

Transportation Demand Management on UNC's Campus: Evaluation, Best Practices and Recommendations for Reducing Single-Occupancy Vehicle Use

by

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Executive Summary

Transportation Demand Management (TDM) is an increasingly popular response to growing concern over traffic congestion, pollution and parking shortages. Instead of simply increasing the supply of roads and parking spaces when congestion peaks and parking is hard to find, transportation planners and public officials have turned to strategies to decrease demand for the facilities. TDM is designed to reduce the demand for single-occupancy vehicles through a set of strategies aimed at changing travel behavior. These strategies can include incentives, disincentives, policies and regulations, land-use planning practices or transit choice improvements. State and local governments, as well as individual employers, are implementing TDM programs to help solve congestion problems in their region.

Universities and colleges serve as residential and employment centers for great numbers of people. Increased car usage and the parking facilities to accommodate them can be seen as a threat to the peaceful, people-friendly feel of many college campuses. Whereas many local jurisdictions engage in TDM to reduce traffic congestion, many universities' primary motivation for TDM lies in parking shortages. "Multiple factors—lack of land for new parking lots, the high costs of building parking structures, pressure from surrounding communities, and the desire to preserve air quality and campus green space"—are leading many universities toward implementing TDM programs (Toor and Havlick 2004, 3). Many campuses struggle with the problem of increased demand for parking and financial or physical inability to construct new facilities. These universities often conclude that it is more feasible for them to manage demand for parking than it is to construct more.

Universities often resemble small, compact cities, complete with residences, concentrated employment, sports facilities, cultural venues and central open space. These types of campuses are particularly well-suited for TDM programs because of their density of employment and residences. TDM programs on campuses are often run by transportation and parking or planning departments and include a wide variety of strategies to reduce single-occupancy vehicle trips and demand for parking. What is unique and challenging for universities is to create programs that will appeal to both students and employees, who have different motivations and needs. Examples of campus TDM strategies include universal transit passes, raising parking rates, campus shuttles, carshares for use during the day for employees and twenty-four hours a day for students, and campus bike-share programs. Most universities have some combination of TDM strategies, and others have comprehensive multi-modal programs that integrate many.

This study examines the Commuter Alternative Program, the TDM program at the University of North Carolina at Chapel Hill, which has been integral in reducing the number of single-occupancy vehicles arriving to the campus. In addition, the TDM programs at Duke University, the University of Washington, the University of British Columbia, and Cornell University are featured as case studies. The case studies include descriptions of the TDM programs at each university, successes, limitations and best practices. A comparison of the five universities reveals similarities and differences, common approaches and conflicting strategies. Here is a summary of the key findings:

- All of the universities have at least one full-time staff member dedicated to promoting alternative transportation and TDM efforts.

- The University of British Columbia is the only TDM program housed in the Campus Planning department, the others are based out of Transportation and Parking.
- Duke has the highest ratio of parking spaces to campus population (.46), and UBC has the lowest (.13).
- All of the universities charge for parking on campus, though Cornell is the only one that has even remote free parking.
- All five universities offer some type of discount on local transit. UNC is the only university in a community with entirely fare-free transit. UW and UBC have universal unlimited transit access for all students and discounts for employees.
- UNC has the lowest rate of carpooling among employees (7%), and UBC has the highest (18%).
- UNC is the only university that does not offer carpools a discount on the parking permit or reserved parking spaces. Cornell has the most robust carpool program, offering discounted or free permits, reserved parking and even cash rebates for four or more people.
- All of the universities have at least some accommodation for vanpools. UW has the highest subsidy (\$70 a month), while UBC does not provide a subsidy or reserved parking spaces.
- All of the universities have a carshare program on or near campus.
- There is a ridesharing program at every university.
- Duke is the only university with a successful bike-share program (Duke Bikes). Cornell is currently piloting their Red Bikes program, and UBC has an underutilized informal bike share.
- UNC and UW have merchant discounts associated with their TDM programs.

The study concludes by offering a set of ten recommendations for the University of North Carolina and its TDM program, formulated using the key findings and best practices from the four other universities. These recommendations range from enhancing marketing of the program to providing affordable housing for employees near campus. The University of North Carolina is an institution that strives to be a leader; it is this author's hope that the university will pursue this ambition into the sustainable transportation field.

Introduction

Transportation has become a serious issue not only for large cities but for smaller towns and suburbs around the country. Since the 1950s the automobile has been the primary mode of travel for the majority of Americans, and land use trends initially pushed residences further from employment centers. More recently, however, employers have been decentralizing to locate closer to their workers and their client bases. While the home-job imbalance may be shrinking, worker selectivity about jobs and improved transportation networks still contribute to long commutes. Reliance on cars for personal travel has reached a breaking point and transportation officials have begun to think in fundamentally different ways about approaching management of traffic and parking issues. Infrastructure costs, land use constraints, and environmental concerns combine to deter public officials from constantly increasing the supply of roads and parking. Increasingly, transportation planners, public officials, and private employers are seeking to manage the demand for automobile trips by using Transportation Demand Management (TDM) techniques. The challenge, therefore, is to find the right mix of incentives and disincentives to encourage people to change their travel modes.

Colleges and universities are like small cities with their compact land use and concentration of residences, employment opportunities and cultural attractions. The influx of people to a relative small area every morning, and the mass exodus every afternoon, can cause tremendous traffic and parking problems. Universities can experience the woes of traffic congestion and parking demand more acutely than other employers because of the job and residential density of many campuses. The majority of colleges and universities face the problem of growing demand for parking and declining financial and physical ability to accommodate it, particularly those that are land constrained and unable to physically expand their campuses. Many universities have come to the conclusion that it is more feasible to manage the demand than it is to construct new parking, and therefore have implemented Transportation Demand Management programs to provide alternatives to their employees.

This paper examines general TDM efforts for communities and employers, focusing on different types of strategies and evaluation techniques. This is followed by a section describing the unique circumstances found on university campuses and specific TDM strategies utilized. An in-depth description of the TDM program at the University of North Carolina at Chapel Hill (UNC) is followed by case studies of four other universities, with descriptions of their TDM programs and their successes and limitations. The case studies are followed by a discussion of university TDM best practices and those specific to the universities researched. The paper concludes with ten recommendations for improving sustainable transportation and the TDM program at UNC.

Methodology

A detailed review of five universities' TDM programs, including the University of North Carolina's, was performed for this research. The other universities, Duke University in Durham, the University of Washington (UW) in Seattle, the University of British Columbia (UBC) in Vancouver, and Cornell University in Ithaca, were selected based on certain criteria. The selection process began with UNC's list of official peer universities and several other

universities that were regarded as having notable TDM programs. Thorough review of universities' TDM programs, transportation plans and student and employee demographics further narrowed the list. Universities were eliminated for having limited information pertaining to TDM (or no TDM at all) and having small campus populations. A final requirement was that the list of universities for potential case studies must include a mix of urban, suburban and traditional "college town" settings.

Duke (urban) was chosen for its proximity to UNC, the newness of its program, and because it is an official peer university of UNC. UW (urban) was also chosen for being a peer university, as well as for the broad range of successful elements of its program. UBC (suburban) and Cornell (college town), while not official peers, were chosen for this study for having well-documented and unique aspects of their programs. Two other universities (University of California-Berkeley and University of Colorado-Boulder) were targeted for this study but requests for interviews were not returned. The literature review was conducted through journal and newspaper articles, books, and case studies. The university case studies were compiled using university websites, reports, transportation plans, personal contacts via email and phone interviews with university TDM coordinators and planners (see Appendix A for the interview guide). The interviews lasted between forty-five minutes and one hour and fifteen minutes.

Literature Review

What is TDM?

Transportation Demand Management (also known as Travel Demand Management or Mobility Management) began in the early 1970s. Federal and local transportation policy started to examine ways of managing the transportation system without continuously expanding capacity. This change came about for several reasons: limited federal funding for highway and capacity infrastructure projects; the oil supply crisis of the 1970s created a shortage in this country; and the Clean Air Act provisions' linkages to transportation policy (Meyer, 1999).

The Victoria Transport Policy Institute defines TDM as "various strategies that change travel behavior...in order to increase transport system efficiency and achieve specific planning objectives" (VTPI, 2010). It is designed to reduce the demand for single-occupancy vehicles (Fraser Basin Council, 2009). Many TDM strategies include the introduction of incentives and disincentives that encourage drivers to consider alternative forms of transportation, routes, and timing and to reduce trip frequency (Nozick et al., 1998). The Fraser Basin Council (2009) analogizes that "TDM is to transportation what prevention is to health care" because it addresses problems before they become insurmountable.

Much of the literature attempts to categorize TDM strategies according to either their outcome or their process. Vlek and Michon (1992) suggest the following categories of TDM measures: *physical changes*; *law regulation*; *economic incentives*; *information, education, and prompts*; *socialization and social modeling* targeted at changing social norms; and *institutional and organizational changes*. A class of Transportation Demand Management that is often overlooked in classifications is land use management. Land use strategies for TDM are means for inspiring wide-ranging changes through infrastructural improvements to the built

environment. Several specific examples of land use-based TDM strategies are listed below. Despite having different names and being categorized in varying ways, TDM strategies offer a demand-based approach that differs drastically from the traditional planning practice of simply increasing supply.

Anthony Downs (2004) examines traffic management strategies differently in his book *Still Stuck in Traffic*. He begins by differentiating between supply-side and demand-side management of congestion. Supply-side simply manages the supply of roadways and tends to be short-term because of *induced demand*, as discussed below. Demand-side aims to reduce number of vehicles and people traveling during peak hours by internalizing the externalities of transportation choice; it attempts to correct for differences between the private and social costs of driving (Downs, 2004). Furthermore, Downs distinguishes between regulatory approaches and market-based approaches. Regulatory approaches “mandate certain behaviors or prohibit others” (Downs 2004, 79) through government fiat instead of attaching prices to different behaviors. In contrast, market-based approaches attach monetary values to different travel behaviors and rely on travelers to choose among them based on preference and ability to pay. The tactic is to raise the price of behaviors to more closely reflect the actual social cost. Many TDM strategies fall into the market-based category because of the lack of authority or political feasibility of regulatory approaches. Downs claims that the most effective strategy for reducing congestion should include both market-based and regulatory elements.

Equity issues have come to the forefront of transportation planning, primarily in terms of environmental concerns, basic access and mobility. Transportation affects where people can live, work and go to school. “Adequate mobility is essential for people to participate in society as citizens, employees, consumers and community members. It affects people’s ability to obtain education, employment, medical service and other critical goods” (VTPI, 2010). For the sake of relevancy, this section will focus on basic access and mobility relative to TDM programs, rather than transportation in general. Many of the market-based disincentives used in TDM programs can be regressive, or disproportionately affect lower-income people who are auto-dependant due to the location of their home or job. For example, road pricing, tolls, or increased parking prices are often criticized for being regressive because they constitute a larger portion of a lower-income individual’s income and thus place a larger burden on that person. Many TDM strategies do not create equity issues, but it is an important consideration when planning to implement changes.

Why Use TDM?

Transportation Demand Management has been gaining popularity because of the increased severity of automobile travel and congestion. History and literature show that the conventional strategy of increasing capacity creates even more demand after the brief respite enjoyed directly after expansion. This *induced demand* is brought on by what Downs (2004) calls the Principle of Triple Convergence. Downs explains that there is often a ‘best route’ that most commuters prefer because it is the quickest and the shortest. This route becomes congested and ultimately reaches equilibrium with the other inferior routes—they are all equally slow and congested. When the ‘best route’ is improved and begins to flow more freely, returning to its superior state, the induced demand for this route occurs for three reasons: people choose this route over others, people choose to drive at peak hours instead of at another time, and people choose to drive instead of take public transportation—Principle of Triple Convergence. For this

reason Downs states that it is impossible to eliminate congestion in metropolitan areas through roadway improvements alone. TDM offers an alternative strategy for combating these fluctuating traffic problems.

Relieving traffic congestion is the major motivation for government agencies to engage in or encourage TDM programs. Congestion is caused by a number of factors, including: increased population, increased income to buy cars and decreased real costs of driving them, increased car usage growing faster than governments' ability to build new roads and transit, too low density in much of the country, and concentrated trips at same times (Downs, 2004). In addition, automobile drivers are not required to pay the full marginal and social cost of driving—the majority of the roads and parking spaces in America are free. Donald Shoup (2008) claims that because parking prices are so far below the price of building parking spaces, that drivers are paying “only a small fraction of the marginal cost of driving and parking”. The chronic underpricing of driving and parking increase demand and create congestion problems.

Studies showing adverse health and environmental impacts of increasing traffic congestion paint a formidable picture. Drivers in the Raleigh-Durham area spent on average 34 hours stuck in traffic and wasted 22 gallons of fuel in 2007, according to Schrank and Lomax (2009). This amounts to a collective loss of over \$421 million wasted on congestion in this region alone. In 2010 the average American household spent 17% of its income on transportation costs (BTS, 2010). The Federal Highway Administration (2010) reports that Americans drove 1.62 trillion miles in passenger vehicles in 2008, and North Carolinians alone drove 101.7 million miles. While these numbers are down from 2007, the general trend is upward and is expected to increase with the growing popularity of hybrid vehicles. Without analyzing the personal and societal costs and benefits of trips made and miles travelled, it can be concluded that vehicle miles travelled are impacting the roads, the environment and other travelers. The Federal Transit Administration's (FTA) Carbon Calculator shows that every 20 mile trip made in a car with average mileage per gallon (23 MPG, according to data compiled by Ward's Auto) emits 17.3 pounds of carbon dioxide into the air. Since 32% of UNC employees lived more than 20 miles from campus in 2009, the air quality effects of commuting in this region are severe.

What are Examples of TDM?

Reasons for participating in TDM activities range as widely as the types of TDM that are utilized. Similar to Vleck and Michon's categorization, the Victoria Transport Policy Institute arranges TDM strategies into four groups: *Transport Choice Improvements; Incentives; Land-Use Management; and Policies and Programs* (2010). Some TDM strategies can fit into more than one category; for example, guaranteed ride home is both a transport choice improvement and an incentive.

	Description	Examples	Approach
Transport Choice Improvements	Improve the accessibility, availability or convenience of alternative modes of transportation	Carshare, bicycle infrastructure, guaranteed ride home	Market-based
Incentives/Disincentives	Encouragement to try alternative modes of transportation/ discouragement from driving alone	Parking cash-out/ road pricing, high parking rate	Market-based
Land-Use Management	Land-use patterns that reduce the need for automobile travel	Location-efficient development, transit-oriented development, car-free planning	Market-based
Policies and Programs	Regulatory programs that reduce barriers to and support for TDM implementation	Commute-trip reduction ordinance, marketing, campus transport management	Regulatory

Figure 1: Categories of TDM strategies

There are also emerging innovations in Transportation Demand Management that should be mentioned here. Perth, Australia, implemented a personalized trip planning program where individuals were given information and incentives to try different transit options (Salzman, 2008). A location-efficient mortgage (LEM) program in Seattle, WA offers larger loans and lower down payments to people who choose to live closer to transit and who agree to own one car or less (City of Seattle, 2010). A developer in the Bay Area of California has introduced what is called Traffic Reducing Housing developments which favor workers that have no commute or short commutes made by alternative transportation (Cities21, 2005). Texas has a Pay-As-You-Drive (PAYD) car insurance option that rewards people who drive less with lower insurance premiums. This type of insurance is gaining popularity and is being written into legislation by more state and local governments (VTPI, 2010). Many of these newer techniques, however, have not yet been evaluated to test their effectiveness.

How are TDM Strategies Evaluated?

There are differing mechanisms for evaluating TDM strategies. The most basic quantitative method, as Nozick et al. (1998) describe, is to choose a metric such as vehicle occupancy or VMT before and after the implementation of a TDM program, then establish whether or not an improvement has occurred. However, this technique is not sufficient to evaluate the quality of the improvement. In a significantly more complex method, Nozick et al. (1998) use a data envelopment analysis (DEA)¹ to measure the baseline performance of 33 worksites. They then are able to isolate the effects of specific TDM strategies by comparing the performances of worksites that implemented the strategy with those that did not. The Victoria Transport Policy Institute suggests an approach to evaluation that falls in between these two approaches. It offers

¹ Data envelopment analysis is used to assess the efficiency of individual inputs by comparing their performance to the “best” one. For example, a specific TDM measure can be deemed successful based on the number of single-occupancy vehicles it takes off the road.

three types of comparison—before-and-after, over time, and with-and-without the TDM intervention. VTPI (2010) recommends using performance indicators, or “specific measurable outcomes used to evaluate progress toward established goals and objectives” to evaluate TDM programs. These are the 12 performance indicators that the Institute recommends: *Awareness, Participation, Utilization, Mode Split, Mode Shift, Average Vehicle Occupancy, Average Vehicle Ridership, Vehicle Trips, Vehicle Trip Reduction, Vehicle Miles of Travel Reduced, Energy and Emissions Reductions, and Cost per Unit of Reduction*. The institute stresses quality baseline data collection and the importance of establishing an evaluation method before beginning a TDM program.

TDM on University Campuses

University campuses are unique communities. As Donald Shoup (2008, 121) puts it, “big universities resemble small cities. They have athletic facilities, concert halls, housing, hospitals, libraries, museums, offices, restaurants, stores, theaters, and-of course-parking”. Balsas (2003) adds that campuses are transitory as well as lasting, they are built at the ideal human scale, they resemble neo-traditional towns with their concentration of services and functions, and they contain their own streets, squares, roads, and open spaces for people to congregate. They are people places. Because of their density of employment and residences, universities are more suited to policies that promote alternative transportation than the rest of the country. “Universities offer a unique set of circumstances: density, high pedestrian traffic, residential proximity, and a centralized campus destination, which have been attributed to TDM trip reduction success” (Fehr & Peers, 2009). Universities not only have the opportunity to affect the behavior of the campus population, but they can develop long-term habits of the students that will spread (Balsas, 2003).

In contrast to increased traffic congestion being the primary motivation, many universities have implemented TDM programs mainly to combat overwhelming parking costs and shortages. Other universities may engage in TDM to enhance the aesthetics of the campus (more green space, less parking) or to promote their sustainability goals, but parking problems appear to be the principal motivating factor. Additionally, universities have a responsibility to their surrounding communities to reduce traffic congestion because they tend to cause most of the problem, particularly in traditional “college towns” (Association for Commuter Transportation, 2008). Pressure from surrounding communities about parking off-campus is another driving force for adopting TDM. Not only is parking itself expensive to build, but it is often difficult for campuses to procure the land to support the increased parking. Particularly in urban settings, universities are simply not able to expand their campus land holdings to create more parking. The costs of building parking structures can range from \$15,000-\$30,000 per parking space, especially when the structures are built on top of existing lots to use land most efficiently (Toor, 2003). The costs of parking permits on campuses tend to be far below the costs of building the parking spaces, creating a perpetual financial burden on the universities. Parking fee increases have a tendency to be met with opposition, mainly because people believe that parking should be provided for free and are not willing to pay for its actual cost.

There are three approaches to dealing with parking shortages on campus: create more, do nothing and let the market take care of it, and manage demand (Toor & Havlick, 2004). While

many universities would likely prefer the “do nothing” option, it is typically unfeasible and so they opt for a combination of creating more and managing demand. Universities generally follow an average cost approach to parking: when a new structure is built, the increased cost is divided among all permit holders. It does not discourage employees or students from parking on campus and does not reflect the real cost of providing parking. There are extensive empirical data showing that parking pricing is one of the most significant determinants of travel behavior; it has much more impact than a monetary increase to other parts of a trip (Toor, 2003). Regardless of parking fees and the frustration of circling for a space, employees and students continue to drive to campus in large numbers and universities are faced with the burden of parking management.

University campus TDM programs are “coordinated efforts to improve transportation options and reduce trips at colleges, universities and other campus facilities” (VTPI, 2010). They are often implemented and run by facility managers and administrators, though some are initiated by student groups to improve their transport options or meet sustainability goals. These TDM programs often require coordination of various organizations, such as campus administrations, local governments, transit agencies, user groups and neighborhood associations (VTPI, 2010). Brown, Hess, and Shoup (1998) claim that campus TDM programs can reduce automobile trips by 10%-30%. The universities with the most robust transportation management programs are generally driven by cost instead of by environmental concerns—it is more cost effective to invest in alternative transportation than to increase parking capacity. For many land-starved universities, it is cheaper to pay people not to drive than it is to accommodate their cars.

There are numerous benefits to effective campus TDM programs. Financial benefits, such as decreased parking costs and maintenance are perhaps the most important for universities. The aesthetic benefits of preserving campus green and people-friendly places are important to alumni and current students. Campuses with bicycle- and pedestrian-friendly infrastructure and good transit access can attract top students and employees that recognize these elements as benefits (UC Boulder, 1999). Improved relations with the surrounding community—decreased so-called “town-gown strain”—are important to many university officials and administrators, as well as to neighborhood associations and town officials. Campus TDM programs that have successful transit elements can greatly improve the overall transit capacity of the area, providing benefits not only for the campus population but for the residents of the surrounding community as well. Regardless of what specific elements a university chooses to implement, the benefits will exist.

Every university with a TDM program offers a different bundle of policies, incentives, disincentives and services. Some universities do not have a program that discourages commuting by single-occupancy vehicle; these tend to be schools that have ample cheap land to expand and convert into parking, often in rural or suburban areas. Toor (2003) has identified twelve techniques often implemented by universities with comprehensive TDM programs:

- Providing transit passes to students and employees allowing free access to bus and/or rail transit
- Developing high-frequency and late-night transit services
- Raising parking rates

- Using “parking cash-out” to pay employees not to drive
- Banning first- or second-year students from bringing cars to campus
- Expanding student and employee housing on or near campus
- Creating employee vanpools
- Providing a guaranteed emergency ride home for employees who participate in transit pass or carpool programs
- Allowing compressed work weeks and telecommuting
- Providing access to shared vehicles for some trips through nonprofit or commercial “carshare” programs or on-campus car rentals
- Marketing alternative modes
- Improving infrastructure and programs to encourage walking and bicycling

A successful TDM program can have any or all of these elements, but the best programs tend to be those that incorporate a combination that can appeal to the majority of the campus population. “For a TDM program to be truly effective, it needs to be tailored to match local conditions, resources, and values” (Fehr & Peers, 2009).

Case Studies



Figure 2: The University of North Carolina

University of North Carolina at Chapel Hill

The University of North Carolina opened its doors in 1795 as the nation’s first public university. It is situated in Chapel Hill, a college town of just over 57,000 people (US Census Bureau, 2011). It covers 729 acres, including the main campus and hospital area (Ellerston, 2001). South Columbia Street is a main thoroughfare running north-

south through campus, as is Manning Drive, which delivers patients and visitors to the hospital. Cameron Avenue and South Road are the two smaller roads running through the center of campus that are frequently congested with automobiles and pedestrians. The campus is informally divided into three sections: north campus, which includes the majority of academic buildings and the two historic quads; middle campus, where the athletic fields, gyms and student unions are located; and south campus, which is primarily the hospital complex, the business school and graduate student housing.

The university is a dominant economic power in the Town with approximately 11,500 faculty and staff, 8,000 hospital staff, and close to 30,000 undergraduate and graduate students (UNC Office of Institutional Research, 2010a). It is also a prevailing cultural resource for the area, with frequent live music and theater performances, a renowned men’s basketball team and a twenty time national champion women’s soccer team. UNC’s campus is constantly expanding in order to fulfill its mission of serving “as a center for research, scholarship and creativity and to teach a diverse community of undergraduate, graduate and professional students to become the next generation of leaders” (UNC, 2011). Such infrastructural expansion not only carries a risk of diminishing the natural beauty and human-scale accessibility of the campus, but also requires increased parking facilities to accommodate the added square footage. The UNC Campus Master Plan describes some of the university goals related to preserving the people-friendly aspects of the campus. Some of these goals include preserving campus landscapes and open spaces, improving pedestrian circulation and safety, promoting alternative transportation (particularly park-and-rides and transit), and improving the range of on-campus residences to accommodate a broad range of student needs while decreasing the need for off-campus housing (Ayers et al., 2006). However, with the addition of over a million square feet of building space (Martin et al., 2001), the impact on traffic congestion and parking on and around the university campus will be severe.

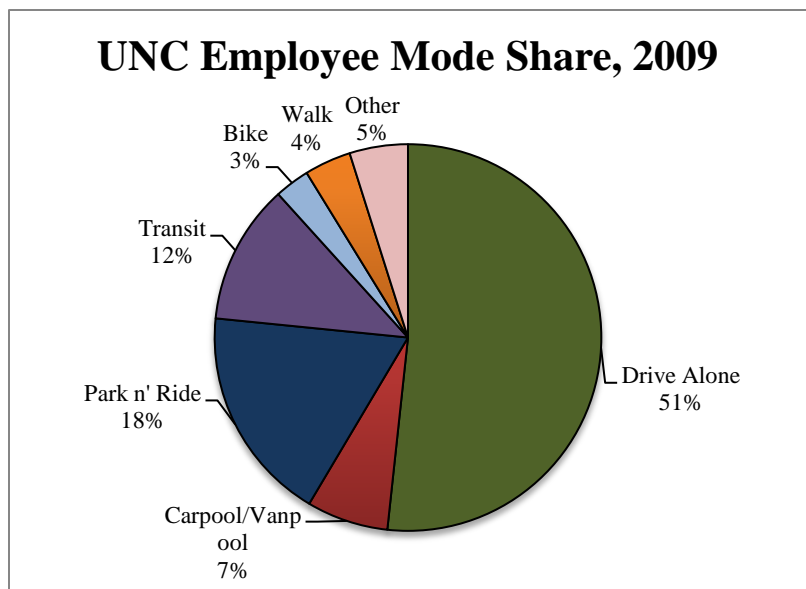


Figure 3: UNC Employee Mode Share, 2009

The UNC Department of Public Safety’s parking allocation guidelines state that currently sixty-nine parking permits are available for every one hundred permanent employees (UNC-DPS, 2010a). Approximately 20,000 parking spaces, on- and off- campus, are available for employees and students, with 73% of those used for permit parking, 10% for reserved use, and 15% for hourly use (C. Stout, personal communication, February 4, 2011). The 2006 UNC Development Plan indicates a net increase of 1,579 parking spaces when all projects are completed, with 480 of them dedicated to commuting employees. The estimated increased shortfall of parking is 2,500 employee spaces, 200 commuting student spaces and 500 resident student spaces, due to the projected increases in university employees and students. Parking on campus is expensive—in 2010 an annual permit for a prime space could cost more than \$2,000 for an employee earning over \$100,000 (UNC-DPS, 2010b). The permits are priced on a sliding scale based on the employee’s salary, are continually pro-rated as the academic year progresses, and are allocated to each department based on percentage of total employees and years of service at UNC (UNC-DPS, 2010a). Permits for students range from approximately \$420-\$690 per academic year for on campus parking (UNC-DPS, 2010b). Hourly parking, either in lots or at meters across campus, costs \$1.50 an hour. For all of these reasons—

increasing campus population, parking conversion to academic buildings, expensive parking permits, and a commitment to campus sustainability—the campus launched an official TDM program in 2002 called the Commuter Alternative Program.

The Commuter Alternative Program (CAP) is a comprehensive program that integrates various forms of alternative transportation with the goal of reducing single-occupancy vehicle trips to campus and decreasing the number of vehicles parked on campus (UNC-DPS, 2009). The program provides benefits, including financial incentives, to members of the campus population (both employees and students) that choose to commute to campus by means other than a single-occupancy vehicle. The program is available to all permanent employees and all non-resident students, meaning those that do not live on campus. The program is funded by a combination of parking revenue, student activity fees and a grant from the NC Department of Transportation and administered by Triangle Transit. The \$125,000 grant from NCDOT funds the staff and intern salaries and non-operational expenses such as marketing, printing and office supplies (C. Kane, personal communication, January 31, 2011). The parking revenue and the student activity fees fund the remainder of the costs associated with CAP.

CAP encompasses all forms of alternative transportation: carpools, vanpools, transit, bicycling, walking, carshare, rideshare, and park-and-rides. At the beginning of each academic year, every UNC employee must choose how he or she is going to commute to campus and register accordingly. If the employee chooses not to drive his or her car to campus, there is a range of options to choose from. The employee can organize a carpool, either herself or by using Zimride, the campus' online ridesharing program, and enjoy the decreased cost of sharing gasoline and a parking permit with other riders. The employee can choose to participate in a vanpool, which is organized through Triangle Transit and receive a \$20 monthly subsidy towards the cost of the ride. She can drive to one of five UNC park-and-rides located at the periphery of town and ride Chapel Hill Transit into campus. These lots are only available for CAP participants with decals. Bicycling and walking are also options under CAP, and employees that choose these options are eligible for a reduced Zipcar membership. The CAP offers a merchant discount card to all participants, as well as a guaranteed emergency ride home if the need arises. All participants also receive up to twelve occasional parking permits for an on-campus lot or for one of the UNC park-and-rides. The benefits for non-resident students are the same except that they only receive two occasional use parking permits instead of twelve.

For those employees or students who choose to ride transit, Chapel Hill Transit is fare free, and CAP will provide participants with a free annual GoPass to use on all regional transit. While Chapel Hill Transit is free at boarding, UNC students actually pay approximately \$106 a year towards transit as part of their mandatory student fees (UNC-Finance Division, 2010). UNC's contract with Chapel Hill Transit accounts for 34% of the total operating costs of the transit system, amounting to \$5.9 million for FY 2010-2011 (Town of Chapel Hill, 2010a). This hidden aspect of the program makes Chapel Hill Transit's fare free boarding more like a mandatory unlimited transit pass for students rather than a free ride.

Special events, either sponsored or promoted by the university, constitute another element of the TDM efforts at UNC. Every spring GoTriangle (the regional TDM program) conducts the Smart Commute Challenge, a campaign with incentives to encourage commuters to try alternative transportation on a temporary basis with the hopes of inspiring permanent behavior change. UNC participates in this event and promotes it to the employees. On campus there is

Car-Free Day, Sustainability Day, Bike to Work Day and Cyclicious (C. Kane, personal communication, January 31, 2011). These are all special events that provide information, prizes and encouragement to people to try alternative transportation. In fall of 2010 the university hosted a transportation forum, during which employees, students and other stakeholders received information about the various transportation options and had an opportunity to ask questions and provide feedback to university and transit officials.

The CAP has contributed to reducing the number of single-occupancy vehicle trips made to campus. According to a longitudinal analysis of the UNC Commuter Survey, in 1997 approximately 74% of employees drove alone to campus and in 2009 that number was 52% (Bushell et al., 2010). Similarly, in 1997 nearly 30% of students drove alone and by 2009 that number had dropped to 18%. These numbers are surprising considering the percentage of UNC employees that reside in Chapel Hill or Carrboro dropped from 47% in 1997 to 36% in 2009. The pattern for students is the same, with 73% living in Chapel Hill or Carrboro in 1997 and 68% in 2009. The most significant drops in driving alone occurred between the 2001 survey and the 2004 survey. The number of employees who used the park-and-rides more than doubled between 2001 and 2004, and the number of students taking transit rose from 21% to 33% during that same time. These changes are largely attributed to Chapel Hill Transit adopting a fare free policy in January 2002, but since the CAP also started in 2002 the successes ought to be credited to the combination. The number of CAP participants in June 2003 was 1,857 and in December

2010 the CAP had 7,545 participants (C. Kane, personal communication, January 31, 2011). This amounts to over 15% of the current total campus population. The program, through its incentives and marketing, has boosted the numbers of employees and students who choose alternative transportation for their trip to campus.

According to Claire Kane, the Transportation Demand Manager at UNC, the program's

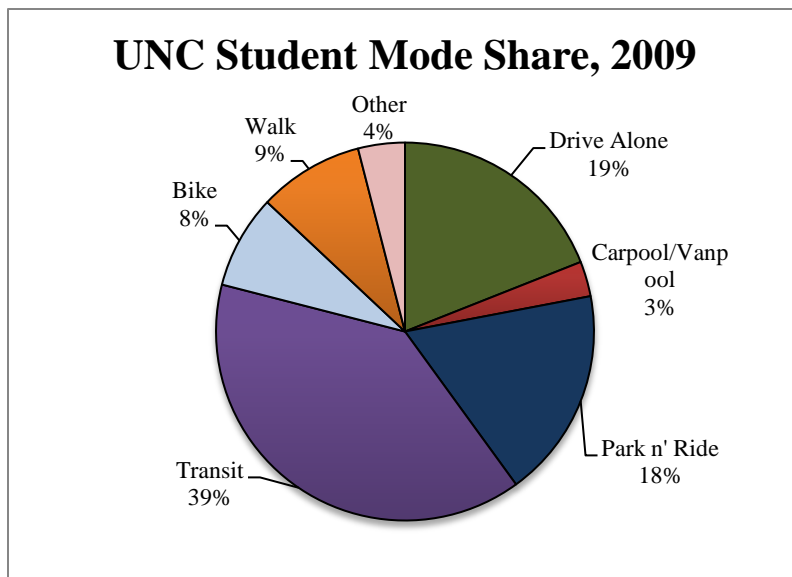


Figure 4: UNC Student Mode Share, 2009

success lies largely with the way it is marketed to people; “I think

that we do a pretty good job of reaching out to people to let them know what their options are and encouraging them to use them” (C. Kane, personal communication, January 31, 2011). Ms. Kane promotes the program and distributes brochures at new employee orientations, department meetings and annual special events on campus. The program’s comprehensive approach to alternative transportation—having something for everyone—makes it appealing to a wide range of commuters. Another component of the program’s success is the collaboration with its regional partners. The UNC Transportation Demand office works with Triangle Transit, Triangle J Council of Governments (TJCOG), the Town of Chapel Hill, and NC State University

to coordinate regional TDM efforts and promote programs and events. This support and coordination of services is integral to the success of the UNC-CAP program (C. Kane, personal communication, January 31, 2011).

Ms. Kane also recognizes the limitations of the programs. The carpool program could be “beefed up”, especially for students—in 2009 just 3% of students and less than 7% of employees carpooled to campus (Bushell et al., 2010). Another concern with the carpool program is that it can be abused by students who register to carpool together and “can easily figure out ways to all park on campus” (C. Kane, personal communication, January 31, 2011). There is also the natural latent demand of parking, especially when it is limited; “when you remove people from the parking pool you will see other people immediately come to fill their place...the statistics are right there regarding how much parking we have and how many people we have” (C. Kane, personal communication, January 31, 2011). The large waiting lists for parking permits, an ever-increasing campus population, and limited funding can make transportation demand management on campus seem like a Sisyphean task at times. The UNC Commuter Alternative Program is continually looking to expand, adapt and improve its options and offerings. The next section examines four other university TDM programs in the United States and Canada.



Figure 5: Duke University

Duke University

Duke University was chosen for this study because of its proximity to, and long-standing relationship with, the University of North Carolina. Duke University is UNC’s primary “peer” university and its top rival. Located in Durham, NC, just twelve miles from the UNC campus, Duke is a larger campus (West, Central and East campuses contain 939 acres) in a more urban setting. Duke’s campus population is approximately 50,000, including 35,000 employees and more than 14,000 students (Duke University, 2010a). The employee commuter mode share in 2009

reflects a heavy reliance on single-occupancy vehicles and low participation in most alternative forms of transportation, with the exception of carpooling (see figure 6). There is not information available for student commute patterns, though the drive alone rate for students is presumed to be low because such a large percentage of them live on or near campus (B. Williams, personal communication, February 4, 2011). Parking spaces at Duke can accommodate less than half of the campus population, with one recent estimate putting the total number of spaces at 23,000 (B. Williams, personal communication, February 4, 2011). Duke has a range of prices for parking, varying from \$7.00 a month for a remote ungated lot to \$97 a month for a premium lot on central campus (Duke University, 2010b). Residential first-year students pay \$240 for an annual pass,

though only approximately 23% of them bring cars to campus. Limited parking availability means high demand and Duke has been working to switch this demand to other forms of transportation.

In June 2007 the University created the Campus Sustainability Committee and charged this new group with creating a Climate Action Plan for the university. Two years later the plan was published, containing a transportation section that outlines a set of strategies aimed at reducing the

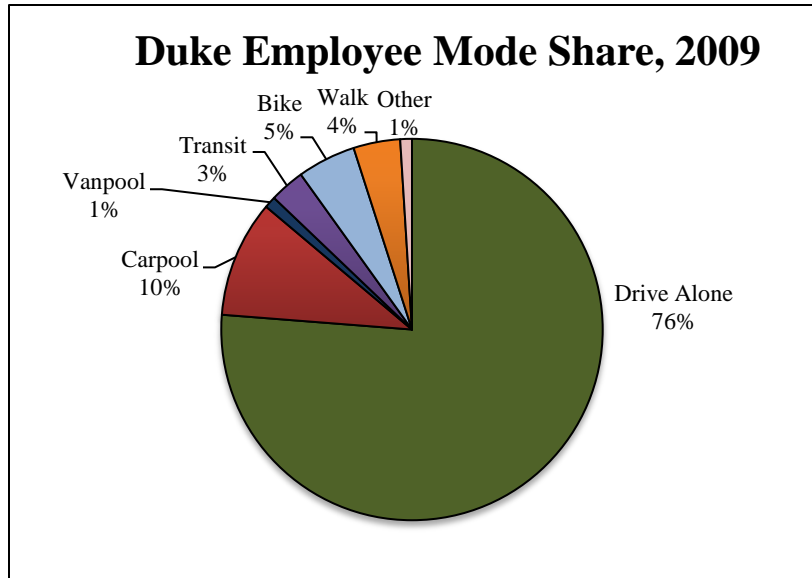


Figure 6: Duke Employee Mode Share, 2009

emissions created by the campus' commuting population. These strategies include the shorter-term goals of hiring a Transportation Demand Management Coordinator, increasing parking prices, increasing transit access, creating park-and-rides, and carpooling incentives (Duke University, 2009). The ultimate goal of the Climate Action Plan is to produce a campus that is 100% carbon neutral by 2050. One of the primary results of this section of the Plan was hiring Brian Williams as the Transportation Demand Management Coordinator in September of 2010. TDM efforts on Duke's campus existed before 2010 but they were administered by different offices and were not centrally coordinated. Now Duke's TDM program is gaining popularity and momentum as Mr. Williams is working to coordinate the existing elements and add new ones.

Duke's TDM program, as such, has been in existence since September of 2010. The program is in its early stages yet still covers most commute options. The university purchases monthly transit passes from both the Durham Area Transit Authority (DATA) and the Triangle Transit Authority (TTA) at full price and sells them to employees and students for 60% of the full cost. There are two free transit options, the Bull City Connector that runs between downtown and the campus, and the Robertson Scholars bus that runs between the UNC campus and the Duke campus. The TDM program offers incentives for carpooling, including discounted or free parking permits (depending on the number of riders in the car) and free occasional parking permits for each rider. Employees may also vanpool to campus, though these are not subsidized by the university. Vanpools do, however, get free a parking permit and a reserved spot on campus. The vanpools are coordinated through Triangle Transit and there are currently thirty-eight Duke employees who commute via vanpool. Those commuters who choose to give up their parking permit and commute to campus on a bicycle can receive up to two free occasional parking permits a month. There is a newly created map online showing the locations of all bike parking spaces on campus, including covered racks. The Duke Student Activities Office runs a bike share program, Duke Bikes, where students can check-out a bicycle for a week for free, and renew it for up to a month. The program has 130 loaner bikes and has been extremely popular; "they keep adding bikes and they keep hitting capacity every month" (B.

Williams, personal communication, February 4, 2011). The Outpost, the campus bike shop, provides free bike maintenance and repairs for students and employees on campus. Duke's campus has eight Zipcars available for use by students and employees, and Greenride, Duke's ridesharing website, is available to assist in coordinating rides. Finally, Duke's TDM participants are entitled to a guaranteed emergency ride home from Triangle Transit if they are registered for carpooling, vanpooling or bicycling. While the program is comprehensive and offers benefits for most types of alternative transportation, there is a list of things that Mr. Williams would like to add or change in the near future.

As of the end of January 2010, there were 1,700 total participants registered for all aspects of the program, amounting to 3% of the campus population. This does not include the free transit riders, walkers or the many cyclists that do not register for various reasons. Mr. Williams is working on creating better tracking systems for these commute modes that are currently unaccounted for, "so [they'll] know how many people are using these services and then [they] can communicate with them and provide them with the proper incentives" (B. Williams, personal communication, February 4, 2011). He believes that people, particularly the bicyclists, neglect to register because the current process is inefficient and burdensome. Potential participants must print the registration form and personally register in the office; Mr. Williams would like to completely automate the process. He is also working with TTA to instate a pre-tax payroll deduction for employees who participate in the vanpool program, and with Duke to provide a subsidy for the vanpool drivers. The ultimate goal for the transit element is to fully subsidize GoPasses for students, which would work on TTA as well as on DATA. With an eye towards the cycling community, Mr. Williams is close to rolling-out a benefit that would provide all bicycle commuters with a free shower at one of two gyms on campus, whether or not they are members of the gym. Finally, he is working with local businesses to develop a merchant discount program for participants in the TDM program.

Despite his constant efforts to improve the program, Mr. Williams can appreciate the successes that it has already achieved. The Bull City Connector started in August of 2010 as a joint effort from Duke and the city of Durham to support the "last mile" trip for many transit commuters arriving to Durham (Bull City Rising, 2010). This has been very successful and an integral part of cutting single-occupancy vehicle trips into campus, with approximately 1,300 trips into campus a day. Duke Bikes, an example of successful alternative transportation efforts on campus was a joint effort between the Office of Student Affairs and Duke Parking and Transportation. Finally, Zipcar, while not a direct substitute for single-occupancy vehicles, has been successful in convincing students that they do not need to bring a car to campus. The successes of the TDM program are paired with challenges, however, such as the lack of data concerning past commuting patterns of the Duke campus population. This has been an issue with Duke and Durham public officials in the effort to implement park-and-rides in the area (Gronberg, 2010), and signifies a dearth of baseline data for evaluating the success of the program. The mechanisms in place for tracking participation are minimal at this point and are limiting the ability to evaluate the various elements of the program. Duke also experiences abuse of the carpool system by students and employees who use people who normally walk or bicycle to campus to register for a carpool. This concern is partially remedied by occasional checks in the lots, but is an aspect of the program that is on the list for improvements. Mr. Williams has spent much of his short time in his position tying up the loose ends of the disparate TDM programs that existed on campus before his arrival, making the appropriate contacts both on and

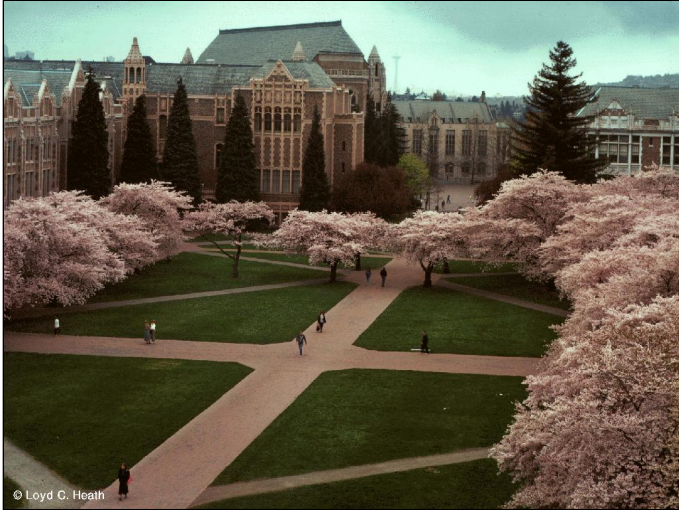


Figure 7: The University of Washington

off campus, and getting the word out about the program and its offerings. So far he has gone through a box of several thousand business cards and has already ordered more.

University of Washington

The University of Washington in Seattle was chosen for this study because it is often lauded as a leader in the campus Transportation Demand Management field because of its revolutionary UPASS

program. The UW is a 642 acre urban campus with almost 32,800² employees and 41,000 students (University of Washington, 2009). In an area known for its constant rain, the level of driving alone to campus among employees and students is surprisingly low at the UW, with just 41% of employees³ and 14% of students arriving to campus in a single-occupancy vehicle. Not surprisingly, parking on the UW campus is expensive and limited. There are 10,600 spaces available and a quarterly permit costs \$423 for faculty, staff and students (C. Gilman, personal communication, February 1, 2011). There is daily parking on campus for \$15 a day. This limited and pricey parking has been an important factor in the success of the UPASS program described below.

The UW is a 642 acre urban campus with almost 32,800² employees

The UPASS program was developed in 1991 for two main reasons: the State of Washington implemented a Commute Trip Reduction law targeting employers with more than 100 employees arriving to work during the morning peak hour; and the City of Seattle's 1983 strict limitations on university parking and traffic impacts. In effect, the UPASS program was intended to ease the strained relations with the city and surrounding neighborhood, as well as comply with the new state

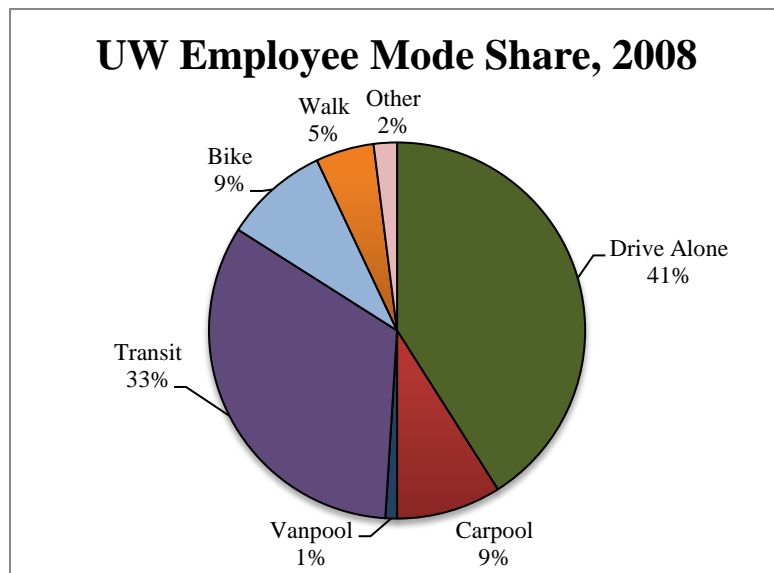


Figure 8: UW Employee Mode Share, 2008

² The number of faculty and staff at the UW included graduate and undergraduate students employed by the university. For this study these employees were omitted so as not to double-count them in the campus population.

³ Faculty and staff are listed separately in the UPASS survey. For this study the average percentage of the two groups is used.

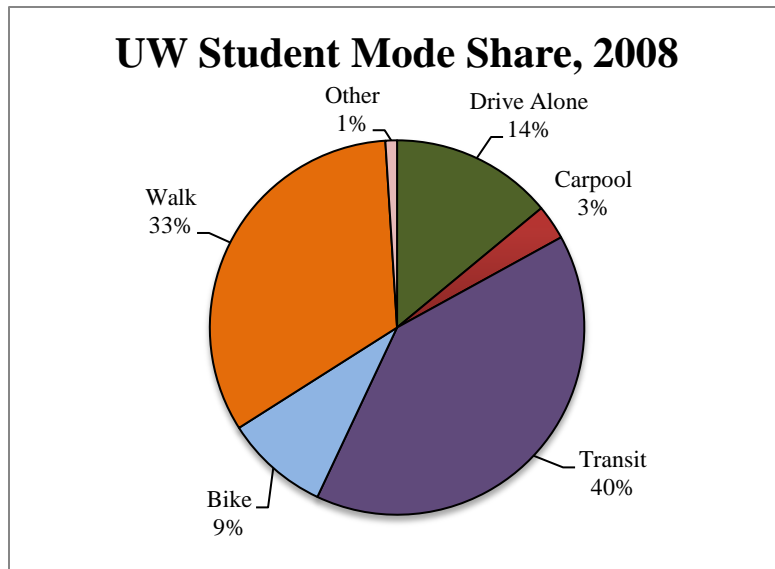


Figure 9: UW Student Mode Share, 2008

mandated trip reduction law. According to Celeste Gilman, the Transportation Systems Manager at the UW, TDM-like programs existed on campus prior to 1991, but the creation of the UPASS program signified an aggressive approach to managing parking and congestion problems both on and off campus (C. Gilman, personal communication, February 1, 2011).

The UPASS program is an “integrated multi-modal program” that is used to reduce the number of

single-occupancy vehicle trips to campus (C. Gilman, personal communication, February 1, 2011). The primary benefit of the UPASS is unlimited free access to six regional transit systems, including the new light rail system and Seattle’s Metro busses. Participants also have the option to carpool to campus, vanpool, bicycle, or walk. The carpoolers split the cost of one parking permit and are eligible for up to three free UPASSes. The carpooling system is not abused at the UW because each rider must swipe their ID card upon entering the parking lot or garage to prove their presence in the car. Vanpoolers with a UPASS are eligible for up to \$70 a month towards the cost of the vanpool. Bicyclists and walkers do not need a UPASS to cycle or walk to campus, but there are other university sponsored benefits for these groups. The university has 5,000 bike rack parking spaces and 600 bike lockers, as well as secure bike rooms to park bikes. These are all free, or available for a minimal cost, and are shown on detailed online maps. There are bike classes offered to members of the campus population, an inexpensive campus bike mechanic, and very successful bike events throughout the year aimed at increasing the number of bicycle commuters. The UPASS offers merchant discounts from local businesses and emergency rides home for participants. There are discounts for UPASS holders on Zipcar, and in January 2011 the campus had the most successful launch of Zimride in Zimride history, with over 3,500 participants and 900 ride matches to date (C. Gilman, personal communication, February 1, 2011).

Currently the program has 41,000 participants, which amounts to 67% of students and 51% of employees. For students the UPASS costs \$99 per quarter and is “opt-out”, meaning that they automatically receive the pass and are billed for it, and they must return the pass to the issuing office to decline participation in the program. The pass costs \$132 per quarter for employees and they must purchase it in person, but they are able to renew online and have the cost deducted pre-tax from the payroll. There have been significant increases in the price of the passes since 2008 due to a “perfect storm of rising transit costs and reduced subsidies available from other sources” (C. Gilman, personal communication, February 1, 2011). Primarily, the regional transit agencies that serve UW are funded by sales tax revenue, and since the economic recession they have had declining funds but not declining costs. In 2008 48,500 people participated in the TDM program, including 83% of students; now at 67%, participation is lower

than when the program started. The declining rate of participation is worrisome to Ms. Gilman since the UPASS program has been such a mainstay of campus culture; now with only 67% of students participating it is “more likely that your friend doesn’t have one” (C. Gilman, personal communication, February 1, 2011).

There are many successes of the UPASS program, and Ms. Gilman attributes them to the integrated multi-modal approach. There is something for everyone—“U-PASS encourages transportation literacy in all the modes and enables people to choose the option that works best for them at any given time” (Association for Commuter Transportation 2008, 27). For example, there is the impromptu carpool, where people who are not regular carpoolers can join together on any given day and park for \$3, as long as they all have valid UPASSes. There is also a discount for occasional drivers, where the person can park for \$5 a day if he or she drives two days or less a week, but it costs \$7 a day if the person drives three days or more. Every parking lot and garage is equipped with an ID scanner, so it can track who is parking where and when. Having parking options other than monthly or quarterly permits increases the chances that people will utilize alternative transportation, because “if they buy a monthly permit, they might as well drive every day” (C. Gilman, personal communication, February 1, 2011). Even every parking permit holder is eligible for a free UPASS so they can utilize alternative transportation if the need or desire arises. The UPASS program has been so successful that a recent survey indicated that students overwhelmingly support making the UPASS a mandatory fee. Ms. Gilman believes that the university is going in that direction based on the positive outcomes from other schools that have mandatory programs. Finally, the University of Washington tracks an extraordinary amount of data pertaining to transportation and participation in UPASS. There is a biennial survey showing commute mode, employee and student residential information, utilization of UPASS, barriers to utilization, etc., an annual UPASS report and profile, traffic counts, bicycle rack utilization, night shuttle ridership, and others. This data is used to continually evaluate, improve and change the program to cater to users’ needs.

The UPASS program at the University of Washington is not without its limitations, with the primary issue being sustainability of the program. The comprehensive program, with its \$25.2 million budget, has three funding streams: parking revenue, user fees, and institutional support. The institutional support has been a constant amount since the program’s inception in 1991. User fees, as mentioned above, have risen significantly due to decreased funding from parking revenue and increased transit costs. The problem that the UW faces with funding the UPASS program through parking revenue is commonly cited in the TDM literature—as a program enjoys more success (i.e. converting single-occupancy vehicle drivers to other forms of transportation), the number of people parking on campus decreases, meaning less revenue. Ms. Gilman concludes by saying that “UPASS has had so many benefits for the institution and the region and our students, staff and faculty. If we aren’t able to get more funding sources and the costs keep growing it won’t be able to continue to provide those benefits” (C. Gilman, personal communication, February 1, 2011). With the upcoming mandatory UPASS for students, some of the funding will be guaranteed in the future, but the TDM staff continues to look for new funding sources.

University of British Columbia

The University of British Columbia (UBC), the only university outside of the United States used in this study, was chosen for its success in reducing the number of single-occupancy vehicle trips to its isolated campus outside of downtown Vancouver. UBC's Point Grey campus is located on a 1005 acre peninsula thirty minutes to the southwest of downtown



Figure 10: The University of British Columbia

Vancouver (InfoVancouver, 2010). The campus is surrounded by water on three sides and the UBC Endowment Lands Ecological Reserve on the other, effectively restricting any physical capacity for sprawling growth by the university. With a campus population of 24,400 employees (including all UBC employees, faculty, and staff and other employees who work on campus but are not staff or faculty), 47,000 students, 6,670 market residents (explained below), and an isolated location, the parking and transportation needs of the university are significant. The UBC campus has approximately 9,300 parking spaces located in surface lots and parking structures (University of British Columbia, 2010a). The rates for parking range from \$4 a day for a surface lot to \$14 a day for a structure. The monthly rate for a permit for employees is \$72 and for students is \$88. This dearth of parking and the high permit costs create a need for alternative forms of transportation.

In 1997 the university created its Land Use Plan (formerly Official Community Plan) to integrate the campus planning with the regional planning in the area. With sustainability, action and education as its guiding principles, the Plan “established bold and broad transportation goals, such as reducing vehicle trips to and from campus by 20% from 1997 levels” (University of British Columbia, 2010b). To help meet these goals the university established the Transportation Planning department, formerly know as TREK (Trip reduction, **R**esearch, **E**ducation, **K**nowledge), to develop strategies to promote sustainable transportation. Transportation Planning has a Strategic Transportation Plan that includes fifty-five policy recommendations and is updated every five years to review targets and set revised goals as targets are met.

Transportation Planning encompasses a variety of alternative transportation options. The highlight of the program is the mandatory UPASS for students—a monthly pass that provides “free” unlimited rides on regional transit and campus shuttles. The students currently pay \$23.75 a month and the university subsidizes every UPASS by \$3.00 per student per month. There are limited opportunities for students to opt-out, and may only do so under extenuating circumstances such as a disability, students on an exchange program, or those taking distance classes (C. Jolly, personal communication, February 3, 2011). Employees may purchase a transit pass for approximately 15% off of the regular price. The university offers reserved parking spaces for carpools until 9:30am, the ability to register multiple vehicles under one parking

permit (allowing carpoolers to share the driving), and emergency rides home. A ridesharing program, Carpool.ca, helps potential carpoolers find people to share rides with. Though unsubsidized, vanpools are encouraged on the UBC campus through a program called Jack Bell Rideshare. UBC offers end-of-trip facilities for cyclists, including bike lockers, free secured bike parking, thousands of bike racks, and showers at many locations on campus. There are maps showing the locations of bike racks, lockers and secure parking on Transportation Planning’s website. A bike shop and mechanic on campus does repairs and maintenance for the campus population and a bike co-op acquires old bikes, repairs them, and offers them for an informal campus bike share. According to Carole Jolly, the Director of Transportation Planning at UBC, the current bike-share program is underutilized, but the campus is exploring opportunities to bring a third-generation bike sharing program to UBC. Zipcar, and another carshare program called Cooperative Auto Network, are available on campus for residents, students and employees who need them.

A final aspect of the University’s dedication to sustainable transportation is the campus housing and real estate market. Though not subsidized or reserved for campus employees, the UBC Properties Trust leases land from the university for 99 years and develops it with mixed-

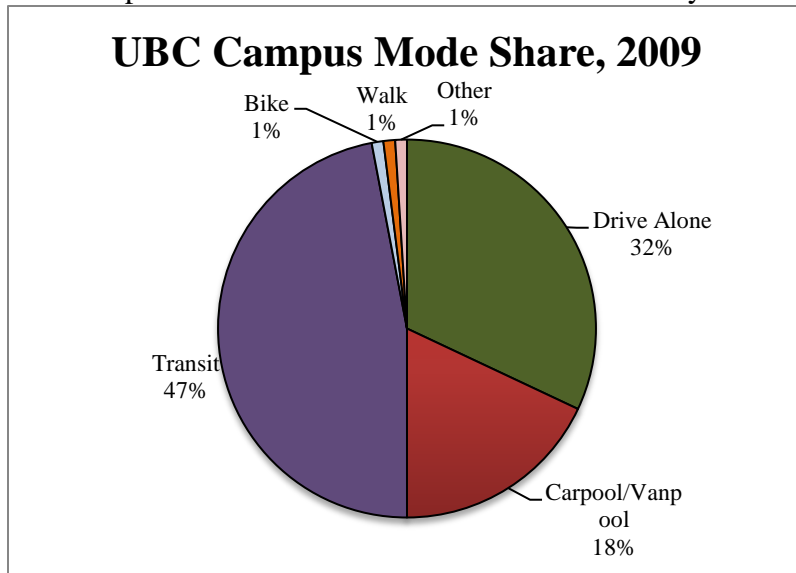


Figure 11: UBC Campus Mode Share, 2009

use neighborhoods. The housing is market-rate, but at least 50% of the units must have at least one person that works or studies at UBC. In addition to providing revenue to the UBC endowment, the Trust’s goals are to: “Socially: move from a commuter campus to a complete community, with places to live and play all day and night. Environmentally: put housing within walking distance of work and study. Financially: don’t sell the residential land - lease it for

99 years, so that it generates perpetual support for students, teachers and researchers, providing a margin of excellence otherwise unattainable” (University of British Columbia, 2009). This is a unique element that was not found in other universities researched.

The tremendous success of the UPASS program has been unexpected. When the program started in 2003, the university anticipated a 30% increase in transit use, and instead it was 53% (C. Jolly, personal communication, February 3, 2011). There are currently 40,000 students with a UPASS and approximately 1,200 employees with a discounted transit pass. The UPASS program at UBC has been so successful that the provincial government is going to make subsidized transit passes available to all post-secondary students in publicly funded post-secondary institutions across the province. The price for UBC students will rise to \$30 a month. The successes of transportation planning efforts are visible in the comparative mode shares of

employees and students. In 1997 the percentage of people who drove alone to campus was 43% and in 2009 it was 32% (see figure 11). While transit ridership increased from 18% to 47%, bicycle riding and carpooling both decreased as a result. The university conducts annual traffic counts at what they call the Screenline, an imaginary line around UBC's main entrance points. Due to this process, they are unable to determine the separate mode shares for employees and students. They also conduct biennial transportation surveys to assess program utilization and barriers to utilization. The program website contains abundant information about all of the various alternative transportation programs and offers opportunities for providing feedback.

The main problem with the current program and a limitation to growth, according to Ms. Jolly, is the insufficient level of transit service for the university. Because of the success of the UPASS program, every bus that travels to campus is "filled to the gills" with students and employees. The campus is the second most popular destination for the regional transit system, after the downtown core. Every time a new bus is added to the system, it is immediately filled up. Transportation Planning is working on ways to meet the growing demand, but with the transit systems in financial distress, it is unlikely that the service will be improved in the near future. Additionally, Ms. Jolly expressed UBC's commitment to making the campus more pedestrian and bicycle friendly as a component of the on-campus cycling plan (C. Jolly, personal communication, February 3, 2011).



Figure 12: Cornell University

Cornell University

Cornell University, located in the town of Ithaca, NY, was chosen for this study not only because of the success of its TDM program, but also for its unique strategy of collaboration with the community. The Cornell campus sits atop a hill overlooking Cayuga Lake, and is bound on two sides by gorges. The campus covers 745 acres and is home to almost 20,000 undergraduate and graduate students (Cornell University, 2010).

Approximately 14,000 faculty and staff work at the university and, as of 2006,

55% of them drove alone to work (see figure 13). The campus has 7,000 parking spaces available for daily commuters (10,000 counting reserved spaces, special event, departmental reserved and metered spaces), with rates ranging from free at remote surface lots to \$730 for prime central campus spaces. Students pay close to \$700 for an annual parking pass, or can pay \$40 weekly or \$103 monthly to park on campus (Cornell University, 2011). While the ratio of parking spaces to campus population may seem low, Cornell's TDM program has almost eliminated the need to create more parking spaces since its inception in 1991.

In 1990 Cornell was faced with the all-too-common predicament of needing to construct 2,500 new parking spaces to accommodate campus growth and not having money or space to

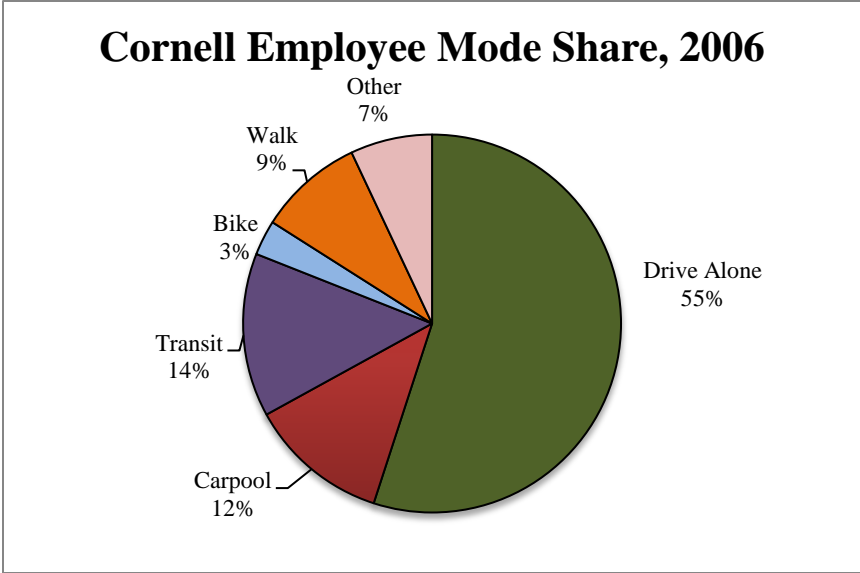


Figure 13: Cornell Employee Mode Share, 2006

construct it. “The big thing for us to try and sell twenty years ago was that it’s cheaper to offer people alternatives to parking than to build parking. Parking, no matter what you charge for it, is almost certainly not going to pay for itself” (D. Lieb, personal communication, February 16, 2011). Ultimately the university made the decision to attempt to reduce the number of cars coming to campus every day instead of constructing the necessary parking structures. Cornell piloted its OmniRide

program in 1990, consisting of free and subsidized transit access and formalized ridesharing benefits. Within the first year of the program a full one-third of Cornell employees had enrolled, reducing the number of cars entering campus daily by 2,200. The university regards this as a great accomplishment. However, the participation rate has remained stagnant at one-third for the last twenty years. David Jay Lieb, the Assistant Director for Transportation at Cornell, cites two reasons for this stagnancy: 1) some people simply prefer to drive their own cars, no matter what the sacrifice, and 2) many people would participate in the TDM program but face a barrier of some sort (Association for Commuter Transportation, 2008). The TDM program at Cornell works to provide options for the second category of people so they might leave their cars at home.

OmniRide is the catch-all name for the TDM program at Cornell. Employees that relinquish their parking permit are eligible for OmniRide, meaning that they can ride TCAT (Tompkins Consolidated Area Transit) for free and can request up to thirty one-day parking passes for free. The OmniRide also provides a free membership to Ithaca Carshare for those employees that are interested, as well as a guaranteed emergency ride home. All first year students are given an OmniRide pass for free, and students can purchase an annual pass in subsequent

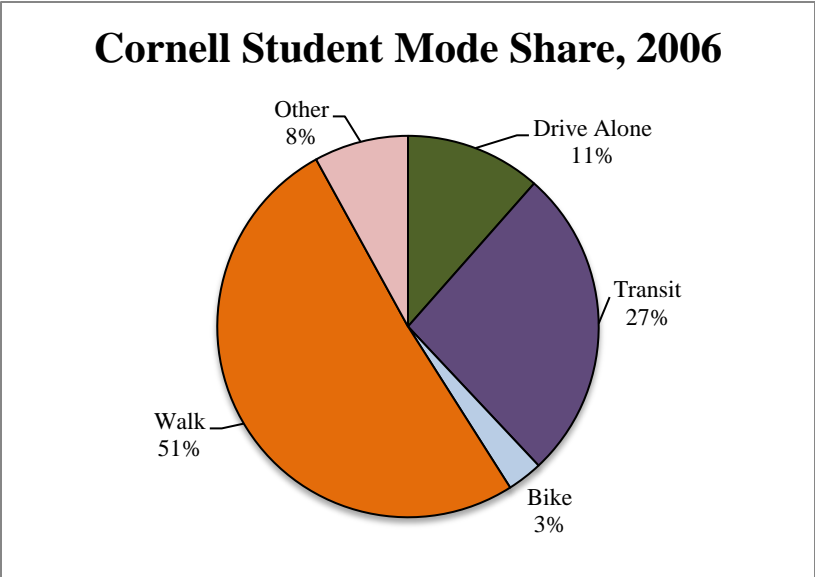


Figure 14: Cornell Student Mode Share, 2006

years for \$200—a \$300

discount off the regular price charged by TCAT. Additionally, all Cornell employees and students are able to ride TCAT for free on nights and weekends. Alternatively, Cornell commuters who forego their parking permit can register for RideShare, a formalized carpooling program with incentives, instead of OmniRide. The more people registered under one carpool, the greater the benefits. For example, carpools with four people parking in a less central lot receive a reserved spot, a free permit and a cash rebate (Cornell University, 2011). Mr. Lieb acknowledges a potential for fraud in the carpooling system, but chooses to ignore it; “we don’t want to punish the 95% in order to regulate the 5%” (D. Lieb, personal communication, February 16, 2011). There is also an informal carpooling program, where there are no incentives but the carpoolers are able to share the cost of the parking permit. Although bicycling is not a main focus of the Cornell TDM program, there are online maps showing routes and rack locations on campus, as well as other resources for cyclists and pedestrians. There is a pilot bike share program currently about to launch, though this is the creation of a student group and not an official campus program (D. Lieb, personal communication, February 16, 2011; Stern, 2011).

Four more recent additions to the Cornell TDM program have come into existence through campus-community partnerships. The creation of eleven park-and-ride lots was a community-wide effort spearheaded by Cornell and coordinated with TCAT. The park-and-ride lots are available to all employees in Ithaca who commute from outside the city. They are located so they “so they intercept traffic as it densifies, but before it causes congestion”, and at the periphery of town to facilitate the formation of carpools, vanpools and transit access (Association for Commuter Transportation 2008, 8). Another joint venture between the city, county and campus was the creation of Ithaca Carshare. Instead of contracting with a national carshare program, campus and government officials opted to start their own not-for-profit carshare program and make it available to city residents, employees and the campus population. To date there are fourteen cars available on and near the campus, with more on-campus cars designated for hourly business use during the day coming soon (D. Lieb, personal communication, February 16, 2011). The vanpool program, though currently under-utilized, is the third TDM element available to the campus employees as well as community members. As of February 2011 there was one vanpool in Ithaca consisting of seven Cornell employees and two non-university employees. Finally, Zimride, a ridesharing program created by a Cornell alumnus, is open to Cornell, Tompkins Cortland Community College, Ithaca College and other local employers. People looking to share rides can limit their search to people in their own institution or open it to everyone, depending on their comfort level.

Collaboration with the community contributes greatly to the success of Cornell’s TDM programs. Before OmniRide there were three separate transit agencies in Tompkins County. They all had different fare structures, fare mediums, transfers, routes, schedules and there was redundancy in the service. Cornell worked with the City of Ithaca and Tompkins County to consolidate the transit systems into one—TCAT. They established a universal fare system and were able to replace redundancy with increased service areas and more frequent headways. Cornell, Ithaca and Tompkins County all contribute one-third to cover the system’s annual deficit and keep the service running (D. Lieb, personal communication, February 16, 2011). The increased ridership spurred by OmniRide resulted in better service and expanded routes from TCAT, prompting a cycle of regional benefits and better service for the entire community. The transit service, vanpool program, Ithaca Carshare, Zimride, and park-and-rides are community resources, not just university resources, which not only help to reduce town-gown strains but

have also been a real sense of pride for the university officials who helped to create them (D. Lieb, personal communication, February 16, 2011).

Despite the successes of Cornell's TDM program, there are some elements that are in need of change. Mr. Lieb's primary concern with the program, and a potential source of stagnant participation, is the inflexibility of the options. Employees must choose whether they are going to purchase a parking permit, participate in OmniRide or Rideshare. Mr. Lieb would like to see a program that caters to employees' needs throughout the life cycle, allowing them to drive when necessary and participate in alternative forms of transportation when possible. Unfortunately at this point the university is not in a position to implement these types of sweeping changes. Additionally, the sale of student OmniRide passes has decreased significantly since the university began giving them to first year students for free. The "perceived value [of the pass] was lowered by giving it away" (D. Lieb, personal communication, February 16, 2011).

Evaluation

All of the universities discussed above have had successes with their TDM programs. It is difficult to comparatively evaluate the level of success of the programs because the available data varies for each. Furthermore, depending on the details of each program, the universities are only able to track participation in certain areas. For example:

- UNC's program misses many cyclists and walkers because of the registration process.
- Duke, because it is such a new program, has not established comprehensive evaluation techniques and their participation tracking is currently limited to purchased transit passes, registered carpools and vanpools.
- UW collects impeccable data and the program can be evaluated in multiple ways.
- UBC, because of the manner in which they collect mode share data, cannot distinguish between the student and employee mode shares and thus cannot accurately measure the effects of specific program improvements.
- Cornell's participation rate consists solely of students who receive or purchase OmniRide and employees who receive OmniRide or register for Rideshare. It does not account for bicyclists or walkers because there is not an official program for them to participate in.

Every university, however, has a documented mode share within the last five years to use as a measure of success, as noted in the figures above, although Duke and UBC do not have separate mode share data for students. One way that the universities can be compared and evaluated is by examining each school's parking policies and mode share.

Parking Discussion

As discussed in the literature review, "parking pricing is one of the most significant determinants of travel behavior" (Toor and Havlick, 2004). Interestingly, the universities examined for this study have widely varying approaches to parking, despite their successful

TDM programs and dedication to decreasing the number of single-occupancy vehicles arriving to campus every day.

	Campus Population	Parking Spaces	Ratio⁴	Annual Price Range	Cost for Central Campus	% Employee Drive Alone
UNC* ⁵	49,500	20,000	0.4	\$415-\$2,154	\$2,154	51%
Duke* ⁶	50,000	23,000	0.46	\$84-\$1,164	\$1,164	76%
UW* ⁷	73,800	10,600	0.14	\$1,692	\$1,692	41%
UBC* ⁸	71,400	9,300	0.13	\$864-\$1,056	\$1,056	32%
Cornell ⁹	29,000	10,000	0.34	Free-\$730	\$730	55%

Figure 15: Parking ratios and rates

*Hospital at university

The ratio of parking spaces to campus population appears to be a fairly accurate indicator of drive alone rates among the universities in this study. The two universities with notably lower drive alone rates, the University of Washington and the University of British Columbia, also have significantly lower parking ratios. There is also a correlation between parking price and drive alone rates at these universities. The University of North Carolina, Duke University and Cornell University have lower parking permit ranges than the other two universities, and tend to have higher drive alone rates for employees. A final factor to consider is the presence of hospitals at four of the five universities. Universities with hospitals experience a different set of parking challenges than those without, but further discussion of this is outside the scope of this study. While parking availability and price are not the only factors attributed to university mode shares and TDM program participation rates, it is undeniable that they play an important role. The following section highlights documented university TDM best practices from the literature, as well as this study’s analysis of the best practices from each university researched above.

Best Practices

Each university researched in this study has a distinct set of strategies employed to accomplish its TDM goals. What may be a complete success at one university may not work at all at another. Each university has unique conditions—geographical setting, location of employee and student housing, parking regulations and availability, land uses, community

⁴ Ratio is the number of parking spaces divided by the campus population.

⁵ UNC prices range from \$415 for an ungated space for an employee earning less than \$25,000 to \$2145 for a prime space for an employee earning more than \$100,000.

⁶ Duke prices are per month and range from \$7 a month for a remote ungated space to \$97 a month for a prime central campus space. For this study, prices were multiplied by 12 for the annual price.

⁷ UW prices are per quarter and are \$423 a quarter for employees and students. For this study, prices were multiplied by 4 for the annual price.

⁸ UBC prices are per month and range from \$72 a month for employees and \$88 a month for students. The prices were multiplied by 12 for the annual price.

⁹ Cornell prices range from free in a remote surface lot to \$730 for a central campus space. Parking permits are also available weekly and monthly for increased relative costs.

integration, student involvement—and the TDM program must be context-sensitive. While there is no one-size-fits-all approach to campus TDM programs, several studies have documented six strategies that are widely considered to be best practices (VTPI, 2010; Balsas, 2003; Toor, 2003):

- Provide a variety of improvements and services, including specialty services such as transport for recreational trips and special events
- Involve administrators, managers, students and staff in planning and implementing the program
- Emphasize benefits to students and staff from improved transportation services, including financial savings, improved choice, improved exercise (for cycling and walking), and environmental benefits
- Improve pedestrian and bicycle conditions on campus and in surrounding areas
- Ensure synergy between transportation modes
- Offer occasional parking options instead of just permitted parking

While these best practices are general guiding principles for all TDM programs, they do not include specific strategies that have proven successful. As stated above, all universities must find the appropriate combination of TDM strategies given their unique context; there is not a single prescription that will cure every university's traffic and parking woes. Below are some specific strategies that this author considers to be the best practice for each university.

Duke: Duke Bikes, the free bike share program for students at the university has proven its success by continuously having every bike loaned out. The program is a collaboration between Duke students, Campus Services, the Office of Student Affairs, the Provost's Office and the Executive Vice President's Office and has been in existence since the 2007-2008 school year. The bicycles come equipped with adjustable seats, lights, helmets and locks. The service is complimented by the Outpost, a student-run bike shop that maintains the loaners as well as other students' and employees' bicycles. Part of the success of the program is attributable to the ease and convenience of the check-out system—students can reserve and check-out the bikes using the Blackboard Transact system they use to manage their classes. *Best Practice: Convenient, free student-run bike share program with low-cost bike shop for repairs.*

University of Washington: The UW's UPASS program is not just a free transit pass; it is a comprehensive, flexible multi-modal program that provides options for all commuters. The program has high participation rates of 67% of students and 51% of employees. One of the keys to the high participation rate for students is that the program is opt-out, meaning that the students have to take action in order to return their UPASS. All employees that have a UPASS also can receive benefits for carpooling, vanpooling, bicycling and walking to campus; they are not committed to only taking transit. Additionally, even those employees who choose to purchase a parking permit receive a UPASS to offer them convenient and free alternatives to driving alone to campus every day. UW offers occasional parking at discounted rates for those commuters that are unable to commit to one mode of travel. *Best Practice: Multi-modal program that provides flexibility, options, and benefits for all alternative modes of travel.*

University of British Columbia: The UBC has a mandatory UPASS program for all students, except for those with extenuating circumstances who wish to opt-out. The passes cost less than \$25 a month for students and the university subsidizes every pass by \$3. Employees get a 15% discount on the passes. The pass provides unlimited access on the region's transit

system and has helped boost ridership among the campus population from 18% in 1997 to 47% in 2009. Increased ridership has, in turn, enabled improved and increased transit service for the rest of the community. *Best Practice: Mandatory, subsidized, unlimited access to regional transit. Unique practice: Housing on campus that financially benefits the university and requires a university affiliate in at least 50% of the units.*

Cornell: Several aspects of Cornell's TDM program benefit not only the campus population, but also members of the community. The regional transit, the vanpools, Ithaca Carshare, ridesharing and park-and-rides are all jointly supported by Cornell, the city of Ithaca and other educational institutions in the area. This collaboration and shared support of the alternative transportation options has led to increased usage and regional benefits. *Best Practice: TDM collaboration with the surrounding community and expanded services to include employees from other institutions.*

Recommendations for UNC

The University of North Carolina has had an official TDM program, the Commuter Alternative Program, in place since 2001. The program currently has just over 7,500 registered participants, and has contributed to the admirable employee drive alone rate of 51%. The CAP's success is supplemented by the fare-free Chapel Hill Transit that serves the campus and surrounding community. While UNC's CAP, through its various TDM strategies, has contributed to decreasing the number of single-occupancy vehicles entering campus every day, the program could benefit from both facial and systematic changes and improvements. The Town continues to experience increased traffic volumes at the principal entry points, indicating that people continue to drive in from surrounding jurisdictions (Town of Chapel Hill, 2010b). Being the community's largest employer, the university has the obligation to the town to augment its efforts to mitigate the single-occupancy vehicle congestion. The following are this author's recommendations for improvement based on both research of other universities as well as personal observations on campus. Following each recommendation is the party/parties involved in implementation, the assessed effectiveness of the recommendation and the estimated cost.

Recommendation #1: Enhance marketing of the Commuter Alternative Program

The Commuter Alternative Program currently produces brochures to distribute at the new employee orientations, department meetings, student events and campus information forums/activities throughout the year. The program is advertised in the Daily Tar Heel, the campus newspaper, and has a web page within the larger UNC Department of Public Safety, although the website is in need of a facelift. Despite the outreach efforts of the TDM coordinator, the discrepancy between the number of participants in CAP (7,545) and the number of commuters claiming alternative transportation for their primary mode to campus (35% of campus population, or 17,325) would indicate that a large percentage of the campus population is not aware of the program, or has not registered for a different reason. This discrepancy is notable, especially considering that 18,610 (63%) students lived off-campus in fall of 2010 (UNC Office of Institutional Research, 2010b), making them eligible for participation in the CAP.

The marketing of the program could be improved upon in a variety of ways, including:

- Send information about alternative transportation and the Commuter Alternative Program to incoming students and parents before arriving on campus.
- Update website with more appealing graphics, improve usability and ensure that links lead to correct pages.
- Improve readability of CAP brochure.
- Place posters in all campus buildings to advertise the program.
- Collaborate with off-campus apartment complexes to promote the program.
- Present at the graduate school orientation to ensure that all incoming students are aware of the benefits.
- Tout the environmental, financial, and health benefits to increase appeal of the program.
- Conduct personalized outreach to eligible, non-participating employees.
- Emulate Stanford University’s “Commute Hero Love Stories”—a series of testimonials from alternative commuters used to lure others out of their cars. This began as a one-time promotion of the TDM program and has lasted over the years. The stories are published on the Alternative Transportation website and, at the time of the promotion, appeared on posters on buses (Stanford University, 2010).

Implementation	TDM Coordinator, UNC Marketing/Communications Department, Marketing Intern
Effectiveness	Marketing campaigns have been shown to increase TDM effectiveness
Cost	Moderate—mostly printing and staff time

Recommendation #2: Improve efficiency and convenience of CAP registration

The Commuter Alternative Program brochure states that “[a]ll online registration has been discontinued with the exception of those done through the Departmental Parking Coordinators”. However, the CAP website frequently asked questions reads “Good news! For most CAP participants, the registration is online and you can do it on your own. It will be available beginning July 15th and we will distribute the website URL before that time” (UNC-DPS, 2010c). Without explicitly saying it, the website implies that registration for CAP ends on August 15th. Employees wishing to register after August 1st of each year must do so in person in the Department of Public Safety, located on the south end of campus. Students must always register in person, regardless of the date, and the in-person registration requires proof of insurance and a valid vehicle license plate.

With conflicting information and unclear deadlines, the CAP registration process could be improved in the following ways:

- Ensure that all materials pertaining to CAP registration contain uniform information.

- Include a step-by-step process for registration, including one for employees and one for students.
- Automate the process entirely—do not require in person registration. The DPS building is located remotely and could be a deterrent for many potential registrants.
- Automatically renew CAP membership each year unless instructed otherwise.

Implementation	TDM Coordinator
Effectiveness	Ease of registration can reduce barriers for participation
Cost	Low—does not require large improvements or expenditures

Recommendation #3: Increase flexibility of program choices

The CAP currently requires participants to choose their primary mode of commuting at the beginning of each academic year. This means that they have a park-and-ride decal, or they have a carpool permit, a vanpool subsidy, a regional transit pass, or, if they are not registered with CAP, an annual parking permit. Requiring members to choose one method for commuting can discourage or prevent potential participants from registering due to fear of having limited options. For example, if an employee needs to drive to campus two times a week, but can take the bus the other three, he or she may reject the CAP and purchase an annual permit because it is more cost effective than paying for daily parking twice a week. Once the annual permit is purchased, the employee is discouraged from taking the bus because he or she would have to pay the fare (if living outside of Chapel Hill/Carrboro). The CAP does, however, provide emergency rides home and discounts on Zipcar membership with the intention of removing barriers for some potential participants.

The CAP could provide more flexibility for commuters in the following ways:

- Allow occasional parking at a discounted price for CAP participants—this encourages people to waive their annual permits because they know they can drive more than twice a month if necessary (CAP participants currently receive two free parking passes a month). Occasional parkers must be CAP participants to be eligible for the discount.
- Allow discounted parking for spontaneous/impromptu carpoolers—this affords people the opportunity to ride together occasionally but not be required to carpool every day. Spontaneous carpools must have a minimum number of CAP participants to be eligible for the discount.
- Provide more than two free parking permits each semester to student CAP participants.
- Provide annual parking permit holders (non-CAP participants) with one 10-Ride Card a year for use on Triangle Transit if they live outside of Chapel Hill or Carrboro—this gives people the incentive to try alternative transportation without committing to an entire year of it.

- Allow potential participants a thirty-day trial period in CAP to see if it works for them before committing to an entire year.

Implementation	Department of Public Safety--Parking, Transportation, TDM Coordinator, Triangle Transit
Effectiveness	Flexibility in programming and options allows potential participants to overcome perceived barriers
Cost	High—requires infrastructure improvements, parking revenue losses and transit expenditures

Recommendation #4: Improve the carpooling element of the TDM program

The carpooling element of UNC’s Commuter Alternative Program currently offers any size carpool the opportunity to share the cost of the permit. There are no preferred or reserved parking spaces for carpools and no discounts on permits. Claire Kane, the UNC TDM Coordinator, cited carpooling as the aspect of the program that needs the most improvement. There is abuse of the program, with students registering with CAP as a carpool with members that would otherwise walk or bicycle to campus instead of drive. In 2009 only 7% of employees and 3% of students claimed carpooling or vanpooling as their primary mode of travel to campus.

UNC could improve its carpooling program in the following ways:

- Provide discounted parking permits for carpools, decreasing in price as the number of riders increases.
- Offer reserved parking spaces for carpools in centrally located lots, at least until the end of the morning peak.
- Allow discounted parking for spontaneous carpools—this affords people the opportunity to ride together occasionally but not be required to carpool every day. Spontaneous carpools must have a minimum number of CAP participants to be eligible for the discount.
- Install electronic card swipes to more closely monitor carpooling honesty.
- Provide cash incentives for carpools of four or more.

Implementation	TDM Coordinator, UNC Parking Services
Effectiveness	Incentivizing carpools will attract more participants
Cost	Moderate--electronic card swipes

Recommendation #5: Collaborate with Town of Chapel Hill on TDM efforts

Chapel Hill’s Town Hall office is located less than one mile from the center of UNC campus. A survey conducted in 2009 showed that 91.6% of Town employees drove alone to work, 8.7% carpooled, and 5.5% bicycled or walked¹⁰. The low rates of alternative transportation are likely a result of the fact that 68.1% of the employees lived at least ten miles

¹⁰ Employees could select multiple options; percentages are out of total responses, not total employees.

from work, and only 14.1% lived within five miles (Town of Chapel Hill, 2010d). While not all of the employees who participated in the survey work at the office located close to campus, all of the Town facilities are accessible by Chapel Hill Transit and the employees could benefit from using the park-and-rides. The Town of Chapel Hill has a Transportation Management Plan and is committed to reducing the number of employees who drive alone to work, thus it is likely that a partnership with the university would be successful.

The University of North Carolina could collaborate with the Town of Chapel Hill in the following ways:

- Pool resources and land to increase the park-and-ride lots that are accessible to both UNC and Town employees.
- Allow UNC employees to carpool with Town employees and still receive the benefits of the CAP.
- Expand Zimride to include Town employees to increase the likelihood of ride matches among commuters.
- Include Town employees in the UNC vanpools to increase ridership and decrease price per person for riders.

Implementation	TDM Coordinator, Transportation Management Coordinator at Chapel Hill, UNC Facilities
Effectiveness	Increasing pool of participants in alternative transportation can reduce barriers for some potential participants
Cost	Moderate to High—may include infrastructure costs to expand park-and-ride lots

Recommendation #6: Improve and/or implement bicycle support services

On any given day on UNC campus there are close to 3,000 people commuting by bicycle to UNC campus (3% employees and 8% students). These bikes require parking, in addition to the numerous bicycles parked permanently on campus. According to a recent count, there are 392 bike racks with 4,733 spaces available for bicycle parking on the main campus (R. Magyar, personal communication, June 23, 2010). Despite the surplus of spaces, there is often a shortage of rack space at major destinations on campus, such as the student union, libraries, cafes and popular study areas. Currently there are no bike lockers or bike rooms on campus for commuters, except for one room available for Computer Science employees. UNC does not have an on-campus bike mechanic, although the nearest repair shop is located within a half-mile of campus. To date there have been a number of attempts, but no successful implementation of a bike share system on campus. Due to the close proximity of shopping, restaurants and other amenities to campus, a bike share program would be ideal on UNC’s campus.

UNC could improve conditions and support for bicyclists on campus in the following ways:

- Provide covered bike racks.
- Provide bike lockers at a low cost to bicycling commuters who do not want to park their bikes outside.

- Convert underutilized rooms or basements in campus buildings to bike rooms, accessible only to those who park their bikes there.
- Provide more bicycle racks at prime destinations on campus.
- Collaborate with Cyclicious (a campus bike advocacy group), or another student group to implement a mobile bicycle repair shop on campus.
- Support any attempt by a student group and/or the Student Activities Office to implement a bike share on campus.

Implementation	TDM Coordinator, student bike organizations, Cyclicious, UNC Facilities
Effectiveness	Encourage bicycle trips by enhancing bicycle support programs and destination facilities
Cost	Moderate—many of the funds required may be regained after implementation (bike locker usage and student activity fees for bike share and repair shop)

Recommendation #7: Improve bicycle circulation on campus

The UNC campus has two segments of bike lane that total less than one mile, and one of these segments ends abruptly, leaving the cyclist in the middle of a three lane road. These roads run along the north-south axis of campus and have higher speed limits and heavier traffic than other roads on campus. The east-west connector roads have no bike lanes and are congested with heavy pedestrian and vehicle traffic throughout the day. Bicycling on the north-south roads can be dangerous because of the volume and speed of vehicle traffic, despite the presence of bike lane segments. Bicycling on the east-west roads is dangerous and inconvenient because of the level of congestion caused by continuous pedestrian crossings. Currently there are no bicycle-specific paths or trails on campus. Bicyclists on campus must contend with fast vehicle traffic, drivers frustrated by pedestrians, high volumes of congestion and distracted pedestrians.

The University of North Carolina could improve the circulation and safety of bicycles on campus in the following ways:

- Educate UNC fleet vehicle drivers about North Carolina laws pertaining to cyclists and general bicycle safety.
- Enforce speed limits and other traffic violations on campus.
- Educate pedestrians about safe street crossing and issue citations for illegal crossing.
- Consider changing timing of traffic light at the intersection of Cameron Ave. and S. Columbia St. to decrease waiting time and pedestrian impatience.
- Consider building paths on campus exclusively for bicycles—this would improve the safety and circulation for both bicycles and pedestrians.
- Collaborate with the Town of Chapel Hill to install bike lanes on roads leading to campus (similar to the existing lane on Cameron Avenue).

Implementation	TDM Coordinator, Planning and Engineering Departments at Chapel Hill, UNC Facilities, NCDOT, campus police
Effectiveness	Increases bicycle usage and channelizes bicycle traffic to primary routes and destinations.
Cost	High—infrastructure costs will be necessary for bicycle paths

Recommendation #8: Hire a campus bike/pedestrian coordinator

The University of North Carolina currently does not have a dedicated bicycle and pedestrian coordinator on its TDM staff. The current TDM Coordinator has mentioned interest in bicycle and pedestrian issues, but simply does not have the time necessary to dedicate to these issues. Toor and Havlick (2004) claim that a full-time coordinator on large campuses is necessary to market, promote and advocate for improved facilities and programs for bicyclists and pedestrians; the universities with the most successful programs have such coordinators. Without a position dedicated to them, bicycle and pedestrian programs and facilities can easily fall through the cracks. In this author’s opinion, the bicycling element of UNC’s TDM efforts needs the most improvement in order to make a comprehensive, successful overall program.

The bicycle and pedestrian coordinator on campus would have the following responsibilities:

- Coordinate construction and maintenance of bike lanes and paths on campus.
- Collaborate with the Town of Chapel Hill’s Bicycle and Pedestrian Planner on bicycle and pedestrian issues on campus and community-wide.
- Organize bicycle promotion events and campaigns on campus.
- Conduct periodic evaluations of bike rack usage and needs around campus.
- Organize bicycle and pedestrian safety education campaigns and activities.
- Partner with the campus police to encourage enforcement of vehicle speed limits and other traffic violations on campus.
- Assist TDM Coordinator with increasing benefits for employees who bicycle or walk to campus.
- Assist TDM Coordinator with marketing and outreach for the Commuter Alternative Program.

Implementation	TDM Coordinator, Director of Transportation at UNC
Effectiveness	A position dedicated to bicycle and pedestrian issues will improve facilities, programs and conditions
Cost	Moderate—funding for a full-time position

Recommendation #9: Build or acquire affordable housing for employees near campus

The UNC Employee Commuter Survey indicates that more employees who live within two miles of campus take transit than drive alone. Similarly, for these employees the rate for bicycling and walking to campus is close to thirty percent. Indeed, living close to campus increases the likelihood that an employee will commute by means other than a single-occupancy

vehicle (Bushell et al., 2010). Not surprisingly, as employees live farther from campus the rate of driving alone increases. According to the Survey, 36% of UNC employees live in Chapel Hill and Carrboro. Perhaps one reason why UNC employees live outside of Chapel Hill is because the median home price in 2009 was \$372,000. This is compared to \$191,000 in Durham County and \$244,000 in Wake County (Town of Chapel Hill, 2010c). Many employees simply cannot afford to live near the UNC campus. Lewis and Clark College in Portland, OR has similar affordability and parking issues to UNC and they have begun acquiring homes in the vicinity of campus and converting them to subsidized employee housing (Toor and Havlick, 2004). The program functions like a home trust in that the university owns the land but sells or leases the home to the employees. The catch is that the residents are prohibited from using their cars on campus.

The University of North Carolina could facilitate employee housing near campus in the following ways:

- Include employee subsidized housing in the redevelopment of the University Square/Granville Towers property and the Carolina North satellite campus development.
- Acquire existing homes that are within walking or biking distance to campus, or near a transit stop.
- Partner with the local Community Home Trust to help university employees qualify for the program’s affordable housing.

Implementation	UNC Facilities and Planning Department, Human Resources
Effectiveness	Employees who live close to campus are more likely to commute by alternative transportation
Cost	High—constructing or acquiring homes and apartments

Recommendation # 10: Raise and/or adjust campus parking prices

According to the UNC Department of Public Safety’s parking brochure, there are sixty-nine parking spaces available for every one hundred permanent employees; the ratio is far lower for students. UNC has a complicated allocation process, based on size of department and cumulative tenure among department employees. Once the number of permits is determined for every department, each department Parking Coordinator is charged with allocating the permits to individual employees. There are waiting lists for parking permits and the rates are based on location of lot and employee income. As such, the demand for parking exceeds the supply. Toor and Havlick (2004) state that campuses that have strong alternative transportation options have a higher rate of mode shift as a result raising parking prices. Donald Shoup (2008) also suggests the “Goldilocks Principle” of flexible parking prices as an alternative to fixed rates: “the price is too high if too many spaces are vacant, and too low if no spaces are vacant. When a few spaces are vacant everywhere the price is just right” (Shoup 2008, 136). The University of North Carolina would benefit not only from increased parking revenue, but from decreased administrative burdens of managing parking.

UNC could benefit from restructuring campus parking programs, prices and policies:

- Incrementally raise parking permit prices across the board for all employees and students until demand matches supply, but maintain the variation based on income for employees to ensure equity.
- Allow occasional parking permits for those employees and students who relinquish their parking permits after the price increase.
- Conduct feasibility analysis of a flexible parking system on campus.
- Use some of the increased revenue from parking to fund improvements to the TDM program.

Implementation	UNC Parking Services
Effectiveness	Parking pricing is one of the most significant determinants of travel behavior
Cost	Low or High—potential investment in electronic parking monitoring system, otherwise very few costs

Conclusion

Transportation Demand Management is becoming a common response to the pressures faced by universities of growing numbers of automobiles on campus and declining funds and land to accommodate them. Universities are coming up with innovative ways to provide access to the campus without destroying the character and beauty that many hold so dear. Fundamental changes to the way transportation management is handled have been driven by the many successes of universities around the continent. The early 1990s marked the first steps by universities towards managing demand of automobile facilities and parking instead of always increasing supply. The University of Washington and Cornell University were pioneers in these efforts, and their programs still prevail as models of TDM efforts. While universities are often better suited to implement TDM efforts, the successes and lessons learned can be applied to other institutions as well.

TDM strategies are context-sensitive; what may be a best practice for one university may not work at all for another. However, there are some strategies that have been documented as widely successful in a range of contexts. The University of North Carolina at Chapel Hill currently employs a number of the literature’s documented best practices, such as offering a variety of programs, involving staff and students in the program planning through the Bicycle and Pedestrian Safety Committee, and ensuring synergy between the transportation modes by providing park-and-rides. In the grand scheme of TDM programs on university campuses, UNC is above average. However, UNC is known as a leader in academics, sports and community culture, and for this reason this author has recommended improvements to the TDM program so the university can be known as a leader in sustainable transportation efforts as well.

Appendix A: Interview Guide for TDM Coordinators

- 1) What is your job title and what are your primary responsibilities?
- 2) How long have you been in your current position?
- 3) How many employees does _____ university have? Breakdown of faculty vs. staff?
- 4) How many students?
- 5) Do you know the mode split for each group's commuting patterns? If not, do you know where I could find that information?
- 6) Is there public transportation in the city? Is it free or subsidized for employees/students?
- 7) What percentage of the employees lives in the university city/town?
- 8) How many parking spaces are available for employees? For students?
- 9) How much does parking cost?
- 10) Will you describe the different elements of the TDM program that you are in charge/affiliated with?
- 11) Are there any specific land use strategies (i.e. employee affordable housing on or near campus, amenities on campus) utilized?
- 12) Why did the TDM program start? Was it in direct response to a specific problem/issue?
- 13) Who/what funds the program? What is your budget?
- 14) If funds come from parking revenue, what percentage of the total revenue do you get?
- 15) How many participants do you have currently? Percentage of total campus population?
- 16) What types of outreach do you do to involve people in your program?
- 17) Are there incentives for participating? If so, what are they? Where does funding come from for them?
- 18) How do you track participation and results of your program? How do you evaluate it?
- 19) Do you have baseline data from when the program started?
- 20) What is the most successful aspect of your program?
- 21) What aspect needs work/improvement?
- 22) Is there anything extraordinary or ground breaking about your program, in your opinion?
- 23) Is there a mechanism in place that allows employees/students to provide feedback/suggestions?
- 24) If so, have you implemented any of these suggestions?
- 25) What issues/challenges have been most prevalent for your program?
- 26) What have you done to overcome them, if you've been able to?
- 27) What have been some opportunities/unexpected outcomes of your program?
- 28) How have you dealt with those?
- 29) Do you have plans to change anything about your program to improve it?
- 30) Do you feel like the university values the program? Do they do anything to explicitly support it/not support it?
- 31) Are there any documents or reports online that I can access to get more information?
- 32) What additional support would you like to see from the university?
- 33) Is there anything else about your program that you would like to add?

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