses conducting ride checks with handheld GPS units is not efficient and is a very expensive and time intensive process. The fiscal and time efficiency of on-time performance studies could be greatly improved if transit agencies made use of an automated vehicle location (AVL) system. The research team stresses the importance of AVL systems to local transit providers. By lobbying for these systems, which can range in price from a costly venture for a large transit provider to an inexpensive option such as the iTrack model for small transit companies, the research can have greater depth while being more efficient.

Survey and Focus Group Analysis Suggestions

The research team was able to develop a series of comprehensive surveys that provided many answers to our questions regarding the commuting population's behavior. The following suggestions focus on improvements that could be made to future survey and focus group projects.

After completing the survey procedure, we found that some questions should be asked that were not. It was also discovered that some of our questions could be worded in a more effective manner. The suggested changes in language that should be applied to future survey questions are listed below:

- Change in language used to designate strength of belief (Questions: 13, 17 for students; Questions: 10, 14 for employees)

- Suggestion includes renaming the categories of "likelihood" such as "definitely would not", "not very likely" etc. We found that the "very likely" and the "definitely would" are too similar in “meaning” in the spectrum of likelihood, while the "as likely as not" seems very far away from the "very likely"

- Add "do not work that day" category to Question 3 and 4 to employee survey
  - This change will allow people to have an answer to the days they don’t commute to campus. Without this option, participants were unable to answer the start and end time of their commute.
- Move “method of commute” and “length of commute” to basic information question section asked on the survey (for future focus group separation)
  - The “basic information” section would have been more useful if we asked for the participant to indicate the method of transportation that they are currently employing to reach campus and the length of their current commute. These questions would have allowed the team to develop focus groups split by the type of mode, or the length of the commute.

The focus group efforts provided additional information that contributed supplementary detail into our understanding of transportation decisions. Again, the research team was able to determine that there could be improvements to the process that might assist future studies. These improvements include:

- Begin the recruitment of focus group participants at least 1 month in advance of the meeting
  - The research team found difficulty in committing certain populations, including; male undergraduates, faculty, and on-campus students, to take part in the focus groups.
- The research team should think creatively to include any member on the campus community rather than just relying on survey respondents.
  - Great difficulty was encountered finding participants because the research team limited the focus groups to only allow for participants of the survey process. The research team would suggest allowing any member of the campus community to participate in the focus group process and would look to stakeholder groups (i.e. classes, sports teams, fraternities/sororities) as potential partners.

RECOMMENDATIONS FOR IMPROVING UALBANY AND HARRIMAN CAMPUS TRANSPORTATION OPTIONS

The results of the extensive examination of commuting behavior confirms the perception that the single occupancy vehicle is the most relied upon form of transportation for the UAlbany and Harriman Campus commuting populations. This study is driven by a desire to explore collaborative opportunities to promote

alternative methods of transportation and reduce VMT. The GIS analysis illustrated potential sources of carpooling and vanpooling opportunities. It is recommended that a point person is identified at OGS to work on marketing opportunities for the Harriman Campus with representatives at UAlbany in order to capitalize on the information gathered in this study.

Green House Gas Emissions Analysis

With the results of our survey, which highlights the percentage of our commuting population using a specific pattern (i.e. SOV use 1-5 days a week, uses public transportation, etc.), our team was able to create estimates of our total GHG emissions based on the total size of the UAlbany population. The following high and low end estimates were made to predict the metric tons of CO2 released, and the gallons of gas consumed due to commuting in SOVs. The figures rely on a miles per gallon (MPG) standard of 22.75 MPG which is a blended average based on the findings published by the Environmental Protection Agency, which uses a 20.3 MPG standard (Environmental Protection Agency, 2010), and the National Highway Traffic Safety Administration, which uses a 25.2MPG standard based on the "average fuel economy for a car sold in 2005" (National Highway Traffic Safety Administration, 2010). Our results are illustrated in Table 7-1 below.

Table 7-1: UAlbany Commuting Population Emissions Estimates

	Commuting Miles Traveled (CMT)		**Gallons of gas*** **		**MTCO2**** **	
2008	Low End*	High End**	Low End	High End	Low End	High End
Faculty	1,806,750	4,405,500	79,418	193,648	704	1,718
Staff	7,667,738	18,696,675	337,043	821,832	2,990	7,290
Students	8,888,400	11,010,300	390,699	483,969	3,465	4,293
	18,362,888	34,112,475	807,160	1,499,449	7,160	13,300
2009	Low End*	High End**	Low End	High End	Low End	High End
Faculty	1,681,920	4,101,120	73,931	180,269	656	1,599
Staff	7,270,800	17,728,800	319,596	779,288	2,835	6,912
Students	8,923,128	11,067,600	392,225	486,488	3,479	4,315
	17,875,848	32,897,520	785,752	1,446,045	6,970	12,826

* Low end uses 15 miles, 73% sov rate for faculty and staff, students use 10 mile, 39% sov rate)

** High end uses 30 miles, 89% sov rate for faculty and staff, students use 10 mile, 50% sov rate)

*** Gallons of gas = VMT/average MPG (22.75)

**** Metric tons CO2 = gallons of gas * 8.87 /1000

If the University was able to implement policies and programs that successfully reduced the number of SOV's, the environmental impact would be lessened. For comparison, we considered how much MTCO2

would decrease if a 2%, 5%, or 10% reduction in commuting miles traveled (CMT) was produced. At 2%, our low end estimates indicate that the metric tons of carbon dioxide (MTCO2) would reduce from 7,160 to 7, 017 annually. If the University was to set a 5% goal, the low end estimate would decrease by 358 MTCO2 (from 7,160 to 6,802). An even more ambitious goal of a 10% decrease would result in the elimination of 716 MTCO2 from being released into the atmosphere annually. As shown in Table 7-2, high end estimates depict an even more compelling story of the benefits the environment would receive if the University was to create successful policies to decrease GHG emissions due to SOV use. Reductions in total MTCO2 are indicated in the parentheses.

Table 7-2: MTCO2 Produced Under Reduction Scenarios

2008	2% Low	2% High	5% Low	5% High	10% Low	10% High
Faculty	690	1,682	669	1,631	634	1,545
Staff	2,930	7,145	2,841	6,926	2,691	6,562
Students	3,396	4,206	3,292	4,078	3,119	3,863
Total	7,017	13,035	6,802	12,636	6,444	11,971
	(143)	(358)	(716)	(265)	(664)	(1329)

2009	2% Low	2% High	5% Low	5% High	10% Low	10% High
Faculty	643	1,568	623	1,520	590	1,440
Staff	2,778	6,774	2,693	6,567	2,552	6,221
Students	3,409	4,229	3,305	4,099	3,131	3,884
Total	6,831	12,571	6,622	12,186	6,273	11,544
	(139)	(348)	(697)	(255)	(642)	(1282)

Transportation Policy Already Implemented

The University has continued to take an active role in promoting alternative transportation during our research period. The team would like to point out the steps that have already been taken by the University in the last year that should play a role in reducing VMT.

- Beginning in the fall of 2010, universal access to the CDTA system will be offered to the UAlbany community.
    - Covers Albany, Schenectady, Rensselaer, and Saratoga County.
- Participating in IPool2.
    - Currently 28 members with 14 active.
- Participating in the vanpool program
    - No vanpools have been set up to date.

- A lunch and learn on the carpool and vanpooling program was held at the University in May and another one will be held this September.
- Additionally, information about the programs were handed out during Earth Day (April 22nd) and a sustainable transportation day in October of 2009

- Hired Zipride to coordinate a ride share program.
  - Currently 9 rides posted.
- In the fall 2010, rolling out *Connect by Hertz*.
  - a car share program coordinated by Hertz

Additionally, members of the research team have participated in outreach activities to inform other institutions about the research methods used in this study. Specifically, presentations were given at the 2009 Transportation Research Board Joint Summer Meeting in Seattle and the Northeast Campus Sustainability Consortium conference held at the University of Vermont in October 2009 and another will be given at the Association for the Advancement of Sustainability in Higher Education conference this upcoming October.

RECOMMENDATIONS FOR FUTURE POLICY

While significant steps are already being taken to reduce VMT and increase transportation options at UAlbany, our team has a series of additional recommendations based on the results of our study. Our recommendations include:

- Improve UAlbany coordination of marketing programs:
  - Pair information on alternative transportation with information about parking, send information in the annual email notice to renew parking permits.
  - Promote new universal access to CDTA routes by UAlbany community
    - Obtain usage data from CDTA to analyze usage to improve coordination of marketing.
- Research the participants that are already using IPool2 to analyze their usage and location.
- Market IPool2 more aggressively to off-campus student commuters.
- Identify potential rewards, both monetary and nonmonetary, that can be administered to provide incentives to use alternative transportation.
- Use automated equipment to record on-time schedule of buses.
- Continue to re-administer the survey on a regular basis to assess changes in commuting patterns.
- Look into partnership opportunities beyond Harriman Campus (i.e. Patroon Creek, NanoTech Complex).
- Explore options to increase the price of parking to act as a deterrent for SOV use.

- Examine ways data is collected on parking permits and develop process for better database collection.
- Consider adding a fuel efficient/hybrid vehicle category as a separate color coded parking permit.
- Explore whether it is feasible to register employees and students up for carpooling and ridesharing programs when applying for parking permits.
- Promote alternative work arrangements.
    - Telecommuting
    - Compressed work-week
- Expand on the Guaranteed Ride Home program offered by CDTA.
    - Offer free rides from campus in case of emergency.

RELATING OUR FINDINGS TO THE TCRP REPORT: *Employer and Institutional TDM Strategies*

Lastly, the Transportation Cooperative Research Program (TCRP), sponsored by the Federal Transit Administration, has recently released Chapter 19 of an ongoing report titled *Travelers Response to Transportation System Changes*. The reports focus is on "TDM", transportation demand management or travel demand management. TDM can be defined as "a process that can encompass a variety of measures intended to influence travel choice" (Transportation Research Board, 2010). Elaborating further, TDM "seeks to manage the demand for travel by SOV, rather than catering for that demand (supply-side strategies), or managing the road system" (Ison & Rye, 2008). Chapter 19, titled, *Employer and Institutional TDM Strategies*, offers a collection of "82 cases used to evaluate the importance of the categories of TDM strategies, and even, to some degree, of particular strategies" (Transportation Research Board, 2010, p. 3). The TCRP report creates a comprehensive and accessible source to compare the results of specific policy actions that have been implemented throughout the country, highlighting the response and change of behavior that has been experienced due to modifications in policy. The TCRP report warns that "the report is not intended for use as a substitute for regional or project-specific travel demand evaluations… or other independent surveys and analyses" (Transportation Research Board, 2010). Having access to this comprehensive report, along with results of our survey and analyses, allows the research team to reevaluate our recommendations based on local conditions and countrywide successes.

Our research efforts entailed clearly defining the existing transit options, the on-time performance of a portion of the alternative transportation offered, the geographic availability of the transit in relation to the commuting base, and whether the alternative transportation options were known by the general public of commuters. This information allows us to determine if the Capital Region has a "good" performing, "moderate" performing, or "poor" performing public transit system. The TCRP report defines a series of

analytical considerations that must be taken into account before comparing the successes of various transportation strategies in different environments. The report emphasizes how important it is to account for setting and context when measuring the success of transit strategies. The authors make mention that the performance of the transit system must be taken into account because, "the effects of some strategies may be much more significant in an environment where there is a good transit service" (Transportation Research Board, 2010, p. 7). Relating this to our situation in the Capital Region, the reliability and convenience of the existing transit option, such as CDTA and the commuter bus systems, must continue to be improved if other strategies that incentivizes or dis-incentivize SOV use are expected to be able to adjust commuter behavior.

An additional analytical consideration takes into account how difficult it can be to create workable data. The TCRP report observes that "available data for conducting these analyses are seriously limited" (Transportation Research Board, 2010, p. 7). This challenge is one that struck the GIS section of this research as the permit data was not collected to be used for comparative measures. The TCRP report highlights that, unfortunately, in many transportation studies "the data collection methods… are often suspect, as in the aggregate format" (Transportation Research Board, 2010, p. 7). The report makes it clear that our difficulties working with the available data is not unusual, and greater effort needs to be shown in the data collection efforts.

According to the TCRP report, the level of vehicle-trip reduction (VTR) that should be expected from any additional TDM strategy is dependent on the current performance of transit services. The report proposes that "examples of effective TDM programs may be found in all types of environments… based on their 82 cases, the better-performing employer and institution programs were located near good transit service" (Transportation Research Board, 2010, p. 12). The categories and different examples of TDM strategies are listed below:

- Employer or Institutional Support Actions:
    - Transportation Coordinators, Transportation Management Association (TMA), On-Site Transit Information and Pass Sales, Rideshare Matching Services, Guaranteed Ride Home (GRH), Preferential Parking, Bicycle Storage, Lockers, and Changing Facilities, Shuttle Bus Services, Contract Transit Service, Vanpool Formation Assistance/Cost Sharing, Use of Company Vehicles, Bicycle Loan Programs.
- Financial Incentives or Disincentives
    - Transit Subsidies, Vanpool Subsidies, In-Kind Incentives, Parking Supply and Pricing.
- Alternative Work Arrangements
    - Flexible Work Hours, Staggered Work Hours, Compressed Work Week, Telecommuting.

A main focus of our recommendations is the role that the University and other large employers who choose to participate, must take to support the goal of reducing vehicle use. The support measures should "serve to raise awareness, provide information, remove impediments, and encourage use of alternative transportation" (Transportation Research Board, 2010, p. 3). The report describes the use of support actions as "by far the most commonly-applied strategies, providing a necessary- but not alone sufficient-ingredient for TDM program success" (Transportation Research Board, 2010, p. 12). The document offers an average empirically based estimate of site-specific vehicle trip reduction impacts for a full-scale employer support program based on the programs that were reviewed. The report indicates that the strongest employer support program alone would only lead to a "4 to 5 percent VTR" (Transportation Research Board, 2010, p. 12). The research clearly states that this average is "drawn from programs that are exemplary more often than not". Low or medium performing programs would most likely have a lesser effect. The employer support program should not be seen as a stand-alone program, as the real test of an employer support program is usually how well it acts as a crucial complement to other physical strategies.

A method of VMT reduction that has seen success within the TCRP case studies is the use of financial incentives and or disincentives to elicit change. Implementing these strategies could be challenging endeavors at the University at Albany due to existing constraints such as the union contracts that stipulate parking provisions. Parking fees and restricted parking areas have been found to be one of the most successful policies to promote a reduction in SOV use. If committed to the goal of reducing VMT, the University should find a way to work with the unions to promote the reduction of VMT for the benefit of employees and the University. The TCRP report indicates that parking fee strategies and restricted parking can successfully provoke large scale change in commuting behavior if administered properly. This upcoming academic year, UAlbany students and Union members are charged only $25 for an annual parking permit. This fee is not large enough to serve as a deterrent to SOV use. According to the TCRP report, parking fees and restricted parking each fulfilled a significant role in reducing VMT at sites that institute the policies. Of the 82 cases, sites where parking supply was restricted "averaged a 20.3% VTR" (vehicle trip reduction). The VTR increased to "27.9% if transportation services were also provided in addition to the restricted parking" (Transportation Research Board, 2010, p. 30). The sites that implemented new parking pricing, rather than restricted parking, and included new transportation services, saw a "31.4% VTR" (Transportation Research Board, 2010, p. 30). Based on the shortage of any real parking deterrents, along with the results highlighted in the TCRP report; it is our belief that an alteration of current parking policies could help promote alternative transportation and lower carbon emissions at the University much more than the aggressive marketing of alternative transportation opportunities.

Participants of the UAlbany survey highlighted that if they were to make the choice to use alternative transportation, there would have to be a program that offered a ride home in case of an emergency. The

TCRP report also found "in numerous surveys that having the assurance of a back-up mode that can be used in the event of a personal emergency or unplanned schedule change can be the "deal clincher" in getting an employee to switch from driving alone" (Transportation Research Board, 2010, p. 23). Measuring the importance of a support program like the Guaranteed Ride Home (GRH) program was found to be difficult in the TCRP case studies due to little "before and after data and the fact the GRH was usually implemented concurrently with other incentive programs" (p. 23). The TCRP report found that in some cases there is "no reliable evidence that the GRH program directly increases alternative mode use… as analysis of commute behavior before and after the demonstration (GRH was instituted) indicated that overall behavior remained virtually unchanged". This result was supported by "surveys that revealed a decrease of less than 1% in SOV use and a 1% increase in High Occupancy Vehicle and transit use" (p. 23). This suggests that as with our UAlbany survey which highlighted a desire to have a GRH program, actual program success in lowering SOV use is either inconsequential or immeasurable.

Alternative work arrangements are strategies that may serve the goal to reducing VMT by University at Albany staff and faculty. Telecommuting and compressed work weeks can both be successful methods to decrease the VMT, but that may come at a cost of supporting other forms of transportation. Telecommuting was shown in the TCRP research to conflict with "the modal shift objectives of transportation services" (Transportation Research Board, 2010, p. 31). While telecommuting may successfully take vehicles off the road, employers that have provided this luxury to employees may have "actually created a harder environment for employees to conform to the schedule discipline of using an alternative mode, particularly ridesharing" (p. 31). Telecommuting and Compressed work weeks, strategies that may realistically only be available to a select number of employees, could potentially undercut efforts to induce a modal shift at the University.

CONCLUSION

Our findings conclude that if UAlbany is to alter the commuting behavior of the University's population, officials must conduct a comprehensive transportation effort that modifies the current surplus of parking, educates the population of the various alternative transportation options that exists, and uses incentives and disincentives to alter the existing commuting behavior. This conclusion is based on our research recommendations along with the findings highlighted in the TCRP's 82 case studies.

The first and most crucial step in generating a better transportation environment has already been completed with this research effort. UAlbany commuters, and the surrounding commuting community, have been thoroughly analyzed through the survey and focus group efforts to better understand commuting behavior. The GIS study conducted helped us to better understand where the population is living. The mass transit options that currently exist were highlighted in the second part of the GIS study, which

included the CDTA bus routes within Albany, Rensselaer, Schenectady, and Saratoga County, and the section analyzing the other mass transit services and schedules. The GPS on-time performance study allows us to determine the viability of vital bus routes to determine if the service is producing acceptable results for users. The survey and focus groups helped create a complete picture of our commuting population modal choices, their behaviors and preferences for services.

Any institution can encourage a better transportation environment by focusing its effort to develop options, improve reliability, have easy access to important information and foster transportation partnerships. This can all be achieved through the technology used in this project which is readily available and relatively inexpensive. Forming partnerships between transit authorities and institutions is key in capitalizing on the synergist possibilities. The process will not occur overnight, and will involve frequent reflection to determine if the right strategies are being implemented but the rewards can be great in terms of VMT reduction and a decreased environmental footprint.

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HANDBOOK

SUMMARY

The handbook serves as a series of tutorials highlighting the steps that should be considered when recreating similar transportation studies. The transportation issues at the University at Albany are not unique and are shared by many throughout the state. The goal of this project is not only to address the transportation and commuting environment at the University at Albany, but to also serve as a model for other universities and institutions that would like to perform similar studies. The handbook addresses the methodology for conducting similar GIS studies, a step by step run through of the processes involved in an on-time performance study, along with a series of suggestions to maximize the amount of knowledge gained from survey and focus group efforts. If the University at Albany improves the alternative transportation on campus, they can do their part to decrease the amount of CO2 introduced into the ozone. By offering a framework for an unlimited number of institutions to conduct similar studies, this study can lead to a vast decrease in greenhouse gas emissions, while improving the quality of life for countless commuters.

TUTORIAL FOR GIS ANALYSIS

INTRODUCTION

The purpose of this tutorial is to provide a synopsis on performing a GIS analysis on regional commuter data. These GIS techniques are an essential tool that allows analysis of commuting patterns to identify areas of high need within a region.

OBTAINING DATA

Commuters are broken down into two segments: 1) density of commuters by postal boundary (zip code), and 2) geocode of commuter permanent addresses in relation to metropolitan mass transit authority's bus routes. A crucial element to any study is reliable data. When commuters are issued parking permits, this data should include their home addresses thus allowing for the creation of a database for GIS analysis. If an institution is not currently requiring parking passes to park at a location, other sources such as payroll, student accounts, etc. may have address information available.

The GIS layers that were needed to complete our project were obtained from these listed sources:

- National Atlas
    - URL: http://www.nationalatlas.gov/maplayers.html?openChapters=#chpbound
    - Data: State Boundaries
- New York State Office of Cyber Security and Critical Infrastructure Coordination
    - URL: http://www.nysgis.state.ny.us/gisdata/inventories/member.cfm?organizationID=522
    - Data: NYS County Boundaries – 1:24,000, NYS Civil Boundaries, NYS Zip Codes, NYS Streets
- Capital District Transportation Authority
    - URL: http://www.nysgis.state.ny.us/gisdata/inventories/member.cfm?organizationID=98
    - Data: CDTA Bus Routes (October 2009), CDTA Bus Stops (November 2009)

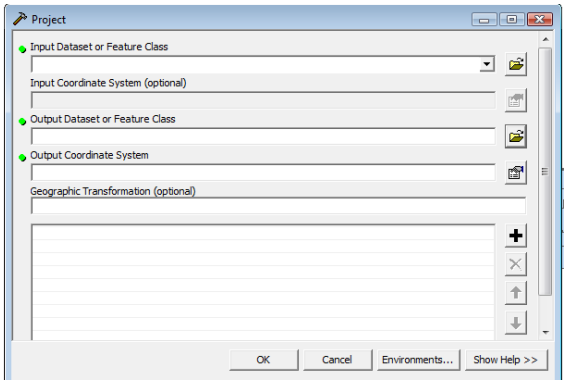
After obtaining the commuter data from the parking authority, or from your available data source, additional filtering is sometimes needed. The research team chose to extract the data to Microsoft Excel 2007 where the filtering was performed. The clean data was then ready for the GIS analysis and broken down into relevant commuter groups based on the premise their anticipated commuting behaviors. For

example, a university may choose to have a separate group for faculty, another for staff and a third for students.

GEOCODING AND PROJECTING THE COMMUTER PERMANENT ADDRESS DATA

The process of geocoding is defined as assigning spatial locations to data that are in tabular form (data) but have fields that describe their locations. Data was reviewed and filtered for consistency. A dBASE table was created with the following attributes: *postal code*, *address 1*, *address 2*, *city*, and *state*. An Address Locator was developed using the ArcCatalog with the state streets shapefile. A formatted spreadsheet was imported into the Address Locator to geocode the permit data. A single re-match was performed to identify additional matches, returning results that remained unchanged. All tied values were matched with an appropriate candidate along the street segment that was most common.

GIS data can be managed in multiple formats, using any of the various selections of programs that are available on the market. This methodology employs a shapefile format, along with ESRI ArcGIS 9.3 software. It is crucial to project GIS data correctly. Projecting data is the process of transforming the spatial relationship of features on the Earth's surface to a flat map. The projection of data is dependent on the location of your study. For example, a study in Albany, New York, would project GIS data in Universal Transverse Mercator grid system (UTM) NAD 1983 Zone 18 using the ArcGIS Project tool. The projection option can be found within the ArcMap program's advanced toolbox. The projection will ask for your Input Dataset, which will be the permit data. The Input Coordinate System option should be blank as there is no coordinate system that is currently associated with the permit data. The Output Dataset, which will be your permit data projected on the coordinate system that is chosen should be named in a way that will make it easily identifiable. After choosing the right Output Coordinate System for your location, leave the Geographic Transformation option empty, and press OK.



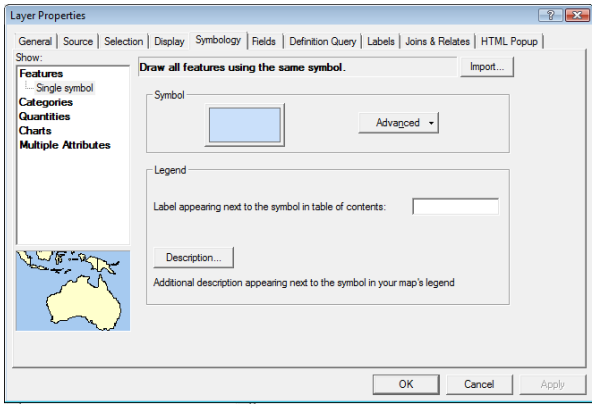
A dialogue box will then appear indicating the progress of the projection. Once completed a new layer representing your projected permit data will appear in the Table of Contents of ArcMap. This layer, when

turned on with the other layers representing the Counties/ Postal Codes, will visualize the addresses of the commuting population.

REPRESENTING DENSITY BY POSTAL BOUNDARY

To represent the density of commuters, cross-tabulations were made for each of the commuter groups by postal boundary and count. Postal codes with extensions (e.g. 12202-1123) were truncated to five digits. A dBASE table consisting of the cross-tab results was exported from Microsoft Excel 2007 and added to the ArcMap project. The dBASE table was joined to the state postal boundary shapefile based on the 5 digit postal value (unique identifier). All values from the dBASE table were joined with 0% omitted from the dataset. The joined shapefile was exported and then re-inserted into the project.

Symbology was created to illustrate the various density values of each of the state's postal boundary. To create the symbology you must either double click on the data layer or right-click on "properties". Once the "Layer Properties" dialogue box appears, click on the "symbology" option. The following screen is displayed:



Next Select "Symbology", and then select "Charts" then "Stacked". Choose a color scheme that is representative of the data. We represented the density using different shades of red. The darkest red represents the postal code with the greatest density of students. Once a color scheme is selected, click "Apply" to visualize the data on the map.

This process was replicated for each commuter group. The symbology remained consistent (modified Natural Breaks: 1-10, 11-50, 51-100, 101-300, 301 <). The research teams chose to do an additional analysis for addresses within a sixty-mile scope of the uptown campus, which focused on the highest density postal boundaries. These decisions to perform additional analyses should be made as your results progress.

INCLUDING BUS STOPS AND ROUTES

To identify the areas where there was a large population of commuters not being serviced by public transportation, the metropolitan mass transit routes were overlaid on the GIS database. These routes were obtained from the state GIS Clearinghouse

The bus stop shapefile was imported into the ArcMap project and a 0.25 mile radius buffer was created for each. Transportation studies have suggested that 0.25 miles is an ideal distance for an individual to walk in order to reach a bus stop; and thus it was used for this analysis (Fairfax County Planning Commission). Table 7-1 indicates the standards for distance from a bus stop that other municipalities have upheld in previous studies.

Table 8-1: Tolerable Walking Distance from Bus Stop by Region/Government Entity

[Maryland] Mass Transit Administration	1500 ft. (0.28 mi.)
[Kansas City, Missouri] Mid-America Regional Council	1500 ft. (0.28 mi.)
[New Jersey] New Jersey Transit	0.25 – 0.5 mi.
[Ontario, Canada] Ontario Ministry of Transportation	0.25 mi.
[NY, CT, NJ, Tri-metro] Regional Plan Association	1000 ft. (0.19 mi.)
[Snohomish City, Washington] Snohomish County Transportation Authority	1000 ft (0.19 mi.)

Source: http://www.fairfaxcounty.gov/planning/tod_docs/walking_distance_abstracts.pdf

It is important to determine the specific area of focus for each section of the study. While some of the GIS analysis included permit data from all over the state, and some out-of-state communities, there was a need to focus on a core area for certain sections of our study. The closest and most highly populated with commuters relevant to the study were recognized as the "core" counties the study. Permits registered outside the core county boundaries were excluded from the bus stop portion of the study. Addresses plotted within a buffer polygon were selected and recorded in tabular form.

WORKS CITED

Fairfax County Plannying Commission. (n.d.). Fairfax County Planning Public Transportation Assessment . Retrieved March 20, 2010, from Fairrax County Planning Commission: http://www.fairfaxcounty.gov/planning/tod_docs/walking_distance_abstracts.pdf

TUTORIAL FOR GPS DATA COLLECTION, POST PROCESSING AND VISUALIZATION IN ARCGIS

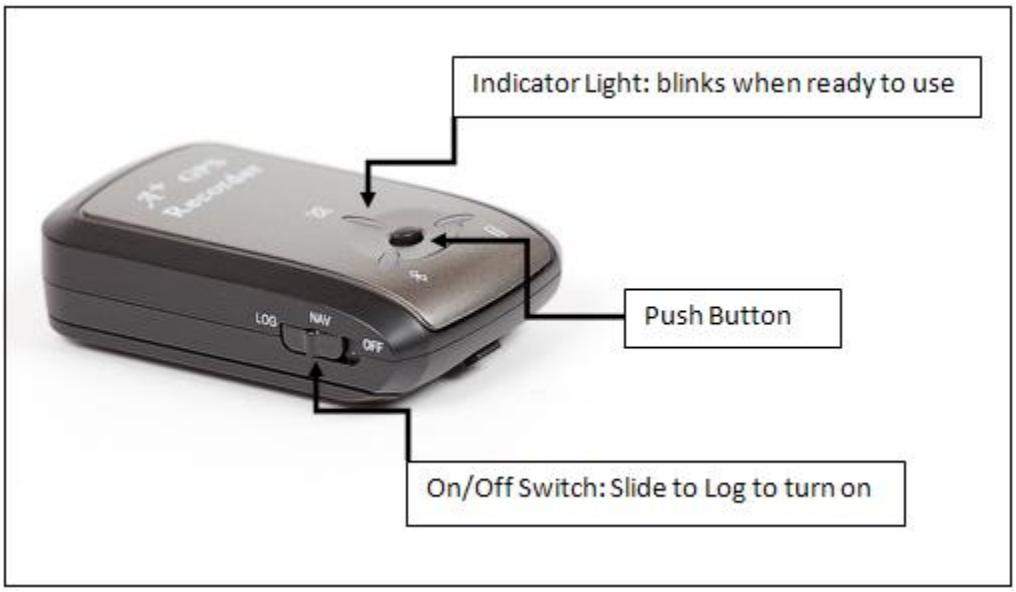
INTRODUCTION

The purpose of this tutorial is to provide guidance for conducting data visualization and analysis in ArcGIS with primary data collected from a handheld GPS unit. The ability to collect primary spatial data in the field and visualize the data in a GIS environment in order to conduct spatial analysis is a powerful analytical capability that has numerous applications. As such, this tutorial provides detailed instructions on all stages of the process from operating the GPS unit in the field, collecting GPS data, post processing GPS data and importing GPS data into ArcGIS for visualization and spatial analysis. This tutorial also provides instructions on how to conduct an on-time performance analysis of transit operations.

CONFIGURING THE GPS UNITS

The model of the GPS unit used in this tutorial is the 747 A+ 66-chanel GPS Trip Recorder. This model has the capability to record a maximum of 125,000 waypoints. The GPS unit automatically logs points at a predetermined interval by the user as well as manually by pressing the center button. It is important to understand how to operate the GPS unit before primary data collection can occur in the field. Figure 8-1 provides a graphic of the A+ GPS Recorder and describes the functions of the unit's switches and buttons.

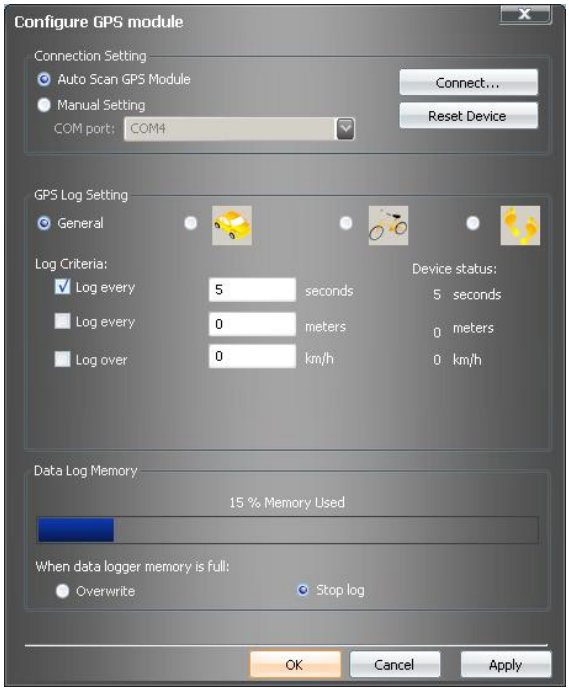
Figure 8-1: Graphic of the A+ GPS Recorder



The graphic illustrates the location and function of the indicator lights, power switch, and push button found on the A+ GPS Recorder. To configure the GPS unit for primary data collection open the Phototagger Software that was provided with the GPS unit on the mini disc. Follow these steps to configure the GPS unit.

- Connect the GPS unit to the computer using the provided mini-USB cable
- Turn on the unit by sliding the power switch to the on position
- Click File>Configure GPS
- The Configure GPS Module will open
- Connection setting = Auto Scan GPS Module
- GPS Log Setting = General
- Log criteria = Log every 5 seconds
- Select "Stop Log" option for when data logger memory is full

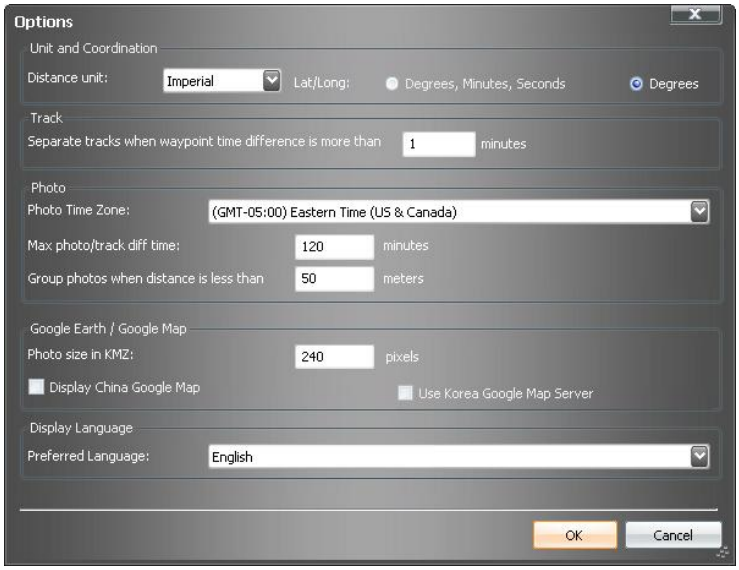
The "Configure GPS Module" dialogue box should be calibrated as shown below:



The next step in calibrating the GPS unit is to specify the coordinate system. To specify the coordinate system:

- On the main menu bar click Tools>Options
- Distance unit = Imperial, Degrees

When correctly calibrated the Options window should appear as shown below:



Before the GPS unit is taken into the field for primary data collection it is a good idea to check and see if the unit's memory storage is clear. If not, it is generally a good idea to clear the unit's memory in order to increase its data collection capabilities in the field. To clear the unit's memory: Click File > Clear Device Log. Now the GPS unit is ready for primary data collection in the Field.

GPS DATA COLLECTION

The purpose of this tutorial is to provide detailed directions on the process of using the A+ GPS Recorder for the purpose of conducting an on-time performance analysis of transit service. The steps for collection of on-time performance data are as follows:

1. Prior to riding the transit route turn the unit on by sliding the switch from "Off" to "Log"; a solid orange light will appear; when the light begins to blink the unit is ready to begin collecting data

2. Board the bus

3. Press the button when the bus departs from the transit stops posted in the route schedule or passes by the stop
4. Continue manually operating the unit for the duration of your shift

5. At the end of the shift exit the bus, and hand off the GPS unit to the next worker. If you are the last worker for the day press the push button as the bus departs the stop then turn the GPS unit off by sliding the switch from "Log" to "Off"

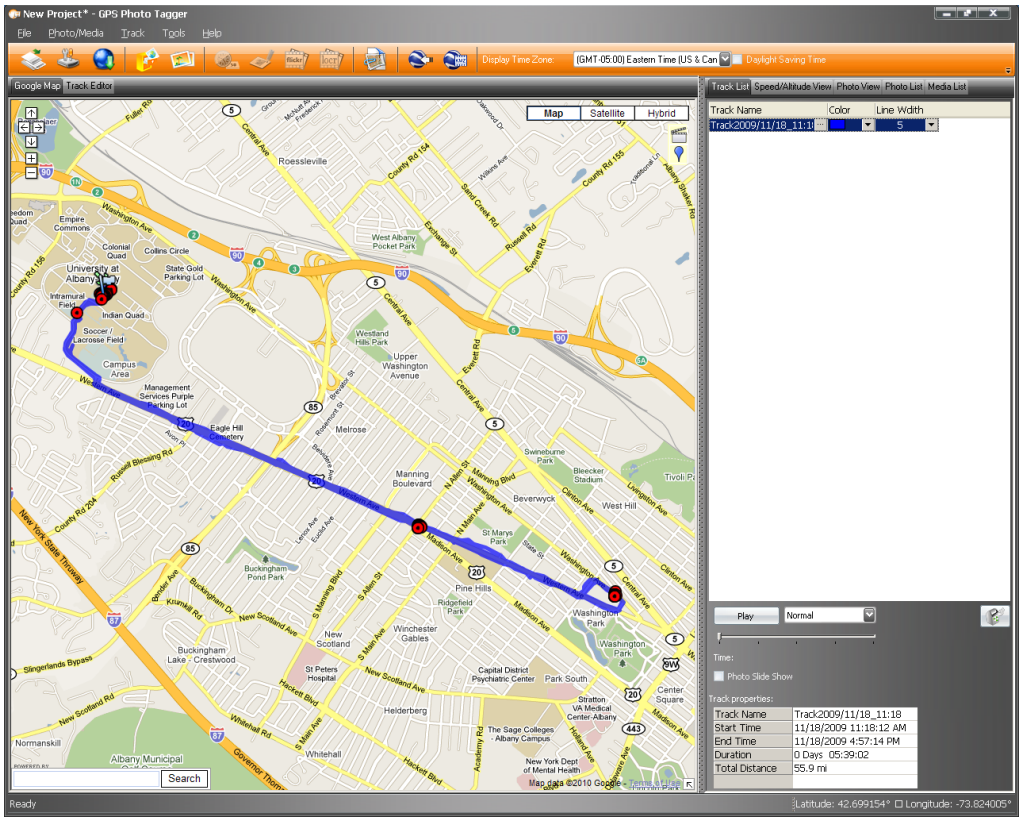
Based on empirical data the A+ GPS Recorder is able to store approximately 24 hours of data before its memory capacity is full.

Post Processing GPS Data

The process for downloading data from the GPS unit is as follows:

1. Open the GPS Phototagger Software Program
2. Connect the GPS unit to the computer via the mini USB cable
3. Slide the power switch on the GPS unit to the on position
4. Click File>Read Device Log
5. Select the GPS track(s) of data collected

A selected GPS track in the GPS Phototagger Software is shown below:



The blue line represents the route of the mass transit shuttle. The red dots along the route represent timing points, a transit stop where the departure time is posted by the transit operator. The red dots are the result of manually pressing the push button on the GPS unit. To export the selected GPS track:

- Click File > Export_Track(s)
- Choose the track(s) you want to export and click “OK”

- Save the file in the appropriate location, give the file a meaningful name and save as type Excel File (*.csv)
- Safely remove the GPS unit from the computer
- Close GPS Phototagger program and open the saved file in Excel
- Edit the Excel spreadsheet so that it contains the attributes shown below:

	A	B	C	D
1	Date	Time	LATITUDE	LONGITUDE
2	11/18/2009	11:18:12	42.68476	73.825965
3	11/18/2009	11:18:17	42.685391	73.826199
4	11/18/2009	11:18:22	42.685357	73.826124
5	11/18/2009	11:18:27	42.685366	73.82609
6	11/18/2009	11:18:32	42.685368	73.826114
7	11/18/2009	11:18:37	42.685294	73.826082
8	11/18/2009	11:18:42	42.685305	73.826064
9	11/18/2009	11:18:47	42.685316	73.826071
10	11/18/2009	11:18:52	42.685342	73.826052

In order to conduct an on-time performance analysis in Excel it is necessary to compute the On-time Percentage (OTP) which determines the Level of Service (LOS) provided by the transit agency. The complete analysis of on-time performance in Excel is shown below:

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	Lat	Long	Date	Actual	Schedule	Actual SEC	Schedule SEC	Diff SEC	Status	Departure	Count	OTP_Result	OTP_Ranges	LOS_Rating	LOS
2	42.66102	-73.7706	11/10/2009	8:13:33	8:12	29613	29520	93	ON-TIME	EARLY	20	63.0	95.0-100.0	A	F
3	42.66669	-73.7918	11/10/2009	8:24:14	8:21	30254	30060	194	ON-TIME	ON-TIME	34		90.0-94.9	B	
4	42.68494	-73.826	11/10/2009	8:33:32	8:30	30812	30600	212	ON-TIME	LATE	0		85.0-89.9	C	
5	42.68498	-73.8261	11/10/2009	8:36:28	8:36	30988	30960	28	ON-TIME	TOTAL	54		80.0-84.9	D	
6	42.6664	-73.7917	11/10/2009	8:47:14	8:46	31634	31560	74	ON-TIME				75.0-79.9	E	
7	42.66114	-73.7708	11/10/2009	8:53:37	8:54	32017	32040	-23	EARLY				<75.0	F	
8	42.66119	-73.7707	11/10/2009	9:00:31	9:00	32431	32400	31	ON-TIME						
9	42.66649	-73.7917	11/10/2009	9:08:12	9:10	32892	33000	-108	EARLY						
10	42.68502	-73.8261	11/10/2009	9:16:40	9:20	33400	33600	-200	EARLY						

It is important to note that the "OTP_Result" field reports the percentage of buses that operated on-time and the "LOS" field grades the level of service provided by the transit operator based on conventions set in the literature. The on-time performance analysis spreadsheet shown above contains formulas that automate the analysis process by allowing data to be copied and pasted into an analysis template that contains the formulas. The data can then be dragged and automatic computation will result with the exception of the "Schedule" column. Data entry in the "Schedule" column requires the analyst to compare the actual time that the bus departed the stop according to when the push button was pressed on the GPS unit with the time that the bus was supposed to depart according to the schedule. This is a tedious and time consuming process that has the potential to introduce error and bias into the study because it requires the analyst to compare every row in the "Actual" column with the bus schedule. The use of Automatic Vehicle Location (AVL) technology is a more efficient method of conducting an on-time performance analysis in terms of time and cost savings as well as improved accuracy. As such, future studies of this nature are encouraged to explore the feasibility of using an AVL system.

ON-TIME PERFORMANCE ANALYSIS FORMULAS

The method of analysis for conducting an on-time performance analysis in an Excel spreadsheet template uses the following formulas to allow for data to be dragged and dropped into the spreadsheets for analysis. The formulas are as follows:
NOTE: Formulas contain column names for illustrative purposes. To operationalize formulas in Excel use cell locations, ie: cell D2.

Excel Formulas:

Actual SEC = Actual*86400 [Note: format cell as general]

Schedule SEC = Schedule*86400 [Note: format cell as general]

Diff SEC = (Actual SEC – Schedule SEC)

STATUS = IF(Diff SEC<0,"EARLY",(IF(Diff SEC>=300,"LATE","ON-TIME")))

COUNT EARLY = COUNTIF(1st cell in STATUS column: last cell in STATUS column,"EARLY")

COUNT ON-TIME = COUNTIF(1st cell in STATUS column: last cell in STATUS column,"ON-TIME")

COUNT LATE = COUNTIF(1st cell in STATUS column: last cell in STATUS column,"LATE")

OTP_RESULT = COUNT EARLY Value/ COUNT TOTAL*100

LOS = IF(OTP_RESULT=95-100,"A",(IF(OTP_RESULT=90-94.9,"B",(IF(OTP_RESULT=85-89.9,"C",(IF(OTP-RESULT=80-84.9,"D",(IF(OTP_RESULT=75-79.9,"E",(IF(OTP<75,"F")))))))))))

It is important to note that in order to visualize the on-time performance data in ArcGIS, additional columns must be added to the data table to allow for data visualization in a GIS environment. The screenshot below illustrates what the Excel table should look like after the on-time performance analysis template is completed. The appearance of the completed Excel table of the on-time performance analysis template is shown below.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	Lat	Long	Date	Actual	Schedule	Actual SEC	Schedule SEC	Diff SEC	Status	Departure	Count	OTP_Result	OTP_Ranges	LOS_Rating	LOS
2	42.66102	-73.7706	11/10/2009	8:13:33	8:12	29613	29520	93	ON-TIME	EARLY	20	63.0	95.0-100.0	A	F
3	42.66669	-73.7918	11/10/2009	8:24:14	8:21	30254	30060	194	ON-TIME	ON-TIME	34		90.0-94.9	B	
4	42.68494	-73.826	11/10/2009	8:33:32	8:30	30812	30600	212	ON-TIME	LATE	0		85.0-89.9	C	
5	42.68498	-73.8261	11/10/2009	8:36:28	8:36	30988	30960	28	ON-TIME	TOTAL	54		80.0-84.9	D	
6	42.6664	-73.7917	11/10/2009	8:47:14	8:46	31634	31560	74	ON-TIME				75.0-79.9	E	
7	42.66114	-73.7708	11/10/2009	8:53:37	8:54	32017	32040	-23	EARLY				<75.0	F	
8	42.66119	-73.7707	11/10/2009	9:00:31	9:00	32431	32400	31	ON-TIME						
9	42.66649	-73.7917	11/10/2009	9:08:12	9:10	32892	33000	-108	EARLY						
10	42.68502	-73.8261	11/10/2009	9:16:40	9:20	33400	33600	-200	EARLY						
11	42.685	-73.8261	11/10/2009	9:24:07	9:24	33847	33840	7	ON-TIME						
12	42.6665	-73.7919	11/10/2009	9:34:02	9:33	34442	34380	62	ON-TIME						
13	42.66116	-73.7709	11/10/2009	9:39:12	9:42	34752	34920	-168	EARLY						
14	42.66092	-73.7707	11/10/2009	9:48:24	9:48	35304	35280	24	ON-TIME						
15	42.66657	-73.7919	11/10/2009	9:57:28	9:58	35848	35880	-32	EARLY						

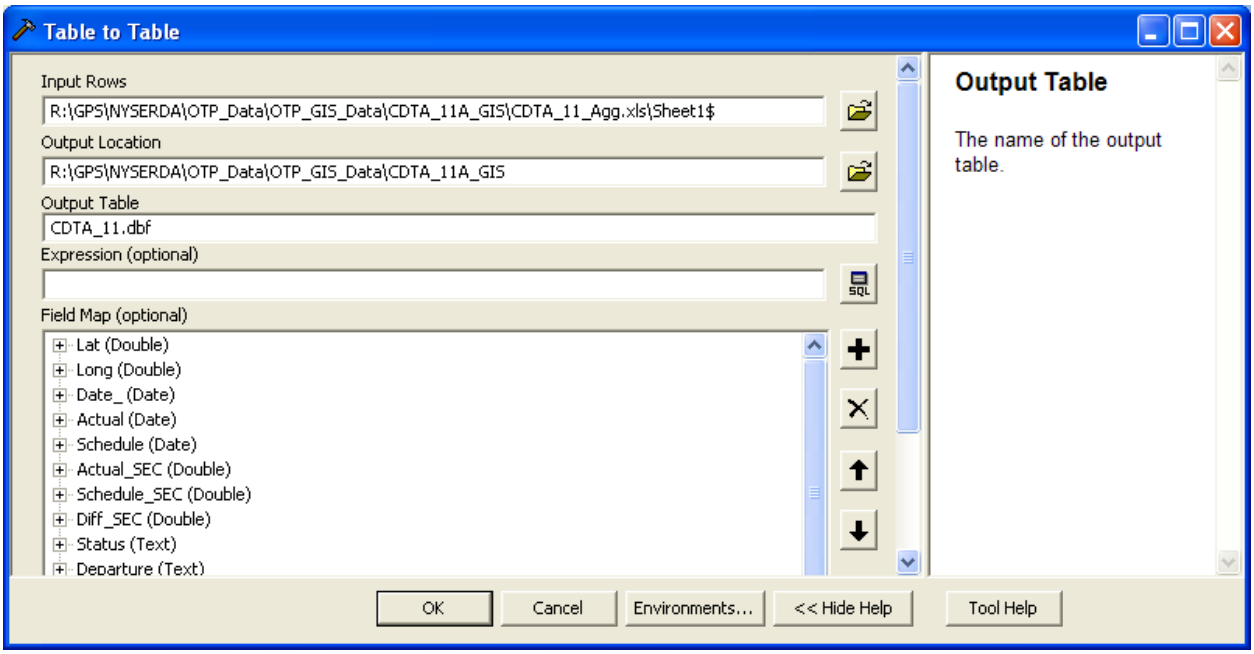
Before the on-time performance data can be visualized in ArcGIS it is necessary to append an additional three columns to the data table. The screenshot below shows the addition of three columns to the table: "Early", "On-time" and "Late". These columns are created by combining the "Departure" and "Count" columns into one column with the data values for early, on-time and late departures duplicated in all the rows of the column. These columns can easily be created by using the copy + paste function. The screenshot below illustrates how the completed Excel table should appear.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	Lat	Long	Date	Actual	Schedule	Actual SEC	Schedule SEC	Diff SEC	Status	Departure	Count	OTP_Result	OTP_Ranges	LOS_Rating	LOS	Early	Ontime	Late
2	42.66102	-73.7706	11/10/2009	8:13:33	8:12	29613	29520	93	ON-TIME	EARLY	20	63.0	95.0-100.0	A	F	20	34	0
3	42.66669	-73.7918	11/10/2009	8:24:14	8:21	30254	30060	194	ON-TIME	ON-TIME	34		90.0-94.9	B		20	34	0
4	42.68494	-73.826	11/10/2009	8:33:32	8:30	30812	30600	212	ON-TIME	LATE	0		85.0-89.9	C		20	34	0
5	42.68498	-73.8261	11/10/2009	8:36:28	8:36	30988	30960	28	ON-TIME	TOTAL	54		80.0-84.9	D		20	34	0
6	42.6664	-73.7917	11/10/2009	8:47:14	8:46	31634	31560	74	ON-TIME				75.0-79.9	E		20	34	0
7	42.66114	-73.7708	11/10/2009	8:53:37	8:54	32017	32040	-23	EARLY				<75.0	F		20	34	0
8	42.66119	-73.7707	11/10/2009	9:00:31	9:00	32431	32400	31	ON-TIME							20	34	0
9	42.66649	-73.7917	11/10/2009	9:08:12	9:10	32892	33000	-108	EARLY							20	34	0
10	42.68502	-73.8261	11/10/2009	9:16:40	9:20	33400	33600	-200	EARLY							20	34	0
11	42.685	-73.8261	11/10/2009	9:24:07	9:24	33847	33840	7	ON-TIME							20	34	0
12	42.6665	-73.7919	11/10/2009	9:34:02	9:33	34442	34380	62	ON-TIME							20	34	0
13	42.66116	-73.7709	11/10/2009	9:39:12	9:42	34752	34920	-168	EARLY							20	34	0
14	42.66092	-73.7707	11/10/2009	9:48:24	9:48	35304	35280	24	ON-TIME							20	34	0
15	42.66657	-73.7919	11/10/2009	9:57:28	9:58	35848	35880	-32	EARLY							20	34	0

Now that the data has been post processed in Excel and configured for compatibility in a GIS environment, it is necessary to aggregate the data tables for each transit route into one data table per route. This step is necessary for the purpose of data visualization in ArcGIS. The copy + paste function can be used to aggregate the individual data tables into one table per transit route. The aggregated data is now ready to be imported into ArcGIS for visualization and spatial analysis.

Mapping Data in Arc GIS

- Save the edited Excel file as "Excel 97 – 2003 (.xls format)" to the project folder
- Open the ArcMap project file "OTP_Analysis.mxd"
- Open ArcCatalog and navigate to the .xls table location and double click on it to view the table
- Right click on the worksheet representing the table and select Export > to dBase (single)
- Fill out the dialogue box as show below and give the .dbf file a descriptive name. Save the .dbf file in the project folder

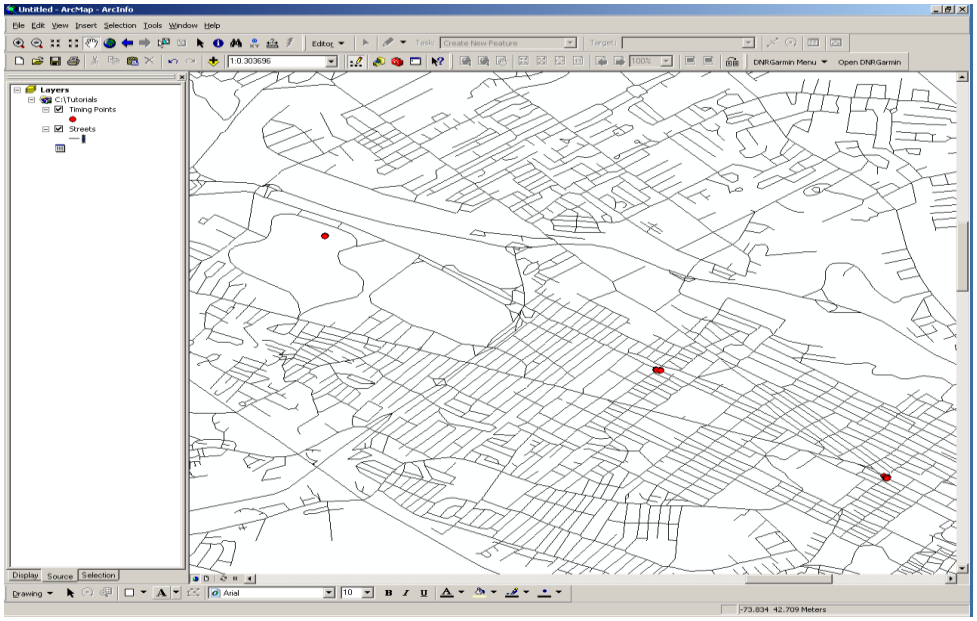


- Open the "OTP_Analysis.mxd" project file and click on the add data button. Navigate to the location of the .dbf file saved in the last step and add it to the project
- Right click on the .dbf file and click on "Display XY Data". It is important to note that the X field represents Longitude and the Y field represents Latitude

  X = Longitude

  Y= Latitude
- Edit the coordinate system of the .dbf file to World Geographic System 1984 (WGS 1984). The coordinate system used for the street network in this project is a projected coordinate system: UTM 18N North American Datum 1983 (NAD 1983 UTM Zone 18N).
- When you have finished editing the .dbf file click "Ok" and the GPS data will appear on the map as shown below

The ArcMap project window shown below contains a city street network and the timing points for a metropolitan mass transit route that were collected using the GPS units.

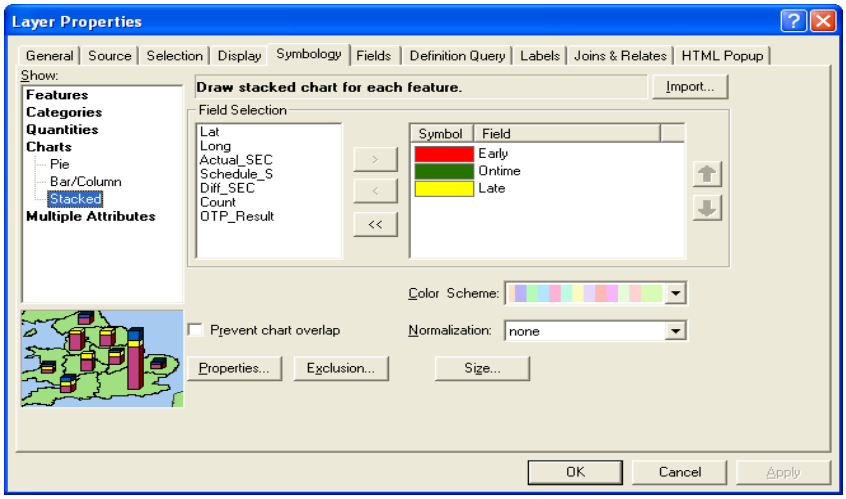


Now that the on-time performance data collected from the GPS units has been successfully imported into ArcMap, the data can be visualized and spatially analyzed.

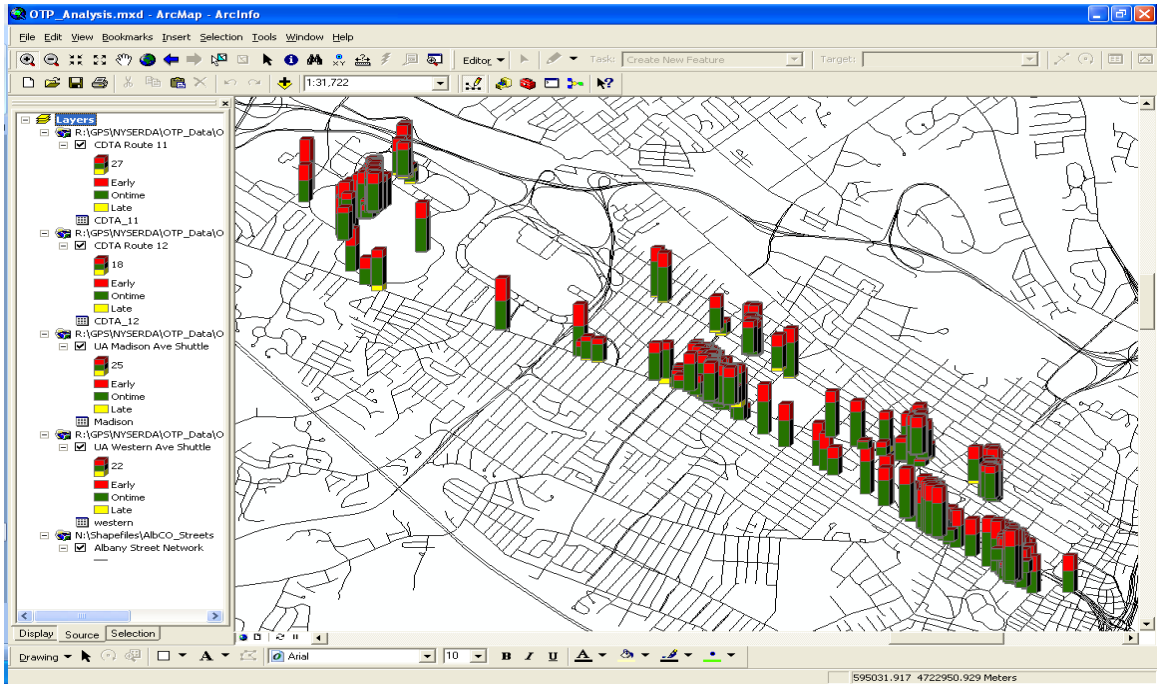
To visualize the on-time performance data in ArcMap follow these steps:

- Double click on the “Events” data variable found in the Table of Contents
- Select “Symbology”
- Select “Charts” then “Stacked”
- For the Field Selection select the fields “Early”, “On-time” and “Late”
- Choose a color scheme that is representative of the data
- Uncheck the box to prevent chart overlap
- Click “Apply” to visualize the data on the map

The Layer Properties dialogue box should be calibrated as shown below:



Once the layer properties have been calibrated and applied the visualization of the data should appear something like what is shown below. The data layers in the Table of Contents illustrate the different transit routes under investigation in this study. The number of early, on-time and late departures are illustrated by using a color scheme that is representative of the data to help with data visualization and analysis.



SUGGESTIONS FOR CREATING A SUCCESSFUL SURVEY ANALYSIS

INTRODUCTION

In order to gather comprehensive information on commuting behavior and preferences, a survey needs to be designed. This survey should solicit quantitative information on commuting modes, travel times and distances, along with demographic attributes. In addition, qualitative questions on the quality of mass transit offerings and desired services should be included. A sample survey is included in this section that can be modified to fit the needs of the institution.

A process by which the survey is created and administered should first be developed. It is advised that committee be formed to review and provide input on the survey formation. Draft surveys are sent to this committee by those assigned to form the survey with subsequent revisions being made based on comments received. These iterations should continue until a final version is deemed acceptable.

Surveys can be administered in many forms. Recently, the use of on –line surveys has become the method of choice due to its relative ease of administration, low cost and ability to track and manage responses. An initial mailing should be sent out to the target population (In the sample survey provided, the entire employee population of approximately 3,500 people and half of the student population, about 9,000 students, were sent this initial request). Reminder emails subsequently are sent to non-respondents on a weekly basis for three weeks. This should garner an acceptable response rate that is demographically representative of the population as a whole.

EXAMPLE OF STUDENT SURVEY

UAlbany Student Transportation Survey

Fall 2009

Informed Consent Form

(Click on the "Next" button below to consent and proceed to the survey.)

This short 10-20 minute survey covers issues related to your experiences with transportation to, from, and within the UAlbany campuses. The results of this survey will be used by the University to inform our ongoing efforts to improve satisfaction with our transportation options.

Your participation in this research is completely voluntary and refusal to participate will involve no penalty. You are free to skip any question that causes discomfort. You will not be asked to identify yourself and no identifying information will be saved in the survey data set at any time. The information from the survey will not become part of your University records.

This survey is administered by the UAlbany Office of Institutional Research, Planning and Effectiveness, using a service called "SNAP surveys." SNAP uses a secure web server, and encrypts your responses to prevent viewing by third parties.

All responses will be held in strict confidence, and used only for research, planning, and program evaluation purposes. Some results of this study may be disseminated or made publicly available, but will only be presented in aggregate form in ways that ensure that no individual students can be identified by their answers.

This project has been approved by the University at Albany's Institutional Review Board (IRB). Approval of this project only signifies that the procedures adequately protect the rights and welfare of the participants. Please note that absolute confidentiality cannot be guaranteed due to the limited protections of Internet access. Please be sure to close your browser when finished so no one will be able to see what you have been doing.

There is no risk involved in taking the survey, but there is the potential benefit of having your participation help UAlbany improve its transportation systems for all students.

If you have any questions concerning the survey, please contact Dr. Joel Bloom, in the Office of Institutional Research, Planning & Effectiveness, at (518) 437-4791 or uasurvey@albany.edu.

If you have questions about your rights as a research participant that have not been answered by the investigator, or if you wish to report any concerns about the study, you may contact the University at Albany Office of Regulatory Research Compliance at (518) 442-9050 or orrc@uamail.albany.edu.

I have read, or been informed of, the information about this study. I hereby consent to participate in the study.

To indicate your informed consent and continue with the survey, please click the "next" button, below. If you do not wish to participate in this survey, you may simply close your browser window.

If you would like to keep a copy of this informed consent form for your records, you may do so now by clicking on your web browser's "print" button.

Q1. Which best describes where you live?

- ❑ Central Quads (Indian, Dutch, Colonial, State)
- ❑ Empire Commons
- ❑ Freedom Apartments
- ❑ Alumni Quad
- ❑ Off Campus

Q1a. Approximately *how far* is your one way commute in miles?

- ❑ Less than ¼ mile
- ❑ Between ¼ and a ½ mile
- ❑ Between a ½ mile and 1 mile
- ❑ Between 1 and 2 miles
- ❑ 2 to 3 miles
- ❑ 3 to 5 miles
- ❑ 5 to 10 miles
- ❑ 10 to 15 miles
- ❑ 15 to 20 miles
- ❑ Over 20 miles

Q1b. On average, *how long* is your one way commute to school?

- ❑ Less than 5 minutes
- ❑ 6 to 10 minutes
- ❑ 11 to 15 minutes
- ❑ 16 to 20 minutes
- ❑ Over 20 minutes

Q1c. What is your 5-digit Zip Code? _____

Q2. In a typical semester, how often do you use the following modes of transportation to get to campus?

	Never	A Few Times a Semester	A Few Times a Month	A Few Times a Week	Daily
Drive alone	❑	❑	❑	❑	❑
Carpool (driver)	❑	❑	❑	❑	❑
Carpool (rider)	❑	❑	❑	❑	❑
Take a CDTA bus	❑	❑	❑	❑	❑

Take a UAlbany bus	❑	❑	❑	❑	❑
Ride a bike	❑	❑	❑	❑	❑
Walk	❑	❑	❑	❑	❑

Q2a. If you drive, what is the average number of people in the car each day including yourself?

- ❑ 1
- ❑ 2
- ❑ 3
- ❑ 4
- ❑ 5 or more

Q3. What time does your earliest class start each day this semester?

	No Classes	6 - 7:59 AM	8 - 9:59 AM	10-11:59 AM	12 - 1:59 PM	2 - 3:59 PM	4 - 5:59 PM	6:00 PM or Later
Monday	❑	❑	❑	❑	❑	❑	❑	❑
Tuesday	❑	❑	❑	❑	❑	❑	❑	❑
Wednesday	❑	❑	❑	❑	❑	❑	❑	❑
Thursday	❑	❑	❑	❑	❑	❑	❑	❑
Friday	❑	❑	❑	❑	❑	❑	❑	❑
Saturday or Sunday	❑	❑	❑	❑	❑	❑	❑	❑

Q4. What time do you aim to arrive on campus each day this semester?

	N/A	6 - 7:59 AM	8 - 9:59 AM	10-11:59 AM	12 - 1:59 PM	2 - 3:59 PM	4 - 5:59 PM	6:00 PM or Later
Monday	❑	❑	❑	❑	❑	❑	❑	❑
Tuesday	❑	❑	❑	❑	❑	❑	❑	❑
Wednesday	❑	❑	❑	❑	❑	❑	❑	❑
Thursday	❑	❑	❑	❑	❑	❑	❑	❑
Friday	❑	❑	❑	❑	❑	❑	❑	❑
Saturday or Sunday	❑	❑	❑	❑	❑	❑	❑	❑

Q5. What time does your latest class end each day this semester?

	No Classes	8 - 9:59 AM	10-11:59 AM	12 - 1:59 PM	2 - 3:59 PM	4 - 5:59 PM	6-7:59 PM	8 PM or Later
Monday	❑	❑	❑	❑	❑	❑	❑	❑
Tuesday	❑	❑	❑	❑	❑	❑	❑	❑
Wednesday	❑	❑	❑	❑	❑	❑	❑	❑
Thursday	❑	❑	❑	❑	❑	❑	❑	❑
Friday	❑	❑	❑	❑	❑	❑	❑	❑
Saturday or Sunday	❑	❑	❑	❑	❑	❑	❑	❑

Q6. Were you here at UAlbany last Spring, or is this your first semester at UAlbany?

- ❑ I was here last Spring.
- ❑ This is my first semester.
- ❑ I was not here last Spring, but this is not my first semester.

Q6a. What time did your earliest class start each day during your last semester at UAlbany?

	No Classes	6 - 7:59 AM	8 - 9:59 AM	10-11:59 AM	12 - 1:59 PM	2 - 3:59 PM	4 - 5:59 PM	6:00 PM or Later
Monday	❑	❑	❑	❑	❑	❑	❑	❑
Tuesday	❑	❑	❑	❑	❑	❑	❑	❑
Wednesday	❑	❑	❑	❑	❑	❑	❑	❑
Thursday	❑	❑	❑	❑	❑	❑	❑	❑
Friday	❑	❑	❑	❑	❑	❑	❑	❑
Saturday or Sunday	❑	❑	❑	❑	❑	❑	❑	❑

Q7. What time did your latest class end during your last semester at UAlbany?

	No Classes	8 - 9:59 AM	10-11:59 AM	12 - 1:59 PM	2 - 3:59 PM	4 - 5:59 PM	6-7:59 PM	8 PM or Later
Monday	❑	❑	❑	❑	❑	❑	❑	❑
Tuesday	❑	❑	❑	❑	❑	❑	❑	❑
Wednesday	❑	❑	❑	❑	❑	❑	❑	❑
Thursday	❑	❑	❑	❑	❑	❑	❑	❑
Friday	❑	❑	❑	❑	❑	❑	❑	❑
Saturday or Sunday	❑	❑	❑	❑	❑	❑	❑	❑

Q8. How much do your commuting patterns vary from one semester to another?

	Not at All	A Little	Somewhat/ It Depends	A Great Deal
Distance of commute	❑	❑	❑	❑
Start/end time of commute	❑	❑	❑	❑
Time length of commute	❑	❑	❑	❑
Frequency of commute/ number of trips	❑	❑	❑	❑
The method of commuting	❑	❑	❑	❑

Q9. How much control do you have over the variation in your commuting patterns from one semester to another?

	None at All	A Little	Somewhat/ It Depends	A Great Deal	N/A
Distance of commute	❑	❑	❑	❑	❑
Start/end time of commute	❑	❑	❑	❑	❑
Time length of commute	❑	❑	❑	❑	❑
Frequency of commute/ number of trips	❑	❑	❑	❑	❑
The method of commuting	❑	❑	❑	❑	❑

Q9a. Please describe the impact that these variations have had on your choice of transportation.

_____

_____

_____

_____

Q10. When you were deciding on your current housing, was the nature or mode of your commute a factor in your decision?

- ❑ Yes
- ❑ No
- ❑ Not Applicable -- I did not have a say in the location of my current housing.

Q10a. Do you think it might be a factor in your next housing decision?

- ❑ Yes
- ❑ No

Q11. In your opinion, do you think the following transportation issues are problems within the University at Albany area?

	Not a Problem	A Minor Problem	Somewhat of a Problem	A Big Problem	A Severe Problem	Don't Know/NA
Traffic congestion	❑	❑	❑	❑	❑	❑
Safety when driving	❑	❑	❑	❑	❑	❑
Safety when walking	❑	❑	❑	❑	❑	❑
Safety when biking	❑	❑	❑	❑	❑	❑
Availability of parking	❑	❑	❑	❑	❑	❑
Availability of bike lanes	❑	❑	❑	❑	❑	❑
Availability of crosswalks	❑	❑	❑	❑	❑	❑
Availability of sidewalks	❑	❑	❑	❑	❑	❑
Availability of bike racks	❑	❑	❑	❑	❑	❑
Availability of bus service	❑	❑	❑	❑	❑	❑

Q12. Which of the following keep you from using alternative forms of transportation (e.g., walking, biking, carpooling or riding transit)?

	Yes -- this keeps me from using alternative transportation.	No -- this is not a factor in my transportation choices.
No bus runs between my home and school	❑	❑
Number of transfers (bus to bus)	❑	❑
Length of trip by bus	❑	❑
Bus does not come frequently or at the right time	❑	❑
Free access for bus limited only to certain routes	❑	❑
Bus stops are not conveniently located	❑	❑
I am not familiar with the bus routes and schedules	❑	❑
I live too far from school to bike	❑	❑
I do not feel safe biking	❑	❑
I live too far from school to walk	❑	❑
I do not feel safe walking	❑	❑
I do not know a person with whom I can carpool	❑	❑
I have to travel to other places on my way to or from school	❑	❑
Driving is the most convenient option for me	❑	❑
Lack of ADA accessible transport	❑	❑
Other...	❑	❑

...Please specify. _____
_____

Q13. If you don't currently use the bus to commute, how likely would you be to take the bus given the following situations?

	Definitely Would Not	Not Very Likely	As Likely as Not	Very Likely	Definitely Would	N/A
If the bus stop was within a five minute walk from home	❑	❑	❑	❑	❑	❑
If the buses ran on a more frequent schedule	❑	❑	❑	❑	❑	❑
If parking cost more or was less available	❑	❑	❑	❑	❑	❑
If the length of commute by bus was similar to length by car	❑	❑	❑	❑	❑	❑
If emergency transportation service was available	❑	❑	❑	❑	❑	❑

Q14. What is your estimated cost per week to commute to and from campus?

- ❑ $0 - $9.99
- ❑ $10.00 - $19.99
- ❑ $20.00 - $29.99
- ❑ $30.00 - $39.99
- ❑ $40.00 - $49.99
- ❑ $50.00 - $99.99
- ❑ $100.00 or more

Q14a. Who pays these expenses?

- ❑ I do
- ❑ My parents do
- ❑ We share the expenses
- ❑ Not applicable -- there is no cost.

Q15. Do you use your car to commute to school?

- ❑ Yes
- ❑ No

Q15a. How much do you spend <u>per year</u> on the following car expenses?

(Even if you are not sure, please make your best estimate. Please give a rough figure rather than a range.)

Car insurance $_____
Car Payments $_____
Car Maintenance $_____
Gasoline $_____

Q15b. Who pays these expenses?

- ❑ I do
- ❑ My parents do
- ❑ We share the expenses

Q16. What price would gas need to be for you to consider carpooling or other alternative transportation options?

- ❑ $3.00 per gallon

- ❑ $3.50 per gallon
- ❑ $4.00 per gallon
- ❑ $4.50 per gallon
- ❑ $5.00 per gallon
- ❑ Over $5.00 per gallon
- ❑ I would continue to drive no matter the price.

Q16a. How much would gas prices need to rise in one week for you to consider carpooling or other alternative transportation options?

- ❑ $.25 in one week
- ❑ $.50 in one week
- ❑ $1.00 in one week
- ❑ $2.00 in one week
- ❑ More than $2.00 in one week
- ❑ I would continue to drive no matter how much the price increases.

Q17. How likely would you be to use the following services or programs if they were offered to you?

	Definitely Would Not	Not Very Likely	As Likely as Not	Very Likely	Definitely Would
Assistance finding carpool partners	❑	❑	❑	❑	❑
Bicycle amenities (racks, lockers, showers, etc)	❑	❑	❑	❑	❑
Preferred parking for carpoolers	❑	❑	❑	❑	❑
Preferred parking for hybrids or fuel efficient vehicles	❑	❑	❑	❑	❑
Rewards for taking transit, walking, biking or carpooling	❑	❑	❑	❑	❑
Ride sharing program	❑	❑	❑	❑	❑
Carpooling program	❑	❑	❑	❑	❑
Vanpooling program	❑	❑	❑	❑	❑
Car sharing program	❑	❑	❑	❑	❑
Bike sharing program	❑	❑	❑	❑	❑
Free access to all CDTA bus routes	❑	❑	❑	❑	❑

Q18. What features would you most desire in an improved bus service? *(Please select up to three.)*

- ❑ More convenient location of bus stops
- ❑ Better and larger waiting shelters at stops
- ❑ Better security
- ❑ Faster service (express buses and fewer stops)
- ❑ More comfortable buses (padded seats, Internet access, space for bags and parcels, etc.)
- ❑ More direct service between the places you want to go (no transfers)
- ❑ Shorter waiting times between buses
- ❑ More appealing look
- ❑ Free access to all CDTA routes

Q18a. What are the most important places to connect by bus to the University at Albany? *(Please select up to three.)*

- ❑ Albany Airport
- ❑ Rensselaer Train Station
- ❑ Colonie Center and Wolf Road
- ❑ Crossgates Mall
- ❑ Clifton Park

- ❑ Delmar
- ❑ Downtown Albany
- ❑ Guilderland
- ❑ Saratoga Springs
- ❑ Schenectady
- ❑ Troy
- ❑ Other...
  ...Please specify. _____

Q19. Do you work, either for pay or as a volunteer?

- ❑ No
- ❑ Yes, on campus
- ❑ Yes, off-campus
- ❑ Yes, both on- and off-campus

Q19a. How many total hours do work in a typical week during the semester (including volunteer work)?

- ❑ None
- ❑ 0-5
- ❑ 6-10
- ❑ 11-15
- ❑ 16-20
- ❑ 21-30
- ❑ 31-40
- ❑ More than 40

Q19b. Does your job or volunteering have an impact on your transportation choices?

- ❑ No
- ❑ Yes...
  ...Please explain. _____
  _____
  _____
  _____

Q20. On which campuses do you regularly attend classes or spend time? *(Please select all that apply.)*

- ❑ Uptown Campus
- ❑ Downtown Campus
- ❑ East Campus
- ❑ Harriman Campus
- ❑ Nano Campus
- ❑ Other...
  ...Please specify. _____

Q20a. What modes of transportation do you use when you travel from one campus to another? *(Please select all that apply.)*

- ❑ Walk
- ❑ Drive
- ❑ UAlbany Bus
- ❑ CDTA Bus
- ❑ Bike
- ❑ Other...

...Please specify._____

Q21. Do you know where to get information on...

	Yes	No
...finding a carpool partner?	❑	❑
...walking and biking to campus?	❑	❑
...taking transit to campus?	❑	❑
...parking on campus?	❑	❑

Q22. What suggestions do you have for encouraging students to choose other transportation options?

_____
_____
_____
_____
_____
_____

Q23. What other information about transportation or commuting to the University do you believe would be helpful for us to know?

_____
_____
_____
_____
_____
_____

Thank you for completing this survey!

Press the SUBMIT button below to save your responses.

After submitting your responses, you will be re-directed to a separate online form containing important links and asking if you might be willing to participate in a focus group next Spring semester.

EXAMPLE OF EMPLOYEE SURVEY

UAlbany Faculty/Staff Transportation Survey

UAlbany Faculty/Staff Transportation Survey

Fall 2009

Informed Consent Form

(Click on the "Next" button below to consent and proceed to the survey.)

This short 10-20 minute survey covers issues related to your experiences with transportation to, from, and within the UAlbany campuses. The results of this survey will be used by the University to inform our ongoing efforts to improve satisfaction with our transportation options.

Your participation in this research is completely voluntary and refusal to participate will involve no penalty. You are free to skip any question that causes discomfort. You will not be asked to identify yourself and no identifying information will be saved in the survey data set at any time. The information from the survey will not become part of your University records.

This survey is administered by the UAlbany Office of Institutional Research, Planning and Effectiveness, using a service called "SNAP surveys." SNAP uses a secure web server, and encrypts your responses to prevent viewing by third parties.

All responses will be held in strict confidence, and used only for research, planning, and program evaluation purposes. Some results of this study may be disseminated or made publicly available, but will only be presented in aggregate form in ways that ensure that no individual respondents can be identified by their answers.

This project has been approved by the University at Albany's Institutional Review Board (IRB). Approval of this project only signifies that the procedures adequately protect the rights and welfare of the participants. Please note that absolute confidentiality cannot be guaranteed due to the limited protections of Internet access. Please be sure to close your browser when finished so no one will be able to see what you have been doing.

There is no risk involved in taking the survey, but there is the potential benefit of having your participation help UAlbany improve its transportation systems for all students.

If you have any questions concerning the survey, please contact Dr. Joel Bloom, in the Office of Institutional Research, Planning & Effectiveness, at (518) 437-4791 or uasurvey@albany.edu.

If you have questions about your rights as a research participant that have not been answered by the investigator, or if you wish to report any concerns about the study, you may contact the University at Albany Office of Regulatory Research Compliance at (518) 442-9050 or orrc@uamail.albany.edu.

I have read, or been informed of, the information about this study. I hereby consent to participate in the study.

To indicate your informed consent and continue with the survey, please click the "next" button, below. If you do not wish to participate in this survey, you may simply close your browser window.

If you would like to keep a copy of this informed consent form for your records, you may do so now by clicking on your web browser's "print" button.

Q1. Approximately *how far* is your one way commute to campus in miles?

- ❑ Less than ¼ mile
- ❑ Between ¼ and a ½ mile
- ❑ Between a ½ mile and 1 mile
- ❑ Between 1 and 2 miles
- ❑ 2 to 3 miles
- ❑ 3 to 5 miles
- ❑ 5 to 10 miles
- ❑ 10 to 15 miles
- ❑ 15 to 20 miles
- ❑ Over 20 miles

Q1a. On average, *how long* is your one way commute to school?

- ❑ 5 minutes or less
- ❑ 6 to 10 minutes
- ❑ 11 to 15 minutes
- ❑ 16 to 20 minutes
- ❑ 21 to 30 minutes
- ❑ 31 to 40 minutes
- ❑ 41 minutes to an hour
- ❑ More than an hour

Q1b. What is your 5-digit Zip Code? _____

Q2. In a typical semester, how often do you use the following modes of transportation to get to campus?

	Never	A Few Times a Semester	A Few Times a Month	A Few Times a Week	Daily
Drive alone	❑	❑	❑	❑	❑
Carpool (driver)	❑	❑	❑	❑	❑
Carpool (rider)	❑	❑	❑	❑	❑
Take a CDTA bus	❑	❑	❑	❑	❑
Take a UAlbany bus	❑	❑	❑	❑	❑
Ride a bike	❑	❑	❑	❑	❑
Walk	❑	❑	❑	❑	❑

Q2a. If you drive, what is the average number of people in the car each day including yourself?

- ❑ 1
- ❑ 2
- ❑ 3
- ❑ 4
- ❑ 5 or more

Q3. What time do you start your commute in the morning?

	6 - 7:59 AM	8 - 9:59 AM	10-11:59 AM	12 - 1:59 PM	2 - 3:59 PM	4 - 5:59 PM	6:00 PM or Later	N/A
Monday	❑	❑	❑	❑	❑	❑	❑	❑
Tuesday	❑	❑	❑	❑	❑	❑	❑	❑
Wednesday	❑	❑	❑	❑	❑	❑	❑	❑
Thursday	❑	❑	❑	❑	❑	❑	❑	❑
Friday	❑	❑	❑	❑	❑	❑	❑	❑
Saturday or Sunday	❑	❑	❑	❑	❑	❑	❑	❑

Q4. What time do you leave work?

	8 - 9:59 AM	10-11:59 AM	12 - 1:59 PM	2 - 3:59 PM	4 - 5:59 PM	6-7:59 PM	8 PM or Later	N/A
Monday	❑	❑	❑	❑	❑	❑	❑	❑
Tuesday	❑	❑	❑	❑	❑	❑	❑	❑
Wednesday	❑	❑	❑	❑	❑	❑	❑	❑
Thursday	❑	❑	❑	❑	❑	❑	❑	❑
Friday	❑	❑	❑	❑	❑	❑	❑	❑
Saturday or Sunday	❑	❑	❑	❑	❑	❑	❑	❑

Q5. How much do your commuting patterns vary from one semester to another?

	Not at All	A Little	Somewhat/ It Depends	A Great Deal	N/A/ This is my first term
Distance of commute	❑	❑	❑	❑	❑
Start/end time of commute	❑	❑	❑	❑	❑
Time length of commute	❑	❑	❑	❑	❑
Frequency of commute/ number of trips	❑	❑	❑	❑	❑
The method of commuting	❑	❑	❑	❑	❑

Q6. How much control do you have over the variation in your commuting patterns from one semester to another?

	None at All	A Little	Somewhat/ It Depends	A Great Deal	N/A
Distance of commute	❑	❑	❑	❑	❑
Start/end time of commute	❑	❑	❑	❑	❑
Time length of commute	❑	❑	❑	❑	❑
Frequency of commute/ number of trips	❑	❑	❑	❑	❑
The method of commuting	❑	❑	❑	❑	❑

Q6a. Please describe the impact that these variations have had on your choice of transportation.

_____
_____
_____
_____

Q7. When you were deciding on your current housing location, was the nature or mode of your commute a factor in your decision?

- ❑ No
- ❑ Yes...

...*Please specify.* _____

Q7a. Do you think it might be a factor in your next housing decision?

- ❑ No
- ❑ Yes...

...*Please specify.* _____

Q8. In your opinion, do you think the following transportation issues are problems within the University at Albany area?

	Not a Problem	A Minor Problem	Somewhat of a Problem	A Big Problem	A Severe Problem	Don't Know/NA
Traffic congestion	❑	❑	❑	❑	❑	❑
Safety when driving	❑	❑	❑	❑	❑	❑
Safety when walking	❑	❑	❑	❑	❑	❑
Safety when biking	❑	❑	❑	❑	❑	❑
Availability of parking	❑	❑	❑	❑	❑	❑
Availability of bike lanes	❑	❑	❑	❑	❑	❑
Availability of crosswalks	❑	❑	❑	❑	❑	❑
Availability of sidewalks	❑	❑	❑	❑	❑	❑
Availability of bike racks	❑	❑	❑	❑	❑	❑
Availability of bus service	❑	❑	❑	❑	❑	❑

Q9. Which of the following keep you from using alternative forms of transportation (e.g., walking, biking, carpooling or riding transit)?

	Yes -- this keeps me from using alternative transportation.	No -- this is not a factor in my transportation choices.
No bus runs between my home and work	❑	❑
Number of transfers (bus to bus)	❑	❑
Length of trip by bus	❑	❑
Bus does not come frequently or at the right time	❑	❑
Free access for bus limited only to certain routes	❑	❑
Bus stops are not conveniently located	❑	❑
I am not familiar with the bus routes and schedules	❑	❑
I live too far from school to bike	❑	❑
I do not feel safe biking	❑	❑
I live too far from school to walk	❑	❑

I do not feel safe walking	❑	❑
I do not know a person with whom I can carpool	❑	❑
I have to travel to other places on my way to or from work	❑	❑
Driving is the most convenient option for me	❑	❑
Lack of ADA accessible transport	❑	❑
Other...	❑	❑

...Please specify. _____

Q10. If you don't currently use the bus to commute, how likely would you be to take the bus given the following situations?

	Definitely Would Not	Not Very Likely	As Likely as Not	Very Likely	Definitely Would	N/A
If the bus stop was within a five minute walk from home	❑	❑	❑	❑	❑	❑
If the buses ran on a more frequent schedule	❑	❑	❑	❑	❑	❑
If parking cost more or was less available	❑	❑	❑	❑	❑	❑
If the length of commute by bus was similar to length by car	❑	❑	❑	❑	❑	❑
If emergency transportation service was available	❑	❑	❑	❑	❑	❑

Q11. What is your estimated cost per week to commute to and from campus?

- ❑ $0 - $9.99
- ❑ $10.00 - $19.99
- ❑ $20.00 - $29.99
- ❑ $30.00 - $39.99
- ❑ $40.00 - $49.99
- ❑ $50.00 - $99.99
- ❑ $100.00 or more

Q12. Do you use your car to commute to work?

- ❑ Yes
- ❑ No

Q12a. How much do you spend <u>per year</u> on the following car expenses?

(Even if you are not sure, please make your best estimate. Please give a rough figure rather than a range.)

Car insurance $_____

Car Payments $_____

Car Maintenance $_____

Gasoline $_____

Q13. What price would gas need to be for you to consider carpooling or other alternative transportation options?

- ❑ $3.00 per gallon
- ❑ $3.50 per gallon
- ❑ $4.00 per gallon
- ❑ $4.50 per gallon

- ❑ $5.00 per gallon
- ❑ Over $5.00 per gallon
- ❑ I would continue to drive no matter the price.

Q13a. How much would gas prices need to rise in one week for you to consider carpooling or other alternative transportation options?

- ❑ $.25 in one week
- ❑ $.50 in one week
- ❑ $1.00 in one week
- ❑ $2.00 in one week
- ❑ More than $2.00 in one week
- ❑ I would continue to drive no matter how much the price increases.

Q14. How likely would you be to use the following services or programs if they were offered to you?

	Definitely Would Not	Not Very Likely	As Likely as Not	Very Likely	Definitely Would
Assistance finding carpool partners	❑	❑	❑	❑	❑
Bicycle amenities (racks, lockers, showers, etc)	❑	❑	❑	❑	❑
Preferred parking for carpoolers	❑	❑	❑	❑	❑
Preferred parking for hybrids or fuel efficient vehicles	❑	❑	❑	❑	❑
Rewards for taking transit, walking, biking or carpooling	❑	❑	❑	❑	❑
Ride sharing program	❑	❑	❑	❑	❑
Carpooling program	❑	❑	❑	❑	❑
Vanpooling program	❑	❑	❑	❑	❑
Car sharing program	❑	❑	❑	❑	❑
Bike sharing program	❑	❑	❑	❑	❑
Free access to all CDTA bus routes	❑	❑	❑	❑	❑
Compressed work week	❑	❑	❑	❑	❑
Ability to work from home	❑	❑	❑	❑	❑
Free taxi rides home in an emergency	❑	❑	❑	❑	❑
Pre-tax bus pass purchases	❑	❑	❑	❑	❑

Q15. What features would you most desire in an improved bus service? *(Please select up to three.)*

- ❑ More convenient location of bus stops
- ❑ Better and larger waiting shelters at stops
- ❑ Better security
- ❑ Faster service (express buses and fewer stops)
- ❑ More comfortable buses (padded seats, Internet access, space for bags and parcels, etc.)
- ❑ More direct service between the places you want to go (no transfers)
- ❑ Shorter waiting times between buses
- ❑ More appealing look
- ❑ Free access to all CDTA routes

Q15a. What are the most important places to connect by bus to the University at Albany? *(Please select up to three.)*

- ❑ Albany Airport
- ❑ Rensselaer Train Station
- ❑ Colonie Center and Wolf Road
- ❑ Crossgates Mall

- ❑ Clifton Park
- ❑ Delmar
- ❑ Downtown Albany
- ❑ Guilderland
- ❑ Saratoga Springs
- ❑ Schenectady
- ❑ Troy
- ❑ Other...

...*Please specify.* _____

Q16. On which campuses do you regularly work or attend meetings or other work-related events? *(Please select all that apply.)*

- ❑ Uptown Campus
- ❑ Downtown Campus
- ❑ East Campus
- ❑ Harriman Campus
- ❑ Nano Campus
- ❑ Other...

...*Please specify.* _____

Q16a. What modes of transportation do you use when you travel from one campus to another? *(Please select all that apply.)*

- ❑ Walk
- ❑ Drive
- ❑ UAlbany Bus
- ❑ CDTA Bus
- ❑ Bike
- ❑ Other...

...*Please specify.* _____

Q17. Do you know where to get information on....

	Yes	No
...finding a carpool partner?	❑	❑
...walking and biking to campus?	❑	❑
...taking transit to campus?	❑	❑
...parking on campus?	❑	❑

Q18. What suggestions do you have for encouraging UAlbany employees to choose other transportation options?

_____
_____
_____
_____
_____
_____

Q19. What other information about transportation or commuting to the University do you believe would be helpful for us to know?

_____
_____
_____
_____
_____
_____

Q20. Which term best describes your employment classification?

- ❑ Teaching Faculty
- ❑ Non-Teaching Faculty
- ❑ Librarian
- ❑ Classified Staff
- ❑ Professional Staff
- ❑ Management/Confidential
- ❑ Other...

...*Please specify.* _____

Q20a. how often do you commute to campus on breaks in during the academic year?

- ❑ 0 times a week
- ❑ 1 time a week
- ❑ 2 times a week
- ❑ 3 times a week
- ❑ 4 times a week
- ❑ 5 or more times a week

Q20b. how often do you commute to campus during the summer?

- ❑ 0 times a week
- ❑ 1 time a week
- ❑ 2 times a week
- ❑ 3 times a week
- ❑ 4 times a week
- ❑ 5 or more times a week

Thanks for your input!

These are the last questions on the survey.

Q21. Are you...

- ❑ Male
- ❑ Female
- ❑ Transgender
- ❑ Other

...*Please specify.* _____

Q21a. What is your age?

- ❑ 18-29
- ❑ 30-39

- ❑ 40-49
- ❑ 50-59
- ❑ 60-69
- ❑ 70 or above

Q21b. How long have you worked at the University?

- ❑ Less than 1 year
- ❑ 1-2 years
- ❑ 3-4 years
- ❑ 5-9 years
- ❑ 10-19 years
- ❑ 20-29 years
- ❑ 30 or more years

Thank you for completing this survey!

Press the SUBMIT button below to save your responses.

After submitting your responses, you will be re-directed to a separate online form containing important links and asking if you might be willing to participate in a focus group next Spring semester.

THANK YOU AND FOCUS GROUP SOLICITATION MESSAGE

Thank you for taking the UAlbany Transportation Survey!

Your responses will help UAlbany evaluate our services, programs, and facilities related to transportation.

Would you be willing to participate in a focus group studying this issue in the Spring?

□ Yes.

□ No, thank you.

Thanks so much for your willingness to participate in a focus group next Spring!

We just need to ask about your affiliation with the University, and get your contact information so we can get in touch with you next Spring.

What is your affiliation with UAlbany? *(Please select the option that comes closest to describing your affiliation.)*

□ Freshman □ Other Student

□ Sophomore □ Faculty

□ Junior □ Staff

□ Senior □ Administration

□ Master's Student □ Other Employee

□ Doctoral Student

Please provide your first name and e-mail address so we can contact you next term.

This information is stored in a data set completely separate from the survey data.

First Name: _____

E-mail Address: _____

Thanks anyway -- we still appreciate your taking the survey!

Please click on "submit" below to exit this page.

After clicking on "submit," you will be re-directed to the UAlbany Green Transportation Web page.

SUGGESTIONS FOR CREATING A SUCCESSFUL FOCUS GROUP ANALYSIS

INTRODUCTION

As it is not possible to answer detailed questions through a traditional quantitative method, a qualitative supplement must be included, specifically in the form of open-ended interviews. The most efficient method of an open-ended interview, a method that facilitates obtaining answers from many subjects at a time, and one that allows for deep exploration of a topic, is the focus group. (Spitze, 2010). Originally developed during the late 1930's to counteract the presence of interviewer bias, focus groups often generate greater topic depth because of the non-directive involvement of the moderator in the group and a homogenous environment that takes away pressure to provide answers that are often socially unacceptable (Krueger 2000). The following outlines suggestions for creating a successful focus group environment.

GROUP SIZE AND COMPOSITION

One of the central elements to the focus group is "full engagement" of all participants. Since beliefs and decisions are often created through the group process, or its "synergy", and much less likely to occur in the traditional one-to-one interview process, it is very important that all group members are full involved in the discussion. Group size plays a vital role in this engagement process. While market research-based focus groups can often succeed with groups numbering up to 12 or more, social scientists have found that the optimum focus group number generally falls between six and eight participants (Krueger, 2000). Although having well over eight participants certainly increases the total number of opinions given, for a variety of topics, the chance for equal participation of all members lessens. As group numbers grow steadily larger, shyer members will tend to remain quiet rather than speak in front of a large group, and more dominating members will contribute a higher percentage of the time.

A balanced flow of conversation is also difficult with over eight participants. Due to the single spotlight and desire of many to express their points, multiple speakers, or worse yet, "side conversations" may occur (Krueger, 2000). While multiple speakers are particularly bad for recording purposes, side conversations are even more deadly to the group conversation because not everyone in the group has access to the information shared. Although no absolute upper limit of the focus group exists (sometimes as high as 10 or 12 for social science purposes), a great measure of this "group engagement" is the *whisper test*: if the moderator is able to hear whispers between multiple participants, the group is too large (Krueger, 2000). Group sizes much smaller than six are equally problematic as well. With well under six participants the total amount of information available is simply too limited. While it may be possible to maintain a useful

discussion with five or four members, a group much smaller than this is generally unable to sustain a thoughtful conversation, independent of the constant moderator guidance, that is likely to produce wholly new ideas through the group process method.

Topic "depth"; the uncovering of underlying beliefs about the specified topic, is the other core element to successful focus groups, and is perhaps even more critical than member participation. Generally in a public setting, participants are more inclined to give answers that are "publically acceptable" or more traditional in nature, rather than what they might actually believe. In this instance members commonly wish to maintain an appearance of political correctness and withhold any potentially offensive beliefs, which could upset other group members or the interviewer (Krueger, 2000). It is crucial, therefore, that the focus group maintains a small, tight-knit, and comfortable setting where sensitive topics can be fully explored.

Unlike most research groups that aim for a wide diversity of participants, they key to topic depth in focus groups is homogeneity. Homogeneity in the group; by ethnicity, age, gender, social class, or other demographic factors, is very important to building a sense of trust within the group, and allowing for frank discussion of the topic, whether it be sensitive or commonplace. The mood of the group should be cohesive enough that the conversation can, essentially, maintain itself, with the moderator playing less of an authoritative, and more of a casual-observer, role. While participants should generally feel comfortable with each other in the group, it is also important, though, that that none are closely acquainted prior to the meeting. This precludes any withholding of information, or any shared "secrets" (Krueger, 2000).

QUESTION DEVELOPMENT

Experts in the field of focus group administration also emphasize the importance of a specific order and "flow" to the question asked during the interview; one in which all questions should be asked, but space allowed for silence and contemplation, over the course of the 1hr – 1 ½ hr meeting (Spitze 2010). The general consensus for conducting a focus group uses a "question route", in which a series of questions are asked in a specific order, most commonly general to specific. These follow five main steps: "opening questions", to set the mood and create comfort in the room; "introductory questions" to introduce the topic at hand; "transition questions" to move from the general to the specific; and most importantly three to five "key questions", which cover the most critical elements of the topic (Krueger, 2000).

The interview is then generally concluded with one to two "ending questions", summarizing the main points discussed. It is also vital to have many sets of questions for each topic. While one or two questions are likely to begin a lengthy discussion for a particular topic, this is not always the case. It is important to have several backup as well as probing questions, to further explore each topic (Commuri 2010).

RECRUITING PROCESS

There are a variety of both methods of, and timetables for, contacting, recruiting, and retaining perspective focus group participants. While emailing is certainly the easiest, cheapest, and least labor-intensive method of contact and retention of recruits, other methods including phone calls, word of mouth, the snow-ball effect, in person recruitment, and advertising are all viable forms of participant recruitment; and in fact, each one of these methods was utilized, with varying degrees of success, over the course of this project.

Regarding online participant recruiting in particular, there are two distinct approaches that can be used; each with their unique strengths and weaknesses, depending on the responsiveness of the various stakeholder groups. If stakeholder groups are thought to be relatively responsive via email, the incremental or "batch" technique can be used. In this case, a small number of people are contacted and invited at a time, and no other perspective members are contacted until a sufficient amount of time has passed, and/or a large number of members from the initial list have RSVP'd as either being able or unable to attend the meeting. The strength of this technique is that, if done correctly, it can yield exactly the number of participants required. With a steady recruitment process, there is no need to turn away any initially contacted perspective recruits. The weakness of this method, alternatively, is that, if not done with enough advance notice, it can have very low yields of respondents, depending on the responsiveness and availability of the stakeholder group.
The other method here referred to as the "blanket" technique, employs an all-at-once strategy. In this manner a blanket invitation is sent to all perspective participants, with the assumption that a critical mass of participants is likely to contact the recruiter more quickly that the incremental approach. This technique can be used just as early as the batch technique, allowing more time for responses from the large number of those contacted, and is also helpful in situations with less lead time. The downside to this technique, of course, is that the recruiter may have to turn away, a large number of people that he or she initially invited, which can be perceived as somewhat unprofessional depending on the associated stakeholder populations.

While there is no definitive contacting schedule and initial number of invitations sent in order to reach the end goal of six to eight participants at each focus group, some guidelines were developed for this handbook that may aid the online recruiting process of future focus groups. For the best results, a series of four email exchanges between the participant and recruiter should occur, and depending on the attrition rate of the targeted group, there should be approximately 14 to 26 participants that initially able to join the group upon first contact one month before the meeting. These figures are based on a low attrition rate of ¼ loss between each confirmation over the four weeks, and a high attrition rate of ½ over the same number of weeks. The final average number of 7 participants, therefore, climbs to between 14 and 26 or higher depending on the respective group's likely attrition rate. These figures only take into account the total number of participants that are initially *able* to attend the focus group. Inability to attend based on schedule

conflicts will likely preclude at least 1/3 of those contacted from attending, and it is likely that another 1/3 will not return the email; so in order to truly have a comfortable base of perspective focus group members, it may be necessary to initially send out as many as 42 to 78 invitations, depending on the variables at hand.

A scheduled set of email exchanges is also important for retention of perspective members. A period of four weeks is optimal for sending initial invitations to members. After immediately confirming those able to attend four weeks before the meeting, it is best to follow up with each respondent two to three weeks later. This two to three week period allows both parties space to reconfirm without frequent burdensome emails, and can help thin out an initially large respondent group. Reconfirmations three to four days before the meeting are important and those the night before, or day of, the meeting are particularly necessary for knowing, definitively, that the target number of participants will be present.

Focus group marketing through brand identification and incentives are also very central elements to successful member recruitment. Often times small sums of money, generally in the area of $25 to $50 per member, is used to entice people into agreeing, and following through with their commitment, to attend a focus group (Krueger, 2000). While cash incentives are primarily used in market research, they are also quite common in the social sciences and other academic arenas. Food is also a common incentive in many focus groups. Whichever enticement is used, specifically mentioning the reward in the invitation to each group is essential. In order to have a successful marketing and advertising strategy of the study, for both participants and various interested parties, it is also useful to have study-identity and branding (Krueger, 2000) such as, *U-Commute*, and display this title throughout various email exchanges and signs advertising the event, and directing participants to meeting areas.

SUCCESSFUL FOCUS GROUP ADMINISTRATION

Some specific elements exist that are necessary for, and lead to, the administration of successful focus groups. The role and importance of the moderator is central to a well-run meeting (Krueger, 2000). On the one hand the moderator needs to have general command over the meeting structure and process: pinpointing potentially dominant speakers and mitigating their effect over the group through seating arrangements and other techniques; drawing input from less talkative or shy participants; specifying meeting guidelines and rules, and maintaining the flow of the conversation to be both on time and on topic. At the same time, the moderator must remain almost as a background figure; letting the participants do a majority of the talking, being an engaged and active listener, but have the ability to guide the conversation at critical moments.

The moderator should also be very comfortable with the focus group topic and question route. As conversations often do not follow the exact outline created for the meeting, the moderator should be able to

easily jump between topics (most successfully done though the use of labeled note cards or other tools); and also set a pace that is both steady, without lagging, but is also not rushed, giving lots of space to explore topics, including periods for pause and reflection (Commuri 2010). In case of an emergency, or inability to attend a meeting, it is also useful for the moderator to layout the question format with enough clarity, so that the assistant moderator or other personnel can run the meeting without great difficulty.

The use of an assistant moderator is also quite important both for technical assistance during the meeting and for recording purposes. The presence of an assistant frees up the moderator from handling supportive tasks such as food service issues, entry or exit of participants, distribution of forms, and microphone maintenance. Assistant moderators are also key to the recording process. While moderators can take notes with some level of detail during the meeting, assistants can take extensive detailed notes during the meeting, allowing for immediate topic discussion following the meeting, and saving the moderator countless hours transcribing the interview. It is also important for both moderator and assistant to designate a private room for the event, free of extraneous sound for the recording process; and it is often useful to have two recorders as backup in the event that one malfunctions.

Full disclosure and consent of participants is also important before initiating focus group interviews. They are almost always required by institutional research board's (I.R.B.) at colleges and universities for the conducting of any research based interviews, and are generally good practice for having a knowledgeable and content set of participants. In this study, participants were given an overview of the study in the invitation, and after an explicit description of the meeting outline, participants were given two consent forms to sign, or not to sign that indicated their willingness to be participants in the study, and their comfort with having the interview recorded and stored on file.

Various other measures for success during the interview also exist. It is very important to select a meeting location that is central to as many participants as possible. Depending on the centrality of the meeting location, it is also useful, often times, to place signage along commonly travelled paths of the respective participant groups. Sometimes reservation difficulties arise when scheduling a number of consecutive meetings as well, so it is always important to reconfirm room reservations a number of times leading up to, and including the day of, each meeting.

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Commuri, Suraj. Personal Interview. 03 March 2010

Krueger, Richard A. and Mary A. Casey. Focus Groups: A Practical Guide for Applied Research 3rd Ed. Thousand Oaks: Sage Publications, 2000.

Spitze, Glenna. Personal Interview. 05 January 2010

SAMPLE FOCUS GROUP DOCUMENTS

Sample Invitation

Dear _____,

Thank you very much for your participation in the Fall 2009 Transportation commuting survey. As you stated in your survey, you would be interested in participating in a follow-up discussion on your commuting preferences.

I am writing to invite you to join a small group of fellow faculty for a lunchtime discussion to help us learn more about this topic

The 'U-Commute focus groups' will provide lunch at the Campus Center 375, and staff and student members from the Planning Department will facilitate the conversations.

The lunch discussion will take place on _____ from 12:00 to 1:30 PM, and will be located in the Patroon Room. **A free catered lunch will be provided.** This group is dedicated solely to fellow faculty members who were interested in follow up conversations regarding the transportation survey conducted in the Fall of 2009

If you are interested in participating, please contact _____ either by phone at _____ or by e-mail at _____

I hope you can join us over lunch and share with us your opinions and experiences. Thanks in advance for your input!

Yours Sincerely,

_____

Research Assistant

Department of Geography and Planning
University at Albany-SUNY

Albany, NY 12222
PH: _____

Sample Focus Group Questions

Focus Group Questions (Female Off Campus)

Hi everyone.

Welcome to our focus group on *commuting to school, your preferences, and alternative methods of transportation*

I'm _____ and I'll be your moderator today. Also this is _____ and he'll be our assistant moderator.

Before we go into our discussion I'll just say a few words about why we are here today and what this process is going to be like just to reemphasize what was in the emails you were sent.

- There is an ongoing research project looking at alternative methods of transportation for Suny students staff and faculty, and we wanted to get a more in depth look at peoples ideas than just the survey that was sent around. So that is what we are doing today in a more focused group, or focus group.
- We will have about 1 ½ hours for our discussion. If we end more quickly that is fine and if people want to stick around that is fine also, although we will not be recording after that time.
- We will not be stopping for breaks, so if you need to go to the bathroom please feel free to go at any time, grab food etc.
- I want to let you know that we are recording these sessions on a digital recorder so we can take notes from them later. Everything said here though is confidential and we will not attach your name to the transcriptions, so feel free to be as candid as you want.

I just want to go over a couple of ground rules before we start also.

- One person at a time should be talking. This is both out of respect but also it makes it difficult to make out 5 voices at once on the recorder.

- So please no side conversations
- Also most of the time we will not have to go in order, but if I see you not talking at all I may pick on you ☺
- Are there any other rules that you think we should have?

Ok, so as kind of an introduction, why don't we go around the room and say our name, the city we're from and what our major (department) is.

Now we're going to get into a few of the questions that we are here today to talk about. I want to start by talking about the overall transportation system here at SUNY

1. **Overall quality of U-Albany transportation**

How do you feel the University's transportation system works for you, or doesn't work for you?

Have you had any major problems since the time you've been here?

2. **PARKING:**

PARKING: What are your thoughts on the parking situation?

Is there enough?

The university is considering a preferential parking for different kinds of drivers. What do you think preferential parking for hybrids? carpoolers?

What is your opinion on carpooling?

What would make parking here so difficult that you wouldn't want to drive at all? What about if they raised the parking fees to $500, $1000 a year for example? Or there was even more congestion?

3. **Bus**

What is your opinion on the bus system?

Do you have friends that regularly use the bus? Do you use the bus yourself?

What are the major problems with the bus, if any?

Would you be more likely to use the bus if you could go anywhere free?

Would you use the bus more if the bus had internet? Was a hybrid?

When do you think you would actually choose to take the bus?

Some people in the survey seemed interest in getting some kind of rewards for using the bus. What do you think about that idea? What kinds of rewards would interest you?

Do you think it would be useful to have a notifier on your IPhone (for example) that told you how close a bus was?

Do you ever use the shuttle? How is that system working for you?

4. **Carpooling**

What is your opinion on carpooling?

Is there anything about it that is unappealing?

When do you think you would actually choose carpooling over driving alone?

Would you be more likely to carpool if you got preferred parking close to campus just for carpoolers?

What about the idea of Zip-car, (where you can rent a car cheaply for a long term or short term)?

5. **Biking**

Do you own a bike?

Have you ever biked to campus?

Some people in the survey talked about not feeling safe biking to campus; what do you think it would take to get you to feel safer biking to campus?

Some people in the survey talked about wanting nice bike facilities on campus. What kinds of amenities do you think it would be nice to have around here?

What do you think about the idea of a bike share for use on campus or ones that you could take home?

6. **Bigger Trips**

How do you get to and from home at the beginning and end of the semester?

Do think it would be a good idea for there to be coordinated pickups at the airport or buses to NYC?

7. **Better Mileage New Car**

The university is thinking about a program where they could get a good discount on a bulk purchase of hybrid cars. What do you think about this idea? Would you be interested in getting a hybrid or a used car with better fuel mileage if the university could get you a good discount toward that?

8. **Anything else**

Are there any other ideas you have about how to make commuting to campus more environmentally friendly?

Thank you all very much for coming

Focus Group Questions (Tuesday – Male Off Campus)

Hi everyone.

Welcome to our focus group on *commuting to school, your preferences, and alternative methods of transportation*

I'm _____ and I'll be your moderator today. Also this is _____ and he'll be our assistant moderator.

Before we go into our discussion I'll just say a few words about why we are here today and what this process is going to be like just to reemphasize what was in the emails you were sent.

- There is an ongoing research project looking at alternative methods of transportation for Suny students staff and faculty, and we wanted to get a more in depth look at peoples ideas than just the survey that was sent around. So that is what we are doing today in a more focused group, or focus group.
- We will have about 1 ½ hours for our discussion. If we end more quickly that is fine and if people want to stick around that is fine also, although we will not be recording after that time.
- We will not be stopping for breaks, so if you need to go to the bathroom please feel free to go at any time, grab food etc.
- I want to let you know that we are recording these sessions on a digital recorder so we can take notes from them later. Everything said here though is confidential and we will not attach your name to the transcriptions, so feel free to be as candid as you want.

I just want to go over a couple of ground rules before we start also.

- One person at a time should be talking. This is both out of respect but also it makes it difficult to make out 5 voices at once on the recorder.
- So please no side conversations
- Also most of the time we will not have to go in order, but if I see you not talking at all I may pick on you ☺
- Are there any other rules that you think we should have?

Ok, so as kind of an introduction, why don't we go around the room and say our name, the city we're from and what our major (department) is.

Now we're going to get into a few of the questions that we are here today to talk about. I want to start by talking about the overall transportation system here at SUNY

1. **Overall quality of U-Albany transportation**

How do you feel the University's transportation system works for you, or doesn't work for you?

Have you had any major problems since the time you've been here?

2. **PARKING**

PARKING: What are your thoughts on the parking situation?

Is there enough?

PARKING: The university is considering a preferential parking for different kinds of drivers. What do you think preferential parking for hybrids? carpoolers?

PARKING: What is your opinion on carpooling?

PARKING: What would make parking here so difficult that you wouldn't want to drive at all? What about if they raised the parking fees to $500, $1000 a year for example? Or there was even more congestion?

3. **BUS**

BUS: What is your opinion on the bus system? Do you have friends that regularly use the bus? Do you use the bus yourself?

What are the major problems with the bus, if any?

BUS: Would you be more likely to use the bus if you could go anywhere free?

Would you use the bus more if the bus had internet? Was a hybrid?

BUS: When do you think you would actually choose to take the bus?

BUS: Some people in the survey seemed interest in getting some kind of rewards for using the bus. What do you think about that idea? What kinds of rewards would interest you?

BUS: Do you think it would be useful to have a notifier on your IPhone (for example) that told you how close a bus was?

BUS: Do you ever use the shuttle? How is that system working for you?

4. **CARPOOLING**

CARPOOLING: What is your opinion on carpooling?

Is there anything about it that is unappealing?

CARPOOLING: When do you think you would actually choose carpooling over driving alone?

CARPOOLING: Would you be more likely to carpool if you got preferred parking close to campus just for carpoolers?

CARPOOLING: What about the idea of Zip-car, (where you can rent a car cheaply for a long term or short term)?

5. **BIKING**

BIKING: Do you own a bike?

Have you ever biked to campus?

BIKING: Some people in the survey talked about not feeling safe biking to campus; what do you think it would take to get you to feel safer biking to campus?

BIKING: Some people in the survey talked about wanting nice bike facilities on campus. What kinds of amenities do you think it would be nice to have around here?

BIKING: What do you think about the idea of a bike share for use on campus or ones that you could take home?

6. **BIGGER TRIPS**

BIGGER TRIPS: How do you get to and from home at the beginning and end of the semester?

BIGGER TRIPS: Do think it would be a good idea for there to be coordinated pickups at the airport or buses to NYC?

7. **BETTER MILEAGE CAR**

BETTER MILEAGE CAR: The university is thinking about a program where they could get a good discount on a bulk purchase of hybrid cars. What do you think about this idea? Would you be interested in

getting a hybrid or a used car with better fuel mileage if the university could get you a good discount toward that?

8. **ANYTHING ELSE**

ANYTHING ELSE: Are there any other ideas you have about how to make commuting to campus more environmentally friendly?

Thank you all very much for coming

APPENDIX

GPS ON-TIME PERFORMANCE ADDITIONAL INFORMATION

Transportation and Land Use Review

A compact and dense pattern of development allows for increased modal options such as public transportation and walking and bicycling. In fact, it is well documented that the greater the population density, the more likely commuters are to switch from SOV travel to public transportation or other alternative modes of transportation (Commuting in America III, 2006). This is due to the fact that in urbanized areas it is more feasible to commute via public transit or an alternative mode due to a compact pattern of development, greater population density, and traffic congestion. In areas where the pattern of land use is more fragmented with a separation of land uses and a lower population density, there are often fewer transportation options because decentralized areas do not have a population density that meets the minimum threshold conducive for the operation of mass transit. As a result, commuters in suburban and rural areas almost exclusively rely on SOV travel for commuting. The relationship between transportation, land use and the environment is interconnected. The pattern of land use determines to a large extent the feasibility of various modes of transportation and thus the environmental quality of a locality or region. A report by the Transportation Research Board (TRB) which examines the interrelationship of land use, motorized travel, energy use and GHG emissions provides recommendations on what constitutes sustainable development and land use practices. The report identifies five attributes of sustainable development which include density, diversity of land uses, design, destination accessibility and distance from transit (TRB Special Report 298, 2009). In addition, the report recommends that Land use and Transportation Planners should consider the "Five D's" when planning for land development and transportation infrastructure. Density is important because a compact form of development allows for an integration of land uses such as housing and employment. Diversity of land uses is critical because a mix of land uses allow people to live closer to their place of employment which increases the feasibility of alternative modes of commuting to work. Design considerations are important during the planning process and should incorporate multi modal transportation infrastructure such as adequate bicycle and pedestrian facilities. Destination accessibility, the proximity of origins and destinations, is important to consider because the shorter the distance between an origin and destination, the more transportation options commuters have to select. Lastly, distance from transit is another important factor to consider because it dictates the ease of access to transit from home and work. In addition, there are specific planning policies and zoning regulations that planners can utilize to achieve the "Five D's" and thereby foster sustainable development (TRB Special Report 298, 2009).

A few of the tools that planners have at their disposal to encourage compact and dense development include the use of overlay zones and various incentives to foster compact development. Overlay zones can be used to facilitate mixed-use development and Transit Oriented Development (TOD); both forms of development are desirable because they promote compact development that is dense in nature, integrates a mix of land uses and is easily served by public transit. A few incentives for compact development include density bonuses, increased Floor Area Ratios (FAR) and tax credits. These tools help promote the desired pattern of development.

Transportation Demand Management

The interrelationship between transportation, land use and GHG emissions is complicated given that each component of the equation is inherently connected. The goal of reducing GHG emissions in the transportation sector requires a comprehensive and multifaceted policy approach that addresses each component. Transportation Demand Management (TDM) is a policy program aimed at reducing SOV commuting and encouraging alternative modes of transportation such as public transit, bicycling, walking and ridesharing. A TDM program utilizes several incentives and disincentives to achieve its objectives such as increasing the cost of SOV commuting by increasing the price of parking, increasing transit service and ease of transit use through prepaid transit pass programs, offering ridesharing programs and a guaranteed ride home program, free parking for carpools and vanpools, shuttle service, bicycling incentives such as secure bike parking facilities and a locker room with showers, intermodal connections such as transit buses equipped with bike racks and land use connections that attempt to identify and target commuter sheds and provide increased transit service to the area. Once the goals and objectives of a TDM program have been implemented it is important that the outcomes of the program are monitored and evaluated in order to determine the effectiveness of the program and areas that need revision. Effective monitoring and evaluation of a TDM program can be measured by tracking the sale of parking permits, conducting traffic counts and transit ridership counts, and administering a survey instrument which collects data for modal split analysis and commuter shed analysis and to gather user feedback (TCRP Report 107, 2005).

A major component of a successful TDM program is promoting transit use. According to the American Public Transportation Association (APTA), public transportation provides numerous benefits "by reducing the growth in vehicle miles of travel, easing congestion and supporting more efficient land use patterns, public transportation can reduce harmful CO2 emissions by 37 million metric tons annually" (APTA, 2008). As such, public transportation plays a vital role in reducing GHG emissions.

LITERATURE REVIEW

In recent times university communities have exhibited an increased interest in environmental sustainability and livability. The concern over environmental sustainability and livability have been addressed in many different facets of university operations from the implementation of recycling programs to the installation of energy conserving light bulbs. One facet of university operations in particular that has become the target of sustainability efforts is the reduction of personal vehicle use on university campuses. In many university and college communities personal vehicle use is the primary mode in which the majority of students, faculty, and staff travel to campus. This transportation mode has become problematic for university and college communities for several reasons. The predominant reliance on SOVs to travel to and from campus has resulted in traffic congestion and an increased demand for parking. In addition, SOV travel contributes to a university's carbon emissions and conflict with sustainability efforts. As such, many universities are addressing the problems posed by SOV travel through various transportation demand management (TDM) strategies that promote alternative forms of transportation to SOV travel. Such TDM strategies often place incentives on desired modes of transportation such as transit usage and ridesharing. As such, transit service has become the centerpiece of many TDM strategies in college and university communities throughout the nation. Given the importance of transit service in creating sustainable campuses it is important to better understand how transit service can be planned to effectively serve the needs of college and university communities.

The Transit Cooperative Research Program (TCRP) Synthesis 39 "Transportation on College and University Campuses," and Synthesis 78 "Transit Systems in College and University Communities" offer valuable information on transportation issues that face institutions of higher education. The TCRP Report 39 contains information derived from a survey that was administered to 30 college and university campuses. The TCRP Report 78 is a follow up to Report 39 and focuses on communities surrounding institutions of higher education to gather primary data on transit agencies that provide campus transit service as well as local and regional transit service. As discussed in the reports, college and university campuses across the nation have experienced increasing traffic and parking problems in recent times. These problems are in need of a solution as many colleges and universities wish to expand their campuses on limited land; they do not have the space or desire to construct additional surface parking as it is very space intensive and expensive to construct and maintain. Therefore, the concept of TDM has gained considerable interest in campus communities in recent times. The recent interest in campus transportation is the product of several factors. As previously mentioned, the growth of college and university campuses places strains on the provision of on-campus parking space and the construction of new educational facilities also requires space which results in generating additional campus traffic. These competing land uses, educational facilities and parking lots, vie for limited space on college and university campuses. To address the mounting problem of college and university growth and its associated traffic congestion and

parking problems, transit service has been used as a means to alleviate congestion and parking issues on many college and university campuses. The use of transit in campus communities is an excellent TDM strategy as identified in the literature because it benefits both the campus community and transit agencies while also providing an environmentally sustainable alternative to the SOV (TCRP, 2001). In addition, campus communities benefit from the provision of transit because they do not have to set additional land aside for parking. Instead, colleges and universities can develop educational facilities and other buildings on the land. Furthermore, transit agencies benefit from providing transit service to campus communities because students, faculty and staff comprise a large and stable market for transit service providers (TCRP, 2001). This market is important to transit providers because it represents a major market segment with considerable growth potential compared to other transit market segments (TCRP, 2001).

Unlimited Access Transit

The use of transit on university campuses has been identified as an excellent TDM approach as well as providing the added benefits of reducing traffic congestion and the need for additional surface parking. While transit is recognized as holding great potential in aiding colleges and universities with both transportation and land use issues, a particular type of transit referred to as "unlimited access" has received much attention and praise in the literature. The use of unlimited access funding systems is a relatively recent trend that has been adopted in some campus communities as it provides primarily students as well as faculty and staff unlimited use of transit service without paying a fare each time the transit service is used (TCRP, 2001). It is important to note that the term "unlimited access" is not in reference to a particular type of transit. It refers to a particular approach to providing transit service where the ridership does not pay a fare for using the service each time transit is used (TCRP, 2001). Unlimited access systems are not free to users; however, the perceived cost of transit usage is minimized to users because a fare is not collected each time the user rides transit. Instead, unlimited access systems are actually prepaid systems in that the cost of transit service is covered through fees paid at the beginning of the semester such as a component of a student activity fee. The actual fee structure varies depending on the institution. Common fee structures to cover the cost of providing unlimited access transit to the campus community include student fees that are added to the tuition bill and fees collected from vehicles registered to park on campus. The passage of the Intermodal Surface Transportation Efficiency Act (ISTEA) in 1991 and the Transportation Equity Act for the 21st Century (TEA-21) in 1997 have provided unlimited access transit systems with additional funding sources. The passage of both acts have resulted in substantial increases in federal funding for transit that is also matched by many states providing increased funding for transit (TCRP, 2001). The various funding sources that are available to transit operators afford the opportunity to test new approaches to providing transit service including unlimited access systems.

The implementation of an unlimited access transit system appears to offer the most attractive alternative to SOV travel because the cost of transit use is not incurred each time a user rides transit. This fact allows unlimited access transit to directly compete with SOV travel because the cost of personal vehicle use is not incurred each time a driver operates their vehicle. While personal vehicle operation is expensive and includes such costs as insurance, maintenance, and fuel; these costs are not incurred each time the vehicle is operated. Traditional transit systems operate with a fare box so that each trip costs the user out of pocket. As such, traditional transit systems are not competitive with personal vehicle use due to the perception that one must pay each time they ride. Alternatively, unlimited access transit systems offer an attractive alternative to personal vehicle use because much like operating a personal vehicle, riding on an unlimited access transit system does not require the user to incur an out of pocket expense each time they travel (TCRP, 2001).

The ability for transit operators serving college and university campuses to provide unlimited access transit is beneficial to the entire campus community because it can help the institution reduce the demand for additional surface parking, increase student access to off-campus housing and employment and significantly reduce congestion both on campus and in the local community. In addition, transit operators are in favor of developing unlimited access transit systems because such systems provide operators with an increase in ridership, a guaranteed revenue source, and allow for improvements in the quality of the transit service (TCRP, 2001)

Planning, Implementing, and Operating Campus Transit Systems

The TCRP Report 39 which is concerned with Transportation on College and University campuses offers lessons learned and issues related to planning, implementing, and operating campus transit systems. It is important to note that a transit system that serves campus communities will experience different planning, implementing, and operating issues compared to a traditional system that does not serve a campus community. In this way, a campus community has an advantage in developing and operating a transit system over a traditional transit system because a college or university has control over land use, parking regulations and fees as well as routing and the cost of transit service. As such, colleges and universities are strategically positioned to successfully implement transportation demand policies that would be much more difficult to attain in non-campus communities where control over land use, parking, and transit service is carried out by separate agencies which makes coordination much more difficult compared to the campus setting where these policies and regulations are centrally controlled by the university administration (TCRP, 2001). The comprehensive control that a university's administration has over the campus can be used to promote transit service while at the same time reducing the reliance on SOV travel. Such TDM measures have the potential to lower the demand for parking, reduce traffic congestion, improve the campus environment and allow for more open space preservation on campus. In this way, a transit based

TDM program is an excellent and effective way for a campus to achieve sustainability goals while improving livability at the same time.

It has been found that colleges and universities are motivated to reduce the demand for parking and increase transit usage and ridesharing programs based four primary reasons. The first reason is the cost of providing additional parking. The second reason is that many campuses do not have adequate space to provide additional parking even if the provision of additional parking is not cost prohibitive. A third reason is that some campuses are becoming concerned with environmental sustainability and the livability of the campus. As such, some campuses are pursuing various TDM strategies. The fourth reason that colleges and universities are attempting to reduce demand for parking and increase transit usage and ridesharing programs is in response to local government regulations that limit parking expansion or attempt to control traffic to and from the campus. These local government regulations are usually part of a community's comprehensive plan or part of the zoning regulations that pertain to university land use and parking regulations. This varies depending on location, whether the institution is public or private, and on the surrounding municipalities land use regulations and controls (TCRP, 2001).

Lessons Learned From Literature

Review of the TCRP Reports have provided valuable insights into transportation issues that face college and university campuses as well as the local and regional communities that surround institutions of higher education. These areas face unique transportation issues because they contain a large population that must travel to and around a common campus destination. The good news is that college and university communities are well suited to confront the transportation issues they face. The favorable position that campus communities find themselves in regarding transportation is due to the fact that university administration has central control over campus operations such as land use, parking regulations, and transit (TRCP, 2001). This central control allows campus communities to experiment with various TDM strategies and transit systems in order to achieve desired objectives.

One of the most noteworthy results from the TCRP reports is the extent to which campus communities are experimenting with unlimited access transit. It was found that these transit systems are being funded by a combination of student fees, parking revenue, and operating assistance provided by the university and from federal and state funding (TCRP, 2001). The provision of unlimited access transit is not only supported by colleges and universities as part of a TDM program, it is also supported by transit operators, students and to a lesser extent by faculty and staff. In making a case for unlimited access transit systems, the university administration is in favor of supporting such transit systems because is supports TDM efforts by reducing traffic congestion and parking demand on campus. Students favor unlimited access transit service because

it offers them greater mobility and transit operators favor unlimited access because it generates a guaranteed revenue source that allows them to provide better service (TCRP, 2001).

Another trend that was identified in the literature and illustrates the direction in which many college and university communities are moving in regards to transportation issues is the increase in multi-university unlimited access transit systems. This trend is especially apparent in large urban areas that have two or more college or universities located within the urban area. A multi-university unlimited access system involves an agreement between two or more institutions of higher education and the regional transit system that serves the urban area. Under a multi-university unlimited access system the regional transit systems arranges a contract with multiple universities to provide unlimited access transit service to students and sometimes faculty and staff of the participating universities (TCRP, 2001).

It has been reported that transit ridership has recently increased and in some places the increase in transit ridership has been substantial (TCRP, 2008). The recent increase in transit ridership has been attributed to several contributing factors that have made transit an attractive alternative to SOV travel. The factors that have been cited for increased demand for transit services include the rising cost of fuel, the imposition of stricter parking regulations and higher fees, an increase in the availability and convenience of transit service, and price incentives and pass agreements such the unlimited access transit systems (TCRP, 2008). Unlimited access transit systems also known as U-Pass systems have become an increasingly utilized method for providing transit service to campus communities (TCRP, 2008). In addition to these contributing factors that have made transit usage more popular in recent times, technology has also played a role in improving the quality of transit service and thus making transit a more appealing option for commuters. The role of technology in transit operations is becoming an integral part of transit service and has been embraced or explored by many transit operators. In particular, GPS is a new technology that has been applied to transit operations. The adoption of GPS technology by transit operators and the transportation industry in general is invaluable because this technology offers the capability to improve efficiency and lower operating costs while also improving customer satisfaction at the same time. In relation to the transit industry, GPS technology is capable of making transit operations run more efficiently through better schedule building and fleet management as well as providing an improved level of customer service by allowing for operational analysis of transit system performance to be conducted. These two capabilities that GPS technology offers transit operators are very beneficial in helping transit meet and efficiently serve the rising demand for transit services that has occurred in recent times. Conducting operational analysis of transit service is very important if transit operators are to retain ridership and successfully implement new programs such as unlimited access transit. The integration of GPS technology into performing operational analysis has resulted in better data that can be visualized and studied to determine if transit operations are running on-time at various time points across the network and where along the network problems are occurring. This capability is a very useful in transit operations and

planning applications because it allows for problems in transit service to be identified and addressed. In addition, it allows operators to check the system's actual on-time performance compared to the times posted in the schedules. This capability is very important because on-time performance of a transit system is a critical factor that is considered by transit users. If a transit system operates on-time and in an efficient manner it is likely to retain its current ridership and gain additional users. It is important that transit operate as efficiently as possible because transit service is becoming an important component of many college and university TDM programs.

In line with current campus community TDM efforts it was found that many colleges and universities are conducting comprehensive transportation demand management programs which include increased transit service and unlimited access services as well as incentives for SOV commuting alternatives such as ridesharing, vanpools, and non-motorized modes of transportation such as bicycle and pedestrian programs. Such comprehensive transportation demand management programs aim to place strong disincentives on SOV use by restricting the availability of parking and placing high fees on parking while simultaneously promoting alternative forms of transportation. These new approaches to TDM and transit will require colleges and universities to work with the surrounding community and the regional transit service in order to achieve a comprehensive transportation demand management program that is effective. The role of transit is becoming increasingly important in meeting the goals and objectives of campus communities such that campuses may continue to expand while meeting sustainability and livability goals and mitigating the negative impacts of development. As such reliable transit service becomes a critical element in making TDM strategies successful. Therefore, it is essential that transit service operates efficiently and on-time in order for the service to be successful and gain ridership.

The Role of Technology in Conducting Operational Analysis

The recent trend of implementing TDM programs in many campus communities and the focus and incentives that such programs place on transit use has resulted in increased demand for transit service. As such, it is important that transit operators are able to meet and efficiently serve increases in demand for transit service. As such, it is advisable that a TDM program that places incentives on transit use through the implementation of unlimited access systems, stricter parking regulations or other means has accounted for the operational efficiency of the transit system to ensure that the transit system can adequately serve increased ridership. Therefore, it is important that transit operators conduct operational analysis including an on-time performance analysis of their transit system to ensure that the transit system is operating in an efficient and timely manner. An operational analysis should check to ensure that the transit system is capable of accommodating increased demand as well as schedule adherence. This is crucial if a TDM program that places incentives on transit use is to be successful.

In the past transit operators have found the process of conducting operational analysis and on-time performance analysis to be time consuming and expensive. The process of conducting operational analysis has traditionally been very involved due to data constraints. It typically has been difficult for transit operators to collect sufficient data and to post-process the data and conduct detailed analysis. This is problematic because conducting operational analysis allows transit operators to identify problems and implement strategies to improve service levels. Fortunately, the application of new technology has greatly improved the cost effectiveness and ease of conducting on-time performance analysis of transit systems. The use of GPS technology has greatly increased the feasibility of conducting on-time performance analysis of transit operations as it allows for accurate data collection and analysis to be carried out in a timely manner. In addition, the use of GPS technology in conducting on-time performance analysis has the added benefit of providing a spatial element to operational analysis. In the past, on-time performance was based on schedule adherence with time being the only factor. The application of GPS in conducting on-time performance analysis allows for time and space to be factors in the analysis. The use of GPS technology includes spatial attributes on the data which can be visualized and mapped in GIS. Improvements in GIS software have made a GPS based on-time performance analysis of transit operations even more feasible because it is possible to evaluate schedule adherence and to visualize where problems are occurring on the transit network. Advancements in GPS technology have made a GPS based on-time performance analysis of transit operations even more viable because the cost of equipment has been reduced significantly. In addition, the size of GPS units has become increasingly compact and the ease of use has improved greatly. These factors have made GPS a viable option for conducting operational analysis. As such, the use of GPS technology to conduct on-time performance and operational analysis of transit systems is explored to better understand the full capability of the technology and the accepted methods for data collection and analysis.

Evaluating On-time Performance

A research project conducted by the Institute of Transport Studies at the University of Sydney demonstrates the use of GPS technology to assess the on-time performance of buses in Sydney, Australia. The research project used hand held GPS data loggers and a GIS program to conduct operational analysis of a Sydney bus operator. The purpose of the study was to illustrate how to conduct a valuable on-time performance study with rather inexpensive GPS equipment and thus demonstrate that it is not necessary for a transit operator to be equipped with an Automatic vehicle location (AVL) system or other type of real-time GPS based system in order to conduct a GPS based on-time performance analysis. The researchers advocated for the use of inexpensive GPS data loggers on the basis that the technology can operate independently of other systems and it serves as a low cost and practical method for collecting performance data. Another attractive feature of using GPS data loggers is that the units are portable. This allows one or two units to be moved between different buses, greatly reducing the cost of conducting operational analysis.

According to the researchers the first step in conducting an operational analysis with GPS data loggers is to identify the routes to be analyzed. Once specific routes have been selected for analysis it is necessary to match individual trips with the transit schedule in order to compare the scheduled times with the actual running times. The research project drew on three main sources of data to conduct the analysis. The three sources of data included: bus stop coordinates, the transit schedule, and GPS data collected from the transit route. Timing points along the route were identified and arrival times at the timing points were recorded. The GPS data were then downloaded for analysis. The data had to be reformatted before it could be imported into GIS. Microsoft Excel was used to reformat the data such that numerical values stored as times were converted to integers. The database was constructed such that each row of the table represented a trip, with columns representing the scheduled arrival times at timing points along the route (Bullock et al., 2005).

The next step in conducting the on-time performance analysis involved the development of a trip processing algorithm and timetable query. The trip processing algorithm and timetable query where created to generate travel time output from the GPS data files. The trip processing algorithm performed three main tasks. The first task breaks the continuous GPS records into separate blocks of records with each block representing a trip. Then, the program examines the trips, determines the type of trip, and analyzes running times and travel times between timing points. In the third task, GIS layers, selection sets and maps are created so that the data can be visualized and analyzed (Bullock et al., 2005).

In determining trip definition the researchers used three criteria to break continuous data into basic trips. To determine where to place a break point the program checks where along the route the record is located, the number of bus stops traveled through on the route and if a reversal in the direction of travel occurred (Bullock et al., 2005). Next, the algorithm defines the type of trip made based on starting and ending points. If the program detects a trip made along the study route it is assessed for on-time performance by measuring the time it takes the bus to travel between timing points. In this way, on-time bus performance is measured by comparing the time the bus arrived at a timing point with the time that the bus was scheduled to arrive at the timing point. It is important to note that this method requires each GPS trip made along the study route to be matched correctly with the corresponding trip listed on the transit schedule. When the GPS start times have been matched with the schedule start times the program compares the time the bus arrived at each timing point and calculates the difference between the actual arrival time recorded by the GPS and the arrival time posted on the transit schedule. In addition, travel times are calculated between each set of timing points.

In order to evaluate on-time performance the researchers developed an Excel spreadsheet that generated statistics on travel times and differences between scheduled times and the actual running time. The

researchers cited this method as being one of the most widely recognized indicators of transit service (Bullock et al., 2005). The researchers caution that before a meaningful on-time performance analysis can be conducted on the timetable query it is necessary to remove outliers from the dataset. From the timetable query the following descriptive statistics were reported on on-time performance: average, median, standard deviation, minimum, and maximum. The researchers favored median time over average time because the median is less affected by the presence of outliers.

In conducting the research the GPS data loggers where set at different polling rates. In this way, half of the GPS data loggers were calibrated to record data at a one-second polling rate while the remaining units were set to record data at a five-second polling rate. The researchers chose to experiment with the polling rate because current literature does not offer any recommendations on the topic. Based on the results of the study it was determined that no observable difference in travel time outputs resulted from the different polling rates. As such, either polling rate appears to be acceptable. The findings of the study did not make an explicit recommendation on the polling rate; however, the researchers did suggest that a five-second polling rate may be a more practical choice if memory storage on the GPS data logger is an issue. In addition, a five-second polling rate will result in the creation of a smaller database as less samples will be recorded. Therefore, if memory and hard drive storage space are constraints it may be beneficial to calibrate the GPS data logger at a five-second polling rate.

The Florida Department of Transportation composed an informative document on the methods and procedures necessary for a transit agency to conduct a comprehensive operational analysis of its transit system. According to the Florida Department of Transportation a comprehensive operational analysis of transit includes an evaluation of routes, existing service levels, and overall operations. A comprehensive operational analysis examines such factors as on-time performance, service coverage, service frequency, and passenger loading (FDOT, 2008). The method for conducting on-time performance analysis is of particular interest and will be examined in more detail.

The data needs for conducting an on-time performance analysis of transit include a schedule or record of headways, GPS time point data, and route locations (FDOT, 2008). A transit schedule or record of headways is necessary because depending on the systems service frequency, on-time performance is measured by using either a schedule or headways. According to the Florida Department of Transportation, headways are used to evaluate on-time performance when service frequencies are under ten minutes and schedules are used when headways are greater than ten minutes (FDOT, 2008). GPS time point data is another data requirement for conducting on-time performance analysis. The position and time information recorded from a GPS is needed to conduct a performance evaluation. Information on route locations is also necessary to carry out an on-time performance evaluation. In an ideal situation the route locations will be

available in GIS format. If a GIS compatible format of transit routes is not available it will be necessary to create one.

In conducting an on-time performance assessment there are two methods for determining on-time performance. If the transit system has a published schedule and operates with headways greater than 10 minutes, on-time performance is calculated by counting the number of departures considered "on-time" and dividing by total departures (FDOT, 2008). The second method for determining on-time performance considers headway adherence and is used for transit systems that operate with headways of 10 minutes or less. In this method, variation of headways is the factor that is used to evaluate on-time performance. The designation of 10 minute headways is based on the fact that riders are typically not willing to wait for a bus for more than 10 minutes without consulting a schedule before waiting at the bus stop (FDOT, 2008). The transit systems under investigation operate at headways greater than 10 minutes. Therefore, the method for calculating on-time performance for transit systems with headways greater than 10 minutes will be examined. This method is referred to as schedule adherence. In conducting an on-time performance analysis based on either method it is considered best practice to have multiple timing points along the route. The schedule adherence method of calculating on-time performance analysis of a transit system is based on determining whether each departure from a bus stop is early, on-time, or late compared to the scheduled time. According to the Florida Department of Transportation, an early departure is when the actual departure time occurred before the scheduled time. An on-time departure occurs when the actual departure time is zero to five minutes after the scheduled time. A late departure is when the actual departure time is over 5 minutes from the scheduled time (FDOT, 2008). In conducting on-time performance analysis New York City Transit (NYCT) uses the same time intervals to evaluate schedule adherence such that a bus is considered on-time if it departs from a time point within 0 to 5 minutes after the scheduled departure time (Nakanishi, 1997). Along the same lines, a recent TCRP publication, TCRP Report 135, which deals with contemporary issues in transit scheduling, recommends the same time intervals in determining on-time performance. The TCRP Report states that a bus is considered on time if it arrives or departs from a time point within 0 to 5 minutes after the scheduled arrival/departure time (TCRP, 2009). According to the TCRP Report a bus that leaves a time point early or ahead of schedule is considered to be a more serious problem than running behind schedule. If a bus departs a stop early this causes passengers who arrive at the stop on time to wait more than an entire headway for the next bus (TCRP, 2009). The current literature on conducting an on-time performance analysis is in agreement on the time intervals that constitute an early, on-time, and late departure. As such, the time intervals used in this study are based on those specified by the FDOT, NYCT, and TCRP guidelines and measure schedule adherence based on departure time. Therefore, the time intervals used in this study are as follows. An early departure is when the actual departure time occurred before the scheduled departure time. An on-time departure is when the actual departure time is 0 to 5 minutes after the scheduled departure time. A late departure time is any actual departure time over 5 minutes from the scheduled departure time.

In order to calculate the on-time performance of a route the number of on-time departures is divided by the total number of scheduled en route departures. The quotient is then multiplied by 100 to give the on-time percentage. In this way, on-time performance is the percentage of trips departing from en route scheduled time points, not including terminals, between 0 to 5 minutes after the scheduled departure time (Nakanishi, 1997). The level of service can be determined from the on-time percentage. Figure 9-1 provides a table prepared by the Florida Department of Transportation that illustrates the on-time performance and level of service for a fixed-route transit system.

Table 9-1: On-time Performance and Level of Service

Fixed-Route On-time Performance LOS		
LOS	**On-Time Percentage**	**Comments***
A	95.0-100.0%	1 late transit vehicle every 2 weeks (no transfer)
B	90.0-94.9%	1 late transit vehicle every week (no transfer)
C	85.0-89.9%	3 late transit vehicles every 2 weeks (no transfer)
D	80.0-84.9%	2 late transit vehicles every week (no transfer)
E	75.0-79.9%	1 late transit vehicle every day (with a transfer)
F	<75.0%	1 late transit vehicle at least daily (with a transfer)

The table above illustrates how the on-time percentage value can be broken into a range and equated with level of service. This technique is useful in qualifying the level of service that is provided by a transit system. According to TCRP Report 135, if schedule adjustments can improve on-time performance by 5 or more percentage points, such adjustments are considered to have made an impressive improvement in the level of service (TCRP, 2009).

The Florida Department of Transportation reports that the further a bus travels the less likely it will maintain on-time performance. It has been reported that altering a routes' path or reducing its length may help to improve on-time performance. The presence of congestion is another factor that can impact a routes' schedule adherence and is something that must be factored into schedule building. Congestion and the variation in passenger loading time make it difficult to achieve reliable on-time service. To address these issues certain strategies have been applied to increase the reliability of on-time performance. Such strategies include "streamlining" where closely spaced stops are consolidated to reduce loading times. In addition, operational strategies such as bus lanes, queue jump lanes, and transit signal priority are viable options that may also improve transit performance (FDOT, 2008).

In reviewing transportation literature on conducting an on-time performance analysis an overview of data collection and analysis methods were consulted. A TCRP publication concerned with measuring the level

of service quality and customer satisfaction in regards to transit outlines the principles of data collection and highlights the need to create a data collection plan. There are two approaches in creating a data collection plan; a manual approach and an automatic approach. The manual approach involves placing inspectors in the field who ride the transit system and collect data. Automatic data collection is another option that utilizes AVL systems to automatically collect data on transit operations. The use of automatic data collection via an AVL system is ideal as it records detailed performance data of transit operations which contain both spatial and temporal attributes. This advanced capability of an AVL system allows for more cost effective data collection as well as allowing for more complex and meaningful analysis of performance data (TCRP Report 47, 1999).

In regards to data collection the TCRP Report cautions that analysts need to be aware that there are several potential problems that can affect the quality of data analysis. Such problems include bias, aggregation error, inconsistency, insignificance, and the cost to assemble data (TCRP Report 47, 1999). The problem of bias results in a systematic set of errors that tend to exaggerate or minimize the performance of a transit system. Potential examples of bias include collecting data from a non-representative sample or by methods that result in the observed situation being different from that experienced by transit riders. Aggregation error is another potential problem that can affect the quality of data analysis. The scale at which performance measures are collected can skew the results. For example, if an on-time performance analysis was conducted on only certain routes of a transit system, it would be incorrect to report on system wide on-time performance based on analyzing only a certain portion of the transit system. Doing so would result in an aggregation error because the appropriate amount of data was not collected to accurately represent system wide performance (TCRP Report 47, 1999).

In performance studies that contain temporal analysis the issue of inconsistency may arise. When monitoring service and performance measures over time it is important to collect data at the same spatial scale and from the same route locations. Failure to maintain such constants in data collection will result in the introduction of inconsistency into the analysis and as such meaningful analysis will not be possible. The issue of insignificance is another serious problem that can arise from poor data collection methods. In order to ensure that valid conclusions that are statistically significant are drawn from an assessment of the collected data it is important that an adequate sample size that is representative of the population was sampled in the study. Another consideration of data collection is the cost to assemble data. When primary data collection is necessary it is good practice to consider data needs and the benefits of specific data collection versus the costs. In this way, a cost-benefit analysis is useful in determining what data to collect and the method in which to collect it with limited resources (TCRP Report 47, 1999).

Reporting On-Time Performance

The presentation of bus transit performance data in tabular format is how on-time performance data has traditionally been reported. The advent of GIS and enhanced visualization techniques now provide the analyst with more advanced methods of presenting data. While traditional performance evaluations have focused on temporal analysis the introduction of GPS and GIS technology into the process of conducting bus transit performance evaluation now make it possible to conduct both temporal and spatial analysis. The added benefit from including GPS and GIS technology in a transit performance evaluation is significant because now it is possible to report time deficiencies and visualize where on the transportation network they are occurring. The visualization of transit performance data is a topic discussed by Kimple along with the potential applications that visualization techniques have to better inform decision makers. Kimple explores how to best incorporate data visualization techniques into transit performance reporting. Research of this nature has become particularly important in recent years due to the proliferation of Intelligent Transportation Systems (ITS) technology. As such, ITS technologies have been increasingly employed by transit agencies in the form of AVL systems with real time tracking and automatic passenger counters. These new ITS technologies provide a wealth of data that often goes unused by transit agencies (Kimple, 2007). If transit agencies are to realize a benefit from investments in ITS technology they must be able to process and analyze the data in a meaningful way that is capable of informing decision makers. To address this short coming, Kimple utilizes data collected from TriMet, the regional transit provider in Portland, Oregon to illustrate how transit performance data can be visualized using various techniques.

One data visualization technique that is of particular interest is using chart maps to illustrate on-time performance. This visualization technique combines GIS and visual graphics to report transit performance. Figure 9-2 provides a map produced in GIS that portrays the use of pie charts as a way to visualize on-time performance at timing points along a bus route. The use of visual graphics in the form of pie charts to represent the breakdown of on-time performance on a transit route during a specified time period overlaid on a GIS base map is an excellent way to visualize transit performance data. By overlaying the pie charts of on-time performance on a GIS base map the communicative ability of the map is greatly increased because it is able to report the on-time performance of multiple stops along the bus route. The visual method of data representation illustrated below provides a far superior breakdown than simply reporting data in a tabular format.

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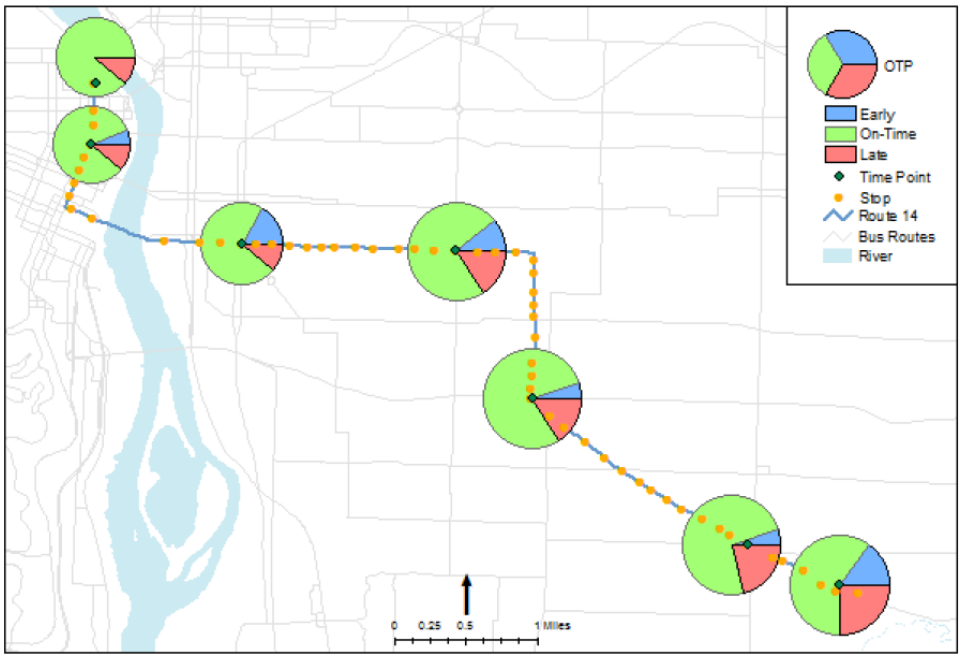
Figure 9-2: Map of On-time Performance using Graphical Visualizations



In regards to using visualization techniques to present transit performance data, Kimple argues that the convergence of information technology, ITS, and GIS present transportation analysts with a plethora of new methods for reporting performance data. As such, these new techniques in reporting performance data offer greater value than traditional reporting methods that rely on only tabular formats. The use of graphics to portray information such as maps and charts provide a visual medium in which data can be analyzed and communicated. Furthermore, visualization techniques that are capable of displaying multiple performance indicators at once are useful as they can illustrate important relationships between transit performance data (Kimple, 2007).

This review of the current literature on conducting an on-time performance analysis of a bus transit system has examined accepted procedures for conducting a performance analysis and various methods for reporting and visualizing the findings. In addition, it has provided context on contemporary transportation issues that face many college and university campuses as well as their surrounding communities. In response to increasing traffic congestion, demand for parking, and environmental sustainability concerns many colleges and universities are implementing TDM programs with transit often serving as a major component. If transit is to adequately serve the increase in demand that will result from the implementation of TDM programs it is important that the performance of transit systems is evaluated. As such, various techniques of conducting performance analysis on transit operations were explored in detail.

STUDENT EMPLOYEE COMPARISON TECHNICAL REPORT

Introduction

Previous to this report, the individual preferences, patterns, and favored solutions of both students and employees have been carefully detailed. It is useful for the purposes of implementation, as well as general transportation education, to understand how these two populations compare and contrast. Through additional analysis of survey data it is evident that there is much overlap between these two groups, including commuting patterns, modal preference, and favored solutions. Some important differences do exist however, including commuting distance, peak morning commute schedules, use of transit and importance of the bicycle, and individualized solutions; particularly by way of pricing mechanisms and telecommuting.

Response Rate, Representation Level, and General Demographics

Both surveys are largely representative of their respective populations both in size as well as demographics. The response rate, though twice as high for employees versus students, is significant for an email survey (15% of students and 29% of employees) and therefore represents a sizable portion of the overall population: 7% of students and 19% of employees[1]. Both surveys also had high completion rates as well: 89% students and 91.5% employees, and therefore present a full picture of patterns and opinions on campus.

Data on gender and ethnicity also generally follow the campus population as well. Females outnumber males in each of the surveys (57%:43% employee and 62%:38% students), and are also somewhat overrepresented compared with the general population, comprising just 41% of employees (faculty only*),

[1] The larger response rate for employees versus students cannot be preciously explained, although it is likely that faculty and staff use, or are familiar with, their University email accounts more so than students. It may also be true that different age groups have different response rates or likelihood of survey completion. There is, on average, a 20-30 years difference between most students and employees, so this could play into response rate differences as well.

and 51% of students. Ethnic distributions, however, almost exactly equal that of the campus population as a whole. The percentages of employees (84%) and students (56%) reporting their ethnicity as "white" correspond directly to 85.1% of employees who report themselves as "non-minority" (faculty only*) and 57% of undergraduates who claim their ethnicity as "white". Additionally, although more detailed ethnicity information on campus employees beyond "minority" and "non-minority" do not exist, the sample populations of "African-American", "Latino" and "Asian" students in this survey, comprising 8%, 6%, and 6% respectively, also nearly follows the percentages of those respective groups in the general population, at 10%, 9%, and 6%, respectively.

Difference in Housing Distance and Centrality of Commuting

Distance of housing to campus and the relationship between housing and commuting is one of the key differences between these two groups. Students are much more likely to live closer to campus than employees, and are also much more inclined to consider housing when making their initial, or think about their future, housing choices. Data on employees and students living under two miles from campus show a significant difference in percentages between the two: 25% students versus 10% employees. The most common commuting distance for the two groups is also shorter for students; as 36% of students live between 2-5 miles, 40% of employees live between 5-15 miles. A higher percentage of employees also live considerably further from campus, than do students, with 25% of employees living over 15 miles from campus versus just 16% of students. Longer commuting distances in miles also necessarily result in longer commuting trips in length. With the vast majority of students taking between "six "to "over twenty minutes" to commute (93%), though, most often travelling between 11-15 minutes, employees commonly take 20-30 minutes (25%), with the majority commuting between 10-30 minutes (63%). The stronger relationship for students between commuting and housing, than employees, is evident in the survey as well. Students were somewhat more likely to consider commuting when making their original housing decision than were employees (64% students versus 50% employees) and are equally (more) likely to consider commuting when thinking about their next housing selection as well (65% students versus 52% employees). A variety of factors including commuting costs, could account for these differences in housing location and centrality of commuting in housing, although more research must be conducted to have certainty in this answer.

Comparison of Travel Demands

Both students and employees have heavy commuting demands throughout the year. Each group is most likely to commute to the uptown campus versus any other campus (91% employees and 90% students), but employees, more than students, are likely to travel to other campuses besides uptown, including: downtown

(24% employees to 16% students), East Campus (9% employees to 4% students), Nano Campus (9% employees to 1% students) and Harriman Campus (3% employees to 0% students). Each group is also present on campus, thereby necessitating a commute, a large portion of the school year (87% of students full-time and 89% of employees). Employees, though, are also on campus during the summer a considerable portion of the time (70% "5 days a week or more"), while only about ¼ as many students are around during this period (24% taking summer classes).

Peak periods of employees and students' weekly commute generally follow similar paths, but do differ slightly, especially during the morning. The bulk of employees tend to be at work by 10am (92% between 6am–10am), while just over half of students are on campus by this time (55%). The period between 8am-10am is the most commonly travelled slot for both groups however, as 35% of students and 50% of employees commute during this range. Both groups are most likely to depart campus around the same time frame as well: 4pm to 6pm, which accounts for 69% employees and 31% of students. Students' departure periods, due to early classes, are more spread out earlier in the day, although both groups are equally likely to leave during the "6pm-8pm" and "8pm and later" ranges, with 15% of each group departing during these periods.

Friday and weekend travel is also led by employees, primarily because there are no Friday classes after 2:30pm. While about half of students report having class on Fridays (44%), nearly all employees work on this day, and are still most likely to leave during the 4pm-6pm range (55%). Employees are also much more likely to work on Saturdays than students. While only 18% of employees do come in during those days, virtually no students do so.

Modal Preference Similarities and Differences

Demanding schedules and commuting limitations due to distant housing have their effect on the ability to commute via alternative means, and result in specific modal preferences. The automobile, like most campuses in this country, is the overwhelming method of commute for the vast majority of both groups (94% of employees and 64% of students generally using this mode to commute). Employees, however, likely due to longer commutes, use their car almost exclusively to commute, and generally use other modes very infrequently. There is almost a 30% differential in the number of employees who use their car to commute *a few days a week* or *daily*, to that of students (89% employees versus 60% of students), and only 4% of employees *never* drive alone versus 29% of students.

Employees are also overwhelmingly more likely to use this method to commute *between* campuses, with 89% employees verses 46% students reporting the use of their car for this purpose. Although questions were not asked in the survey as to car ownership, it is almost certain that a higher percentage of employees

own a car, than students. This is particularly evident in the 29% of students who *never* drive alone versus the 4% of employees; a probable indication that this group does not own their own car.
Carpooling, on the other hand, is not used with great frequency by either group. Neither group reports being a rider or driver regularly (*a few times a month* to *daily*), more than 20% of the time, and both groups report *never* being the driver of a carpool 72% of the time. Among those that do carpool though, students are slightly more likely than employees, to be the driver or rider. Students report driving with at least one other person 16% of the time to employees' 11%, and are slightly less likely to *never* ride in carpools: 63% of the time to employees 71%.

Use of other alternative transportation modes for campus commutes, though, specifically transit and pedestrian commuting, varies greatly between the two groups. Students use CDTA and the UAlbany shuttle with substantially higher regularity than do employees, with students riding these two transit systems *a few times a month* to *daily* 44% and 38% of the time, respectively, compared to just 13% and 7% of the time by employees. Differences in inter-campus travel by transit between these two groups are even more significant. While employees use CDTA and the UAlbany shuttle only 11% and 14% of the time for these commutes, students use them 49% and 43% of the time, which, in the case of CDTA, is actually more often than students' use of the car for these trips.

Students are also slightly more likely to commute by foot, than employees. Twenty-two percent report commuting by way of walking *a few times a month* to *daily* while only 6% of employees report this same level of activity. For inter-campus travel though, both groups share around the same likelihood: 11% of employees and 14% of students.

While commuting patterns do not changes dramatically for students or employees between semesters, some variation exists, and this is experienced primarily by students rather than employees. Between 20%-45% of students report *some* or *a great deal* of variation in "distance", "method of commute", "length of trip", "frequency of trips", and "start and ending times". For employees, however, this variation is not quite as substantial, generally ranging from 5%-25%. This data could prove useful in the future to determine how likely transportation improvements will still work for the group for which it was intended.

Questions were also asked about perceived control over this variation. Both groups feel that they have little control over the variation that does occur, with between 65%-85% reporting *little* or *no* control over this variation in most categories. Only in one category, "trip start and end time", did both groups indicate the sense of control over this variation, with 42% of students and 39% of employees reporting *some* or *a great deal*. Students, additionally, feel some control over "frequency of trips" with 42% reporting *some* or *a great deal* of control versus employees' 27%. More investigation will ideally uncover both the general perception of lack of control over variation, as well as the differences in perception between the two groups.

Challenges to Alternative Transportation

Students and employees generally have similar reasons for preferring certain commuting modes over others, such as the overall convenience of cars, and significant limitations to transit, but there are very important nuances as well, between the two groups, such as employees' great concern with bicycle safety and infrastructure. Driving is simply the most convenient mode of travel for both of these groups. It is the number one reason given by employees for "being kept from alternative transportation", and also ranks as the number two reason for students. The need to "travel from other places to and from work/school" is also a primary factor to the popularity of the car, (the #3 reason for both employees and students) and likely accounts for its *convenience* factor. Another issue assisting the success of automobile-commuting, although possibly going hand-in-hand with its popularity, is the general awareness of where to obtain information on parking, with 92% of employees and 68% of students reporting knowledge on this topic.

Both employees and students believe there are significant weaknesses with the alternative transportation systems on campus though. Regarding the transit system; nearly half of students and employees report "infrequent or untimely bus service" as an issue limiting their use of alterative transportation, with 48% of students, and 46% of employees reporting this answer. "Length of trip by bus" is also a problem for both groups, with 31% of students and 42% of employees reporting this issue as a concern. Information distribution on bus schedules and routes, unlike that of the parking system, is also problematic for many employees and students, as 38% of faculty and 46% of students report not knowing where to find information on this mode.

Bicycle concerns, while of much more serious import to employees, are concerns for both groups, as well, and limit their use of alternative transportation. Lack of bicycle lanes and bicycle safety are the third and fourth biggest limitations for students, with 47% and 46% of students reporting these concerns as among their biggest transportation concerns. For employees, these two issues are even more critical; ranking in at #1 and #2, with 73% and 66% reporting these issues as their biggest transportation problems. Information distribution is again a problem for this mode, as nearly 75% of both groups report "not knowing where to find information" on commuting to campus via bicycle.

Limitations to the carpooling and pedestrian commuting modes are also reported by both groups. Lack of knowing a potential carpooler keeps 44% of students and 36% of faculty from using alternative transportation, and an overwhelming majority; 89% of students and 79% of faculty, do not know where to find information on carpool networking. Regarding pedestrian barriers, safety is the dominant issue above others, limiting 38% of employees and 33% of students from using alternative transportation, and ranks as

the 5th largest issue on campus for each group. Lack of crosswalks are also troublesome for both groups, with nearly a third of each reporting this issue as one of the campus' largest problems (40% and 28%).

A fifth problem area, although not as easily solvable as some other alternative systems, is that of distance from campus. This issue, in fact ranks as the #1 reason limiting students from walking as a form of alternative transportation, and the #5 reason that students are limited in bicycling to campus. For employees, distance is just as much of a hindrance, with the inability to walk and bike due to this issue, ranking as the #2 and #4 issue limiting their use of alternative transportation. Aside from programs aimed at encouraging students and employees into settling or relocating closer to campus, there is probably little that can be done to mitigate this exact problem.

Group Differences

Although the majority of opinions on the limitations of various alternative transportation systems are shared, some concerns are much more of a problem to one group than another. Bicycle infrastructure issues, while ranking high for both groups, are substantially more problematic for employees than students. As is evident in previous paragraphs, there is almost a 30% differential between the number of employees and the number of students who feel that this issue is a problem. Availability of bike racks follows the same trend. With 52% of faculty reporting this issue as a concern compared with just 31% of students, there is nearly a 20 point differential between the two groups. The location of bus stops and bus routes is more problematic for employees than students, as well. While "no runs between home and work" is the 6th most commonly reported answer limiting employees' use of alternative transportation, at 46% of employee responses, it is only the 11th for students, at 29%. Lengthy distances from campus probably plays a considerable role is this difference, as bus routes and close bus stops are less common, far outside the city. Employees also believe pedestrian issues, particularly, the "availability of sidewalks", to be an issue, much more so than do students. While in ranking, the two groups are only separated by three places (employees placing it as the 7th most important problem on campus versus 10th for students), there is almost a 20 point margin between the percentage of those reporting those problems: 46% employees versus 25% students.

Impacts of Modal Preferences

Although current transportation preferences for single occupancy vehicles is most harmful to the environment; increasing levels of carbon dioxides, other problems arise from these patterns as well, which are felt on a much more personal degree for the campus community. Availability of parking, traffic congestion, and safety while driving, are all significant problems for drivers on campus. Availability of parking is the most troubling for both groups; in fact the #1 biggest problem for students and #3 biggest

problem for employees, of all transportation concerns. Traffic congestion and driving safety are problems as well, with 42% of students and 30% of faculty reporting congestion as a problem, and 39% of students and 33% faculty reporting the problem of safety.

Single occupancy vehicle driving is also quite significant in terms of financial cost. Although both groups tend to spend a substantial amount per year on commuting and general driving expenses, (at least $3,500 for each group), employees tend to bear the brunt of car-expenses. Their average yearly car-related expenses total $3,960, and just over 20% spend between $1,560-$2,600 on commuting, while only 10% of students have commuting expenses within that range. While employees are certainly better able to afford these high costs than students, the financial burden of car-ownership and commuting remains significant to both groups, and could be softened with the addition of free or reduced price alternative transportation.

Comparison of Alternative Transportation Solutions: Similarities

Both employees and students report a number of solutions or potential improvements to SUNY's alternative transportation system that would greatly aid in the reduction of single occupancy vehicle usage. Small changes to car pricing, most notably gasoline increases, both groups report, could potentially dissuade some employees and students from using SOV's. Forty percent of students and between 26-27% of employees indicate that they would be likely to consider changing their patterns if gas prices rose to either $4/gallon or rose at least $1 in a week. While the University at Albany certainly cannot have any control over the price of gasoline, this information on price tipping-points for employees and students, is useful to know. Pricing mechanisms alone though, certainly will never do the trick. Of those that do not currently use transit, only 35% of students, and 18% of employees, would be more likely to use the bus if parking cost more or was less available, and most troubling of all; 32% to 47% of employees and students would continue to drive alone no matter the price increase in gasoline.

While car-related pricing increases certainly cannot solve the entire single occupancy vehicle problem, students and employees both support a number of measures to improve the University's alternative transportation system. Of all the transit improvements suggested by planners, four of these stand out to employees and students alike. Transit rides being "similar in length to that by car" is likely to entice 51% and 54% of faculty and students that do not currently use transit, into doing so, and it is the #1 and #3 most desired transit improvement for the two groups, respectively. A "higher frequency of buses", is likely to encourage 58% of students and 40% of employees, respectively, into using transit, as well. "Closer bus stops" and "more direct service", additionally, are very popular with each group, likely to increase student ridership 49% and 24%, and employee ridership 38% and 35%, respectively. Emergency transportation, as well, is popular with both groups, and if available, is likely to entice 41% of students and 37% of employees, that do not currently use the transit system, into doing so. Linkages to specific destinations

are also important for increasing more ridership. Although increasing destination access is not weighted against other improvements, both groups are generally interested in each of their top four choices, including Downtown Albany, the Rensselaer train station, Colonie Center, and Albany International Airport, with 67%, 43%, 43%, and 32% of students; and 42%, 38%, 27% and 36%, of employees, requesting these destinations, respectively. Two other improvements were also popular with both groups as well: "rewards for using alternative transportation" is likely to be used by 46% of students and 34% of employees, if offered, ad "preferred parking for carpoolers", is additionally, likely to be used by 34% of students and 22% of employees, if offered.

Comparison of Alternative Transportation Solutions: Differences

Some improvements, however, are much more popular with students than employees. While "free access to all CDTA bus routes" is students' #1 choice for improvements, with 57% of students *very* or *definitely* likely to use the service if available, it is only employees' #5 choice, with just 30% *very* or *definitely* likely to use the service. Students also have certain destination preferences different from employees. While Crossgates mall is students' #2 choice of all those listed, with 55% of students selecting this choice, just 29% of employees are interested in this destination: a 25% margin. There are other transportation solutions though, that are more favored by employees. The number one and two most favored alternative transportation improvements, in fact; "working from home", a "compressed work-week", were designated only for employees, in their survey set. As these are highly popular solutions, they certainly should be included as a part of the alterative transportation package available to employees.[2]

Non-Issues

Other potential solutions or proposed issues are not particularly problematic for either group and should not be rapidly implemented. Programs on "carpooling", "ride sharing", "preferred parking for hybrid or fuel

[2] Although these two options are listed alongside other solutions, to which students top options are compared, they do not affect percentages and scores of other solutions within employees' categories. While ranking is certainly shifted, employees can express equal interest in other solutions, and have an equal interest level comparable to students.

efficient vehicles", "assistance finding carpool partners", "van-pooling", "car-sharing", "bicycle amenities", and "bike-sharing" are all likely to be used by a quarter or less of employees and students: (22%, 21%, 21%, 20%, 15%, 13%, 13%, and 6% of employees, and 24%, 23%, 21%, 21%, 20%, 17%, 18%, 13% of students, respectively). Many features of an improved bus service are not popular with employees or students either, including: "better and larger waiting shelters", "better security", "more comfortable buses", "better ADA accessibility", and "more appealing look": (29%, 22%, 13%, 6%, 3% of employees; and 39%, 32%, 22%, 10%, 6% of students, respectively). Similarly, many bus destinations are not overly appealing to many employees or students, including Clifton Park, Delmar, Guilderland, Saratoga Springs, Schenectady, and Troy, each receiving less than 20% of employees or students interest.

Conclusion

While different transportation demands and limitations, such as distance to campus and frequency on campus, certainly result in variations of modal use between the two groups, many of their concerns and proposed solutions are quite similar. The top four solutions to reducing SOV use for all groups are that of: transit improvements, bicycle improvements, work place or schedule changes, and pricing changes. Other areas of continued research as well could aid transportation understanding, including suitable rewards for each group, ways to improve the bicycle infrastructure, and realistic methods to upgrade the transit system.

FACULTY AND STAFF TECHNICAL REPORT

Sample validity

Out of 2,737 surveys sent out, a total of 815 University at Albany faculty and staff responded. With a campus-wide employee population of 4,197, this sample represents both a significant portion of all faculty and staff (19%), and a high response rate (29%). The vast majority of respondents (85%) also filed out surveys in full, leaving no questions blank. This high completion rate provides researchers a rich supply of data from which to draw conclusions on commuting behavior.

Social Demographics of Respondents

Slightly over half of faculty and staff in this survey report their gender (56.6%) or sex (56.9%) as female. While data is not available for all employees, at least among faculty, men slightly outnumber women 59% to 41%, so it is likely that women are somewhat over-represented in this survey. Transgendered employees, on whom there is no overall University data, comprise less than 1%. The ethnic distribution of employees in this survey is more representative of the overall University population. "White" faculty and staff comprise the overwhelming majority of employees in this survey (83.8%). This closely mirrors data

available on the faculty ethnic distribution in which 14.9% are members of a "minority group" and 85.1% are members of a "non-minority group". Although further distinctions do not exist for overall campus employees; of the 16.2% who are "non-white" in this survey; 6.2% are Asians, 3.8% are Latinos, 3.6% are African-Americans, .4% are Native Americans, and 2.3% are "unspecified".
Additional types of demographic data, including age and marital status, were also collected in this survey. For questions on "age" and "the year in which they were born", faculty and staff most commonly report being between 50-59 years of age (33.5%), with an average birth year of 1961. Age ranges of 40-49 and 30-39 are also quite common, at 24.8% and 17.8% of the population, respectively. While 50% of respondents report being between 40-58 years of age, those above or below 30 or above 60, however, are much fewer in number, and together accounting for just 23.8% of the total. With regard to marital status, the two most frequently given responses for faculty and staff are married (60.4%) and single (37.9%). Only a small percentage, (1.7%), report being either divorced or widowed.

Data on "levels of employment" and "specification of occupation" were also collected in this survey. Faculty and staff have most commonly worked for a period of 5-19 years (45.5%), and almost an equal number have worked either 0-4 years (26.1%) or 20 years and more (26.1%). Within the distribution of "time status", the overwhelming majority are "full-time" (88.7%), with "half-time" and "quarter-time" at 4.0% and 2.8%, respectively. Of the 15 remaining weekly rates, from .1 to .9-status, none are reported by more than 1% of faculty, and in total, only account for 4.5% of all employees.

Among various professional categories offered in the survey, University employees also most often categorize themselves as "professional staff" (41.1%) and "teaching faculty" (29.6%). Approximately 16% describe themselves as "classified staff". Other professions, including "non-teaching faculty", "librarian", and "management/confidential" are far less common, only accounting for between 2%-6% of employees each.

Housing Patterns

With a keen understanding of both social demographics and employment characteristics of University at Albany employees, attention will now focus on factors that influence commuting practices at the University. One of the key issues in commuting, influencing the degree to which employees are able to use alternative transportation methods, is the commuting origin itself. About 10% of faculty and staff live two miles, or under, from campus; and just about one third (33.4%) take 15 minutes or less to commute to campus. This is reasonably good news for transportation and environmental planners at the University, as, understandably, fewer vehicle miles travelled, and less time spent travelling, results in a smaller carbon dioxide footprint. The number of employees living at this distance is also significant because, as other

studies have shown, when faculty and staff live "three miles or less" from campus, they are more likely to bike, and much more likely to walk, as a form of commuting. [3]

The bulk of faculty and staff, however, live between 5-15 miles from campus (40%). From this distance, commutes most commonly take between 21-30 minutes (nearly 25%), and almost half are between 16-30 minutes. Some faculty and staff indeed travel considerably greater distances, and take much longer, to commute to campus. Over 25% live more than 15 miles away, and nearly that many (21%), travel over 30 minutes to get to campus.

The possibility of having to commute from great lengths was not a limiting factor for a large number of faculty and staff when they made their current housing selections. The percentage for whom "the nature or mode of commuting was a factor in their housing selection" (49.4%) is slightly trumped by that for whom commuting "was not a factor" (50.6%), and the results for employees' taking commuting into their next housing decision is only a shade higher at 52.3%. It is clear, no doubt, that building back the consciousness of commuting into the housing selection process is a necessary step towards reducing the university's transportation footprint, although the strengthening of that connection will be a lengthy endeavor.

Commuting Demands

The other critical element of any commute is its end-point, or destination. Of all the SUNY campuses in the Capital Region, faculty and staff overwhelmingly spend the majority of their time on the uptown campus (91%). While a significant percentage of employees also spend considerable time at the downtown campus (24%), other campuses, such as the East Campus, Harriman Campus, and Nano Campus, are used far less frequently for meetings or work, each regularly visited only 3%-9% each.

There are also certain travel periods that are heavier than others, to both the uptown, and other campuses. The peak period of commuting to campus, for faculty and staff, is between 8am and 10am, with just over 50% travelling during that period. When the "6am to 8am" time period is also added on, this four hour

[3] While faculty and staff that live over three miles away, walk *somewhat frequently* (*a few times a month*" to *daily*) less than 1% of the time, those that live three miles or under, do so 23% of the time. Similarly, while faculty and staff that live three miles, or under, from campus, use their bike to commute *somewhat frequently* (nearly 15% of the time), those that live beyond that threshold do so only 3% of the time. (Franklin, C., 2010. *Getting to Green: An Analysis of the University at Albany Transportation Survey Data*)

span accounts for nearly 92% of all employees' weekly "Monday through Friday" travel to campus. A moderate portion of employees also travel Saturday and Sunday as well (about 1/5 as many as those commuting Monday-Friday). This group tended to leave their homes slightly later in the morning, with nearly an equal number travelling during the 10am-12pm period as during 6am to 8am (23%), and an overall majority travelling at some point during this six hour period (87%). In terms of departure patterns, the vast majority leave from 4pm to 6pm, during the "Monday to Thursday", and "Friday to Sunday" periods, accounting for 69% and 55-74% of total departures, respectively. While some faculty and staff do in fact leave slightly earlier or later than that, with 9% departing between 2pm –4pm, and 15% between 6pm -8pm, almost no one travels home before or after those periods.

Faculty and staff also come in quite regularly during the summer and over breaks. Employees most commonly come in "5 or more times a week", with 70.4% reporting this answer for "summer", and 62.3%, during "breaks". Among employees that do not come in "5 days or more" per week during these periods, being on campus anywhere between 0 and 4 days per week garnered a 4.7%-6.5% response over summer and 6.3%-9.5% over breaks.

Current Modal Choices and Preferences

With information gathered on social demographics, and the commuting demands and limitations of employees, attention can now be shifted to the modal choices employees make each day. The overwhelming majority of faculty and staff at the University at Albany "regularly" use their car as the means to commute to work (94%), and for travelling between campuses (89%). 74% of employees drive alone *daily* and 16% *a few times a week*, for a total of 89% of employee commuters driving in single occupancy vehicles the majority of the work week. 4% *never* drive alone, 11%, regularly drive with "more than one person in the car", and virtually none drive with more than two people on a regular basis.

Alternative methods of commuting, those separate from single occupancy driving, are far less common. Of all alternative transportation means, carpooling is the most frequently practiced, but it is still low compared to the SOV. Just 14% of faculty and staff are drivers and 13% are riders in carpools more than *a few times a semester*, and nearly 72% of employees *never* carpool at all during the entire semester. Transit, by either the UAlbany shuttle or CDTA, is used just as infrequently. Only 13% of employees ride the CDTA more than *a few times a semester* and 78% report *never* using it over the course of the semester. The UAlbany shuttle is equally under-used with just 7% reporting taking it *more than a few times a semester* and 85% *never* taking it. Bus use for "inter-campus travel" is slightly more common among employees, with 11% using CDTA and 14% using UAlbany shuttle regularly, but is still far below that of the automobile.

Of all alternative methods of commuting, however, bicycling and walking are the least commonly used. Only 5% and 6% of employees use bicycling and walking as a means of commuting *more than a few times*

a semester, respectively, and nearly 88% *never* use either of these modes at all. Although bicycling between campuses is almost never done (2%), walking is actually practiced with some regularity, about as common as CDTA bus use, at 11%.

Employees do not tend to change these transportation patterns much over the course of semesters. Among categories on potential commuting-variation between semesters, changes in "distance", "method of commute", "trip length", and "frequency/number of trips" are all relatively rare with 94%, 92%, 88%, and 86% of employees reporting *little* or *no* change between semesters, respectively. The only significant commuting-related variation between semesters is that of "trip start/end times", with 25% reporting *some* or *a great deal* of variation. This may stem from changes in work schedules or different sets of activities before and after work.

Questions were also asked about the perceived control employees have over any variation in commuting patterns between semesters. Faculty and staff, overall, report that they have relatively little control over this variation, quite surprisingly. Between 68% and 83% of faculty and staff report that they have *little* or *no* control over variation in four separate categories: "distance", "time length", "frequency/number of trips", and "method of commute". Only in one category, "start/end time of commute", did employees report some "control" over the variation that occurs between semesters (39% reporting *some* or *a great deal* of control). The reason or reasons behind this perceived "lack of control" will remain a topic for researchers to investigate further, in follow-up studies.

Reasons Behind Modal Choice

Beyond external commuting limitations and travel demands, employees report a number of strengths and weaknesses to the University's transportation system, that lead to a preference for various modes over others. The underlying reasons that University employees predominantly use their car as a means of commuting, are "convenience" and "having to travel to other places to and from work". At 82% and 65%, they are the #1 and #3 most common reasons employees are prevented from using alternative transportation with "living too far from work to walk" as the #2 most common reason.

Programs on "driver safety" and "information on parking", work quite successfully on campus, further promoting the automobile as a common mode of transport. Ninety-two percent of survey respondents report "knowing where to find information on parking", and 67% believe "driving safety" is only a *minor problem* or *not a problem*.

Faculty and staff find many flaws in the currently available alternative transportation systems on campus. For carpooling, the second most frequently used mode after driving-alone, the biggest problems are lack of "carpool networks" and "information distribution". "Not knowing someone with whom employees can

carpool" prevents 36% of employees from using alternative transportation, and 79% are uncertain "where to find information on finding a carpool partner".

Employees also take issue with many elements of the transit system. "Lack of runs between home and work" and "infrequent or untimely bus service", keep 46% of faculty and staff "from using alternative transportation", and 48% report the "availability of bus service" as *somewhat* to *a severe* problem. Lengthy bus trips, information distribution, and number of bus transfers are major issues for employees. "Trip length" and "number of bus transfers" keep 42% and 35% of faculty and staff from using alternative transportation, respectively, and 46% claim confusion on "locating scheduling and route information".

Bicycling and pedestrian problems, though, are the most acute of all alternative transportation means. "Feeling unsafe" while bicycling keeps 50% of faculty and staff from using alternative transportation, and 66% report bicycling safety as a *somewhat* to *severe* problem. "Lack of bike lanes or bike racks" are also major issues for many employees as well, with 73% and 52% reporting these two subjects as *somewhat* to *severe* problems, respectively. One of the most significant concerns for both bicycling and walking is information distribution, similar to other modes, with 74% of employees *uncertain* in finding information on either of these commuting options.
Pedestrian issues such as "safety", "sidewalks", and "crosswalks", are problems for faculty and staff as well. Between 40% and 52% report these issues as *somewhat* to *severe* problems on campus, and "safety while walking" in particular, keeps 33% "from using alternative transportation". The most significant of all barriers to alternative transportation though, particularly with respect to non-motorized travel, is "length of trip". An excessive "trip length" prevents 77% of employees from walking to campus, and 55% of employees from bicycling to campus.

Drawbacks to Automobile Prevalence at the University

Although there are specific reasons employees prefer various modes of transportation, these preferences do not come without a cost. Certainly the most significant dilemma with the high use of single occupancy vehicles is their impact on the environment. Roughly *every vehicle mile driven* produces a pound of carbon dioxide that is emitted into the atmosphere, and with employees overwhelmingly using single occupancy vehicles to commute, every year, millions of pounds of carbon dioxide are released from University commuters, further speeding up the process of global warming (Savecarbon.org, 2010).

In addition to the environmental detriments, there are also social and financial costs to driving. "Availability of parking" and "traffic congestion" are major issues for employees at the University as well, with 59% and 39% reporting these topics as *somewhat* to *severe* problems, respectively. These concerns represent additional stress adding to daily life of the commuter. Driving to campus every day also is quite

costly. While 70% of faculty and staff "most commonly" spend between $0 and $29.99 a week to commute ($0 to $1560 a year), 17% of employees spend considerably more; ranging from $40 to $100 or more ($2,080 to $5,200+). Additional car related costs, including "insurance", "payments", and "maintenance" are also quite substantial for employees. When combined, these items (including gasoline, which accounts for the largest portion of expenses), most commonly cost employees $3,960 per year and 16% of our survey participants spend as much as $7,377 or more.

Supported Solutions for Reducing SOV's

Faculty and staff at the university report interest in a number of solutions to reduce single occupancy vehicle use and ways to improve the transportation system in general. The only true way to dramatically reduce the impact of employee commuting is to *end the need for commuting all together*, and that is just what faculty and staff propose to do, at least for part of the work week. The top two most popular choices selected out of 15 proposed solutions and services are "the ability to work from home" and having a "compressed work week", with 65% and 51% of employees reporting *high or definite* likeliness of use.

Among faculty and staff that "do not normally use the bus" for their commute, 51% report being *very* or *definitely* likely to use transit if "the ride was similar to the length by car", and out of nine possible improvements, "faster service" was chosen among the top three by nearly two-thirds of employees. As bus rapid transit services (BRT's) are becoming ever more popular and available, this solution could be utilized by a high number of employees.

Other solutions such as "higher frequency of buses", "more conveniently located bus stops", "availability of emergency service", and "more direct service" are also popular. The first three options would likely influence 40%, 38%, and 37% of those that "do not normally use transit to commute" and between one-half and two-thirds of employees also place "more direct service" and "more convenient location of bus stops" among their three top choices for transit improvements. Faculty and staff also express interest in maintaining or improving transit service to their three most commonly visited destinations: downtown Albany, the Rensselaer Train Station, and the Albany Airport. Each of these locations was a top three choice for at least 35% of employees, out of twelve possible sites.

Additional solutions, involving monetary rewards or penalties may also work. Thirty-four percent of employees report a *high* or *definite* likelihood of interest in "rewards for using alternative transportation" if offered, and slightly over a quarter (between 25-27%) would be "likely to consider carpooling and other alternative transportation" if gas rose to at least *$4/gallon* or more than *$1 in a week*.

Solutions to Avoid

Many proposed solutions for reducing the use of SOV's, though, have little chance of success among faculty, and should not be implemented. Monetary penalties, for example, only go so far. Only 18% of University employees would be *very likely* or *definitely* likely to use the bus "if parking cost more or was less available", and 41%-47% are likely to drive regardless of any price increase of gasoline.

Faculty and staff are also not overwhelmingly interested in carpooling and related programs. Only about one-fifth of employees report being *very* or *definitely* likely to use programs involving "carpooling", "ride-sharing", "preferred parking for hybrid or fuel efficient vehicles", or "assistance finding carpool partners". "Van-pooling" and "car sharing" are particularly unappealing to most faculty and staff as 63% and 70% report being *highly* or *definitely unlikely* to use those services, respectively, if offered.

Many bus issues and solutions are not particularly popular with employees either. "Prohibitive costs" of riding transit and "lack of ADA-accessibility" concern about 20% of faculty and staff, and improvements such as "more appealing look", "more comfortable buses", "better security", "better and larger waiting shelters at stops", and "pre-tax bus pass purchases" are placed in the top three "most desired improvements" by less than a third of respondents. Major service increases in transit to Colonie Center, Wolf Road, Crossgates Mall, Clifton Park, Delmar, Guilderland, Saratoga Springs, Schenectady, or Troy will likely find little support, as no more than 10-20% of employees place any of these locations within their top three destinations for "continued" or "increased service".
Improvements to the bicycle system on campus are equally unlikely to shift employees away from using automobiles. Both "bike sharing" and "bicycle amenities" are quite unappealing to faculty and staff, overall, with 85% and 72% reporting *high* or *definite* disinterest in using these services if they were offered, respectively. It is puzzling, that although "bike safety" and "bike lanes" are the two most commonly reported transportation *issues*, theoretically signifying a high bicycle ridership or interest group number, the services related to bicycling were among the lowest of all those desired.

Conclusion

University faculty and staff share a wide range of information in this study; ranging from commuting patterns and preferences, to solutions that are likely to reduce SOV use, and others that are not. Options with the highest interest among all employees, are telecommuting, a compressed work week, emergency taxi service, rewards for using transit, faster bus service, closer routes to employee housing, and better safety programs for bicyclists and pedestrian commuters. Further directions for research could also include determining what "rewards" are likely to entice employees into using alternative transportation, and

determining both the locations of employee stops “to and from work”, and the distance of bus stops to employee housing.

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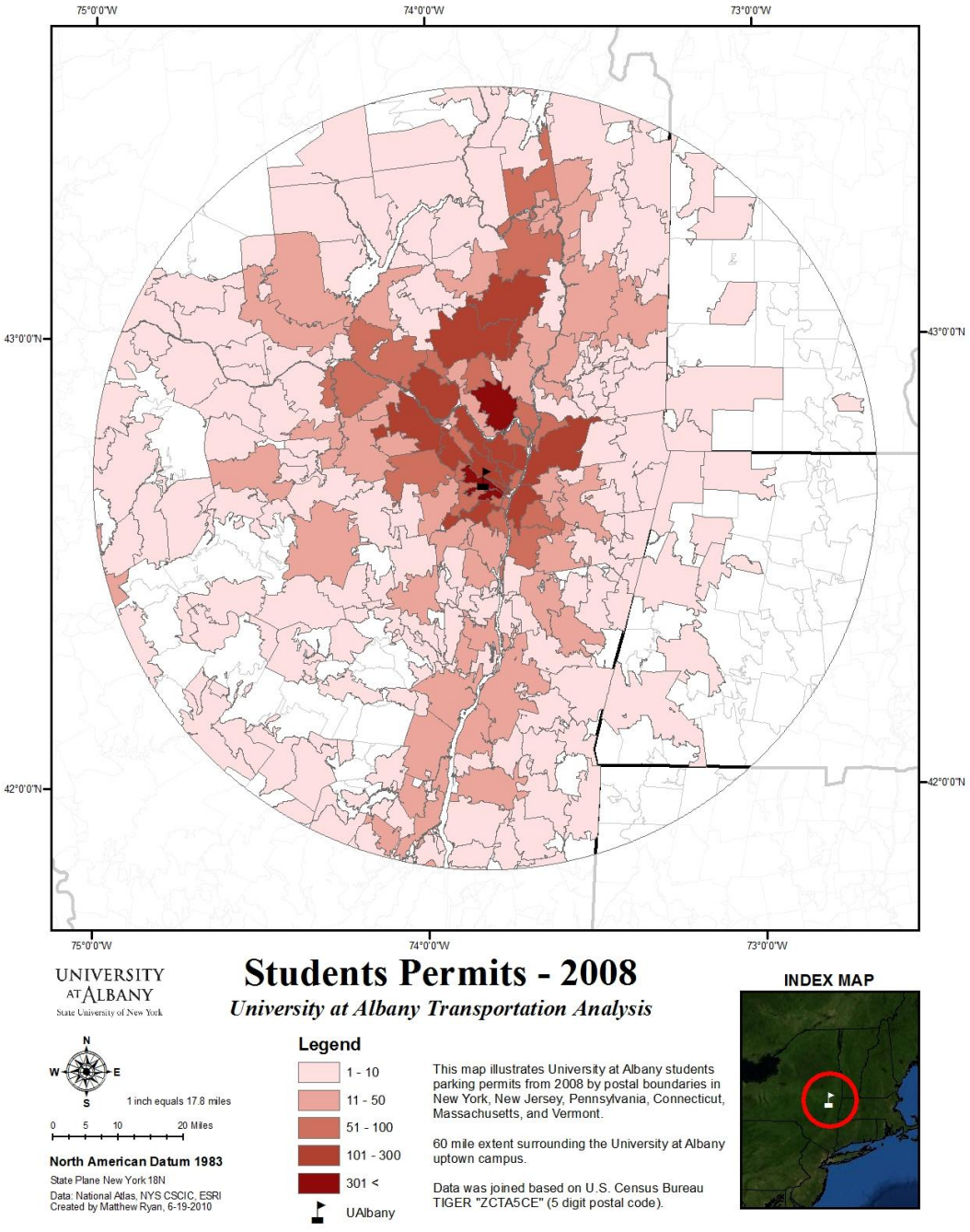
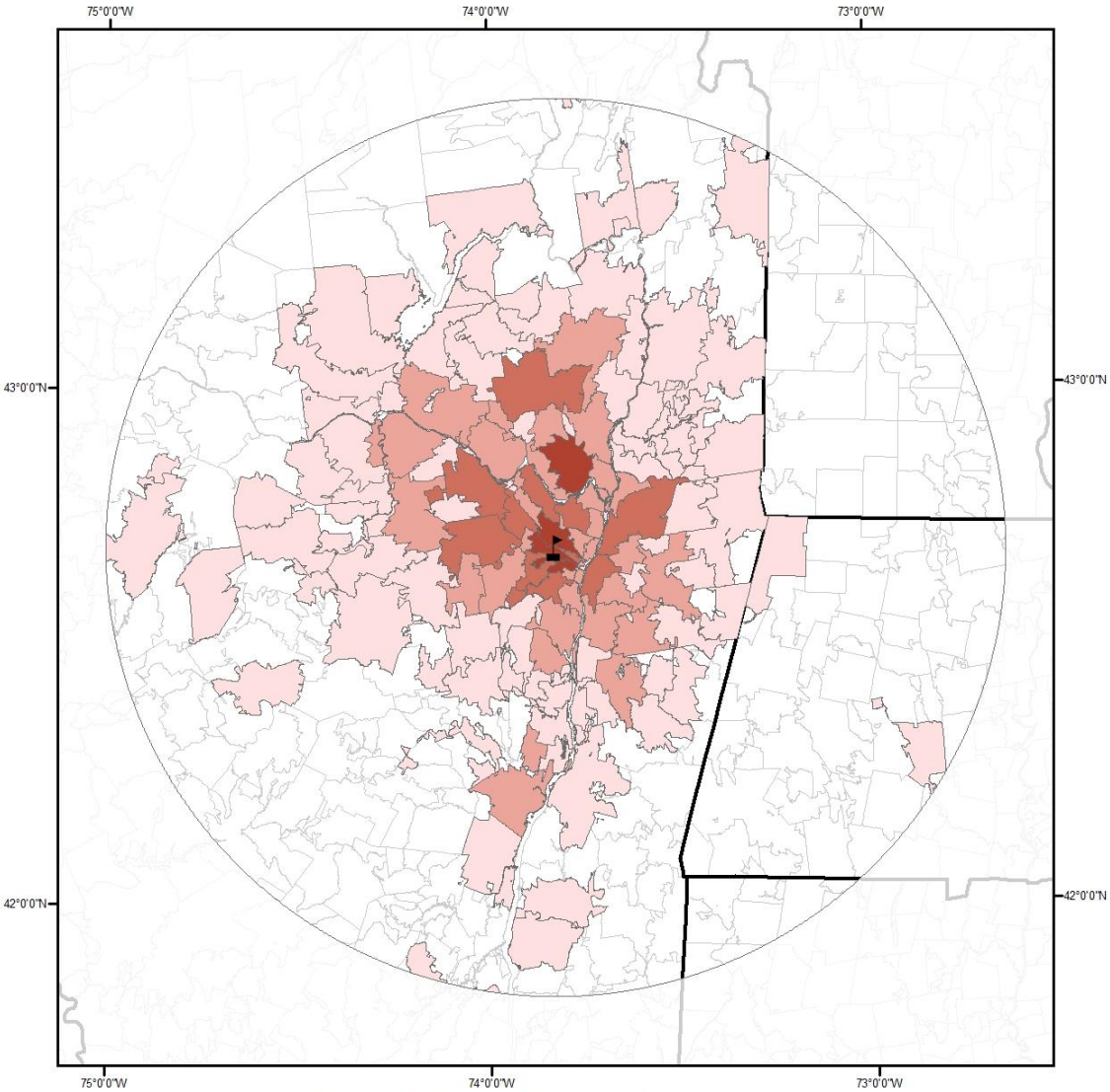
ADDITIONAL MAPS AND GRAPHICS

60 Mile Radius Maps



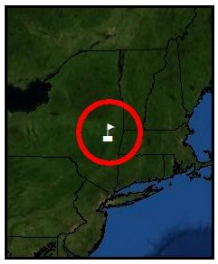


UNIVERSITY AT ALBANY
State University of New York

Staff Permits - 2008

University at Albany Transportation Analysis

INDEX MAP



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North American Datum 1983

State Plane New York 18N

Data: National Atlas, NYS CSCIC, ESRI
Created by Matthew Ryan, 6-19-2010

Legend

- 1 - 10
- 11 - 50
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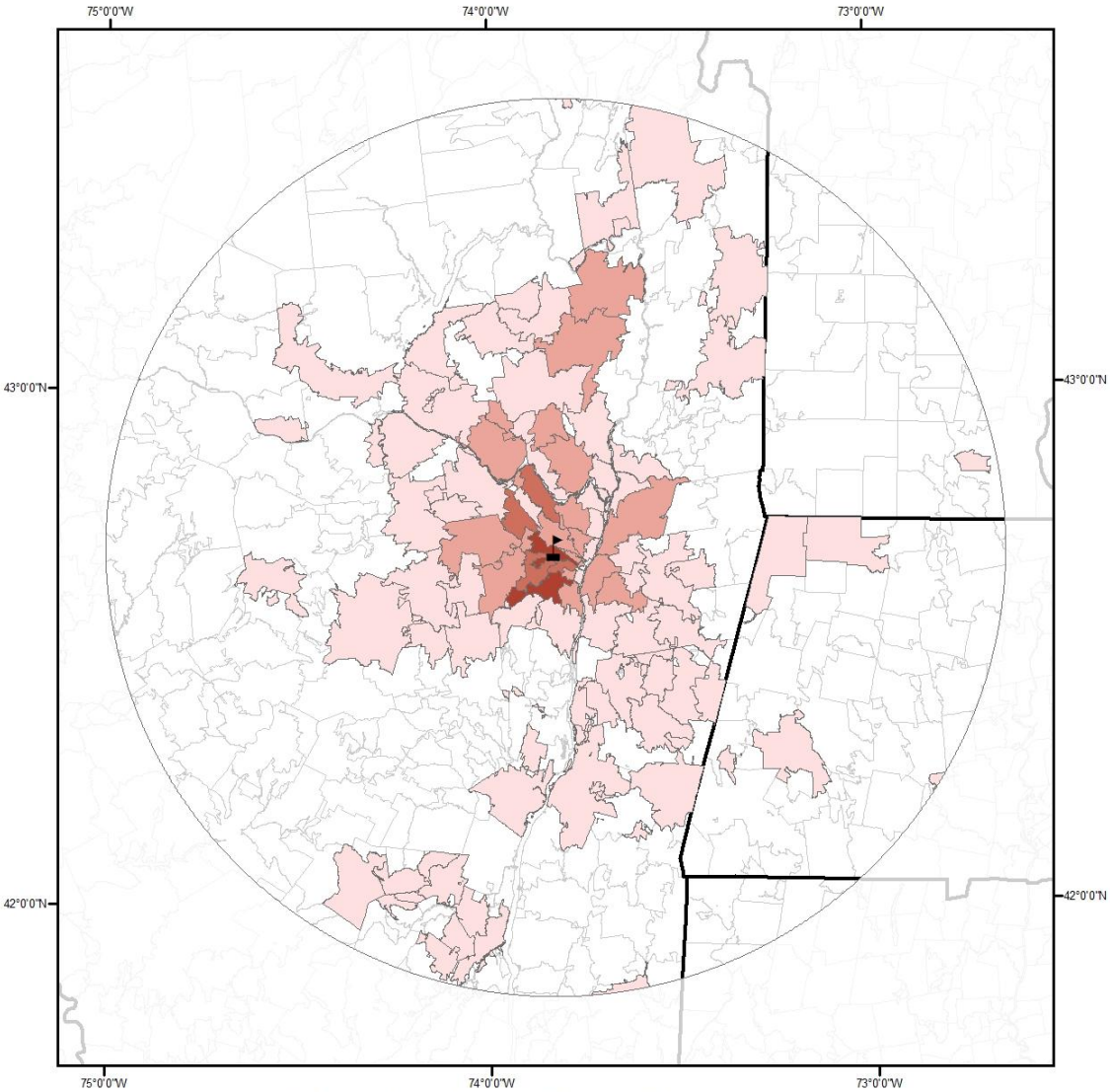
- UAlbany

This map illustrates University at Albany staff parking permits from 2008 by postal boundaries in New York, New Jersey, Pennsylvania, Connecticut, Massachusetts, and Vermont.

60 mile extent surrounding the University at Albany uptown campus.

Data was joined based on U.S. Census Bureau TIGER "ZCTA5CE" (5 digit postal code).



UNIVERSITY AT ALBANY
State University of New York

Faculty Permits - 2008

University at Albany Transportation Analysis

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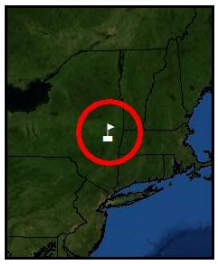

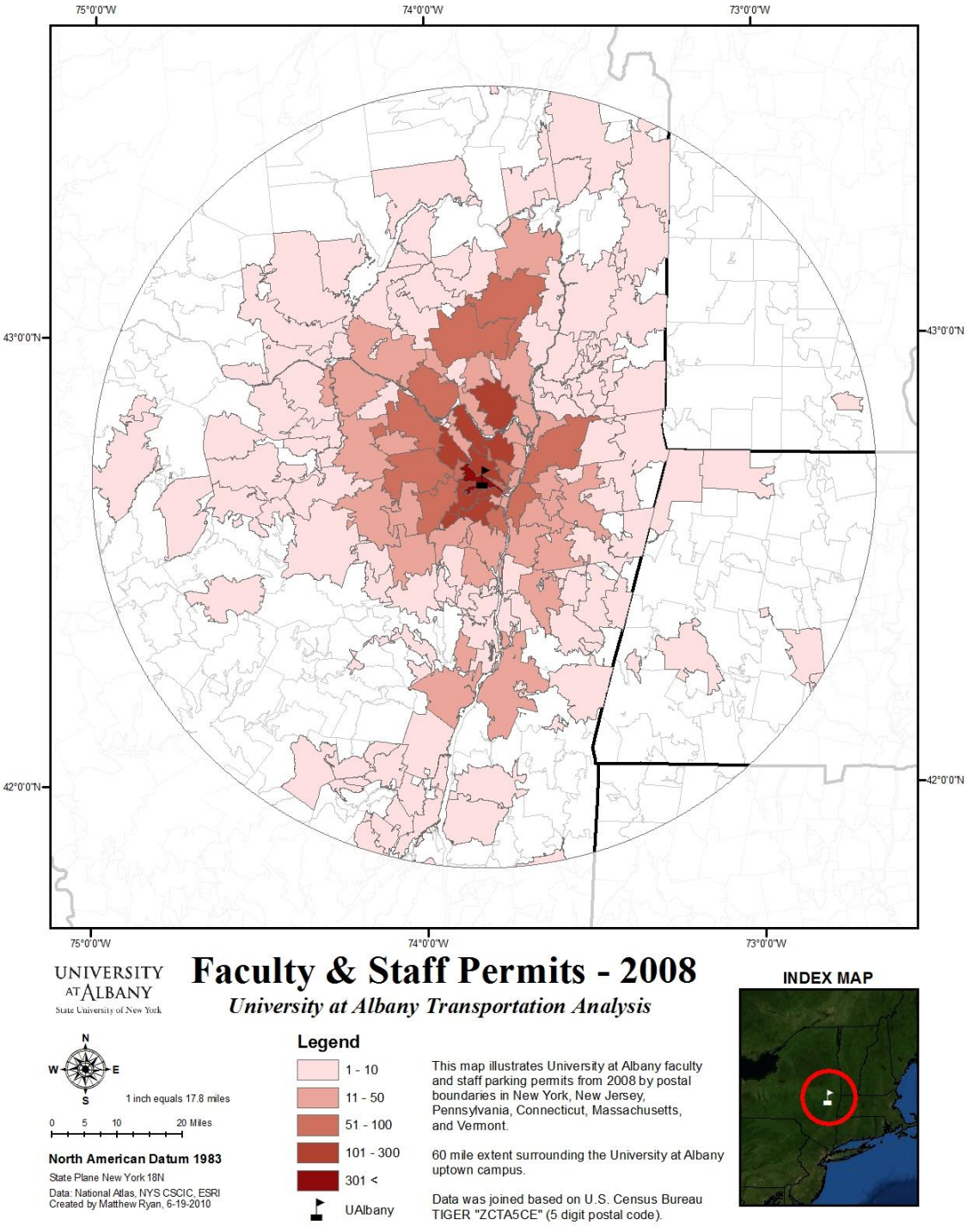
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State University of New York
Faculty & Staff Permits - 2008
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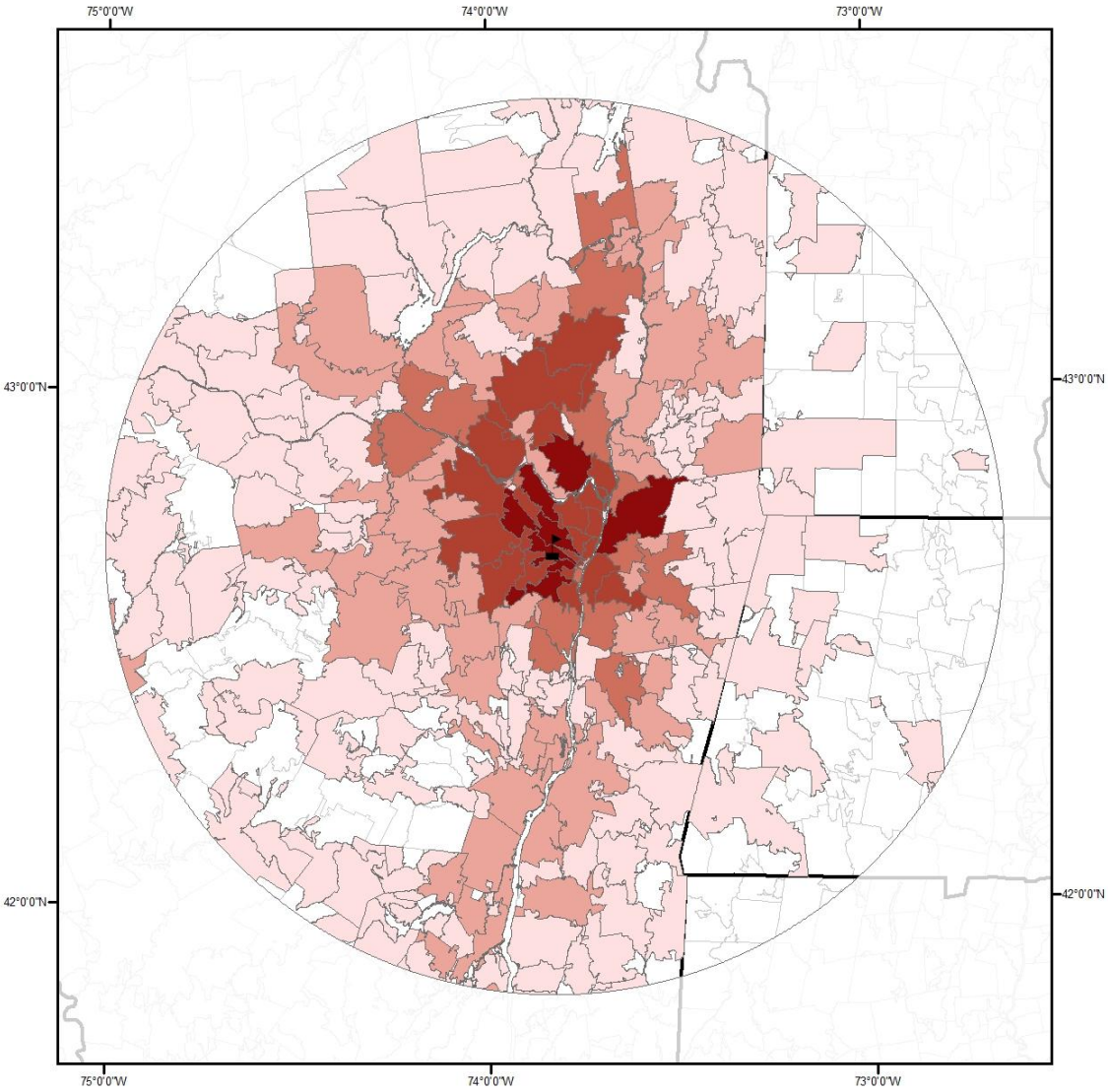

UNIVERSITY AT ALBANY
State University of New York

Faculty, Staff & Student Permits - 2008

University at Albany Transportation Analysis

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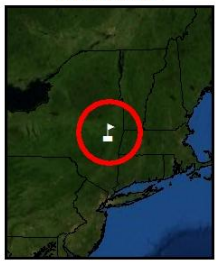

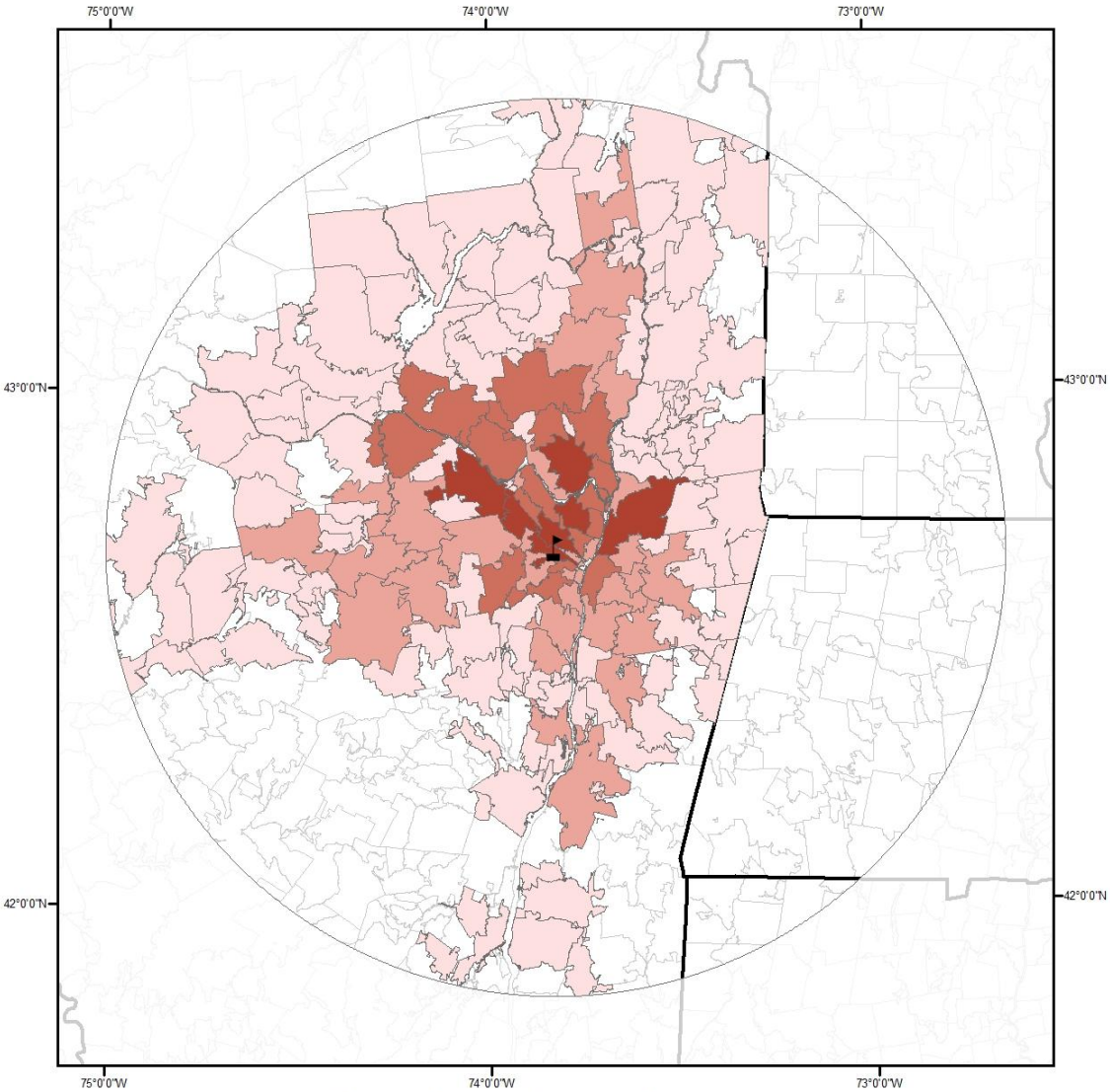

UNIVERSITY AT ALBANY
State University of New York

Harriman Permits

University at Albany Transportation Analysis

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1 inch equals 17.8 miles

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North American Datum 1983

State Plane New York 18N

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This map illustrates Harriman parking permits by postal boundaries in New York, New Jersey, Pennsylvania, Connecticut, Massachusetts, and Vermont.

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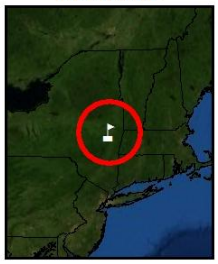
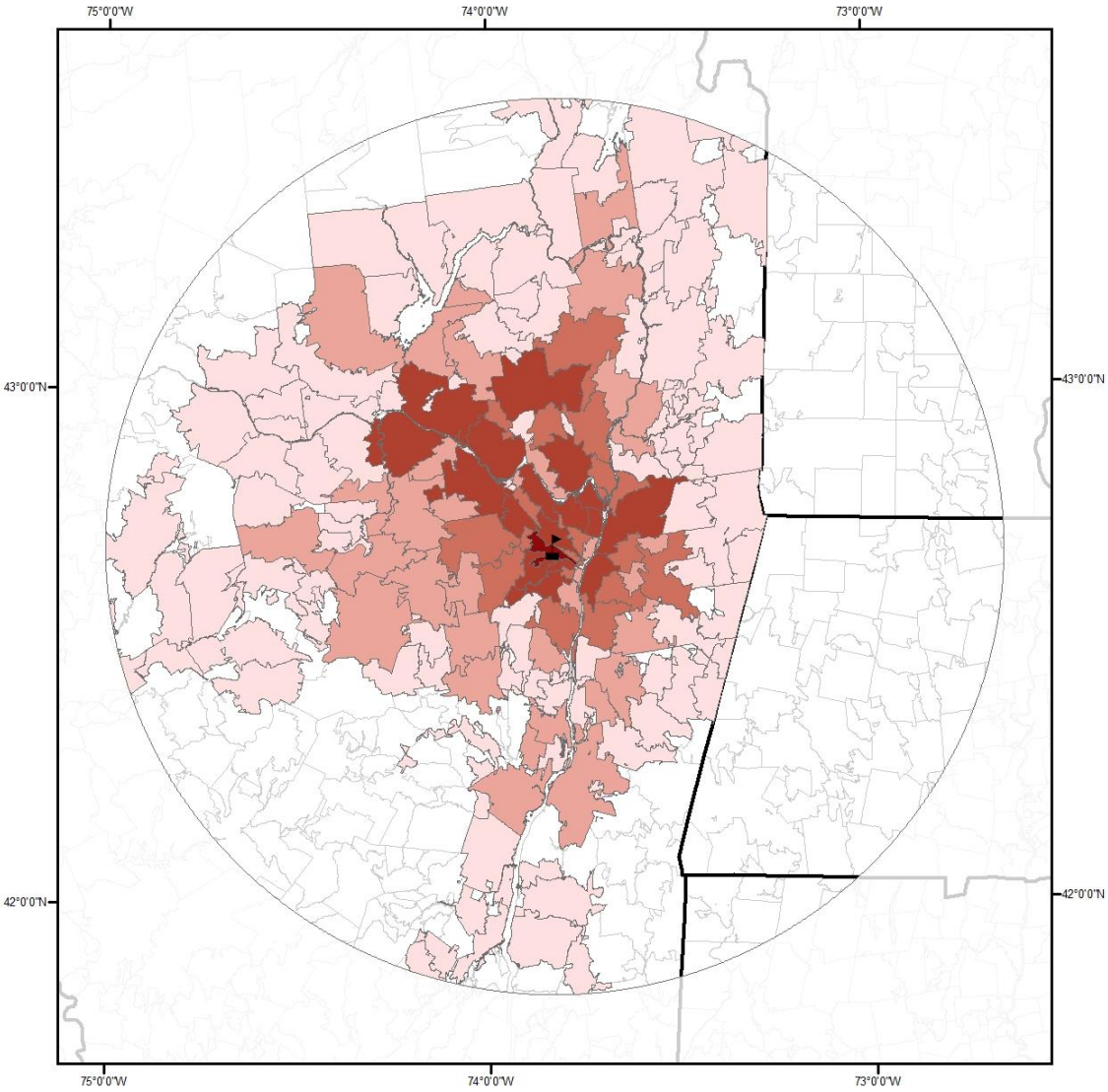
INDEX MAP





UNIVERSITY AT ALBANY
State University of New York

Harriman with UAlbany Staff Permits

University at Albany Transportation Analysis

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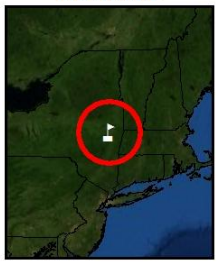

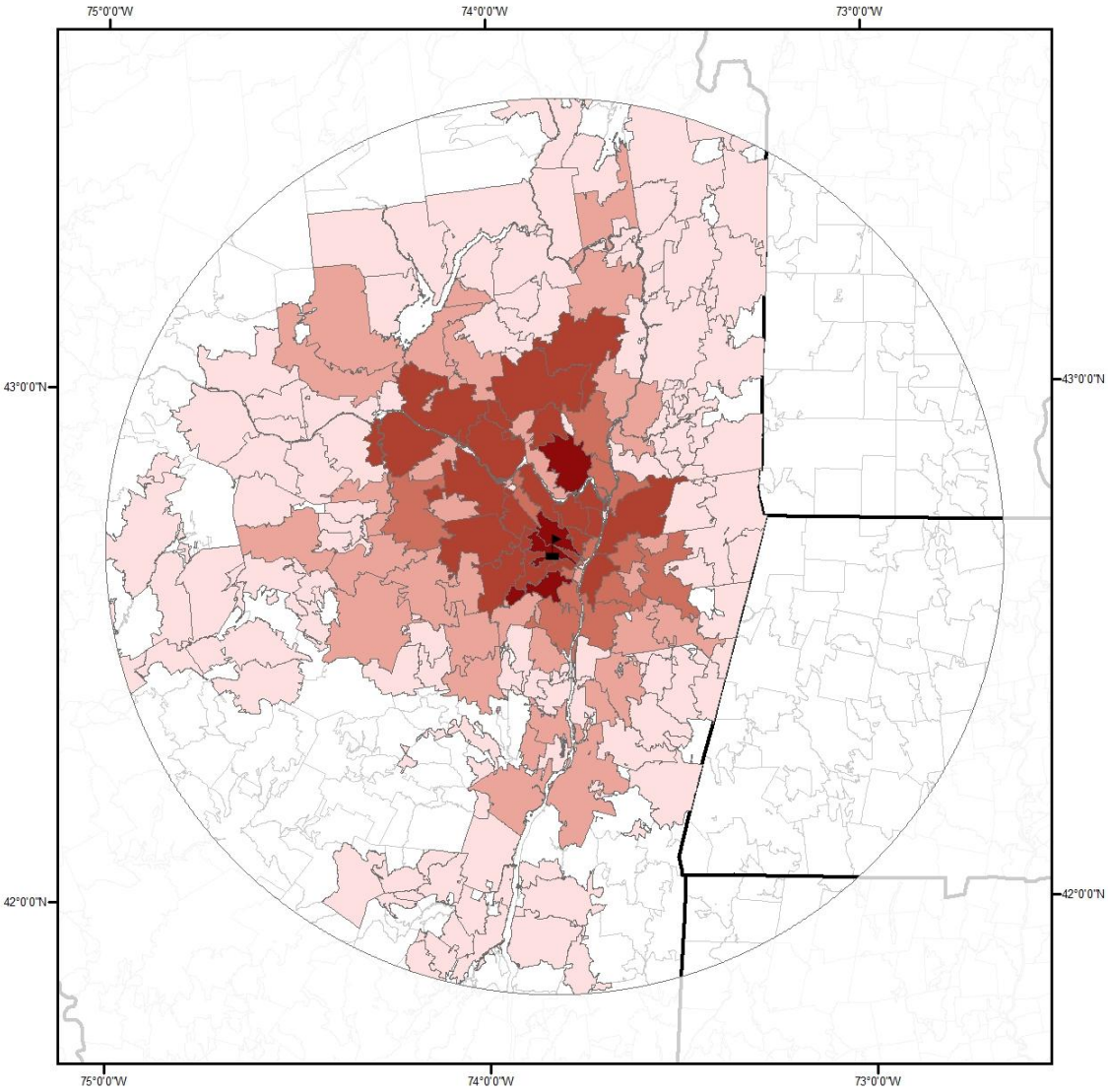

UNIVERSITY AT ALBANY
State University of New York

Harriman with UAlbany Staff & Faculty Permits

University at Albany Transportation Analysis

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1 inch equals 17.8 miles

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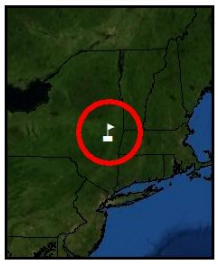
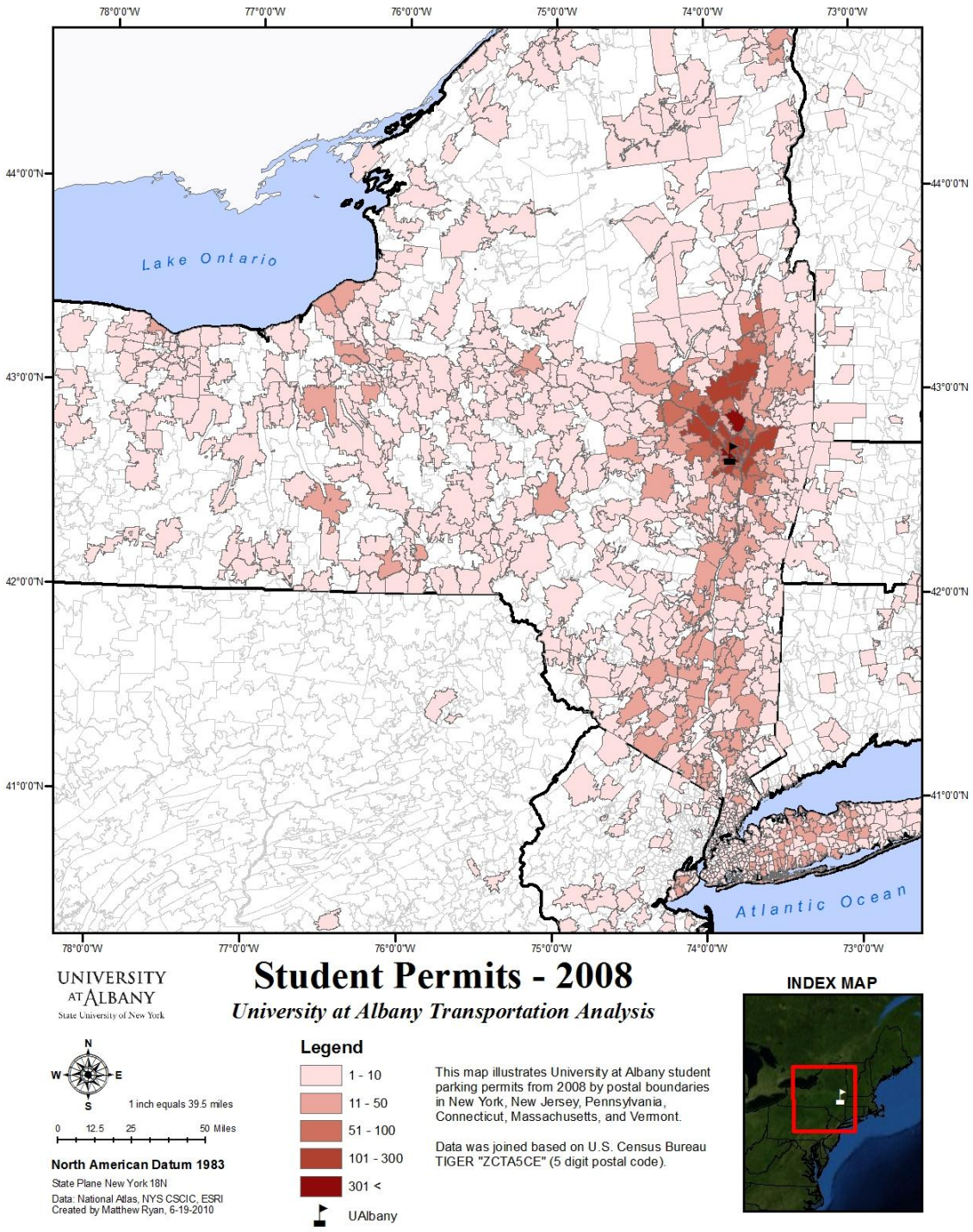
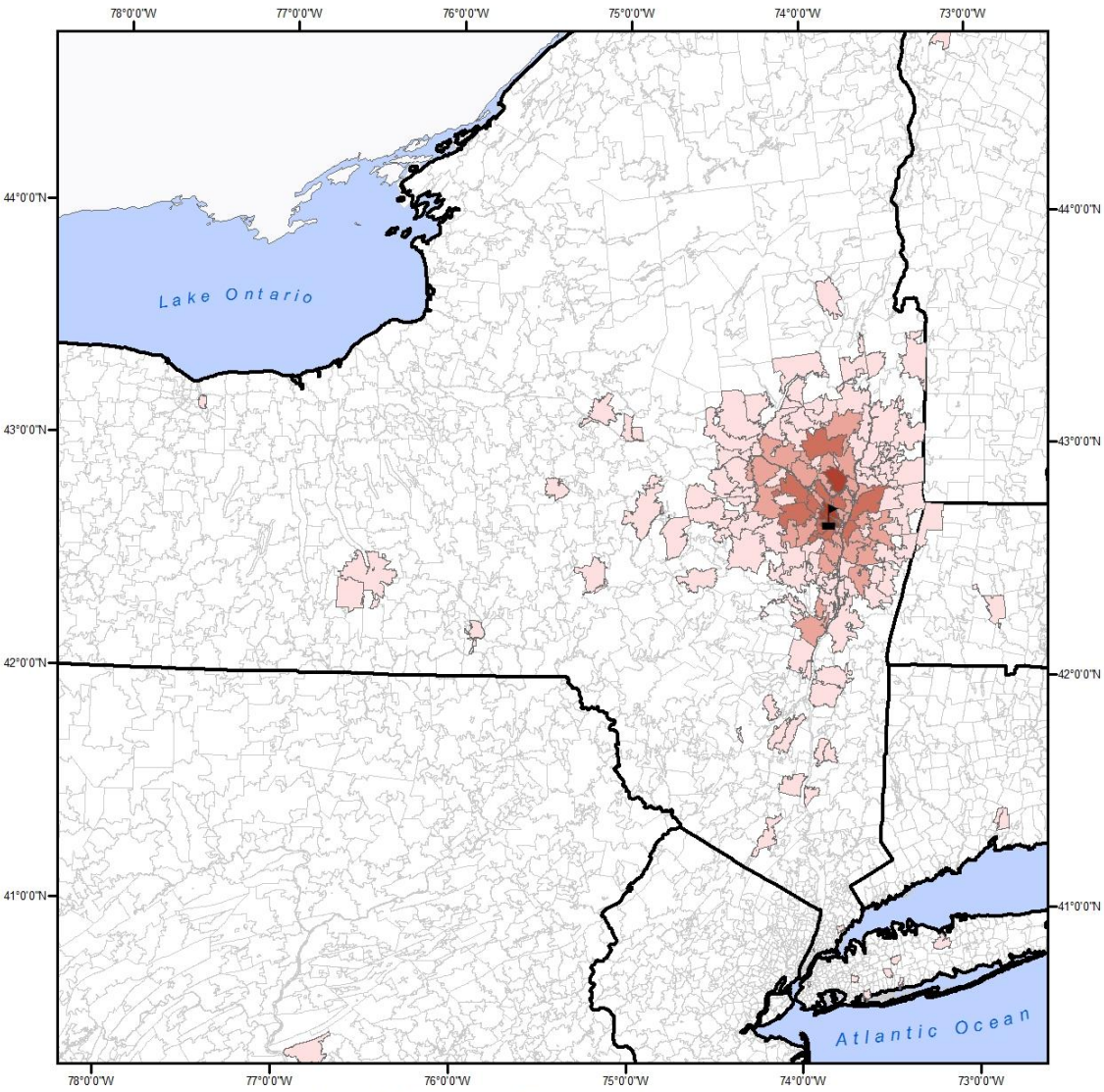


Maps Featuring all Permits





UNIVERSITY AT ALBANY
State University of New York

Staff Permits - 2008

University at Albany Transportation Analysis

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North American Datum 1983

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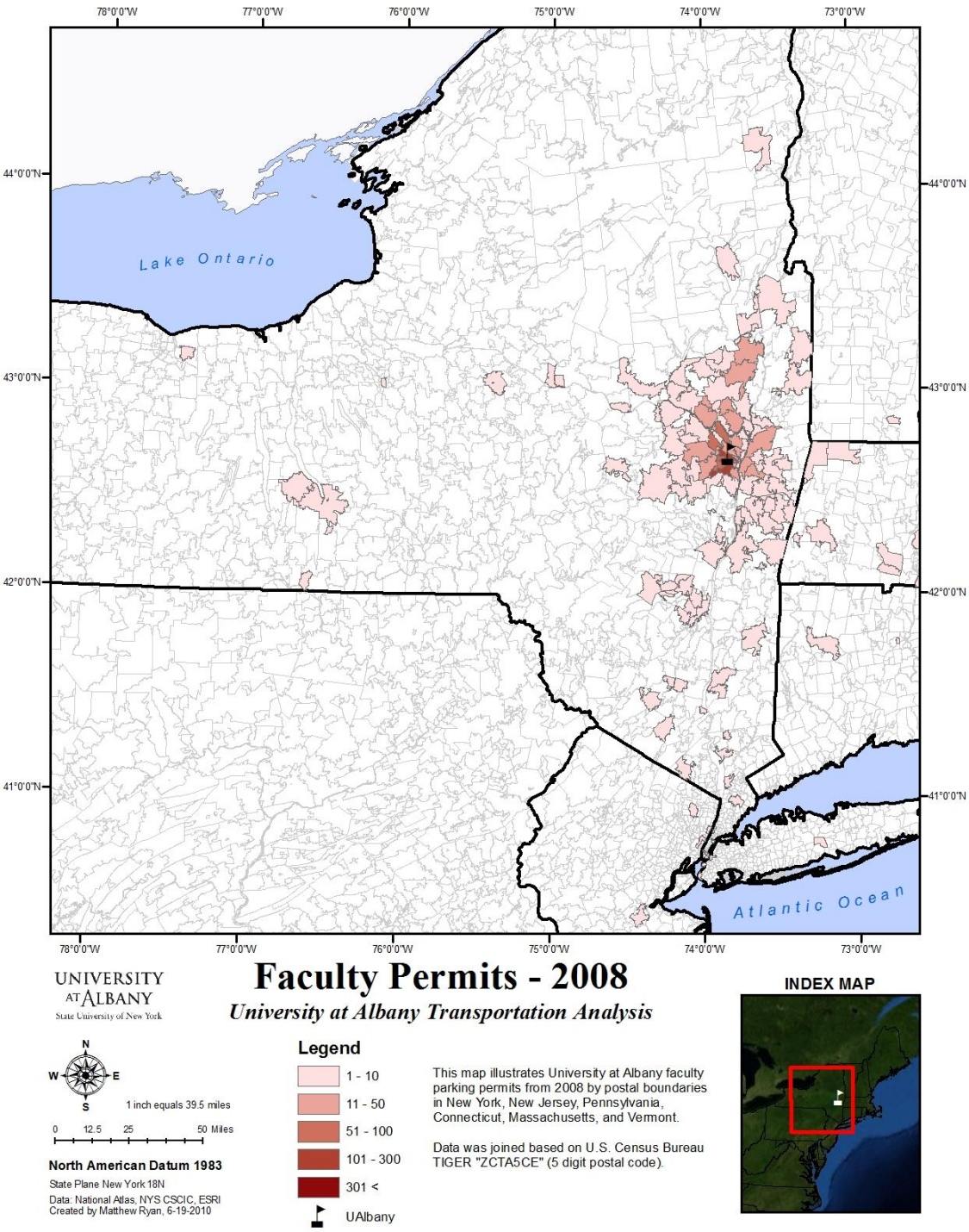
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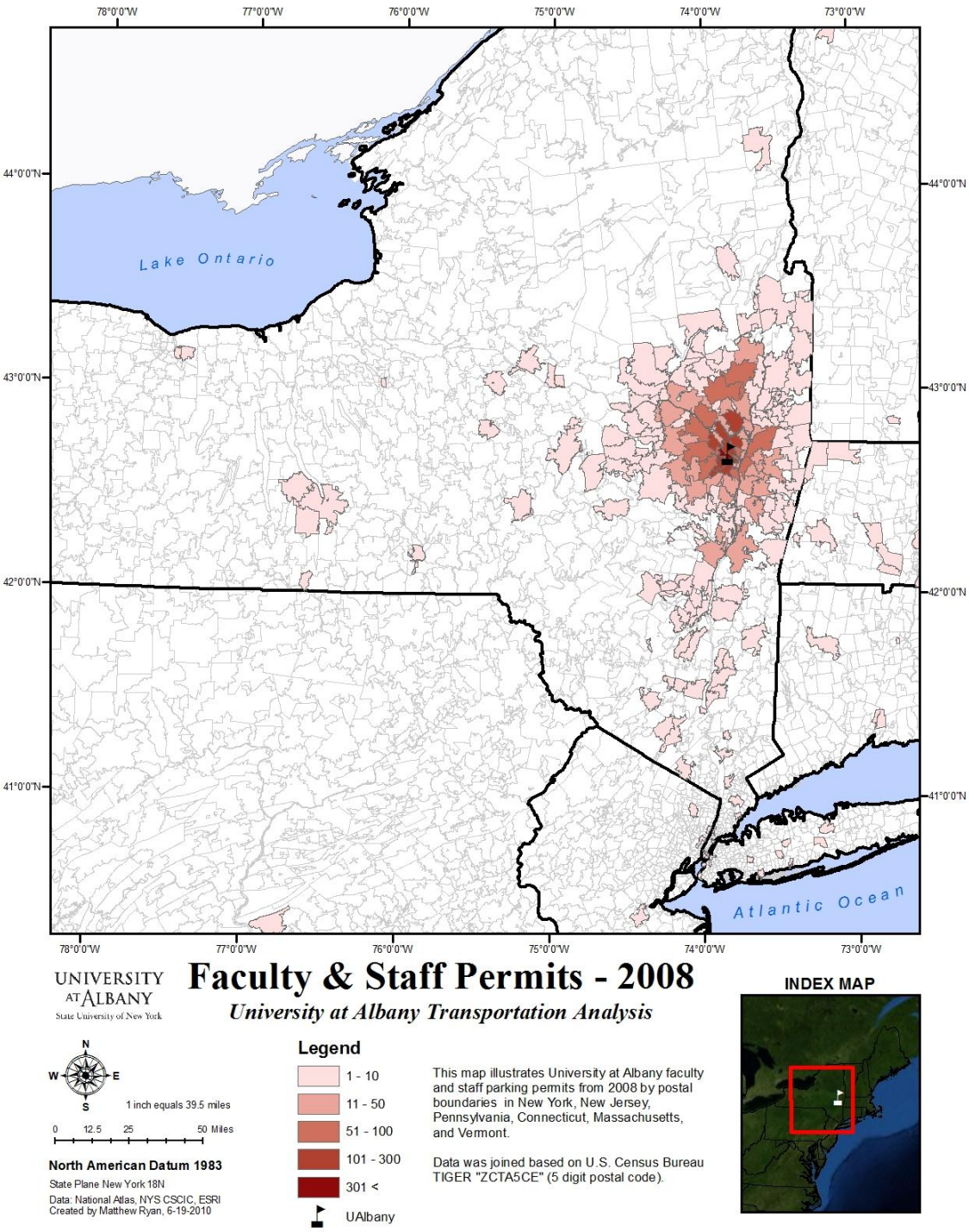
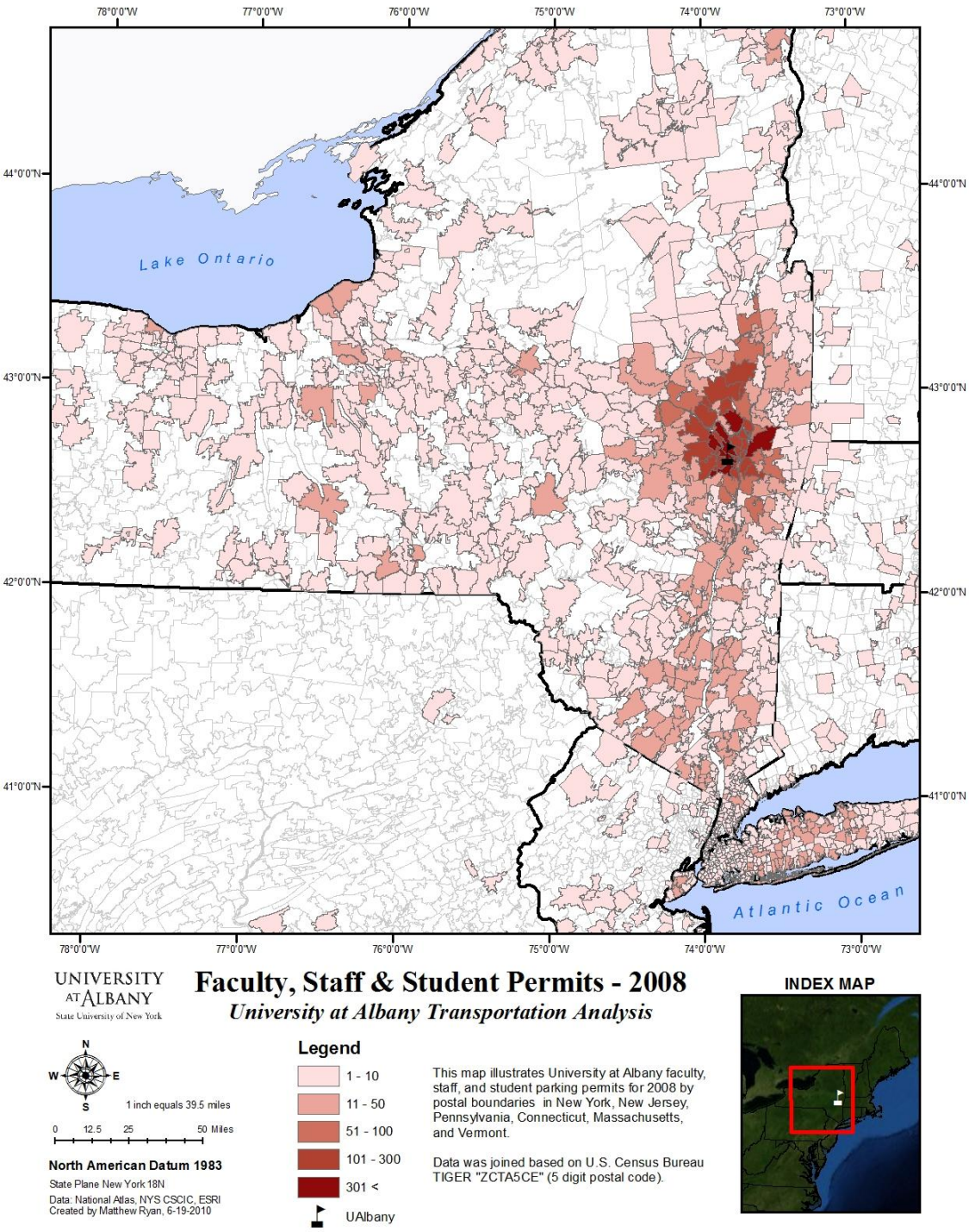
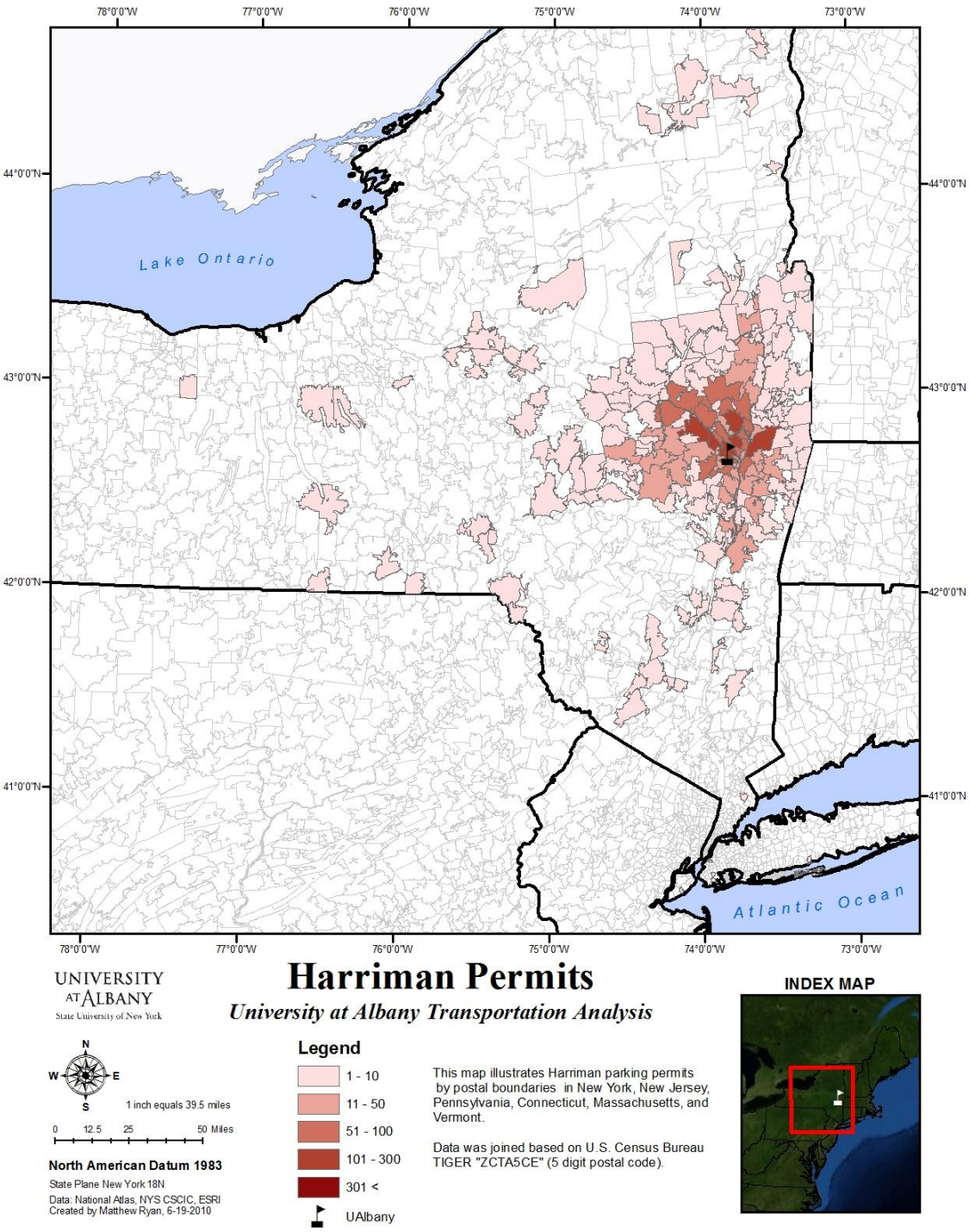
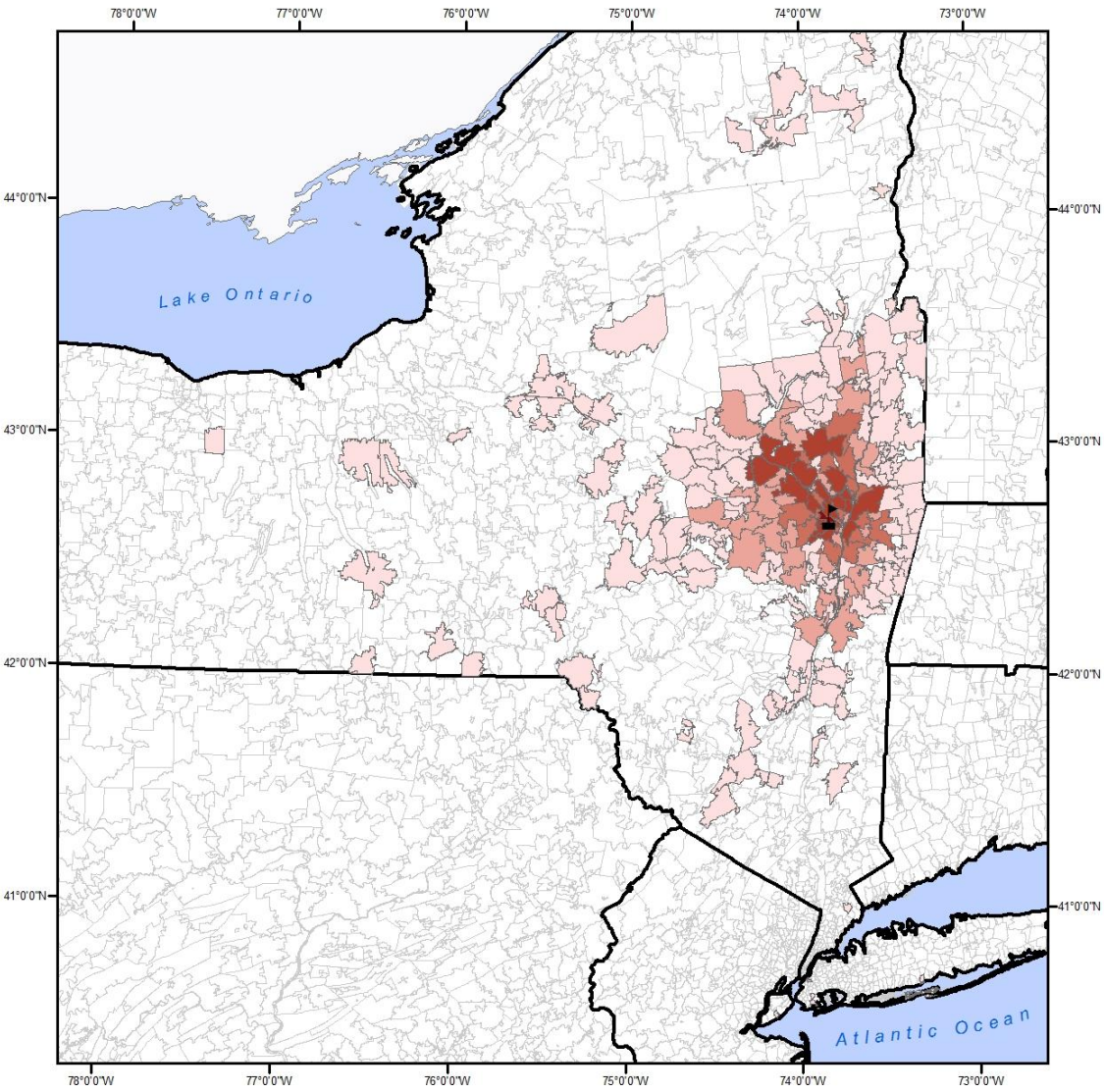
UAlbany
This map illustrates University at Albany faculty parking permits from 2008 by postal boundaries in New York, New Jersey, Pennsylvania, Connecticut, Massachusetts, and Vermont.
Data was joined based on U.S. Census Bureau TIGER "ZCTA5CE" (5 digit postal code).


78°0'0"W
77°0'0"W
76°0'0"W
75°0'0"W
74°0'0"W
73°0'0"W
44°0'0"N
43°0'0"N
42°0'0"N
41°0'0"N
Lake Ontario
Atlantic Ocean
UNIVERSITY AT ALBANY
State University of New York
Faculty & Staff Permits - 2008
University at Albany Transportation Analysis
INDEX MAP
N
W
E
S
1 inch equals 39.5 miles
0 12.5 25 50 Miles
North American Datum 1983
State Plane New York 18N
Data: National Atlas, NYS CSCIC, ESRI
Created by Matthew Ryan, 6-19-2010
Legend
1 - 10
11 - 50
51 - 100
101 - 300
301 <
UAlbany
This map illustrates University at Albany faculty and staff parking permits from 2008 by postal boundaries in New York, New Jersey, Pennsylvania, Connecticut, Massachusetts, and Vermont.
Data was joined based on U.S. Census Bureau TIGER "ZCTA5CE" (5 digit postal code).


78°0'0"W
77°0'0"W
76°0'0"W
75°0'0"W
74°0'0"W
73°0'0"W
44°0'0"N
43°0'0"N
42°0'0"N
41°0'0"N
Lake Ontario
Atlantic Ocean
UNIVERSITY AT ALBANY
State University of New York
Faculty, Staff & Student Permits - 2008
University at Albany Transportation Analysis
N
W
E
S
1 inch equals 39.5 miles
0 12.5 25 50 Miles
North American Datum 1983
State Plane New York 18N
Data: National Atlas, NYS CSCIC, ESRI
Created by Matthew Ryan, 6-19-2010
Legend
1 - 10
11 - 50
51 - 100
101 - 300
301 <
UAlbany
This map illustrates University at Albany faculty, staff, and student parking permits for 2008 by postal boundaries in New York, New Jersey, Pennsylvania, Connecticut, Massachusetts, and Vermont.
Data was joined based on U.S. Census Bureau TIGER "ZCTA5CE" (5 digit postal code).
INDEX MAP


78°0'0"W
77°0'0"W
76°0'0"W
75°0'0"W
74°0'0"W
73°0'0"W
44°0'0"N
43°0'0"N
42°0'0"N
41°0'0"N
Lake Ontario
Atlantic Ocean
UNIVERSITY AT ALBANY
State University of New York
Harriman Permits
University at Albany Transportation Analysis
INDEX MAP
N
W
E
S
1 inch equals 39.5 miles
0 12.5 25 50 Miles
North American Datum 1983
State Plane New York 18N
Data: National Atlas, NYS CSCIC, ESRI
Created by Matthew Ryan, 6-19-2010
Legend
1 - 10
11 - 50
51 - 100
101 - 300
301 <
UAlbany
This map illustrates Harriman parking permits by postal boundaries in New York, New Jersey, Pennsylvania, Connecticut, Massachusetts, and Vermont.
Data was joined based on U.S. Census Bureau TIGER "ZCTA5CE" (5 digit postal code).



UNIVERSITY AT ALBANY
State University of New York

Harriman with UAlbany Staff Permits

University at Albany Transportation Analysis

N
W E
S

1 inch equals 39.5 miles

0 12.5 25 50 Miles

North American Datum 1983

State Plane New York 18N

Data: National Atlas, NYS CSCIC, ESRI
Created by Matthew Ryan, 6-19-2010

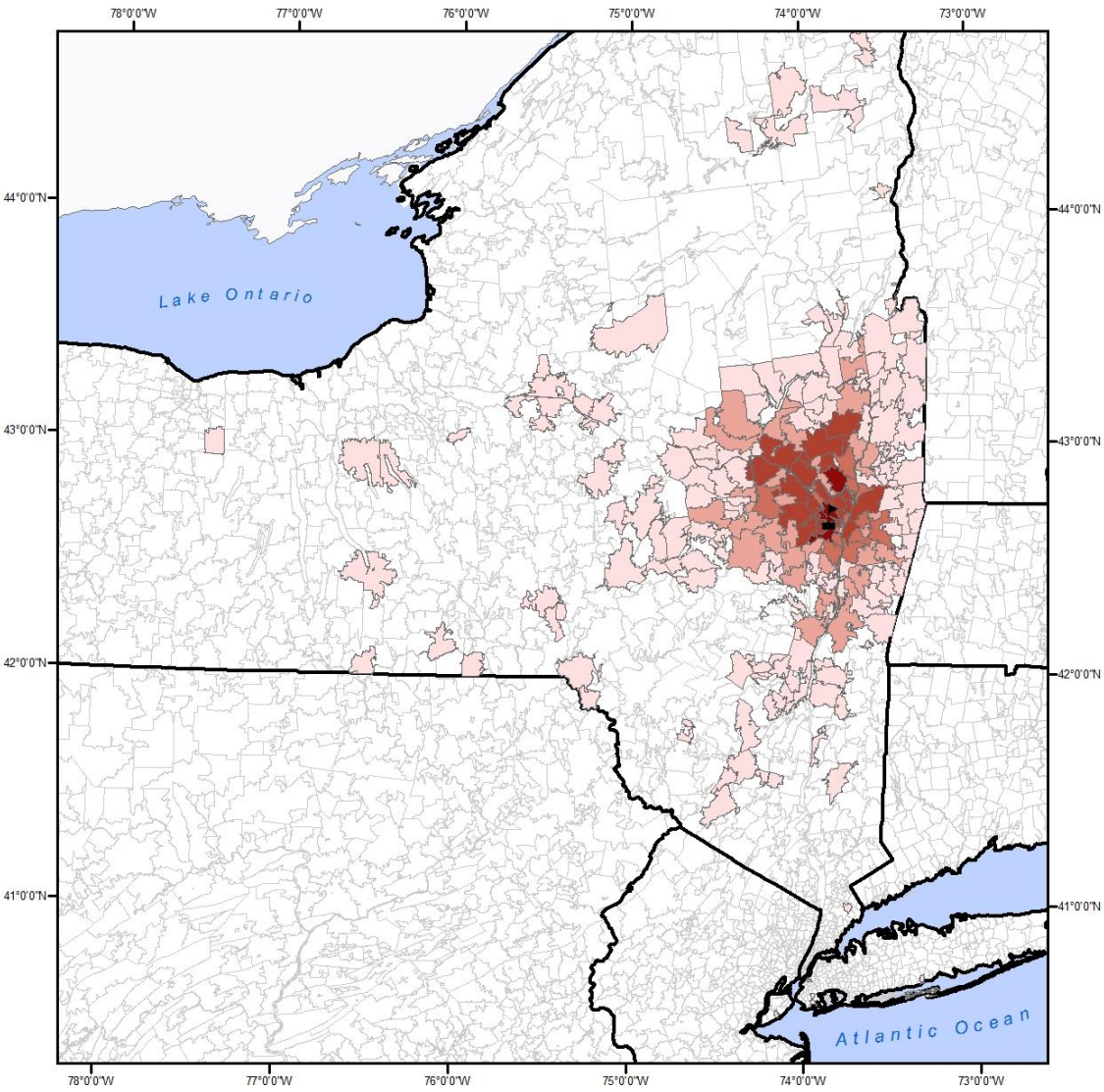
Legend

- 1 - 10
- 11 - 50
- 51 - 100
- 101 - 300
- 301 <
- UAlbany

This map illustrates Harriman parking permits combined with University at Albany staff permits (2008) by postal boundaries in New York, New Jersey, Pennsylvania, Connecticut, Massachusetts, and Vermont.

Data was joined based on U.S. Census Bureau TIGER "ZCTA5CE" (5 digit postal code).

INDEX MAP



UNIVERSITY AT ALBANY
State University of New York

Harriman with UAlbany Staff & Faculty Permits

University at Albany Transportation Analysis

INDEX MAP

N
W E
S

1 inch equals 39.5 miles

0 12.5 25 50 Miles

North American Datum 1983

State Plane New York 18N

Data: National Atlas, NYS CSCIC, ESRI
Created by Matthew Ryan, 6-19-2010

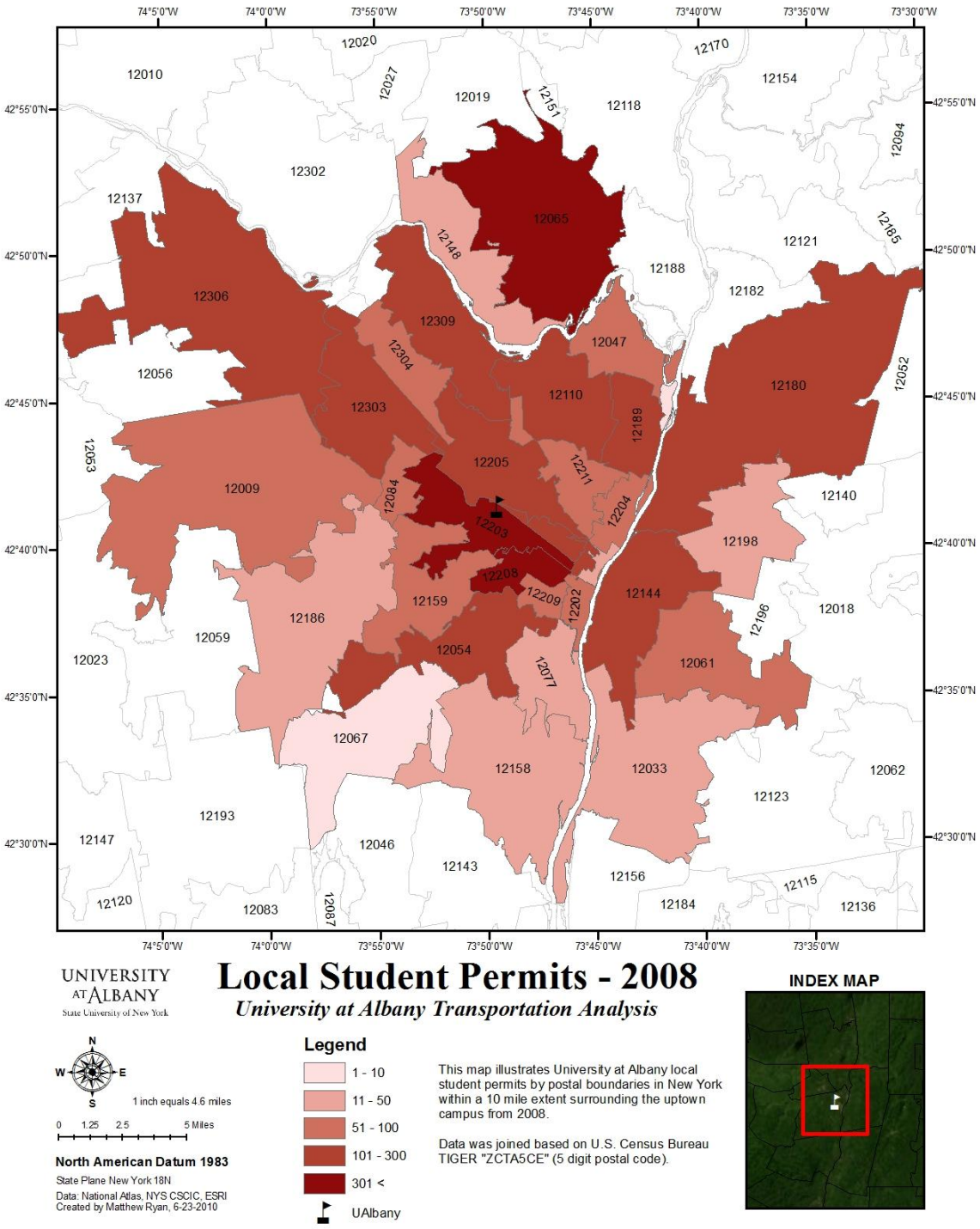
Legend

- 1 - 10
- 11 - 50
- 51 - 100
- 101 - 300
- 301 <
- UAlbany

This map illustrates Harriman parking permits combined with University at Albany staff and faculty permits (2008) by postal boundaries in New York, New Jersey, Pennsylvania, Connecticut, Massachusetts, and Vermont.

Data was joined based on U.S. Census Bureau TIGER "ZCTA5CE" (5 digit postal code).

Local Maps


74°5'0"W
74°0'0"W
73°55'0"W
73°50'0"W
73°45'0"W
73°40'0"W
73°35'0"W
73°30'0"W
42°55'0"N
42°50'0"N
42°45'0"N
42°40'0"N
42°35'0"N
42°30'0"N
12020
12010
12027
12019
12151
12118
12170
12154
12094
12302
12137
12065
12148
12121
12185
12188
12306
12182
12309
12047
12304
12056
12180
12052
12303
12110
12189
12053
12205
12211
12009
12084
12204
12140
12203
12198
12208
12209
12202
12144
12159
12186
12196
12018
12059
12054
12023
12077
12061
12067
12158
12033
12062
12123
12193
12147
12046
12143
12156
12115
12120
12083
12087
12184
12136
UNIVERSITY AT ALBANY
State University of New York
Local Student Permits - 2008
University at Albany Transportation Analysis
INDEX MAP
N
W
E
S
1 inch equals 4.6 miles
0 1.25 2.5 5 Miles
North American Datum 1983
State Plane New York 18N
Data: National Atlas, NYS CSCIC, ESRI
Created by Matthew Ryan, 6-23-2010
Legend
1 - 10
11 - 50
51 - 100
101 - 300
301 <
UAlbany
This map illustrates University at Albany local student permits by postal boundaries in New York within a 10 mile extent surrounding the uptown campus from 2008.
Data was joined based on U.S. Census Bureau TIGER "ZCTA5CE" (5 digit postal code).