THE EFFECT OF Land USE PLANNING on UNIVERSITY TRANSPORTATION SYSTEMS

by

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The unique situation of university campuses makes them excellent environments in which to examine the transportation-land use relationship specifically, how to optimally occupy and manage space while maintaining maximum mobility and accessibility. The literature suggests that data and a thorough discussion of campus land use and transportation are lacking; moreover, as available land on campus disappears planners are urgently in need of effective approaches to managing transportation and land use.

This report analyzes the results of a survey of 34 four-year residential and commuter universities with enrollments of more than 15,000 located in small cities of populations between 50,000 and 249,999. The report includes in-depth case studies of three of the campuses (the University of California-Santa Barbara, the University of Oklahoma-Norman, and Harvard University) in an effort to illustrate real-world situations encountered by campus transportation and land use planners, such as town-gown coordination, adherence to local zoning ordinances, and the implementation of effective alternative transportation programs.

The trends identified by the survey results show that most development is on previously used land—often surface parking lots—in the central campus, thereby suggesting that campuses generally have little room for new development and that most changes will be in the form of redevelopment (and lost parking). Consequently, campus planners often find themselves in the difficult position of deciding between the construction of expensive parking structures or searching for ways (which can be politically unpopular) to substantially reduce parking demand. Many respondents commented on the potential of park & ride programs, the expansion of transportation alternative programs, and in particular, unlimited access transit pass programs to address this decrease in parking supply. However, such programs are only successful at reducing parking demand when they are implemented with policies (often controversial) that reduce the supply of inexpensive and convenient parking.

The survey results further show that the availability of land in the campus interior is a greater determinant of the type of parking than the relative costs of lots versus structures, as campuses more frequently build structures on the periphery than lots in the interior. This implies that land availability is also a greater determinant than convenience or accessibility. Most schools appear to be striving to maintain a pedestrian-oriented campus, if only in the campus core. Moreover, mode split data analyzed in the report suggests that the area in which a school is located (i.e., urban, suburban) is a greater determinant of its campus transportation traits than the campus being residential or commuter.

### Key Words
- Land
- Planning
- University
- Transportation
- Systems

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The unique situation of university campuses makes them excellent environments in which to examine the transportation-land use relationship: specifically, how to optimally occupy and manage space while maintaining maximum mobility and accessibility. The literature suggests that data and a thorough discussion of campus land use and transportation are lacking; moreover, as available land on campus disappears planners are urgently in need of effective approaches to managing transportation and land use.

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Chapter 1: Introduction

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1.1 Overview

Many college graduates recall their experiences on campus as relatively carefree times before the reality of health insurance, utility bills, income tax, and car payments set in. Many lived in dormitory rooms that in retrospect resembled closets, or in apartments or fraternity/sorority houses within walking distance of a picturesque campus with open quadrangles ideal for studying on a blanket or playing a game of frisbee. As young, active students with little or no income, residential choice and transportation decisions are significant and unique over the short period of four years; meanwhile, graduate and non-traditional students with jobs and/or families have the same or fewer options on possibly tighter budgets. Universities are facing the reality that residential choice and transportation options factor greatly into employee compensation as well, thereby becoming recruitment and retention issues. Academic and athletic standings have long been considered dominant factors in competition among institutions of higher-education; yet maintaining an aesthetically-pleasing and livable campus that is easily accessible is becoming an evermore significant factor. As campus land availability decreases, the challenge for the campus planner is to meet the need for adequate and attractive
academic, administrative, athletic, and boarding facilities while maintaining campus livability and accessibility.

1.2 Problem Statement

The unique situation of university campuses makes them excellent environments in which to examine the transportation-land use relationship: specifically, how to optimally occupy and manage space while maintaining maximum mobility and accessibility. For the purposes of this study, the definition of land use is the function of space: for example, the campus land used for parking, vehicular access roads, the pedestrian network, academic and administrative buildings, athletic facilities, boarding facilities, etc. One example of the transportation-land use relationship on a campus is the effect that the function of a space may have on transportation (and vice versa), as land consumed for a parking lot provides campus access to motor vehicles and, if convenient and inexpensive, may encourage campus users to drive to campus rather than consider a transportation alternative (e.g., transit) that consumes less land (thereby leaving space available for preferred functions such as an auditorium or a stadium). As Miller remarks in *TCRP Synthesis 39: Transportation on College and University Campuses* (2001), “university communities are incubators for new approaches to meeting mobility challenges.” This reality has made university transportation systems the topic of several studies that investigate innovative approaches and project implementations. Most recently, Daggett and Gutkowski’s “University Transportation Survey” (2003) suggests that further research is required to answer the question “how does land use planning at the university and community levels affect transportation systems on or around university
The literature (as shown in Chapter 2) suggests that data and a thorough discussion of campus land use and transportation are lacking; moreover, as available land on campus disappears planners are urgently in need of effective approaches to managing transportation and land use. One of the basic assumptions of this research is that campuses which are exempt from local zoning ordinances (as the majority are) have a relative amount of freedom to develop as they wish, compared to the host communities and the regulatory controls that govern them.

As with any transportation demand management (TDM) system, a comprehensive approach, consisting of unlimited access programs, ridesharing, parking demand management, transit, bicycling, and walking is most effective. Land use is a significant element of almost each of these strategies and often dictates the need for or the physical feasibility of each. Particularly on a university campus, where land is preferably used for academic facilities instead of parking lots, the importance of land use in transportation planning is extremely high.

Not only are university campuses currently in need of solutions to the problems of congestion, inefficient land use, dangerous intermodal conflicts, and maintaining campus attractiveness/livability, but they are also prime environments in which to experiment with new approaches to optimizing the transportation-land use relationship. For example, the concept of carsharing (that is, a short-term rental arrangement, not to be confused with carpooling) is relatively new but appears to have great potential to reduce parking demand by providing a single vehicle for multiple users; a university campus may be an ideal situation in which to test this potential.
1.3 Purpose and Objectives

The purpose of this project is to provide a thorough analysis of the relationship between transportation and land use on university campuses. It is hoped that the conclusions will provide meaningful guidelines for transportation and land use planning both on university campuses and in areas without universities to improve mobility, accessibility, and livability via an efficient multimodal system.

Among the objectives of the project are:

- to identify trends in transportation and land use on university campuses through a survey of universities;
- to identify innovative approaches and technologies;
- to provide campus land and transportation planners with an overview of the state of the practice;
- to provide detailed examples of challenges and opportunities in campus planning through case studies of three universities.

1.4 Scope

This project examines land use planning and transportation systems of university campuses in the US, including their interaction with the surrounding community (as reported from the university’s point of view). The data encompass the results of a survey of campus parking and transportation planners and administrators conducted in the summer of 2003, as well as observations of information presented on the survey respondents’ websites. The research is limited to residential and commuter universities that:
• offer at least a Bachelor’s degree;
• have enrollments of at least 15,000;
• are located in cities with populations between 50,000 and 249,999.

Sixty-four campuses met these criteria and the survey respondents were included in the research regardless of urban, suburban, or rural setting. The descriptions of each campus as urban, suburban, or rural and as residential or commuter that are used in this study are those listed by the College Board at the time of data collection. The descriptions are self-reported by the campuses as they are taken from the schools’ responses to the College Board’s Annual Survey of Colleges, and these designations may therefore be somewhat subjective.

The research examined planning frameworks, circulation, parking, residential demographics, campus-community coordination, transit operations, and development regulations. Discussions of project financing and cost are beyond the scope of this research, but certainly warrant attention and are recommended for future research.

It is anticipated that the results of the study will assist in identifying optimal land use patterns for communities (university or non-university) that wish to maintain/create a balance between compact development and livability. The role of parking is expected to dominate the study. The underlying assumption of the project is that university campuses seek to foster livable spaces within their boundaries that enable students, faculty, and staff to focus on academic and extracurricular activities without the distractions of inconvenient or inefficient transportation or land use. The lessons learned from these bounded communities may contribute to our understanding of how to optimize the transportation-land use relationship to improve livability.
1.5 Expected Benefits of This Research

It is hoped that by identifying trends in campus land use strategies for transportation and by providing detailed examples of ‘real-world’ situations via the case studies, this research will provide insight and guidelines for land use that might be applied to both university and non-university areas. The guidelines may influence policy-making and planning practices, and reduce transportation-related costs by suggesting approaches that improve efficiency, mobility, and accessibility.

1.6 Report Organization

The report begins with a Literature Review (Chapter 2) in order to assess the current state of research on campus transportation and land use. Chapter 3 describes the research methodology, including an explanation of how the sample population/survey candidates were determined as well as development and deployment of the survey and a brief description of the responding sample group. Chapter 3 also explains how case studies were selected and how the case study research was performed. In Chapter 4, survey results are analyzed and general trends in campus transportation and land use are identified, followed by the presentation of the three case studies in Chapter 5. The final chapter provides the conclusions of the research and identifies areas of opportunity for campus systems as well as possibilities for further research.
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2.1 Introduction: University Transportation

A literature review has been conducted in order to determine the current state of research in the area of transportation on university and college campuses. As suggested by Pavlovich (1992), for university administrators “defining the problem [of campus transportation] is really a two-part question: one, what are the real transportation needs of students and faculty; and two, in relation to the university’s policies, what are the university’s responsibilities in responding to these needs?”

An excellent point of departure from these questions is the University of Colorado Environmental Center’s guide to campus transportation, which provides a thorough overview of the best innovative approaches to parking, transit pass programs, bicycling, walking, car and van pooling, ‘town-gown’ coordinated planning efforts, and state legislation (Poinsatte and Toor 1999). The guide is somewhat of a “how-to” manual for university and community transportation administrators, introducing them to common
campus practices and providing tips for implementation, such as a checklist for a successful Transportation Demand Management (TDM) program.

*TCRP Synthesis 39* also provides a general overview of campus transportation by drawing on the results of a survey of 30 universities and discussing the approaches to funding, organization and management that many are taking. The synthesis identified four trends that appear to be taking place on the campuses studied: 1. the increasing popularity of unlimited access pass programs; 2. unlimited access systems involving several universities in large urban areas; 3. the growth of comprehensive TDM programs; 4. intensified coordination between universities and the communities that surround them.

More recently, Dagget and Gutkowski (2003) conducted a survey of universities with the following conclusions:

- The master plan provides an excellent opportunity for both universities and the surrounding communities to address transportation issues and to establish working relationships with one another as a framework for accomplishing goals.
- The results of the survey indicate that demand for parking is greater than supply, thereby creating substantial opportunities for TDM programs, transit, bicycle and pedestrian facility improvements, and land use.
- Local land use codes, regulations and Adequate Public Facilities (APF) ordinances do not apply to most of the universities surveyed, allowing campuses to develop according to their own needs regardless of the impacts to the surrounding community and its transportation systems.
- Transit is a very significant part of a university transportation system and often serves the to-and-from campus trip, remote parking lots, circulatory routes, or the general
public. They have relatively good access to the campus, utilize an unlimited access program, and serve a student population that is concentrated within one mile of the campus.

Several studies have examined the transportation systems of individual universities; for example, Boyd et al. (2003) found that mode split is a function of the student’s distance from campus and that UCLA’s unlimited access program, BruinGo, increased transit ridership while decreasing automobile trips. Likewise, Meyer and Beimborn (1996, 1998) drew similar conclusions from their study of the University of Wisconsin-Milwaukee and its UPASS program, and further found that “the UPASS program has the potential to have a major impact in attracting and retaining students at the University.” The University of Wisconsin’s multimodal system was also studied by Gerhard (1984), whose analysis is from the point of view of the university administrator. UW’s approach began in the early 1980s with the development of a University Transportation Planning Committee, made up not only of students, faculty, and staff, but also members from the District DOT, the Regional Planning Commission, and the City Planning Office, thus incorporating all of the area’s elements. The Committee examined land use studies, residence surveys, and transportation surveys for each UW campus in order to identify areas in need of improvement, such as pedestrian facilities, bicycling facilities, access for people with disabilities, ride sharing programs, and mass transit.

This ‘united front’ approach was also used at the University of Illinois at Champaign-Urbana with particular success. The Champaign-Urbana Mass Transit District (CUMTD) developed a service concept involving an integrated (campus and
local community) network, unlimited access, short high-frequency campus routes, service to remote parking lots, extended late night service, and a low, mandatory transportation fee for all students, faculty, and staff (approved through student referenda). Moriarty et al. (1991) explain that by integrating the campus transportation system with the existing community system, costs were kept to a minimum and service was provided for intra-campus trips as well as to-and-from campus trips, thereby creating a more comprehensive service network than would have otherwise been possible from separate systems. TDM strategies were also used to complement the integrated transit system, such as subsidized employee bus passes, reduced parking costs for shared ride and remote lot users (and the provision of a shuttle bus service to remote lot users), and an increase in the price of close-in parking. The program turned out to be so successful that the administration was able to postpone $5 million of parking garage construction. One might suggest that the long-term implication of university’s TDM program is that land can be used for academic buildings rather than additional parking.

The University of Washington’s U-PASS system is a comprehensive TDM program that involves increased transit service, shuttle service, car and van pools, ride-matching, bicycles, reimbursed rides home, commuter tickets, and merchant discounts. As described by Williams and Petrait (1993), U-PASS’s predecessor turned out to be unsustainable, and the need for a new transportation program arose when 1) a new university development plan called for the construction of four parking garages and 2) projections for the University of Washington Medical Center indicated more faculty, staff, and patient vehicle trips would be arriving. The implementation of the U-PASS program resulted in a considerable mode shift: before U-PASS, 21% of commuters used
transit and 33% drove alone; after U-PASS, 33% used transit and 23% drove alone.

Williams and Petrait go on to cite 5 lessons learned from the U-PASS program:

- Include both incentives and disincentives to balance a TDM program
- Create flexible commuting options
- Use parking fees as a disincentive for driving alone as well as a means for funding other TDM strategies
- Run a comprehensive education program to increase the likelihood of acceptance
- As demand may be greater than expected, be prepared to meet the excess so that first-time users don’t get a poor impression of service and revert to driving alone.

While it appears that most universities are beginning to establish truly multimodal transportation systems on their campuses and reduce congestion, a glimpse of what may lie ahead is in order. Markowitz and Estrella (1998) suggest that distance learning may eventually become the dominant form of higher education. They cite California State University at Monterey Bay’s Master Plan, which in 1998 predicted that of a future enrollment of 25,000 full-time students, only 8,300 would physically be on campus. The land use implications of such concepts may be positive for transportation both on the university campus and in the surrounding communities. Moreover, car-sharing has come to several campuses including the San Jose State University campus (Business Wire 2002), and although it is still too early to determine whether the program is successful, the potential of the concept is quite encouraging.
2.2 Transit and Unlimited Access Programs

2.2.1 Unlimited Access Programs

A key aspect of comprehensive TDM programs on university campuses is the unlimited access pass. In unlimited access programs, the university pays the local transit agency a lump sum to enable students (and sometimes faculty and staff, depending on the arrangement) to use their university identification to ride the transit system fare-free. Brown et al. (2001) conducted a survey of 35 unlimited access programs on university campuses and found several explanations for the increasing popularity and success of this approach. Among the reasons cited for a university to offer unlimited access passes are:

- Reduce parking demand (and consequently improve land use options) and reduce the costs (to the university) associated with parking
- Increase accessibility for students
- Increase university attractiveness to prospective students and improve the ability to retain students
- Reduce students’ cost of attending college
- Increase transportation equity (e.g., eliminate the award of parking proximity based on seniority, etc.)

The benefits to the local transit agency are also very attractive, such as increased total transit ridership, guaranteed revenue, and an overall improvement in transit service. The cost to the university is a function of the total number of rides that are taken by students (and in several cases faculty and staff). Not only is this cost often much less than that of providing parking, but it is less than the cost of conventional transit passes because 1) bulk purchase reduces transaction costs, 2) unlimited access users take up...
excess transit capacity (i.e., students fill empty seats during off-peak hours), and 3) the program avoids adverse selection (i.e., as the number of participants increase, the university’s cost per person decreases).

Program implementation options vary from partial coverage, for instance, potential users can opt-in or opt-out of the program, or universal coverage, in which all potential users are given a pass regardless of whether or not they want or will use it. As such approaches involve the imposition of student fees in order to fund the program, they often require approval via a student referendum. Funding may also be extracted from parking revenues, which play the double-duty of automobile disincentives.

Brown et al. point out that unlimited access is beneficial for both the university and local transit agencies as it

- Increases total transit ridership
- Fills empty seats
- Improves transit service
- Reduces operating costs and subsidies.

Furthermore, the potential for unlimited access programs in non-university areas appears promising: employers in areas of Colorado and California have successfully established unlimited access programs for their employees.

2.2.2 Case Study: Iowa State University

Bourne and Schauer (1990) examined a case study on the highly successful CY-RIDE transit service at Iowa State University, which has enabled the administration to eliminate automobiles from the campus core and construct new buildings on land that
was previous occupied by parking lots. Moreover, additional parking demand that would be expected to arise from the newly constructed facilities has been shifted to alternative modes of transportation, namely the convenient and reliable high-frequency transit service. The key to success at Iowa State appears to have been the careful, incremental implementation of the TDM strategies. First a close relationship was formed between the student body, the university administration, and the city of Ames, Iowa, in what is now known as the Ames Transit Agency. The creation of the alliance inferred that every stakeholder’s needs would be met; for example, the students were assured inexpensive, convenient service, while the city was able to share the burden of cost with both the university and the students. As a result of improved service, demand increased, which was met with a proportional increase in service. Only after transit service was proven effective and successful did the University move to reduce the amount of parking on the central campus and raise the price of permits.

Bourne and Schauer further note that the city of Ames is a supportive area for transit:

*the spatial development pattern of Ames lends itself to relatively long travel distances for a small community along a few major corridors. This pattern makes a bus service extremely attractive, because many of the outlying apartment buildings are beyond a comfortable walking distance from the ISU central campus…CY-RIDE is competitive with walking and bicycling. It is also more time-efficient than driving, because of the lack of parking spaces on campus.*
Another key is that each strategy complements another, so that travelers almost have no reason to drive a single occupancy vehicle (SOV) (in fact, those who choose to drive may very well find it a hassle to do so, due to the high cost of what little parking exists). For example, students who live within four-blocks of a transit route are ineligible for a campus parking permit. This approach has proven to influence land use decisions, in that “CY-RIDE has become a major selling point for rental units.” Perhaps most importantly, the authors note that “the net result of CY-RIDE service has been an intensive academic use of the existing central campus….Academic interaction, which is one of the primary functions of the university, has been enhanced by the close spacing of buildings allowed by minimized central campus parking.”

2.3 The Campus Parking Issue

It is expected that the parking issue will occupy the majority of time and effort of the research, since approximately 350 square feet of land are typically required to maneuver and store a single automobile in a parking space (Sadfie 1997). As in Dober’s (1964) words: “the automobile at rest takes up more space than that needed for housing a single student. In the space occupied by twenty automobiles, three hundred students could be given instruction.”

2.3.1 Parking as a Single Element of the Whole Transportation Scene

Kirkpatrick (2003) suggests that rather than begin campus transportation planning at the point of a vehicle’s arrival on campus, one should start at the departure point of the
trip to campus in order to examine how the traveler gets to school/work. Such a
“paradigm shift” is necessary because:

1. many colleges and universities cannot operate and maintain the traditional
   expansion of surface lot and structure parking in a cost-effective manner;
2. the campus community typically is not willing to pay the increasing cost;
3. increasingly, space is not available as we strive for a pedestrian-oriented
   campus; and
4. the traditional parking system of one vehicle per person no longer meets the
   diverse needs of all customers.

-(Kirkpatrick 2003)

This new approach enables planners to create a “menu of options” as to how people
travel to campus, rather than simply looking for new, cost-effective solutions to the old
problem of storing SOVs and consuming valuable land. Kirkpatrick further notes
significant trends in parking at the University of Michigan at Ann Arbor:

1. Campus aesthetics are very important in attracting new students; large amounts
   of unsightly surface lots are not supportive of this principle.
2. Core-area surface lots are being consumed for new buildings.
3. Accessibility, both for people with disabilities and service vehicles, must be
   prioritized as space for vehicles in the core-area of campus dwindles.
4. Costs for maintenance and expansion of parking are increasing.
5. Although the construction of peripheral parking solves some issues, it increases
   the cost of transportation between these areas and the campus.
6. Construction costs for parking are increasing as more amenities must be
   provided for security and aesthetics, and for the creation of a low-maintenance
   facility.
7. The consumer often ends up paying for the costs of deferred maintenance.
In order to “expand planning beyond the traditional parking paradigm” and focus on home-based work trips, Kirkpatrick notes that the University of Michigan planners identified the assumptions and goals shown in Table 2.1.

**Table 2.1: Assumptions and Goals used in University of Michigan Parking Planning Process; Kirkpatrick 2003.**

<table>
<thead>
<tr>
<th>Assumptions</th>
<th>Goals</th>
</tr>
</thead>
<tbody>
<tr>
<td>• The supply of core-area surface parking, or centrally located parking, will continue to decline as building expansion occurs and as colleges and universities implement a pedestrian-oriented campus.</td>
<td>• To voluntarily reduce the demand for core-area parking.</td>
</tr>
<tr>
<td>• Parking in campus core-areas will continue to be restricted for service access, visitor parking, and handicapped parking.</td>
<td>• To maintain a percentage of vacant core-area parking throughout the day.</td>
</tr>
<tr>
<td>• Planning for parking and transportation systems will support the Campus Master Plan direction of a pedestrian-oriented campus.</td>
<td>• To meet the parking demand by providing better service at reduced costs.</td>
</tr>
<tr>
<td>• Parking Services will initiate planning with the surrounding community to develop shared resources.</td>
<td></td>
</tr>
<tr>
<td>• Transportation access will increasingly be part of parking solutions.</td>
<td></td>
</tr>
</tbody>
</table>

The resulting “menu of options” from this approach maximizes flexibility and includes: several levels of parking permits in which the cost reflects the parking area’s proximity to buildings; free perimeter parking that includes shuttle transportation to the core campus; park-and-rides that are coordinated with the local transportation authority (“this option provides an opportunity to share resources with the surrounding community”); a free bus pass program with the local transit agency (the option “most positively received by the campus community”); bicycle lockers; and prioritized accessibility for disabled parking and service vehicles.

Toor (1999, 2003) also notes that providing more transportation options to campus users is more cost effective than simply providing more parking options. For
example, Stanford University approached transportation from an economic standpoint and found that as part of a comprehensive TDM program that widened traveler options, parking cashout—that is, paying people not to drive—was less expensive than building more parking. Furthermore, the University of Colorado offers an unlimited access program to students, faculty, and staff which has reduced parking demand on campus. The result has been a decrease in parking demand of 350 spaces. Toor notes that:

the annual cost of the bus pass program is $393,400; it costs $1,125 per parking space left open. For comparison, the annual debt service to provide one additional parking space is $2,723. Thus, it is 2.5 times as expensive to provide one additional parking space compared to reducing demand by one space. The net annual savings to campus, compared to providing 350 new spaces, is thus $560,000.

Bourne and Schauer (1990) likewise found that Iowa State University was able to save $750,000 per year in parking, while spending only $160,000 on transit service (net savings of $590,000).

Toor (1999, 2003) also recognizes that some drivers would be alternative users, but because they need to drive occasionally, they may have to purchase a full permit. Since they have therefore already paid for a permit that allows unlimited parking over a set period of time, there is no disincentive for them to drive to campus. Having a choice of more flexible options such as “occasional parker” programs or daily parking coupons enables people to exercise their possibilities and not feel obligated to drive simply because they have already paid to park.
2.3.2 Design

Design of parking on campuses provides opportunities for experimentation as well. Kirkpatrick (1989) notes that the design elements that must be taken into consideration when planning parking include: security, aesthetics, accessibility to multiple activity areas (Kirkpatrick notes that at Eastern Michigan University, the turnaround time of using peripheral parking is usually much shorter than for parking on the main campus), and a pedestrian emphasis. Dober (2000) includes the following factors in decisions concerning parking from an architect’s perspective: proximity to destination (within 1000 feet), available land, site character, climate, cost, and the school’s policy on how much of the parking demand it is willing to accommodate. Regarding land values, Dober prescribes that multi-level parking structures be considered “when land values per square foot exceed the cost per square foot of on-grade parking solutions by a factor of 3.5 or more.” Pavlovich (1993) advises that parking stall dimensions and aisles can be reduced slightly from the standard full-size in order to accommodate more spaces. Moreover, planning for parking must take into account aspects such as the mix of resident and commuter students, the daytime and evening enrollments, and the spatial distribution of facilities on campus. Siting of parking areas “is as important as the number of spaces provided,” and is affected by 1. the hourly, daily, and semesterly fluctuation of student rosters; 2. the priority given to pedestrians and landscaping; and 3. financial feasibility (Pavlovich 1993).

Table 2.2 compiles the indicated and suggested planning standards for parking from various authors and illustrates the differences to parking approaches over time. It is interesting to note that Smith’s 1960 report, which mainly discusses siting for new
campuses and where to add parking on established campuses, tends toward the high end of parking space to student ratios; here, the beginnings of the approach of building more parking to accommodate more vehicles are clear.

Table 2.2: Comparison of campus parking ratios: 1960 to 1998.

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Student</strong> (commuter/non-storage)</td>
<td>0.13 to 0.59 spaces per student <em>(average: 0.41 spaces per student)</em></td>
<td>0.28 spaces per student</td>
<td>0.15 to 0.45 spaces per student</td>
<td>0.15 to 0.32 spaces per student <em>(average: 0.24 spaces per student)</em></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Suggested planning standard: 0.50-0.67 spaces per student</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Visitor/guest</strong> (non-event)</td>
<td>N/A</td>
<td>0.03 spaces per employee</td>
<td>N/A</td>
<td>0.002 to 0.03 spaces per student <em>(average: 0.02 spaces per student)</em></td>
</tr>
<tr>
<td><strong>Faculty/Staff</strong></td>
<td>N/A</td>
<td>0.70 spaces per employee</td>
<td>0.50 to 1.00 spaces per employee</td>
<td>0.06 to 0.38 spaces per student <em>(average: 0.13 spaces per student)</em></td>
</tr>
</tbody>
</table>

1Smith does not differentiate between resident and commuter students; it is assumed that these are overall values.

Dober (1992) offers a very articulate opinion as to the potential for a vastly negative impact that parking can have on an entire campus:

*How sad to see a potentially attractive campus scene blemished by execrably located and atrociously designed parking. Too often in the guise of privilege and necessity, accommodations for the automobile have come to take precedent over all other campus design considerations. The time has come to put the park back in parking, for there are few campuses whose design would not be immediately improved if parking were treated as a landscape element. Some in-close parking is necessary for the handicapped, for visitors, and for those on campus who need ready access to their vehicles. Except in places with extreme climates, there are no other reasons for other kinds of parking to intrude into and abuse the central campus environment, defined as the 125 to 150 acres that lie*
within a five-minute walking distance from the presumed nodes, or center of campus—abuse physically with its reflection of glass and metal, abuse in safety terms, abuse as physical elements that are incompatible with the patterns of architecture and open space that make the campus an enjoyable place. If campus design were a theological statement, there would be only one deadly sin: the presence of parking in the wrong location. In these instances, parking contributes to a sense of place the same way open sewers did to the medieval townscape… Where the convenience of the automobile has precedent, campus design suffers most—and deserves the most draconian resolution.

2.3.3 Governing Policies

Rich (1998) proposes that parking can be an asset to a campus if treated properly, mainly in that it might be able to attract more prospective students as well as generate revenue from permit sales and event parking. Revenue from permit sales can be maximized by overselling student parking “by as much as 200 percent” since the entire student body will not have classes at the same time; likewise, faculty and staff parking can be oversold about 130%.

2.4 Tapping into Human Power: Bicycles and Pedestrians

2.4.1 Bicycles

It is often suggested that universities are ideal settings for high amounts of bicycling and walking due to the young student population. Yet Toor (1999, 2003) notes that “there is room for a significant increase in bicycling at many campuses for a very modest investment.” A bicycle infrastructure can range from basic provision of safe routes and bicycle racks, to refined amenities such as grade-separated crossings, covered bicycle parking, bicycle signals at intersections, and programs such as free bicycle check out to students and employees. Toor further notes that one bicycle parking space costs
about $100, or less than 1% of a new vehicle parking space. The example of Stanford University is notable: rather than spending a minimum of $18 million on parking for 900 drivers, the administration was able to spend $4 million in bicycle facility improvements and motivate the would-be drivers to bicycle instead. It therefore appears that bicycling may be an area of vast opportunity for some campuses.

2.4.2 Pedestrians

The most important priority for any campus is the separation of vehicles and pedestrians. Dober (1992, 2000) discusses pedestrian space as “a significant campus design determinant” in which paths “generate a skeleton which gives shape and scale to the campus design.” Among the design considerations given to a path is the function, that is, whether it will serve large volumes of traffic seeking the most direct route in the typical 10-minute break between classes, or a lower volume of more leisurely users who will appreciate differences in terrain, landscape, and other visual attributes. After determining how the path will serve the campus population, elements such as size, length, cross-section, and surface treatment may then be appropriately calculated. Specifically, Dober recommends that in the central campus paths be about 15 feet wide (wide enough for six people abreast) and no less than 6 feet. A hierarchy of paths usually results from these details, determining major and minor pedestrian routes; still, the basic necessities of any path are accessibility to those with disabilities, safety and security, easy maintenance, and aesthetic compatibility with the surrounding area. Dober further suggests that:

in principle, a well-designed pedestrian-oriented campus will have most of its buildings, landscapes, and walks situated within a (largely) vehicle-free zone whose diameter can be traversed on foot in about ten
minutes...assuming walking speeds from 3.5 to 4.0 miles per hour and gradients of less than 4 percent, the space thus defined will be in the 100-to 125-acre range. Land this size would be an appropriate central campus area for most institutions.

Campus land use is further influenced in that other facilities can be located outside of this central area according to function, for example, residential buildings, athletic facilities, research centers, etc..

2.5 Transportation and Land Use

2.5.1 Background: Transportation and Land Use in Non-University Settings

As yet, no study has delved into the affect of land use planning by universities and their surrounding communities on transportation systems. Therefore, a literature search was conducted to provide some background on the relationship between transportation and land use.

TCRP Report 16: Transit and Urban Form provides a thorough overview of the influence of land use on transit, as shown in Figure 2.1. The illustration implies that “there remains considerable elasticity in the relationship,” specifically that “the relationship between residential densities, employment center densities, and transit patronage is robust.” (Case 1 of the U.S. National Bicycling and Walking Study (1992) confirms that this is true for walking and bicycling as well.) Of particular interest for this study is the finding that “strategic changes in local and regional land use policies are capable of influencing transit use as much as any other demand management strategy likely to be implemented in metropolitan America.” In this light, it would appear that the
effectiveness of land use as a TDM strategy on university campuses is likely to prove quite strong.

Vuchic (1999) also discusses the relationship between transportation and land use, suggesting that activities such as work, trade, housing, etc., compete with transportation modes for valuable land. Figure 2.2 illustrates the planning process that might take place based on this idea, and could be used in campus land use planning as well.

As discussed previously, a substantial part of several universities’ TDM programs involves charging for parking as both a disincentive to driving alone and as a funding source for other strategies. The Transportation Research Board’s (TRB’s) report on Strategies to Attract Auto Users to Public Transportation (1998) found that in non-university areas, increasing parking pricing is the most effective strategy to reduce work
trip SOV use. Its effectiveness is much more significant when implemented as part of a comprehensive program of strategies rather than alone. Likewise, TRB’s *Building Transit Ridership* (1997) found that in order to experience any significant mode shift away from SOV use, an inter-disciplinary approach (i.e., involving public policy, land use, etc.) that focuses on making the SOV less attractive (rather than trying to make transit more attractive) will be necessary. Finally, Taylor et al. (2002) concluded that external factors such as job growth and traffic congestion have a greater influence on transit ridership than do internal factors like fares. Not surprisingly, the study also confirmed that more successful transit agencies target their most responsive markets and customize their service to these riders’ needs. As discussed previously, this is the
approach that the more successful campus transportation systems have taken, as well as involving the student body in the development and implementation of the programs.

2.5.2 Transportation and Land Use on Campus

Specific to campus land use, Toor (1999, 2003) notes that “some of the key planning decisions that affect transportation are the amount of student housing provided on campus, the amount, (if any) of faculty and staff housing provided, and the degree to which activities are spread across satellite campuses.” Toor’s interview with Stanford University’s Transportation Programs Manager reveals that providing more housing is “the most cost effective way” to manage transportation demand.

As parking will clearly be one of—if not the single—most significant types of land use for transportation on campus, there appears to be great potential for carsharing in a university setting. San Jose State and the University of California at Berkeley are among several universities attempting to manage high parking demand and a limited amount of land by locating vehicle pods on campus. A university setting may prove ideal for carsharing due to the high residential density of students, high parking costs, limited land, the minimal income of most students, and their low annual mileages. University employees would also benefit greatly from shared vehicle access, as they could commute to work via an alternative mode but have a vehicle available to them during the day should they need it. By including carsharing in a university’s ‘menu of transportation options,’ the administration is providing users with access to a private vehicle when it is needed and eliminating much of the incentive for people to bring an automobile to
campus in the first place. By sharing fewer cars among more users, the critical problem of vehicle storage could be largely avoided.
Chapter 3: Methodology

3.1 Survey
   3.1.1 Candidate Eligibility
   3.1.2 Survey Distribution
   3.1.3 Sample Group
   3.1.4 Survey Design

3.2 Case Studies
   3.2.1 Selection of Candidates
   3.2.2 Case Study Method and Research

The Literature Review (Chapter 2) helped to identify the desired traits of the survey sample population as well as to design the survey. Case studies were then conducted to provide a more detailed illustration of the trends and innovations revealed by the survey results. The following sections explain the research process in more depth.

3.1 Survey

3.1.1 Candidate Eligibility

The Literature Review (Chapter 2) revealed a set of universities that are the forerunners in managing their situations; that is, these campuses stood out during the preliminary research phase as taking innovative and/or particularly effective approaches to transportation and land use planning. Among these campuses were the University of Colorado at Boulder, the University of Illinois at Urbana-Champaign, Iowa State University, the University of Michigan at Ann Arbor, Stanford University, the University of Wisconsin at Madison and the Universities of California at Berkeley and at Davis.

The “College Search” service on the College Board website (collegeboard.com) was used to compare these campuses and reveal their shared traits. The most common characteristic among these campuses was that each was located in a community with a
population between 50,000-249,999 (what the College Board defines as a “small city”). Other characteristics were not as exclusive:

- four-year schools in the United States with enrollments of more than 15,000;
- public or private;
- commuter or residential;
- and various settings of urban, suburban, or rural.

These determinants were intentionally left broad in order to incorporate a large amount of diversity in the sample population. For example, although the University of Virginia’s host community (Charlottesville) is considered a “small city” by the College Board’s definition, its suburban setting is very different from the “small city” of Cambridge, Massachusetts and the urban setting that it provides for Harvard University. It is hoped that this variety will result in a larger assortment of approaches that transfer across urban/suburban/rural lines and can be shared among campuses regardless of setting. The College Board obtains its information from a survey that it conducts each year, so the information is provided by the schools themselves and may therefore be somewhat subjective, particularly in the designation of each campus as urban, suburban, or rural and as residential or commuter.

The sample population was built around these characteristics, and the College Search service on the College Board website identified 64 universities that fit the description (Appendix A lists these eligible survey candidates).
3.1.2 Survey Distribution

The parking and transportation office (or equivalent) of each of the 64 campuses was contacted prior to the distribution of the survey in order to introduce the project and ensure a greater response rate. In addition to hard copies of the survey, an online version was created using a survey website called “Zoomerang.” Candidates were offered the option of either being sent a hard copy in the mail or having the link to the online survey emailed to them. Despite the lengthiness of the survey, a response rate of 53% was achieved, with 34 of the 64 invited schools responding. It is difficult to say if the high response rate was due to the easy access of the online survey, the personal contact that was made with each campus prior to and following the distribution of the surveys, or the nature of the campus transportation field, as most of the schools contacted seemed quite enthusiastic about the project and the prospect of sharing information with peer institutions.

3.1.3 Sample Group

Table 3.1 displays the respondents grouped by setting (urban, suburban, and rural) and whether they are listed as residential or commuter campuses by the College Board. Of the respondents, 13 are urban campuses, 19 are suburban and 2 are rural; within these distinctions, 2 of the urban schools and 7 of the suburban schools are commuter campuses. Table 3.2 illustrates the breakdown of the sample group (and the sample population) in terms of region, setting, and commuter/residential classification.
Table 3.1 Responding campuses used in the study; both the setting and commuter/residential classifications are according to the College Board; enrollment figures are from the Integrated Postsecondary Education Data System College Opportunities On-Line (IPEDS COOL) website; population data is from the 2000 US Census.

<table>
<thead>
<tr>
<th>Institution</th>
<th>Enrollment</th>
<th>City</th>
<th>Population</th>
<th>Commuter or Residential</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Urban (13)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UNIVERSITY OF ARKANSAS</td>
<td>15752</td>
<td>FAYETTEVILLE, AR</td>
<td>58047</td>
<td>RESIDENTIAL</td>
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<td>EAST CAROLINA UNIVERSITY</td>
<td>19412</td>
<td>GREENVILLE, NC</td>
<td>60476</td>
<td>RESIDENTIAL</td>
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<td>FLORIDA STATE UNIVERSITY</td>
<td>34982</td>
<td>TALLAHASSEE, FL</td>
<td>150624</td>
<td>RESIDENTIAL</td>
</tr>
<tr>
<td>HARVARD UNIVERSITY</td>
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<td>CAMBRIDGE, MA</td>
<td>101355</td>
<td>RESIDENTIAL</td>
</tr>
<tr>
<td>INDIANA UNIVERSITY</td>
<td>37963</td>
<td>BLOOMINGTON, IN</td>
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<td>Ames, IA</td>
<td>50731</td>
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<td>110257</td>
<td>COMMUTER</td>
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<tr>
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<td>HUNTINGTON, WV</td>
<td>51475</td>
<td>COMMUTER</td>
</tr>
<tr>
<td>UNIVERSITY OF NEBRASKA</td>
<td>22764</td>
<td>LINCOLN, NE</td>
<td>225581</td>
<td>RESIDENTIAL</td>
</tr>
<tr>
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<td>18956</td>
<td>EUGENE, OR</td>
<td>137893</td>
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</tr>
<tr>
<td>SYRACUSE UNIVERSITY</td>
<td>18072</td>
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<td>147306</td>
<td>RESIDENTIAL</td>
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<tr>
<td>TEXAS TECH UNIVERSITY</td>
<td>25573</td>
<td>LUBBOCK, TX</td>
<td>199564</td>
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<tr>
<td>UNIVERSITY OF WISCONSIN</td>
<td>40922</td>
<td>MADISON, WI</td>
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</tr>
<tr>
<td><strong>Suburban (19)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>UNIVERSITY OF ALABAMA</td>
<td>19130</td>
<td>TUSCALOOSA, AL</td>
<td>77906</td>
<td>RESIDENTIAL</td>
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<tr>
<td>BRIGHAM YOUNG UNIVERSITY</td>
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<td>105166</td>
<td>RESIDENTIAL</td>
</tr>
<tr>
<td>COLORADO STATE UNIVERSITY</td>
<td>28103</td>
<td>FORT COLLINS, CO</td>
<td>118652</td>
<td>RESIDENTIAL</td>
</tr>
<tr>
<td>UNIVERSITY OF FLORIDA</td>
<td>46515</td>
<td>GAINESVILLE, FL</td>
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<tr>
<td>FLORIDA ATLANTIC UNIVERSITY</td>
<td>23345</td>
<td>BOCA RATON, FL</td>
<td>74764</td>
<td>COMMUTER</td>
</tr>
<tr>
<td>UNIVERSITY OF MICHIGAN</td>
<td>38248</td>
<td>ANN ARBOR, MI</td>
<td>114024</td>
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<tr>
<td>MICHIGAN STATE UNIVERSITY</td>
<td>44227</td>
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<td>46525</td>
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<tr>
<td>NEW MEXICO STATE UNIVERSITY</td>
<td>15224</td>
<td>LAS CRUCES, NM</td>
<td>74276</td>
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</tr>
<tr>
<td>UNIVERSITY OF NORTH TEXAS</td>
<td>27858</td>
<td>DENTON, TX</td>
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<tr>
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<tr>
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<tr>
<td>UNIVERSITY OF OKLAHOMA</td>
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<td>NORMAN, OK</td>
<td>95694</td>
<td>COMMUTER</td>
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<tr>
<td>PURDUE UNIVERSITY</td>
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<td>85175</td>
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<tr>
<td>SOUTHWEST MISSOURI STATE UNIVERSITY</td>
<td>18252</td>
<td>SPRINGFIELD, MO</td>
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<tr>
<td>UNIVERSITY OF CALIFORNIA-DAVIS</td>
<td>27292</td>
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<td>60308</td>
<td>RESIDENTIAL</td>
</tr>
<tr>
<td>UNIVERSITY OF CALIFORNIA-IRVINE</td>
<td>21885</td>
<td>IRVINE, CA</td>
<td>143072</td>
<td>RESIDENTIAL</td>
</tr>
<tr>
<td>UNIVERSITY OF CALIFORNIA-SANTA BARBARA</td>
<td>20373</td>
<td>SANTA BARBARA, CA</td>
<td>92325</td>
<td>RESIDENTIAL</td>
</tr>
<tr>
<td>UNIVERSITY OF VIRGINIA</td>
<td>22739</td>
<td>CHARLOTTESVILLE, VA</td>
<td>45049</td>
<td>RESIDENTIAL</td>
</tr>
</tbody>
</table>
Table 3.2: Breakdown of the sample group and population.

<table>
<thead>
<tr>
<th>Classification</th>
<th>Number of respondents</th>
<th>Percentage of sample group</th>
<th>Percentage of sample population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban</td>
<td>13 (2)</td>
<td>38%</td>
<td>41%</td>
</tr>
<tr>
<td>Suburban</td>
<td>19 (7)</td>
<td>56%</td>
<td>52%</td>
</tr>
<tr>
<td>Rural</td>
<td>2 (0)</td>
<td>6%</td>
<td>8%</td>
</tr>
</tbody>
</table>

*The number in parentheses denotes how many of these schools are considered ‘commuter’ campuses by the College Board.

<table>
<thead>
<tr>
<th>Classification</th>
<th>Number of respondents</th>
<th>Percentage of sample group</th>
<th>Percentage of sample population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commuter</td>
<td>9</td>
<td>27%</td>
<td>38%</td>
</tr>
<tr>
<td>Residential</td>
<td>25</td>
<td>73%</td>
<td>63%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Region</th>
<th>Number of respondents</th>
<th>Percentage of sample group</th>
<th>Percentage of sample population</th>
</tr>
</thead>
<tbody>
<tr>
<td>West</td>
<td>7</td>
<td>21%</td>
<td>30%</td>
</tr>
<tr>
<td>Southwest</td>
<td>5</td>
<td>15%</td>
<td>9%</td>
</tr>
<tr>
<td>South</td>
<td>8</td>
<td>24%</td>
<td>25%</td>
</tr>
<tr>
<td>Midwest</td>
<td>12</td>
<td>35%</td>
<td>30%</td>
</tr>
<tr>
<td>New England</td>
<td>1</td>
<td>3%</td>
<td>2%</td>
</tr>
<tr>
<td>Mid-Atlantic</td>
<td>1</td>
<td>3%</td>
<td>5%</td>
</tr>
</tbody>
</table>

3.1.4 Survey Design

The purpose of the survey was to identify major trends in land use and transportation planning on university campuses as well as candidates for case studies. In order to determine correlations among aspects of campus transportation and land use systems, numerous questions requesting very specific details were included, such as the mode split for trips to-and-from campus, student and faculty/staff residential demographics, and transit system management. A pilot survey was developed and tested with the University of Virginia Department of Parking and Transportation Services; the final survey was comprised of 47 questions including multiple choice, open ended, and ratings, and is included in Appendix B. The survey was divided into 6 sections:

1. General Campus Transportation, Land Use and Planning
2. Circulation
3. Parking
4. Residential Demographics
5. New Development/Campus-Community Coordination/Development Control
6. Transit

As with any survey-based project, limitations arise due to:

- the integrity and compatibility of the sample population characteristics
- the survey response rate
- the accuracy of the responses
- the effectiveness of the survey questions to convey what information is sought by the researcher
- the researcher’s interpretation of the survey results.

3.2 Case Studies

3.2.1 Selection of Candidates

Three case studies were conducted to provide greater detail and insight to the trends and approaches identified by the survey results. In order to best represent the sample group (or more specifically, the majority of suburban campuses in the sample group) as described in Table 3.2, two of the three cases selected were suburban campuses. (Because rural campuses comprised only 6% of the sample group, they were not included in the case studies.) Moreover, one commuter campus was selected as a case study to represent that aspect of the sample group. Table 3.3 provides the
After determining which assortment of campuses (i.e., two suburban, one commuter, etc.) would best reflect the sample group, case study candidates were chosen on the basis of observations made throughout the research. Originally, it had been expected that the survey results would reveal the campuses with the “most successful” transportation and land use approaches, which would then be researched further as case studies. Success was to be measured in terms of: 1. reducing parking demand; 2. reducing land use- and transportation-related costs to the university and surrounding community; 3. maintaining an aesthetically pleasing environment; 4. reducing the number of vehicle trips to/from and within campus; 5. reducing the impact that the university has on the surrounding community (e.g. spill-over parking, etc.). However, only one university (the University of California at Santa Barbara) indicated that it had been able to reduce parking demand; questions regarding cost were not included in the final survey; data regarding aesthetics is too subjective; very few schools were able to provide mode split data for trips to/from and within campus; and the survey results on spill-over parking did not reveal any unique or innovative approaches.

Therefore, the researcher’s own observations of the universities’ websites and individual survey responses (specifically, which campuses stood out in implementing
innovative and effective approaches) were coupled, where possible, with the limited mode split and parking demand data to select cases that would best illustrate trends and best practices. Based on this approach, case study candidates were initially Harvard University, the University of Oregon-Eugene, the University of Wisconsin-Madison, the University of Florida-Gainesville, the University of North Texas, Northwestern University, the University of Oklahoma-Norman, and the Universities of California-Davis, Irvine, and Santa Barbara. Almost each of these campuses had motor vehicle mode splits (for trips to-from campus) below the mean for their respective urban/suburban group and added less parking than the mean for their group. The University of California-Davis was eliminated from the initial candidate list because it is already the subject of at least one case study (Takemoto-Weerts 1998).

The candidates for the urban campus case from this group were Harvard University, the University of Oregon-Eugene, and the University of Wisconsin-Madison. Harvard was eventually selected due to the extensive documentation of its planning process on the Harvard Transportation Services website, which indicated that Harvard is undergoing a “substantial” expansion. Harvard also reported the lowest motor vehicle mode share for trips to/from campus (27%) compared to Oregon (40%) and Wisconsin (51%). Moreover, the Harvard case clearly illustrates the trend indicated by the survey results that surface parking is being lost to the construction of academic facilities, and it is one of the few schools that is not exempt from local zoning ordinances or trip generation restrictions.

Two case studies remained for suburban campuses, one residential and one commuter: suburban residential candidates were the University of Florida-Gainesville,
Northwestern University, and the Universities of California at Irvine and Santa Barbara. Eventually the University of California-Santa Barbara was chosen due to the fact that it was the only school that reported reducing its parking demand and of these schools it reported the lowest motor vehicle mode share for trips to/from campus. Furthermore, it had one of the most comprehensive alternative transportation programs of all survey respondents. Northwestern University was a very close second, due partly to its creative parking policies and implementation of a “walking zone” to determine eligibility for parking permits (that is, faculty, staff and students who live within the designated “walking zone” are not eligible for a parking permit). In addition, Northwestern reported that no additional parking was constructed in the last 10 years. However, the motor vehicle mode share for trips to/from campus of UC-Santa Barbara (30%) was significantly lower than that of Northwestern (50%).

The final case study was reserved for a suburban commuter campus, with the University of Oklahoma-Norman and the University of North Texas as candidates. While the University of North Texas had initially been selected because of its rapid growth, full-service transit system, and comprehensive Office of Commuter Services, there was insufficient parking data in its survey response. Furthermore, the University of Oklahoma-Norman had a lower motor vehicle mode share for trips to/from campus (57%) than the University of North Texas (80%); for commuter campuses, Oklahoma’s mode share was second only to the University of Louisiana-Lafayette (30%). Eventually the University of Oklahoma was chosen because its survey response and website indicated unique approaches to planning relative to other respondents, such as close working relationships with the local MPO and the FTA.
3.2.2 Case Study Method and Research

The three case studies performed here loosely follow the Harvard Business School Case Method. While Gentile (1990) advises on form and general content, McNair (1954) identifies three major elements of the case study: the recording of experience, interpretation of experience, and communication of the researcher’s insight to the executive (in this case, the campus transportation/land use planner). Cases were researched via phone interviews with transportation administrators, papers, presentations, briefs, and the internet. Each of the campuses used as a case study was sent a draft of the case prior to final inclusion in this report so that they could comment on or clarify any aspect. Limitations of the case studies arise due to the selection of the cases, the information provided by each university, and the researcher’s interpretation and understanding of each study.
Chapter 4: Survey Results and Analysis

4.1 General Campus Transportation, Land Use and Planning
   4.1.1 Planning Framework
   4.1.2 Trends in Campus Planning Approaches: Parking, Transit, and Alternatives

4.2 Circulation
   4.2.1 Obstacles to Circulation
   4.2.2 Mode Splits: Mode Shares of Motor Vehicles and Alternatives
   4.2.3 Residential Choice
   4.2.4 Carsharing Potential

4.3 Parking
   4.3.1 Existing and Newly Constructed Parking
   4.3.2 Types and Locations of New Parking
   4.3.3 Approaches to Land Use
   4.3.4 Parking Regulations and Management
   4.3.5 Innovative Parking Regulations
   4.3.6 Parking Technology
   4.3.7 Permit Prices and Overselling
   4.3.8 Spillover Parking
   4.3.9 Final Thoughts on Parking

4.4 Residential Demographics

4.5 New Development/Development Control/Campus-Community Coordination
   4.5.1 New Development/Development Control
   4.5.2 Campus-Community Coordination

4.6 Transit
   4.6.1 Operations and Management
   4.6.2 Attributes of a Successful (or Failing) System
   4.6.3 Final Thoughts on Transit

4.7 Final Thoughts

4.8 Summary of Findings
   4.8.1 General Planning
   4.8.2 Motor Vehicle Mode Share
   4.8.3 Parking
   4.8.4 Redevelopment and Limited Land Availability

4.1 General Campus Transportation, Land Use and Planning

4.1.1 Planning Framework

The first question was intended to discern the framework within which campus transportation planning takes place, e.g. a campus master plan. Definitions of the terms
“campus master plan” (CMP) and “long range development plan” (LRDP) appear to be somewhat vague within the field of campus planning. Some interchange the terms, while others such as the University of Colorado at Colorado Springs differentiate between the two, defining the campus master plan as a framework that:

concentrates on the physical development of the campus and its facilities as directed by its academic programmatic needs. It encompasses elements of campus organization, land and building use, vehicular and pedestrian circulation, infrastructure, open space, relationship to the community, sensitivity to the campus site, and building design to ensure compliance with physical master plan principles.

In contrast, a long range development plan:

serves as the principal policy document to guide the future conservation and development of a campus in support of the campus's educational mission...Similar to a general plan or comprehensive plan for a city, a LRDP provides a broad vision and understanding of the campus's physical development, primarily formed by academic programmatic needs, land use, open space, and pedestrian and vehicular circulation.


In light of these definitions, it might be said that a campus master plan provides the detailed physical implementation of the principles set forth in the long range development plan.

Figure 4.1 illustrates the types of planning frameworks in place at the responding institutions and suggests a considerable amount of overlap in planning, that is, that some tools are used in combination with others. Table 4.1 indicates the combinations of planning tools used and shows that about a third of the respondents have at least a
Table 4.1: Overlap of planning frameworks: many survey respondents indicated having more than one type of planning framework in place; these are the reported combinations.

<table>
<thead>
<tr>
<th>Combination of plans</th>
<th>% (#) of respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>• CMP w/ transportation element ONLY</td>
<td>21% (7)</td>
</tr>
<tr>
<td>• CMP w/ transportation element</td>
<td></td>
</tr>
<tr>
<td>• LRDP w/ transportation element</td>
<td>15% (5)</td>
</tr>
<tr>
<td>• LRDP w/ transportation element ONLY</td>
<td>12% (4)</td>
</tr>
<tr>
<td>• Stand-alone transportation plan ONLY</td>
<td>12% (4)</td>
</tr>
<tr>
<td>• Stand-alone transportation plan</td>
<td></td>
</tr>
<tr>
<td>• CMP w/ transportation element</td>
<td>12% (4)</td>
</tr>
<tr>
<td>• LRDP w/ transportation element</td>
<td></td>
</tr>
<tr>
<td>• CMP w/o transportation element ONLY</td>
<td>9% (3)</td>
</tr>
<tr>
<td>• CMP w/ transportation element</td>
<td></td>
</tr>
<tr>
<td>• Planning office w/i transportation/parking department</td>
<td>6% (2)</td>
</tr>
<tr>
<td>• Stand-alone transportation plan</td>
<td></td>
</tr>
<tr>
<td>• CMP w/o transportation element</td>
<td>3% (1)</td>
</tr>
<tr>
<td>• LRDP w/o transportation element</td>
<td></td>
</tr>
<tr>
<td>• Stand-alone transportation plan</td>
<td></td>
</tr>
<tr>
<td>• LRDP w/ transportation element</td>
<td>3% (1)</td>
</tr>
<tr>
<td>• Stand-alone transportation plan</td>
<td></td>
</tr>
<tr>
<td>• Other (Planning office for transit only)</td>
<td>3% (1)</td>
</tr>
<tr>
<td>• CMP w/ transportation element</td>
<td></td>
</tr>
<tr>
<td>• Other (Transportation Planner in Planning Department)</td>
<td>3% (1)</td>
</tr>
<tr>
<td>• CMP w/o transportation element</td>
<td></td>
</tr>
<tr>
<td>• Other (Facilities Planning and Management Office)</td>
<td>3% (1)</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>100% (34)</td>
</tr>
</tbody>
</table>
campus master plan and a long range development plan in place. Moreover, the University of Oklahoma has a “planning office for transit only,” and the University of Wisconsin has a “transportation planner in the planning department” in addition to their planning documents. Some of the respondents, including the University of Florida and Northwestern University, have Transportation and Parking Advisory Committees to enable campus user input into the planning process. According to the University of Florida website, the Transportation and Parking Advisory Committee “is responsible for reviewing and recommending all programs, policies and regulations governing transportation, parking, bicycles and pedestrians on campus. This responsibility includes: the review of programs to enhance campus access, the review of proposed site locations for new pedestrian, bicycle and parking facilities, and the review of financial matters pertaining to the operation of Transportation and Parking Services.”

For the most part, institutions appear to be diligent about keeping the plans updated. Figure 4.2 illustrates when the governing campus plan was updated on all responding campuses. Institutions are willing to seek outside help in their planning efforts, as 64% of urban, 47% of suburban, and both rural campuses usually hire a consultant for new development projects. The need for this assistance comes from the result that on average, urban schools project their enrollments to increase 12%, suburban schools project 11% growth, and rural schools project 7%; residential campuses are projecting an average enrollment increase of 8% and commuter campuses project 21%. These trends illustrate the growing popularity of commuter schools, most likely due to their affordability and flexibility, as most of their students are typically able to work full-time while attending school.
4.1.2 Trends in Campus Planning Approaches

The major question of the planning section was intended to determine dominant trends within campus planning and land use by asking “how do campus land use planning and transportation facilities most typically respond to transportation demand?” Twelve possible answers were offered, including:

- construction of parking lots or structures on the interior or the periphery of campus
- improving transit
- improving pedestrian facilities
- improving bicycle facilities
- coordinating with the local community.
Each respondent was asked to indicate how frequently the approach was used (frequently, occasionally, or never). Overall, improving transit is the most frequently used approach on both urban and suburban campuses and on residential campuses. However, on commuter campuses the most frequently used approaches (overall) focus on periphery parking, which implies a greater focus on commuter student access to campus than on residential campus life. For rural campuses, both respondents indicated that improving general campus transit and coordinating with the local community are the most frequently used approaches. The responses were examined by parking, transit, and alternative options, and are shown in Figures 4.3 through 4.5.

Regarding the four possible answers involving parking practices, the responses shown in Figure 4.3 suggest that availability of land in the campus interior is a somewhat greater determinant of the type of parking than the relative costs of lots versus structures,

![Parking Responses: How frequently are these approaches used?](image)

Figure 4.3: Parking responses to the question “How do campus land use planning and transportation facilities most typically respond to transportation demand?” Responses suggest that location is more significant than facility type in campus planning. (The number on top of each bar indicates actual number of responses.)
as campuses more frequently build structures on the periphery than lots in the interior. This hints that land availability is also a greater determinant than convenience or accessibility. Most schools appear to be striving to maintain a pedestrian-oriented campus, if only in the campus core.

As shown in Figure 4.4, the next four options examined campus transit. Improving the transit system under the university’s authority (whether it be transit between peripheral parking and the central campus or the general campus service), is the most frequently used approach; initiating changes outside the university domain (such as improving transit between the campus and the local community) might be near impossible given the state of some town-gown relations. But even in the best of circumstances, coordination and logistics can be very challenging, especially given the fiscal conditions in some areas. That said, the option of coordinating with the local

![Transit Responses: How frequently are these approaches used?](image)

Figure 4.4: Transit responses to the question “How do campus land use planning and transportation facilities most typically respond to transportation demand?” Responses suggest that systems under the university’s authority are more likely to be used than coordination with the local community or its transit system. (The number on top of each bar indicates actual number of responses.)
community as a response to transportation demand is most frequently used on urban, rural, and residential campuses than on others. Urban areas often have more extensive transit and transportation options available, so it is easier for a school such as Iowa State University to implement a joint transit program when the facility/infrastructure is already in place.

The final alternatives involved improving/building more on-campus housing, improving the pedestrian network, and improving the bicycle network, as shown in Figure 4.5. Of these three approaches, improving/building more on-campus housing was the most frequently cited approach, with pedestrian network improvements close behind. This is not to say, however, that all campuses focus on housing to help manage transportation demand, because just as many urban campuses (23%) ‘frequently’ use this approach as ‘never.’

Figure 4.5: Alternative responses to the question “How do campus land use planning and transportation facilities most typically respond to transportation demand?” Responses suggest that systems under the university’s authority are more likely to be used than coordination with the local community. (The number on top of each bar indicates actual number of responses.)
Relative to expensive housing improvements and construction as a response to transportation demand, improvements to the bicycle network are easy and inexpensive. On-campus housing influences a number of issues besides just transportation, such as campus-wide revitalization efforts, the university’s image/reputation, the importance of attracting new students by maintaining architectural, aesthetic, and land use standards within the competitive sphere of higher education, and improving town-gown relations by helping to relieve some of the pressure of student housing on the surrounding community. The bicycle network, however, is one area that certainly warrants attention, as few respondents were able to provide information regarding the number of bicycle parking spaces on campus. Relative to the costs of other campus improvements, bicycle parking is inexpensive and a lack of adequate bicycle parking can be a very significant determinant of mode choice. The University of Wisconsin at Madison and the University of California at Davis reported having the same number of parking spaces for bicycles as for vehicles; the University of Oregon at Eugene and the University of California at Santa Barbara reported having more bicycle parking spaces than vehicle parking spaces. Correspondingly, all four schools have higher bicycle mode shares than the mean for trips to/from and on-campus. (See Takemoto-Weerts (1998) for a case study on UC-Davis and the existing bicycle culture there.)

4.2 Circulation

4.2.1 Obstacles to Circulation

Most campuses are designed around ‘the 10-minute rule,’ meaning that faculty and students should be able to walk from destination to origin within the 10-minute break
between classes. However, external factors often arise which interfere with campus circulation, such as railroads. Most often, motor-vehicle roads which may have once quietly rambled through campus may now present a problem as heavily trafficked thoroughfares or access roads which create vehicle-pedestrian conflicts and compromise safety and time. More than half of all respondents (55%) confirmed that a physical obstacle, such as a busy thoroughfare, dangerous intersection, or railroad compromised travel/flow on campus. Within these results, more urban campuses reported obstacles (69%) than suburban campuses (44%). Among the remedies used to counteract such interferences, particularly pedestrian-vehicle conflicts, are traffic-restricted areas/street closures, pedestrian/bicycle overpasses and underpasses, signalized intersections, speed enforcement, and perimeter roads that leave the inner area accessible only to pedestrians and special access vehicles (including transit). Texas Tech appears to have the most radical situation described by survey respondents:

A major US highway divides the campus into two halves. The Texas Department of Transportation is currently working to construct a major east/west freeway in place of that highway. The goal is to provide for more efficient movement through the city east to west. The portion of the freeway that cuts through the campus will be constructed below-grade so that it doesn’t visually separate the two halves of campus. It will also provide several grade-level bridges so campus roads connecting the two halves of campus will be uninterrupted.

-as reported in Texas Tech University Traffic and Parking Services survey response

Only one campus, the University of Oregon in Eugene, explicitly reported working with the local community to help improve such conditions on campus. It is possible that many of the remedies reported above are the result of joint efforts, or that the lack of cooperation may be a result of jurisdictional designations that prohibit municipal actions
on campus. Although the conditions at each institution are unique and may prevent a shared response to university transportation issues, it would seem that since local roads adjacent to and cutting through campus are often the cause of conflicts, more collaboration would be taking place.

4.2.2 Mode Splits

During development of the survey, questions regarding campus mode split were written with the intention that they would reveal those schools with the best transportation demand management programs and land use plans. In retrospect, mode split is not a reliable identifier, particularly because this is not readily available data at some schools, some responses seemed more like best guesses than researched answers, and because the wording of the questions might have been vague. For example, it was not clear whether the survey was seeking faculty/staff mode splits or those of students.

However, the data obtained regarding mode splits for trips to/from and within campus, despite the fact that it is unclear whether they reflect faculty/staff, student, or both, are still quite revealing. Motor vehicle mode share data were divided according to urban/suburban and residential/commuter campuses and are displayed in Table 4.2 (trips to/from campus) and Table 4.3 (trips within campus). Figures 4.6 and 4.7 display the mean mode split for urban, suburban, residential, and commuter campuses for trips to/from and on-campus, respectively. As expected, on-campus trips have much greater pedestrian mode shares while trips to/from campus are heavily dominated by motor vehicles.
Table 4.2: Motor vehicle mode share data for trips to/from campus.

<table>
<thead>
<tr>
<th></th>
<th>n</th>
<th>mean</th>
<th>median</th>
<th>variance</th>
<th>maximum</th>
<th>minimum</th>
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<tbody>
<tr>
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<td>9</td>
<td>48%</td>
<td>45%</td>
<td>4.9%</td>
<td>95%</td>
<td>26%</td>
</tr>
<tr>
<td>Suburban</td>
<td>14</td>
<td>75%</td>
<td>76%</td>
<td>3.7%</td>
<td>100%</td>
<td>30%</td>
</tr>
<tr>
<td>Residential</td>
<td>14</td>
<td>58%</td>
<td>54%</td>
<td>5.5%</td>
<td>95%</td>
<td>26%</td>
</tr>
<tr>
<td>Commuter</td>
<td>9</td>
<td>74%</td>
<td>75%</td>
<td>4.8%</td>
<td>100%</td>
<td>30%</td>
</tr>
</tbody>
</table>

Table 4.3: Motor vehicle mode share data for trips within campus.

<table>
<thead>
<tr>
<th></th>
<th>n</th>
<th>mean</th>
<th>median</th>
<th>variance</th>
<th>maximum</th>
<th>minimum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban</td>
<td>5</td>
<td>10%</td>
<td>10%</td>
<td>0.4%</td>
<td>20%</td>
<td>5%</td>
</tr>
<tr>
<td>Suburban</td>
<td>9</td>
<td>27%</td>
<td>30%</td>
<td>4.5%</td>
<td>60%</td>
<td>0%</td>
</tr>
<tr>
<td>Residential</td>
<td>5</td>
<td>15%</td>
<td>10%</td>
<td>1.4%</td>
<td>30%</td>
<td>5%</td>
</tr>
<tr>
<td>Commuter</td>
<td>9</td>
<td>24%</td>
<td>20%</td>
<td>4.9%</td>
<td>60%</td>
<td>0%</td>
</tr>
</tbody>
</table>

Urban Campus Mode Split for Trips To and From Campus

- Motor Vehicle: 50%
- Pedestrian: 19%
- Bicycle: 8%
- Transit: 21%
- Car/Van Pool: 2%

Suburban Campus Mode Split for Trips To and From Campus

- Motor Vehicle: 74%
- Pedestrian: 53%
- Bicycle: 9%
- Transit: 11%

Urban Campus Mode Split for On-Campus Trips

- Motor Vehicle: 10%
- Pedestrian: 52%
- Bicycle: 11%
- Transit: 27%

Suburban Campus Mode Split for On-Campus Trips

- Motor Vehicle: 27%
- Pedestrian: 53%
- Bicycle: 9%
- Transit: 11%

Figure 4.6: Urban and suburban campus mode splits for trips to and from campus and on-campus.
Motor Vehicle Mode Share

Student t-tests at the 95% level reveal that the differences in the motor vehicle mode share between urban and suburban campuses for both trips to/from campus and within campus are significant. For trips to/from campus, the motor vehicle share for suburban campuses (74%) is more than the shares of motor vehicle (50%) and transit (21%) combined on urban campuses. Relative to campus setting, on-campus trips illustrate a virtual flip-flop in mode shares of transit and motor vehicle: 27% transit and
10% motor vehicle on urban campuses compared to 11% transit and 27% motor vehicle on suburban campuses. Three reasons in particular may account for these differences. First of all, urban areas often have more extensive transit systems than suburban areas. The second and perhaps the most significant determinant of the lower vehicle mode share on urban campuses is the lack of available land for and cost of parking. Parking will be discussed in greater depth in Section 4.3, but at this time it is important to note that parking appears to be an excellent tool for a campus to manipulate its mode split, albeit with much anticipated resistance by campus users. Third, residential diversity in urban areas may offer more housing options for campus users in terms of proximity, affordability, and availability, consequently providing more transportation alternatives to driving a private vehicle.

For trips to/from campus, student t-tests at the 95% level indicated a statistically significant difference between residential and commuter campus motor vehicle mode shares (although the practical difference was not large); there is no significant difference between these shares for trips within campus. In light of the results of urban and suburban campuses, it appears that the area in which a school is located is a greater determinant of its campus transportation traits than the number of residents on the campus.

**Mode Shares of Alternatives**

Bicycle mode share was statistically the same in both settings, as was the pedestrian share for on-campus trips. However, the pedestrian share of trips to/from campus for urban settings was more than double that of suburban settings, perhaps due to
a wider range of housing options within walking distance for those living off-campus as well as infrastructure designs that contribute to ‘walkability.’ Moreover, parking issues in urban areas may provide travelers with a greater incentive to walk than to drive. The transit mode share was significantly higher on urban campuses than on suburban campuses for both types of trips, as urban areas often have much more extensive transit systems in place than suburban areas.

Possible answers for the mode split questions in the survey included ‘motor vehicle’, ‘pedestrian’, ‘bicycle’, ‘transit’, and ‘other’ but no specific space for car or van pooling. There were not enough ‘other’ responses to warrant a significant allusion to car or van pooling, but conversations with various campus parking and transportation departments suggest that car and/or van pooling is and could be an important alternative to single-occupancy vehicle trips. That said, it is possible that respondents grouped car/van pooling with the ‘motor vehicle’ share as no occupancy requirements were described for this option. (The University of Wisconsin in Madison, Harvard University, and the University of Oregon in Eugene used the ‘other’ response to indicate car/van pooling mode shares for trips to/from campus of 16%, 5%, and 1%, respectively, resulting in a mean of all respondents of 2%).

Observations of respondents websites revealed innovative programs such as the University of California-Davis “Transitpool” and “Trainpool.” Campus users who access campus by bus or train can purchase a bus/train pass from the UC-Davis Transportation and Parking Services (TAPS) for less than the regular fare. The discount is $18 per month for users, who also receive Emergency Rides Home and 2 free days of campus parking per month in the event they cannot take transit on a particular day (any parking
permit the user may already have in his/her possession must be returned to the TAPS office). Some participants are also eligible for a pre-tax payroll deduction to buy their passes, thereby saving users more money.

‘Emergency’ or ‘guaranteed’ rides home may provide an opportunity to shift single-occupancy vehicle trips to alternatives. Drivers frequently cite needing a vehicle available in the event of an off-campus or personal emergency, so offering a guaranteed ride home program eliminates the need to drive to campus every day. However, evidence of such a program was found on only three of the respondents’ websites, so the potential of these programs to shift the mode split is still untested.

4.2.3 Residential Choice

Comparison of residential and commuter campuses (regardless of urban or suburban setting) reiterates the importance of housing choice in a transportation system, and particularly in a close-knit community such as a university campus. As expected, the responding residential campuses (in which an average of 39% of students live in college housing) have a significantly lower mode share of motor vehicles than commuter campuses (in which an average of 18% of students live in college housing) for trips to/from campus and on-campus, as shown in Figure 4.7. However, for on-campus trips, residential campuses have a lower pedestrian mode share (43%) than commuter campuses (57%). Furthermore, the transit mode share for on-campus trips on residential campuses was higher (34%) than the transit (8%) and motor vehicle (24%) shares of commuter campuses combined.
One initial hypothesis as to why these trends exist was that perhaps residential campuses consumed more acres than commuter campuses due to on-campus housing and other traditional residential university facilities, and therefore required a campus transit system to transverse the larger area. But further research showed that several of the commuter campuses had full service transit systems in place on their campuses as well. Acreage data was obtained from each university’s website in an attempt to determine whether residential campuses are typically larger than commuter campuses and therefore incline campus users to choose transit over walking.\(^1\) Table 4.4 provides a brief analysis of the campus acreage data; because the nine commuter campuses included in this study tended to have smaller enrollments than the residential schools, only residential campuses with enrollments of less than 30,000 were included. Student-t tests at the 95% confidence level indicate that the mean acreages are not statistically different.

<table>
<thead>
<tr>
<th>Table 4.4: Comparison of Residential and Commuter Campus Acreage.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Residential Campuses</strong></td>
</tr>
<tr>
<td>(&lt;30,000 enrollment)</td>
</tr>
<tr>
<td>n= 17</td>
</tr>
<tr>
<td>Mean acreage 1046</td>
</tr>
<tr>
<td>Median 579</td>
</tr>
<tr>
<td>Variance 1557020</td>
</tr>
<tr>
<td>Highest acreage reported 5300</td>
</tr>
<tr>
<td>Lowest acreage reported 175</td>
</tr>
<tr>
<td><strong>Commuter Campuses</strong></td>
</tr>
<tr>
<td>n= 9</td>
</tr>
<tr>
<td>Mean acreage 811</td>
</tr>
<tr>
<td>Median 380</td>
</tr>
<tr>
<td>Variance 873748</td>
</tr>
<tr>
<td>Highest acreage reported 3000</td>
</tr>
<tr>
<td>Lowest acreage reported 70</td>
</tr>
</tbody>
</table>

\(^1\) The consistency of the acreage data is questionable, as some schools include the land area consumed by athletic stadiums while others do not, some include areas that are physically separated from the core campus while others only report the acreage of the core, and so on. Still, the information is presented here under the assumption that if a dominant trend indeed exists, it will appear regardless of outlying points.
4.2.4 Carsharing Potential

The final question in the Circulation section asked if the administration had considered implementing a formal carsharing (i.e., short-term rental) program such as Flexcar or Zipcar (not to be confused with carpooling). This question was included because a university setting appears to be ideal for carsharing due to the high residential density of students, high parking costs, limited land, the minimal income of most students, and their low annual mileages. University employees would also benefit greatly from shared vehicle access, as they could commute to work via an alternative mode but have a vehicle available to them during the day should they need it. Locating one or more carsharing stations on campus could greatly reduce parking demand, as one estimate suggests that one shared vehicle replaces six cars on the road (Flexcar 2004); moreover, residential students who bring a car to campus for occasional use and consume valuable parking space could instead join a carsharing program. However, only 4 of 23 respondents had implemented or even considered implementing such a program, and with varying success. Harvard University has signed up 500 faculty, staff, and students in the first 2 years of their collaboration with Zipcar. The University of California at Santa Barbara has considered working with FlexCar to begin an on-campus program, but said in the survey response that “FlexCar indicates that to be cost effective 50 to 100 cars need to be in place in the network at $1700/month/car which is too costly for UCSB alone to afford.” Clearly further research is warranted to determine whether carsharing is as ideal for a campus as it initially appears.
4.3 Parking

4.3.1 Existing and Newly Constructed Parking

Of all aspects of campus transportation, vehicle storage consumes the most land and can be the most difficult to manage policy-wise. Figure 4.8 illustrates the mean number of existing on-campus parking spaces reported by survey respondents, while Figure 4.9 provides the mean ratio of existing parking spaces to enrollment\(^2\) in order to adjust for the range of enrollments in the study. (As respondents were asked for on-campus parking data, these figures do not represent the total parking capacity for the campus because off-campus facilities may be used as well.) The value for rural campuses represents two very different figures reported by the respondents, the University of Missouri-Columbia and Utah State University. The University of Missouri reported 23,000 (+ or -) existing parking spaces, while Utah State reported only 7400. The difference is due to the four hospitals of the University of Missouri Health Care

![Mean Number of Existing Parking Spaces by Campus Type](chart)

Figure 4.8: Mean number of existing parking spaces on campus as reported by survey respondents by campus type.
System in Columbia, which attracts employees, patients, and visitors from the region, thereby illustrating the massive impact that such a facility can have on a campus.

Table 4.5 provides the statistical data on the existing number of parking spaces. The student t-test indicates that there is a significant difference between the residential and commuter parking amounts at the 95% level. It was taken into consideration that the discrepancies in enrollments of the 9 commuter schools versus the 25 residential schools may contribute to this difference in parking, so the ratios of existing parking spaces to enrollment in Figure 4.9 were examined. Despite the lower motor vehicle mode share of residential campuses to commuter campuses discussed in section 4.2.3, there is no significant difference (at the 95% level) in the ratios, which may be due to residential schools having more dormitories and boarding facilities such as dining halls.
At the 95% level, student t-tests show that there is not a significant difference between the amounts of parking on urban and suburban campuses despite the larger motor vehicle mode share on suburban campuses. While the high cost of parking contributes to the lower vehicle mode share of urban campuses, suburban campuses experience more of a ‘spillover’ effect of parking in the surrounding neighborhoods, in a way relieving some of the pressure for on-campus parking, but not overall demand.

Figure 4.10 compares the number of existing parking spaces to campus size for each type of campus, illustrating that urban campuses have a higher concentration of parking on their land and suggesting a difference in lot versus structure construction.
Table 4.6 displays data on parking spaces constructed in the last 10 years while Figures 4.11 and 4.12 illustrate the mean and the ratio of these new spaces to enrollment, respectively. Once again, the rural grouping’s offset by the University of Missouri Health Care System illustrates the increased demand that a regional facility produces for a university campus. Student t-tests showed that there were no significant differences (at the 95% level) between the amounts of parking added to urban schools compared to suburban nor to residential campuses compared commuter; there were no significant differences among the ratios of new parking to enrollment either. These similarities in parking provisions exist despite the differences in motor vehicle mode shares between campus types. One reason for the trend may be that most campuses may have large amounts of parking associated with a special events facility, such as a football stadium, which is not influenced by urban/suburban or residential/commuter distinctions. Section 4.5.1 will discuss how much new parking was added relative to how many additional square feet of buildings were constructed in the last 10 years.

<table>
<thead>
<tr>
<th></th>
<th>n</th>
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<th>variance</th>
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<td>1921</td>
<td>1850</td>
<td>1444954</td>
<td>4000</td>
<td>100</td>
</tr>
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<td>Suburban</td>
<td>18</td>
<td>2010</td>
<td>1992</td>
<td>1972926</td>
<td>5000</td>
<td>0</td>
</tr>
<tr>
<td>Rural</td>
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<td>7675</td>
<td>7675</td>
<td>110000000</td>
<td>15000</td>
<td>350</td>
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<td>2465</td>
<td>2000</td>
<td>9375563</td>
<td>15000</td>
<td>0</td>
</tr>
<tr>
<td>Commuter</td>
<td>8</td>
<td>2041</td>
<td>1842</td>
<td>2232641</td>
<td>5000</td>
<td>447</td>
</tr>
</tbody>
</table>

3 It should be noted that of all responses, Northwestern University and the University of Oregon reported constructing 0 and 100 spaces respectively. The University of California at Santa Barbara was the only campus that was able to eliminate any planned or existing parking facilities due to reduced demand in the last 10 years. UCSB reported that “TDM [transportation demand management] tends to slow the pace of parking demand increases on our campus;” UCSB’s strategies will be examined in more depth in the case study.
4.3.2 Types and Locations of New Parking

Figure 4.11: Mean number of parking spaces constructed on various types of campuses in the last 10 years.

Figure 4.12: Mean ratio of parking spaces constructed to enrollment.

4.3.2 Types and Locations of New Parking
The ratio of parking spaces to acreage demands a discussion of surface lot versus structure parking, particularly regarding recent trends in construction. Survey respondents were asked to report on the types and campus locations of parking built in the past 10 years, given the options of surface lots on the campus periphery or central campus, structures on the periphery or central campus, or parking associated with a new special events facility which could be used for day-to-day purposes when the facility is not in use. For each campus, the amount of each type of newly constructed parking was determined as a percentage of all the parking added to that campus; then the mean value of each type of parking for that kind of campus was calculated in order to determine a profile of an average urban/suburban or residential/commuter campus. The results are shown in Figures 4.13-4.16. For example, on an average urban campus, 42% of all parking spaces added in the last 10 years would have been in the form of a surface lot on the campus periphery. (Parking added via a new special events facility was not included in the figures because only urban campuses added any parking (11%) in this way.)

The majority of spaces constructed on urban campuses were in the form of surface lots on the campus periphery, while the majority of spaces constructed on suburban campuses were in the form of structures in the campus core.\(^4\) It had originally been expected that urban campuses would favor structures over lots due to high-density development trends typical of urban areas\(^5\). However, further research indicated that land values contribute to the fact that urban campuses are building more lots while suburban

\(^4\) It should be noted that 3844 (67\%) of the surface lot spaces built on the periphery of urban campuses were from one school, thereby offsetting the comparison to suburban campuses. Omitting this outlier, the percentage of surface lot spaces built on the periphery of urban campuses is 35%.

\(^5\) As discussed in Chapter 3, the urban/suburban/rural distinction is subjective since the College Board asks respondents to classify themselves on a survey. This fact may make the trends indistinct.
campuses are building more structures. 2000 Census data on the median value of a single family owner-occupied home in each city was obtained with the result that the mean value of such a home in a suburban area is $176,421 (the median is $145,400), compared to $128,492 in an urban area (the median is $104,100). (The average value for the rural areas of Columbia, Missouri and Logan, Utah was $120,500.) Therefore, the cost of land in the suburban study areas appears to outweigh the cost of building an expensive parking structure, while in an urban area a parking structure might be cost-prohibitive relative to land prices.

What types of parking have been constructed on urban campuses in the last 10 years?

- Surface lots on the periphery
- Structures on the periphery
- Surface lots in or adjacent to the campus core
- Structures in or adjacent to the campus core

Figure 4.13: Matrix of recently constructed parking types and locations on an average urban campus.
Figures 4.15 and 4.16 illustrate the profiles of parking constructed in the last 10 years on residential and commuter campuses. As shown, an average residential campus builds most of its new parking in a structure in the central core, followed by surface lots on the periphery. This trend is the most intuitive, as institutions would prefer to conserve space in the central campus (for academic and administrative buildings, as well as residence halls) by building structures, but can afford (relatively) to consume land on the periphery with surface lots. Furthermore, vehicle storage for residents is often banished to the outskirts of campus since these vehicles are not used as frequently compared to commuters who require convenient access to the inner campus each day.
What types of parking have been constructed on residential campuses in the last 10 years?

- Surface lots on the periphery
- Structures on the periphery
- Surface lots in or adjacent to the campus core
- Structures in or adjacent to the campus core

![Matrix of recently constructed parking types and locations on an average residential campus.](image)

The majority of parking on commuter campuses is constructed as surface lots on the periphery. As only 2 of the commuter campuses are in urban areas and the remaining 7 are in suburban areas, this result is not a reflection of the trend on urban campuses. Most commuter schools have been founded in this century, so these campuses tend to be more adept to accommodating vehicles than schools established before the automobile. Three of the nine commuter schools included in this study were founded circa 1960 (the remaining six were founded between 1888 and 1906), so the past 10 years represents a substantial portion of their campus development, particularly the construction of parking. Therefore the term “periphery” may have different meanings to residential and commuter...
campuses: for example, although the periphery of a residential campus may mean the area beyond the football stadium, the periphery of a commuter campus might simply be the area between the central core and the campus boundary. Moreover, these newer commuter campuses are more often located in areas that are not as built up with high-density development as older, traditional residential campuses that often precede the communities that surround them.

**What types of parking have been constructed on commuter campuses in the last 10 years?**

- Surface lots on the periphery
- Structures on the periphery
- Surface lots in or adjacent to the campus core
- Structures in or adjacent to the campus core

Figure 4.16: Matrix of recently constructed parking types and locations on an average commuter campus.

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**4.3.3 Approaches to Land Use**
Another way to conserve land is to use it for multiple functions, for example, building an athletic field over an underground parking structure, or integrating administrative offices into the design of a parking structure. Few schools have used this approach yet, as it is still a new concept and increases the expense of an already expensive parking facility. But 23% of urban universities and 28% of suburban universities have included a bookstore, research facility, administrative office, or other similar space in a parking structure. Due to the low number of schools that have actually tried these designs, it is not possible to determine any unique correlations to explain why some schools have implemented them and others have not. Still, the 3 campuses constructing such facilities in urban areas each had median single-family home values above the median value for the urban sample group in this study; however, no such trend exists for the 5 suburban campuses implementing such designs.

4.3.4 Parking Regulations and Management

All but one school regulates parking with permits; in addition, Tables 4.7 and 4.8 illustrate the combinations of measures that schools use to regulate parking, with a large majority using both permits and meters. Cash-out programs, in which the university pays those who choose an alternative mode the same amount that they would pay had they driven and parked a vehicle on campus, are used by a few schools. This arrangement eliminates the subsidy bias towards private vehicles and supports alternative modes fairly.

Table 4.7: Overlap of parking regulations on urban campuses:
reported combinations of regulatory measures.
<table>
<thead>
<tr>
<th>Combination of regulatory measures</th>
<th>% (#) of urban respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Permits and meters</td>
<td>69% (9)</td>
</tr>
<tr>
<td>• Permits ONLY</td>
<td>8% (1)</td>
</tr>
<tr>
<td>• Permits, meters and cash-out program</td>
<td>8% (1)</td>
</tr>
<tr>
<td>• Permits, meters, and prohibitive policy for first-years</td>
<td>8% (1)</td>
</tr>
<tr>
<td>• Permits, meters, and eligibility policy based on residential location</td>
<td>8% (1)</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100% (13)</td>
</tr>
</tbody>
</table>

Table 4.8: Overlap of parking regulations on suburban campuses: reported combinations of regulatory measures.

<table>
<thead>
<tr>
<th>Combination of regulatory measures</th>
<th>% (#) of suburban respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Permits and meters</td>
<td>44% (8)</td>
</tr>
<tr>
<td>• Permits, meters, cash-out program, and prohibitive policy for first-years</td>
<td>17% (3)</td>
</tr>
<tr>
<td>• Permits ONLY</td>
<td>11% (2)</td>
</tr>
<tr>
<td>• Permits and cash-out program</td>
<td>6% (1)</td>
</tr>
<tr>
<td>• Permits, meters and cash-out program</td>
<td>6% (1)</td>
</tr>
<tr>
<td>• Permits, meters, and prohibitive policy for first-years</td>
<td>6% (1)</td>
</tr>
<tr>
<td>• Permits, meters, and eligibility policy based on residential location</td>
<td>6% (1)</td>
</tr>
<tr>
<td>• Parking is not regulated</td>
<td>6% (1)</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100% (18)</td>
</tr>
</tbody>
</table>

In addition to the data shown here, several of the suburban campuses checked the “other” box, indicating programs such as fare-free transit and car/van pools as parking regulations, as well as technologies such as multi-space meters and in-vehicle meters. Both Florida State University in Tallahassee and Florida Atlantic University in Boca Raton have implemented a mandatory Student Transportation Access Fee which is payable with tuition and includes a parking decal; the fee at Florida State University is based on the number credits taken that semester ($4.90 per credit hour). Some universities strictly limit the number of parking spaces available to students: for example, the University of Oregon noted in its survey response that “only 400 on-campus residents may get storage permits” and the University of Wisconsin has only 300 student spaces.
4.3.5 Innovative Parking Regulations

In addition to the survey, the website of each respondent was perused in order to find innovative approaches to campus transportation management. Following are the observations obtained from this research:

- The University of California-Irvine uses stack parking to maximize the number of vehicles that can fit into a particular area. In stack parking, the driver parks the vehicle in the aisle of the structure/lot and leaves the keys with the parking attendant so that the vehicle may be moved in the event that it is blocking another vehicle that needs to be moved.

- Like most schools, the University of Michigan at Ann Arbor heavily discourages students from bringing a vehicle to campus: there is no storage parking on campus and no vehicle may be parked on campus for more than 48 hours, which probably makes having a vehicle on campus for residents more of an inconvenience than a necessity. Freshmen and sophomores are not eligible for parking permits.

- Syracuse University bases faculty/staff lot assignments on title and years of service to the university, and parking fees are based on income.

- Texas Tech allows employees to share a reserved parking space provided each person signs a Share Space Agreement and completes a vehicle registration form. Only one of the vehicles under that registration may be parked on campus at a time. Texas Tech also offers transferable and non-transferable permits.
• The University of Florida in Gainesville allows three person carpools to park for free; student decal eligibility is based on residence location and number of credit hours and are available in annual, monthly, and weekly permits.

• Both Northwestern University and the University of California-Irvine have implemented “walking zones” that surround the campus and determine eligibility for parking permits and/or alternative transportation programs: for example, if a faculty/staff member or student lives within the “walking zone” he/she is ineligible for a permit.

4.3.6 Parking Technology

Observations regarding new parking technology were also recorded, with the following findings:

• The University of Wisconsin at Madison has a Flex Parking Program that helps reduce parking demand and consequently the need for new and expensive parking facilities. Essentially a “pay-as-you-park” program, a meter is installed in the user’s vehicle and is activated with a Smart Card to record parking activity. The University’s Flex Parking website reports that they “have seen a reduction in days parked through the [2-year long] pilot” program. The State of Wisconsin also has a State Commuter Benefits Program that assists with the Flex Parking system by allowing users to pay for Smart Cards before taxes. The Smart Card acts like a debit card from which parking charges are deducted with each use. The in-vehicle meter must be visible from outside the car so that parking enforcement officers can ensure that the meter has been activated, and will issue a citation otherwise.
• The University of Michigan at Ann Arbor is using an Automatic Vehicle Identification (AVI) System. Vehicles with the new technology will have a credit card-sized device attached on their windshield which will automatically open the gate to the proper parking area upon the vehicle’s approach of the gate. The gates will still have card swipers for those who for eligibility reasons/university status do not have an AVI device. The administration has cleverly required that the gate be activated by the AVI device/swiping of one’s card upon both entrance and exit or else the system will be out of sync. For example, if a vehicle is not recorded to have exited a parking area due to the gates being up for after-hours access, the driver will not be able to enter the parking area when the gates are down. This tactic helps to prevent the transfer of the AVI device from a vehicle that has activated the system to another that has not yet entered the lot. Moreover, the system can assist with data acquisition so that administrators have a better idea of who is parking for how long.

• The University of Michigan also has scratch-off cards that cost $35 for a 10-pack. Each scratch unit is valid for one day of parking; the user scratches the card to reveal the appropriate date and displays the card in the vehicle’s windshield. Other schools such as Utah State University have similar daily permits in the form of punch cards. Day to day permits like this help to prevent the “all you can eat” syndrome that is often enabled by long term permits: since the parking has already been paid for, the user might as well drive and park every day rather than occasionally using alternative modes.

• The Universities of Missouri and of Arkansas use CashKey technology for their meters. The CashKey is programmed at the time of purchase ($10-$15 initial deposit
required) for the desired amount ($25 minimum) and is inserted into the meter to deduct money from the user’s account, thereby eliminating the need to carry coins to feed the meter. The user purchases parking time in $0.25 increments each time the CashKey is inserted into the meter, so the key is inserted multiple times until the desired amount of time is reached. The user returns to the Parking Office to add value to the CashKey. The CashKey can also be used in combination with coins at the meter.

- The University of Arkansas also uses debit cards at multiple space meters. Debit cards can be purchased from the Parking Department and can be inserted into the meter to add value by depositing money. There is a single meter for several spaces and the user inserts the debit card, identifies the number of the space they are parked in, and purchases parking time in 30-minute increments. The meter displays the balance of the card and prints a receipt to indicate the expiration time of the parking, the space number, the amount paid, and the time of purchase. Texas Tech also uses multiple space meters in a system called Park and Pay.

4.3.7 Permit Prices and Overselling

As permits are the most important method of regulating parking, data on permit prices was collected from each respondent’s website, with the results shown in Table 4.9. The “high end costs” refer to the highest prices found for a permit on campus, typically for faculty/staff reserved spaces; “low end costs” are the lowest permit prices, usually for remote student lots. (Oakland University in Rochester Hills, Michigan, does not charge for parking nor attempt to regulate parking demand (e.g., through policies
such as prohibiting first-year students from bringing a car to campus); Oakland was
not included in the analysis of parking costs in order to avoid any offset that it might
create in the calculations.) Student t-tests at the 95% level indicated that there was not a
significant difference in the high end permit prices between urban and suburban
campuses but that there was a significant difference between the low end prices. Permit
costs on urban campuses reflect the high density development of such areas as well as
the ability of the administration to balance high parking costs with the numerous other
transportation options available to campus users (e.g. walking, transit, etc.).

| Table 4.9: Range of Parking Permit Costs on Urban (n=12) and Suburban (n=16) Campuses. |
|---------------------------------|---------------------------------|---------------------------------|---------------------------------|
|                                 | High End Parking Costs          | Low End Parking Costs           |
|                                 | Urban                           | Suburban                        |
| Mean                            | $627.48                         | $495.31                         | $135.72                         | $84.44                          |
| Median                          | $607.00                         | $420.00                         | $110.00                         | $62.50                          |
| Variance                        | 200923.72                       | 93442.76                        | 20697.51                        | 3753.20                         |
| Maximum                         | $1620.00                        | $1,013.00                       | $560.00                         | $252.00                         |
| Minimum                         | $126.96                         | $85.00                          | $26.00                          | Free                            |

Because faculty/staff and students have quite varied schedules, it is possible to
sell many more permits than for which there are spaces in order to optimize parking
facility efficiency. Overselling is defined as the ratio of permits sold to the number of
spaces available for a particular permit. Survey respondents were asked whether the
parking department intentionally oversells student and faculty/staff permits, and if so, by
how much; the results shown in Table 4.10 indicate that overselling is a more common
practice at residential universities than at commuter schools. However, the sale of
commuter permits at residential schools are more likely to be oversold or oversold at a
higher ratio than on-campus resident vehicle permits; two of the residential campuses that
reported overselling commuter permits do not oversell on-campus resident permits for
vehicle storage. Indiana University reported that “the student lots never fill up so we
don’t cap the sale of permits” which suggests that other campuses reporting unlimited
permit sales may not experience excessive student parking demand, or that the permits
are simply “hunting licenses” without a guarantee of a parking space. Overselling is a
simple tactic to maximize revenue while optimizing the space used for parking, but the
“hunting license” aspect that it can induce is politically unpopular with drivers at some
campuses.

Table 4.10: Mean oversell ratios of campuses that intentionally oversell permits.

<table>
<thead>
<tr>
<th>Permit type</th>
<th>Residential Campuses</th>
<th>Commuter Campuses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% of campuses that intentionally oversell</td>
<td>Mean oversell ratio (permits:spaces)</td>
</tr>
<tr>
<td>Faculty/Staff</td>
<td>76%</td>
<td>1.26:1 (+ 6 campuses that do not limit permit sales)</td>
</tr>
<tr>
<td>Student</td>
<td>64%</td>
<td>1.90:1 (+ 8 campuses that do not limit permit sales)</td>
</tr>
</tbody>
</table>

4.3.8 Spillover Parking

Spillover parking refers to the parking of campus-associated vehicles in areas
adjacent to the campus, e.g., curb-side parking on neighboring streets, and it is frequently
a source of town-gown tension. Survey respondents were asked how the university and
the local community have managed spillover parking and how successful these measures
have been. Tables 4.11 and 4.12 illustrate the combinations of efforts that schools use to
regulate spillover parking. More urban campuses have attempted to manage spillover
parking than suburban campuses, suggesting that it is a more significant problem on
urban campuses and which follows the results that urban campuses provide slightly less
parking than suburban, thus forcing more vehicles to seek parking elsewhere. Two urban
campuses reported a lack of success with using meters to regulate spillover parking, and a third campus was unsuccessful with municipal permits and 2-hour parking restrictions. However, Indiana University found municipal permits and zoning codes to be “very successful”; likewise, the suburban campuses of the Universities of Virginia, Florida, and California at Davis were very successful with municipal permits. The University of California at Irvine has very successfully used zoning codes that prohibit on-street parking in the city as well. The remaining respondents reported being “somewhat successful” with their approaches. It is therefore indicated that cooperation with the local community in developing municipal permits and zoning codes is the most effective way to manage spillover parking. It also appears to be a win-win situation for both the campus and the community, as the campus does not have to enforce parking regulations in these areas and the municipality generates revenue from the sale of permits as well as from parking tickets.

<table>
<thead>
<tr>
<th>Combination of regulatory measures</th>
<th>% (#) of urban respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meters ONLY</td>
<td>23% (3)</td>
</tr>
<tr>
<td>No attempt has been made</td>
<td>23% (3)</td>
</tr>
<tr>
<td>Municipal permits and 2-hr parking restrictions</td>
<td>15% (2)</td>
</tr>
<tr>
<td>Municipal permits, meters, and zoning codes</td>
<td>15% (2)</td>
</tr>
<tr>
<td>2-hour parking restrictions ONLY</td>
<td>8% (1)</td>
</tr>
<tr>
<td>Municipal permits and zoning codes</td>
<td>8% (1)</td>
</tr>
<tr>
<td>Meters and zoning codes</td>
<td>8% (1)</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100% (13)</td>
</tr>
</tbody>
</table>

Table 4.11: Overlap of parking regulations on urban campuses for spillover parking: reported combinations of regulatory measures.

Table 4.12: Overlap of parking regulations on suburban campuses for spillover parking: reported combinations of regulatory measures.
4.3.9 Final Thoughts on Parking

The final question of the parking section openly asked respondents to discuss any parking issues which they felt was significant but which had not yet been addressed. Among the themes repeated by respondents were that:

1. Surface lots are being replaced by campus buildings, which often creates a need to conserve land via construction of expensive structures and/or underground parking. Harvard University further noted that a “new financial model which is not just “fee for service” has had to be implemented.”

2. Park and ride programs and unlimited access/fare free transit programs (either campus-based or coordinated with the local transit system) are often subsidized by parking revenue or student fees and many respondents felt that such implementations helped to reduce parking demand.

Individual observations from this section included:

**University of Louisiana:** “Our biggest problem is the City of Lafayette grew much faster than the University, thus there is not any available land to use for parking.”
University of Oregon: “Outstanding bike path system, large amount of bike parking….Guaranteed Ride Home program for faculty/staff, priority carpool parking spaces, student-run night safety shuttles….Established Transportation Resource Center for the provision of information and transportation counseling.”

Colorado State University: “Oversell must be reduced, but difficult to implement without making the students move more to city streets.”

University of California-Irvine: “We have an extensive alternative transportation program that offers incentives for carpooling, vanpooling, using public transit, walking, and biking. Local AQMD [Air Quality Management District] requires such a program.”

University of California-Santa Barbara: “The stated goal is to reduce parking demand. This goal is complicated by politics (keeping the masses happy) and the need to pay for the increasing expense of keeping parking inventory in supply….Ideally, to use market forces to reduce parking demand, the user should ‘pay’ each and every time they park and ‘save’ each and every time they do not park.”

University of Missouri-Columbia: “On our campus we have parking capacity, the issue is convenience.”

4.4 Residential Demographics

Data regarding the percentage of undergraduate students living in college housing on each campus was obtained from the College Board in order to examine the effect of campus housing capacity on transportation, most notably the motor vehicle mode share for trips to-and- from campus. As shown in Table 4.13, housing demand exceeds capacity at the majority of universities; the results shown in Table 4.14 indicate that campus
planners are responding to this demand, as 20 of the 27 campuses (about 74%) experiencing excessive demand are planning capacity increases. These trends suggest that more surface lots are likely to be replaced by buildings in the future, which begs the question, will offering more on-campus housing reduce parking demand (as it reduces parking supply)?

Table 4.13: Does demand for on-campus housing exceed capacity?
Percentage of yes/no responses based on campus type.

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban</td>
<td>67%</td>
<td>33%</td>
</tr>
<tr>
<td>Suburban</td>
<td>82%</td>
<td>18%</td>
</tr>
<tr>
<td>Residential</td>
<td>77%</td>
<td>23%</td>
</tr>
<tr>
<td>Commuter</td>
<td>78%</td>
<td>22%</td>
</tr>
</tbody>
</table>

Table 4.14: Are there any plans to increase this capacity?
Percentage of yes/no responses based on campus type.

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban</td>
<td>69%</td>
<td>31%</td>
</tr>
<tr>
<td>Suburban</td>
<td>71%</td>
<td>29%</td>
</tr>
<tr>
<td>Residential</td>
<td>74%</td>
<td>26%</td>
</tr>
<tr>
<td>Commuter</td>
<td>67%</td>
<td>33%</td>
</tr>
</tbody>
</table>

As data on mode splits for trips to/from campus is limited, this part of the analysis looks at all of the campuses collectively, rather than dividing them into ‘urban,’ ‘residential,’ etc. For the campuses for which mode split data was available, a median motor vehicle mode share (for trips to/from campus) was determined, as well as the median percentage of undergraduates living in college housing (based on data obtained from the College Board). The respective points for each campus were plotted (as shown in Figure 4.17) to determine whether a correlation between campus housing and mode split exists. The yellow box on the plot indicates mode shares below the median; the blue box indicates the percentages of undergraduates in college housing above the median; the green box indicates the combined areas of the yellow and blue boxes, that is, which
Figure 4.17: The yellow box on the plot indicates motor vehicle mode shares below the median; the blue box indicates the percentages of undergraduates living in college housing above the median; the green box indicates the combined areas of the yellow and blue boxes, that is, which campuses have both high percentages of housing and low vehicle mode shares. As a slight majority of campuses fall in either the green or white areas, the data suggest that a correlation exists between housing capacity and motor vehicle mode share for trips to/from campus.
campuses have both high percentages of housing and low vehicle mode shares. A slight majority of campuses fall in either the green or white areas; however, the limitations of the data mentioned earlier prevent any clear indication of a correlation between housing capacity and motor vehicle mode share for trips to/from campus. While more campus housing might imply more resident vehicle storage, policies or permit types that restrict students from bringing cars to campus are much easier to implement than trying to shift the mode split for those commuting to campus. Moreover, housing a greater portion of students on campus relieves pressure on the local community, which suffers from loss of property taxes and lower home values of student-rented houses.

4.5 New Development/Development Control/Campus-Community Coordination

4.5.1 New Development/Development Control

Section 4.3.1 included an analysis of how much new parking was added to the various campus groups in the last 10 years. This section will begin by examining how many square feet of new building space were constructed which may have created the demand for the additional parking. Survey respondents were asked how many square feet of new building space were added to the central campus in the last 10 years; few respondents were able to provide this information, but the mean value of the results was calculated by campus type, and is shown in Table 4.15 and Figure 4.18. Student t-tests at the 95% level indicated that there is not a significant difference between the mean square footages of the campus groups.
Table 4.15: Number of respondents to the question “How many square feet of new building space have been added to the central campus in the last 10 years?”

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban</td>
<td>1,202,185</td>
<td>3</td>
</tr>
<tr>
<td>Suburban</td>
<td>1,121,113</td>
<td>5</td>
</tr>
<tr>
<td>Residential</td>
<td>1,331,625</td>
<td>5</td>
</tr>
<tr>
<td>Commuter</td>
<td>1,218,308</td>
<td>3</td>
</tr>
</tbody>
</table>

The inherent nature of the resident/commuter distinction suggests that construction on commuter campuses is likely to be in the form of additional parking to accommodate the majority of commuting students, while residential campuses are likely to add building space to house their majority of resident students. Data on five-year enrollment projections indicate an average increase of 8% on residential campuses and 21% on commuter campuses, which suggests that commuter schools may be adding more parking relative to residential campuses in the future. In contrast, residential campuses can curtail parking demand created by additional building space with policies prohibiting residents from bringing vehicles to campus or innovative TDM programs. Finally, data
indicate that much surface lot parking is being replaced by buildings, so what the residential campuses gain in new building space might be lost in parking.

The data illustrated in Figures 4.19 and 4.20 indicate that most development is on previously used land in the central campus, thereby suggesting that campuses have generally little room for new development and that most changes will be in the form of redevelopment. Consistent with the fact that commuter campuses are still early on in their development, they hold the largest percentage of greenfield development and this often occurs in the central campus, an area in which other universities have usually used up all developable land.

The vast majority of respondents (83% of urban (n=12), 82% of suburban (n=17), and 100% of rural campuses (n=2)) reported the existence of a regional highway in the vicinity of the campus. As Turner (1995) notes, proximity to a major roadway is often a factor in the siting of new campuses, particularly for commuter schools, in order to
enhance accessibility. However, when asked how the proximity of the highway has affected campus development, many respondents indicated that it had land-locked the campus. Bounded peripheries like this are likely a contributing factor to why most development takes place in the central campus. In the extreme case of Texas Tech mentioned earlier, the freeway divides the campus in two and calls for creative and expensive designs (such as major underpasses) to make the campus functional and safe for users.

4.5.2 Campus-Community Coordination

When asked to what extent the school includes the local community in its campus planning decisions, the answers varied a great deal. Results were interpreted as ‘no contact’, ‘limited/informational basis’, and ‘full cooperation’. Based on this interpretation, about half of the respondents indicated that the local community was only informed of campus plans, while the other half noted that local representatives served on

![Figure 4.20: Percentage of responses indicating where new development most typically takes place.](image)
the campus master plan committee, that the campus plan must meet the city’s approval prior to implementation, that public meetings are held, or that some other equivalent tactic is used to include the local community in campus planning. This distribution was the same within the urban, suburban, and rural breakdowns. Four of the respondents to this question indicated that the university does not include the community in planning.

Multi-jurisdictional issues are frequently difficult to resolve due to politics and finances, but these results suggest that half of the universities and their home cities have merely developed a tolerance for one another. However, some respondents have taken very active approaches to working with their community rather than simply informing it of the university’s decisions. For example, Western Kentucky University “has a Campus Master Planning Committee with persons from the city planning and zoning commission” as does Marshall University, and the University of Wisconsin in Madison “must go through city approval process on all development.” As for implemented projects, the University of Michigan at Ann Arbor jointly owns a parking structure with the city of Ann Arbor.

The results further imply that universities are exempt from zoning codes and restrictions implemented by the local city, thereby eliminating any potential motivation for the university and municipality to work together. True to these implications, Figure 4.21 illustrates that although more than half of the municipalities have building codes that prohibit particular types of development, a good number of the campuses are exempt from these codes. Figure 4.22 indicates that few municipalities have trip generation restrictions, and the portion of universities to which these restrictions are applicable is even lower.
Figure 4.21: Does the local government have building codes that prohibit particular types of development, such as vertical growth? Is the university exempt from these codes? This figure indicates the percentage of respondents who answered “yes.”

Figure 4.22: Does the local government have restrictions on the development of new facilities regarding trip generation? Is the university exempt from these restrictions? This figure indicates the percentage of respondents who answered “yes.”
It is impossible to say whether exempting campuses from municipal development codes is beneficial to the university and to the surrounding community because each case is unique, and it is possible that in some areas the campus planning supports a more efficient transportation and land use system than the municipal framework does. In the case of trip generation restrictions however, it seems that this is an excellent area for improvement: implementing municipal trip generation restrictions that are applicable to all local facilities including the university would provide the impetus for cooperation. The shared responsibility of managing traffic demand could result in a pooling of resources (both capital and labor) as well as be a politically friendly way of addressing shared transportation problems and of dissipating town resentment of university exemptions. Cross-jurisdictional issues must be resolved when the origins and destinations of trips lie in either the campus or the community, and implementing municipal trip generation restrictions that are applicable to universities is a possible starting point for future coordinated efforts. (The local zoning board and planning commission will most likely need to collaborate with campus planners to develop a special set of restrictions unique to the university’s situations; for example, the traffic generated by large university functions such as football games, concerts, etc.)

4.6 Transit

4.6.1 Operations and Management

An excellent area for town-gown collaboration is transit. Although not directly an aspect of land use, transit can decrease the single-occupant vehicle mode share thereby reducing parking demand, which is why it is considered in this study. Operation can be
the responsibility of the university, municipality, a joint-collaboration, a contracted vendor, or an arrangement in which one or the other will contribute funds to the operation while not being directly involved in the day-to-day management. Figure 4.23 illustrates that for urban campuses about one third are university-operated, one third are municipally-operated, and about one third are a joint-collaboration. The “Other” responses included a contracted vendor who operates with stops on/adjacent to campus and an unlimited access or coordinated fare program in place for university users. Figure 4.24 shows the breakdown for suburban campuses, with a majority of municipally-operated transit systems. Of the three “Other” responses, two campuses indicated that there were both university and municipal transit services, but they remained separate
rather than joined in a collaborative effort; the third respondent had an outside operator, most likely a contracted vendor, with stops on/adjacent to the campus. Of the two rural campuses, Utah State University has both university and municipal systems but they remain separate; the University of Missouri contracts for services (and uses a reduced student fees program).

Of the municipally-operated systems serving urban and suburban campuses (including joint-collaborations), six respondents indicated that the service operated with stops on/adjacent to campus, two had unlimited access/coordinated fare programs, and the majority (eleven respondents) had both. In addition, several respondents noted that an unlimited access program was under consideration or being tested through a pilot

Who operates the transit that serves the suburban campus?

![Pie chart showing transit system arrangements on suburban campuses (n=19). “Other” responses included two campuses that had separate university and municipal transit services and one campus with an outside operator.](image)

Figure 4.24: Transit system arrangements on suburban campuses (n=19). “Other” responses included two campuses that had separate university and municipal transit services and one campus with an outside operator.
program. As mentioned in Chapter 2 (Literature Review), unlimited access programs are becoming increasingly popular for the ease of implementation and substantial effect they often have on increasing ridership; in particular, Bourne and Schauer (1990) and Brown et al. (2001) persuasively describe successful implementations and program details.

Respondents were asked to indicate how satisfied (“very,” “somewhat,” or “not at all – ridership needs to increase or the program may be abandoned”) they were with the performance of the transit arrangement in order to determine which type of arrangement is most effective at fulfilling the needs of the university. As shown in Figure 4.25, university-operated transit was most frequently seen as “very” satisfactory by campuses with that type of system in place, followed by “other” arrangements which included a contract with a third-party and co-existing but separate university and municipal systems. While municipally-operated systems had the most “somewhat” satisfactory votes, it had

![How satisfied are you with the current transit arrangement?](image)
the least “very” satisfactory. Further examination reveals that the services seen as “very” satisfactory were implemented via an unlimited access/coordinated fare program for university-users, while 3 of the 8 “somewhat” satisfactory services operated only with stops on or adjacent to campus. No correlation is blatantly clear here, but the trends do suggest that unlimited access/coordinated fare programs do their part to encourage ridership.

4.6.2 Attributes of a Successful (or Failing) System

To further understand the dynamics of campus transit, respondents were asked to indicate to what factors they attributed the success (or lack thereof) of the transit system arrangement. Although a very subjective question, it is intended to shed some light on the elements of successful and unsuccessful systems, as shown in Table 4.16. The perceived convenience of the private vehicle is often cited as the main incentive for driving; however, several campuses noted that both good campus-community cooperation and parking restrictions contributed to the success of the transit system. New Mexico State University provides an especially insightful answer, noting that the students’ rural backgrounds have often left them unfamiliar with and uninterested in any transportation mode other than the private vehicle and incognizant of being denied convenient parking.

The University of Oklahoma in Norman was the only campus to mention the use of resources such as FTA funding; this initiative begged the question, why hadn’t more universities reported taking advantage of federal funding opportunities? Further research was conducted to see if funding had been withheld from particular areas as a result of EPA air quality nonattainment status; the findings showed that only one (7%) of the
Table 4.16: To what factors do you attribute the success/lack of success of the transit system/arrangement?

<table>
<thead>
<tr>
<th>Factor</th>
<th>“very” satisfactory</th>
<th>“some what” satisfactory</th>
<th>“not at all” satisfactory</th>
</tr>
</thead>
<tbody>
<tr>
<td>University-operated</td>
<td>• &quot;Transit serves areas of high demand and the university is the largest trip generator in town. We transport 1.2 million people a year.&quot;</td>
<td>• &quot;Both the city and the university are very content with the university-operated arrangement; OU is easily Norman’s greatest trip attraction which makes the arrangement logical. We are the designated recipient of federal funding and answer directly to the MPO and FTA in that regard. Performance could be improved by adding service if local subsidy increases. The university pays the largest share of expenses, and there is currently an effort to increase the subsidy from the city of Norman.&quot;</td>
<td>• &quot;No-fare boarding for undergrads; paid for with fees.&quot;</td>
</tr>
<tr>
<td>Municipally-operated</td>
<td>• &quot;Close working relationship and cooperation&quot;</td>
<td>• [lack of success due to] &quot;shortage of vehicles during peak periods&quot;</td>
<td>• [lack of success due to] &quot;not as quick or reliable as personal vehicle.&quot;</td>
</tr>
<tr>
<td></td>
<td>• &quot;University financial support&quot;</td>
<td>• [lack of success due to] &quot;no dedicated service roads&quot;</td>
<td>• [lack of success due to] &quot;lack of close proximity parking attribute to the success.&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• [lack of success due to] &quot;Express routes to enclaves lacking; transit district unwilling to recharge for use wants to have annual agreements that do not take into account actual number of riders.&quot;</td>
<td></td>
</tr>
<tr>
<td>Joint-collaboration</td>
<td>• &quot;Coordinated board of directors that includes city, university administration and students. Good management of the transit system.&quot;</td>
<td>• &quot;good cooperation&quot;</td>
<td>• &quot;Students attending NMSU are mainly from rural areas and are not receptive to the limitations of public transit (waiting at stops, having to walk...&quot;</td>
</tr>
</tbody>
</table>
|  | "We are able to capitalize on the expertise of the transit folks and get the students more bang for their buck."
|  | "Parking limitations"
|  | Investment in transportation things get cut like operating routes and service (time)."
|  | "cooperation between local provider and university"
|  | [lack of success due to] "not enough funds"
|  | to/from stops, etc.). They are used to driving themselves, and expect to be able to get as close as possible to their destination.... The student government funds the local transit system, and all students can ride for free. Ridership is so low, however, that the routes have been reduced by 50% over the past two years."
| Other | "Access"
|  | [lack of success because] "Students are too affluent: transit is seen as what poor people ride"
|  | "Services are reviewed annually and contracts are adjusted."
|  | [lack of success due to] "pick-up drop off points"
urban campuses and five (26%) of the suburban campuses were designated nonattainment areas for either ozone or carbon monoxide. It is possible that the subjective nature of this open-ended question may have led to a misinterpretation of the factors contributing to the success of the transit system, but federal sources should nonetheless be considered for any campus program in need of funding.

4.6.3 Final Thoughts on Transit

The final question of this section asked: “what initiatives has the university undertaken to form a cooperative alliance with the local community and establish a seamless transition between respective transportation systems, and how successful have these initiatives been?” The question enables campus transportation planners to share ideas with their peer institutions in their own words, and Table 4.17 sorts the responses according to the indicated level of success. The majority of responses focus on unlimited access programs, further illustrating their effectiveness.

Table 4.17: What initiatives has the university undertaken to form a cooperative alliance with the local community and establish a seamless transition between respective transportation systems, and how successful have these initiatives been?

<table>
<thead>
<tr>
<th>“Very successful”</th>
<th>“Somewhat successful”</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>University of Arkansas-Fayetteville:</strong> “The university provides fare free transit service to about 1/3 of the city including paratransit service. We review input from the city for route changes.”</td>
<td><strong>University of California-Santa Barbara:</strong> “Ongoing negotiation to improve cost-effectiveness and level of service.”</td>
</tr>
<tr>
<td><strong>University of Florida-Gainesville:</strong> &quot;unlimited access transit pass program for students and faculty and staff&quot;</td>
<td><strong>Colorado State University:</strong> &quot;Unlimited student access&quot;</td>
</tr>
<tr>
<td><strong>Iowa State University:</strong> &quot;The local transit agency is a joint city/university undertaking. ISU has park and ride program, annual pass buy down for f/s and student annual fee that allows no-fare boarding throughout city.&quot;</td>
<td><strong>Florida State University:</strong> &quot;We pay the city almost $200,000 annually to allow FSU students unlimited access to public transit system.”</td>
</tr>
<tr>
<td><strong>University of Oregon-Eugene:</strong> &quot;unlimited access bus ridership programs, helping to establish special limited stop shuttle to and from campus, working to</td>
<td><strong>Indiana University-Bloomington:</strong> &quot;Student fees pay for access to the community bus system.”</td>
</tr>
</tbody>
</table>
**help get Bus Rapid Transit system underway**

<table>
<thead>
<tr>
<th><strong>Texas Tech University:</strong> “Student services fees pay for on campus transportation and allow students unlimited access to community transportation.”</th>
<th><strong>University of Michigan-Ann Arbor:</strong> “Looking at unlimited access program”</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>University of Wisconsin-Madison:</strong> “The unlimited access bus pass is our biggest program. We also partner with the local transit agency on two park and rides we operate.”</td>
<td><strong>University of Oklahoma-Norman:</strong> “The city of Norman recently funded a needs assessment jointly with CART. There are a number of local businesses which provide small subsidies to CART.”</td>
</tr>
<tr>
<td><strong>Purdue University:</strong> “free bus rides”</td>
<td></td>
</tr>
</tbody>
</table>

### 4.7 Final Thoughts

The final question of the survey asked respondents to discuss any land use or transportation initiative which they felt was significant but which had not yet been discussed. Here are the responses in the administrators’ own words:

- “Harvard is largely a pedestrian campus and its parking is being placed underground to preserve that orientation at a large cost to the university and the users of the system. We are currently trying to improve our bike racks and covered bike stalls as well as increase our bike shower facilities. Increased use of ZipCar targeted towards our graduate population…”

- Iowa State: “A significant land use for us is the “outdoor classroom”…”

- Wisconsin: “I think our campus is unique in its limited parking availability and our success in getting both students and staff to use a variety of alternatives.”

- CSU: “Off-site park&ride opportunities need to be developed with a true shuttle from lot to transit center drop point.”

- UC-Irvine: “Charging a significant amount for parking permits may induce some individuals to use alternative transportation or rideshare…”
• UC-Santa Barbara: “The tendency for the University to build buildings on surface parking lots without compensation to the “self-supporting” parking unit. Inadequate funding for bicycle infrastructure improvements: racks, lockers, showers, bike and clothes lockers. Not promoting telecommuting and remote work locations at all or in a unified way. Parking pricing that sells parking to the full-time user at the cheapest rate is HUGE and because of political reasons (pleasing the masses) this is unlikely to change.”

• Western Kentucky University: “Our campus is land-locked regarding future peripheral parking. We do not want to create surface parking because of the loss of green space. We are in the process of building a 5-7 story parking structure with 900 spaces adjacent to an existing structure that houses 1000 spaces.”

4.8 Summary of Findings

The survey was intended to identify trends in transportation-related land use on university campuses in the areas of:

- planning frameworks
- circulation
- parking
- residential demographics
- new development
- development control
- campus-community coordination
- transit.

Based on the preceding analysis of the survey responses, the findings can be summarized as follows.
4.8.1 General Planning

The campus planning process appears thorough and updated, as approximately one-third of the respondents have both a campus master plan and a long range development plan in place and more than half are in the process of or have updated the plans within the last four years.

4.8.2 Motor Vehicle Mode Share

- For trips to/from campus, the motor vehicle share for suburban campuses (74%) is more than the shares of motor vehicle (50%) and transit (21%) combined on urban campuses.

- Relative to campus setting, on-campus trips illustrate a virtual flip-flop in mode shares of transit and motor vehicle: 27% transit and 10% motor vehicle on urban campuses compared to 11% transit and 27% motor vehicle on suburban campuses. This may be due to urban areas often having more extensive multimodal (particularly transit) systems, parking costs, housing options, and a lack of available land.

- For trips to/from campus, student t-tests at the 95% level indicated a significant difference between residential and commuter campus motor vehicle mode shares (commuter schools being slightly higher); there is no significant difference between these shares for trips within campus. In light of the results of urban and suburban campuses, it appears that the area in which a school is located is a greater determinant of its campus transportation traits than the number of residents on the campus.
• Despite the higher motor vehicle mode share (for trips to/from campus) at commuter schools, there is no significant difference between the amounts of parking on residential and commuter campuses. The amounts are probably evened out by the extra parking provided for those living on residential campuses.

4.8.3 Parking

• Within the distinctions of ‘urban’ and ‘suburban’, the majority of spaces constructed on urban campuses were in the form of surface lots on the campus periphery, while the majority of spaces constructed on suburban campuses were in the form of structures in the campus core. It appears that land values in the respective areas may be a contributing factor to this trend.

• The majority of respondents regulate on-campus parking with both permits and meters; Table 4.9 presents mean costs of permit prices on urban and suburban campuses. (An overview of innovative regulatory measures and technologies was also provided in this chapter.)

4.8.4 Redevelopment and Limited Land Availability

• The availability of land in the campus interior is a greater determinant of the type of parking than the relative costs of lots versus structures, as campuses more frequently build structures on the periphery than lots in the interior. This hints that land availability is also a greater determinant than convenience or accessibility. Most schools appear to be striving to maintain a pedestrian-oriented campus, if only in the campus core.
• Most development is on previously used land—often surface parking lots—in the central campus, thereby suggesting that campuses generally have little room for new development and that most changes will be in the form of redevelopment (and lost parking).

• More than half of all respondents (55%) confirmed that a physical obstacle, such as a busy thoroughfare or dangerous intersection compromised travel/flow on campus. Most often, motor-vehicle roads which may have once quietly rambled through campus may now present a problem as heavily trafficked thoroughfares or access roads which create vehicle-pedestrian conflicts and compromise safety and time.

• Although the intent of a highway located near to the campus is to enhance accessibility, many respondents indicated that such highways had land-locked the campus. Bounded peripheries like this are likely a contributing factor to why most development takes place in the central campus.

• The loss of parking to new development is perhaps the most significant trend identified by the survey results. Many respondents commented on the potential of park & ride programs, the expansion of transportation alternative programs, and in particular, unlimited access transit pass programs to address this decrease in parking supply. Unlimited access programs appear to be one of the most effective ways to decrease parking demand.

• Combined with transportation alternative programs, restrictive parking policies or disincentives to parking provide an opportunity to decrease parking demand. While such approaches can be politically unpopular, improving transportation options while taking away parking “rights” has the potential for great success; for example,
establishing “walking zones” around the campus to determine parking permit eligibility; combining an unlimited access transit program with a policy that prohibits first-year students from bringing a vehicle to campus; implementing a formal carsharing program (if feasible) while limiting the amount of resident storage parking. Restrictive parking policies and transportation alternative programs will be most successful if they are implemented together, so that as one decreases access to parking supply, the other decreases parking demand by providing alternatives.

• The greatest opportunity for campuses to manage their transportation and land use systems appears to be better town-gown cooperation. The survey results indicated that the majority of universities and their host communities have merely developed a tolerance for one another, and that few campuses are required to adhere to local zoning codes. Yet the co-existence of these entities requires that they co-plan and co-manage the physical area that they share. The areas in which this cooperation is most needed are safety and circulation conflicts (e.g. busy local roads that transverse the campus) and spillover parking. An excellent starting point for cooperation is an unlimited access transit pass program (i.e., one that gives campus users easy access to the local transit system, if it exists). Some universities indicated having a member of the local zoning board on the campus planning board or needing municipal approval of campus master plans prior to implementation. Other options include municipal parking permits to manage spillover parking and, where appropriate, adherence to local zoning and development codes. It is impossible to say whether exempting campuses from municipal development codes is beneficial to the university and to the surrounding community because each case is unique, and it is possible that in some
areas the campus planning supports a more efficient transportation and land use system than the municipal framework does. Still, university and municipal planning frameworks must recognize the campus-community interface and work with it rather than being at odds with each other.
Chapter 5: Case Studies

5.1 Case Study Introduction
Section 3.2 in Chapter 3-Methodology explains how the three case studies were selected and researched. The purpose of the case studies is to illustrate a situation encountered by the campus in order to help other administrators formulate approaches to their own transportation and land use planning challenges.

5.2 University of California-Santa Barbara

5.2.1 Introduction
The University of California at Santa Barbara (UCSB) case represents residential campuses set in suburban areas and was selected for a variety of reasons: it was the only campus in the survey to report an offset in parking demand due to TDM; it reported a very low motor vehicle mode share for trips to/from campus (30%); and it has an extremely thorough Transportation Alternatives Program (TAP) in place. Moreover, the
physical situation of its campus limits space for parking and offers unique challenges to campus planners. This case study describes how the administration confronted dissent from the campus population due to a large and rapid increase in parking rates.

5.2.2 Background

The Santa Barbara campus of the University of California, about 100 miles northwest of Los Angeles, is situated on somewhat of a point jutting out into Pacific Ocean as shown in Figure 5.1. As idyllic as it appears (complete with lagoon), this geographic boundary presents the most formidable of all constraints considered by campuses. What land is available is limited by a fault line running under the campus and preventing the construction of any facility, whether for parking or academic functions.

Figure 5.1: The University of California at Santa Barbara is situated between the Pacific Ocean and the City of Santa Barbara.
The population of Santa Barbara is 92,325 according to the 2000 U.S. Census; approximately 10,000 UCSB students live in adjacent Isla Vista and many commute to campus by bicycle. Isla Vista is also subject to spillover parking from the campus, and a parking permit program for the area is under consideration. UCSB has reached its quarterly average enrollment cap of 20,000.

5.2.3 Case Story

Like most campuses, UCSB faces the challenge of meeting transportation demand within a (sometimes) difficult political atmosphere. In an effort to replace parking lost to new construction while preserving sites for future development, a 2001 analysis of campus parking facilities recommended that underground parking structures be built. However, the increased cost of locating replacement parking underground meant that parking rates would increase from $35/month in 2002 to $125/month or more by 2005 or 2006. This plan met dissent from users of the Santa Barbara campus, and the administration responded by appointing ‘The Chancellor’s Special Advisory Committee on Parking’ (CSACOP) with faculty, administration, and student body representatives. The responsibilities of the Committee included improving communication with campus users and evaluating and recommending parking policies and transportation alternatives.

One of the initial observations of the CSACOP was that the University of California Master Plan (for the entire UC system, not solely the Santa Barbara campus) was implemented in 1960 and that its approach to parking is no longer appropriate:

The existing University of California policy treats parking systems as an auxiliary enterprise, which is “financed from parking fees collected from
students, faculty and staff.” Hence, the construction cost of new structures is borne by those that pay parking fees, and fees rise unless one or more of the following actions is taken: 1) supply is increased on existing lots by changes in policy; 2) demand for parking spaces is reduced by changes in behavior or policy; 3) alternative sources of revenue are found. (CSACOP 2002)

The Committee further found that the original 2001 analysis that had estimated the need for three structures (and consequently the large and rapid increase in user fees) was unreliable. The Committee found a more accurate approach used by other institutions and made a new estimate that indicated that two parking structures would be sufficient, rather than three. The new method used parking permit sales to determine what portion of each campus population group (i.e., faculty, staff, graduate, undergraduate, visitor) buys which type of permit. This information was then combined with survey data that indicated when and how many parkers from each user group were parking on campus in order to determine occupancy levels as a function of time. These occupancy levels were increased by 10% to calculate the number of spaces needed to accommodate permit holders. Although there is a cap of 20,000 students on the campus, CSACOP used this model to forecast the needed number of spaces due to growth in the faculty and staff populations; the result was a need for 5700 to 6000 total spaces on the campus by 2010 (at the time of the 2002 CSACOP study there were about 5200 spaces). Approximately 835 surface lot spaces were expected to be lost to new construction by 2004; therefore between 1200 and 1500 spaces would need to be supplied, suggesting that two new structures were required, contradictory to the previous estimate for three new structures. At the time of data collection for this thesis (summer 2003), UCSB
reported having 6000 existing spaces, with 900 of those having been built in a structure within the last 10 years. These results for existing and additional spaces are approximately half of the mean values reported for all suburban campuses in this study, suggesting that overall, UCSB has several transportation alternatives in place for those accessing campus. The proximity of the major student residential area, Isla Vista, likely contributes to the lower parking demand.

Among the policy recommendations of the CSACOP were that:

- The Parking and Transportation Committee should be disbanded and separate Parking Ratepayer and Alternative Transportation boards should be established in its place: essentially, the Parking Ratepayer Board represents those who travel to campus via a single-occupancy vehicle, while the Alternative Transportation Board represents those who use alternative modes to access campus. Both Boards are to be represented on the Campus Planning Committee and the Senate Budget and Planning Council. (These administrative changes were to take place by January 2003, but as of October 2003 the two boards had not yet been formed. The delay in the formation of the separate Parking Ratepayer and Alternative Transportation boards has prevented the implementation of the CSACOP recommendations. Policies based on the following CSACOP recommendations cannot be created until the appropriate administrative framework is in place.)

- Somewhat of a campus zoning ordinance that requires “every new capital project [to] have a parking and transportation plan that addresses parking replacement costs and proposes mitigations” should be implemented.
• A tighter relationship between TAP and the local transit agency, the Metropolitan Transit District (MTD), should be formed, as all exchanges thus far are mainly at the staff level rather than the leadership level and have failed to produce any type of meaningful service arrangement for the campus. CSACOP suggested that the Chancellor meet personally with MTD leaders, as well as participate in meetings with Santa Barbara’s Downtown Parking Commission and MTD in order to represent the needs of UCSB. James Wagner, TAP Program Manager, noted that creating a relationship at a higher level of administration will likely lead to a more functional relationship between the transit agency and UCSB, thereby ensuring that UCSB’s needs are met through flexible MTD service.

• According to Mr. Wagner, grant money has been secured for the purchase of in-vehicle meters that fulfill the needs of the occasional parker. CSACOP endorses the use of these meters, which support alternatives by avoiding the ‘all-you-can-eat’ syndrome created by long-term parking permits. Mr. Wagner also indicated that TAP is considering technologies that allow parkers to pay for their space via a cell phone.

• “The Transportation Alternatives Program (TAP) should be established as a financially independent operation, encouraged to becoming increasingly profitable as it decreases campus need for single-occupant-vehicle use, measured as a demonstrable drop in the need for parking places.” For example, “a portion of [proposed] core funding from the campus to Parking Services should be used for TAP; the amount should be in proportion to the demonstrable reduction in use of single occupancy vehicles to access the campus....” In the past, parking revenue was
used exclusively for parking facilities and did not support alternatives that could
manage parking demand.

Another of the Committee’s recommendations was that starting in the 2002-2003
academic year the campus should provide $250,000 to Parking Operations as part of a
new core funding program (not implemented as of October 2003). The Parking
Operations’ Statement of Operations for July 1, 2001 to June 30, 2002 indicated a net
loss of $92,190 after operating expenditures and capital charges had been figured. As
dictated by the 1960 Master Plan, campus parking services are funded solely by user fees
(totaling $3,734,306) such as annual permit sales, gate sales, parking meter income, etc..
In contrast, the TAP Statement of Operations for the same period indicates that 80\% of its
income comes from a subsidy from Fines & Forfeitures Income from the Citations
Program; the remainder comes from the sale of MTD Bus Passes, for a total TAP income
of only $92,708, approximately the same amount lost at Parking Operations or 2.5\% of
the total Parking Operations income. TAP income and operations balanced perfectly
with no net loss or income. (UCSB Transportation & Parking Services 2002) It appears
that new core funding would not only more than cover Parking Operations annual loss,
but that TAP should be able to decrease capital charges for parking as it decreases
demand (which is the suggested measure of TAP’s profitability). Therefore, it almost
seems misguided to devote the core funding to Parking Operations with an adjustable
amount allocated to TAP; it would appear to be more effective to invest the funds in TAP
and allow Parking Services to continue as a user-fee-based program.
5.2.4 Conclusions

The comprehensiveness of UCSB’s Transportation & Parking Services and Transportation Alternatives Program is quite extensive; the reader is referred to http://www.tps.ucsb.edu/ for more details on the program. However, it should be noted that only 900 parking spaces (less than half of the mean for suburban campuses) were constructed over the last ten years, which the TAP Manager, Mr. Wagner, attributes to charging for parking; a ban on undergraduate parking within a 2 mile radius of campus; and the development and effective marketing of a wide range of TAP options, which include:

- half-priced carpool parking
- half-priced employee bus passes
- student-funded bus passes (for students)
- Emergency Ride Home program
- vanpool program
- online real-time carpool matching service.

The UCSB case stresses the importance of accurate planning analyses as well as innovative program options to managing parking demand. Mr. Wagner recommends that parking is the best area in which to make the costs of driving a single-occupancy vehicle visible to the user and to alert them to alternatives. For example, providing as many parking options as possible, such as short-term parking, allows those accessing campus to choose from a variety of options depending on their needs for that particular day, rather than making a decision for the entire semester or academic year. Furthermore, administrative and funding frameworks need to support campus services as efficiently as
possible, including fund sharing and effective communication between administrators and campus constituents.

Among the lessons to be observed from the UCSB case are that the campus population must be included in the formulation of recommendations, especially when potentially controversial issues are being decided. Transportation alternative programs and demand management should approach parking as a single piece of the entire transportation system rather than the dominant element. Reorganizing funds to focus on decreasing parking demand rather than increasing parking supply is one method of adjusting the hierarchy of modes.

Within the context of reorganizing frameworks to shift the attention paid to parking, the recommendation that the UCSB Parking and Transportation Committee be broken into separate Parking Ratepayer and Alternative Transportation boards may or may not be beneficial. That is, while granting the Alternative Transportation Board exclusivity and freeing it from the dominance of parking may give more power to alternative modes, a separate Parking Ratepayer Board may experience the same exclusivity that would not be possible in a more holistic, systematic and coordinated approach. The intention may be that the two will balance each other out, but it seems more likely that motor vehicles will have half of the pie while the remaining modes fight over the rest, as opposed to all modes being given equal slices. Still, the CSACOP recommendations had not been implemented as of October 2003, so the result cannot be examined; furthermore, the success of UCSB’s TAP speaks for itself in reducing parking demand.
Lesson: Facilitate communication with the campus population through surveys and/or representative committees.

5.3 University of Oklahoma-Norman

5.3.1 Introduction

The University of Oklahoma (OU) in Norman was selected to represent a suburban commuter campus because of the example of regional cooperation and coordination that it provides. In particular, the transit arrangement that OU has with the City of Norman and the Oklahoma City region is unique and creates funding opportunities for the OU transit system that would not otherwise be available. Although funding is not primarily considered in this study, the OU case illustrates ways for universities to engage in regional cooperation and create a seamless integration between transit systems.

5.3.2 Background

Norman is situated about 30 miles south of Oklahoma City (OKC) on Interstate 35. It is the seat of Cleveland County and the third largest city in the state with a population of 95,700 according to the 2000 Census. One comment on the OU survey response noted that “while Norman is a “small city” [by this study’s definition] it is more properly a suburb of Oklahoma City. Thus, commuting distances for many students, faculty, and staff are longer than those in a city like Charlottesville [which is the principal city in the vicinity].”
The OU transit arrangement is different from those of other survey respondents in that the university operates the transit system that serves the City of Norman. The system has five city routes and two campus routes transporting 800,000 passengers annually, and was created in 1980 specifically to address issues of limited parking on campus. As mentioned in the survey response, “OU is easily Norman’s greatest trip attraction, which makes the arrangement logical. We are the [grantee] of federal funding and answer directly to the MPO and FTA in that regard.”

A sense of regional cooperation dominates this case study, as OKC and Norman operate under a single MPO, the Association of Central Oklahoma Governments (ACOG). Public transit for the region is provided via two distinct bus systems, one serving OKC and one serving Norman. The larger, OKC system is METRO Transit; the OU system, serving both OU and the City of Norman, is known as CART (Cleveland Area Rapid Transit) to OU students and as METRO Transit to Norman residents; operating under the name METRO Transit in Norman is intended to suggest a seamless regional system to passengers. While CART/Norman-METRO and OKC-METRO effectively coordinate to serve the region on an express route between Norman and OKC, they otherwise have separate operations.

Until the 2000 Census, the City of Norman was considered part of the Oklahoma City urbanized area; subsequently, OU’s transit system, CART, received funding passed on from the regional transit authority and designated recipient of federal funding, the Central Oklahoma Transportation and Parking Authority (COTPA). This arrangement made it logical for CART to use the METRO Transit name, particularly in marketing to Norman residents to reinforce the fact that it provides access to OKC (although to OU
students, the system was and is still marketed as CART). However, the 2000 Census identified Norman as an urbanized area separate from OKC, directly making its transit provider, the University of Oklahoma (CART), the grantee of federal funding (from the federally designated recipient, the Oklahoma DOT). CART has retained use of the METRO Transit name to avoid confusion for its riders, however the names can be confusing for researchers: essentially, Norman-METRO Transit is another name for CART, the transit system operated by OU.

5.3.3 Case Story

In developing the survey for this project, one campus parking and transit administrator expressed a desire to know what initiatives could be taken to form a cooperative alliance between the university and the local community in order to establish a “seamless transition” between the respective transportation systems. The transit arrangement at OU appears to have accomplished this mission by gaining recognition as the transit provider for Norman and by effectively coordinating on a regional scale with the larger OKC METRO Transit. For example, although Norman-METRO Transit/CART holds the titles and performs the maintenance on its vehicles, it purchases the vehicles through OKC-METRO Transit to secure lower prices as part of the larger fleet. However, each transit system submits its own budget separately to ACOG (the MPO for both OKC and Norman) for the Transportation Improvement Plan (TIP).

Before the 2000 Census, Norman-METRO Transit/CART relied on the regional transportation authority (COTPA) to secure funding from the FTA. However, because the 2000 Census indicated that the City of Norman’s population was more than 50,000
people, it came to be considered an independent urbanized area (defined as an area with a population of more than 50,000) separate from the urbanized area of OKC. With this distinction comes opportunities for formula funding from the FTA, specifically, Section 5307-Urbanized Area Program and Section 5309-Capital Investment Program. The formula which determines the allotment of Section 5307 funds is based on population, population density, and transportation data; the grant usually contributes 80% of the funds needed for capital and planning projects while the remaining 20% is supplied locally (operating assistance is a 50%-50% split) (ACOG 2003). The FTA description of Section 5307 notes:

*The Urbanized Area Formula Program makes Federal resources available to urbanized areas and to the Governors for transit capital and operating assistance in urbanized areas and for transportation-related planning. An urbanized area is an incorporated area with a population of 50,000 or more that is designated as such by the Bureau of the Census....Under this formula program, state and local agencies are permitted to:*

a. allocate program resources among recipients in an urbanized area without Federal involvement;

b. identify and select the projects (capital, operating, or planning) to be included in a metropolitan and a statewide transportation improvement program;

c. self-certify that various statutory requirements have been or will be met; and

d. submit a single grant application and one budget for the Section 5307 program in lieu of many individual project applications and budgets.

*The Federal role in program management activities is, to the maximum extent feasible, limited and non-intrusive.*

(FTA 2004b)

(In this case, the Oklahoma DOT is the designated funding recipient and allocates program resources to CART.) In addition, the FTA notes that other programs created by
TEA-21 may be able to provide complementary funding to cities participating in the Urbanized Area Program under the:

- Clean Fuels Formula Program
- Job Access and Reverse Commute (JARC) Program
- Over-the-Road Bus Accessibility Program
- Transportation and Community and System Preservation Pilot Program.

The FFY 2004-2006 ACOG TIP explains that the City of Norman will be using funds from JARC to further the Welfare-to-Work initiative in addition to Section 5307 funds.

Section 5309, the Captial Investment Program has three main aspects: new and replacement buses and facilities, modernization of existing rail systems, and new fixed guideway systems. The Section 5309 Summary notes that “Eligible recipients for capital investment funds are public bodies and agencies (transit authorities and other state and local public bodies and agencies thereof) including states, municipalities, other political subdivisions of states; public agencies and instrumentalities of one or more states; and certain public corporations, boards, and commissions established under state law.” (FTA 2004a). As the transit provider for the urbanized area of Norman, Norman-METRO Transit/CART is granted these funds by the Section 5309 funding recipient, the Oklahoma DOT. Under Section 5309 for bus and bus-related projects,

eligible purposes are acquisition of buses for fleet and service expansion, bus maintenance and administrative facilities, transfer facilities, bus malls, transportation centers, intermodal terminals, park-and-ride stations, acquisition of replacement vehicles, bus rebuilds, bus preventive maintenance, passenger amenities such as passenger shelters and bus stop signs, accessory and miscellaneous equipment such as mobile radio units,
supervisory vehicles, fareboxes, computers, shop and garage equipment, and costs incurred in arranging innovative financing for eligible projects.

(FTA 2004a)

The ACOG TIP cites that “the FFY 2004 program for MetroTransit Norman is just over $4 million, with $3.1 million coming from federal sources under the FTA Sec. 5307 and Sec. 5309 programs.” (ACOG 2003)

The ACOG TIP further acknowledges that the reauthorization of TEA-21 will determine the future of OKC’s and the City of Norman’s grantee status, as Norman may once again be designated part of the OKC UZA rather than remaining its own UZA: “This will have a direct impact on the amount of Surface Transportation Program Urbanized Area (STP-UZA) funds suballocated to the Oklahoma City Area Regional Transportation Study area [which includes Norman] in the future, and will determine the City of Norman’s eligibility to access the UZA funds under the MPO’s adopted STP Procedures for the Oklahoma City Urbanized Area Funds.” (ACOG 2003) When the Norman and OKC UZAs are grouped together, Norman makes up approximately 10% of the entire population, therefore affecting the formula funding for each area. If Norman is included in the OKC UZA, ACOG estimates its FFY 2004-2006 federal apportionment to be $16 million; if Norman is not included, the estimate is lowered to $14,336,000.

Apart from capital improvements funding from the federal government, Carl Weckenmann, Norman-METRO Transit/CART Planner, notes in the OU survey response that “the university pays the largest share of expenses.” Yet a close working relationship between the university-operated transit and the community exists. Local apartment complexes have paid small subsidies to the system in exchange for the placement of bus
stops in front of the complexes to increase and advertise the accessibility of the
apartments. Moreover, the City of Norman receives Community Development Block
Grant (CDBG) funding for urban redevelopment, a portion of which is reserved for
public service providers such as transit: $25,000 is set aside “to ensure the continued
transportation bus service for low/mod persons” by providing free bus passes to
qualifying residents of Norman. (City of Norman, Oklahoma, Department of Planning &
Community Development 2004)

Finally, Norman-METRO Transit/CART maintains healthy lines of
communication with the community through periodic public hearings and the
establishment of Transportation Committees; the Norman-METRO Transit website
explains that “University students and faculty, community representatives, and METRO
Transit officials work together on these committees to assure the best possible transit
system for all of Norman.” (University of Oklahoma Parking and Transit Services 2004)

5.3.4 Conclusions

The main lesson to be learned from the University of Oklahoma case is the
importance of coordination. Although OU’s transit situation is relatively unique to that
of other universities, it illustrates the potential advantages of inter-agency cooperation,
particularly on a regional level. While not every campus transit system will be eligible
for federal funding, coordinated efforts among entities such as regional transit authorities,
MPOs, local transit agencies, state DOTs, and campus administrators may provide
benefits that would otherwise be unavailable. Even if eligibility requirements for funding
are not met, agencies can pool their resources, such as staff, vehicles, databases, land
holdings, etc., to meet common goals like traffic demand management. Effective communication and the sharing of experiences may also prove a valuable asset between agencies. As noted in the survey analysis, inter-jurisdictional problems may be best approached with inter-jurisdictional solutions. CART/Norman-METRO Transit has successfully maintained its sovereignty while serving its customers’ need for regional accessibility; moreover, it has optimized its operations by taking advantage of benefits extended to its associate (for example, purchasing vehicles as part of a larger fleet). The result is a transit system that has a significantly larger mode share for trips to/from the OU campus than the mean for suburban campuses.

The key to building this successful relationship may be the presence of a third party, in this case the MPO and the regional transportation authority under which both CART/Norman-METRO Transit and OKC-METRO Transit operate. This presence set up areas of common ground on which both transit system operators could relate to one another and take advantage of existing lines of communication to plan coordination strategies.

The lesson of cooperation applies to non-university areas as well, as coordinating efforts and creating a sense of regionalism through political, economic, and social frameworks will help the entire area to compete in the modern global market. In contrast, a competitive ‘free-for-all’ may inefficiently promote isolation among entities that are too small to play a role in the larger national or international context.

**Lesson:** Collaborate with all relevant parties to maximize resources and opportunities for success.
5.4 Harvard University-Cambridge, Massachusetts

5.4.1 Introduction

The case of Harvard University in Cambridge, Massachusetts provides an example how a residential campus might approach the increasing loss of parking to new campus buildings while managing boundary constraints in an expensive and densely populated urban area. The Harvard case also illustrates the possible challenges and benefits of a tight town-gown relationship in which the campus is not treated as an entirely separate planning entity exempt from city regulations.\(^6\)

5.4.2 Background

According to the 2000 U.S. Census, the population of Cambridge is 101,355 and it is the third most densely populated city in Massachusetts. Cambridge is adjacent to Boston, placing it within the Massachusetts Bay Transit Authority (MBTA) region. More than 75% of Harvard University’s employees live within the MBTA region; however, faculty members do not usually travel during traditional on-peak hours, so “the MBTA does not service Harvard employees equally.” (Harvard University Operations Services, 2001a)

The campus and the City of Cambridge are tightly linked, as the University pays more than $500 million annually to Cambridge in taxes, payroll, municipal fees and services, voluntary payments in lieu of taxes, and purchases of goods and services. Moreover, Harvard University was one of the few schools in the survey to report being

\(^6\) Although the Harvard campus includes areas of both Cambridge and Allston, the discussion in this case study is limited to the City of Cambridge and the areas of the campus located there.
subject to local development codes and traffic generation restrictions. The applicability of Cambridge ordinances to Harvard has created a close working relationship between university and municipality. The City of Cambridge developed a Committee on University-Community Relationships, which in 1991 recommended that Harvard make annual “Town Gown Presentations” to the City of Cambridge Planning Board: “This information-sharing effort is a foundation of university-community relations in Cambridge.” (Harvard University Operations Services, 2004b)

5.4.3 Case Story

Harvard’s academic mission is driving extensive campus development. Current capital plans for the schools forecast the construction of more than one million square feet of new building space in Cambridge during the next five to ten years. Most of this activity will take place on sites currently used as surface or structured parking facilities. Academic program goals and objectives are closely associated with the preservation of parking—a shared resource among the schools—and the availability of robust transportation services. (Harvard University Operations Services 2001b)

With the constraints of the surrounding density of Cambridge and Boston, the last frontier for new development on the Harvard campus is land currently used for parking. Yet Harvard University Operations Services (UOS) notes that parking demand already exceeds supply and that as of 2001, the campus was managing 5,763 spaces, 75% of which were in surface lots and 25% in parking structures. (Harvard UOS, 2001b) Moreover, new construction is expected to displace 2100 spaces while creating a demand for another 2500 (Harvard UOS 2001a). Adding to this difficult position is the view of
“parking as regulatory currency,” as Harvard “meets zoning requirements through the allocation of existing parking spaces—a finite resource. Existing unallocated parking spaces represent Harvard’s remaining development potential.” (Harvard UOS, 2001a) In other words, the campus cannot develop further unless it can provide the required number of parking spaces for the new development. To keep account of the number of allocated and unallocated parking spaces, Harvard Planning and Real Estate created a Parking Zoning Allocation Program (PZAP) which in 2001 determined that there were “925 unallocated spaces for zoning, which will support the current development estimate of 1.7 million square feet.” (Harvard UOS, 2001c)

Although Harvard must supply enough spaces to comply with zoning, the City of Cambridge also limits the growth of parking and has placed a “cap” on the amount of parking that Harvard can have, so it is absolutely necessary that the University find a way to maintain its parking inventory in order to preserve its development potential. These governing regulations are part of Cambridge’s Parking and Transportation Demand Management Planning (PTDM) and Parking Space Registration Ordinance, which “is intended to reduce the number of vehicle trips within the City and requires owners and developers to establish formal mitigation procedures to reduce single-occupancy vehicle use.” (Harvard UOS, 2001b) Therefore, Harvard’s approach to new development has had to “replace parking lots to new construction with no net growth and manage demand for parking spaces through other transit alternatives.” (Harvard UOS, 2001a)

Realizing that “the challenge is much broader than parking— it is really about campus access,” campus planners undertook a consultative planning process with representatives from the University and faculty. (Harvard UOS, 2001a) Research was
conducted to determine the mode split for trips to and from campus, followed by an
analysis of ‘who’ was using campus parking. Findings indicated that more than 70% of
faculty had parking permits, and that the parking composition was 23% faculty, 37%
administrative staff, 23% other staff, and 17% vendors, contractors, and ‘other’ users.
Twenty-seven percent of the parkers reported Cambridge residences; further findings
indicated that of Harvard’s Cambridge-based employees, approximately two-thirds were
peak-hour commuters who could be satisfied by the MBTA service schedule. Faculty
members usually commute during non-peak-hours, suggesting that the MBTA schedule
does not meet faculty members’ needs (Harvard UOS 2001a).

Cost analyses showed that despite being in the MBTA service region, convenient
and low-cost parking had made driving alone cost-competitive with taking transit. A
Harvard Presidential Brief on campus parking notes that “parking rates have historically
been quite reasonable because most parking is in open lots and the debt on the existing
garages is nearly retired.” (Harvard UOS 2001b) For example, the ratio of the cost of a
monthly transit pass to the cost of a monthly pooled parking permit was 0.96. This
situation is reflected in the finding that of faculty and staff living within 1 mile of the
MBTA stop for Harvard, 26% were monthly pooled parking permit holders, compared to
only 9% being monthly MBTA pass holders (Harvard UOS 2001a). Therefore, the
availability of alternatives existed, but there was no incentive to choose them over the
convenience of driving alone. Better incentives to using alternatives combined with
disincentives to driving and parking and a reorganization of how land was used for
parking (i.e., a shift from surface lots to underground structures) could help manage
demand while preserving the campus parking inventory.
The new CommuterChoice program enables those accessing the Harvard campus to choose their mode of travel from the options of carpool, vanpool, transit (subway, bus, rail), bike, or carsharing. The CommuterChoice website (http://www.commuterchoice.harvard.edu/) describes the incentives for each mode such as reduced parking rates for carpools, discounted MBTA passes, and an Emergency Ride Home program. The website indicates that Harvard subsidizes MBTA passes up to 40% for employees, the maximum allowable by the IRS. Therefore, the current average cost of a monthly transit pass for a Harvard employee living within the same area of the 2001 comparison of parking permit and transit pass holders is $23.75 (Harvard UOS 2004a).

At the same time, Harvard University Director of Transportation John Nolan notes in a message to the Harvard community that beginning in September 2004, parking rates will increase by an average of $170 to $320 from the previous year due to parking structure construction (Harvard UOS 2004b); therefore the current equivalent of the 2001 monthly pooled permit costs $52.50. This brings the current cost ratio of transit to parking to 0.45 compared to the 2001 value of 0.96. Data on the percent change in permit holders and pass holders due to this shift was unavailable.

5.4.4 Conclusions

The financial planning of Harvard’s Transportation Strategic Plan could be a case study in itself, and the reader is referred to the website at

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7 Harvard has the most developed carsharing program of all the survey respondents. An arrangement has been made in which Harvard University allows the carsharing organization ZipCar free use of three parking spaces near Harvard residential complexes. Faculty, staff and graduate students may join ZipCar for $20 per year, to be credited to the first month of membership.
http://www.uos.harvard.edu/transportation/dep_tra_tsp.shtml for more details regarding the funding of the parking structures and how it has affected parking rates. Yet it should be noted that for 30 years the University has adjusted user rates according to the cost of the service, which the administration acknowledges has been low until now because the majority of parking has been in surface lots. However, the development plans for campus parking will cost more than $500 million over the next 25 years (this figure represents new construction, replacement of existing garages, operation, and TDM program support). Financial planning efforts have determined three sources of funds: “user fees, a fringe benefit assessment (.25 percent on the salary base), and a modest infrastructure fee ($15/sq.ft., escalated annually from FY-00) charged to construction and renovation projects that add new floor space. The latter two fees are new and recognize, in part, the impact of the University’s physical growth on the demand (more faculty and staff) and supply (zoning benefits) of parking. However, under current models parking fees are still projected to bear nearly 70 percent of the cost.” (Harvard UOS 2001b)

The position of Harvard relative to other survey respondents is unique because it is one of the few schools that is not exempt from local zoning ordinances. The amount of parking available to Harvard is limited due to the “cap” that Cambridge has implemented. Therefore, the most significant implication of compliance is that “parking is regulatory currency”; that is, the University has a limited pool of parking spaces that it can allocate for development projects and since this pool cannot be replenished due to the cap, it must be optimally managed in order to maintain the University’s development potential. Through discussions with campus users, planners determined that the best management strategy is to maximize land use with underground parking structures and to regulate
demand with a comprehensive alternative transportation program, thereby acknowledging that the issue is campus accessibility and not simply parking supply.

While the Harvard case is somewhat special because the university is subject to local municipal codes, it illustrates how one campus is navigating the difficult position of managing future development and a finite parking supply in an area in which people are accustomed to inexpensive and convenient parking. Administrators have recognized that parking is like a kind of currency exchanged between the university and the local municipality, and it should also be treated as such between the university and its users; that is, maintaining a balance of give (more transportation options like discounted transit passes, carsharing, emergency rides home) and take (incentives for driving alone like inexpensive and convenient parking) will help to increase the accessibility of the campus for people rather than for vehicles.

Lesson: Change focus from parking to campus accessibility; balance parking disincentives with alternative transportation incentives; consider partnering with local government to co-manage shared transportation problems.
Chapter 6: Conclusions, Recommendations, and Opportunities

6.1 Conclusions
6.2 Recommendations
6.3 Guidelines
6.4 Opportunities for Future Research

6.1 Conclusions

Among the lessons learned from this research are that the data do not suggest a correlation between on-campus housing and motor vehicle mode split and the area in which a school is located is a greater determinant of its campus transportation traits than the number of residents on the campus. That is, urban campuses have a significantly lower motor vehicle mode share for trips to and from campus as do suburban campuses, as well as twice the pedestrian mode share for on-campus trips. It appears that the reasons for these differences include 1) the more extensive transit systems in place in urban areas; 2) the lack of available land for parking and high parking costs typical of urban areas; 3) the wider range of residential choices (and consequently commuting distances) available in high-density urban areas. Therefore, universities wanting to devote campus land to academic facilities rather than parking lots may want to direct their resources towards the transportation aspects of the surrounding area rather than providing additional on-campus housing to students. Understandably, a suburban or rural campus does not have the opportunities afforded by an urban school such as Harvard University and its location within one of the nation’s largest transit service areas; however, working with local agencies to arrange an unlimited access transit pass program may elicit a similar response in the transit mode share. Raising campus permit prices
while co-managing spillover parking with the municipality through municipal permits should also discourage driving to campus alone and thereby reduce parking demand. The university can also implement restrictive parking policies, such as prohibiting undergraduates from bringing vehicles to campus or making residents within a certain radius of the campus ineligible for a parking permit. Short-term parking options, such as hourly or daily permits, and a Guaranteed Ride Home program will also fill a niche for the campus user who needs to drive to school occasionally but ends up driving everyday because he/she has already paid for a semester or annual permit or may need a vehicle in the event of an emergency.

When parking demand cannot be reduced further or surface lot parking is lost to redevelopment and new facilities must be constructed, the comparison of land values to facility cost determines the location and type of the new parking facility. The new facility is likely to be paid for by the users through a substantial increase in permit prices. The campus transportation department must therefore supply a greater menu of alternative transportation options to meet the fall-out from former parkers and to counter the resistance that will undoubtedly result from permit cost increases, as shown in the University of California-Santa Barbara case study. A successful and comprehensive TDM program will balance incentives for alternatives with disincentives to driving alone. An unlimited access program should help to shift the mode split as well as discounted permit for carpools. If the university has access to less expensive land at another location (within a reasonable distance of the main campus), a park-and-ride program could reduce facility costs and any consequential increases in user costs.
Very few of the campuses surveyed were subject to municipal zoning ordinances or, if they existed, traffic generation restrictions. However, as most trips originate or end either on or off campus, the municipal and university transportation systems are inextricably linked and call for better planning processes and operations to solve challenging situations. Shared problems such as spillover parking, congestion, intermodal conflicts, development issues, and inefficient transit systems require shared responsibility by town and gown. Both entities could pool their resources for successful solutions to deficient conditions: the university gains a partner in development and transportation management, while the municipality gains greater control and/or input as to the development practices of the university. The intention of better cooperation is to recognize the transportation/land use interface between university and municipality and to create a more holistic approach to shared problems, particularly transportation-related ones.

6.2 Recommendations

In addition to the guidelines above, a number of recommendations based on the research are offered:

- Relative to expensive housing improvements and construction as a response to transportation demand, improvements to the bicycle network are easy and inexpensive. Given the typically young and physically active student populations (which are often looking for ways to save money) bicycling is an excellent mode choice with much potential. Greater attention to bicycle parking facilities, path
networks, security, and safety (particularly regarding bicycle-pedestrian conflicts) is suggested.

- Emergency/Guaranteed Ride Home programs may provide an opportunity to shift single-occupancy vehicle trips to alternatives. Drivers frequently cite needing a vehicle available in the event of an off-campus or personal emergency, so offering a Guaranteed Ride Home program eliminates the need to drive to campus every day. However, evidence of such a program was found on only three of the respondents’ websites, so the potential of these programs to shift the mode split is still untested.

- A university setting appears to be ideal for a formal carsharing program (such as Flexcar or Zipcar) due to the high residential density of students, high parking costs, limited land, the minimal income of most students, and their low annual mileages. University employees would also benefit greatly from shared vehicle access, as they could commute to work via an alternative mode but have a vehicle available to them during the day should they need it. Locating one or more carsharing stations on campus could greatly reduce parking demand, as one estimate suggests that one shared vehicle replaces six cars on the road (Flexcar 2004); moreover, residential students who bring a car to campus for occasional use and consume valuable parking space could instead join a carsharing program. However, one respondent that considered carsharing found it to be financially unfeasible, so individual campuses should determine if carsharing is a reasonable option for their particular situation.

- Few schools have, as yet, attempted multiple land uses such as incorporating administrative offices or academic facilities in a parking structure. When a parking
structure is deemed necessary, vertically stacking functions in structures conserves land and centralizes the campus.

- Short-term parking permits or “pay as you park” programs may be more effective at decreasing parking demand and improving the mode share of alternatives than long-term (i.e., annual or semester) permits. Short-term parking makes the costs of driving more visible as well as avoids the “all you can eat” syndrome of long-term parking permits: that is, since the driver has already paid for the permit, they might as well use it as much as possible. Furthermore, short-term parking is politically-friendly, relatively easy to implement, and satisfies a market niche that is often neglected.

- The recommendation that campuses and their local municipalities attempt a greater level of cooperation may also be applicable to cities within a region. Several authors (including Dreier et al. (2001), Orfield (2002), and Pastor et al. (2002)) have argued that the fates of a region’s central city and its suburbs are related and that individual municipalities will be more successful economically if they engage in regional cooperation. For example, Orfield (2002) has suggested policies such as tax-revenue sharing to eliminate inefficient competition for large tax-bases among local cities; the intent of such a strategy is to improve sustainability and encourage more diverse types of development to reduce economic and social spatial isolation within a region.

### 6.3 Guidelines

Based on the conclusions of the research, guidelines for campus planners have been formed. This section highlights situations that are likely to be encountered at universities and suggested treatments for each one. It is expected that many of the
suggestions will have overlapping effects and may be applied to problems other than the ones described here.

**Problem:** Parking demand needs to be reduced because supply is decreasing due to development on surface lots

**Possible Strategies:**

- Create a campus zoning ordinance for new buildings that requires them to:
  - include bicycle parking (racks, lockers) at the new building
  - implement a program that educates the users of the new building on transportation alternatives and assists the users in forming car and van pools, finding bicycle-friendly routes to school, etc.
  - assist in the creation of a GIS program which contains the residential addresses of the users of the new building, so that campus transportation planners will have readily available data to assist in determining transit and vanpool routes.

- Reduce resident vehicle storage through restrictive policies (e.g., prohibiting first- and second-year students from bringing a vehicle to campus; requiring all vehicles parked on campus to be moved within 24 hours); restricting resident parking will free parking spaces for daily commuters.

- Provided an adequate pedestrian and/or bicycle network is in place, make residents within a particular radius of campus ineligible for a campus parking permit (the appropriate distance could be determined using the GIS program).
• Consider building a parking structure under the new building, funded mainly by user fees.

• If applicable, coordinate with the local transit agency to develop an unlimited access program.

• If applicable, develop a Park&Ride program, either with the university-operated transit system or the local transit agency.

• Raise parking permit prices to reduce demand, balanced by a comprehensive alternatives program.

• Include technology in the construction of the new building that facilitates telecommuting, such as wireless networking, etc.

• Allow users of the building to work on flexible schedules to stagger parking demand.

• Offer short-term parking options via meters or scratch/punch cards that enable daily parking; short-term parking makes single-occupant vehicle costs more visible and increases the mode choice options for those whose travel needs change daily.

Problem: The university would like to develop a closer working relationship with the municipality in order to co-manage shared problems (e.g., spillover parking) and are in need of a starting point

Possible Strategies:

• Invite local representatives from the municipal zoning board or planning commission to serve on the university campus master plan committee.

• Submit the campus master plan to the city for approval prior to implementation.

• Hold public meetings on university development/campus master planning.
• Make annual town-gown presentations to the city (as Harvard University is required to do).

• Support the creation of a community bicycle infrastructure that links with the university bicycle network; possible implementations include on-street bike lanes, bicycle underpasses or overpasses, bicycle parking throughout the community, etc.

• Implement an unlimited transit pass program with the local transit authority:
  • negotiate a fare acceptable to both parties, keeping in mind that the program will increase transit ridership, fill empty seats (particularly during off-peak hours), reduce transaction fees.
  • work with student council and faculty/staff representatives to determine whether the transit pass fees should be mandatory, opt-out or opt-in; a student referendum might be appropriate to determine what the campus community prefers.

• Develop a municipal permit program or develop zoning ordinances to manage spillover parking.

• Co-manage intermodal conflicts caused by dangerous intersections or busy local roads on or adjacent to campus.

**Problem:** Campus planners have decided to develop a comprehensive transportation alternatives program and are unsure as to what elements to include

**Possible Strategies:**
• Survey campus users to determine their needs; maintain an open dialogue with users for continuous input, perhaps through a committee of faculty, staff and student representatives (such as the one described in the University of California-Santa Barbara case study).

• Implement a Guaranteed/Emergency Ride Home Program: offer reimbursement for taxi fare.

• Provide car/vanpool matching: use a university-wide GIS program to match riders based on schedules and locations.

• Implement car/vanpool discounts for parking: the discount can increase with the number of riders in the pool.

• Make an arrangement with the local transit authority (if applicable) for discounted fares or an unlimited access program.

• Provide a commuting consulting service that helps users to determine the most convenient and cost-effective mode for their particular needs; include services such as finding bicycle-friendly routes to campus, carpool matching, etc.

• Establish a formal membership for transportation alternatives program: members of the campus community who sign up agree to use alternatives for most of their trips to/from campus, but also receive a number of free days of parking each semester. For example, the University of California at Santa Barbara has a Transportation Alternatives Program Incentive Card, through which the holder receives benefits such as participation in the Emergency Ride Home Program, up to 6 days of free parking each quarter, and free student bus passes (or ½ price employee passes) provided they
agree that they will travel to campus via an indicated alternative mode of transportation for the majority of their trips.

6.4 Opportunities for Future Research

Perhaps the most fundamental assumption on which this research is based is the appropriateness of the College Board descriptions for each campus as residential or commuter and the campus setting as urban, suburban, or rural. Towards the end of the project it was realized that these designations are self-reported by the universities in response to the College Board’s Annual Survey of Colleges and that there may exist a particular degree of subjectivity in these classifications. It is therefore suggested that any future research along the lines of this project determine more objective definitions of these terms. For example, one might define urban/suburban/rural settings according to levels of population density for the community that surrounds the campus; the amount of undeveloped land in the area might also influence the definition. Likewise, the definition of resident student versus commuter student needs to be determined: that is, is a student who does not live in university-supplied housing but who lives adjacent to campus (for example, across the street) considered a resident or a commuter? Once these terms have been defined, what proportion of each group of students will determine whether a campus is residential or commuter?

Two other data areas require clarification: mode splits and residential demographics. Based on the survey responses, mode split data did not appear to be readily available from universities; however, this may be due in part to the fact that more specific mode split data was not requested. For example, the average weekday mode
splits will be very different for faculty, staff, and commuting students than for campus residents. Moreover, there will be several links in each trip originating or ending on campus, as walking or using a parking lot shuttle may be involved at some point in a trip dominated by single-occupancy vehicle use. Likewise, student and faculty/staff residential demographics were not readily available from survey respondents and this lack prevented any useful analysis of the relationship between mode split and residential distance from campus. It is expected that a GIS analysis of residential distance from campus would prove very beneficial to campus planners, especially when determining routes for transit service or vanpools, or when making decisions regarding future on-campus housing.

For future campus land use studies it will also be useful to determine what portions of campus land are used for different functions. For example, what area of land (that is, acreage or square footage) is used for parking (resident storage or commuter), for boarding facilities, for instructional buildings, serves as open space, etc.? This data would be quite useful in determining the amount of developable land that remains on campus and the options for its future use.

Beyond these concerns, several opportunities for research on the affect of TDM programs on mode split exist. For example, unlimited access programs have been found successful in increasing transit ridership, yet how do they influence parking demand? The same can be said for Guaranteed/Emergency Ride Home programs, short-term (i.e., hourly or daily) parking permits, and the regulatory parking technologies and policies observed in this research. Furthermore, the theoretical potential of carsharing programs
in university settings has been explained here, yet how does this play out in reality: is it feasible, and if so, does it reduce parking demand?

An opportunity for further research also exists in the area of project financing strategies and costs. For example, some universities have user fees in place that raise revenue for the exclusive funding of the system in question; that is, parking fees contribute only to the maintenance and operation of existing parking facilities and the construction of new parking facilities rather than any alternative transportation programs that could reduce parking demand. Further research would help to answer questions such as: is revenue-sharing among different types of campus transportation facilities better for the system as a whole? Research regarding the costs of construction, maintenance and operation of different types of parking facilities and alternative transportation programs might also be useful.
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## APPENDIX A:

The Sample Population:
Universities to which the survey was distributed

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<td>LAWRENCE</td>
</tr>
<tr>
<td>49</td>
<td>UNIVERSITY OF LOUISIANA AT LAFAYETTE</td>
<td>LAFAYETTE</td>
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<td>50</td>
<td>UNIVERSITY OF MICHIGAN-ANN ARBOR</td>
<td>ANN ARBOR</td>
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<td>51</td>
<td>UNIVERSITY OF MISSOURI-COLUMBIA</td>
<td>COLUMBIA</td>
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<tr>
<td>52</td>
<td>UNIVERSITY OF NEBRASKA AT LINCOLN</td>
<td>LINCOLN</td>
</tr>
<tr>
<td>53</td>
<td>UNIVERSITY OF NORTH TEXAS</td>
<td>DENTON</td>
</tr>
<tr>
<td>54</td>
<td>UNIVERSITY OF OKLAHOMA NORMAN CAMPUS</td>
<td>NORMAN</td>
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<tr>
<td>55</td>
<td>UNIVERSITY OF OREGON</td>
<td>EUGENE</td>
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<tr>
<td>56</td>
<td>UNIVERSITY OF SOUTH CAROLINA AT COLUMBIA</td>
<td>COLUMBIA</td>
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<td>UNIVERSITY OF SOUTHERN MISSISSIPPI</td>
<td>HATTIESBURG</td>
</tr>
<tr>
<td>58</td>
<td>UNIVERSITY OF VIRGINIA-MAIN CAMPUS</td>
<td>CHARLOTTESVILLE</td>
</tr>
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<td>59</td>
<td>UNIVERSITY OF WISCONSIN-MADISON</td>
<td>MADISON</td>
</tr>
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<td>60</td>
<td>UTAH STATE UNIVERSITY</td>
<td>LOGAN</td>
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<td>61</td>
<td>VIRGINIA COMMONWEALTH UNIVERSITY</td>
<td>RICHMOND</td>
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<td>62</td>
<td>WEBER STATE UNIVERSITY</td>
<td>OGDEN</td>
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<tr>
<td>63</td>
<td>WESTERN KENTUCKY UNIVERSITY</td>
<td>BOWLING GREEN</td>
</tr>
<tr>
<td>64</td>
<td>WESTERN MICHIGAN UNIVERSITY</td>
<td>KALAMAZOO</td>
</tr>
</tbody>
</table>
APPENDIX B:

The Effect of Land Use Planning on University Transportation Systems

SURVEY

Part A: General Campus Transportation, Land Use and Planning

For universities with more than one campus, please provide information regarding the campus about which you were contacted.

A-1. Does your school have (please check all that apply):

- A stand-alone transportation plan (as opposed to being a piece of a larger plan)
- Campus Master Plan with a transportation element
- Campus Master Plan without a transportation element
- Long Range Development Plan with a transportation element
- Long Range Development Plan without a transportation element
- A planning office within your transportation/parking department
- None of the above
- Other

A-2. When was the plan last updated?

A-3. What is the total number of faculty and staff affiliated with this campus?

___________________ people

A-4. How do campus land use planning and transportation facilities most typically respond to transportation demand? Please indicate how widely practiced each approach is at your university (while the preferred approach will understandably depend on the particular set of circumstances, please provide a general assessment):

<table>
<thead>
<tr>
<th>Approach taken:</th>
<th>Frequently</th>
<th>Occasionally</th>
<th>Never</th>
<th>N/A</th>
<th>Briefly explain:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Build more surface parking lots in campus interior</td>
<td>?</td>
<td>O</td>
<td>?</td>
<td>?</td>
<td>________________</td>
</tr>
<tr>
<td>Build more parking structures in campus interior</td>
<td>?</td>
<td>O</td>
<td>?</td>
<td>?</td>
<td>________________</td>
</tr>
</tbody>
</table>
Build more surface parking lots on campus periphery | O | ? | ?
Build more parking structures on campus periphery | O | ? | ?
Improve transit between peripheral parking and central campus | O | ? | ?
Improve general university transit system | O | ? | ?
Improve transit between university and local community | O | ? | ?
Improve transit in other areas (please describe) | O | ? | ?
Coordinate with local community | O | ? | ?
Improve/build more on-campus housing | O | ? | ?
Improve pedestrian network | O | ? | ?
Improve bicycle network | O | ? | ?
Other (please describe) | O | ? | ?

A-5. Is there a large facility on campus that attracts trips (such as a regional hospital)? If so, how has this element affected the parking and transportation system at your university?

Part B: Circulation

B-1. Are there any physical obstacles that compromise travel/flow, such as a busy thoroughfare, dangerous intersection, or railroad cutting through campus, etc.?
Yes ______ No ______
What approach, if any, has been taken to address such obstacles?

B-2. What is the mode split for trips to-and-from campus?
Motor vehicles _______  Pedestrians _______
Bicycles _______  Transit _______  Other

B-3. What is the mode split for trips within campus?
Motor vehicles _______  Pedestrians _______
Bicycles _______  Transit _______  Other
B-4. Is there a preferred mode split that the administration would like to nurture?

Motor vehicles
Pedestrians
Bicycles
Transit
Other

B-5. Has the administration considered implementing or has it implemented a formal carsharing program on campus? (For example, has the university contracted with a company such as Flexcar or Zipcar to locate shared vehicles on campus?)

Yes  No

If so, please discuss the success/lack of success that has been experienced so far.

Part C: Parking

C-1. How many existing parking spaces are there on the campus at present?

____________spaces

C-2. How many new parking spaces has the university constructed in the last 10 years (total, not net)?

____________spaces

C-3. Has the university been able to eliminate any planned or existing parking facilities due to reduced demand in the last 10 years?

Yes  No

If “yes,” how many?

planned spaces

existing spaces

Please describe what factors you believe are responsible for the reduction in demand:

C-4. Of the parking constructed within the last 10 years, what kinds were built and what are the respective amounts of each? (Providing a detailed map showing quantitative amounts is acceptable; please be sure to indicate new parking.)

Satellite/peripheral lots  ____________% or # of spaces
Satellite/peripheral structures  ____________% or # of spaces
In-close (adjacent to or within central campus area) lots  ____________% or # of spaces
In-close structures  ____________% or # of spaces

A new special events facility was built (e.g. football stadium) and the associated parking is used for day-to-day purposes when the facility itself is not in use  ____________% or # of spaces

Other (please describe)  ____________% or # of spaces

C-5. Have any multiple-land use approaches been taken, such as a parking structure under a building or playing field?  Yes  No

If “yes,” please describe:

C-6. How many exterior bicycle parking spaces are supplied on campus?

____________spaces
C-7. How is parking regulated? (Please check all that apply.)

<table>
<thead>
<tr>
<th>Option</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permits</td>
<td>_____</td>
</tr>
<tr>
<td>Meters</td>
<td>_____</td>
</tr>
<tr>
<td>Cash-out program</td>
<td>_____</td>
</tr>
<tr>
<td>Policy prohibiting first-year students from bringing vehicles to campus</td>
<td>_____</td>
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<tr>
<td>Policy making students who live within a specified distance of transit service ineligible for campus parking permit</td>
<td>_____</td>
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<tr>
<td>Other</td>
<td>_____</td>
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</table>

C-8. How have the university and local community managed spillover parking, that is, curb-side parking on neighboring streets? (Please check all that apply)

<table>
<thead>
<tr>
<th>Option</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Municipal permits</td>
<td>_____</td>
</tr>
<tr>
<td>Meters</td>
<td>_____</td>
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<tr>
<td>Zoning codes</td>
<td>_____</td>
</tr>
<tr>
<td>Not a problem</td>
<td>_____</td>
</tr>
<tr>
<td>No attempt has been made</td>
<td>_____</td>
</tr>
<tr>
<td>Other (please explain)</td>
<td>_____</td>
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</tbody>
</table>

Has this approach been successful in reducing spillover parking?

- Very successful _____
- Somewhat successful _____
- Not successful _____

C-9. Please describe the types of parking permits/coupons offered to students/faculty/staff during the 2002-2003 school year:

<table>
<thead>
<tr>
<th>Type of Permit</th>
<th>Offered to: (student or fac/staff)</th>
<th>2002-2003 Price (please indicate if price per semester, year, etc.)</th>
<th>Quantity sold during 2002-2003</th>
</tr>
</thead>
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</tbody>
</table>

C-10. Does the parking department intentionally oversell student parking permits?

Yes _____  No _____  N/A _____  If so, by how much? ___________%

C-11. Does the parking department intentionally oversell faculty/staff parking permits?

Yes _____  No _____  N/A _____  If so, by how much? ___________%

C-12. Please discuss any parking issues that you feel are significant but which have not yet been addressed, as well as any successful parking innovations that your university has implemented.
Part D: Residential Demographics

D-1. What is the projected enrollment in five years? ______________ students
D-2. Does demand for on-campus housing exceed capacity? Yes______ No______
D-3. Are there any plans to increase this capacity? Yes______ No______
D-4. Approximately what percentage of students live:
   - On campus ______
   - Within ½ mile of campus ______
   - Within 1 mile of campus ______
   - Within 5 miles of campus ______
   - Within 10+ miles of campus ______
D-5. Approximately what percentage of faculty/staff live:
   - On campus ______
   - Within ½ mile of campus ______
   - Within 1 mile of campus ______
   - Within 5 miles of campus ______
   - Within 10+ miles of campus ______

Part E: New Development / Campus-Community Coordination / Development Control

E-1. How many square feet of new building space have been added to the central campus in the last 10 years? ____________ square feet
E-2. What is the ratio of developable acreage to total campus?
   ________ developable acres to ________ total campus acres
E-3. Where does new development most typically take place? (please select one from each group)
   Group A: _____ in the central campus  _____ on the periphery of campus
   _____ in a satellite area that is not contiguous with the rest of campus
   Group B: _____ on new greenfields  _____ on previously used land (e.g. parking surface lots)
E-4. What are the zoning code requirements for parking spaces on campus?
   Does the institution presently meet the requirements? Yes______ No______
E-5. Is there a regional highway in the vicinity of the campus? Yes______ No______
   How has this affected campus development?
E-6. Is an outside consultant usually hired for new development? Yes______ No______
If available, please provide the name of the consulting firm.

__________________________________________________________________________

Would it be possible to contact the consultant regarding this research? Yes______ No______

E-7. Does the school include the local community in its campus planning decisions? If so, to what extent?

E-8. Does the local government have building codes that prohibit particular types of development, such as vertical growth? Yes______ No______

Is the university exempt from these codes? Yes______ No______

E-9. Does the local government have restrictions on the development of new facilities regarding trip generation?

Yes______ No______ If “yes,” please provide a copy of the restrictions, if available.

Is the university exempt from these restrictions? Yes______ No______

Part F: Transit

F-1. If there is a transit system that serves the campus, is it: (please check one)

_____ university-operated  _____ operated by the local community  _____ joint-collaboration

_____ other (please explain) __________________________________________________________

F-2. If the campus is served by local community transit, how is the service implemented? (please check all that apply)

_____ there are stops on or adjacent to campus

_____ there is a coordinated fare or unlimited access program in place for the university

_____ other (please explain) __________________________________________________________

F-3. Is the university transportation department satisfied with the performance of the transit system/arrangement?

_____ Very satisfied  _____ somewhat satisfied

_____ not satisfied at all; ridership needs to increase or the program may be abandoned

F-4. What factors do you attribute to the success/lack of success of this transit system/arrangement?
F-5. What initiatives has the university undertaken to form a cooperative alliance with the local community and establish a seamless transition between the respective transportation systems (for example, an unlimited access transit pass program, cooperative parking policies, etc.)?

F-6. How successful have these initiatives been?

Very successful _______ Somewhat successful _______ Not successful _______

Part G: Additional Information

Please discuss any land use or transportation initiatives which you feel are significant but which have not yet been addressed.