The Road Less Traveled

Sustainable Transportation for Campuses

The high costs of parking expansion have propelled many institutions toward a transportation demand management strategy to shift many trips from single occupant automobiles to other modes of travel.

by Will Toor

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Why Does Transportation Matter?

Any university that is attempting to make the transition toward sustainability must confront the issue of transportation. The daily movement of people back and forth to campus in automobiles burning fossil fuels is one of the largest impacts a typical educational institution imposes on the life-support systems of the planet. In addition, the travel patterns that students learn while in college are likely to influence their future travel choices. The personal automobile has become the dominant mode of travel in the United States, with over 95 percent of personal trips taking place by car. Vehicle miles traveled grew from 1 trillion miles annually in 1970 to 2.6 trillion miles in 1998 (Bureau of Transportation Statistics 2000).

This growth in individual automobile use has profound environmental implications. Transportation accounts for more than two-thirds of the U.S. consumption of petroleum. Of this, over 50 percent is used for personal vehicles, making U.S. citizens the most profligate petroleum users on the globe. The average U.S. citizen consumes 5 times more energy for transportation as a resident of a wealthy Asian country, 1.65 times as much as Canadians and Australians, and 2.5 times as much as Europeans (Newman and Kenworthy 1999).

Despite improvements to automobile technology that have been driven by the Clean Air Act, automobiles continue to be a large source of air pollution. The American Lung Association's *State of the Air Report 2002* (2002) concludes that more than 142 million Americans are breathing in unhealthy amounts of ozone pollution linked to lung and heart disease. Highway vehicles emit 26 percent of all volatile organic compounds and 32 percent of nitrogen oxides—the precursors to ozone formation. They are also responsible for over 60 percent of nationwide emissions of carbon monoxide (Benfield and Replogle 2002). In addition, there is increasing evidence of health effects associated with "toxic tailpipe emissions" in the immediate vicinity of high-volume roadways. Benzene, butadiene, and diesel exhaust appear to be the major culprits and can lead to elevated cancer levels for residents near major roads (South Coast Air Quality Management District 1999).

Transportation energy use is also responsible for a substantial portion of greenhouse gas emissions. Overall, transportation accounts for 32 percent of U.S. carbon dioxide emissions, with motor vehicles accounting for the bulk of these emissions (about 25 percent). Transportation is also the fastest growing source of carbon emissions. Although there has been some increase in vehicle efficiency since 1970 (approximately a 17 percent increase), which would tend to reduce carbon emissions, the large growth in the U.S. vehicle fleet, and in per capita vehicle miles traveled, has led to an increase in carbon emissions since 1970 of more than 50 percent (Benfield and Replogle 2002; Mackenzie 1997). Other impacts include the damages associated with oil drilling and oil spills, and the non-point-source water pollution from runoff from roads and parking lots.

At the same time, all of the investment that society has made in new and expanded roads, expanded parking supply, and more personal vehicles has not led to a decrease in congestion. The opposite has occurred, with very significant increases in congestion in most of the United States during the last 20 years. In fact, some analysts argue that new road construction induces new travel, so that new roads can actually worsen congestion (Litman 2001).

Given all of these problems associated with automobile-dependent transportation, what options do campus planners have? One area to explore is the use of vehicles owned by the institution (e.g., departmental cars, construction equipment, campus buses). In this arena, the institution has control over the vehicle technology, and there are opportunities for switching to more sustainable vehicle types and fuels.

One approach a number of campuses are taking is using biodiesel for vehicles such as campus shuttle buses. Although the reduction in tailpipe emissions is not as large as that attained from switching to compressed natural gas or hybrid electric buses, the advantage is that existing diesel vehicles can be used, so the capital cost of making the change can be very low. The life-cycle emissions of carbon dioxide from biodiesel combustion are also reduced significantly, because the carbon in the fuel comes from photosynthetic fixing of atmospheric carbon. The University of Montana is operating its campus shuttle system on 100 percent biodiesel, using both commercially purchased fuel and fuel refined from the waste cooking oil from the campus dining halls. The University of Vermont is using a 20 percent biodiesel mix in campus buses (Campus Ecology Program 2002).

Other alternatives available include hybrid electric vehicles to replace smaller sedans. Soon there will be hybrid electrics available for small SUV and minivan applications, electric vehicles as an alternative for small utility vehicles, clean natural gas (CNG) pickup trucks, and CNG and hybrid electric buses. The University of California, Davis, has replaced 10 diesel buses with new, low-emission buses: 9 natural gas buses and 1 that runs on a mixture of natural gas and hydrogen. Clean-fuel buses are used for 85 percent of the mileage of this campus transit system (U.S. Department of Energy 2002). A number of campuses have purchased electric vehicles, although the environmental benefits of electric vehicles will vary substantially depending on the source of electricity.

Campuses can also create incentives to affect private vehicle choice. At the University of Colorado, for example, parking staff are examining the possibility of preferential parking locations and lower permit fees for hybrid electric vehicles.

However, the largest impact is from the travel of employees and students in private vehicles. Although this travel is not under the direct control of the institution, it is heavily influenced by institutional policies and planning decisions. College or university policies that decrease vehicle miles traveled by these groups can be expected to have substantial environmental benefits. The rest of this article will focus on this latter set of issues.

Transportation in University Communities

Throughout North America, college and university campuses have experienced growth in numbers of students, staff, and faculty over the last 40 years. In addition, as with the broader population, per capita automobile use and ownership have increased significantly to the point that almost every urban campus faces serious impacts from car traffic and parking shortages.

During the last decade, a number of major North American universities have begun grappling with how to provide access to the campus while maintaining quality of life and environmental values. It has been a difficult and fascinating process, which has led to some fundamental changes in the way many schools approach transportation. Multiple factors, such as the lack of land for new parking lots, the high costs of building parking structures, pressure from surrounding communities, and the desire to preserve air quality and campus green spaces, are leading many institutions toward a new vision based on expanded transit access; better bicycle and pedestrian facilities; and financial incentives for students, faculty, and staff to drive less (Daggett and Gutkowski 2002; Miller 2001; Poinsatte and Toor 1999; Toor and Havlick 2002). This is a stark contrast to the traditional approach to campus transportation planning, which tended to assume that the primary solution to increased demand is building new parking. The new vision goes under the general rubric of "transportation demand management" or TDM.

Perhaps the most important driving force behind these new approaches is the economics of parking when cheap land is no longer available for surface parking lots. The transition from surface parking to parking structures can increase the cost of parking by an order of magnitude and require substantial capital outlays. Those campuses with the most robust transportation programs have typically been motivated more by cost containment than by environmental concerns. Simply put, it was *cheaper* for them to invest in transportation alternatives than it was to build more parking.

Another important factor is pressure on campuses from surrounding communities to reduce negative off-campus transportation impacts. Parking and traffic impacts off of the campus are perhaps the most widespread source of town-gown conflict. These conflicts can be mitigated by strategies that reduce the use of automobiles for access to campus. Several educational institutions have signed agreements with the surrounding community capping the number of automobile trips to the campus in return for approval of further campus growth.

Demand management techniques used by educational institutions include

- the provision of transit passes to students and employees allowing free access to bus and rail transit (Brown, Hess, and Shoup 2001);[1]
- developing high-frequency and late-night transit services (Poinsatte and Toor 1999);
- raising parking rates to reduce demand (Wilson and Shoup 1990);
- using so-called "parking cashout" to pay employees not to drive (Shoup 1997);
- banning first- or second-year students from bringing cars to campus;
- expanding student and employee housing on or near campus to reduce trip lengths;
- creating employee van pools;
- providing a guaranteed emergency ride home for employees who participate in transit pass or carpool programs;
- allowing compressed work weeks and telecommuting;
- providing access to shared vehicles for some trips through nonprofit or commercial "carshare" programs or on-campus car rentals;
- marketing alternative modes;
- improving infrastructure and programs to encourage walking and bicycling.

Figure 1 **A student places his bicycle on the HOP bus, a high-frequency shuttle serving the University of Colorado at Boulder.**

Photo courtesy of Spense Havlick

Some examples of these strategies will be described later in this article. For other examples, see Litman (2001), Poinsatte and Toor (1999), and Toor and Havlick (2002).

Because universities tend to have high densities of employment and of residents on or adjacent to campus, they are well suited to policies focused on greater use of walking, bicycling, and transit than is the norm in the United States. A number of universities and surrounding communities have been able to achieve transportation modal splits that are closer to European numbers than the American norm. For example, Boulder, Colorado, has seen a sixfold increase in transit use by university students during the 1990s (Toor 2002). During this time, students also increased their bicycle use (from 20 percent of all trips to 31 percent) and reduced the percentage of trips taken in single-occupant vehicles from 49 percent to 36 percent (Caldwell and Parker 2001). During this period, the city and the university invested heavily in transit passes, high-frequency transit service, and improved bicycle infrastructure, while the university parking inventory remained essentially static.

The Economics of Campus Parking

The traditional response to demands for parking by campus constituents, or complaints about off-campus spillover, has been to expand campus parking supply. For growing schools that do not have land available for surface parking, this presents a financial challenge.

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Many schools do not have additional land that can be devoted to surface parking lots. In fact, new construction often uses up land that used to be devoted to surface parking. The supply of surface parking decreases as institutions convert parking lots into other uses, such as new research buildings, dormitories, stadiums, and theaters, while the new uses increase parking demand. The campus is then faced with either acquiring new land—a very expensive proposition at urban campuses, and often impossible—or constructing parking structures over existing surface lots. The capital cost of construction is quite high, generally in the range of $15,000–$30,000 per *net new* parking space (Cook 1999; Shoup 1995). The high end of this range comes when structures are built on top of surface lots and existing spaces are lost, so that the net number of new spaces may be substantially lower than the total number of spaces built. Thus, for 1,000 spaces, a campus would be looking at between $15 million and $30 million in capital costs.

Recovering this from users would require monthly parking fees of $100 or more—much higher than is typically charged or is politically acceptable to the campus community. Either the university must use general fund dollars to subsidize the cost, or the costs are spread across users who park in surface lots and the surface parkers subsidize the structures. This second strategy requires that the bulk of parking be in surface lots, as the cost per person increases rapidly as the percentage of structured parking increases. Even if the money can be recovered from user fees, construction of parking structures still requires the use of the limited capacity that most institutions have to borrow money for capital construction, putting these parking structure costs in direct competition with the construction of new academic and research buildings.

Is It Cheaper to Invest in Alternatives?

Are there other approaches to managing transportation demand that are less expensive? In most cases, where land constraints lead to the use of structured parking, the answer is yes.

Consider first the practice of providing transit passes to the campus community. In a typical case, the institution will contract with a transit agency to allow students, employees, or both to ride the transit system without paying a fare. This will lead to an increase in transit use and will cause some people to shift from driving to campus to riding transit. This will free up some parking spaces directly and will have an indirect political impact. When constituents complain about lack of parking, the school will now be able to respond that they provide the pass program as an attractive alternative. In any area with an existing transit system that has unused capacity, a transit pass program may be a viable option.

More than 50 universities with more than 800,000 students and employees offer transit passes. Student ridership increased between 71 percent and 200 percent during the inaugural year of these programs (Brown, Hess, and Shoup 2001). Typically, students vote to increase their fees in order to allow any student with a valid university identification to ride local or regional routes fare free, whereas faculty and staff transit passes are either paid by the university, through general funds or out of parking revenues, or may be optional fees paid by individual employees. Students and employees benefit from inexpensive transportation; the university benefits from decreased parking supply costs, improved community relations because of the reduction in off-campus traffic, and by a greener image.

The faculty/staff bus pass program at the University of Colorado provides an instructive example of reduced parking supply costs. This program allows each permanent faculty or staff member who is eligible for benefits to ride local and regional buses and light rail by showing his or her university identification. Because some employees have reduced the number of times they drive to campus or stopped driving to campus because of the availability of free transit, some parking spaces are freed up—a total of 350. 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 (University of Colorado Environmental Center 2002, pp. 18–19).

Almost every urban campus faces serious impacts from car traffic and parking shortages.

Next, consider the simplest financial incentive—raising the price of parking. There are extensive empirical data that show that parking pricing is one of the most significant determinants of travel behavior (U.S. Environmental Protection Agency 1998). Interestingly, increasing the cost of parking seems to have a greater impact on travel behavior than a similar dollar increase in other components of the total cost of a vehicle trip.

The elasticity of demand will depend on the alternatives that are available. Even in cases where there is no transit serving a workplace, price increases have been shown to reduce single-occupant commuting and increase car pooling. Planning professor Donald Shoup (1997) at the University of California, Los Angeles, has analyzed a set of studies of the impact of financial incentives on employee transportation behavior in areas with good public transportation and areas with little or no public transportation and found surprising results. In five examples of areas with little or no public transportation, the average financial incentive offered not to drive was $49, with a resultant 26 percent decrease in parking demand. In two areas with good public transportation, financial incentives averaging $45 led to a 21 percent reduction in parking demand. When Cornell University raised the price of parking in 1991, as part of a comprehensive demand management approach, the effect was to reduce single occupant vehicle trips by 26 percent, with most of the shift to car pooling (Cornell University Office of Transportation Services 1996). A number of campuses give substantial reductions in the cost of a parking permit for car pools. At the University of Maryland, carpool permits can be 75 percent less expensive than drive-alone permits; at Cornell, car pools with three or more people can actually receive rebate payments.

One advantage to raising parking prices to manage demand is the revenue that can be generated. In a scenario where new parking is developed, the revenue from increased permit fees goes to paying for the new parking. There is, therefore, no net revenue. In the demand management scenario, however, there is significant new revenue that is generated that can be used for other purposes. This opens up the possibility of investing parking revenues in additional transportation options. Another benefit is the low-risk nature of this decision. Unlike a supply-side approach, which locks in long-term debt and the possibility of default, a demand-side approach incurs no risk and is reversible.

On the negative side, it is often difficult for parking consumers to accept a price increase that is not linked to an obvious, tangible benefit such as the construction of additional parking facilities. However, if incrementally increasing parking rates and using these additional monies to fund transportation alternatives will lead to overall lower parking rates than the rate increases needed to subsidize the capital costs of building more parking, then the argument against incremental increases will be blunted.

Another important option is the creation of opportunities for occasional parking. If the only way to have a secure parking spot on campus is to buy an annual or semester pass, people may buy passes to ensure access when they need it. This, however, creates an incentive to use their prepaid permit. At least one institution has eliminated permits and instead sells daily coupons.

Some schools offer occasional parker programs, allowing users to purchase coupons to park on campus a limited number of times each semester. A number of campuses require users to give up their parking permits as a condition of receiving discounted carpool parking, transit passes, or cash benefits—but give these users occasional parking privileges.

A variant of the carpool approach is giving students or employees access to shared vehicles. At the Massachusetts Institute of Technology, for example, students have access to vehicles through the company Zipcar©. Students pay a membership fee and then are able to reserve cars through phone or on the Internet. Cars are located in off-street parking lots in the campus vicinity. Stanford University contracts with a private car rental agency to allow students easy access to short-term rentals as an alternative to car ownership.

Paying Employees Not to Drive

Because of the political difficulty involved in raising parking rates, some institutions have taken an alternative approach—paying employees not to drive. The concept here is that the campus makes a monthly cash payment to any employee who chooses not to purchase a parking permit. The cost difference between having a parking permit and not having one is then the sum of the cost of purchasing a permit and the cash payment offered to those who do not purchase a permit.

An advantage of this approach, compared to simply raising parking rates, is that there will be less opposition from employees. The downside is the cost of the program, although it may be possible to couple an increase to the cost of parking so that the net cost to the university is reduced.

A variation is a parking cash-out system, where the cost of parking is raised, but, at the same time, employees are given the equivalent amount in cash. Then employees can choose whether to spend this on parking or keep the money and find another means of transportation.

The leading U.S. example of an educational institution using this approach is Stanford, which in the mid-1990s began a program of paying any employee who did not purchase a parking permit during the year $90 (which has since grown to $160). This modest financial incentive, known as the "Clean Air Cash" program, convinced many employees to look for other ways to get to campus. Stanford's administration also slowly raised parking rates, increasing them by about 15 percent annually, but still holding them well below the actual cost of providing parking. The administration also turned a main road through campus into a bike/transit mall and increased transit service to campus. At the same time, Stanford invested $4 million in improving bicycle facilities and got 900 more people to shift from cars to bikes. Compared to the $18 million or more Stanford would have had to spend on parking structures for the same number of people, this was relatively inexpensive.

Taking Bicycles Seriously

Bicycles are the most efficient form of transportation, with the lowest energy input and lowest output of pollutants and greenhouse gases. Active transportation—bicycling and walking—can also contribute to the health of the campus population. Campus populations are well suited to bicycle use. One study of 23 research universities found that 64 percent of students lived within one mile of campus, and 84 percent lived within five miles (Daggett and Gutkowski 2002). If appropriate bicycle infrastructure is provided, bicycles are very competitive for trips of this length. Providing safe and pleasant routes to and through campus, and adequate bicycle parking, are the basic investments necessary. These are relatively inexpensive: The cost of one bicycle parking space (about $100) is less than 1 percent of the cost of one new automobile parking space. Some campuses have invested in additional features such as covered bicycle parking, grade-separated crossings for bike paths (see figure 2), bicycle signal heads at signalized intersections, full-service "bike stations" with secure parking and repair service available, free bicycle checkout for students and employees, and even zero-interest loans for bicycle purchases by students (Poinsatte and Toor 1999; Associated Students of the University of Montana 2002). The impact can be significant. The University of California, Santa Barbara, campus has achieved a student bicycle mode share of greater than 50 percent. There is room for a significant increase in bicycling at many campuses for a very modest investment.

Figure 2 **Students use a grade-separated bicycle path at the University of California, Davis.**

Photo courtesy of David Takemoto-Weerts

What Is the Appropriate Balance Between Parking and Alternatives?

One common assumption in campus planning is that the modal split is fixed. As an example, suppose that 30 percent of trips to campus are currently by automobile that parks on campus. Then, the assumption is that as the campus grows, 30 percent of the trips will continue to terminate at a campus parking space. There is a substantial problem with this analysis—the assumption that the mode share and parking demand per person is fixed is only reasonable if the price is also fixed. In many circumstances, the permit fees required to build the "needed" additional parking will be substantially higher than initial fees. The increasing cost of parking will lead to a reduction in demand.

If the institution is at the cusp, where maintaining or expanding parking supply will require a shift from surface parking to a high percentage of structured parking, the price increases required will be so large that existing local data on the elasticity of demand as a function of much smaller price increases will not give good information on the demand impacts. In this case, a prudent policy may be to raise the parking fees to the level required for construction before committing to the construction and determine the impact on demand before locking in decades of debt.

Colorado State University provides an instructive example. When planners first looked at the university's master plan, they projected, based on the expected increases in the university population, that the parking supply would need to be expanded from 12,259 spaces to 19,803 spaces over a 20-year period (Nelson/Nygaard Consulting Associates 2000). However, when they looked at the permit fees that would need to be charged in order to build enough parking structures to provide this supply, they projected that permit fees would need to increase from $5 per month to $40 per month—and that such a large price increase would cut the demand to 10,000 spaces—even with the projected 20-year increase to the campus population.

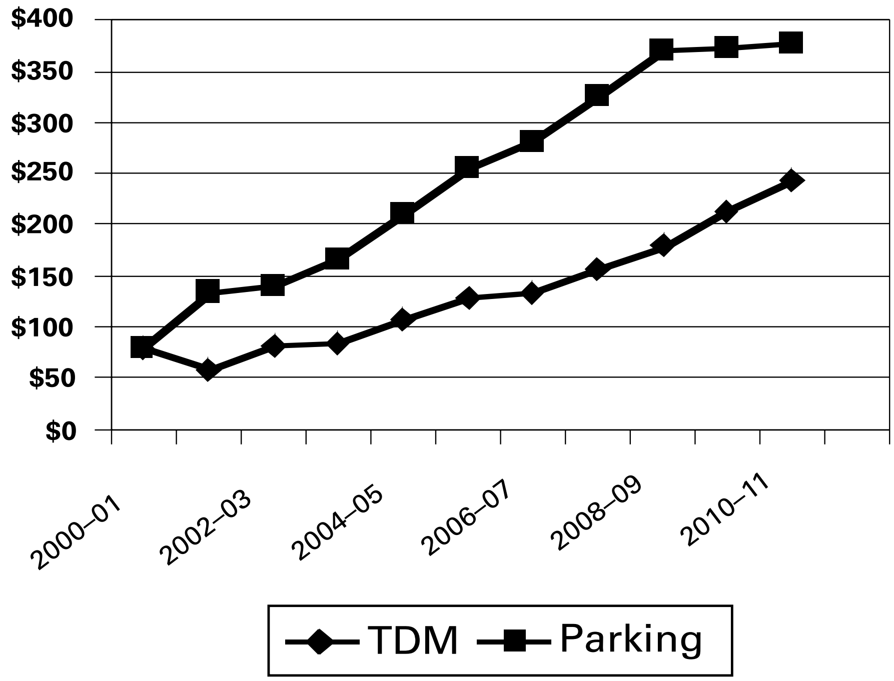
The University of California, Santa Barbara, provides another example. In 2000–2001, parking permits cost $35 each month. However, the Parking and Transportation Committee projects that permit fees will have to be raised by approximately $100 per month over the next five years in order to cover the costs of a new garage at "Lot 3." The committee is proposing that this be accomplished by increasing the monthly permit fees by $20 for each of the next five years. In the words of the committee in its recommendation for the 2001–2002 rate structure,

> There's some possibility that extremely high parking fees will lead to a substantial exodus to alternative transportation, a plus from an environmental standpoint, but a serious problem for supporting loan payments for the expensive new garages; e.g., we could even face a "death spiral," in which high rates reduce permit demand leading to even higher rates, etc. The new rates will produce some information on elasticity of demand; should demand prove more elastic than we expect, we may have to rethink the strategy for the future. (University of California, Santa Barbara Parking and Transportation Committee 2001)

The most cost-effective scenario involves some combination of investment in new parking and in transportation alternatives. This may require that parking rates be raised not only to pay the cost of providing any new parking that is constructed, but also to pay for a range of transportation alternatives. Figure 3 illustrates the parking fees that must be charged to support parking expansion, compared to the fees that must be charged to support a TDM scenario.

This is *not* simply a theoretical construct. The University of California, San Diego, planned to build 13 new parking structures over a 10-year period to accommodate expected growth. In response to an economic analysis, this has been modified to six structures plus TDM measures, eliminating 4,000 planned parking spaces at a net cost savings. The university's analysis also showed that it cost approximately $2,000 each year to provide parking for one additional car, and half this, or $1,000, to reduce parking demand by one space through demand management (Laurenson 2001). Cornell made the decision to invest in a TDM program, rather than building the 3,100 new parking spaces it was originally contemplating. In the ensuing six years, Cornell only built 350 spaces. The Cornell transportation department estimates that the campus saved nearly $12 million in the first six years of the program, compared to what would have been spent on an expanded parking supply (Eagan and Keniry 1998).

Figure 3 **Comparison of Parking and TDM Fees**



Source: Barbara Laurenson, Nelson/Nygaard Consulting Associates

The Land Use–Transportation Connection

It has become a truism in planning circles that one cannot separate land use and transportation planning. This is just as true for institutions of higher education as it is for cities. 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.

From the other side, the transportation policies and infrastructure at a campus will largely determine the appearance and feel of the campus. Decisions about parking will affect the amount of green space, the amount of impervious surface, and the amount of land available for buildings.

For instance, the new master plan at the University of Maryland plans to increase the amount of green space on campus, decrease the amount of impervious surface, and make the campus more pedestrian friendly while, at the same time, allowing more academic and support facilities to be built (University of Maryland 2002.) The university proposes to meet these seemingly contradictory goals by eliminating much of the existing surface parking, reducing car travel through campus, and moving people by clean-fuel shuttles and by bicycle. The university's transportation plans are clearly influenced by the desired character of the campus.

Student housing is a key determinant of transportation. When students live on campus, their daily transport needs are likely to be largely met through walking, biking, and campus shuttles, with personal cars being used primarily for weekend travel. At schools where first- and second-year students who live on campus are restricted from bringing cars, this effect will, of course, be even more pronounced. By contrast, students living off campus will be more likely to drive to school. Many of the campuses mentioned in this article, including Stanford; the University of Maryland, College Park; and the University of Colorado at Boulder, are planning new student housing partially to meet their transportation goals.

Town-Gown Relations

If a university generates traffic and overflow parking in surrounding neighborhoods, chances are it is also generating community-relation problems. Many times, residents' complaints about noise, safety, pollution, and the inconvenience of finding parking in front of their own houses lead to serious conflicts between the municipality and the university or college. This flash point for town-gown conflict is perhaps as important as disputes over student housing and off-campus student behavior in residential neighborhoods.

A TDM approach may reduce this conflict. In fact, cooperative efforts on transportation may help improve strained relations, because there is a convergence of interests between the institution's desire to provide cost-effective access to campus and the community's desire to reduce off-campus traffic and parking impacts. These can include joint planning and funding of bicycle, transit, and pedestrian improvements in the campus and surrounding area.

One difficulty is that any TDM strategy that involves managing parking supply and price may simply displace parking demand off campus. To prevent this in commercial districts adjacent to educational institutions, it is common to install parking meters. Some cities have also implemented residential parking permit (RPP) zones in nearby residential streets. RPP programs allow residents to purchase full-time parking permits, often for a nominal fee, while restricting nonresident parking.

Because university populations provide such a good market for transit and bicycle use, local government efforts to expand these services will be more successful if they serve university populations. This is an important point. Unlike car travel, where adding additional travelers degrades the overall service, adding more riders to transit makes it possible to increase frequency and thus improve service for all other travelers. This is why a number of communities have been able to maintain long-term funding commitments to improving transit facilities that serve student populations.

The University of Washington offers an example of a creative approach to a significant conflict over university traffic. In the late 1980s, planners estimated that the university's expansion plans would bring 10,000 more cars a day. The city of Seattle was extremely concerned, and, ultimately, the university and the city agreed to a master plan that allowed the university to grow—without increasing traffic or parking demand in surrounding neighborhoods (University of Washington 1998, 2002). In response, the university created the "U-PASS" program, with the goals of improving transit, providing more bicycle facilities, and changing the financial incentives around parking. Parking costs were increased from $24 per month to $46.50 per month followed by more gradual increases, with much of

Smart Transportation Tips

Following are a few of the lessons from institutions that have had some success:

- Make sure to ask the right questions when developing transportation plans—and when hiring consultants to create these plans. A transportation plan should not simply examine how much parking to supply, but should look at how to provide access to campus at the lowest cost and environmental impact.
- Make sure that your administrative structure supports your transportation goals. If all you have is a parking department, consider creating a broader transportation department.
- Pursue partnerships with local governments and transit agencies. Even if there is a history of conflict, there are many opportunities to improve access to campus while also addressing the needs of surrounding communities.
- If your campus does not yet have a transit pass program, seriously consider creating one. It is one of the simplest and most popular steps a campus can take to start managing demand.
- Do not be afraid to use the power of the market. If there is excess demand for parking, consider raising the price.
- Take nonmotorized travel seriously. The short trip lengths and young, healthy populations at many campuses allow for high mode shares. These types of trips are the cheapest to serve and have the least environmental impact.
- Harness the power of students. Many of the programs mentioned in this article were initiated or funded by students, whether through student government action or by direct vote of the student body.

the additional revenue going to support the alternatives. The net effect: While the campus population grew 7 percent during the 1990s, parking demand fell 22 percent and car trips fell 17 percent during the morning peak, and 5 percent averaged over the day. Stanford offers a similar example, where the general-use permit that the university negotiated with Santa Clara County requires the university to cap peak-period trips to and from campus (Santa Clara County 2000). Using the set of techniques described earlier, Stanford was able to add 2 million square feet of building space during the 1990s under this permit while holding with no net increase in peak-period traffic and has recently renegotiated a similar clause in its next general-use permit.

Conclusion

We have seen that universities have many opportunities to simultaneously save money, reduce the environmental impact of transportation to and from campus, and improve community relations. Because parking has not typically been priced at the true marginal cost of new parking supply, good economic analysis of transportation options for university communities will generally show that an economically efficient transportation policy will rely less on parking and more on transportation alternatives compared to most universities' current practice. This is one of those happy cases where the bottom line supports sound environmental policy.

We have also seen that there is a wide variety of strategies available to meet the needs of different types of institutions. Most of this article has focused on the broad set of approaches a university can take to influence the transportation behavior of students, employees, and visitors.[2] The most important determinants are the supply and price of parking, the land-use plans that determine the length and type of trips, the financial incentives to drive alone or travel in other ways, the level of transit service available, and the ease of bicycle use. The decisions planners make in these arenas will have a very significant impact on transportation mode share.

Notes

1. See also www.sppsr.ucla.edu/its/ua/ for profiles and contact information on university transit pass programs.
2. The topics examined in this article will be explored in much more detail in a forthcoming book—*Transportation and the Ivory Tower: Sustainable Mobility for Campus Communities* (Toor and Havlick 2004).

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Acknowledgments

The author thanks the Colorado Office of Energy Conservation and the University of Colorado Outreach Grant Program for financial support of this work and acknowledges stimulating conversations with David Cook, John Daggett, Spense Havlick, Barbara Laurenson, Francoise Poinsatte, and Jeff Tumlin.