Promoting Alternative Transportation for the WPI Community

A WPI Interactive Qualifying Project

By Dusty Cyr, Anthony Hannoush, Michael Josephs, and Anthony Mikelonis

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An Interactive Qualifying Project
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Degree of Bachelor of Science

by
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Report Submitted to:

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EXECUTIVE SUMMARY

Project Mission Overview

This project aimed to encourage and promote alternative transportation by the WPI community. The methods used to do this included researching the current methods of alternative transportation already existing around WPI, researching what other colleges and cities have done to encourage and promote alternative transportation, understanding how people travel to and around campus, and finally producing a list of recommendations to promote and encourage alternative transportation.

Methodology

When researching the current state of transportation methods at WPI, we gathered information about where students, faculty, and staff live from various departments, and conducted interviews with top decision makers at the WRTA and WPI Facilities Department. Additionally, a campus-wide survey was conducted to gain insight into how WPI community members are traveling and what forms of alternative transportation would change travel habits for the better.

We obtained general statistics and alternative transportation information about other colleges through online and print-based research. More specific college information was obtained through contacting these schools, conducting interviews, and gathering published information from these colleges.

Findings

After we conducted research, interviews, and a campus-wide survey various findings about how to change traveling habits at WPI were discovered. Listed below are some of our findings:

- Around half (54 percent) of on/near campus undergraduates (the largest WPI population) say that they sometimes or always use a personal vehicle to travel somewhere outside of campus, translating to a large amount of personal vehicle use. In addition, 75 percent of faculty and 88 percent of staff indicated that they commute primarily with a personal vehicle.
- One of the most promising methods to decrease personal vehicle usage is carpooling. On/near-campus personal vehicle users indicated that they would consider carpooling if it were made easier. Most significantly, 11 percent of on/near- campus graduate students and 12 percent of on/near-campus undergraduate students who always use personal vehicles said that they would definitely change how they travel if carpooling was made easier. Additionally, another 43 percent of graduate students and 30 percent of

undergraduate students who always use a personal vehicle to travel off-campus said that they would possibly change how they travel with easier carpooling.

- The survey further indicated that on/near-campus undergraduate students would utilize the WRTA bus system if it were more frequent or more convenient. 31 percent of undergraduate students who live on or near campus and sometimes utilize cars would possibly change their travel habits and 29 percent who always utilize cars would possibly change as well. In total, 74 percent of undergraduates who live on or near campus, and utilize a car at all, would at least consider utilizing the WTRA instead of their cars were the bus system to improve.
- Another finding was that bicycles are currently underutilized on and around campus, but may cut down vehicle use for short trips if free or inexpensive rentals were offered. Of the 558 respondents who indicated that they live on campus or near campus, a combined 2 percent of these respondents indicated that they always use a bicycle to commute or travel off campus. However, 64 percent of all respondents indicated that free or inexpensive bicycle rentals would definitely or possibly change the way they travel off campus.
- In terms of community members who commuted, the most promising finding was that WPI personal vehicle commuters would consider carpooling if it were easier. 11 percent of on/near-campus graduate students and 12 percent of on/near-campus undergraduate students who always use personal vehicles said that they would definitely change how they travel if carpooling was made easier.
- Another promising finding was that commuters who live in areas accessible by the WRTA would utilize the bus system if it were to improve. Of the commuters who live within Worcester, 50 percent of undergraduates responded that they would definitely change their travel habits if the WRTA were to improve.
- The survey results also indicated that faculty members would benefit from a more convenient MBTA Commuter Rail. One third of undergraduate car commuters who live in the surrounding communities of Worcester, and one third of those who live farther away said that a more frequent or convenient MBTA would possibly change how they travel, with 22 percent of undergraduate car commuters who live farther away saying that they would definitely change how they travel.
- Lastly, the survey indicated that bicycle rentals would not replace many vehicle commutes, but may change habits for short trips once commuters are on campus. Of the 347 survey respondents who indicated that they commute to campus via personal vehicle, 27 percent indicated that free or inexpensive bicycle rentals would definitely change how they travel. 68 percent of this group of personal vehicle commuters who indicated that free or inexpensive bicycle rentals would definitely change how they travel also travel between the main campus and Gateway at least occasionally, with 35 percent indicating that they travel between campuses at some point each week.

Recommendations

Based on the findings above, we recommend:

- that WPI's Carpool World website be improved by the Web Development Office, and that the WPI Office of Student Life, the WPI Human Resources, and the WPI Department of Facilities promote and advertise it heavily.
- that the WPI Department of Facilities create a free or inexpensive bike rental program, and provide more infrastructure such as air pumping stations and bike rooms around campus.
- that the WPI Department of Facilities install a WRTA Information Ticker and/or WRTA kiosk in the Rubin Campus Center.
- that the WRTA and WPI Department of Facilities work together to get a WRTA stop on campus.
- WPI Human Resources work with the MBTA to offer a reduced-price rate for the Commuter Rail.
- that the WPI Web Development Office create a clear, updated, and central website with information about all transportation options for WPI community members.
- that the WPI Police Department through SNAP increase transportation routes to and from Union Station.

ABSTRACT

This project focused on promoting and improving the use of sustainable, alternative transportation by the WPI community. We conducted research of other universities with successful alternative transportation programs, surveyed the WPI community's transportation habits and preferences, created maps of where the WPI community comes to campus from, and interviewed key figures. Based on our findings, we produced a list of recommendations aimed at promoting and increasing the use of sustainable, alternative transportation by the WPI community.

AUTHORSHIP PAGE

All members of the team contributed to the writing of this report. The breakdown for each member is as follows:

Michael Josephs wrote the Executive Summary. In addition, he wrote the section 2.2.2 on UC Davis as well as made contributions to other areas of the background chapter. Also, Michael wrote sections 4.3.3 and 4.4.4 about on and off campus bicycling in the Findings chapter. He also made contributions to the recommendations section in addition to general edits and rewrites of various sections throughout the report.

Anthony Hannoush wrote section 2.2.1 on Duke University as well as added contributions to the background. He also wrote section 4.3.4 on Zipcar rentals for on/near-campus members, and section 4.3.5 on MBTA results for on/near-campus members. He also made general edits and did general rewrites of various sections throughout the report.

Anthony Mikelonis wrote section 2.1 on environmental and health impacts from motor vehicles as well as added contributions to the background. In addition, he wrote section 2.2.3 on the University of New Hampshire, section 4.3.1 on/near campus commuters, and section 4.4.1 on commuter carpooling. He also made general edits and did general rewrites of various sections throughout the report.

Dusty Cyr wrote Chapter 1, section 2.3 on alternative transportation at WPI, Chapter 3, the introduction to Chapter 4 through 4.1 and 4.2, section 4.4.4 on faculty members and the MBTA, and Appendices A-C. He also wrote “WPI to Target Plaza” in Appendix D. In addition to this authorship, he made general edits to various sections throughout the report.

Emmit Joyal wrote section 4.3.2 on the WRTA for on/near-campus members and section 4.4.3 WRTA results for off-campus members for the findings chapter.

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CHAPTER 1: INTRODUCTION

Transportation sources produce over one-quarter of the United States' greenhouse gas emissions each year, significantly contributing to global warming, pollution, and waste (EPA, 2012). There are over 253 million personal vehicles registered in the United States, with each vehicle producing an average of 5.1 metric tons of C02 per year, leading to pollution, traffic congestion and a worn-out transportation grid (DOT, 2013; EPA, 2011). These actions are not environmentally sustainable, and they also constitute a major financial burden to drivers as gas prices fluctuate and insurance rates increase. Unless more effort is made increasing the sustainability of the transportation section by providing, encouraging, and promoting alternative, sustainable transportation options, a negative impacts such as "acid deposition and air pollution, human health effects, global climate change and noise pollution" will continue to occur ("Air Quality | Sustainable Transport | Air Pollution," 2014).

Worcester, Massachusetts, like many American cities, has integrated alternative transportation into its practices, but it remains a city designed for and dominated by the automobile. As a consequence, the third largest city in the state has a 54/100 walkability rating from WalkScore.com (compared to 80/100 for Boston, MA), meaning that the city is "somewhat walkable" (WalkScore, 2014). However, more positively, Worcester has the distinction of having the second-highest ridership of the state's commuter rail service, with the Framingham-Worcester line providing daily service between Worcester and Boston, with several stops in other towns along the route (Kush, 2014).

Worcester Polytechnic Institute (WPI) lies near the center of Worcester, and efforts are underway at the campus level to improve the campus's sustainability; however, few efforts have been taken to encourage the use of sustainable, alternative transportation. Encouraging sustainable, alternative means of transportation also helps diminish the environmental impact of WPI operations, promotes a safer and healthier campus, and helps the community economically. With nearly 6000 students and over 900 employees at WPI, transportation is a major part of WPI's environmental footprint and energy expenditures as a large number of these WPI community members travel to and around campus every day ("Campus Sustainability Report," 2013). As of 2011, approximately 25 percent of the student body and 95 percent of employees commuted to campus via a personal vehicle, translating to a large number of personal vehicle miles ("Sierra Magazine's 2011 "Coolest Schools"," 2011). Promoting alternative forms of transportation can help reduce WPI's impact on the environment and reduce traffic and congestion around the campus.

In response to these issues, WPI is undertaking a campus-wide effort to improve sustainability. Created in 2007, WPI's Task Force on Sustainability focuses on "resource conservation and

reduction in the harmful environmental impacts of [WPI's] operations," in order to improve WPI's overall long-term sustainability and to emphasize environmental and technological responsibility (WPI; "WPI's Task Force on Sustainability"). Other colleges such as Duke University and University of California, Davis have employed similar but far more ambitious programs to encourage and promote sustainability, including boosting alternative transportation. Their successes can serve as inspiration for WPI to encourage its own alternative transportation. However, in order to encourage alternative transportation, WPI needs to better understand what its community members are interested and willing to do. WPI must also uncover what sustainable, alternative transportation options are right for its community, and how to motivate its community to use these options.

This project, sponsored by the WPI Department of Facilities, focuses on how to make the WPI community's transportation more sustainable. In order to achieve this goal, we sought to learn what habits and dispositions WPI community members have currently, to see the scope of the problem and what modes of alternative transportation options to pursue, inspired by innovative approaches taken by other colleges. We then researched various forms of alternative transportation and evaluated the feasibility of each for the WPI community. Lastly, we produced a series of recommendations to encourage and promote the use of alternative transportation to inform and convince WPI community members to consider alternative transportation.

Based on our assessment of conditions in Worcester and at WPI, as well as the best practices in other communities, our recommendations are aimed at improving access to and use of alternative means of transportation. Our goal is that our recommendations foster a shift towards sustainability in the transportation behaviors and practices of the WPI community.

CHAPTER 2: BACKGROUND AND LITERATURE REVIEW

In this section, we discuss what sustainability means to the WPI campus, how our transportation choices affect the environment and human health, and current modes of transportation available to the WPI community. We also present the approaches that three notable colleges take to sustainable transportation. Our understanding of WPI's environment and best practices as other colleges informs our recommendations for WPI.

2.1. How Transportation is Part of Sustainability

Sustainability is a relationship between a productive economy, a healthy human society, and the slower-changing ecosystem with few environmental impacts, which maintains and supports all forms of life systems for future generations (Costanza, 1991). Sustainable transportation is any form of transportation that has a low impact on the environment, including fuel-efficient public transit such as city buses and commuter rails, carpooling, and non-motorized methods of transportation such as walking and cycling. ("Sustainable Engineering and Ecological Design," 2013) Because of road congestion, fossil fuel consumption, and greenhouse gas emissions, the single-passenger automobile is not a sustainable form of transportation.

Furthermore, WPI already has implemented a Sustainability Task Force team and part of WPI sustainability mission statement goes as the following, "… the reduction in the harmful environmental impacts of our operations, all directed toward enhancing the long-term sustainability of WPI's activities and the environment of which we are a part. We are an educational institution; thus, these goals are interwoven with our academic goals in teaching about the practices of **sustainable design** and the impacts of behavioral changes, as well as in conducting **research in the reduction of environmental impacts** and in methods of enhancing sustainability." ("The WPI Task Force on Sustainability," 2014) As we will discuss in the next section 2.1.1, we will explain about how harmful motor vehicle transportation and health impacts studies that makes this mode of transportation not sustainable for future generations, including for WPI community members. Furthermore, our project is to help to reduce harmful effects and to promote better sustainable practices in the WPI community, which we will discuss in detail in Chapter 3.

2.1.1 Environmental and Health Impacts from Motor Vehicles

The United States currently has 250-255 million registered vehicles, translating to four vehicles for every five people. ("National Transportation Statistics," 2013). The large number of motor

vehicles has affected the global environment by increasing carbon and complex gaseous emissions. The transportation sector is responsible for thirty percent of all U.S. carbon dioxide emissions, with cars and light trucks contributing to sixty percent of that (EPA, 2011). These emissions are harmful to the human body. For example, high exposure to carbon monoxide emissions can reduce delivery of oxygen to the heart, brain, and other vital organs, which may lead to death. ("EPA State and County Emissions Summaries," 2008) The leading cause of death for the ages 11-27 is motor-related accidents. Alternative transportation, such as bicycling and carpooling, can reduce the number of motor vehicles on the road, which in turn can decrease health and environmental impacts throughout the United States.

In the state of Massachusetts, motor vehicles are responsible for forty-two percent of carbon dioxide emissions, producing thirty-one metric tons of carbon dioxide. (*State-Level Energy Related Carbon Dioxide Emissions, 2000-2009*, 2010). In Worcester, Massachusetts, motor vehicles are responsible for 33 percent of greenhouse gas emissions, higher than the national average of 25 percent (Roberts et al., 2006). As shown in Figure 1, motor vehicles greatly contribute to levels of carbon monoxide, lead, and ammonia, among other pollutants. ("EPA State and County Emissions Summaries," 2008)

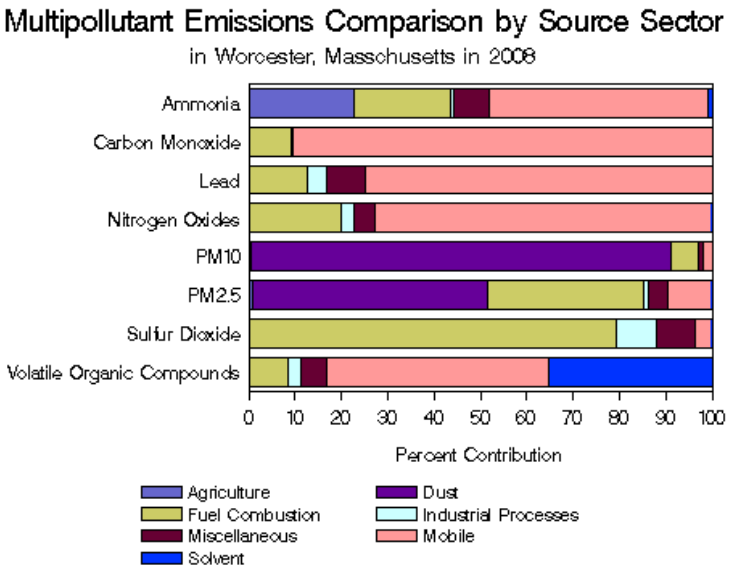


Figure 1: EPA measures of pollution causes in Worcester, MA in 2008

2.2 Notable Sustainable Transportation Efforts at Other Colleges

A number of universities across the United States promote alternative transportation to reduce the use of personal vehicles. The most common alternatives are carpools, bicycles, and public transportation.

2.2.1 Duke University

The efforts of Duke University to promote alternative transportation have produced beneficial effects. Results from a commuter survey conducted in 2013 show that 75 percent of Duke University employees drive alone to campus, down from 77 percent in 2012. Since beginning a carbon emissions baseline in 2007, Duke has reduced its carbon footprint by 16 percent, translating to roughly 53,200 metric tons of carbon dioxide. This is equivalent to the energy used by 2,738 homes or the emissions from 11,083 vehicles per year ("Transportation Sustainability Facts," 2013).

Bike Programs

In 2010, Duke hired its first Transportation Demand Manager and improved its GreenRide website with messaging and calendar functions, created an online map of bike racks, and began working on a GPS tracking system for its campus buses. The following year, Duke launched its DukeBike.com website, which lists information for commuters who bike to Duke and in Durham (Scurry, 2011).

At Duke University, faculty, staff and students who bike to campus do not have to purchase a parking permit and can register as a bicycling commuter. Parking permits range from $8.25 to $166.75 a month. Being a bicycle commuter means that one's primary transportation is by bicycle. Bicycle commuters receive up to 2 free daily parking passes per month for days that they choose to drive to the University. Additionally, all students can borrow bikes through the "Duke Bikes Program" ("Duke University Climate Action Plan," 2009). Bicycles are checked out for seven days at a time and loans can be updated up to three times. Any Duke student, faculty or staff member can also bring their own bike for free tune-ups or repairs during the academic school year.

The League of American Bicyclists has added Duke to a list of 35 colleges listed as a "Bicycle Friendly University." The program recognizes colleges that excel at encouraging and providing a bicycle-friendly campus for all of their students, employees and visitors. Duke's transportation demand management coordinator, Brian Williams, notes, "We've addressed safety on all our roads, adding bike lanes, wide shoulders to every street on campus. The Bicycle Friendly University award highlights the work of the Duke community to make riding a bike easy." Duke Community members account for nearly 700 full-time bike commuters, a number that doubled from 2011 to 2012 ("Duke University Climate Action Plan," 2009).

Carpooling and Vanpooling

In 2008, Duke University improved its carpool program for staff and faculty by offering new incentives such as free parking for groups of at least 4, and 24 individual daily parking passes for drivers who share a ride with at least one other person ("Transportation Sustainability Facts," 2013). In 2009, Duke launched GreenRide, a website where Duke Commuters can find carpooling partners. Duke also added "Ride and Airport Cab Share" to their website to allow members of the Duke Community to connect and set up cost-saving rideshares for one-time trips.

For staff, faculty, and graduates, three carpooling participants pay only $4.50 monthly per person while two participants pay half of the annual permit price. Depending on the parking lot location, this could be a huge saving. For example, a monthly fee at the "PGIII" lot costs $63.25 a month or $37 at the "Smith Warehouse" lot. For undergraduates, three participants pay a monthly fee of $44 per person while two participants or less each pay the normal rate. Again, the fee rate for students varies depending on the lot, and incentives are limited to five individuals in each case ("Transportation Sustainability Facts," 2013).

Duke Parking & Transportation Services works with Triangle Transit to establish a vanpool program. Duke provides free parking, Triangle Transit provides the van and pays for maintenance, gas, and insurance, and riders pay low monthly fees based on monthly round-trip mileage. The primary vanpool driver of 12 or more people does not pay the monthly fee. In order to start a new vanpool, riders must form a group of at least seven people who live and work close to each other and share nearly the same work hours. Duke's GreenRide website and the Triangle Transit helps find commuting partners. Duke University had 38 vanpoolers and nearly 800 carpoolers in 2012 ("Transportation Sustainability Facts," 2013).

Bus Services

Duke University offers the "GoPass," a free local and regional bus pass to all undergraduate, graduate, professional school students, and qualified Duke Staff and faculty. This has been in effect since Duke partnered with the Triangle Transit in August 2011. Triangle Transit is a regional bus service for the triangle region of North Carolina in the counties of Wake, Durham and Orange. To be qualified, employees must work on or within half a mile of East, West, Central, Medical Center campus, or the American Tobacco Campus (Scurry, 2011). During the 2012-2013 academic year, the parking and transportation services at Duke distributed about 8,500 GoPasses ("Transportation Sustainability Facts," 2013). In 2012, the Triangle Transit reported more than 150,000 boarding's' by Duke GoPass holders. The combined usage of buses and personal vehicles is expected to reduce single occupancy vehicle use by 1000 passengers. An official at Duke states, "We prefer that ultimately we get to a situation where people would turn in a [parking] permit for a GoPass. We want to motivate people to consider this as an alternative."("Transportation Sustainability Facts," 2013)

Based on data gathered from the bus programs of the University of North Carolina and North

Carolina State University, as well as national data, the estimate cost of the program for Duke University was between $125,000 and $150,000. ("Transportation Sustainability Facts," 2013) Duke mainly uses the income produced from parking permit fees to pay for these bus passes. In addition, John Tallmadge, Director of Commuter Resources at Triangle Transit, states that for financing, "Duke will only pay for the GoPass when it's used and at half price" (Scurry, 2011).

Additionally, the Bull City Connector is fare-free, hybrid-electric bus service that links Duke University to downtown Durham and medical facilities. The city of Durham provides services for the college attendees and Duke contributes toward operating costs of the services to Durham. (Scurry, 2011)

Summary

Duke University showcases what happens with a university when it decides to actively change people's behavior. With over than 30,000 employees, about 14,000 students, and tens of thousands visitors, Duke University produces a substantial demand for transportation. The use of public transit and alternative modes of transportation is a key in meeting the need of sustainable transportation ("Duke University Climate Action Plan," 2009). The university encourages those who commute to campus to explore alternative transportation options since vehicle usage increases everyday traffic jams, pollution, and demand for costly garage infrastructures.

Duke is setting goals to increase the suitability and motivation for commuters to use alternative modes of transportation so that they can achieve their goal of carbon neutrality. Carbon neutrality means having net zero carbon emissions by balancing a measured amount of carbon released with an equal amount repossessed. Duke's Carbon Neutrality goal is to have 21 percent reduction by 2015, 45 percent by 2020, and eventually 88 percent by 2050 ("Duke University Climate Action Plan," 2009).

WPI can learn from Duke's efforts to change the behaviors of even the most ardent drivers who say they cannot switch from a personal vehicle. Duke University targets commuters who cannot find an alternative to their personal car by advertising tips on how to save gas for those who still commute to campus alone ("Duke University Climate Action Plan," 2009). Even though personal vehicles are the least sustainable option, small savings in gas still add up to savings in sustainability.

2.2.2 UC Davis

Like Duke University, UC Davis has taken steps in recent years to reduce its carbon footprint by encouraging and promoting alternative transportation options, especially bicycling and carpooling. UC Davis effectively advertises alternative transportation available on its campus. Information is easily accessed under the UC Davis transportation methods section of their

website ("Alternative Transportation," 2013). Also, all relevant biking information is easily found on their Bike Barn website ("ASUCD Bike Barn," 2013).

UC Davis employs a unique parking pass system on its campus that aims to reward employees and students who utilize alternative transportation. Faculty and staff are charged higher rates compared to the students to discourage personal vehicle use. However, they have flexible buying options. For example, to encourage more bicycle use during the warmer months, UC Davis offers the option of only purchasing a winter parking pass for a significantly reduced price when compared to the annual pass cost ("Permit Types & Rates," 2013). This is true for both students and non-students.

The annual parking permit for commuter faculty and staff is $504. There are greatly discounted offers for choosing to carpool or join in a van commute program, so that drivers of private vehicles are almost penalized for using cars on campus. Putting such a high premium on a parking pass almost forces students and staff to consider the many alternative transportation options available at UC Davis.

Bike Programs

Through the Bike Barn at UC Davis, students and staff can purchase bicycles and take classes to learn about bicycle repair. In addition, the university offers bike rental programs through the Bike Barn for those not interested in owning a bicycle or keeping one on campus throughout the school year ("Bike Garage | ASUCD Bike Barn," 2013). In addition to these basic services, UC Davis also offers summer vacation secure storage of bicycles for only $20 ("Bicycle Program," 2013) for students who will return in the fall. The university goes a step further by reserving a locker room and showers solely for bike commuters.

Carpooling Programs

Like some other universities, UC Davis utilizes the car-sharing service Zipcar, where members can reserve a vehicle for a specified amount of time, and for a fee. Additionally, to incentivize carpooling, UC Davis has reserved premium parking spots for employees and students who choose to carpool. Depending on the number of people in a carpool, the cost of a non-student parking permit is $300-$432 cheaper than a parking permit for a single-user vehicle. This deep discount further incentivizes carpooling at UC Davis.

Summary

UC Davis has managed to create a culture of bicycling on campus to the point where bikes are the main mode of transportation. Additionally, the high parking pass fees and incentives for

carpooling greatly encourage carpooling. UC Davis' parking pass system is also exemplary. The high prices discourage personal vehicle use. The flexibility and incentives it offers (such as premium parking and reduced rates for carpoolers and winter-only parking passes) allows those who must use vehicles on campus at least some options to travel more sustainably. Lastly, UC Davis' operates a clear and easy-to-find alternative transportation website that explains all transportation options available on their campus.

2.2.3 University of New Hampshire

The University of New Hampshire (UNH) has nearly 15,000 students and 1,000 faculty, and is located in a suburban area just outside of Dover and Portsmouth, NH ("About UNH Facts," 2014; "WildCat Transit Bus Fees," 2013). UNH has made recent investments to promote sustainable transportation around its campus. In 2007, UNH invested $2.2 million in the reconstruction of Main Street-East and in 2010, $500,000 for reconstruction on Main Street-West. Both streets are part of the core campus. The reconstruction enhanced bicycle lanes and safety, improved transit, including bus pull-in/pullouts with lighted shelters, and improved pedestrian safety with expanded sidewalks and improved crosswalk lighting.

In 2008, UNH was responsible for the restoration of a $1 million intermodal rail station and expansion of its historic train station ("Transportation Management at UNH," 2014). The reconstruction of the station involved a full intercity bus system, indoor rail/bus transit passenger waiting areas, and a UNH Dairy Bar restaurant, which is a part of highlighting the historic 19th century train station in Durham, NH. The Amtrak station in Durham served over 55,000 passengers in the 2012-2013 academic year ("Transportation Management at UNH," 2014). UNH expanded an existing compressed natural gas station for low emission biodiesel transit and non-transit vehicles in 2011. Also, UNH created additional expansions of bike lanes, bus pullouts, and expanded sidewalks in 2013. Future plans for UNH include improving the bus transit system by adding routes and introducing the NextBus transit online bus tracker.

Campus Connector and WildCat Transit

UNH is large in area sized campus to get around, as result the school provides shuttle service called Campus Connector, which connects all members to get to different destinations around campus. Campus Connector is a free to all members of the Durham and UNH community, which does include residents of the town and visitors to the school. Additionally, the new Campus Connector shuttles run not on gasoline, but on compressed natural gas (CNG). WildCat Transit is an off-campus system, also free for all UNH members of the community ("WildCat Transit Bus Fees," 2013). WildCat Transit connects the UNH community with Campus Connecter shuttle system and other commercial bus services with the Dover and Durham Amtrak Downeaster train stations.

In 2008, the WildCat Transit won the Federal Transit Administration “Success in Enhancing Ridership Award,” being recognized for getting at least 5 percent more passengers per year over a two-year period ("Transportation Management at UNH," 2014). WildCat Transit is also noted for its passenger friendly bus shelters with solar lighting, regularly updated transit and parking information and biodiesel transit buses, which collectively have increased ridership by 21 percent ("Transportation Management at UNH," 2014). In 2008, all new transit vehicles were California Air Resources Board (CARB) certified B20 diesel or CNG fueled buses with bike racks. In the academic year 2012-2013, an estimated 1.2 million trips representing over 5 million private vehicle passenger miles were eliminated by mass transit ("Transportation Management at UNH," 2014).

Methods of Promoting Bicycling and Bicycling Programs

UNH is working closely with the town of Durham and NHDOT to expand the biking infrastructure in Durham. As improvements to the main streets across campus focused on bike lanes and shared lanes for bikes, UNH has been expanding bike parking on campus with new bike racks.

UNH currently has a bicycling program called Cat Cycles Program. The Cat Cycle program allows UNH community members to rent a bicycle for up to a week at a time for free. The bikes are equipped with a lock, fenders, and a cargo basket ("UNH Transportation Services," 2013).

Amtrak Downeaster Rail Service

Downeaster rail service, which began in the 1990s, runs 145 miles between Boston and Brunswick and is managed by New England Passenger Rail Authority. In fiscal year 2012, Amtrak Downeaster had serviced 540,000 passengers ("Amtrak Sets New Ridership Record," 2013). Downeaster offers five daily roundtrips serving the communities of Freeport, Brunswick, Portland, Old Orchard Beach, Saco/Biddeford, and Wells Maine; Dover, Durham (UNH), and Exeter in NH; Haverhill, Woburn, and Boston’s North Station in Massachusetts ("Amtrak Downeaster Home Webpage," 2013). The rates range from $6 to $29 depending on destination, and college students can receive 15 percent off with a student advantage card and many discounts exist for seniors, children, military personnel, and veterans ("Amtrak Downeaster Deals," 2013). The train station in Durham is on the premises of the UNH campus and UNH financed the reconstructed in 2007 to reopen the station. Onboard amenities include free wireless internet, the Downeaster Cafe, different class seats (such as Business and Coach), and limited spaces for bicycles with a service charge of $5.00 ("Amtrak Downeaster On-board Amenities," 2013).

Summary

As part of the Sustainability Institute on campus, UNH has a Transportation Demand Management (TDM) program, whose mission is to "reduce our use of single occupancy vehicle private vehicles" ("Transportation Management at UNH," 2014). UNH also has a Cat Cycle bicycling program, public transit discounts for all its members, and online publicizing of up-to-date information for all alternative means of transportation to community.

2.3 Alternative Transportation at WPI

The WPI community already has access to several modes of alternative transportation. The university is located near the center of Worcester, the second largest city of Massachusetts, which is home to an extensive bus system, the Worcester Regional Transit Authority (WRTA), and a train station, Union Station. Figure 2 shows the location of WPI relative to Union Station, and to WRTA bus routes (yellow lines).[1] The campus is less than a mile and a half from Union Station, and surrounded by WRTA bus routes.

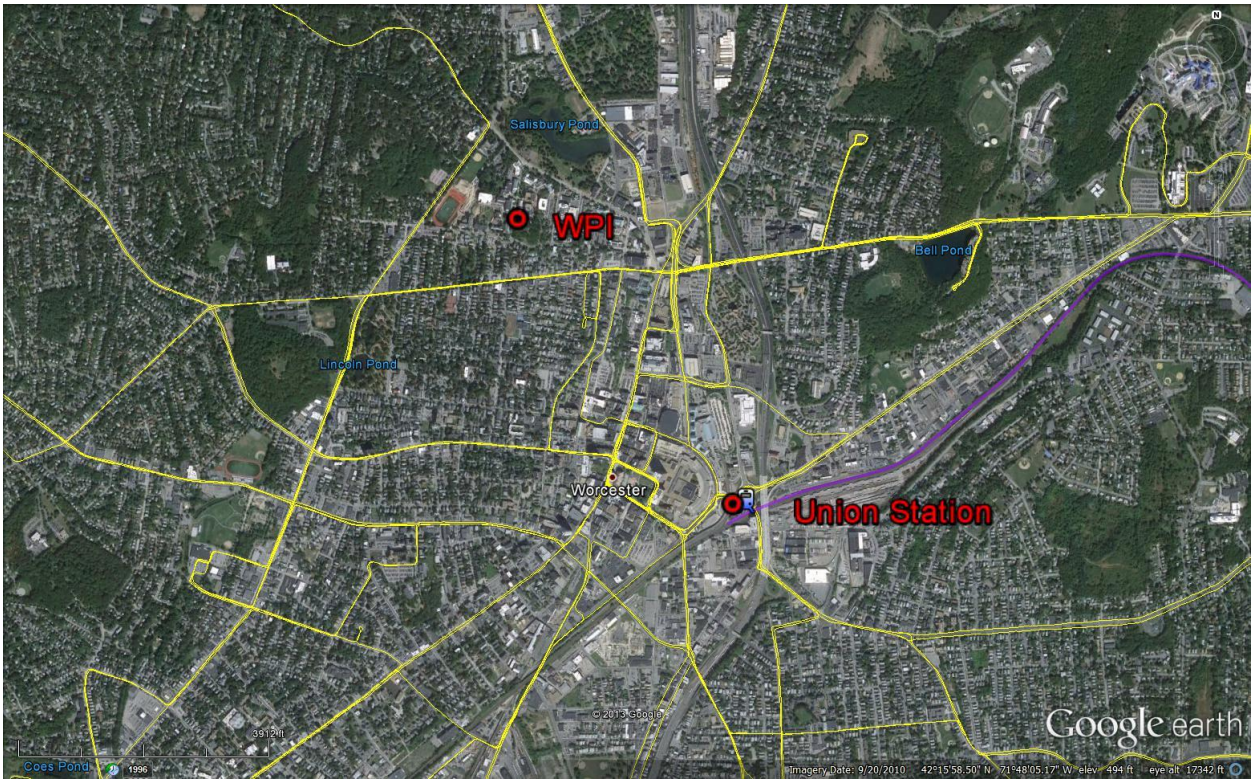


Figure 2: Alternative Transportation in Worcester

Additionally, WPI operates several of its own forms of alternative transportation. The following sections detail both WPI-owned alternative transportation, and Worcester's alternative transportation.

[1] WRTA bus route data as of August 22, 2012

2.3.1 WPI-Owned Alternative Transportation

The 2013 Campus Sustainability Report states that WPI community members already have access to several forms of alternative transportation, including the Security Night Assistance Patrol (SNAP), the Gateway Shuttle, and the WRTA. Here, we will cover each option mentioned in the report, and discuss whether the option is in fact both *alternative* and *more sustainable.* *Alternative* simply means a mode of transportation that is not a personal vehicle, while a *more sustainable* option could act as a complete replacement for a personal vehicle, rather than a supplement.

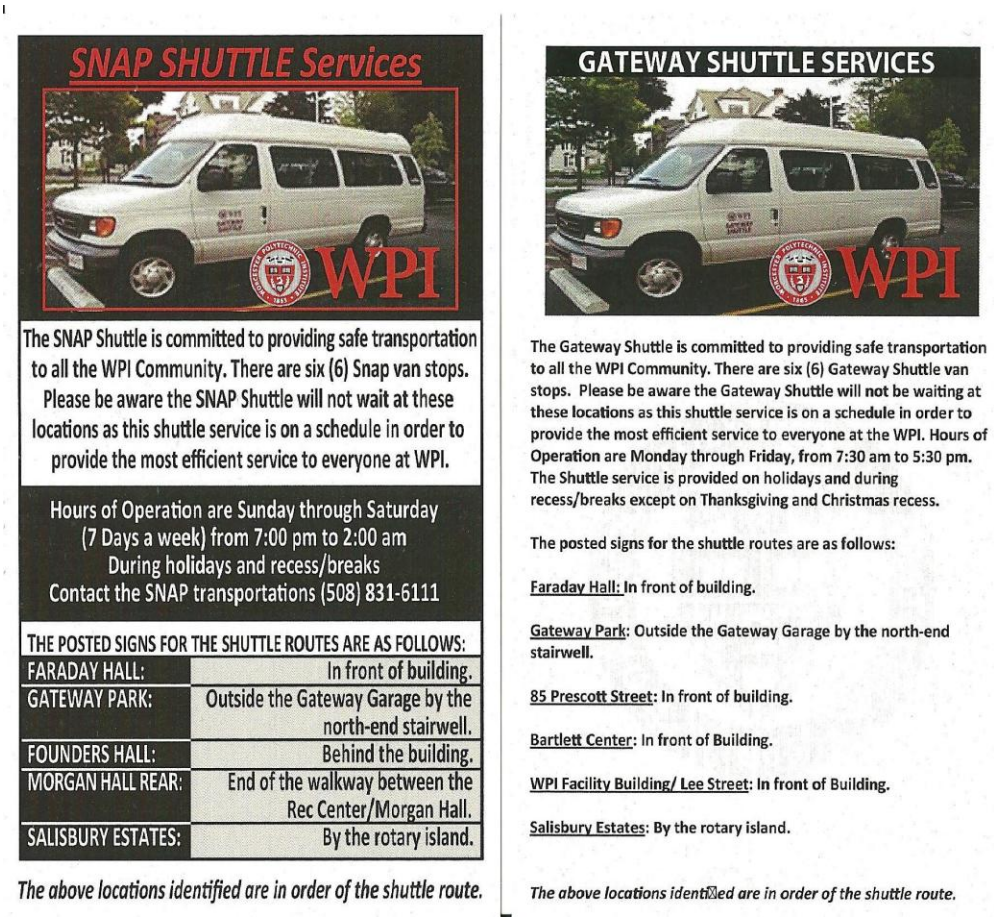
SNAP Vans

Both the 2012 and the 2013 Campus Sustainability Reports mention SNAP in their transportation slide ("2013 Campus Sustainability Report,"). Fundamentally, SNAP is a secure, safety-oriented shuttle/carpool service run in the evening and nighttime by the WPI Police. The service takes WPI community members to any location on campus or any residence within one mile of campus, as well as to Union Station, seven days a week. SNAP vans run from 6 PM to 4 AM in the fall and spring, and from 4 PM to 4 AM in late fall and winter. The website states that SNAP is used for residential destinations, and not for rides to "shopping centers, restaurants, bars, or any other commercial locations," with the exception of the grocery store Price Chopper on Park Avenue ("Campus Police: SNAP - Transportation Services - WPI," 2013).

Despite the heavy advertising for the service, there are a few necessary limitations to the SNAP service. First, SNAP was designed as a safe alternative to walking in less-than-ideal areas at night. The service is not meant to replace a personal vehicle and be a complete source of transportation. There is no service to commercial destinations, and a relatively small (one mile radius) area of coverage. Additionally, only two to three vans service the entire WPI community. The service does not run during the day, when many students are active. While SNAP is a good alternative to taking a walk alone to an off-campus apartment at night, the SNAP service is not a replacement for a personal vehicle, and therefore is not a standalone form of alternative transportation.

SNAP and Gateway Shuttles

The 2012 and 2013 Campus Sustainability Reports also mention the SNAP shuttle and Gateway shuttle. Both shuttles travel designated routes to popular areas of campus, including the Morgan residence hall, and the Gateway parking garage.



SNAP SHUTTLE Services

The SNAP Shuttle is committed to providing safe transportation to all the WPI Community. There are six (6) Snap van stops. Please be aware the SNAP Shuttle will not wait at these locations as this shuttle service is on a schedule in order to provide the most efficient service to everyone at WPI.

Hours of Operation are Sunday through Saturday
(7 Days a week) from 7:00 pm to 2:00 am
During holidays and recess/breaks
Contact the SNAP transportations (508) 831-6111

THE POSTED SIGNS FOR THE SHUTTLE ROUTES ARE AS FOLLOWS:

FARADAY HALL:	In front of building.
GATEWAY PARK:	Outside the Gateway Garage by the north-end stairwell.
FOUNDERS HALL:	Behind the building.
MORGAN HALL REAR:	End of the walkway between the Rec Center/Morgan Hall.
SALISBURY ESTATES:	By the rotary island.

The above locations identified are in order of the shuttle route.

GATEWAY SHUTTLE SERVICES

The Gateway Shuttle is committed to providing safe transportation to all the WPI Community. There are six (6) Gateway Shuttle van stops. Please be aware the Gateway Shuttle will not be waiting at these locations as this shuttle service is on a schedule in order to provide the most efficient service to everyone at the WPI. Hours of Operation are Monday through Friday, from 7:30 am to 5:30 pm. The Shuttle service is provided on holidays and during recess/breaks except on Thanksgiving and Christmas recess.

The posted signs for the shuttle routes are as follows:

Faraday Hall: In front of building.

Gateway Park: Outside the Gateway Garage by the north-end stairwell.

85 Prescott Street: In front of building.

Bartlett Center: In front of Building.

WPI Facility Building/ Lee Street: In front of Building.

Salisbury Estates: By the rotary island.

The above locations identified are in order of the shuttle route.

Figure 3: Handouts for SNAP shuttle and Gateway Shuttle (Note the two photos are the same)

However, like the SNAP shuttle, the Gateway Shuttle is not a standalone form of alternative transportation, and was not meant to be. As the 2013 Campus Sustainability Report reveals, the true purpose of the Gateway Shuttle is to "[provide] travel to and from Gateway and its parking garage"; in other words, to provide a shuttle to facilitate drivers of passenger vehicles, a highly unsustainable method of transportation ("Campus Sustainability Report," 2013). The Gateway shuttle is virtually identical to SNAP, having the same stops and operating in identical fashion. While the shuttles can replace private vehicle trips between Gateway and the main campus, neither can completely replace a commuter's personal vehicle, so neither qualifies as a true alternative.

Zipcar and Carpool World

Two more modes of alternative transportation mentioned on the Campus Sustainability Report are Zipcars and Carpool World. Zipcars are available to rent per hour or per day for Zipcar member, as an "environmentally friendly alternative to the costs and hassles of keeping a car on campus." ("Zipcar,") WPI drivers over the age of 18 can pay a fee to use the car sharing service, with three cars available to reserve twenty-four hours a day, seven days a week. Zipcars can be

rented per day or per hour, with daily and hourly rates. Gas and insurance are free, and maintenance is not required by the drivers.

According to the WPI website(s) on Zipcar, the service provides numerous benefits to the environment and riders. Each Zipcar replaces over fifteen privately-owned cars, while reducing individual car usage by “as much as fifty percent.” ("Zipcar") Financially, members save about $5,232 per year using the service “when compared to car ownership.” ("Transportation Strategies")

However, there are several disadvantages to using the service. Zipcars can be an expensive option for travelling short distances, with a price of $69 per day, or $7.50/$8.50 (depends on the car) per hour. For example, a trip to a store a few miles away would cost a minimum of $7.50 (to rent the car for an hour), whereas using a personal vehicle would only cost a fraction of a gallon of gas, which has hovered between $3 and $4 a gallon. Additionally, only three Zipcars serve the entire campus of over six thousand members, meaning that if a member does not reserve early enough, Zipcars will not be available for their timeframe. Also, due to prices and time availability, it is unreasonable to use a Zipcar when the driver’s timeframe is not exact, as other drivers are waiting for the car, and there is a hefty late fee.

Zipcars can be classified as sustainable, alternative transportation if they are used as an occasional replacement for a personal vehicle. Instead of having a personal vehicle, a driver simply rents one of the Zipcars, all of which are hybrids, and returns it for another user. However, if a Zipcar user has a personal vehicle that they use regularly, and simply uses Zipcar as an alternative while their car is being repaired (or for a similar reason), then the Zipcar is not functioning as sustainable, alternative transportation. It is not replacing the personal vehicle, rather, it is augmenting it. Additionally, a Zipcar is just as likely as any other car to be used by a single passenger.

Carpooling can also be classified as sustainable, alternative transportation, with the ability to completely replace several personal vehicles with a single, shared ride. Carpool World, a free carpool matching service, is available to the WPI community for this purpose. After signing up, riders enter their location and destination, and are shown matches to their trip. Phone and email addresses are then provided for the riders to get in touch with one another and set up the trip. This service comes with limitations, much like other carpooling services. Carpoolers are dependent on each other’s schedules, which may become a problem if someone has to alter their plans. Additionally, finding a carpool to an obscure or less-popular destination might be very difficult, especially if the carpooler is looking for a specific time. Carpooling is unlikely to be widely used without strong incentives, and the only incentive for carpooling currently at WPI is access to “premium parking spaces” in the Park Avenue parking garage specifically for carpoolers ("Sierra Magazine's 2011 "Coolest Schools"," 2011).

Park Avenue Parking Garage and Electric Charging Stations

The 2012 and 2013 Campus Sustainability Reports also highlight the newly-built Park Avenue parking garage for commuter students, faculty, staff and visitors, complete with 527 spaces. Commuter students are charged $100 annually, while faculty, staff, and visitors park for free. The recently-opened parking garage reduces car clutter around campus, "further enhancing walkability and green spaces." ("Carpool Worcester Polytechnic Institute Rideshare,") This garage also houses one of three new charging stations for electric vehicles. Data from the 2013 Campus Sustainability Report reveals that the electric charging stations have produced an impact, reducing greenhouse gas emissions, as shown in Figure 4.

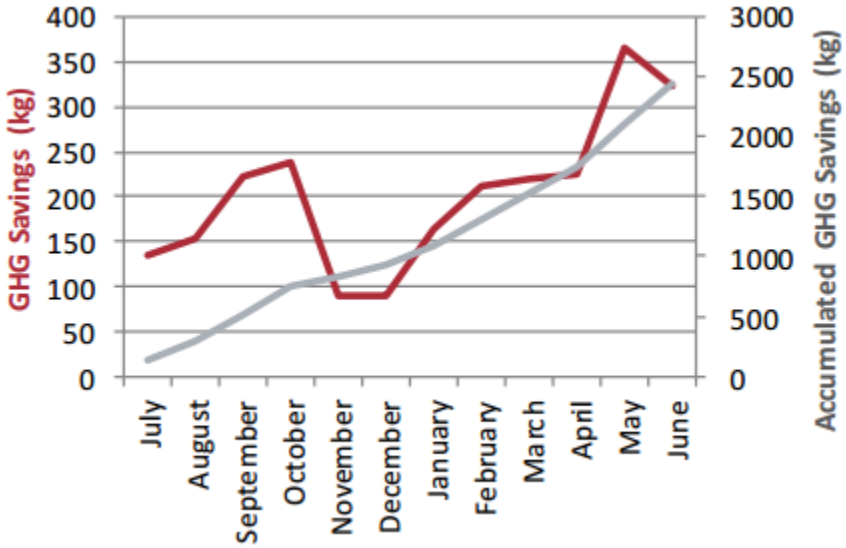


Figure 4: Greenhouse gas (GHG) savings as a result of the charging spaces (2012-2013) ("Campus Sustainability Report," 2013)

By adding significant parking capacity that 485 faculty and 425 staff can use at no cost, the garage arguably encourages unsustainable behavior. While the parking garage does eliminate a "campus parking crunch," it also provides the space for many more personal vehicles (Sutner, 2013). Therefore, through the lens of transportation, the Park Avenue parking garage does not qualify as a sustainable, alternative transportation option.

Walking Paths

Preliminary plans are underway to improve the existing walking path infrastructure around the WPI campus, shown in Figure 5.

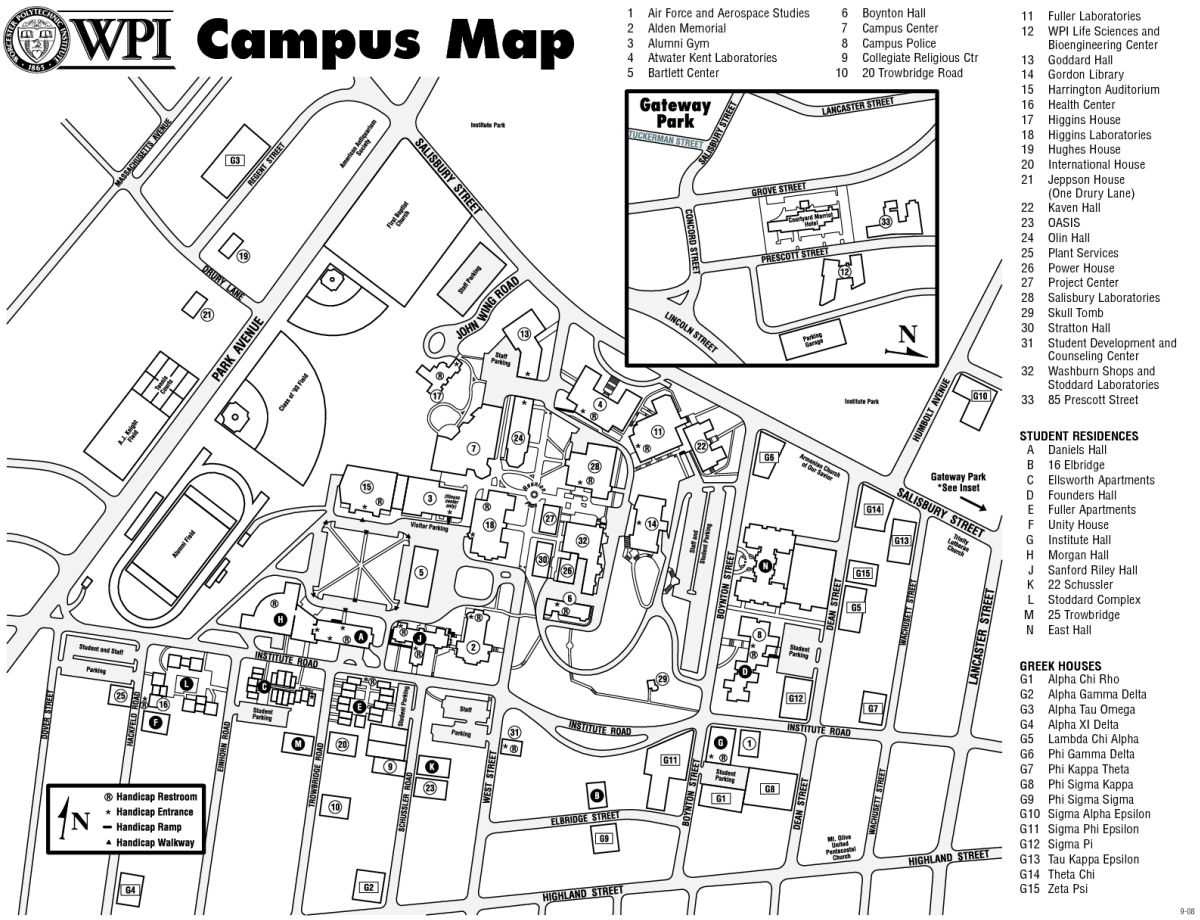


Figure 5: WPI Campus Map

The WPI Department of Facilities is currently working on amendments to the Campus Master Plan, created in 2004, which include expansions and additions of east-west walking paths. Figure 6 illustrates one of the new concepts, a revitalized south West Street, with wide sidewalks, seating, and plentiful lighting.

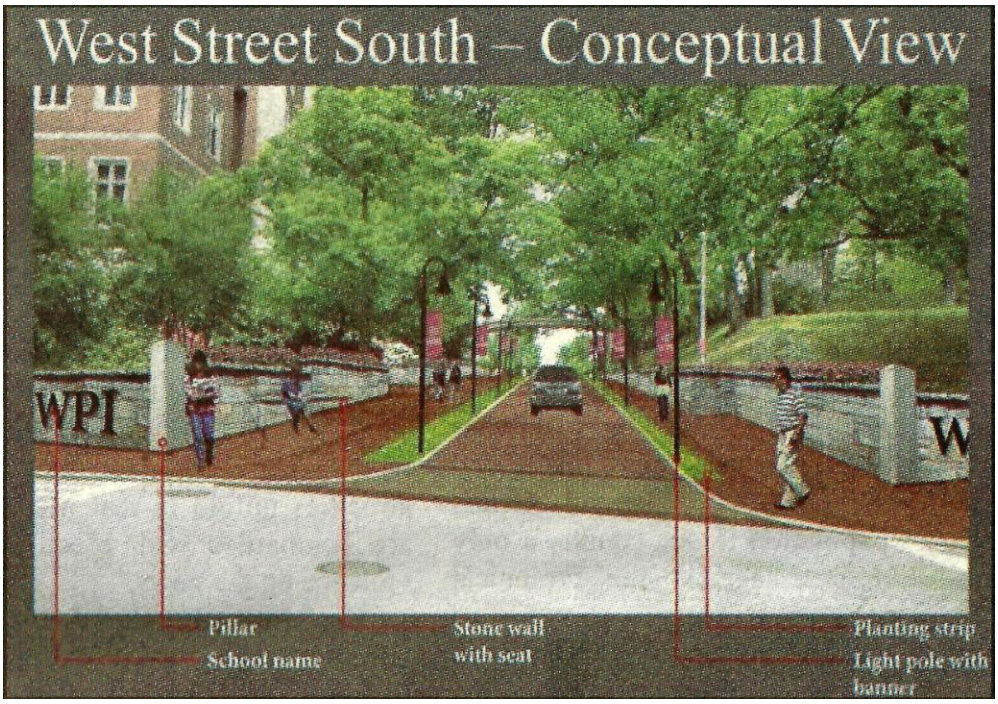


Figure 6: West Street South Concept (Handel, 2014)

Additional plans include an "east-west promenade" that would make a direct route from the Park Avenue garage to the library, also creating a straight "tunnel of vision" from the west end of campus to the east end (Handel, 2014). The east-west promenade and West Street would meet at the fountain, a popular crossroads in the heart of campus. These plans, if finalized, will revitalize the campus walking paths and make it easier to traverse the campus on foot from any direction. These changes may not directly impact transportation choices, but will make walking through campus more pleasant and safe for pedestrians who have to cross busy, congested streets.

2.3.2 Public Transportation in Worcester, Massachusetts

Buses and Commuter Rail

The Worcester Regional Transit Authority (WRTA) is the second largest regional transit authority in the state of Massachusetts. Forty-eight buses on twenty-eight fixed routes serve the entire city of Worcester and thirty-six of its surrounding communities. The buses, seven of which are "clean, diesel-electric hybrid buses," bring riders to restaurants, shopping centers, colleges, and more for a fee of $1.50 per one-way trip, or $3.50 for a one-day pass (Authority). This fare can be reduced by twenty cents if the patron pays with a CharlieCard. Additionally, the WRTA offers the College Semester UPASS, which allows college students with a valid college I.D. to ride the WRTA for an entire semester for $100.

The benefits of utilizing public bus systems are substantial. Since buses transport so many passengers at a time, the fuel to passenger ratio is low. Also, many bus systems are trying to "go green" by increasing the fuel efficiency and lowering the emissions of their buses. Worcester's own WRTA (Worcester Regional Transit Authority) bus system has begun to implement such changes. The WRTA includes clean diesel and hybrid diesel buses as part of its fleet, and recently replaced three diesel transit buses with the zero-emission all-electric transit buses. The change eliminates 53 tons of harmful emissions per year, and results in "significant reductions in petroleum fuel consumption (more than 23,000 gallons annually) and operating costs (nearly $500,000 per bus over 12 years)." ("WRTA awarded for "Green Fleet" bus procurement project," 2013) Busses also can reduce the number of passenger vehicles on the road. Every person who takes the bus is potentially eliminating one car from the road, which reduces congestion as well as emissions and pollution.

The WRTA operates four routes that service the WPI campus, detailed in Appendix B, and is eager to work with WPI to increase ridership by the WPI community. According to Stephen O'Neil, administrator of the WRTA, the most important factor for WRTA increasing its efforts is demand. If there is a demand, Mr. O'Neil states that the WRTA will go to "great ends to make things happen" (O'Neil, 2013). Other colleges, including Clark University and Quinsigamond Community College, use the service heavily, but as of now WPI does not have a significant presence on the WRTA.

The heart of the WRTA is the Union Station hub, where all of the twenty-eight bus routes originate. Union Station provides access to several mass transit options, including AMTRAK and the Framingham/Worcester commuter rail line, with stops including Grafton, Newton, Framingham, and ending in Boston's South Station (MBTA, 2013). From there, riders have access to the T (Boston's subway system), several commuter rail lines via the MBTA (Massachusetts Bay Transportation Authority), AMTRAK, and Logan International Airport. The Framingham/Worcester Line, shown in Figure 7, operates 19 inbound and 22 outbound trips daily and provides an alternative to driving a personal vehicle.

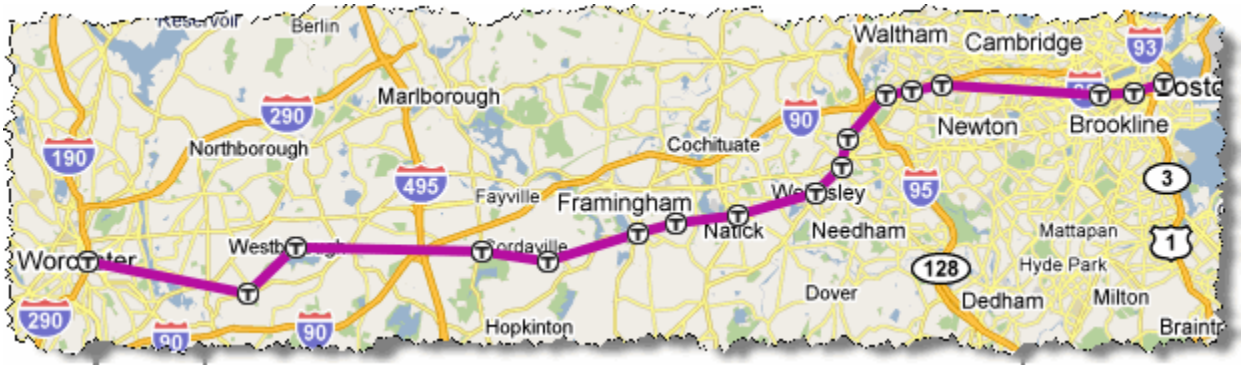


Figure 7: Map of Framingham/Worcester Line

In January 2014, the Massachusetts Bay Transportation Authority (MBTA) announced an expansion of the Framingham/Worcester commuter rail line: the inclusion of three more trains inbound to Boston, and four more outbound trains to Worcester on weekdays, mostly during rush hour times. On weekends, four more inbound and outbound trains were added.

Other Options

Taxi services are available in Worcester through privately-owned companies, and are not affiliated with WPI. The CityRide shuttle program (formerly known as the Woo Bus), takes full-time undergraduate students of WPI, Clark University, Assumption College, and College of the Holy Cross to a number of popular destinations around Worcester.[2] Including stops at the Blackstone Valley Mall, Target Plaza, and Union Station, the CityRide shuttle service is designed as "free and safe transportation" for students, and as an alternative to students filing into their separate cars and driving to those destinations (COWC). However, the shuttle service only runs on Friday and Saturday nights, so while the program provides a free and reliable service to many popular destinations, this service is not available for most of the week. Because only full-time undergraduates can ride the shuttles, moreover, graduate students, faculty, staff, and part-time undergraduates do not have access to the CityRide service.

2.3.3 Safety as an Obstacle to Alternative Transportation around WPI

Security is always a concern when considering alternative transportations such as biking and walking. In 2012, the *Worcester Telegram & Gazette* reported that the city of Worcester had the fifth highest violent crime rate in New England, with 958.7 violent crimes per 100,000 people in the year 2010. Out of those figures, twenty-nine were shootings and seven were homicides, while in 2011 twenty shootings took place (Sutner, 2012). While the situation in Worcester is not as dire as in other New England cities like New Haven and Springfield, these statistics are especially important to the colleges in Worcester. WPI in particular has an open-campus layout where it is possible to walk from the streets directly into the heart of the WPI campus without passing through any security or check-ins.

The WPI community is notified via email of criminal incidents on or near campus, as well as incidents concerning WPI students in off-campus housing. These incidents include assault, robbery, theft, and attempted break-ins, among others. After an incident occurs, students, faculty and staff are sent an email safety notification stating the type of crime, as well as the date and time the crime occurred. The email then links to the central WPI Campus Safety Notifications website, which provides a more detailed account of the incident, including a brief description of

[2] Information on the CityRide shuttle program is difficult to find at this time, due to the restructuring of the program and the dissolution of the COWC. Currently, all webpages on the service state "COWC is being reorganized."

the crime and suspects, current status of investigation, contact information, and specific preparation advice relevant to that crime ("WPI Campus Safety Notifications," 2013). This information is available on the website for every crime that meets criteria[3] that has occurred from September 3, 2008 until the present, and is regularly updated (WPI Police, 2013). We describe an application of these data in the methodology section's "Crime Map."

Additionally, the WPI Police publishes an Annual Security and Fire Safety Report, which includes the latest information about the measures campus police are taking to handle crimes, and the nature of the crimes committed the previous year. Table 2, highlighting specific crimes, was adapted from these data (Police, 2013):

Table 1: Highlighting Specific Crimes

Type of Crime	2010 Report	2011 Report	2012 Report	Average Report
Robbery	5	2	4	3.7
Aggravated Assault	2	4	0	2
Burglary	11	5	7	7.7
Motor Vehicle Theft	2	3	0	1.7

Note that these statistics include crime that takes place on campus, non-campus (property owned by WPI that is not part of the main campus), and on public property (area within the "same reasonably contiguous geographic area of the university") (Police, 2013).

These forty-five instances in three years do not show all of the crime data committed, but rather some of the more violent forms of crime. Areas of elevated crime, particularly aggravated assault and robbery, are especially important when discussing the location and placement of biking and walking paths, and also for potential locations for bus stops.

[3] WPI Campus Police have certain criteria, but we have been unable to obtain this information from them

CHAPTER 3: METHODOLOGY

The goal of this IQP is to encourage and promote sustainable, alternative transportation by the WPI community, which in turn helps the WPI community as a whole become more environmentally and financially responsible, and thus, more sustainable. In order to achieve this goal, the team developed these research objectives:

1. Research the current methods of alternative transportation already existing around WPI and the Worcester community.
2. Research what other comparable colleges and cities have done to encourage and promote alternative transportation.
3. Understand how WPI community members travel to and around campus.
4. Produce a list of recommendations to the WPI Department of Facilities and any other relevant groups to promote and encourage sustainable, alternative transportation.

This chapter describes how we carried out these research objectives, and how we used the information we gathered to produce a list of recommendations to promote and encourage sustainable, alternative transportation.

3.1 Research the current methods of alternative transportation already existing around WPI and the Worcester community.

Before delving into what can physically be improved to encourage and promote alternative transportation (such as shuttles, bike paths, more Zipcars), we researched what alternative transportation already exists at WPI and in Worcester, and its effectiveness. This provided a starting point, as some modes of alternative transportation already exist and are utilized. For example, the Worcester Regional Transit Authority (WRTA) bus system serves the city of Worcester and its surrounding communities, and the MBTA commuter rail includes the Framingham/Worcester Line, beginning in Worcester's own Union Station and ending in Boston (see Section 2.3.1 for full information regarding the WRTA). Both of these alternative transportation services are used by WPI community members. Knowing what alternative transportation already exists allowed us to see what WPI community members use as alternative transportation, and how accessible and practical that transportation is currently.

The alternative transportation options available to WPI that we examined included the Security Night Assistance Patrol (SNAP) van service, the SNAP and Gateway Shuttles, Zipcar, Carpool World, and the WRTA. For each of these, we sought to learn:

- Whether these modes of alternative transportation were sustainable
- The associated monetary cost of using these modes of alternative transportation, if

applicable
- How each of the these modes of transportation are used (i.e. as a replacement for a personal vehicle, or as a supplement to one)

We also looked into taxi services and consortium shuttles, but (as discussed in sections 2.3.1 and 2.3.2) we concluded that these are either unsustainable or not practical alternatives to cars, and we didn't pursue them. We drew information from some of our personal experiences with some of the alternative transportation options, such as SNAP and Zipcar, and supplemented this with available handouts and webpages for each mode. We also compared sometimes conflicting and contradictory information regarding times and stops, and analyzed how well advertised and clear the information about each mode is for WPI community members looking for a way to get around without using a personal vehicle.

We conducted specific research on the WRTA bus system's viability as a replacement for a personal vehicle, since its service range includes WPI, several neighboring colleges, popular shopping and entertainment centers, and Union Station, Worcester's transportation hub that serves the MBTA and Amtrak. We also interviewed the administrator for the WRTA, Stephen O'Neil, for more information regarding the bus system's willingness to offer more reduced rates to college students, more routes that service WPI, and general information regarding current changes to the system. After we had conducted a survey of WPI community members' transportation habits and interests, we presented WRTA-specific findings to Mr. O'Neil in the form of evidence-based recommendations. We also hoped to learn what the experience of taking the WRTA is like for WPI students, and whether problems with the WRTA were hindering the use of the service by WPI community members. Each member of the team took at least one trip on a WRTA bus, reporting on ease of use, service, and areas for improvement. Destinations included Union Station, Lincoln Plaza, and the main WPI campus. We then qualitatively documented our experiences with the WRTA, addressing what worked well and what areas we deemed needed improvement, such as lateness. These experiences can be found in Appendix D.

Also, because walking and biking are two important alternatives to private vehicles, we researched the safety of the campus and its surroundings for cyclists and pedestrians. Specifically, we sought to answer the following questions:

- Where are the safest places to walk and bike around campus?
- How safe is the area around campus for bicycling and walking? Is it reasonable to suggest promoting walking and bicycling)?

With Worcester ranked the 5th highest city for violent crime in Massachusetts, a study of the safety near WPI could help shape possible recommendations to support walking and biking. We obtained safety information through the "Safety Notification" website, and mapped it using

Google Earth. We developed a "Safety Map" showing areas of high crime near the WPI campus, along with areas that are safer, with less reported crime (See Appendix A).

Besides understanding alternative transportation options for the WPI community, we also researched where WPI community members live, as this shapes their transportation habits. We sought information from the offices of the Provost, Student Life, and Human Resources regarding faculty addresses, student addresses, and staff addresses, respectively. Each source provided us with a list of zip codes and the numbers of students, faculty, and staff residing in each zip code. We mapped these data using Google Fusion Tables, creating a "Commuter Students Map," "Faculty Map," and "Staff Map," which show where each population lives, color coded by population density. By overlaying the WRTA bus routes and MBTA commuter rail routes directly onto the maps, we were able to see where WPI commuters originate and how many commuters live near public transportation. The "Commuter Students Map," "Faculty Map," and "Staff Map" can all be found in Appendix C.

We also listed the current transportation options for the WPI community and identified them as *more sustainable* or *less sustainable*. A more sustainable transportation option is one that is practical, environmentally-friendly and a non-cost-prohibitive replacement for a personal vehicle. For example, while Zipcar is a car-sharing program that might offset the use of a personal vehicle for a few trips, it is an expensive and impractical substitute for a personal vehicle. Therefore, it is not a true alternative to a car; nor is it as sustainable as taking the WRTA to campus.

The team did encounter several problems during this leg of our project. We contacted the WPI Police numerous times for more information about the criteria for "Safety Notifications" and for maps illustrating the locations of crime around the WPI campus while we were researching biking and walking paths, but we obtained no new information. Also, we experienced difficulty when researching the schedules for SNAP and the SNAP/Gateway Shuttles due to websites stating conflicting information, and brochures stating information that contradicted the websites. These discrepancies made it initially difficult to research SNAP and the shuttles, but were in themselves an important finding.

3.2 Research what other comparable colleges and cities have done to encourage and promote alternative transportation.

Besides focusing inward on the current modes of alternative transportation available to WPI community members, we also researched alternative transportation available to community members of different colleges and cities. More specifically, we searched for colleges and cities with successful, model alternative transportation programs that we could use as a resource for our recommendations. In general, we were looking for what alternative transportation programs

at each colleges were the most used and what made these programs successful through the following criteria:

- What kinds of incentives did other colleges provide for using alternative transportation?
- Which forms of alternative transportation resulted in the reduction of personal vehicle use?
- How much were certain forms of alternative transportation (such as buses or shuttle services) used in relation to each other?

Through our research, we determined what alternative transportation programs and actions were the most beneficial to the university's sustainability. We regarded the most effective programs to be those that took the most cars off the road and were most utilized by students, faculty and staff; these successes shaped what we focused on when looking at WPI's alternative transportation.

We narrowed our search to colleges that either were similar in size and/or location to WPI, such as Clark University, or had well-utilized alternative transportation programs that could effectively replace personal vehicles, including Duke University, UC Davis, and the University of New Hampshire. We obtained information for the above criteria through online reports and email exchanges with representatives from the colleges for more detailed information, including how successful their alternative transportation programs were. Some universities, such as Duke, provided substantial information on their alternative transportation programs on the internet, so no further research was required. Others, such as UC Davis, provided much more data on alternative transportation usage when the team contacted their representatives.

The team did encounter one common problem while researching other colleges with notable transportation, in that some universities simply did not provide many details about their transportation programs on their websites, and did not respond to queries; such was the case with Clark University.

3.3 Understand how WPI community members travel to and around campus.

Recommendations are useful only if the community will be responsive to them. Therefore, the team surveyed the entire WPI community to determine the community's current transportation habits, and to which options and methods for improving alternative transportation they would be most responsive. We focused on finding how the WPI community travels, what alternative transportation options they use, to what extent they use them, and what alternative transportation options drivers indicated would change how they travel.

We sent a brief online survey to the entire WPI community in order to address the following questions:

- What transportation modes do WPI community members use to commute as a function of distance from campus?
- Which modes of alternative transportation did commuter students, faculty and staff who drive personal vehicles say would change how they travel?
- Which modes of alternative transportation did students, faculty and staff who live on or near campus and drive personal vehicles say would change how they travel?
- What percentage of commuter students, faculty and staff currently use alternative transportation, and what modes are most used?
- How many trips could be saved if commuters used alternative transportation more frequently?
- What are some opinions and comments from the WPI community about alternative transportation?
- Which existing modes of transportation did WPI community members say need to be improved the most?

The complete survey and responses can be found in Appendix E. Past research done on alternative transportation at WPI has focused mainly on students. Our team chose to survey the entire community because while 25 percent of students commute by personal vehicle, 95 percent of faculty and staff commute by personal vehicle. Therefore, faculty and staff, while a smaller population than students, are disproportionately responsible for personal vehicle use. We designed the survey and marketed it for all WPI community members from the beginning.

The questions themselves were designed to be easy to understand and answer. We had consulted previous IQP surveys to see how those surveys were set up, and what respondents had to say about the survey design. These lessons helped shape the survey and ensure we did not repeat the same mistakes that others had in the past, such as confusing questions, and questions where respondents felt like no response option fit their opinion.

We tested the survey by timing friends and roommates as they took the survey, aiming for a two to four minute duration. Additionally, we asked for the testers' opinions on the survey, including questions they thought were confusing or unclear. Overall, these tests did not result in any significant changes, as nearly all feedback we received was positive and the survey durations were always within two to four minutes. We changed only subtle word choices in certain questions to make them more explicit.

The final survey design included a total of eight questions, keeping the survey concise and quick to fill out. Most of the questions were closed-ended multiple-choice questions to keep responses organized, logical, and in a format suitable for easier analysis. A few questions were optional open-response type questions asking respondents to share their thoughts regarding WPI's current transportation options, or about alternative transportation options. These questions were added to

give us actual quotes from the community, information about specific members' experiences with transportation, and opinions and options we had previously not considered. As the main incentive, we offered a $50 Dunkin' Donuts gift card to be given to a random respondent to further motivate potential respondents, as well as to check that repeat survey takers were at a minimum. We decided to use the online Qualtrics platform for our survey to ensure that all responses would be uniform, accounted for, and to make our progress easy to view as we advertised the survey. One possible drawback to this method is that a respondent can take the survey multiple times, and this is discussed later in Section 3.3.1.

The survey was approved by the WPI Institutional Review Board (IRB), and distributed using the Qualtrics survey platform from November 13, 2013 until December 2, 2013. A total of eight questions were asked, keeping the survey concise and quick to fill out. We sought to advertise and distribute the survey to as many people as possible, including posting tear-off flyers, handing out business cards, table-sitting at the Campus Center, reaching out to various groups and organizations to help promote the survey, and placing ads on the WPI TV network and in the school newspaper.

The survey was advertised multiple times to all faculty and staff through email messages with help from our sponsor, Facilities Systems Manager Liz Tomaszewski. These messages resulted in a large number of faculty and staff responses, as detailed in the following section. Unfortunately, since recent changes to WPI policy now prevent students from sending email to the entire undergraduate body, we were not able to send the survey directly to the undergraduate email alias, and thus we had to find other ways get the survey to students. We advertised and promoted the survey by posting general flyers and tear-off flyers on bulletin boards in all main campus buildings. In addition, we rented a table at the Rubin Campus Center twice, handing out cards to passersby, and had two laptops set up for students, faculty or staff to take the survey right there.

We also recruited the help of WPI organizations and clubs to help spread the survey to the widest audience possible. This included contacting the Student Government Association (SGA), class boards, Academic Advising, the presidents of all fraternities and sororities at WPI, and the presidents of club sports and science/technology clubs. We also had the two largest departments at WPI, the Mechanical Engineering (ME) and Biomedical Engineering (BME) departments, send out the survey to all ME, Aerospace Engineering (AE) students, and all BME students. Additionally, advertisements were placed on the WPI TV network and in *The Towers*, the school newspaper. However, despite these advertising efforts, students as a whole responded in a smaller percentage than faculty and staff, most likely because advertising efforts only reach to those that see them, whereas listservs (such as the emails to faculty and staff from Ms. Tomaszewski) present the survey to the entire population

As is true when collecting any data from a population, there were some flaws in the survey. We were not able to stop multiple responses from some survey takers. However, we took a general look through the respondents who provided an email address for a chance to win the $50 gift card to look for duplicates, and found very few. This method is still incomplete, as a respondent could have used multiple email address, entered a phony address, or taken the survey multiple times without entering an email address. We could not come up with a way to address these concerns, but deemed these issues generally unlikely because we did not find significant duplicates in the visible email addresses. There was also a more specific flaw in the survey questions. One question that asks if higher parking fees and fines would change how a respondent travels can mislead respondents into thinking that they're saying they support parking fines and fees being higher if they select that higher parking fines and fees would change how they travel.

After the survey was completed, we performed an in-depth analysis of the demographics and response rates. A survey with a high response rate and a population distribution similar to the actual population distribution is much more likely to accurately represent the views and data for the WPI community. This analysis is provided in the following subsection.

3.3.1 Demographics of the Survey

A majority of our findings come from the survey issued to all students, faculty and staff. As the table below demonstrates, our survey response rates, divided by population, range from 7.1 percent to 50.6 percent.

Population	Count	Percent of Survey Takers	Percent of Population
Freshman	120	12%	11.5%
Sophomore	119	12%	13.0%
Junior	145	15%	16.7%
Senior	125	13%	11.8%
Total Undergrads	509	52%	12.9%
Graduate Students	138	14%	7.1%
Total Students	647	66%	10.9%
Staff Member	215	22%	50.6%
Faculty Member	105	11%	21.6%

TOTAL:	967	99%	14.1%

Table 2: Final Survey Distribution

The highest population response rates came from WPI employees, and particularly staff, with over 50 percent of staff responding to the survey. Student response rates, meanwhile, accounted for just under 13 percent of the undergraduate population and 7 percent of the graduate student population. One potential explanation for the differing response rates for students and employees is that these groups were solicited in fundamentally different ways, as outlined in the previous section.

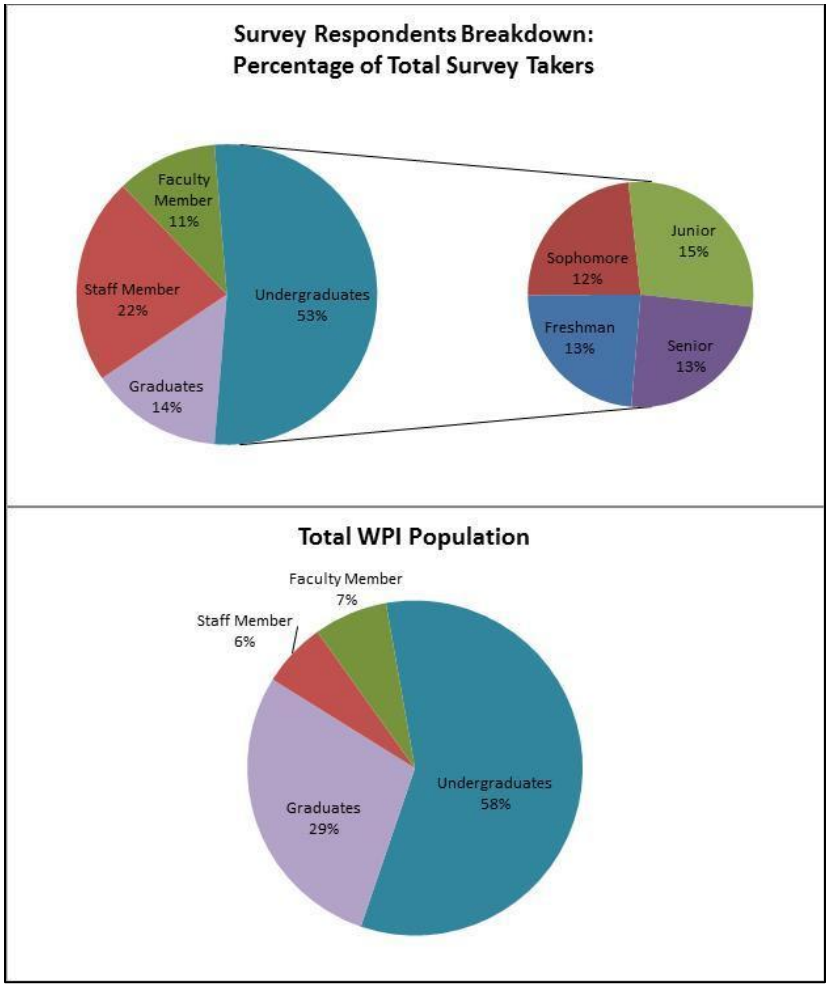


Figure 8: Survey Respondents Breakdown vs Actual Population Breakdown

Figure 8 shows the similarities between the breakdown of survey takers and the actual breakdown of the WPI community. Note that the percentage of student respondents is very close to the percentage of students in the total WPI population, meaning that students have nearly the same representation in the survey results as they have in the actual WPI population. Faculty also

have a similar representation, accounting for 11 percent of survey responses and 7 percent of WPI's population.

While the graduate student representation in survey differs significantly from the actual graduate population, over 66 percent of graduate students are only part-time (Campus Sustainability Report, 2013). Part-time students may rarely come to campus, and most likely do not have as significant an impact on WPI's transportation usage as full-time students. While this mitigates some of the gap in the survey data, as these are students that are not commuting as frequently as full-time community members, this discrepancy may cause the graduate student population to be underrepresented and certain findings to be exaggerated, due to a small representation in the survey results. Lastly, while staff are more heavily represented in the survey than their actual population, the high response rate for staff (51 percent) suggests that the study will have highly accurate results for staff.

3.3.2 Survey Analysis

As discussed previously, we wanted to gather the following information from our survey:

1. What transportation modes do WPI community members use to commute as a function of distance from campus?
2. Which modes of alternative transportation did commuter students, faculty and staff who drive personal vehicles say would change how they travel?
3. Which modes of alternative transportation did students, faculty and staff who live on or near-campus and drive personal vehicles say would change how they travel?
4. What percentage of commuter students, faculty and staff currently use alternative transportation, and what modes are most used?
5. How many trips could be saved if commuters used alternative transportation more frequently?
6. What are some opinions and comments from the WPI community about alternative transportation?
7. Which existing modes of transportation did WPI community members say need to be improved the most?

In order to find this information, we created a Microsoft Excel spreadsheet that would allow us to filter survey data by population (Points 2-7), distance (Points 1-2), commuting habits (Points 2-4), and preferences for alternative transportation (Points 6-7). We organized all of the survey data into a format that allowed us to break down the data based on responses to each question using the "Countif" and "Countifs" commands. For example, the first question asked respondents what population they belong to (freshman, graduate student, faculty member, etc.). We could then filter all other responses based on what respondents chose for that first question, i.e, we could filter by only freshman responses, or only faculty responses, etc. We then could further

break down the data by multiple questions, i.e., filtering by faculty members who answered that they commute using a personal vehicle in the second question.

General data for the entire community, which we used to find the survey demographics in section 4.2 as well as the general transportation habits of the WPI community, we analyzed and graphed in a standard Excel spreadsheet. We created another Excel spreadsheet that broke down all of the survey data into a form where the Countif and Countifs functions could be utilized to filter the survey data by each question. We used this spreadsheet to find data for on-campus personal vehicle users and off-campus personal vehicle commuters, which we then documented in a third Excel Spreadsheet. This third Excel Spreadsheet displayed what modes of alternative transportation would possibly or definitely change the habits of all personal vehicle users organized by on/off campus status, commuting distance from campus, and population. These numbers we then turned into percentages by dividing the number of people who said a particular mode of transportation would change how they travel by the total number of people in that criteria.

As an example, using this spreadsheet, we could calculate the percentage of off-campus faculty members who live in the surrounding communities of Worcester and drive to campus more than three times per week, who said that a more frequent or convenient commuter rail would definitely change how they travel. This method proved time consuming, as this six-way filtering had to be done for each mode of alternative transportation, for each population, at every distance from campus (including on-campus), and for "possibly" changing how a respondent travels or "definitely" changing how a respondent travels. However, this analysis allowed for a complete breakdown of the survey data for personal vehicle users, addressing Points 2-5.

Lastly, we focused on the open-response comments from the survey respondents to address Points 6-7. Respondents had much to say about certain modes of alternative transportation, such as the WRTA or the SNAP van service, and these quotes were used to reinforce or illustrate numbers from the survey data breakdowns.

3.4 Produce a list of recommendations to the WPI Department of Facilities and any other relevant groups to promote and encourage sustainable, alternative transportation.

The purpose of this IQP is to promote and encourage sustainable, alternative transportation by the WPI community. A list of recommendations, based on our findings, gives the WPI Department of Facilities and other target organizations including the WRTA information and recommendations to turn into actions and results. The WPI Department of Facilities and the WRTA have the resources to turn our ideas and recommendations into actions, which we believe will greatly increase and encourage sustainable, alternative transportation.

The team reviewed the findings from the survey, interviews with WRTA Administrator Stephen O'Neil and Facility Systems Manager Liz Tomaszewski, the Commuter Student, Faculty, Staff Maps, and research on model colleges and cities with alternative transportation programs. We also presented our findings to Mr. O Neil and Ms. Tomaszewski in follow-up meetings, tailoring the data to fit what was most relevant to each person (i.e. data on WRTA usage for Mr. O'Neil.) Mr. O'Neil indicated the kinds of changes the WRTA was willing to consider, and Ms. Tomaszewski suggested the changes the WPI Department of Facilities was willing to consider, shaping our recommendations. Case studies from other universities provided additional evidence for the viability of alternative transportation programs. From this information, we produced a series of recommendations aimed at improving and promoting alternative transportation by the WPI community, with a focus on getting personal vehicle users out of their cars. These recommendations are documented in Chapter (5), and were presented to Executive Vice President/CFO Jeffrey S. Solomon, Ms. Tomaszewski, Professor Suzanne LePage, WPI Chief of Police Cheryl Martunas, Associate Dean of Students Gregory Snoddy, and WPI's Sustainability Task Force at the conclusion of the project.

4. FINDINGS

This chapter is divided into four main sections. The first section outlines where the WPI community is travelling from, including maps and an analysis of what alternative transportation options are the most relevant for community members who vary by location. This information is often referenced in later sections. The second section provides a general overview of the WPI community's transportation habits, providing a background on how the community utilizes alternative transportation, the number of personal vehicles coming to campus, and general dispositions towards alternative transportation. The third and fourth sections run parallel to each other, describing the willingness of on-campus personal vehicle users (section three) and off-campus personal vehicle commuters (section four) to utilize alternative transportation options.

4.1 Where the WPI Community is Travelling From

In order to understand where the WPI community is travelling from, we created three maps using zip code data gathered from various WPI offices. Color-coded from cool to warm colors in order of increasing population, the maps illustrate where the WPI community lives and therefore commutes from. Excerpts of these maps appear in this chapter, but the full versions are interactive, clickable online maps that allow a user to select any zip code and view how many WPI commuter students, faculty or staff live in that zip code. With these three maps, it is possible to study the feasibility of different alternative transportation by location.

Commuter Students

Figure 9 shows where the 1,089 commuter students live based on their zip code. For our purposes, a "commuter student" is an undergraduate or graduate student that does not live on campus, and does not participate in distance learning. As can be seen, commuter students generally have a wide spread over the eastern half of Massachusetts. However, the highest concentration is within Worcester and its surrounding communities, decreasing radially outward from this area.

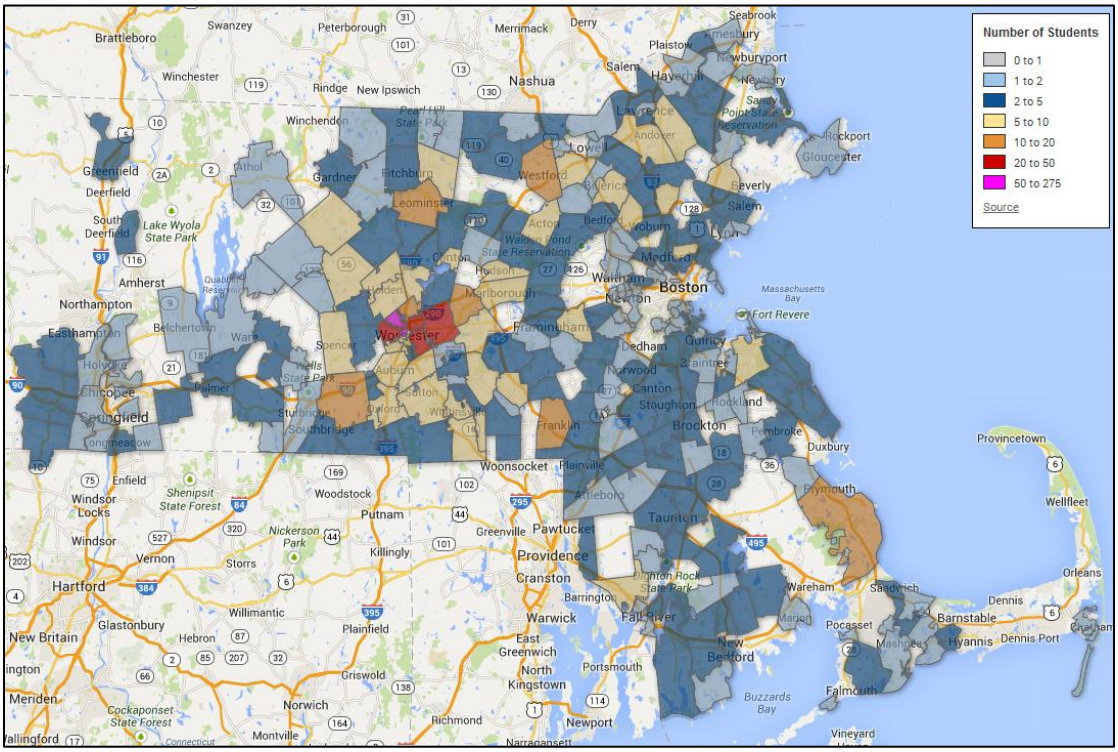


Figure 9: Screenshot of Commuter Students Map (Zip code count data courtesy of the WPI Office of the Bursar)

Because of this concentration, the Worcester Regional Transit Authority (WRTA) bus system appears as a possible method of transportation for a large number of commuter students, due it its service area covering much of the darker red and purple (higher concentration) zip codes. Additionally, carpooling is an option, as there are multiple zip codes with double-digit amounts of commuter students. However, location is not the only factor to consider, and the use of alternative transportation by commuter students is discussed in greater detail later in the chapter.

It should be noted that commuter students living outside of Massachusetts are not included in this map, and we have no information about this population. We suspect that the few commuter students at extreme ends of the state, such as Cape Cod, that approach a two hour driving distance are part-time students whose WPI-related travel habits have less impact on WPI's sustainability than full-time students.

Faculty

Faculty has a far more concentrated population distribution than commuter students. While the heaviest concentrations are still in Worcester and its surrounding communities, the remaining faculty members are mostly found in a wide corridor between Worcester and Boston, as can be seen in Figure 10, which shows the geographic distribution, by zip code, WPI faculty members.

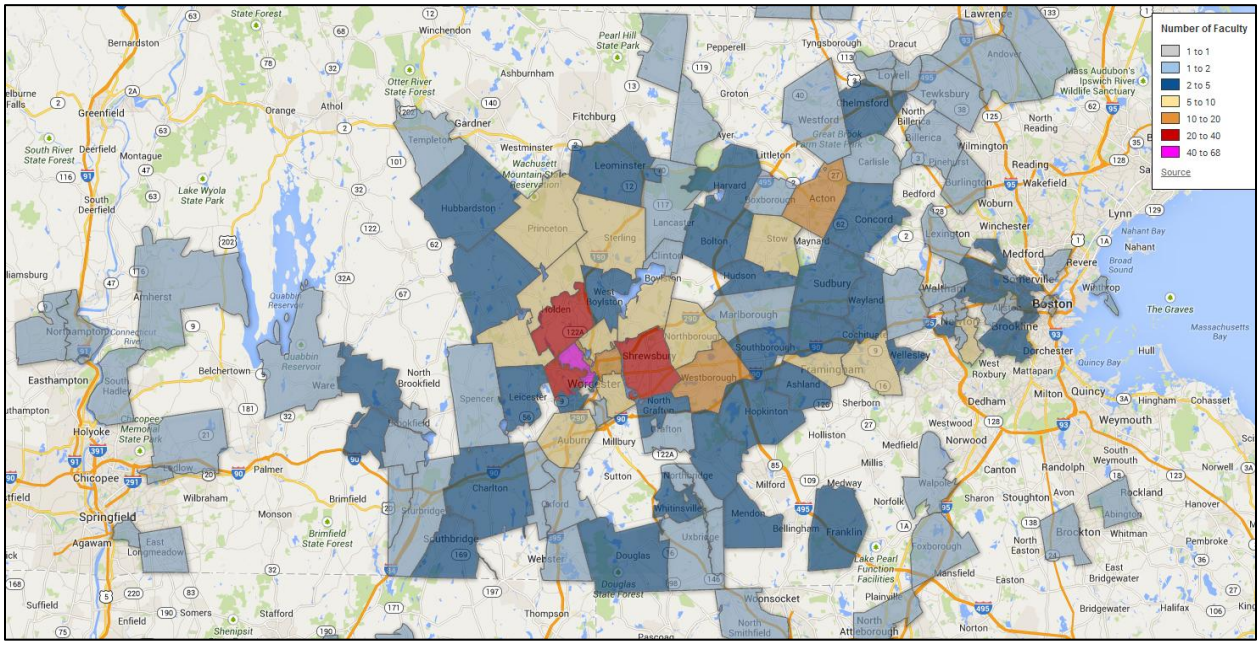


Figure 10: Excerpt of Faculty Map (Zip code count data courtesy of the WPI Office of the Provost)

Higher concentrations ease the use of carpooling, and additionally, as we have seen with commuter students, the large commuter student population in and around Worcester suggests the possibility of WRTA use by commuters. The Massachusetts Bay Transit Authority (MBTA) commuter rail also becomes important, as the corridor between Worcester and Boston, where a large population of faculty lie, is traversed by the Framingham/Worcester commuter rail line. We discuss this opportunity for alternative transportation in detail in section 4.3.4.

Staff Members

Staff members are most heavily concentrated in Worcester and its surrounding communities, as shown in Figure 11. In fact, from the map, staff members are almost exclusively from these areas, forming a bull's-eye with the city of Worcester at its center.

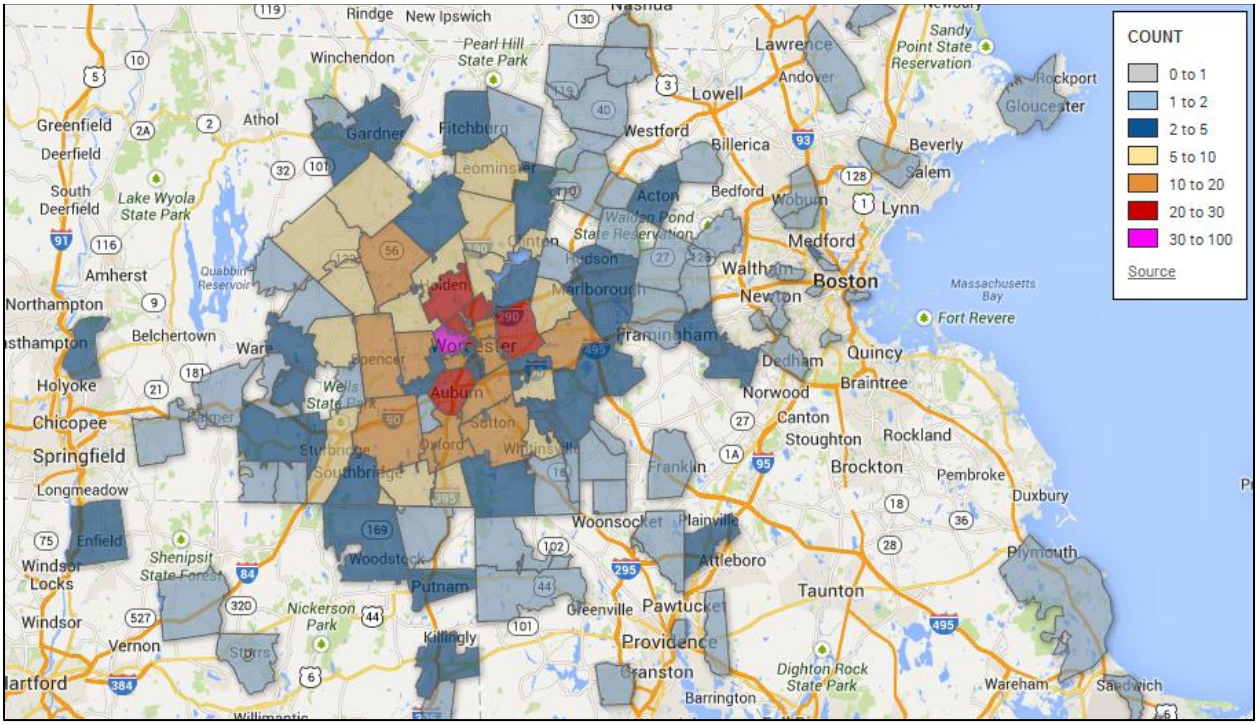


Figure 11: Excerpt of Staff Map (Zip code count data courtesy of WPI Human Resources)

Like both commuter students and faculty members, staff members have significant populations in the WRTA's area of operation. Also, due to the high concentrations of staff around Worcester and its surrounding communities, carpooling also becomes a viable option.

4.2 How the WPI Community as a Whole Travels

Extrapolating the data from the survey for the entire WPI population, Figure (12) illustrates how each population of WPI community members come to campus. As shown, the two primary modes of transportation for the WPI community are walking (this includes "Live on Campus") and personal vehicles. Alternative transportation is significantly smaller by comparison, but not nonexistent; for example, approximately thirty-three community members carpool to campus, and 129 community members bike to campus.

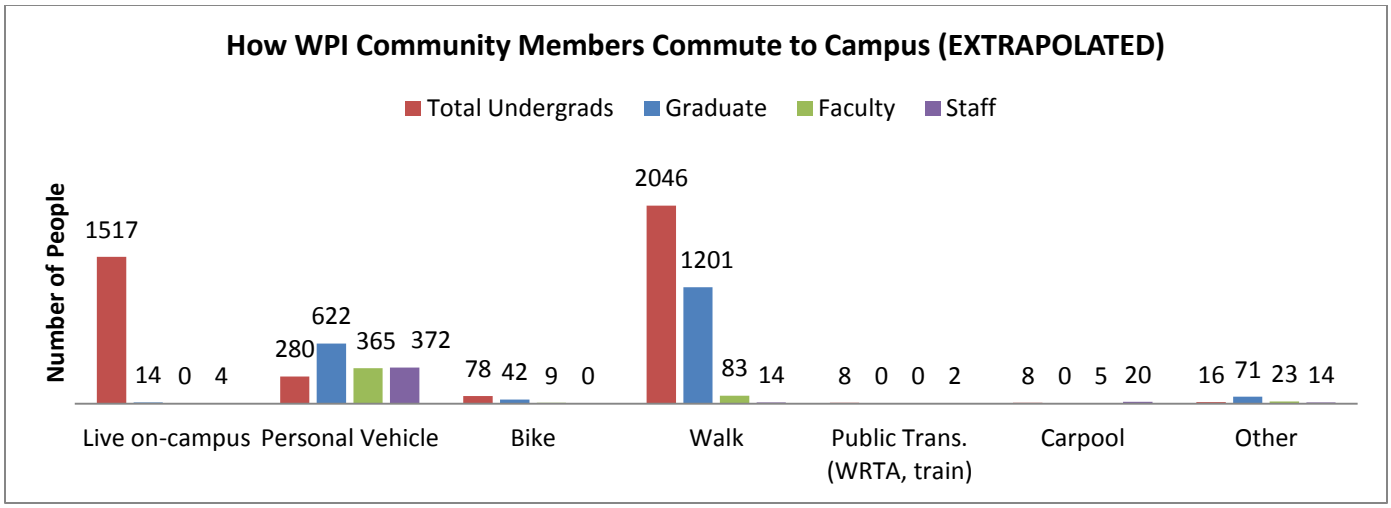


Figure 12: How WPI Community Members Commute to Campus (EXTRAPOLATED)

As shown in Figure (12), WPI students and employees bring upwards of 1600 personal vehicles to campus. However, this data includes part-time students and employees who may be coming to campus only a few times per month or year. Therefore, Figure (13) shows how many full-time commuters are bringing personal vehicles to campus.[4] From the figure, approximately 1,470 personal vehicles are coming to campus each day, not including the added number of personal vehicles from outside visitors. Using an average of five round trips per week, this translates to approximately 7,350 personal vehicle round trips to WPI each week, and 205,800 personal vehicle round trips to WPI each academic year.[5] Furthermore, there are over a million personal vehicle round trips to the WPI campus every five years.

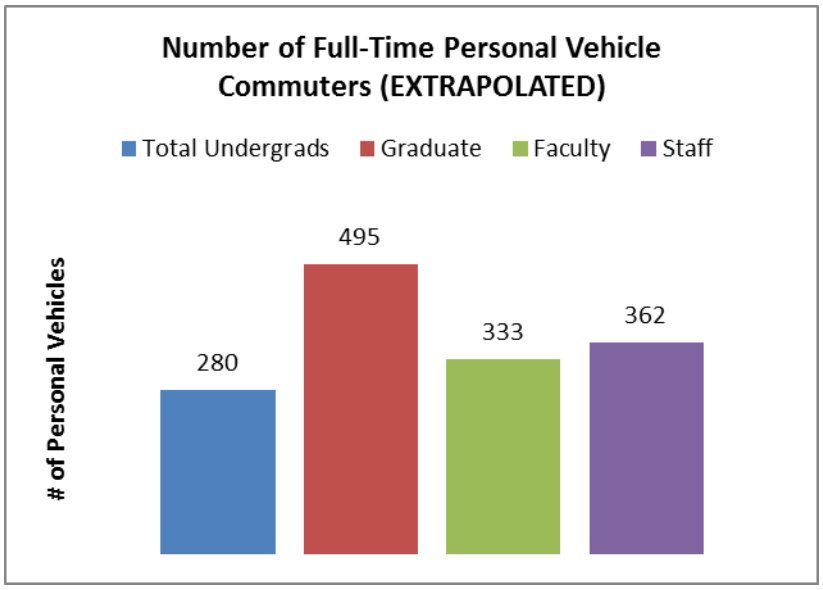


Figure 13: Number of Full-Time Personal Vehicle Commuters (EXTRAPOLATED)

Figure (14) graphs how WPI community members commute campus by their commuting distance, from within walking distance to outside of Worcester's surrounding communities. As illustrated by the graph, the

[4] "Full-time" is defined as three or more trips to campus each week.

[5] Five was the mean number of trips from the survey data.

majority of respondents who live outside of walking distance use personal vehicles, ranging from 65 percent for respondents who live in Worcester to 94 percent for respondents who live in surrounding communities. Personal vehicle usage decreases moderately to 87 percent for respondents who live farther away, but nevertheless remains the dominant mode of transportation for commuters.

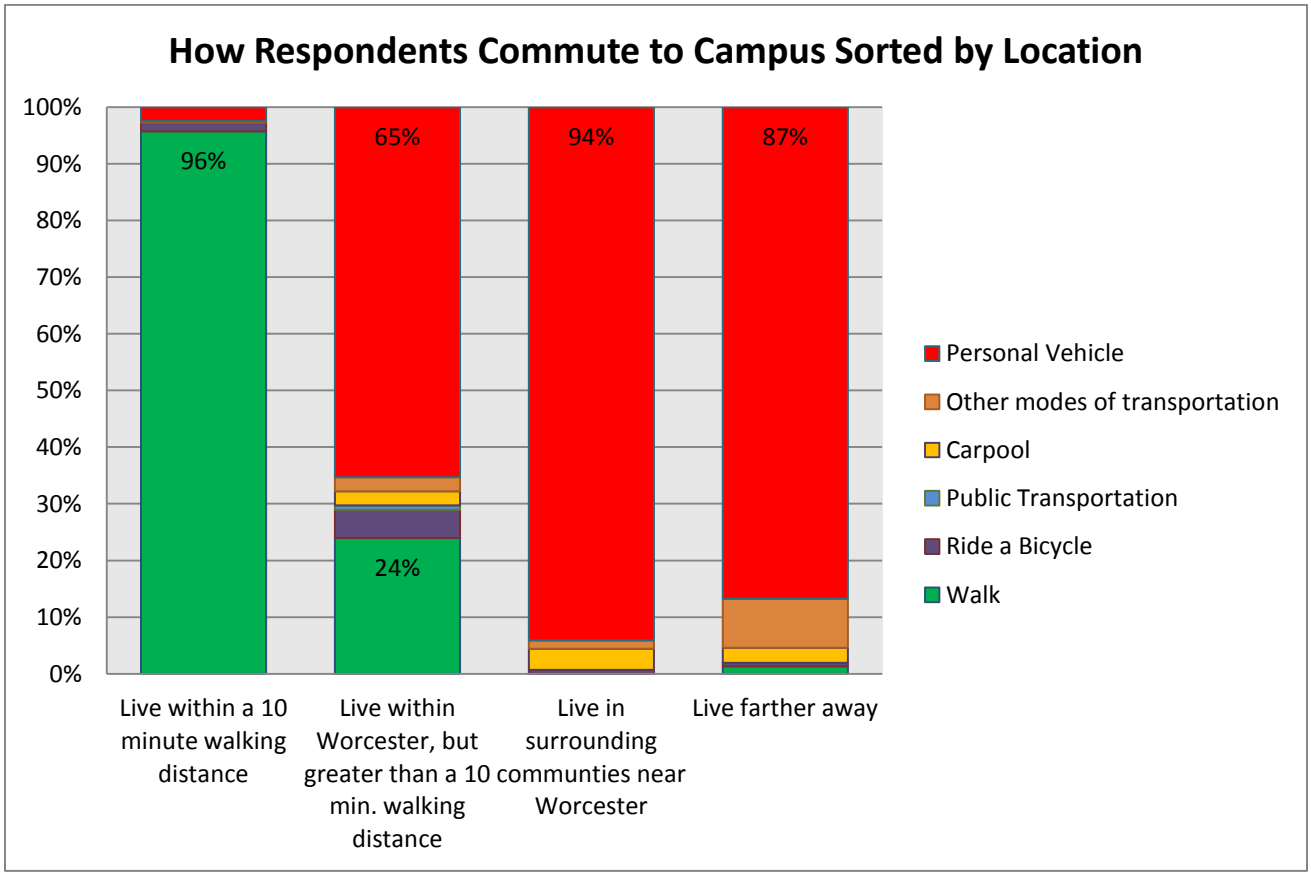


Figure 14: How Respondents Commute to Campus Sorted by Location

Alternative modes of transportation, other than walking, are used by very few respondents. Only 2 percent of respondents who live within walking distance said that they usually bicycle to campus, the same percentage for personal vehicle use at this distance. Bicycling increases to 5 percent for respondents who live within Worcester, but at this distance, personal vehicle usage is fourteen times greater. Public transportation, which combines the percentages for the WRTA and the MBTA, stagnates at every distance from campus, with only 1 percent of respondents who live within Worcester using public transportation. Carpooling also is relatively low at every distance, with only 4 percent carpooling from surrounding communities, declining slightly to 3 percent for farther away. Therefore, while some forms of alternative transportation are used be community members to commute to campus, these forms are significantly outnumbered by personal vehicle use.

The lack of alternative transportation use by WPI community members is also illustrated by what the survey respondents said about their use of alternative transportation. As shown in Table (3), when asked about what forms of alternative transportation respondents have used, significant majorities said that they had never used several modes of transportation, with some modes seeing many respondents not even knowing of those modes.

Table 3: Percentages of Respondents who said they've Never Used/Never Heard of Alternative Transportation Options

Mode of Alternative Transportation	"Never used it"	"Never heard of it"
WRTA Bus System	74%	4%
MBTA Commuter Rail	34%	5%
Zipcar	83%	3%
Carpool World Website	47%	52%
SNAP and Gateway Shuttles	38%	2%

From Table 4, most modes of transportation are well-known but not well-used, with large majorities saying that have never used the WRTA, Zipcar, and the Carpool World website. However, the Carpool World website stands out, as 52 percent of survey respondents had never even heard of the site, despite the site consisting of the entirety of WPI's carpooling program. In short, this table reinforces Figure 12; most forms of alternative transportation are not being utilized, while personal vehicles are the transportation mode of choice

The following sections of this chapter focus on both on-campus personal vehicle users and off-campus personal vehicle commuters, and which modes of transportation both groups said would change how they travel.

4.3 Alternative Transportation for On-Campus Drivers

On-campus drivers may not individually produce as great an impact on WPI's transportation sustainability as off-campus commuters, but the much larger number of on-campus community members' points toward a substantial impact by this population. Around half (54 percent) of on/near campus undergraduates (the largest WPI population) say that they sometimes or always use a personal vehicle to travel somewhere outside of campus, translating to a large amount of personal vehicle use. The following subsections describe what modes of alternative transportation on-campus drivers said would change how they travel.

4.3.1 On/near-campus drivers would consider carpooling if it were made easier.

As illustrated in Figure 15 and Figure 16, a significant percentage of the on/near-campus drivers would change how they travel if carpooling were made easier. 11 percent of on/near-campus graduate students and 12 percent of on/near-campus undergraduate students who always use personal vehicles said that they would definitely change how they travel if carpooling was made easier. Additionally, another 43 percent of graduate students and 30 percent of undergraduate students who always use a personal vehicle to travel off-campus said that they would possibly change how they travel with easier carpooling.

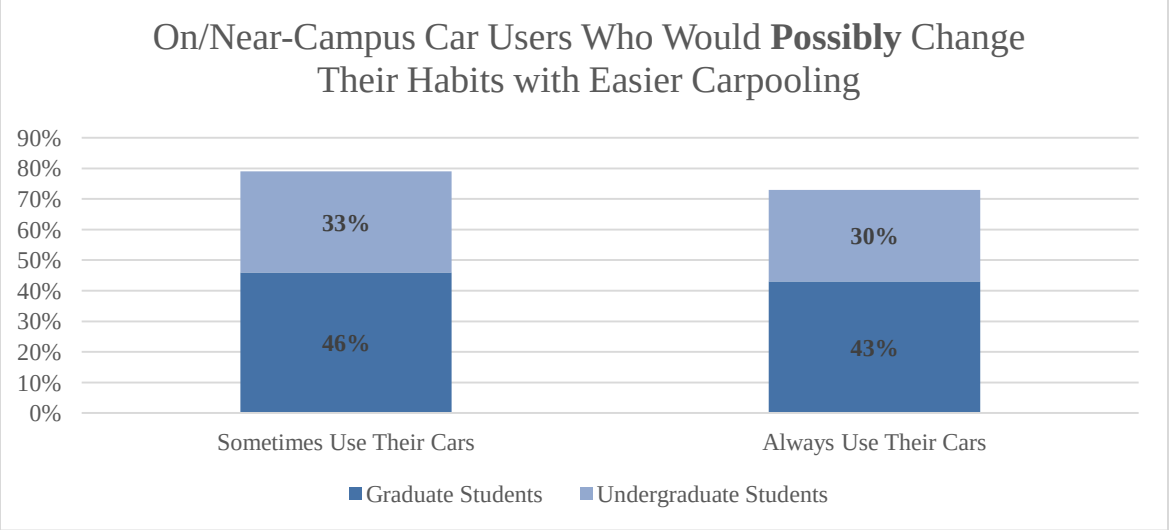


Figure 15: On/Near-Campus Car Users Who Would Possibly Consider Carpooling

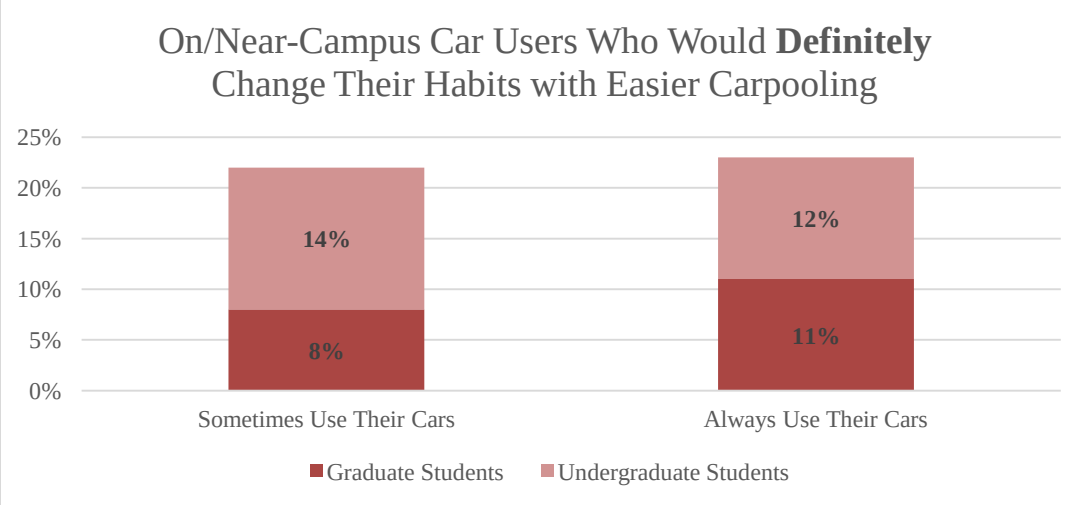


Figure 16: On/Near-Campus Car Users Who Would Definitely Consider Carpooling

Out of the 241 students that live on/near-campus and use their cars, 111 of them are interested in changing their traveling habits given easier carpooling options. Considering this large number of on/near-campus community members who drive personal vehicles, these would translate into a

46 percent reduction in personal vehicle use.

4.3.2 On/Near campus undergraduate students would utilize the WRTA if there are more frequent or convenient bus routes.

The majority of undergraduate students who live on or near campus and utilize their personal vehicle to travel to off campus destinations indicated they would possibly or definitely change how they would travel with WRTA bus system, if there are more frequent or convenient routes. Figure 17 shows students who live on or near campus and use their cars to travel to off campus destinations. Students who sometimes use their cars to travel to off campus destinations are shown in blue and students who always utilized their cars to travel to off campus destination are shown in red. Those who responded that they would definitely change their travel habits are shown in the darker shades and those who responded that they would possibly change their travel habits are shown in the lighter shades. Their percentages shown are of undergraduate students who utilized their cars to travel to off campus destinations. Undergraduates were the only population from the survey which could be analyzed in this respect due to the lack of respondents representing other populations in the WPI community. In total, 74 percent of undergraduates who live on or near campus, and utilize a car at all, that would at least consider utilizing the WTRA instead of their cars were the bus system to improve. This is the majority of students who fit within this population.

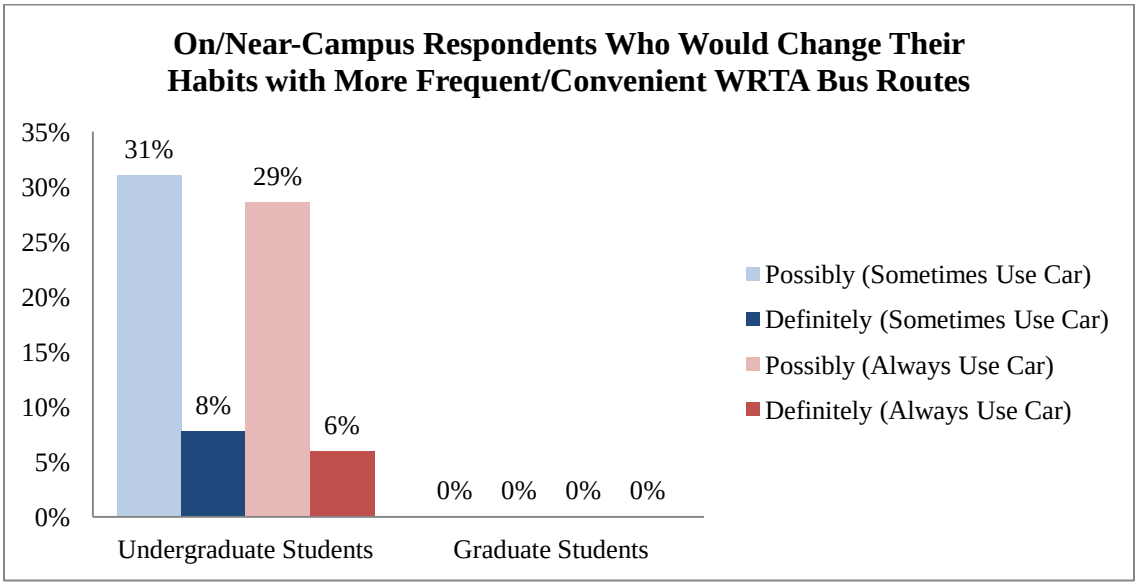


Figure 17: On/Near-Campus car users who would utilize an improved WRTA system

On-campus students utilizing the WRTA will not reduce the number of cars coming to campus each day, as they leave their cars parked on campus during their residence. But if students are willing to utilize the WRTA instead of their own vehicle, then they may not bring a car to

campus in the first place. At the very least, an increase in WRTA student ridership will decrease the number of driving trips taken by on or near campus undergraduate students .This would help to decrease the number of cars on the roads in the areas around campus, making it safer for pedestrians, as the less cars that are on the road the less chance there is of a pedestrian being struck by one.

4.3.3 Personal vehicle usage for short trips can be cut down if bicycle usage is encouraged.

Students who live on campus or near campus currently underutilize bicycles. Of the 558 survey respondents who mentioned that they live on campus, 62 percent responded that they never use bicycles to travel off campus. A combined 2 percent of these same respondents indicated that they always use bicycles to travel off campus. Of those same on campus respondents, 64 percent indicated that they always or sometimes use personal vehicles to travel off campus. This indicates that there is room for improving bicycle usage on campus.

Although our survey indicates that bicycles are rare on and near campus, other findings indicate that free or inexpensive bicycle rentals on campus may increase the utilization rate of bicycles. Of the respondents who indicated that they live on campus or near campus, many were enthusiastic about a free or inexpensive bicycle rental system. As Figure 18 shows, a combined 64 percent of these 558 respondents indicated that free or inexpensive bicycle rentals would definitely or possibly change the way they travel off campus.

Of the 119 respondents who indicated that they live on or near campus and always travel off campus with a personal vehicle, nearly 20 percent indicated that free or inexpensive bike rentals would definitely change how they travel, while, 38 percent indicated that they would possibly change the way they travel off campus.

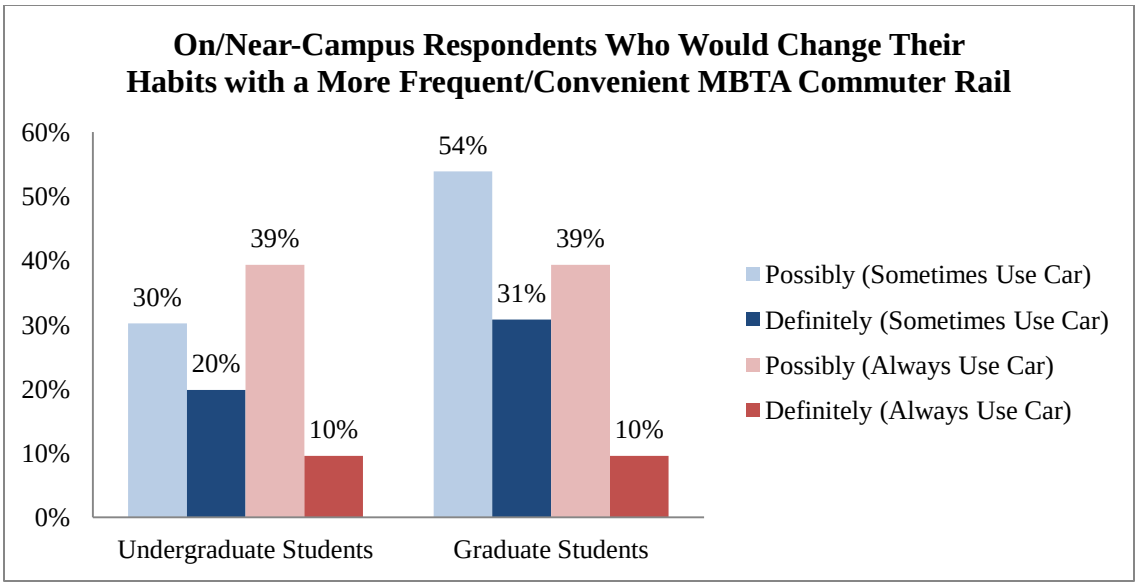


Figure 18: On/Near-Campus who would change their habits with a more frequent/convenient MBTA Commuter Rail schedules

Comments from the survey suggest why bicycles usage is not higher. Common themes in the survey comments related to bicycling include issues with safety and storage. One respondent writes, "I would like to see more enclosed bike locking stations so bikes can be protected from the weather, mainly in the winter." Other comments mentioned storage issues: "WPI Residential Services could make the residence halls more bicycle friendly…" Other respondents focused on the road conditions, which may deter using a bike as a primary commuting mode: "I ride my bike most days and cold weather is not a deterrent to me. However, narrow roads, lack of bike lanes, and especially poorly maintained roads (potholes etc) are safety concerns. Depending on how well my route gets plowed, I may have to stop for a few months. If there were better bike infrastructure (shoulder on roads and repaired potholes) that would make a HUGE difference." Other comments focused on building bike lanes into current infrastructure: "Bike paths would be really nice. They can double as snow banks during the winter." Still others focused on promoting a culture of biking: "More bike lanes. More bike signage. More conversations about bikers to promote more respect for biking…"

In conclusion, WPI community members seem open to utilizing bicycles. Offering free or inexpensive bicycle rentals would likely eliminate short trips that are currently being made with personal vehicles.

4.3.4 On/Near Campus Members would consider better Zipcar Services

Since Zipcars are located on campus, they are convenient for on/near campus students. There are quite a few students that have used Zipcars, however there are also complaints about their services. From the survey results, we calculated high percentages of on/near-campus car users who would change their habits with a better Zipcar service. Altogether, 39.4 percent of students

that live on/near-campus at use their cars said that better Zipcar services would possibly or definitely change their habits.

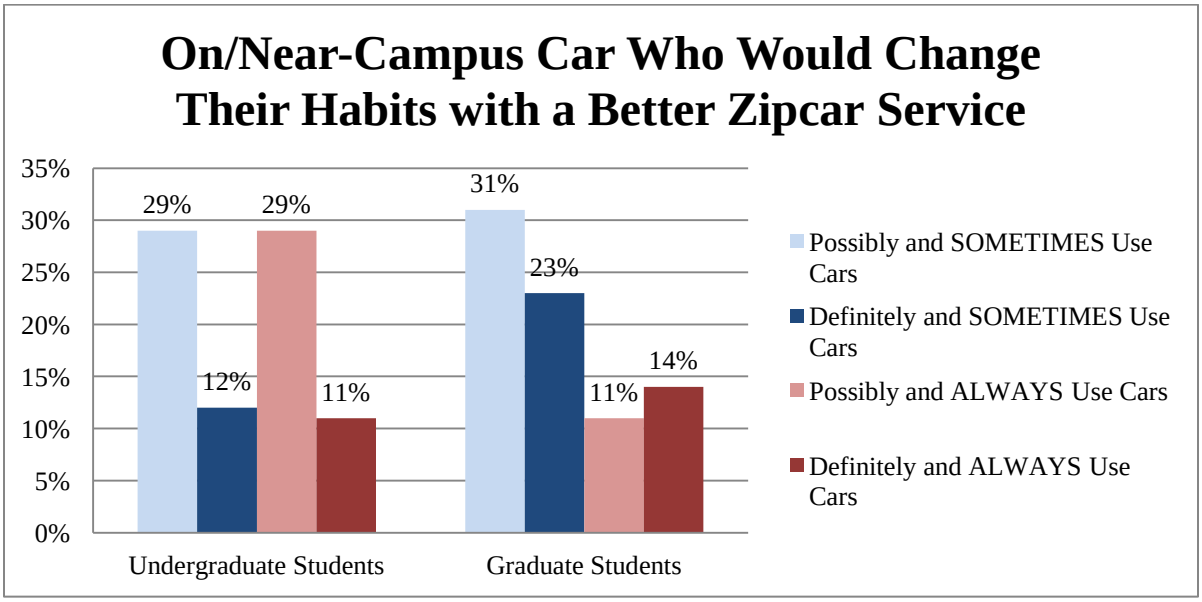


Figure 19: On/Near-Campus car users who would change their habits with a better Zipcar service

Looking first for possible converts, we found that thirty-one percent of graduate and twenty-nine percent of undergraduate student respondents living on or near campus who sometimes use their cars said that a better Zipcar service would possibly change how they travel. Similarly, eleven percent of graduate and twenty-nine percent of undergraduate student respondents living on or near campus who always use their cars said that a better Zipcar service would possibly change how they travel. These are a total of 65 out of 241 students, or 27 percent of student respondents said, they would possibly change their habits with a better Zipcar service. The same percentage of undergraduate students that either sometimes or always use their cars said they would possibly change their traveling habits.

Looking for more likely converts, we found that 23 percent of graduate and 12 percent of undergraduate students that live on or near campus that sometimes use their cars said that a better Zipcar service would definitely change how they travel. 14 percent of graduate and 11 percent of undergraduate students that live on or near campus that always use their cars said that a better Zipcar service would definitely change how they travel. These are a total of 30 students out of 241 students that would possibly change their habits with a better Zipcar functionality.

Even though Zipcars won't likely reduce the number of cars that come to campus, they could have an impact on the type of transportation students will choose to use while on campus. As for students that live on campus, it could change their minds completely about having a car at school. Two students complained about the Zipcars being "too expensive". One of them stated

that “Taking a taxi is cheaper depending on how long/how far you go/how many people you go with.”

4.3.5 MBTA Usage by On/Near Campus Members

Our survey included results for students that live on/near campus that would be willing to change their transportation habits given a better MBTA service. 54 percent of graduates that use cars would possibly change their transportation habits given more frequent and convenient MBTA service. 36 percent of graduate student respondents that always use their cars said they would possibly change their transportation habits given more frequent and convenient MBTA service.

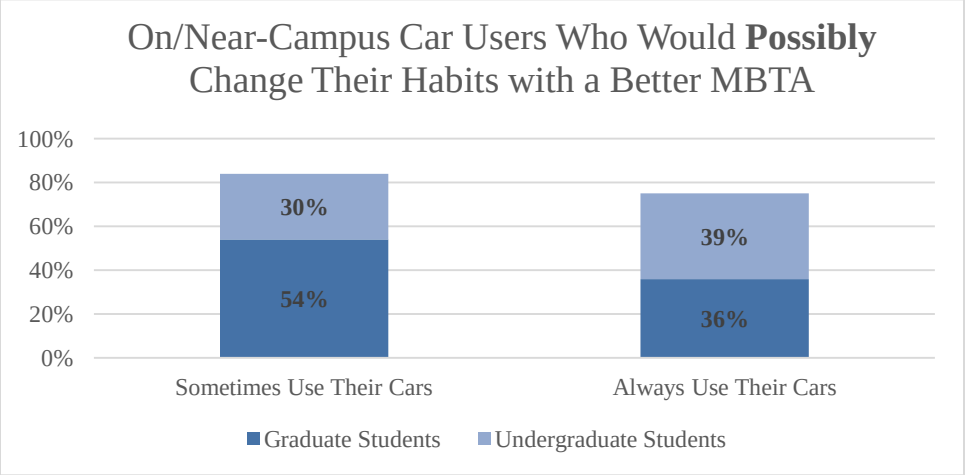


Figure 20: On/Near-Campus Car Users Who Would Possibly Change Their Habits with a Better MBTA

Looking at more likely changes in traveling habits of these students, we found that 31 percent of graduate students that live on/near-campus that sometimes use their cars would definitely change their transportation habits given more frequent and convenient MBTA service. 14 percent that always use their cars would definitely change their transportation habits given more frequent and convenient MBTA service.

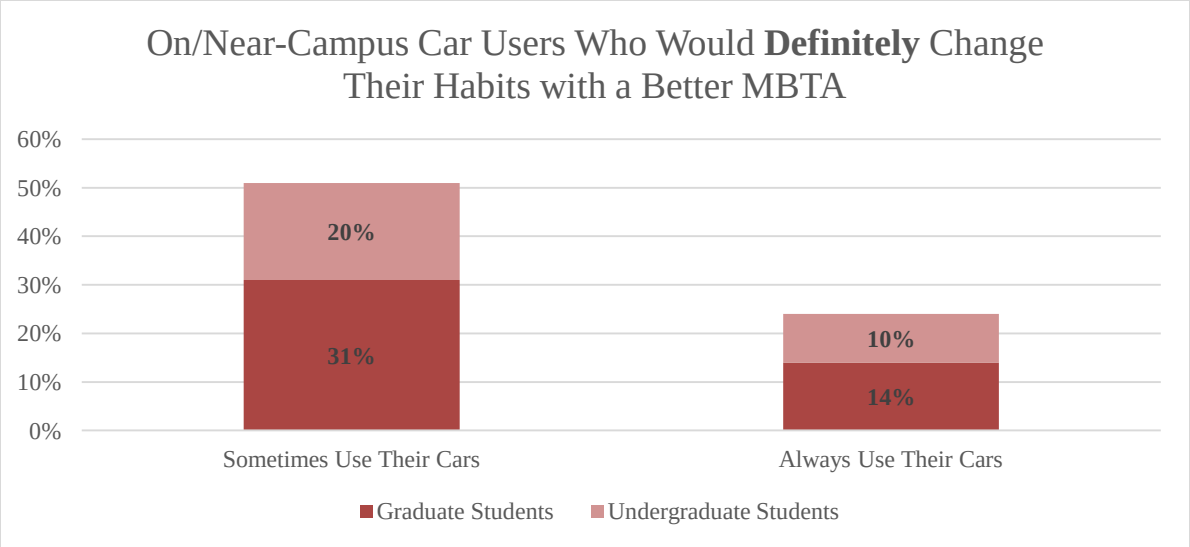


Figure 21: On/Near-Campus Car Users Who Would Definitely Change Their Habits with a Better MBTA

Comparing graduate and undergraduate students results, we can see that graduates would be more interested in changing their traveling habits given a better MBTA. We can also see that the lowest static of both groups, is of students that always use their cars and would definitely change their commuting habits given a better MBTA. There was more students that said they would possibly change their traveling habits rather than definitely.

Looking just at undergraduate students, 30 percent that live on or near campus who sometimes use cars and 39 percent that always use their cars would possibly change their transportation habits given a more frequent and convenient MBTA service. 20 percent that sometimes use their cars and 10 percent that always use their cars would definitely change their transportation habits given more frequent and convenient MBTA service.

There are 39 out of a total 241, or 16 percent of, students who would definitely change how they travel. A total of 85 out of 241, or 35 percent of, students would possibly change their transportation habits. Of the students that live on/near campus and use cars, 5.4 percent have never heard of the MBTA, 26.5 percent have never used it, 9.5 percent have used it but were not satisfied, and 54.7 percent have used it and were satisfied. Altogether, 51.5 percent, or 241, of students that live on/near campus that use cars will be willing to change their habits if the right changes were made to the commuter rail.

To understand what changes would motivate use of MBTA, we consulted survey comments. One student stated, “First having an occasional van do pickups or drop offs at the train station during the day. Lots of students use the commuter rail and it is difficult for them to get between campus and the train station”. One student recommended “it would be nice if the gateway shuttle arrival times at [Union Station] corresponded with when the train is there.” Another student suggested

better advertisement saying “More information about the train and bus schedules and station (for example, I don't know where the bus stations are located).”

One comment also complained about MBTA’s charge rate saying, “mbta raised the rates and reduced the service”… “if it is cheaper, faster, and safer to drive to work wherever, people will not choose public transportation.” Below is a price chart of round trips to WPI using the MBTA taken from various stops.

	Cost/Day	Monthly Pass	Cost/Semester
South Station (Boston)	$20.00-$26.00	$314.00	$1256.00
Newtonville	$11.00	$184.00	$736.00
West Newtonville, Auburndale	$10.00	$167.00	$668.00
Wellesley (Hills, Farms, Square)	$9.00	$151.00	$604.00
Natick, West Natick	$8.00	$134.00	$536.00
Framingham	$7.00	$118.00	$472.00
Ashland, Southborough	$6.50	$109.00	$436.00
Westborough	$6.00	$100.00	$400.00
Grafton	$5.00	$82.00	$328.00

Table 4: Current price rates for MBTA Commuter Rail Worcester-Boston Line

4.4 Alternative Transportation for Off-Campus Personal Vehicle Commuters

This section presents findings regarding WPI commuters traveling by their personal vehicle three or more times weekly in this section. To help accomplish our goal for the project and produce recommendations, we focused on seeing the willingness to changing their traveling habits. By extrapolating percentages from our survey respondents, we developed Figure 22, estimating the number of private car commuters traveling to campus three or more times a week. We calculate that approximately 1470 different personal vehicles travel to campus at least three times per week, distributed fairly evenly throughout different WPI populations.

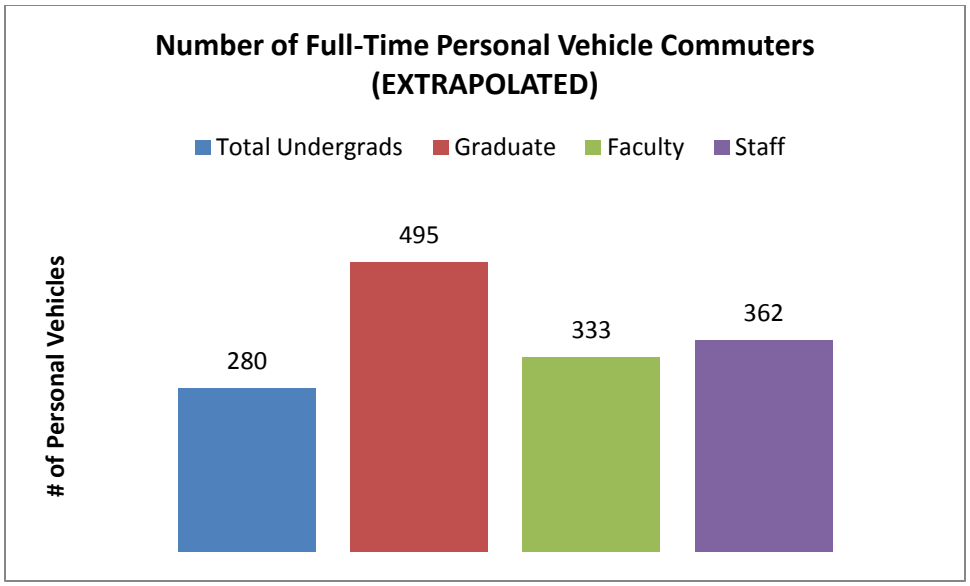


Figure 22: Number of Full-Time Personal Vehicle Commuters

4.4.1 WPI Personal Vehicle Commuters would consider easier carpooling if it's easier

The results show that all three types of car commuters (students, faculty, and staff) can have an impact in lowering nearly 1500 driving their personal vehicles to campus if carpooling was easier. Analyzing our survey of full-time personal vehicle commuter respondents closer, we found 324 commuters are willing to change their traveling habits, if they are given an easier way to carpool. The 324 of these respondents are broking down by 34 undergraduates, 35 graduate students, 72 faculty members, and 183 staff member respondents. Figure 23, categorizes each respondent by different WPI community members that will definitely or possible change how they travel if carpooling was easier.

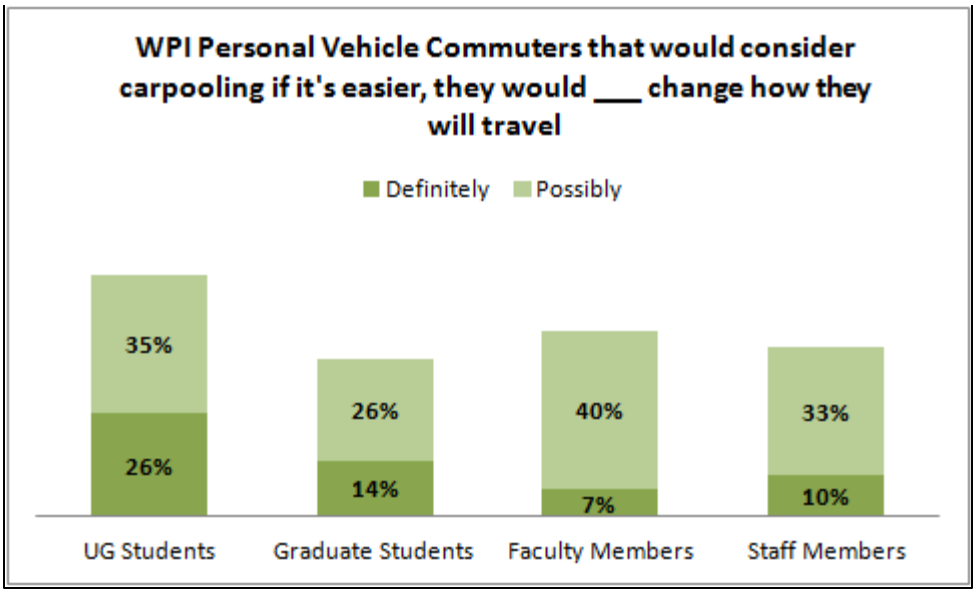


Figure 23: Percentages of each of the members of the community that will definitely or possibly change their traveling habits, if it's easier to carpool

As shown from the figure above, 71 percent of 34 undergraduate students, 40 percent of 35 graduate students, 47 percent of 72 faculty, and 43 percent of 183 staff members would definitely or possibly change how they would travel if easier to carpool. Using our survey results, we broke down each full-time WPI community member even further by how far they live to commute to campus and figure 24 categorizes these members who live within Worcester, live in one of surrounding communities, and live farther away to campus.

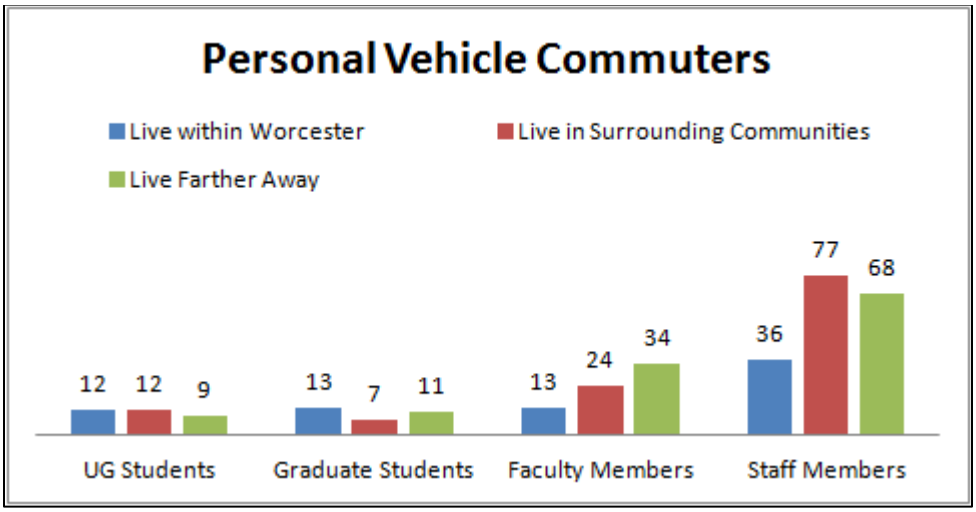


Figure 24: The total number of respondents that commute to campus by their own personal vehicle to campus three or more times in a week

The results shown in figure 24, the total numbers for both personal vehicle commuting graduate and undergraduate respondents are so very few students to represent their respective larger student bodies. In which we would not consider any results for full-time students that would

consider change their traveling habits, if it was easier to carpool as percentages from our survey. On the other hand, the total amounts of both faculty and staff respondents would be considered representing as percentage samples of WPI members of employees, shown also figure 24. Figure 25 & 26, represents full-time faculty and staff members respectively that would possibly change how they travel if it's easier to carpool that live within Worcester, live one of the surrounding communities, and live farther away from campus.

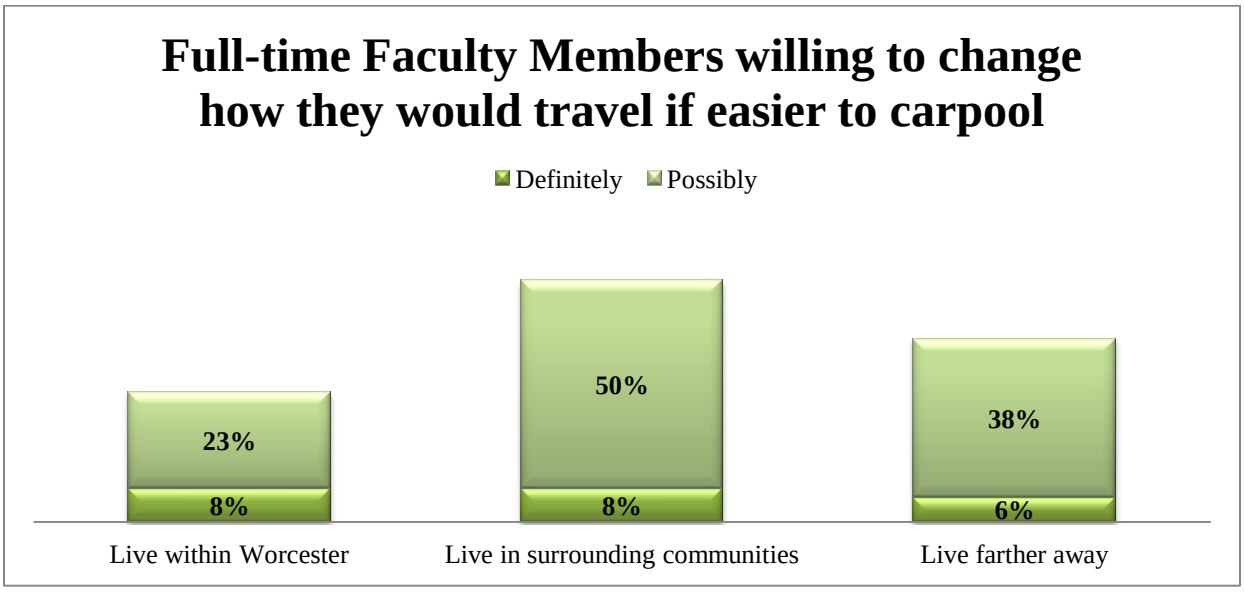


Figure 25:Full-time Faculty Members that commutes by personal vehicle which is willing to change how they would travel if easier to carpool

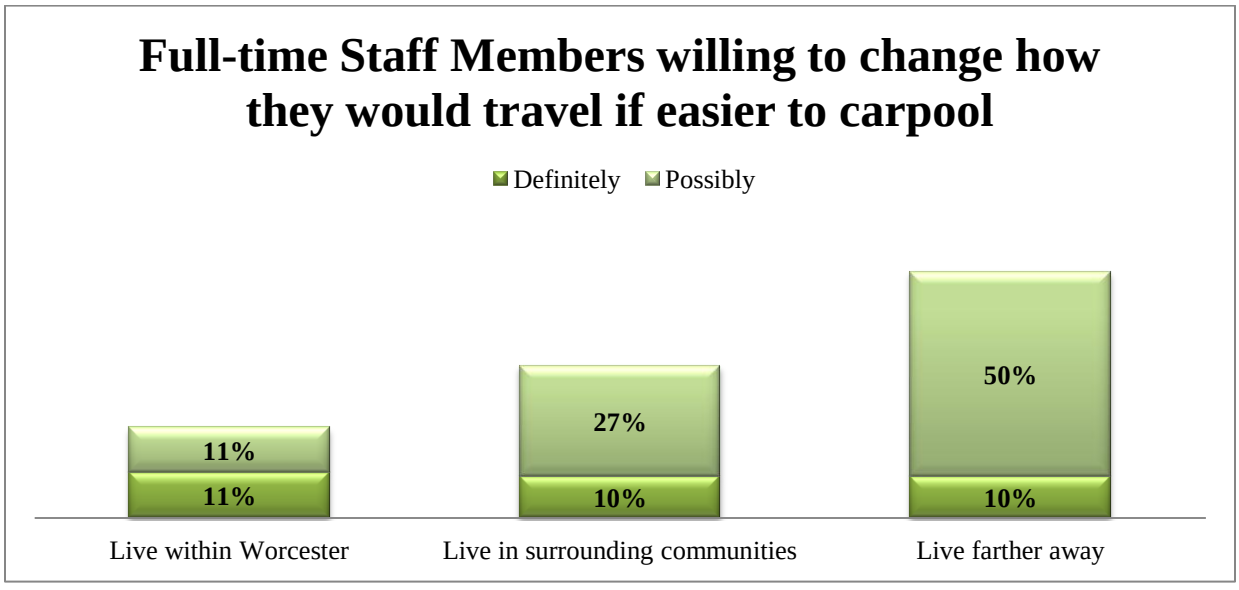


Figure 26: Full-time Staff Members that commutes by personal vehicle which is willing to change how they would travel if easier to carpool

From figure 25, 58 percent of 24 faculty respondents that live in surrounding communities and 44 percent of 34 faculty respondents that live farther away would change their traveling habits if

easier to carpool. From figure 26, 37 percent of 77 staff respondents that live in surrounding communities and 60 percent of 68 faculty respondents that live farther away would change their traveling habits if easier to carpool. These results will help us provide evidence to promote easier methods of carpooling and know personal vehicle commuters would consider carpooling if it was easier.

As in previous sections, our survey had an optional comment area, and we received 45 comments about carpooling. Most of the comments indicated willingness to carpool if they knew someone who has a matching schedule and destination. As some examples, "I would be willing to carpool if someone was close by to my home and worked the same hours" and "Carpooling may be difficult because I arrive early and sometimes leave after 5pm when many individuals leave to go home."

Also, some informing comments that recommends a method to help promote carpooling for the community, such as "Give an incentive to carpool; i have an attendant at the garage in the morning and giveaway coupon to those who arrive with more than one person." This comment makes a valid point about carpooling incentives that encourages changing how the community travels to campus.

4.4.2 Commuters who live in areas accessible by the WRTA would utilize the bus system if it were to have more frequent or convenient routes.

A large portion of commuters who make three or more trips to campus per week and live in areas accessible by the WRTA would utilize the bus system if it were to have more frequent or convenient routes. Figure 27 shows commuters who live in areas accessible by the WRTA (within Worcester and surrounding communities) and expressed interest in changing their travel habits. It is further broken down into percentages of undergraduate students, graduate students, faculty members, and staff members who responded that they would either possibly or definitely change their travel habits if the WRTA were to have more frequent or convenient routes. Those who answered definitely are shown with the lighter shade of blue and those who responded possibly with the darker shade. The most promising population that would change their travel habits are undergraduate commuters who live within Worcester. 50 percent of this population responded that they would definitely change their travel habits if the WRTA were to have more frequent or convenient routes. The largest population that would change their travel habits are faculty commuters who live within Worcester. A total of 54 percent of this population responded that they would either definitely change or possibly change their travel habits if the WRTA were to have more frequent or convenient routes.

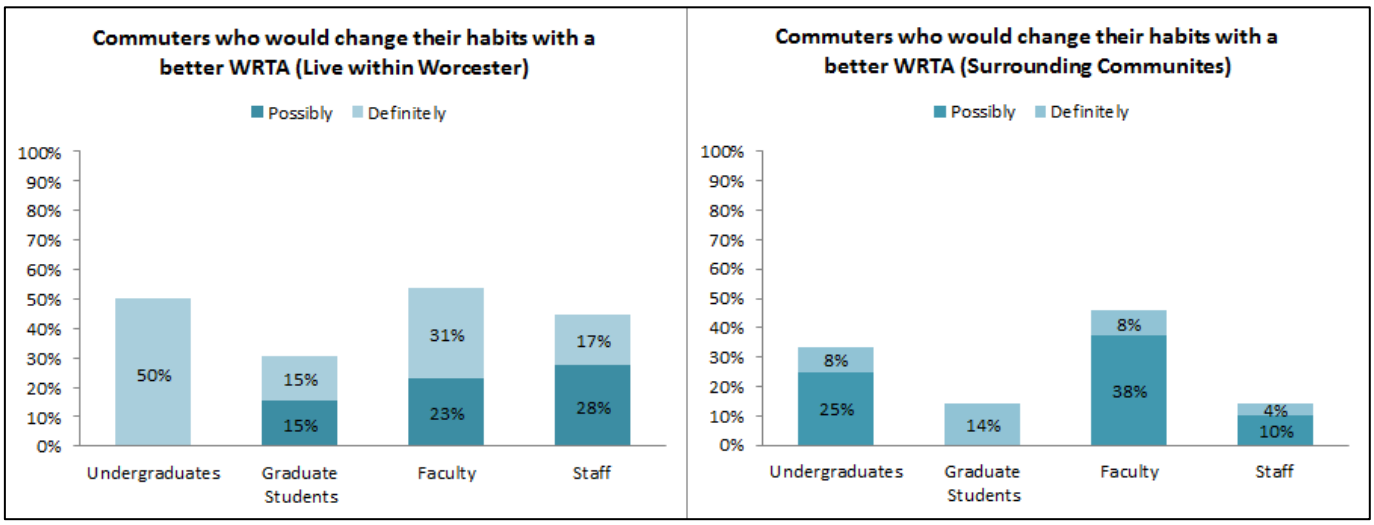


Figure 27: Commuters who live in areas accessible by WRTA and would utilize the bus system if it improved

While commuters living in surrounding communities showed interest in changing their travel habits, they reported being less likely to take the bus than those who live within Worcester. Figures 28, 29, and 30 show the population densities for student, faculty, and staff commuters respectively, for each zip code in the Worcester area. Overlaid onto these maps are the WRTA bus routes shown in yellow. It can be seen that even to reach WPI from these areas, utilizing the bus system would require multiple route transfers and significantly increase travel time. Also, in many of the surrounding communities there are only one or two bus routes accessible and even then one would have to commute just to get to a bus stop. One can see in areas such as Shrewsbury, where there is a sizable commuter population, there is only the one route to service a large area. Riding the bus also forces one to adhere to a fixed schedule. To many, this is seen as too great an inconvenience. Many of the comments obtained from the survey allude to these inconveniences. However, as can been seen in figures 28, 29, and 30, there are sizeable populations of commuters living in areas serviced by the WRTA and as seen in figure 27, there is still interest in changing travel habits if the bus system were to have more frequent or convenient routes.

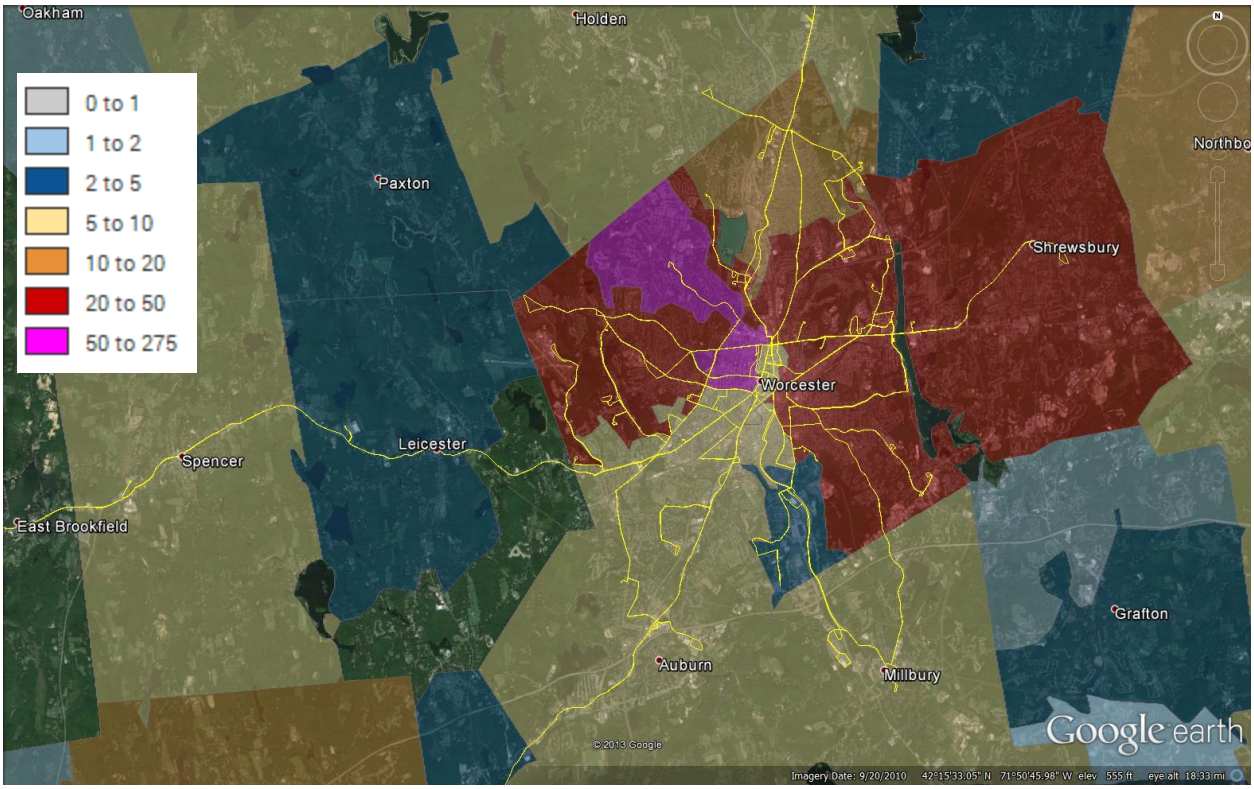


Figure 28: Commuter Students living in areas serviced by the WRTA

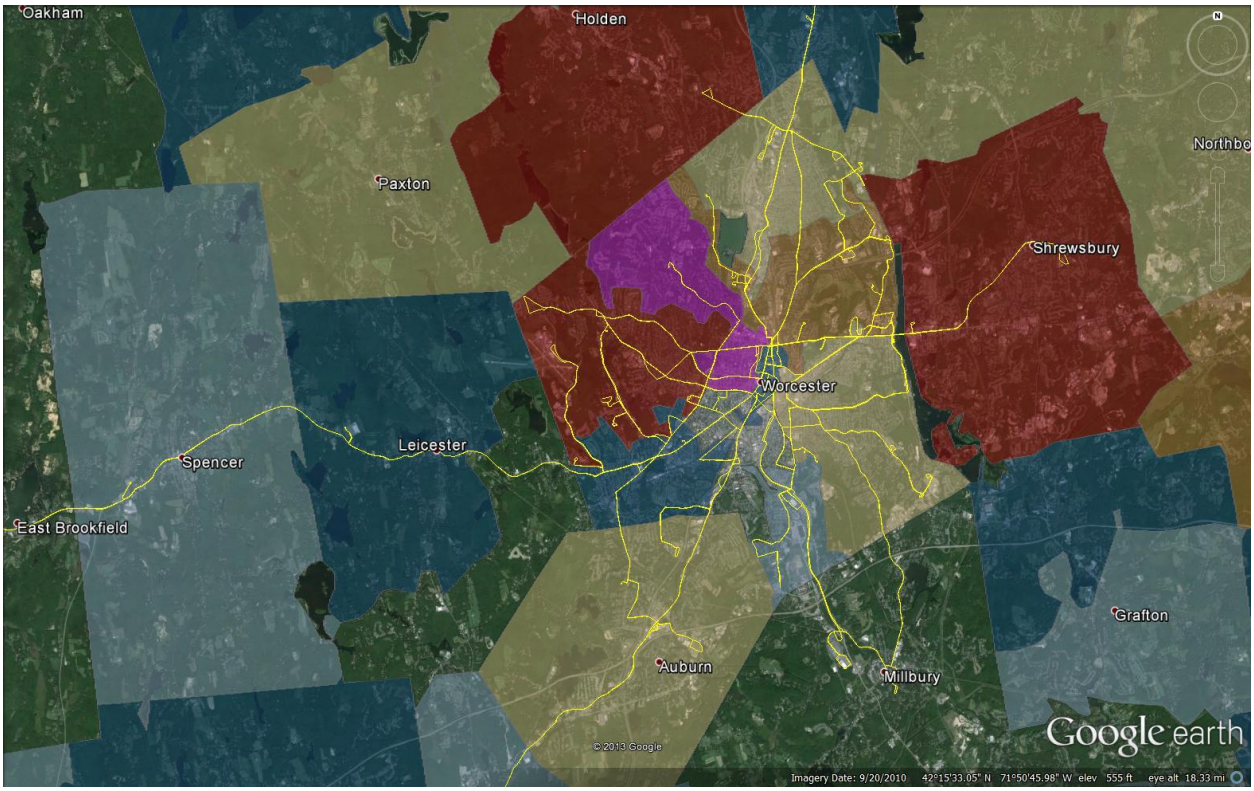


Figure 29: Faculty commuters living in areas serviced by WRTA

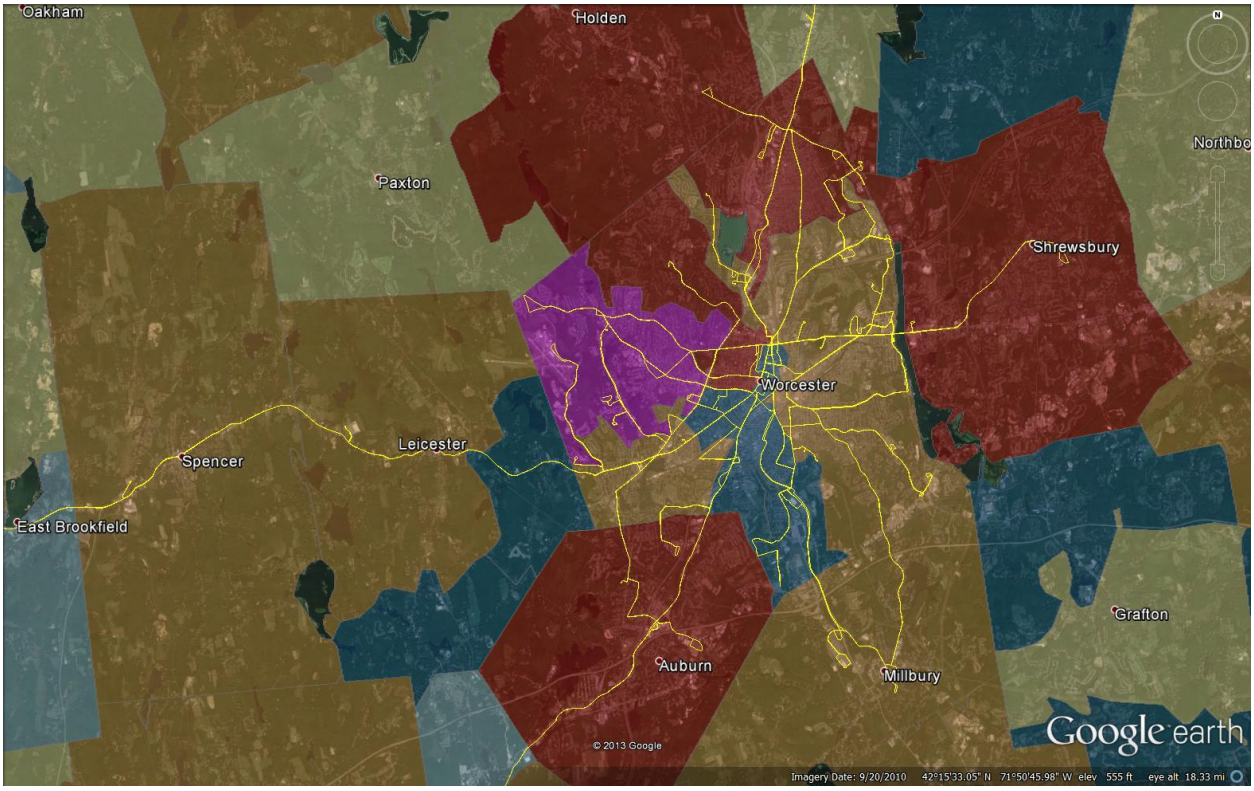


Figure 30: Staff commuters living in areas services by WRTA

Commuters utilizing the WRTA will reduce the number of cars coming to campus each day if they are willing to utilize the WRTA instead of their own vehicle. At the very least, an increase in WRTA student ridership will decrease the number of driving trips within Worcester once these commuters are on campus. This would help to decrease the number of cars on the roads in the areas around campus, making it safer for pedestrians, as the less cars that are on the road the less chance there is of a pedestrian being struck by one.

4.4.3 WPI Employees would benefit from a more convenient MBTA Commuter Rail.

All three types of car commuters (students, faculty, and staff) have populations that live near the Framingham/Worcester line (see Appendix C) for full Commuter Student, Faculty, and Staff Maps), and percentages of all three types of commuters expressed interest in a more frequent and convenient MBTA commuter rail, as shown in Figure 31. However, using the "Commuter Student" Map, only roughly two dozen commuter students live in a zip code with an MBTA stop, or in a zip code very near to an MBTA stop. Therefore, while the percentages are high, the actual counts to which these percentages extrapolate are fairly low.

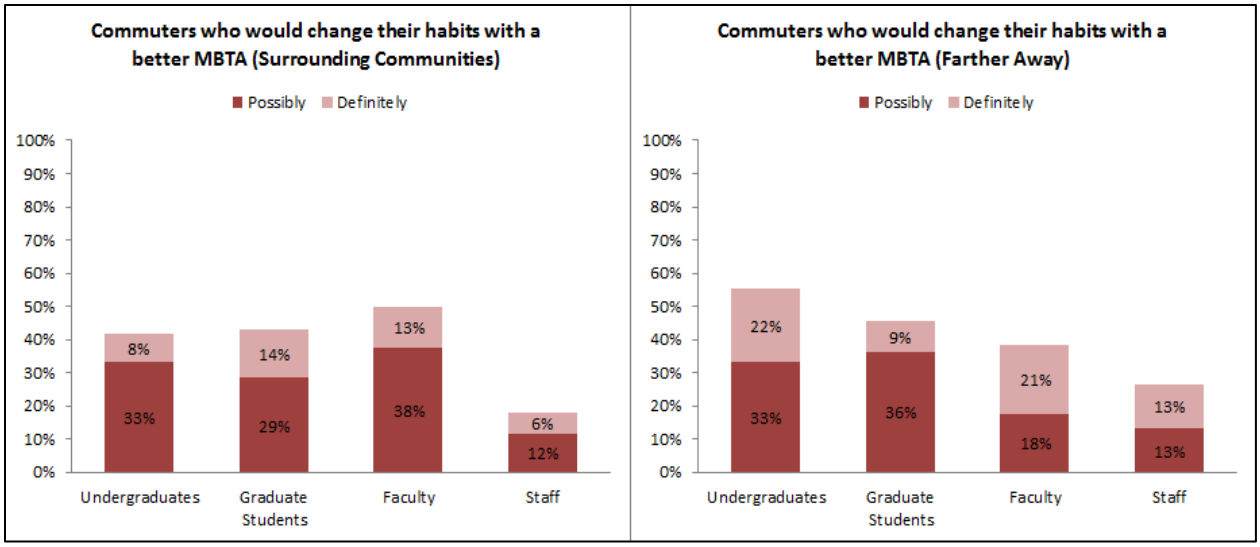


Figure 31: Commuters who would change their habits with a better MBTA

However, the Framingham/Worcester Line runs through or very near the zip codes of roughly forty-three faculty members and twenty-four staff members. This is illustrated in Figure 32, an excerpt of the Faculty Map that is overlaid with the route of the Framingham/Worcester Line.

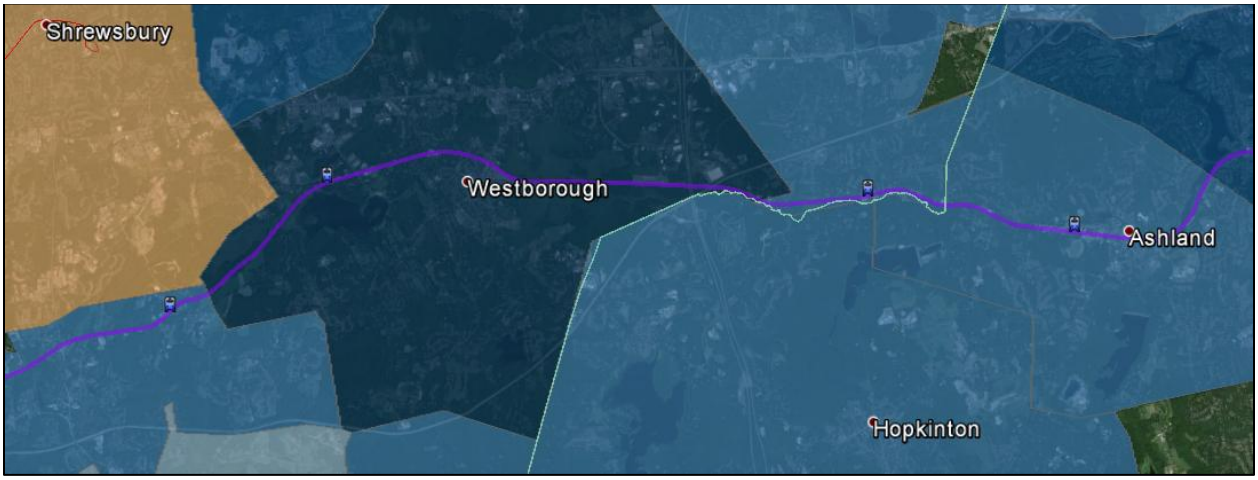


Figure 32: Excerpt of Faculty Map with Overlay of MBTA Commuter Rail

As shown in Figure 31, 38 percent of faculty car commuters who live in Worcester's surrounding communities said that a more frequent or convenient WRTA would possibly change how they travel, with 36 percent who live farther away reporting that they would possibly change how they travel. Another 13 percent of faculty car commuters who live in Worcester's surrounding communities said that they would *definitely* change how they travel, with 21 percent of those living farther away saying they would *definitely* change how they travel. Staff members also expressed interest in an improved MBTA, with 18 percent of staff members who live in the surrounding communities of Worcester and 26 percent of staff members who live farther away

saying that an improved MBTA would possibly or definitely change how they travel.

4.4.4 Bicycle rentals will not replace many vehicle commutes, but may change habits for short trips once commuters are on campus

Due to the distance restrictions of bicycling, this form of transportation would not replace the majority of vehicle commuting trips. However, data from the survey suggests free or inexpensive bicycle rentals may change the habits of vehicle commuters once they arrive on campus.

Currently 2 percent of all respondents who do not live on campus indicate that they usually commute by bicycle while 45 percent percent usually commute by person vehicle. For the majority of commuters, bicycling is not a viable option due to distance.

The figure below shows commuters who would change their travel habits if free or inexpensive bicycle rentals were offered. What it seems to show is that offering free or inexpensive bicycle rentals would cut down on just under one quarter of all vehicular commutes. However, a closer look at the data is needed to see what this chart really means.

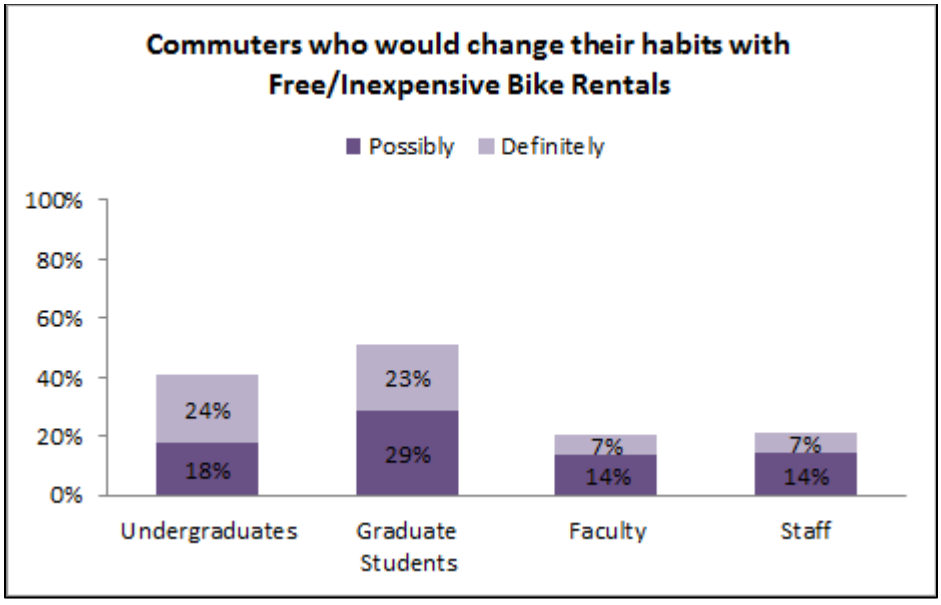


Figure 33: Commuters who change their traveling habits with Free/Inexpensive Bike Rental Program on campus

Of the 347 survey respondents who indicated that they commute to campus via personal vehicle, 27 percent indicated that free or inexpensive bicycle rentals would definitely change how they travel. However, more than half of that 27 percent also indicated that they live outside of Worcester and thus too far to reasonably bike to campus each day. Digging into the data a bit more, it was found that 68 percent of this group of personal vehicle commuters who indicated that free or inexpensive bicycle rentals would definitely change how they travel also travel

between the main campus and Gateway at least occasionally, with 35 percent indicating that they travel between campuses at some point each week. Even though bicycle rentals will not replace many vehicle commutes, bicycles hold promise of changing habits for short trips once commuters are on campus.

CHAPTER 5: RECOMMENDATIONS AND CONCLUSIONS

Based on our research of alternative transportation, successful alternative transportation programs at other universities, and WPI's current transportation options and habits, we have compiled a list of recommendations for improving and encouraging the use of alternative transportation by the WPI community. Each recommendation is aimed at a specific office that we believe can address our ideas.

We recommend that WPI's Carpool World website be improved by the Web Development Office, and that the WPI Office of Student Life, WPI Human Resources, and the WPI Department of Facilities promote and advertise it heavily.

There is significant potential for the increased use of carpooling for WPI community members, especially those that drive personal vehicles. As discussed in sections 4.3.1 and 4.4.3, significant percentages of both on-campus drivers and personal vehicle commuters stated that they would possibly or definitely change how they travel if…. WPI's current carpooling program, the Carpool World website is not well-known or well utilized: per Table (3), 47 percent of survey respondents reported that they had never used the website, and 52 percent of survey respondents stated that they had never even heard of the website. We attribute this lack of use and knowledge of the carpooling website to a lack of promotion both online and in-person. This mode of alternative transportation is the only mode that is not well-known, and considering the lack of infrastructure changes needed, is an inexpensive recommendation to carry out.

We recommend to the Web Development Office to create more links to the site around WPI's webpage, and that the Office of Student Life promote the site to students, Human Resources promote the site to faculty, and the Department of Facilities promote the site to staff. We also recommend that WPI provide more incentives to carpoolers such as reduction in parking costs or meal plans rather than premium parking spaces. As mentioned in section 2.2.2, a reduced parking fee for carpoolers has worked well at UC Davis, and we suggest implementing a similar program here.

We recommend that the WPI Department of Facilities create a free or inexpensive bike rental program, and provide a better bike infrastructure such as air pumping stations and bike rooms around campus.

There is a great potential for eliminating short trips that WPI community members might use personal vehicles for by offering bike rentals on campus. Other schools have successfully incorporated bike share programs into their campuses. We propose that WPI facilities or a student organization work with bike rental companies (such as X, Y,Z) to begin this project. Effective locations for bike rental stations include in front of East, at Faraday, in front of Library, and in front of Harrington. Bike rental stations would also pay themselves in short time through

benefits to the environment, health, and safety. Lastly, more bicyclers on campus could help create a culture of biking at WPI which would reduce the amount of personal vehicles and increase these benefits.

Several survey respondent's comments mentioned that more bike security would make them more willing to have bicycles on campus. WPI could supplement security by adding bike storage rooms to all residence halls and a large one in the Park Ave. Garage for commuters to store bicycles. In these storage halls, an added benefit would be installing bicycle maintenance and air pumping stations as exists in the Park Ave. Garage.

Road infrastructure around campus could be improved for bicyclists. WPI should encourage Worcester to become more biker friendly and enhance their own road infrastructure as the city does.

We recommend that the WPI Department of Facilities install a WRTA Information Ticker and/or WRTA kiosk in the Rubin Campus Center.

Sections 4.3.2 and 4.4.3 describe how on-campus personal vehicle users and personal vehicle commuters said that more frequent or convenient WRTA routes would change how they travel. However, many of the comments in the survey about the WRTA included complaints about respondents not knowing bus schedule information, being confused about where the buses operate, and what locations the buses travel to. A few comments mentioned about the lack of WRTA buses that go to Union Station, when in fact every WRTA does in fact begin and end there.

Originally proposed by WRTA administrator Stephen O'Neil following our presentation to him, a WRTA information ticker can be installed in the campus center, providing a constant stream of information about the WRTA, current routes and times, and any notifications or alerts. The ticker would be in a prominent location, and would be constantly updated, most likely through the real-time BusTracker website the WRTA currently runs. Furthermore, we recommend the WPI Department of Facilities work with the WRTA to install and maintain a kiosk in the Rubin Campus Center, complete with information and maps of the bus routes, particularly those that service WPI. This way, many of the problems respondents mentioned in the survey, and in particular WPI community members unfamiliarity with the bus system, would be alleviated. According to Mr. O'Neil, the WRTA would buy the kiosk and install it in the campus center, as long as WPI maintains the kiosk following installation. We recommend installing the kiosk and the ticker as a way to bring the WRTA to the forefront for all community members passing through the Campus Center, and in turn boost usage of the service.

We recommend that the WRTA and WPI Department of Facilities work together to get a WRTA stop on campus.

As an extension of the previous recommendation, we recommend that the WRTA and the WPI Department of Facilities work together to get a WRTA stop on campus, ideally in Beech Tree Circle, or on Institute Road, near the Daniels residence hall. Currently, the WRTA has stops along Salisbury Street and Grove Street, the northern and eastern edges of campus. However, these are peripheral areas of campus, and are not located near the center of campus as are Beech Tree Circle and Institute Road. Having the buses on-campus versus on the periphery would greatly increase visibility for the buses, and make it much more convenient for WPI community members to depart/board the buses right from residence halls or academic buildings.

We recommend WPI Human Resources work with the MBTA to offer a reduced-price rate for the Commuter Rail.

As discussed in section 4.4.4, a significant number of faculty members live in areas that the Framingham/Worcester Line operates in. 38 percent of faculty car commuters who live in Worcester's surrounding communities said that a more frequent or convenient WRTA would possibly change how they travel, with 36 percent who live farther away reporting that they would possibly change how they travel. Getting these faculty members out of their cars and into MBTA trains would reduce the number of personal vehicle trips, and therefore boost WPI's sustainability. However, while the infrastructure is there (the MBTA has stops in many of the areas where faculty live), and while the MBTA is actually addressing faculty members' wishes of a more frequent and convenient MBTA with more trains and more times, commuting using the train is currently very expensive. An important component of sustainability is economic viability, and it is currently not economically viable to use the MBTA to commute to Worcester. The standard fare is $10.00, with a $3.00 surcharge for buying the ticket on the train. Interzone fares are available for commuters not coming from Boston, ranging from $2.50 to $5.50, increasing as the distance of the commute increases. Monthly passes are also available, ranging from $314 for commuters from Boston, to $82.00-$167.00 for interzone travel.

These prices rival the cost of operating a personal vehicle. However, the MBTA has several reduced-rate programs that we recommend WPI Human Resources look into. Either the Online Corporate Pass Program or the Semester Pass are potential cost-savers for MBTA commuters, and could make the commuter rail a viable transportation option for WPI faculty, and even staff and commuter students who live in areas serviced by the MBTA.

We recommend that the WPI Web Development Office create a clear, updated, and central website with information about all transportation options for WPI community members.

While researching other colleges' alternative transportation programs, we noticed that colleges with the most successful and utilized alternative transportation programs had detailed, dedicated web pages for these programs. Duke University, UC Davis, and UNH all had large amounts of information and detail about their modes of alternative transportation, incentives, and usage. WPI can follow suit by creating a similar page, with the following criteria:

- Fully describe public transportation options (WRTA, MBTA commuter rail) and provide links to their websites along with schedule and route information for WPI community members
- Fully describe all forms of WPI-owned alternative transportation options (Carpool World, bike rental program (if created), with schedules and pertinent information easily available
- List the incentives for using alternative transportation (should these be created)
- Include how-to guides for riding the WRTA bus (similar to the WPI Computing and Communication Center's how-to guides for network registration), addressing comments in our survey about not knowing how to ride the bus or where it goes.
- Provide clear maps of all alternative transportation accessible by WPI community members (i.e. locations of WRTA bus stops, Union Station, Zipcar parking spots, etc.)
- Link to Google Maps or create a map system that allows a user to enter their starting location and destination. The map program then lists the different modes of transportation that are available for this trip, the duration of the trip for each mode of transportation, and the estimated cost. This would most likely form the basis of an MQP.

As an alternative or supplement to the above items, list common destinations for WPI community members (Union Station, Price Chopper, etc.), and list the different modes of transportation that are available to get from campus to each location, the duration of the trip for each mode of transportation, and the estimated cost.

The WPI Web Development Office could identify the best ways to create such a website, and how best to advertise and promote all alternative transportation options for WPI community members, with an emphasis on sustainable transportation. Therefore, less emphasis would be placed on less sustainable forms of alternative transportation, such as the SNAP service, with more emphasis placed on carpooling, public transportation, biking and walking.

We recommend that the WPI Police Department through SNAP shuttles or Gateway Shuttles increase transportation routes to and from Union Station.

As we mentioned in an earlier recommendation, WPI has a significant number of faculty members along the Framingham/Worcester MBTA Commuter Line. Through survey analysis and comments we found that a main issue turning WPI community members away from the MBTA is lack of transportation to and from Union Station. Taxis can be expensive, walking takes over 20-30 minutes, and from discussion with WPI members and our own experience, the WRTA takes about 20 minutes to get from Union Station to WPI.

We believe the ideal option would be to have SNAP make dedicated pickups and drop-offs in coordination with the MBTA schedule during the morning and afternoon commuting times. In addition, if this were to be implemented, the WPI Police should advertise the service primarily through Human Resources but also through the Office of Student Life.

Conclusion

Sustainable, alternative transportation involves reducing the amount of single-passenger personal vehicle use in favor of more environmentally-friendly and economically viable forms of transportation. For the WPI community, this means getting people out of their cars and into WRTA buses, carpooling programs, bike rentals, and other forms of sustainable, alternative transportation. There are several alternative transportation options already available to WPI community members, but they are either not widely used or not widely known. However, as evidenced by our survey, large numbers of the WPI community are interested in alternative transportation if it were made easier or more convenient. Some of these wishes are already coming to fruition, as the MBTA is adding trains and times to its Framingham/Worcester commuter rail line, thus making the MBTA "more frequent/convenient." The WRTA is highly interested in gaining new riders in the form of WPI community members, and has worked with the university in the past to attract new riders. The Carpool World website is functional, but relatively unknown, which can be fixed with promotion and advertising. In all, a large potential exists for boosting the use of sustainable, alternative transportation by the WPI community.

APPENDIX A: CRIME MAP

The WPI community is notified via email of incidents on or near campus, as well as incidents concerning WPI students in off-campus housing. These incidents include assault, robbery, theft, and attempted break-ins, among others. After an incident occurs, students, faculty and staff are sent an email titled "Safety Notification" stating the type of crime, as well as the date and time the crime occurred. The email then links to the central WPI Campus Safety Notifications website, which provides a more detailed account of the incident, including a brief description of the crime and suspects, current status of investigation, contact information, and specific preparation advice relevant to that crime. This information is available on the website for every crime that meets criteria that has occurred from September 3, 2008 until the present, as is regularly updated.

From this information, the team utilized Google Earth to compile a "Crime Map" of the WPI community. Using an aerial view of the WPI campus and its surrounding areas, the team placed markers at the locations of every crime reported on the Safety Notifications website. However, some notifications listed only the street the crime occurred at, and not the physical address. Therefore, the team produced a second, more refined Crime Density Map, included in this Appendix. Instead of markers for individual incidents, streets and intersections are marked by the number of incidents that occurred on them. The legend is as follows:

- Green indicates that no crimes occurred in the immediate vicinity
- Yellow indicates that one crime occurred in this area, or that one or more crimes occurred near this area (i.e. this area is adjacent to a high crime area)
- Orange indicates that two crimes occurred in this area
- Red indicates that three or more crimes occurred in this area

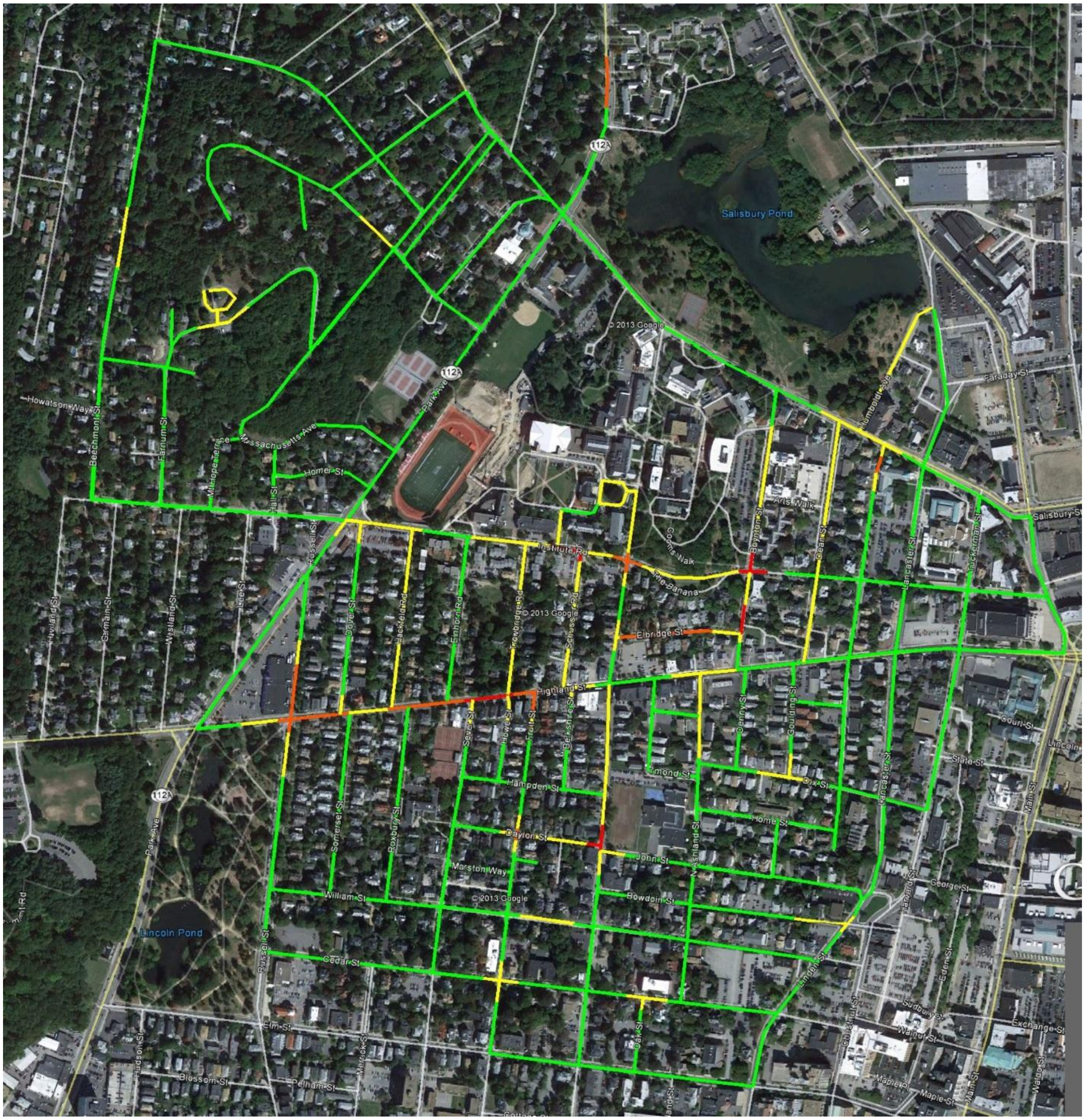


Figure 34: Crime Density Map

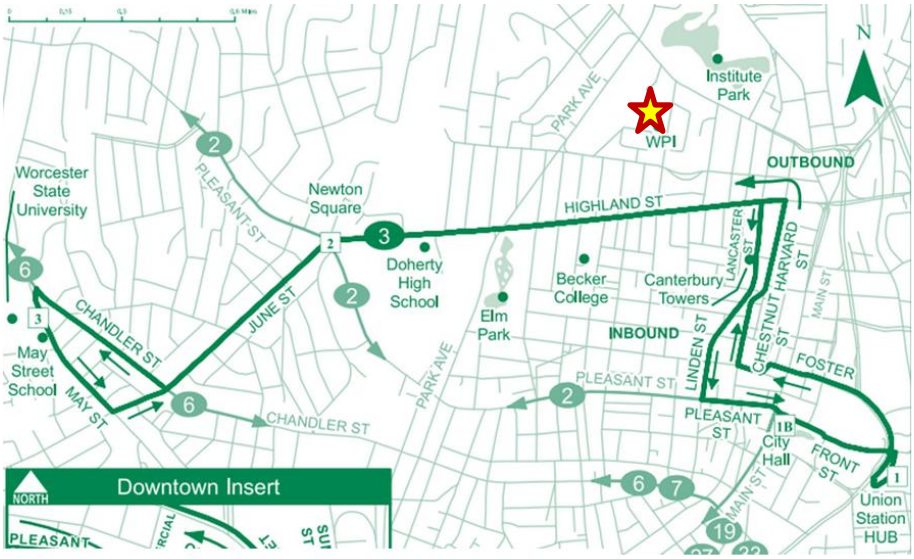
The map uses data from October 4, 2008 to August 29, 2013, and includes nearly every crime reported by the Safety Notifications website for roughly five years. While the map cannot predict just where crimes will take place, it provides a big-picture look at where crime hot-spots around campus are, important information when discussing bike paths, bus stops, etc.

From the map, several areas of interest are illustrated. Elevated crime areas include a significant portion of Highland Street, the location of numerous shops and restaurants frequented by WPI students. The intersections of Institute Road and Boynton Street, as well as Institute

Road and Schussler Road are other crime hot-spots, and the area around Price Chopper, a major destination for WPI students, has elevated crime levels as well

APPENDIX B: WORCESTER REGIONAL TRANSIT AUTHORITY (WRTA) ROUTES

Route 3 (Union Station Hub – Worcester State University via Highland St.)



OUTBOUND WRTA

WEEKDAYS

See the map for matching timepoint locations

	1 BUS STARTS Union Station Hub	2 BUS Leaves Newton Square	3 BUS ENDS Worcester State University
AM	5:05	5:15	5:25
	5:50	6:00	6:10
	6:45	6:55	7:10
	7:40	7:50	8:05
	8:40	8:50	9:05
	9:40	9:50	10:05
	10:40	10:50	11:05
	11:40	11:50	12:05
PM	12:40	12:50	1:05
	1:40	1:50	2:05
	2:40	2:50	3:05
	3:40	3:50	4:05
	4:40	4:50	5:05
	5:40	5:50	6:05
	6:40	6:50	7:00
	7:35	7:45	7:55
	9:20	9:27	9:35
	10:20	10:27	10:35
	11:35	11:42	11:50

SATURDAYS

	1 BUS STARTS Union Station Hub	2 BUS Leaves Newton Square	3 BUS ENDS Worcester State University
AM	10:20	10:30	10:40
	11:20	11:30	11:40
PM	12:20	12:30	12:40
	1:20	1:30	1:40
	2:20	2:30	2:40
	3:20	3:30	3:40
	4:20	4:30	4:40
	5:20	5:30	5:40

NO SUNDAY SERVICE

INBOUND WRTA

WEEKDAYS

See the map for matching timepoint locations

	3 BUS STARTS Worcester State University	2 BUS Leaves Newton Square	1B BUS Leaves City Hall Front St.	1 BUS ENDS Union Station Hub
AM	5:25	5:30	5:40	5:45
	6:10	6:15	6:25	6:30
	7:10	7:15	7:25	7:30
	8:05	8:15	8:25	8:30
	9:05	9:15	9:25	9:30
	10:05	10:15	10:25	10:30
	11:05	11:15	11:25	11:30
PM	12:05	12:15	12:25	12:30
	1:05	1:15	1:25	1:30
	2:05	2:15	2:25	2:30
	3:05	3:15	3:25	3:30
	4:05	4:15	4:25	4:30
	5:05	5:15	5:25	5:30
	6:05	6:15	6:25	6:30
	7:00	7:10	7:20	7:25
	7:55	8:00	8:10	8:15
	9:35	9:38	9:45	9:50
	10:35	10:38	10:45	10:50

SATURDAYS

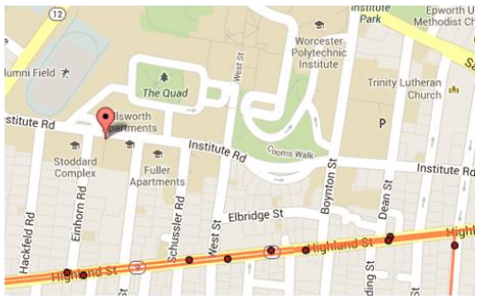
	3 BUS STARTS Worcester State University	2 BUS Leaves Newton Square	1B BUS Leaves City Hall Front St.	1 BUS ENDS Union Station Hub
AM	10:40	10:45	10:55	11:00
PM	11:40	11:45	11:55	12:00
	12:40	12:45	12:55	1:00
	1:40	1:45	1:55	2:00
	2:40	2:45	2:55	3:00
	3:40	3:45	3:55	4:00
	4:40	4:45	4:55	5:00
	5:40	5:45	5:55	6:00

– PLEASE NOTE –

On Weekdays, most inbound Route 3 buses continue as Route 30 outbound.

On Saturdays, most inbound Route 3 buses continue as Route 19 outbound.

NO SUNDAY SERVICE



ROUTE 8 (Union Station Hub – Greendale Mall via Shore Drive)

OUTBOUND WRTA

WEEKDAYS

See the map for matching timepoint locations

	1 BUS STARTS Union Station Hub	1A BUS LEAVES City Hall Main St	2 BUS LEAVES Salisbury & Park Ave	3 BUS LEAVES WRTA Park Ave	4 BUS LEAVES Shore Drive	5 BUS ENDS Greendale Mall
AM	5:30	5:33	5:40	5:43	5:50	6:00
	6:30	6:33	6:40	6:43	6:50	7:00
	7:30	7:33	7:40	7:43	7:50	8:00
	8:30	8:33	8:40	8:43	8:50	9:00
	9:30	9:33	9:40	9:43	9:50	10:00
	10:30	10:33	10:40	10:43	10:50	11:00
	11:30	11:33	11:40	11:43	11:50	12:00
PM	12:30	12:33	12:40	12:43	12:50	1:00
	1:30	1:33	1:40	1:43	1:50	2:00
	2:30	2:33	2:40	2:43	2:50	3:00
	3:30	3:33	3:40	3:43	3:50	4:00
	4:30	4:33	4:40	4:43	4:50	5:00
	5:30	5:33	5:40	5:43	5:50	6:00
	6:30	6:33	6:40	6:43	6:50	7:00

NO SATURDAY OR SUNDAY SERVICE

INBOUND

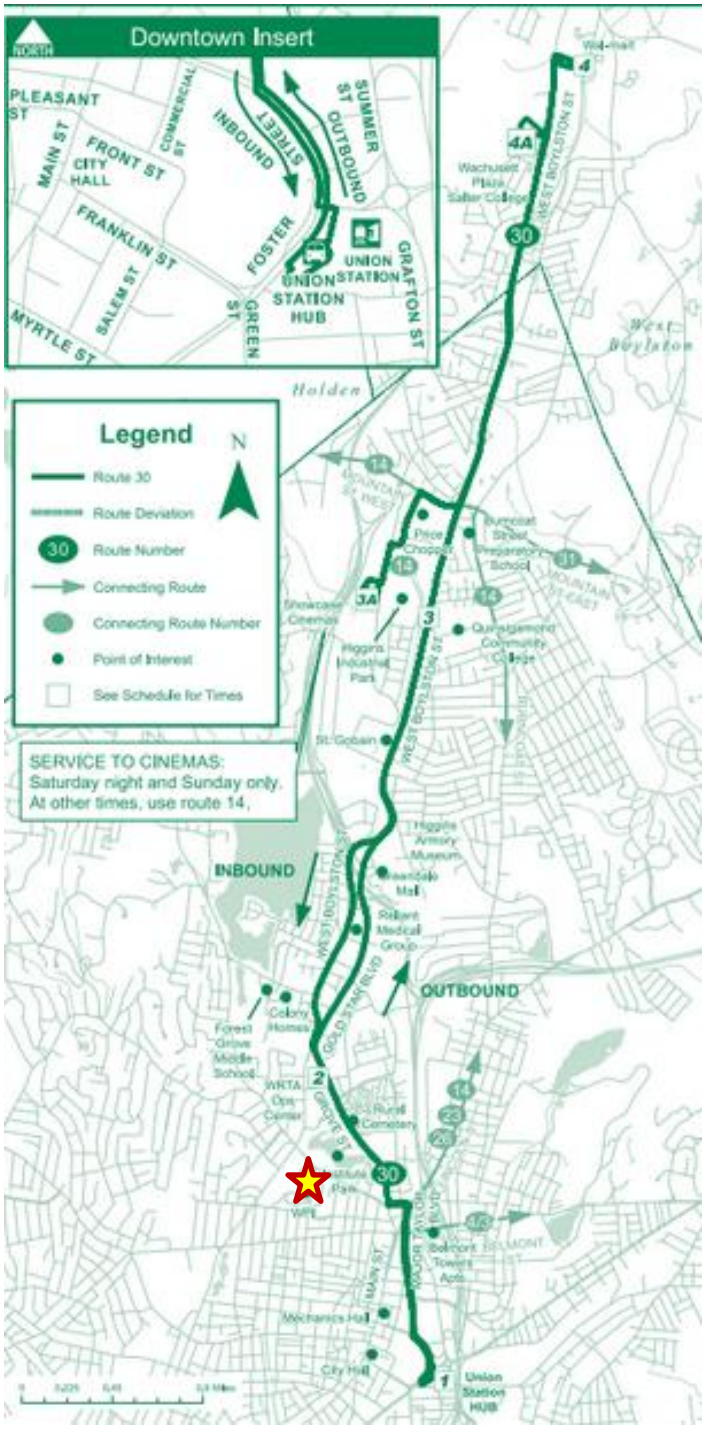
WEEKDAYS

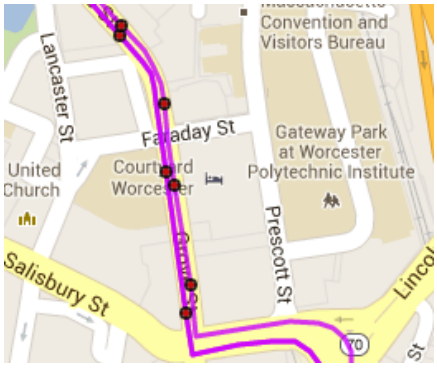
See the map for matching timepoint loca

	5 BUS STARTS Greendale Mall	4 BUS LEAVES Shore Drive	3 BUS LEAVES WRTA Park Ave	2 BUS LEAVES Salisbury & Park Ave	1B BUS LEAVES City Hall Front Stre
AM	6:00	6:07	6:15	6:18	6:25
	7:00	7:07	7:15	7:18	7:25
	8:00	8:07	8:15	8:18	8:25
	9:00	9:07	9:15	9:18	9:25
	10:00	10:07	10:15	10:18	10:25
	11:00	11:07	11:15	11:18	11:25
PM	12:00	12:07	12:15	12:18	12:25
	1:00	1:07	1:15	1:18	1:25
	2:00	2:07	2:15	2:18	2:25
	3:00	3:07	3:15	3:18	3:25
	4:00	4:07	4:15	4:18	4:25
	5:00	5:07	5:15	5:18	5:25
	6:00	6:07	6:15	6:18	6:25
	7:00	7:07	7:15	7:18	7:25

NO SATURDAY OR SUNDAY SERVICE

Route 30 – (Union Station Hub – W. Boylston Wal-Mart via Grove St. & W. Boylston St.)





OUTBOUND

WEEKDAYS

See the map for matching timepoint locations

	1 BUS STARTS Union Station Hub	2 BUS Leaves WRTA Ops Ctr.	3 BUS Leaves Quinsigamond Community College	4A BUS Leaves Wachusett Plaza	3A BUS Leaves Showcase Cinemas	4 BUS ENDS Wal-Mart
AM	5:45	5:55	6:05	BR		6:15
	6:00	6:10	6:22	BR		6:35
	6:30	6:40	6:50	BR		7:05
	7:00	7:10	7:20	BR		7:35
	7:30	7:40	7:50	BR		8:05
	8:00	8:10	8:20	BR		8:35
	8:30	8:40	8:50	BR		9:05
	9:00	9:10	9:20	BR		9:35
	9:30	9:40	9:50	BR		10:05
	10:00	10:10	10:20	BR		10:35
	10:30	10:40	10:50	BR		11:05
	11:00	11:10	11:20	BR		11:35
	11:30	11:40	11:50	BR		12:05
PM	12:00	12:10	12:20	BR		12:35
	12:30	12:40	12:50	BR		1:05
	1:00	1:10	1:20	BR		1:35
	1:30	1:40	1:50	BR		2:05
	2:00	2:10	2:20	BR		2:35
	2:30	2:40	2:50	BR		3:05
	3:00	3:10	3:20	BR		3:35
	3:30	3:40	3:50	BR		4:05
	4:00	4:10	4:20	BR		4:35
	4:30	4:40	4:50	BR		5:05
	5:00	5:10	5:20	BR		5:35
	5:30	5:40	5:50	BR		6:05
	6:00	6:10	6:20	BR		6:35
	6:30	6:35	6:50	BR		7:00
	7:00	7:10	7:19	BR		7:30
	7:25	7:35	7:44	BR		7:55
	8:00	8:10	8:19	BR		8:30
	8:15	8:28	8:35		8:42	
	9:15	9:28	9:35		9:42	
	10:15	10:28	10:35		10:42	
	11:35	11:48	11:55		12:02	

BUS ENTERS WACHUSETT PLAZA (SALTER COLLEGE) BY REQUEST ON MOST WEEKDAY AND SATURDAY OUTBOUND TRIPS.

SATURDAYS

See the map for matching timepoint locations

	1 BUS STARTS Union Station Hub	2 BUS Leaves WRTA Ops Center	3 BUS Leaves Quinsigamond Community College	4A BUS Leaves Wachusett Plaza	4 BUS Leaves Wal-Mart	3A BUS ENDS Showcase Cinemas
AM	5:50	6:00	6:10	BR	6:25	
	6:50	7:00	7:10	BR	7:25	
	7:50	8:00	8:10	BR	8:25	
	8:50	9:00	9:10	BR	9:25	
	9:50	10:00	10:10	BR	10:25	
	10:50	11:00	11:10	BR	11:25	
	11:50	12:00	12:10	BR	12:25	
PM	12:50	1:00	1:10	BR	1:25	
	1:50	2:00	2:10	BR	2:25	
	2:50	3:00	3:10	BR	3:25	
	3:50	4:00	4:10	BR	4:25	
	4:50	5:00	5:10	BR	5:25	
	5:50	6:00	6:10	BR	6:20	6:32
	6:50	7:00	7:10	BR	7:20	7:32
	7:50	8:00	8:10	BR	8:20	8:32
	8:50	9:00	9:10	BR	9:20	9:32

SUNDAYS

	1	2	3	4	3A
AM	11:00	11:10	11:18	11:26	11:40
	12:00	12:10	12:18	12:26	12:40
PM	1:00	1:10	1:18	1:26	1:40
	2:00	2:10	2:18	2:26	2:40
	3:00	3:10	3:18	3:26	3:40
	4:00	4:10	4:18	4:26	4:40
	5:00	5:10	5:18	5:26	5:40
	6:00	6:09	6:16	6:25*	

**This trip ends at Walmart.*

BUS ENTERS WACHUSETT PLAZA (SALTER COLLEGE) BY REQUEST ON ALL SATURDAY OUTBOUND TRIPS.

INBOUND

WEEKDAYS

See the map for matching timepoint locations

	4 BUS STARTS Wal-Mart	3A BUS Leaves Showcase Cinemas	4A BUS Leaves Wachusett Plaza	3 BUS Leaves Quinsigamond Community College	2 BUS Leaves WRTA Ops Center	1 BUS ENDS Union Station Hub
AM	5:45			5:47	5:55	6:10
	6:15			6:24	6:34	6:45
	6:35		6:38	6:47	6:55	7:10
	7:05		7:08	7:17	7:25	7:40
	7:35		7:38	7:47	7:55	8:10
	8:05		8:08	8:17	8:25	8:40
	8:35		8:38	8:47	8:55	9:10
	9:05		9:08	9:17	9:25	9:40
	9:35		9:38	9:47	9:55	10:10
	10:05		10:08	10:17	10:25	10:40
	10:35		10:38	10:47	10:55	11:10
	11:05		11:08	11:17	11:25	11:40
	11:35		11:38	11:47	11:55	12:10
PM	12:05		12:08	12:17	12:25	12:40
	12:35		12:38	12:47	12:55	1:10
	1:05		1:08	1:17	1:25	1:40
	1:35		1:38	1:47	1:55	2:10
	2:05		2:08	2:17	2:25	2:40
	2:35		2:38	2:47	2:55	3:10
	3:05		3:08	3:17	3:25	3:40
	3:35		3:38	3:47	3:55	4:10
	4:05		4:08	4:17	4:25	4:40
	4:35		4:38	4:47	4:55	5:10
	5:05		5:08	5:17	5:25	5:40
	5:35		5:38	5:47	5:55	6:10
	6:05		6:08	6:17	6:25	6:40
	6:35		6:38	6:47	6:55	7:10
	7:00		7:03	7:12	7:20	7:35
	7:30		7:38	7:47	7:55	8:10
	7:55		7:58	8:04	8:14	8:25
	8:30		8:38	8:47	8:55	9:10
		8:45		8:52	9:00	9:15
		9:45		9:52	10:00	10:15
		11:00		11:07	11:15	11:30

BUS ENTERS WACHUSETT PLAZA (SALTER COLLEGE) ON ALL WEEKDAY INBOUND TRIPS ORIGINATING AT WAL-MART.

SATURDAYS

See the map for matching timepoint locations

	4 BUS STARTS Wal-Mart	3A BUS Leaves Showcase Cinemas	3 BUS Leaves Quinsigamond Community College	2 BUS Leaves WRTA Ops Center	1 BUS ENDS Union Station Hub
AM	6:25		6:42	6:50	7:00
	7:25		7:42	7:50	8:00
	8:25		8:42	8:50	9:00
	9:25		9:42	9:50	10:00
	10:25		10:42	10:50	11:00
	11:25		11:42	1:50	12:00
PM	12:25		12:42	12:50	1:00
	1:25		1:42	1:50	2:00
	2:25		2:42	2:50	3:00
	3:25		3:42	3:50	4:00
	4:25		4:42	4:50	5:00
	5:25		5:42	5:50	6:00
		6:32	6:42	6:50	7:00
		7:32	7:42	7:50	8:00
		8:32	8:36	8:41	8:47
		9:32	9:36	9:41	9:47

SUNDAYS

	3A	3	2	1
AM	11:40	11:45	11:50	12:00
PM	12:40	12:45	12:50	1:00
	1:40	1:45	1:50	2:00
	2:40	2:45	2:50	3:00
	3:40	3:45	3:50	4:00
	4:40	4:45	4:50	5:00
	5:40	5:45	5:50	6:00

– PLEASE NOTE –

On Saturdays, most inbound Route 30 buses continue as Route 6 outbound.

ROUTE 31 (Union Station Hub – Lincoln Plaza via Grove St. & W. Boylston St.)

OUTBOUND — WEEKDAYS

See the map for matching timepoint locations

	1 BUS STARTS Union Station Hub	2 BUS Leaves WRTA Ops Center	3 BUS Leaves Quinsigamond Comm. College	4 BUS Leaves Summit East Mtn. Burncoat St.	5 BUS Leaves Great Brook Valley	6 BUS ENDS Lincoln Plaza
AM	5:15	5:22	5:30	5:33	5:37	5:50
	6:15	6:22	6:30	6:33	6:37	6:50
	7:15	7:22	7:30	7:33	7:37	7:50
	8:15	8:22	8:30	8:33	8:37	8:50
	9:15	9:22	9:30	9:33	9:37	9:50
	10:15	10:22	10:30	10:33	10:37	10:50
	11:15	11:22	11:30	11:33	11:37	11:50
PM	12:15	12:22	12:30	12:33	12:37	12:50
	1:15	1:22	1:30	1:33	1:37	1:50
	2:15	2:22	2:30	2:33	2:37	2:50
	3:15	3:22	3:30	3:33	3:37	3:50
	4:15	4:22	4:30	4:33	4:37	4:50
	5:15	5:22	5:30	5:33	5:37	5:50
	6:15	6:22	6:30	6:33	6:37	6:50
	7:15	7:22	7:30	7:33	7:37	7:50
	8:15	8:22	8:30	8:33	8:37	8:50

INBOUND — WEEKDAYS

See the map for matching timepoint locations

	6 BUS STARTS Lincoln Plaza	5 BUS Leaves Great Brook Valley	4 BUS Leaves Summit E. Mountain Burncoat St.	3 BUS Leaves Quinsigamond Community College	2 BUS Leaves WRTA Ops Center	1 BUS ENDS Union Station Hub
				*4:55	5:05	5:15
AM	5:50	5:55	6:01	6:05	6:15	6:25
	6:50	6:55	7:01	7:05	7:15	7:25
	7:50	7:55	8:01	8:05	8:15	8:25
	8:50	8:55	9:01	9:05	9:15	9:25
	9:50	9:55	10:01	10:05	10:15	10:25
	10:50	10:55	11:01	11:05	11:15	11:25
PM	11:50	11:55	12:01	12:05	12:15	12:25
	12:50	12:55	1:01	1:05	1:15	1:25
	1:50	1:55	2:01	2:05	2:15	2:25
	2:50	2:55	3:01	3:05	3:15	3:25
	3:50	3:55	4:01	4:05	4:15	4:25
	4:50	4:55	5:01	5:05	5:15	5:25
	5:50	5:55	6:01	6:05	6:15	6:25
	6:50	6:55	7:01	7:05	7:15	7:25

*This inbound trip begins at Brook Street & West Mountain Street

SATURDAYS

	1 BUS STARTS Union Station Hub	2 BUS Leaves WRTA Ops Center	3 BUS Leaves Quinsigamond Community College	4 BUS Leaves Summit East Mtn Burncoat St.	5 BUS Leaves Great Brook Valley	6 BUS ENDS Lincoln Plaza
AM	11:20	11:27	11:35	11:38	11:42	11:55
PM	12:20	12:27	12:35	12:38	12:42	12:55
	1:20	1:27	1:35	1:38	1:42	1:55
	2:20	2:27	2:35	2:38	2:42	2:55
	3:20	3:27	3:35	3:38	3:42	3:55
	4:20	4:27	4:35	4:38	4:42	4:55
	5:20	5:27	5:35	5:38	5:42	5:55

– PLEASE NOTE –

On Weekdays, all inbound Route 31 buses continue as Route 25 outbound

NO SUNDAY SERVICE

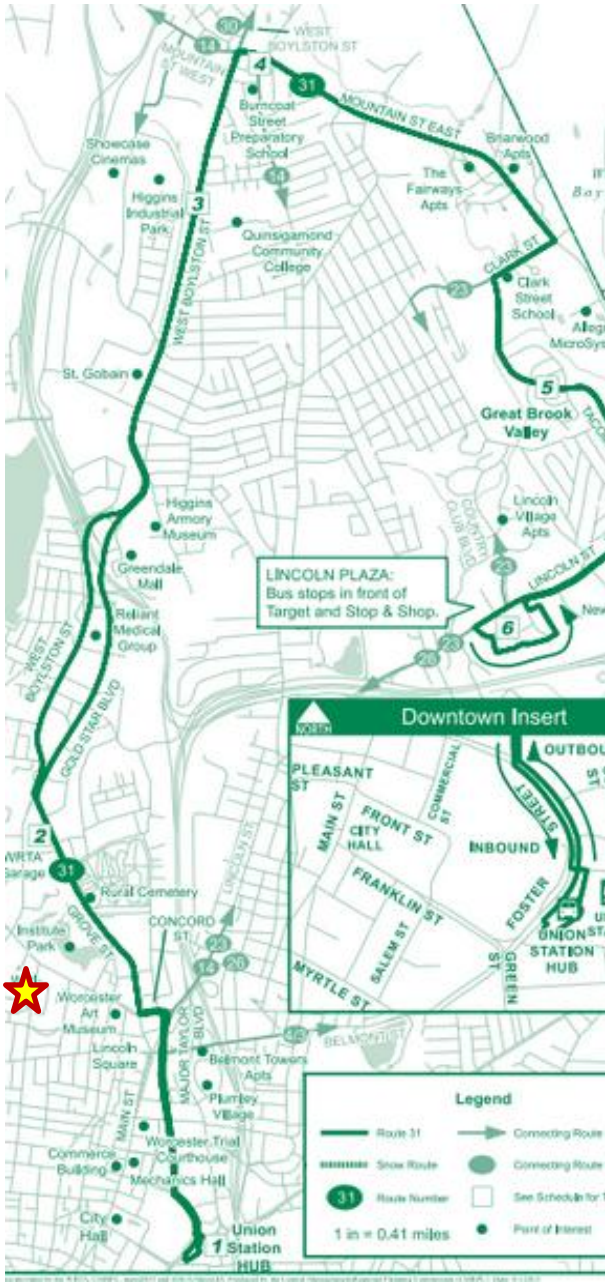
SATURDAYS

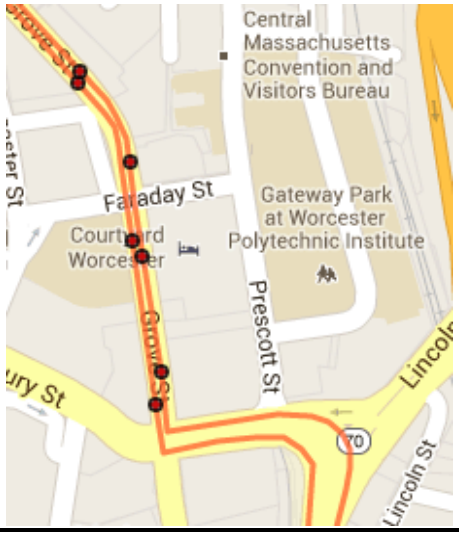
	6 BUS STARTS Lincoln Plaza	5 BUS Leaves Great Brook Valley	4 BUS Leaves Summit East Mtn. Burncoat St.	3 BUS Leaves Quinsigamond Community College	2 BUS Leaves WRTA Ops Center	1 BUS ENDS Union Station Hub
AM	10:55	11:00	11:06	11:10	11:20	11:30
PM	11:55	12:00	12:06	12:10	12:20	12:30
	12:55	1:00	1:06	1:10	1:20	1:30
	1:55	2:00	2:06	2:10	2:20	2:30
	2:55	3:00	3:06	3:10	3:20	3:30
	3:55	4:00	4:06	4:10	4:20	4:30
	4:55	5:00	5:06	5:10	5:20	5:30

– PLEASE NOTE –

On Saturdays, most inbound Route 31 buses continue as Route 25 outbound.

NO SUNDAY SERVICE





APPENDIX C: COMMUTER STUDENT, FACULTY AND STAFF MAPS

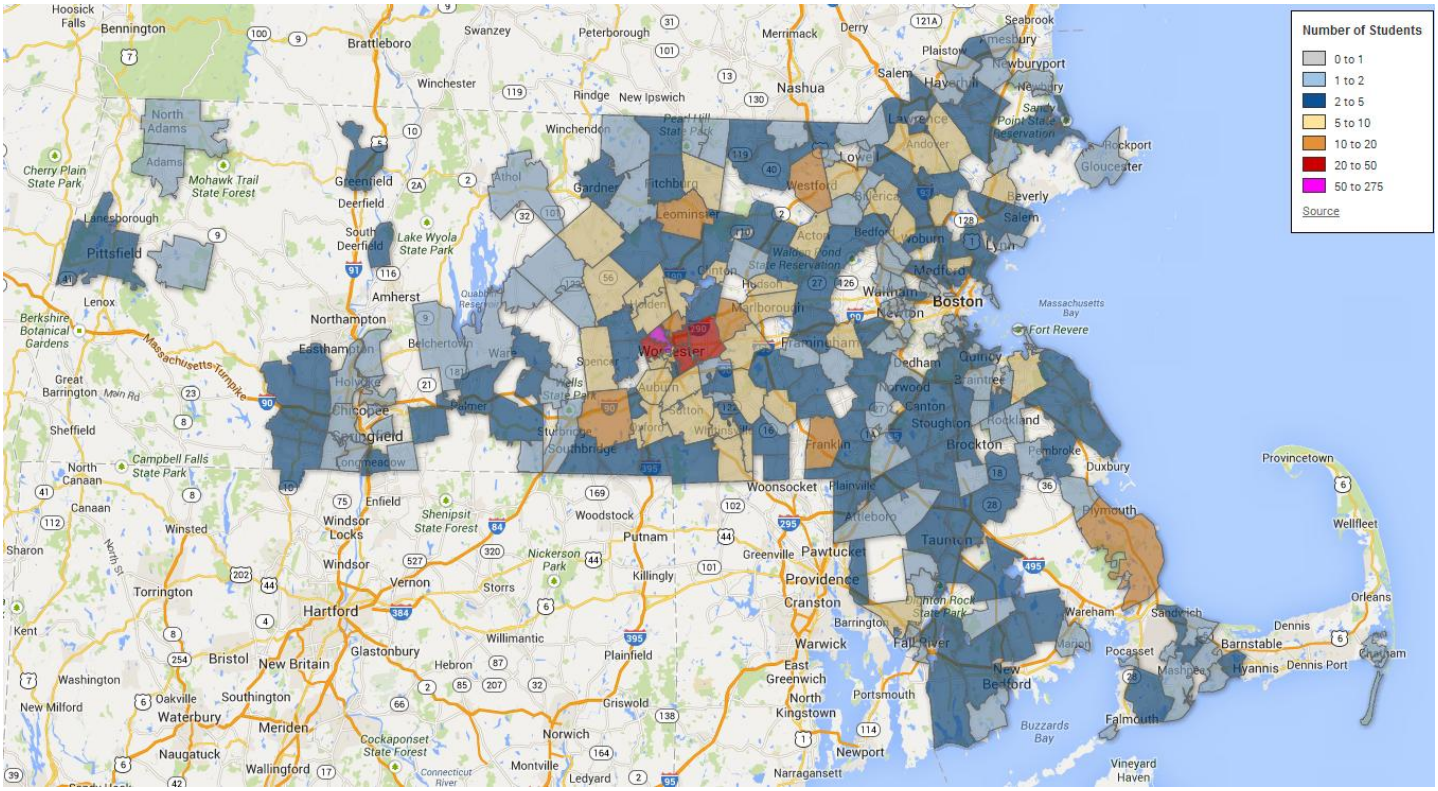


Figure 35: Commuter Students Map

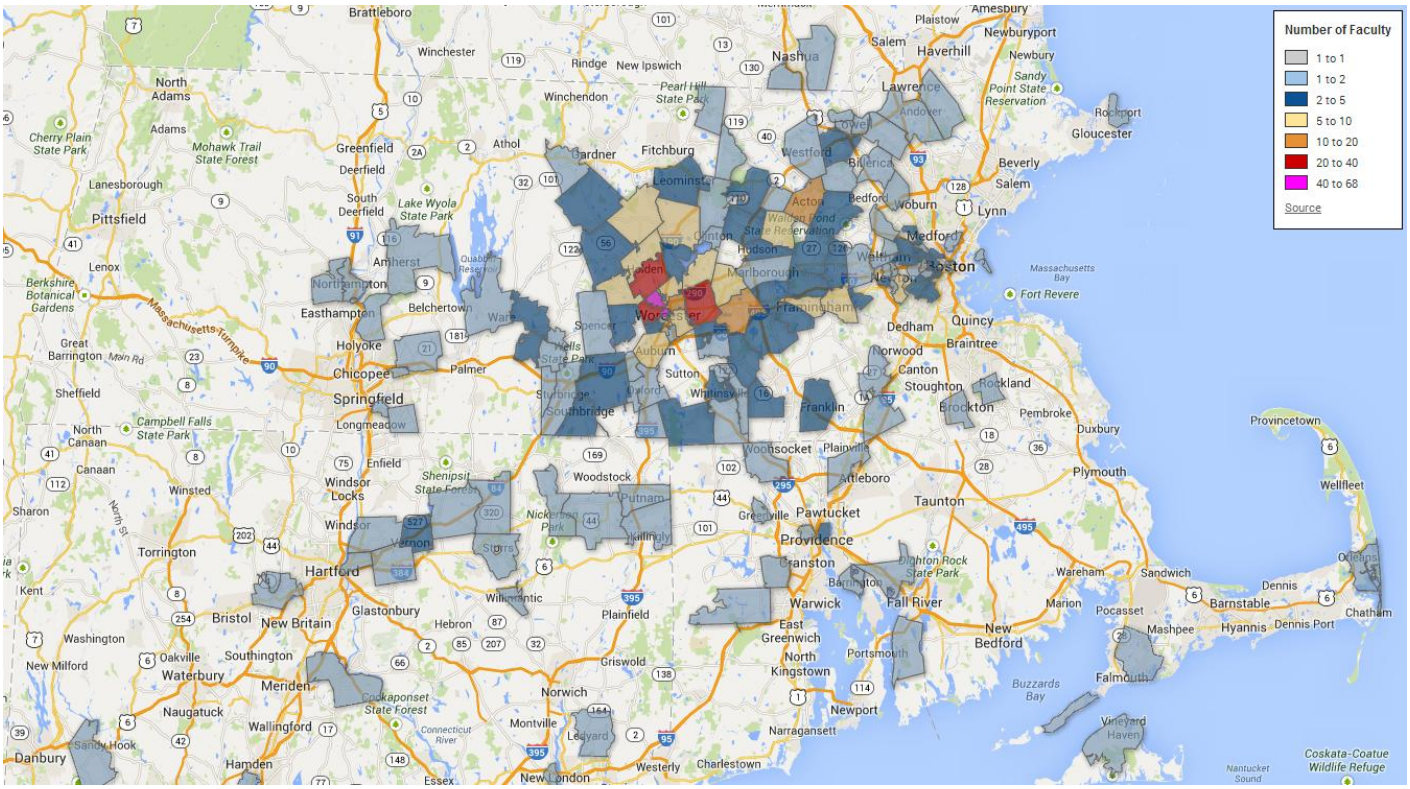


Figure 36: Faculty Map

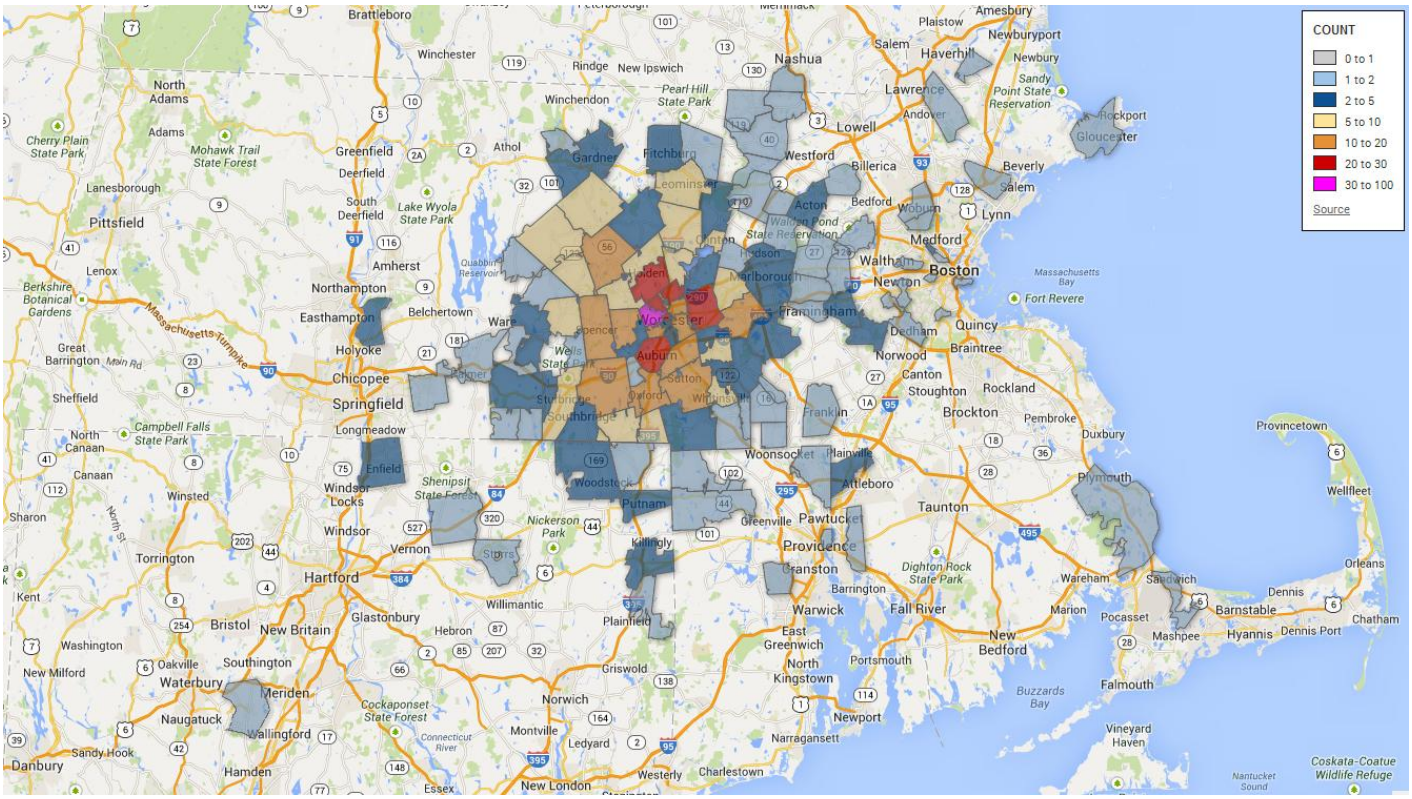


Figure 37: Staff Map

APPENDIX D: WRTA BUS EXPERIENCES

WPI to Target Plaza (Saturday November 16, 2013)

Two members of the team simulated a trip by a WPI student from the main campus to Lincoln Plaza, where Target, Dick's Sporting Goods, and Stop & Shop are located. Lincoln Plaza is 2.6 miles away from WPI by road, and takes roughly ten minutes to drive to with average traffic. Using the WRTA website, the team members found a route that connected WPI and Lincoln Plaza: Route 31. The bus tracker service, which displays the location of every stop on the route and provides real-time updates on where the bus is, proved to be slightly confusing. The bus tracker only showed when the next bus was, not any of the buses after, which meant that the team members (who wanted to leave around 2:30 PM), could not see buses for that time if they looked at 12:30 PM. Also, the inbound/outbound indication proved to be confusing. At first, one member of the team thought that the inbound/outbound text on every stop signified that that particular stop was for an inbound or outbound bus only. This led to confusion once the team member saw that every stop was marked "outbound." It was later realized that the indicator shows not whether the stop is inbound or outbound, but whether the bus on that line is currently inbound or outbound.

Route 31 has stops on Grove Street at the Faraday residence hall, so the team members decided to get on the bus at that location. Consulting a PDF of the entire route schedule proved to be much easier to follow, and the team members saw that a bus passed by Faraday between 2:20 and 2:27 PM (it is located in-between the two stops with these times). The bus would then arrive at Lincoln Plaza at 2:55 PM, before turning into an inbound bus to Union Station. The next bus would arrive at Lincoln Plaza one hour later at 3:55 PM, and follow suit.

Figure 38: WRTA Bus Stop

The two team members arrived at the stop (Stop 385) on time, and noticed that the stop was on the wrong side of the street for an outbound bus. There was no indication on the sign about what side of the street the bus would be on, but luckily the team realized that for an outbound bus, the bus would be on the *other* side of the street. There was a stop on the other side of the street (Stop 368), which the team relocated to.

The stop itself consisted of a pole with a sign at the top showing it was a WRTA stop and indicating what route(s) that the stop was for (although this one in particular did not for unknown reasons). A second sign at chest-level indicated what the stop number was, had a QR code for a smartphone to scan that linked to the online bus tracker, provided a phone number to call for the bus tracker, and listed a number to text to show upcoming bus times. Both members had so-called "dumb" phones that did not have access to the internet, so they tried the texting option.

Figure 39: Detail of WRTA Bus Stop

Immediately, the team received a text stating the time of the text (2:21 PM), the location of the stop (Grove Street and Faraday Street), the route number (31) the ending destination (G.B.V./LIN), and the estimated time of arrival (3 min). This proved to be extremely useful, as it ensured they were at the proper place, and gave them an idea of when the bus would arrive.

The bus arrived at 2:27 PM, a minute or so late but still within reason, and drove up to the stop without needing a prompt by the team members. The first team member paid the $1.50 for a one-way pass in the mandated exact change. The second member paid a reduced-fare of $1.30 using a CharlieCard, which is valid for all WRTA buses, and the MBTA T and Commuter Rail. This second option proved to be easier and much faster than the first, as the card simply needed to be tapped on a sensor to make the transaction. The bus itself was roomy and varied from nearly empty to ¼ full during the route.

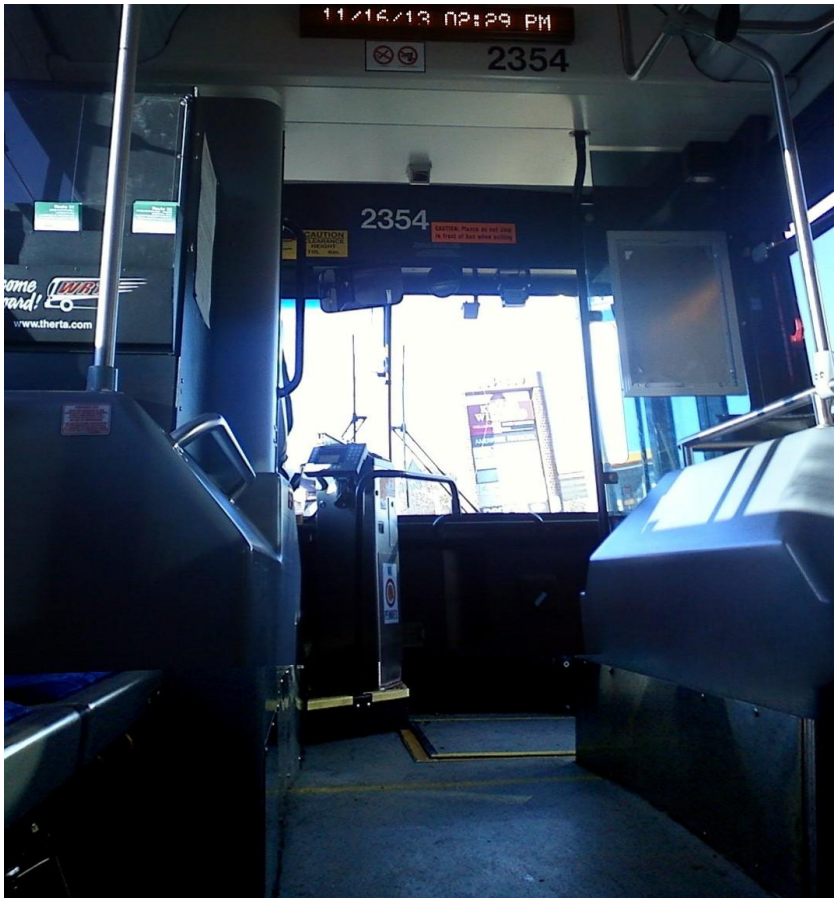


Figure 40: Interior of WRTA Bus

While on the bus, the team members noted that there were plenty of stops, at least one every thirty seconds for the majority of the ride. Riders frequently got on and off

during the ride, with the bus stopping at many of the stops. When a rider wanted to get off, they pulled a thin yellow cord that ran the length of the bus on either wall, which provided the bus driver and the passengers an audio notice of "stop requested," and a text of that message on the display screen towards the front of the bus. The bus then pulled over at the next bus stop.

The ride itself was bumpy and not incredibly pleasant, but nonetheless satisfactory. The driver drove reasonably, only acting aggressively once (driving on the wrong side of the road for a few moments when a car waiting to turn right onto a side street while no oncoming cars were coming). The bus arrived at Lincoln Plaza on time, stopping at Target at 2:52 PM, where the first team member got off. The bus then stopped in front of Stop & Shop at 2:53 PM, before waiting at a designated stop just outside of Lincoln Plaza for a few minutes. The remaining team member elected to stay on the bus for the return trip to WPI, as the other team member remained at Lincoln Plaza to catch the next bus one hour later.

The return trip to WPI was along the lines of the trip to Lincoln Plaza, and the bus arrived at the Grove Street/Faraday Street stop (the stop on the other side of the street that the team originally went to) at 3:20 PM, a few minutes ahead of its scheduled time (after 3:20 PM but before 3:30 PM).

Overall, the team noted that while the bus tracker was confusing to use, actually using the bus was very easy. While riding the bus took far longer to get to Lincoln Plaza than driving (approximately half an hour versus ten minutes), the bus arrived and departed relatively on time. Getting on and off the bus, payment, and riding the bus was a simple and straightforward procedure. However, a few problems remain. For grocery trips where a student would buy a large amount of groceries, the bus is not a particularly viable method of transport, as transporting a large number of groceries by bus would be cumbersome and awkward. Also, it would be difficult to use the bus to go to Stop & Shop to buy time-sensitive food items, like meat or frozen dinners, as the bus does not return for an hour, and the trip back is about twenty minutes, not including the walk from Faraday to wherever the student lives.

Figure 41: WRTA Bus Stopped at Stop & Shop

WPI to Union Station (Saturday, November 16, 2013)

Two members of the team aimed to catch a Route 3 WRTA bus that makes stops on Highland Street from

3:45-3:55 PM on Saturdays. This bus was going inbound to Union Station, simulating a WPI student taking the bus to catch a train at the station. One member arrived late, and unfortunately both of the team members missed the bus, with the next available inbound bus to Union Station an hour away.

The team members then looked on the WRTA website at two other routes that service WPI: Routes 30 and 31. The website showed a bus making an inbound stop at the WRTA Operation Center at 4:10pm. The team then drove to the parking area behind Jillian's Restaurant to get close to the stop, arriving at 3:55pm. Outside, there was a computer monitor mounted on the side of the building displaying available bus times, displaying that the next inbound bus was coming about 10 minutes late by using the Bus Tracker on the website. At 4:30pm, the bus was a couple minutes away according to the bus tracker. A couple minutes later, the monitor showed that the bus was approaching, but as the team looked down Grove Street towards Park Avenue, the bus was not there. The bus was actually coming from the opposite direction, on the other side of the street.

The team members then realized what they were seeing was the time for the outbound bus. After not being sure what direction the buses were going from the Bus Tracker, the team members decided not to go on the bus at all due the fact that once they arrived at Union Station, they would still have to take another bus back to WPI, and it was getting late.

WPI to Union Station (Friday, December 6, 2013)

Two team members arrived in front of Goddard Hall on Salisbury Street at 1:15pm, expecting that the bus was going to arrive a few minutes later from the original online PDF schedule from the WRTA website. One member used his smartphone to check how far the bus was from our stop, and the bus arrived on-time at 1:21pm. Throughout the trip, one team member used his iPod as a stopwatch to keep track of how certain milestones of the trip took.

Entering the bus, both team members paid $1.50 into the machine. The team members assumed they needed exact change for the fee to put into the machine, but one realized that the machine has a change slot, so exact change was not necessary. The bus was mostly full, with few empty seats. After about 19 minutes being on the bus, it entered the sheltered outdoor waiting area at the Hub, near Union Station, just as the bus the team members were planning on taking back to WPI was leaving, meaning that the bus they were on was arriving late. The team members entered the WRTA Hub building to see the size of the waiting area for riders, which consisted of several benches and a Dunkin' Donuts. Additionally, both the inside and outside waiting areas had displays of the next available route numbers with designations and the amount of time before the arrival of the bus for that route.

The team members decided to head back outside, due to the congestion of the smaller inside waiting area. As they waited for the bus to take them back to WPI, the team observed that every bus has a bus rack for two bikes. Also, circular bike poles were available at the stop to chain, lock, and secure a person's bike. There was also a small air pump station.

After only ten minutes of waiting at the WRTA Hub, one team member noticed that the Bus Tracker app stated that there was a Route 8 bus coming in. A couple minutes later, the app showed the bus approaching the station. The team members looked around and waited for the bus to actually approach, but eventually realized that it was a glitch in the system.

After waiting half an hour as expected, the Route 27 bus arrived at the stop on time, and one team member boarded the bus. (The other took a different bus back to WPI, which arrived shortly afterward.)

Union Station to Kleen' N Hard Sports (Friday, December 6, 2013)

The bus was full of passengers and as it travelled, the passengers were pulling the yellow cord at least once every tenth to quarter of a mile. The team member politely started a short conversation with a passenger, asking her opinion of the new system. It was clear that the passenger was not satisfied. She stated that the new routes and schedules are confusing changes from the older system, which was more convenient and involved less walking to catch the bus, especially for the elderly. She also mentioned that the older Hub was better for passengers than the new location at Union Station, because the older Hub had an outdoor waiting area, whereas the new Hub has an indoor waiting area.

During the entire trip, the team member kept track of the time between each trip milestone. After the trip was complete, the team member compared the actual times to the scheduled times for that particular route, noting the differences. This data is shown in Table (3):

Table 5: WRTA Route Times

Checkpoints	Scheduled time	Actual time	Scheduled Duration	Actual Duration
Catching the route 8 bus	1:18pm	1:21pm	0 mins	3 mins
Arrived at Union Station	1:30pm	1:40pm	12 mins	18:56 mins

Arrival of route 27 bus	1:35pm	2:10pm	5 mins	30 mins
Arrived at Designation on James Street	~1:56pm	2:39pm	21 mins	28:46 mins
Arrival of bus on James Street	~2:20/2:50pm	2:55pm	0 mins	5 mins
Arrived at Union Station	~2:45/3:15pm	3:20pm	25 mins	25 mins
Arrival of route 30 or 8 bus	~3:00/3:30pm	3:31pm	5 mins	6 mins
Back onto Salisbury	~3:17/3:40pm	3:51pm	17/10mins	19:46 mins
Total Amount of Time	1 hr & 35 mins/ 1 hr & 43 mins	2 hrs & 16 mins	Total time difference	41/33 mins

Table 6: Google Maps: Time to get Kleen N' Hard and back to Salisbury Street

Personal Vehicle (I-290)	Walking (Park Ave)	Bicycling (Park Ave)	WRTA
22-26 mins	2 hrs & 34 mins	1 hr	2 hrs & 10 mins

APPENDIX E: SURVEY QUESTIONS AND DATA

We are an IQP team researching transportation by the WPI community. The answers to these quick, easy questions will allow us to make recommendations to the WPI Department of Facilities regarding transportation options for the WPI community.

There are only 8 QUESTIONS and should take no more than a minute or two. Enter your email address at the end (optional) for a chance to win a $50 DUNKIN DONUTS GIFT CARD.

All responses are strictly confidential and no personal data will be collected.

1.) Are you a:

#	Answer		Response	percent
1	Freshman		120	12 percent
2	Sophomore		119	12 percent
3	Junior		145	15 percent
4	Senior		125	13 percent
5	Graduate Student		138	14 percent
6	Staff Member		215	22 percent
7	Faculty Member		105	11 percent
	Total		967	100 percent

2.) About how far is your commute to campus (one-way)?

#	Answer		Response	percent
1	I live on campus		225	23.29 percent
2	I live very close to campus (no more than a 10 minute walking distance)		333	34.47 percent
3	I live within Worcester (outside of a 10 minute walking distance)		121	12.53 percent
4	I live in one of the surrounding communities, near Worcester		136	14.08 percent
5	I live farther away/other, please specify:		151	15.63 percent
	Total		966	100.00 percent

I live farther away/other, please specify:
Leominster
1 hr drive, ~50 miles
Oxford, MA
About 20-30min drive
Watertown, MA (45 miles)
one hour by car
45 minutes
About 25 miles (Framingham)
30 minutes (20 miles)
10 miles away
Leominster
Lancaster
Hopkinton
30 minutes away
Shirley
Oxford @ 30 minutes
Framingham - 40 min
RUTLAND
Boston (Chinatown)
20 miles
Acton
23 miles away
Oxford
30 minute drive
Leominster (25 mi.)
approx. 25 miles
Sutton, Ma 24 miles
1 to 1.5 hours
53 miles
Rutland, MA
Dudley
Sturbridge, MA
several towns out, 20 miles
14 miles
Ayer, MA (25 miles)
Hardwick - 26 miles one way
Boston
N. Brookfield
20 miles
In CT - approx 47 miles from campus
Sturbridge MA, about 26 miles away
Princeton
Princeton

45 miles
20 miles away
CT (45 minutes away)
45 miles
23 miles
1 hour / 40 miles
Thompson, Conn.
About 45 miles one-way
36 miles via highway, 31 miles by back roads
north of Boston
Townsend, MA
I live in Southern NH, but plan on moving to MA by May.
Douglas
about 50 miles each way
Concord, MA
Natick, MA
20 Miles
in Connecticut
Acton, MA
Northern Rhode Island
20 miles/ 40 minute drive
Providence
westborough
40 miles RT
40 minutes away
Northampton: 1 hour 15 mins.
22.5 mi
Sutton
Marlboro, 35 minutes
Sudbury, MA
Gardner, 45 minutes
hudson,nh
1.25hr drive or 1.5hr train ride
I live at Faraday Hall, which is on campus technically but still about a 10 min walk
30 minutes
50 minute drive, each way
75 miles
25-30 min
I live 15 miles away
Cambridge
providence
45 mins
75 miles
Sturbridge

Framingham
45 minutes (20 miles)
Dudley
Waltham
35 miles away
50 miles
1.25 hrs.
1 hour 15 minutes
20mi each way
Boston - 50 miles
20 miles north
13.5 miles away
20 miles one way
Lincoln, MA

3.) How do you usually commute to campus each day?

#	Answer		Response	percent
2	I live on campus		198	20.50 percent
8	Personal Vehicle		347	35.92 percent
3	Ride a Bicycle		15	1.55 percent
4	Walk		373	38.61 percent
5	Public Transportation (WRTA, Commuter Rail, etc.)		2	0.21 percent
6	Carpool		12	1.24 percent
7	Other, please specify		19	1.97 percent
	Total		966	100.00 percent

Other, please specify
Commuter Rail + Bicycle + Walk
combination carpool (2 days a week)/personal vehicle (remaining days)
I use a personal vehicle 4 times per week and carpool once per week. My husband also works at WPI. I carpool with him ont he 5th day. We would carpool more often if it wasn't for our kids' schedules.
Personal Vehicle 2/wk, Walk 2/wk
Car in winter; bicycle in summer
Drive or walk
public transit, but do not commute everyday.
Walk from Faraday Hall
Walk at the daytime and take Snap at night
My own car
Drive
personal car
drive part time work at WPI
work from home
panda/piggyback
booty
car or bike
WPI SNAP
Drive my own car

4.) How do you usually travel somewhere that's away from campus?

#	Question	I always use this	I sometimes use this	I rarely use this	I never use this	Total Responses	Mean
1	Personal Vehicle	23.61 percent	27.38 percent	9.33 percent	39.68 percent	504	2.65
2	WRTA Buses	1.51 percent	9.03 percent	14.41 percent	75.05 percent	465	3.63
3	Walk	35.97 percent	51.38 percent	9.29 percent	3.36 percent	506	1.80
4	Ride a Bicycle	2.63 percent	10.53 percent	10.53 percent	76.32 percent	456	3.61
5	Carpool with a Friend	11.00 percent	56.82 percent	15.89 percent	16.29 percent	491	2.37
6	SNAP	6.28 percent	32.64 percent	34.52 percent	26.57 percent	478	2.81

OR

4.) How many round trips do you make to the WPI campus per week on average?

#	Answer		Response	percent
1	1-2		45	6.16 percent
2	3-5		285	38.99 percent
3	6-10		199	27.22 percent
4	More than 10		202	27.63 percent
	Total		731	100.00 percent

5.) About how often do you travel between the main campus and Gateway Park?

#	Answer		Response	percent
1	Never		476	50 percent
2	At least once a week		80	8 percent
3	At least several times a week		64	7 percent
4	Once a day or more		43	5 percent
5	Occasionally (but less than once a week)		291	31 percent
	Total		954	100 percent

5A.) HOW do you usually travel between the main campus and Gateway Park?

#	Answer		Response	percent
1	Personal Vehicle		98	21 percent
2	Carpool with a Friend		13	3 percent
3	Walk		275	59 percent
4	Ride a Bicycle		18	4 percent
5	SNAP/Gateway Shuttle		60	13 percent
	Total		464	100 percent

(Optional) Any comments about any of these?

Text Response
long wait times for snap
SNAP has never provided me with fast or reliable service. Therefore I don't bother using it any more.
SNAP can be faster
Zipcar called my girlfreind at 4 am told her the battery in her car might be dead and to call them if it was at 7am when she needed the vehcichle they couldnt jump the battery right away so I gave her my car, Zipcar is awful and no one should use it.
SNAP wait could be shorter
The WRTA bus system is terrible. I live 2 miles from campus right off of Park Ave and would have to transfer 3 buses to come to WPI.
WPI Carpool WW?
SNAP can sometimes take a long time to arrive
SNAP needs to be more efficient and faster
I wish there was more regular train service between Worcester and Boston.
SNAP need more vans, MTBA Needs better hours
WRTA busses don't run frequently/late enough, don't go to shopping, etc. outside Worcester (shrewsbury, etc). don't go down Park ave. Can't buy day passes on bus with charlie card, so transfers are very expensive.
Snap is not timely. Very inefficient and don't feel very safe when I ride in the vans.
If there was a clear route on a bus from the WPI area to Charlton or at least dead horse hill, I'd use the bus .. but that hill!!
Wayfinding at Union Station is very poor, parking is expensive and inconvenient, ticket machines were broken.
The commuter rail system is pretty good when it is on time but it doesn't have enough evening hours back to Worcester.
WRTA was usable from my house to WPI, but not ideal in terms of bus stop locations and times.
The Gateway shuttle does not always come on time, and due to the schedule, you must leave over 30 minutes early to make a meeting on the hill on time.
Commuter rail is great for going to conferences in Boston but really limited in the times it actually comes to Worcester.
the gateway van stops on the other side of campus, a 15 minute walk for me, and at times that are not convenient--would add 1 hour onto a brief trip to Gateway...thus I take my car. Walking to Gateway is too long for me (0.4 mile), and too dangerous in winter.
I park at work. If I need to go somewhere while at work, it's within walking distance, so I walk.
WRTA experience was over 20 years ago.
Gateway shuttle going TO prescott street is painfully slow due to the nearly-useless stop at Salisbury Estates. Also the route and times are more confusing now due to the 10Faraday stop.
MBTA for personal use - not for traveling to/from WPI
zip car is too expensive, but i have considered it for other uses (one car family)
While I have used the MBTA it has not been to get to/from Worcester - so I can't comment on that.
I have not needed to use any of these options
Although I have used a commuter rail to/from Boston, it is not an option for me to travel to work
It would be easier for me to carpool with others if I didn't have a "Mom" schedule which differs from

day-to-day.
I realize the SNAP shuttle covers a wide area, but I tried to use it once and waited so long I gave up and walked to my car anyway.
There is no commuter rail between where I live and Worcester, otherwise, I'd be happy to use public transportation. I have toyed with the idea of carpooling ...
I prefer to walk instead of using the Gateway Shuttle
I stopped using commuter rail because of the difficulty of getting from the train station to campus.
SNAP is limited to a 1 mile radius.
Gateway shuttle often can't fit the number of people wanting to ride.
WRTA: Don't know if they even come up near WPI or where their routes go. Don't feel safe using this in the evenings. MBTA: Great way to get into Boston! Lack of trains on the weekends sucks though, it's tough to plan around such a tight schedule. Also, tough getting to/from Union station when SNAP isn't running. Worcester taxi services don't like to pick up the phone when you call for a ride. Zipcar: Way too expensive for college students for the amount it would get used. Not worth it. Carpool Website: Don't know what this is. SNAP: Takes way too long to get from one place to another. Also, only servicing residential addresses is a terrible idea. And the range is too short. Gateway shuttle: Too long of a ride; it's almost always faster to walk. I only use this if the weather is terrible, in which case it's too crowded because everyone else has the same idea.
The Gateway shuttle takes forever - even walking is typically faster! Also, every 15 min is not enough - especially when going to main campus to teach, I cannot be late.
No good way (that i know of) to get to/from commuter rail
I wish there was a bus or commuter rail from my town (Leominster) to Worcester.
Used the commuter rail to commute into Boston. Have not used it to commute to Worcester.
MBTA does not link my home and WPI
The bus system in this city drives me crazy. I would love to be able to take buses everywhere but it couldn't possibly be more inconvenient, not if that was the deliberate intent.
WRTA: Not comfortable walking at night to the bus stop that I use to get home (about 1 mile from campus) with no reasonable alternatives. Also, walking from that bus stop (Newton square) is extremely difficult in winter because side-walks and especially corners are not shoveled well.
I have checked the schedule for the Commuter Rail system is currently too limiting, especially if there is problem at home for which I must leave campus.
Use MBTA, but not for commuting
SNAP is great for short trips, bus/train compliments it well for cheaper trips that are longer in duration.
I used to use MBTA Commuter rail when I worked in Cambridge. It is not an option between my home and Worcester.
the commuter rail worked when I used it, but in general it is extremely outdated and very slow
police don't keep gateway shuttle schedule updated -- once waited for an hour for no ride
we need to make more the carpool website. i totally forgot about it.
if there was rail transportation into Worcester from south central MA I'd take it - I like to take trains and do work while I commute. Commutes are often stressful.
Have only used WRTA and MBTA in years past. They do not service western MA.
I've ridden trains extensively in Europe & Japan, and wish US trains were as useful.
I do walk to all locations on campus (my office is across Park Ave. from main campus)
If it's cold, I am less likely to walk or wait for the shuttle

It's much faster to walk, even carrying equipment in the snow, than to take the Gateway Shuttle.
The Gateway shuttle is almost never on time.
Public transports works well
I am new to WPI and have not yet heard of these modes of transportation.
Waiting for SNAP shuttle is often frustrating
I recommend the Peter Pan/Greyhound buses over the MBTA.
The SNAP shuttle takes too long and you never know when it will arrive
SNAP takes too long
When I comment on the MBTA in reference to this survey, I mean the commuter rail. I grew up near Boston, and am very satisfied with the subway and buses within Boston. SNAP works for necessary transit during the winter months to get home after dark, however it usually take a half an hour to get home (what would usually be a 10 minute walk). The WRTA always takes an absurdly roundabout route to get anywhere, often requiring changing buses.
Not enough coverage from the WRTA.
WRTA is very poor in Worcester and the quality of service is not reliable.
commuter rail from Worc to Boston is SLOW
SNAP would be better utilized with an app that SGA and Computer Science is in talks about. WRTA could be better utilized with more integration of maps and maybe an app with schedules and routes as soon as WPI students get on campus for NSO
The commuter rail schedule is inconvenient and the frequency of problems is high.
Gateway Shuttle timing is bad. Can't to a meeting on time on the Hill that starts on the hour because shuttle pickup here is :52 minutes past the hour, then stops at 85 Prescott. I suggest establishing a single stop for all of gateway and Farraday at the intersection of Prescott and Farraday then simply shuttle directly between Bartlett and Gateway on a more per hour schedule. Also, eliminate the shuttle to the Salisbury Estates. Ridership to and from their is near zero. Consider improved efficiency of the Gateway Shuttle route, perhaps dropping off at the corner of Olin Hall and Goddard Hall instead of Bartlett. The loop would then be much shorter and coudl be more trips per hour. This iwll likely increase ridership.
Zipcar - friend rented the car, I simply rode along for the ride. Nice, clean, car. Seems to be a good system.
I wish the SNAP and Gateway Shuttles had more vans so the wait time was less.
Snap takes forever
Not enough people know about WPI carpoolworld.
Snap needs better times for pick up
SNAP is somewhat unreliable sometimes, too slow.
They are all satisfactory but if storing a bike over the summer wasn't a problem I would definitely prefer a bike.
I get dizzy in the SNAP vans because they have to drive so fast... :(
Zipcar can get expensive since it requires both an annual fee and a rental rate per hour or day.
I love SNAP
I don't like the "commercial location" aspect of SNAP.
SNAP from Union Station has TWICE taken over 45 minutes to pick me up, even after having called 20 minutes ahead. Commuter Rail is extremely reliable. I've only been delayed on it once, and I've taken it over two dozen times.
I'm so glad SNAP drives to Gateway! Thank You!!

these options dont really apply to me. I just walk to WPI campus each day.
It would be nice if SNAP arrived sooner after receiving a call.
SNAP takes way to long
I've found that SNAP isn't very "user-friendly" in my experience. That's why I haven't used it yet.
I have had experiences of waits up to an hour for SNAP or calls that never even came and had to be reregistered multiple times before a vehicle came.
snap is a little far from gym, it is some what difficult in winter
SNAP is sometimes slow.
Usually I should wait for 30 minutes or more for SNAP that is not satisfactory for me.
the formatting of this survey is not so great.
The train is fine for getting to boston, but is a long walk and expensive.
Commuter Rail was a very unpleasant experience.
The commuter rail is great when going between Worcester and Boston but if you take it to campus there is currently no way for students to get from the train station to campus during the day. Getting a cab can be expensive and in the winter it is too far to walk.
SNAP is too slow and is preferential toward friends of the drivers.
MBTA takes way too long. Taking the Peter Pan bus into Boston is way faster.
The shuttle is usually running behind and it takes longer than to just walk. I am either going to be late to a meeting because I had to circle Faraday 2 times so I walk in the bitter cold, or I have to leave 30 minutes early to ensure I get there. I would ride my bike to Gateway more often, but I am worried about the safety of it and there's not enough places to chain it. Also, I drive more often then walk to school because if I have to work late, I don't want to have to wait an hour for the SNAP shuttle to show up when I'm ready to leave.
Extremely long waits for SNAP, with drivers who are so unfamiliar with the Worcester area that they end up leaving me two streets away from my house, in an area more dangerous than I'd have had to have walked through if I hadn't taken SNAP at all.
SNAP service is good but many a times we need to wait for an average of 20-25 mins
I wish there was a SNAP variant that would drive you within 5 miles of campus instead of just 1 mile.

Statistic	Value
Total Responses	196

6.) What has been your experience with...?

#	Question	Used it and was satisfied	Used it and wasn't satisfied	Never used it	Never heard of it	Total Responses	Mean
1	WRTA (Worcester bus system)	13.20 percent	8.03 percent	74.37 percent	4.40 percent	909	2.70
2	Commuter Rail system (MBTA)	51.49 percent	9.81 percent	33.63 percent	5.07 percent	907	1.92
3	Zipcar	12.58 percent	1.34 percent	83.18 percent	2.90 percent	898	2.76
4	WPI Carpool World Website	0.44 percent	0.55 percent	47.29 percent	51.72 percent	903	3.50
5	SNAP and Gateway Shuttles	46.26 percent	14.18 percent	38.02 percent	1.54 percent	910	1.95

7.) Which of following would change how you would travel?

#	Question	Would DEFINITELY change how I travel	Would POSSIBLY change how I travel	Would NOT change how I travel	Total Responses	Mean
1	More frequent/convenient WRTA bus routes	13.60 percent	28.21 percent	58.19 percent	897	2.45
2	More frequent/convenient Commuter Rail system	18.99 percent	30.28 percent	50.73 percent	895	2.32
3	Free or inexpensive bicycle rentals	23.88 percent	29.60 percent	46.52 percent	892	2.23
4	Increased safety and security in the areas near WPI	28.27 percent	32.07 percent	39.66 percent	895	2.11
5	More convenient/inexpensive Zipcars	14.77 percent	26.85 percent	58.39 percent	894	2.44
6	Easier to carpool	15.44 percent	36.47 percent	48.10 percent	894	2.33
7	Higher parking fees	15.75 percent	19.01 percent	65.24 percent	889	2.49
8	Higher/better enforced parking fines	14.19 percent	16.89 percent	68.92 percent	888	2.55

8.) How do you think alternative transportation could be improved around WPI? Also, if you are not willing/able to use alternative transportation, why? (OPTIONAL)

Text Response
Zipcars are too expensive
More snap vans, bus routes within campus
Have dedicated bike lanes that are separated from the car roadways on the roads that surround campus (or ideally, throughout Worcester)
SNAP needs to be expanded. Response times are slow at times. The bike system would be helpful too.
A bike rental system would be really cool and pretty useful, anytime that wasnt the winter.
More clarification on the stops/places where alternative transportation can be found around campus.
Students should wear rollerskates
I would use bikes. Bus routes are generally a pretty inefficient use of time in my busy schedule. I have used the consortium buses to go to Holly Cross and back.
More shuttle services to the grocery store, pharmacy, etc. Most students on campus have a car so they can get to the grocery store and run other errands when they need to. Providing alternative, shared shuttle services would help. Once you go outside a 5 mile radius or so from campus, no other option is available besides personal vehicle. Improved bus routes or commuter rail times won't change much.
I think that alternative transportation for people who live close to WPI could be improved by having more options available. I think that people are looking for a cheap and easy way to travel but also would like to be comfortable. Sitting on the city bus with people you don't know and waiting for your stop may not be the best way to get to WPI for some people, although it is cheap the person may not be comfortable. I personally have a schedule where I may have to leave campus at any given time. I couldn't see myself using any other mode of transportation other than my personal vehicle.
I live off campus (about a 10 min drive on 290). I do not know much about the transportation options on campus because i really have no need for them. I think taking a bus or train would probably cost the same as the price of gas I would use, plus it would restrict me to only travel during those times. So basically to sum this up, i got nothin.
I would be willing to carpool
More direct bus routes that travel Park Avenue from end to end would be terrific!
Earlier SNAP hours.
More SNAP vans, possibly more zipcars
Make SNAP better. Expand their maximum radius from campus, have more vans, allow pick-up / drop-off at places previously not allowed, and get friendlier drivers and assistants.
More SNAP vans since the wait can sometimes be up to 45 min (happens frequently from personal experience)
WPI taxis the we cld swipe bonus points to use
1) I live far enough away that carpool and public transit options are pretty limited. 2) If we could safely encourage more walking to Gateway, that might help a bit. 3) Lack of showers in the various staff/faculty buildings can be a deterent to substantial cycling to work.
I think it was absurd to build that huge parking garage and NOT charge a fee. Copious free parking urges people to behave unsustainably. I also think it's ridiculous for WPI to reserve parking spots that encourage people to drive between the main campus and Gateway. It's a 10-minute walk, and there are shuttles!

I noticed that "higher/better" enforced parking fines are on the list. I would prefer to see more/cheaper parking options on campus. Especially since we have the new parking garage, I don't understand why I would need to buy parking pass or receive a ticket to park there when there are a hundred other spaces available. I also think more information or methods of traveling to places besides Boston would be nice. If I wanted to go to providence I would have no clue how to get there besides my own car.
Most definitely. Better transit to popular/useful locations such as the grocery store or further places would be extremely useful. For instance if snap were to have a daytime service that you scheduled to run errands that would be amazing.
Don't charge higher fees for parking. That will only hurt the people who need to bring a car to campus. Most places I travel to by car are not accessible by bus or bike or walking and probably never will be because of distance and location. WRTA busses already run at significantly below capacity and are a net loss for the city and state, so it is unlikely more frequent bus routes would be feasible.
possibly more bike paths on roads to make it safer
SNAP transportation has a higher limit than 1 mile. Perhaps, 2 -3 miles or something more reasonable. Cheap apartments or housing commuter students can afford.
Because I need the flexibility of a vehicle beyond work, so to rent/zipcar/bus etc.. would not be cost effective right now.
I would like to see the WRTA routes changed and would like to see the bus stop closer to campus. I would also like to see dept heads be more flexible about staff hours if they need to carpool.
I believe the school can advertise these other transportation options on their website may increase better travel habits and create benefits/awards to those who use good traveling habits. I live in the surrounding communities and I highly doubt I change my traveling habits due to the fact I live 10+ miles away from the community
Way more bicycles and a fleet of segways would help.
I live in Worcester but it is not convienent to use public transportation due to the length of additional time it would take.
Unless you live within Worcester alternative transportation is virtually non-existent.
More options for students to get to places like Walmart and Target. I am not willing because I live on campus. There would be no point in me using alternative transportation.
Shuttles could run more frequently. Also, better communication about carpools.
I live in a somewhat remote area. I also have children to drop off on the way to/from work. There are zero options for me to use public transport to get to work. Carpooling is an option, but would be challenging due to daycare pick up/drop offs.
Personally I bike to work around 20-30 percent of the time, however it's not my MAIN mode of transportation. It's a goal to get to bike more than half of my trips to WPI (I live approximately 2 miles away, so not far).
I like having the freedom and flexibility of commuting to work in my personal vehicle.
Most faculty and staff are not going to change just because not everyone works the same hours, everyone comes from different locations, and having to depend on or wait for someone else before you can leave is not what most ppl will want to do. being 30 minutes away also does not make changing how to get to work very easy, i'm not close so I have to drive other alternatives are hard to come by
My husband and I share a car (he works elsewhere in Worcester) and I have carpooled with other members of WPI. The problem is that not everyone leaves at the same time so there can be a lot of waiting around. However, I think carpooling is a great alternative especially with the perception of

limitied parking on campus.
Having bikes to get to Gateway would be an excellent choice. Or even just to get around campus!
I do not like being dependent on others to get me to my destination. Especially, since I have a two year old son I need to get to if there is an emergency. Late arrivals/departures can really put a damper on my family time.
Easy access is a big factor. That way more people would take advantage.
i live to far away and there is no alternative transportation near my house. - i think alt transport around campus could help people stop driving to Gateway and back.
A WRTA bus stop right on or at the main campus would be helpful, but it would have to be coordinated with a bus that came from my neighborhood otherwise there are too many complications in the route. (I'm not comfortable walking after dark.)
For students and very local staff/faculty, public transportation that arrives close to WPI could be a very feasible option. However, for me living so far away, driving is probably the only option for me.
Introduce tax deduction account reimbursement program for commuting expenses. Why should I use alternative transportation when I am satisfied with my current one (commuter rail + bike)? (Note that I had at question to answer "NOT change", as, e.g., higher parking fees will not change my rail commuting behavior... - is this in the idea of the survey??)
Alternative transportation (like bicycles) would not be feasible, as I am generally in dress clothes. In the winter, it would be too cold to ride to campus, and my clothing would restrict whether I could ride a bike safely.
It would be great if there was a carpool parking lot. Something nice an close to campus that was well maintained to encourage folks to use it. My only issue with carpooling is that I am a single parent and being without a vehicle can be difficult. Having access to a Zip car could make that an easier burden.
I live two miles from campus on Salisbury street, and would have walked many days if there were reasonable sidewalks. Currently is it is not without danger...
Bike pathes would help me feel safer using the bicycle to work. I would definitely use my bike more.
If there was public transportation in all of Worcester county, one could actually get to the city of Worcester without a car. MBTA station is 10-15 miles from my house, no buses to it. Buses from MBTA in Worcester to WPI are ??? don't even know how that could be done. Also, the Worcester city bus routes are very inconvenient (hell, they don't even stop at the greendale mall--one has to stop on a bridge and climb down two flights of steps to get to the edge of the parking lot to trudge throught the snow and crazy drivers to get to the mall) and it seems that the bus routes all go through downtown Worcester on each trip...thus taking all buses into the BUSIEST traffic area during commuting hours.
The WRTA stopped having a bus come to WPI (Salibury Street) for about 2 years and it has started up again I had to car pool or take a cab to campus everyday. I would take the bus more frequently but the bus to Oxford would not get me home until 7:15 PM.
More trains to and from Boston would be great for WPI and Worcester
I want to drive my own car so that I am not at the mercy of some other staff member. I have a shorter workday so would not want to be waiting for my ride.
More regular bas or shuttles around neibouring towns to WPI. Save cycle routes/lanes around the city and to/from gateway. Trams around the city
Occassional use of a personal vehicle to travel to Campus is essential for Gateway personnel, but designated spaces are often full in the Library Lot. More clearly defined/communicated areas in the Park Ave Garage would be helpful.

I often have errands/appts. right after work, or stay to use the fitness center. I need my car to do this. Zip cars would be an added expense and not sure how this would have any benefits.
I'm not sure exactly how to streamline the Gateway shuttle.
Better bike routes.
I live locally, and have a car that gets good gas milage. My schedule is different everyday, so I just find it convenient to have my own car and come and go as I please.
Alternate transportation is difficult for me because of where I live. If I were to live closer to the city, I would certainly take advantage of it. Car pooling also can be difficult because of the hours I work are inconsistant.
For me commuter rail service is the missing link. My biggest problems keeping me from using it are: -service is mostly oriented towards people commuting from Worcester to Boston, not the opposite direction -need more frequent service at more times throughout the day -need better public transit options from the train station to campus and back
I think if there were parking fees to use specific lots/garages, it may encourage more staff/faculty to carpool. It would also be highly unpopular and everyone would freak out. For students, I think bicycle rentals would be a great idea - I have seen the bicycle rental racks in Boston and they seem to work. The only issue would be if students were using the bicycles to go food shopping and they are unable to lock the bicycle while they shop, someone could easily steal it.
more bike lanes. More bike sinage. More conversations about bikers to promote more respect for biking. More bike centered events and biking promotion. this is actually a great city to bike in (geographically), but traffic is not set up for it and there are almost NO bike racks off campus. I don't have to take busses for work, but am open to taking Worcester busses on occasion and the commuter rail to Boston certainly. But schedules and (commuterrail) prices are an issue andhave to be worth it.
For medical reasons, I like to use my own vehicle. I wouldn't want to have to wait for alternative transportation if I became ill. I have 2 auto-immune diseases which can cause problems at any time so I like to be independent in that respect. I don't want to depend on others for rides.
If I lived closer I would use alternative transportation.
My commute to work is tied to daycare drop off and pick up, so using my own vehicle with carseat if much preferred. I am tied to the opening and closing schedule of the daycare facility.
With added stops the Gateway shuttle takes too long to make the loop to GWP and it is easier to take my own vehicle or share a ride. It takes more time to walk to the Bartlett Center, wait, travel, and get to the meeting/event than to drive yourself, especially if you need to be there at a specific time for a meeting. On paper it sounds like you have enough time, but you really don't if you want to be a little early to get a seat and settle in etc..prior to the meeting/event. It takes too much time out of the day to attend a meeting there if you take the shuttle. In nice weather I sometimes walk, but not in the bad weather.
I use my vehicle several times a week to do errands during my lunch hour as I attend school in the evenings.
I live in the next town, my commute is only 15--20 minutes. I would consider carpooling if there were fees to park my car on campus. Otherwise because I own a car, I would not use these other options to get to and from WPI. However, if there were a bicycle rental I would consider using that during my lunch break each day- Why? To get exercise and save on gas.
I have carpooled on certain occasions, but due to my work schedule of extended days and working through evening events, it tends not to be an option for me to carpool.
There is no commuter rail from Sturbridge. If there was, and the schedule worked for my family and

allowed for flexibility, I would take it. I would carpool if I didn't have such a wacky schedule. My husband also works at WPI and we split up childcare responsibilities, which means our schedules don't align. When we can (1-day per week during school year and most days in the summer), we do carpool to WPI together. Parents need to be careful with carpooling because they could be stuck if their kids get sick at school and they are at work without access to a vehicle. This factor makes it difficult for us to consider carpooling with others who live in our town.

I cannot use alternative transportation. There are no bus routes or trains to my town, it's too far to use a bicycle (20 miles), and my travel times vary greatly which makes carpooling almost impossible. I have a car, so using a Zipcar would only add an expense to my budget. Increased safety and security are always good, and fees would be resented (and possibly hard to pay), but neither changes that I still have to drive to work, regardless. I try to always park legally, so higher/better enforced fines normally would not affect me directly, but it might help with things like cars taking up two spaces and being left in parking lots not only overnight but not moved for weeks at a time (check the lots after snow storms, they're easy to find).

I have to stops I have to make going to and from work and need my personal vehicle.

If snap could travel more than a mile

Although I use a car to get to campus, I keep a bicycle in my office and ride it around the city if I need to purchase things during the day. Part of my job involves purchasing items for student projects so I use my bicycle frequently.

I would love to live closer and be able to use public transportation, but that's not currently possible. I will look into carpooling, however.

Driving my personal vehicle to and from WPI is very important to me. With my own car I have my own personal space and freedom to arrive and leave on my own terms. I realize that a personal car is an enormous energy burden on our society. However there is bigger picture here. I live on a farm and grow organic meats, wheat, and vegetables. Much of my family's diet originates from our backyard. My home is heated with sustainably harvested firewood. Solar panels provide a portion of my home's electrical needs. I never use a clothes drier. I am an avid recycler. Alternative transportion options are more challenging for residents in rural areas like myself.

carpooling in theory is great, however unrealistic living outside walking distance and having 2 children in numerous extracurricular activities.

Have shuttle busses to campus meeting the morning and evening trains. Los of companies do this.

Part of the challenge is always work hours. I work in a department where we tend to have later meetings or a need to stay late to support an event. To carpool or rely on public transportation does not offer flexibility to meet the demands of my job and ensure safe and cost-efficient travel home.

More frequent shuttles would be good.

Zipcars are too expensive. I would definitely promote and use free or inexpensive bicycle rentals. SNAP is only good if you are traveling within a 1 mile radius of campus. I think it would be good to expand the radius for special events, like dinner with the Dean, etc.

AT this point, the shuttle going to the Gateway area should probably be upgraded from a van to a mini-bus. There should also be a responsive on-demand alternative after dark - I've requested SNAP pick up for student workers helping out late at night, and have gotten either very poor service or an outright refusal to do the pick up at all. An increased police presence in the Gateway area would also encourage more walking at dusk and later, but it's very, very rare to see a WPI cruiser on Prescott Street or the vicinity. It's definitely not safe for female students or employees to make the walk from Prescott St. to campus after dusk, so travel by personal vehicle is the only option -- which means more cars going to and

from campus than is necessary.
I like the idea of bike rentals for people wanting to get around near campus. Also if the Zip Cars were less expensive it might be an option for folks. Like the idea of increased security it might make students and / or employees more likely to walk / ride bike somewhere close by after dark if they felt more secure about the area surrounding WPI. MBTA is a good option if you have to travel into Boston but that's about all it's good for as it doesn't have many other stops with reliable transportation after you get to those stops (Framingham might have soem city buses but other stops don't (I used to work in Boston for 7 years and took the T frequently) Unfortunately unless they put a train line through Sturbridge or within close proximity I cannot use alternative transportation as riding a bike 26 miles one way twice a day would be too long. My wife also works here and we do carpool one day per week during the school year (have kids so their schedules after school keep us limited to the one day for now) but we do carpool almost every day during the summer when our kids are out of school.
Bike lane on Salisbury Road from Assumption to WPI. Or a sidewalk on Salisbury from Assumption to WPI.
At the campus level, there is little reason not to walk. Communities such as Princeton will never be connected to any mass transit system; buses disappeared years ago. The potential exists for carpooling but individual schedules rarely match.
Not 100 percent sure what "alternative transportation" is. Something other than driving my own car? Because walking is always a good option. Also, see the previous two questions for details about walking, SNAP, MBTA, etc. Carpooling sucks because then you're tied to everyone else's schedule. I don't always know what time I'm heading to or leaving campus.
Focus on pedestrian safety!
I am not able to use alternative transportation because I transport my children, so I need their car seats in my car. Twice a week, I drive to work. Twice a week, I drive to my day care provider near work, leave my car there, then walk the rest of the way to work.
If the bus routes were more direct I would definitely consider utilizing them.
bicycle paths and a good connection between main campus and gateway would be great
I can't use alternative transportation because I have small children and need to coordinate pick ups and drop offs. I own a car with high fuel efficiency in order to compensate for this.
Besides buses to and from my home I do not see that any would affect me.
I would love to use public transit, regular shuttles to from the train station would be great.
It would be nice to have a group van from my town (Leominster) for all the employees who live there and commute to WPI.
It would be useful to have more bus routes. I would also probably ride my bike here if I did not have to ride it on the street with vehicle traffic.
More frequent shuttles to and from Gateway.
I am unable to have an alterative transportaion plan because of the distance I commute, and the late or ever change hours of my work week.
I generally travel to campus when I teach or have meetings. Mostly these are all back to back and so for flexibility and time management reasons, I prefer to use my personal vehicle.
For my job I regularly travel to off-campus meetings throughout the region, so I need access to transportation throughout the day.
Many days I need my car for work and client visits

Statistic	Value
Total Responses	438

Enter your email address below if you want to be entered in a raffle to win a $50 Dunkin Donuts gift card! (OPTIONAL)

(Redacted for privacy purposes)

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