1 EXECUTIVE SUMMARY

During Phase II, the Transportation Team focused on providing implementation ideas that could aid current and future sustainability efforts by operations staff. While the Energy Team focused on technologies that provide lower environmental impact in both electricity generation and transportation, we focused on techniques that can reduce vehicle-miles traveled and promote the utilization of lower impact modes by the U-M community. Our investigation found some goals for the short-term (increasing parking-rate differentiation & establishing a transportation survey) and some longer-term approaches (transit integration, shifting parking payment systems). Furthermore, some approaches do not include a goal date because further investigation into earlier steps will be required to accurately set goal dates for these more advanced solutions.

Our first prioritized recommendation is to **Restructure Parking Fees on Campus**: Better utilization of existing parking capacity as an alternative to the construction of new capacity; Providing for growth of the University while minimizing growth in vehicle-miles traveled for the University commute; Reducing barriers to occasional transit use, walking, or cycling by car commuters; Ensuring that trips that prioritize close-in parking have such parking available when needed; Cost savings associated with any parking structures forgone or parking subsidies reduced. We have found three major steps toward restructuring from short-term to long-term:

- **Increase Parking-Rate Differentiation by 2013**: increasing fee differentiation sufficient to spur move even utilization throughout the system;
- **Reduce Parking Subsidies by 2015**: subsidies are often thought of as a tool to encourage particular behaviors, and the subsidies surely encourage drive-alone commuting;
- **Shift from Monthly or Annual Parking Payment**: annual parking payments regularize parking revenue and allow commuters to pay and forget but it discourages occasional commuting by walking, cycling, or public transit

Our second prioritized recommendation is to **Optimize Campus-oriented Transportation and Land Use to improve the alternatives to automobile reliance**. We found five major implementation areas that can promote reduced carbon emissions and air pollution from cars and buses; reduced fuel, parking, and maintenance costs for commuters; reduced parking and bus costs for U-M; reduced traffic congestion and associated time savings; Increased physical activity and community health:

- **Increase U-M Bicycle Mode Share:** Reduced carbon emissions and air pollution from cars and buses; reduced fuel, parking, and maintenance costs for commuters; reduced parking structure and bus costs for U-M; Reduced traffic congestion and associated time savings; Increased physical activity and community health.
    - **Develop campus bicycle master plan, contract for bicycle services, expand parking facilities by 2013**
    - **Open bicycle service center, institute bicycle rentals by 2015**
    - **Develop intercampus bikeway network, open card-swipe bicycle sharing system**
- **Enhance Pedestrian Facilities:** Reduced carbon emissions and air pollution from cars and buses; reduced fuel, parking, and maintenance costs for commuters; reduced parking and bus costs for U-M; reduced traffic congestion and associated time savings; Increased

physical activity and community health; Enhance campus vitality and opportunities for interaction.
  - **Initiate planning process for diversifying land uses; begin adding sidewalks, ADA-compliant curb ramps by 2012**
  - **Continue planning process, complete sidewalk network, improve street crossings by 2015**
  - **In cooperation with City, consider pedestrian extensions and transit mall development**
- **Further Integrate Campus Transit:**
  - **Pilot AATA, U-M transit integration by 2014:** move one or two U-M routes into AATA control, ideally combining routes to test transit commutes to campus.
  - **Fully integrate U-M transit into AATA:** Change low ridership lines to AATA to increase route ridership and integrate on campus routes to go further into the community minimizing transfers during commutes, more sustained federal funding for switching to hybrids or fuel cell buses;
- **Simplify the U-M Campus-Airport Connection:**
  - **Increased promotion of campus-airport transit by 2012**
  - **Establish a direct campus or downtown to airport link by 2014**
  - **Integrate a U-M to airport link into U-M transit**
- **Unify Goods Movement:**
  - **Establish the level of current courier-use by 2012:** current levels of private courier-use are unknown; therefore, total expenditure and extent are unknown.
  - **Integrate courier service into campus mail service by 2015:** possible savings from use of ‗in-house' courier service over private services.

Our third prioritized recommendation is to begin to **Track Transportation Habits of Campus Stakeholders by 2012:** U-M has limited knowledge on where community members are commuting from and how they are commuting. U-M's transportation expenditures are significant long-term investments in fixed physical infrastructure, so transportation system development conducted with limited knowledge of current and future trends comes at a heavy cost. A regular transportation survey could avert tens of millions of dollars in unnecessary spending at a minimal cost.

2 INTRODUCTION

This report contains suggested implementation strategies whose schedules will depend greatly on the master planning timelines and/or more specific study. It also contains a discussion of the specific barriers associated with each idea. Some ideas may not directly save money since some benefits are not currently considered budget line items, however, overall benefits and cost savings are possible across many departments. For example, eliminating the parking subside will accrue savings for multiple units.

3 ACTION PLAN

3.1 Prioritized Recommendation A: Restructuring Parking Fees

Faculty and staff commuting to the University of Michigan constitute a significant share of the environmental impact of the operations of the campuses. While precise estimates of faculty and staff commuting habits are unavailable, roughly 15,000 vehicles belonging to faculty and staff are parked each day at the University of Michigan (based on Parking and Transportation Services vacancy counts), and a large majority of commuters to the University of Michigan drive alone to work (**Error! Reference source not found.**). While many of the factors shaping this commute are beyond the control of the University, one signifcant factor remains squarely within University control: provision of and charging for parking. Parking policies have been shown to have significant influence over travel behavior, including mode choice, the feasibility of mixing and matching modes, and the demand for parking by at any given location.[i] With such a large number of automobile commuters to the University of Michigan, change in policies or incentive structures for commuting can have a significant impact on the University's overall environmental impact. This section analyzes current parking pricing policies and their outcomes, and proposes alternatives that can simultaneously ease parking shortages, facilitate commuting by multiple modes, and reduce the presure for construction of costly parking structures.

Table 3-1: Distribution of Commuters to U-M Campuses by Mode, 2000[ii] (Note: Data are for the census tracts containing the respective campuses. The boundaries of the Central and Medical campus tract follow those campus' boundaries closely; others reported in this table contain non-University territory as well).

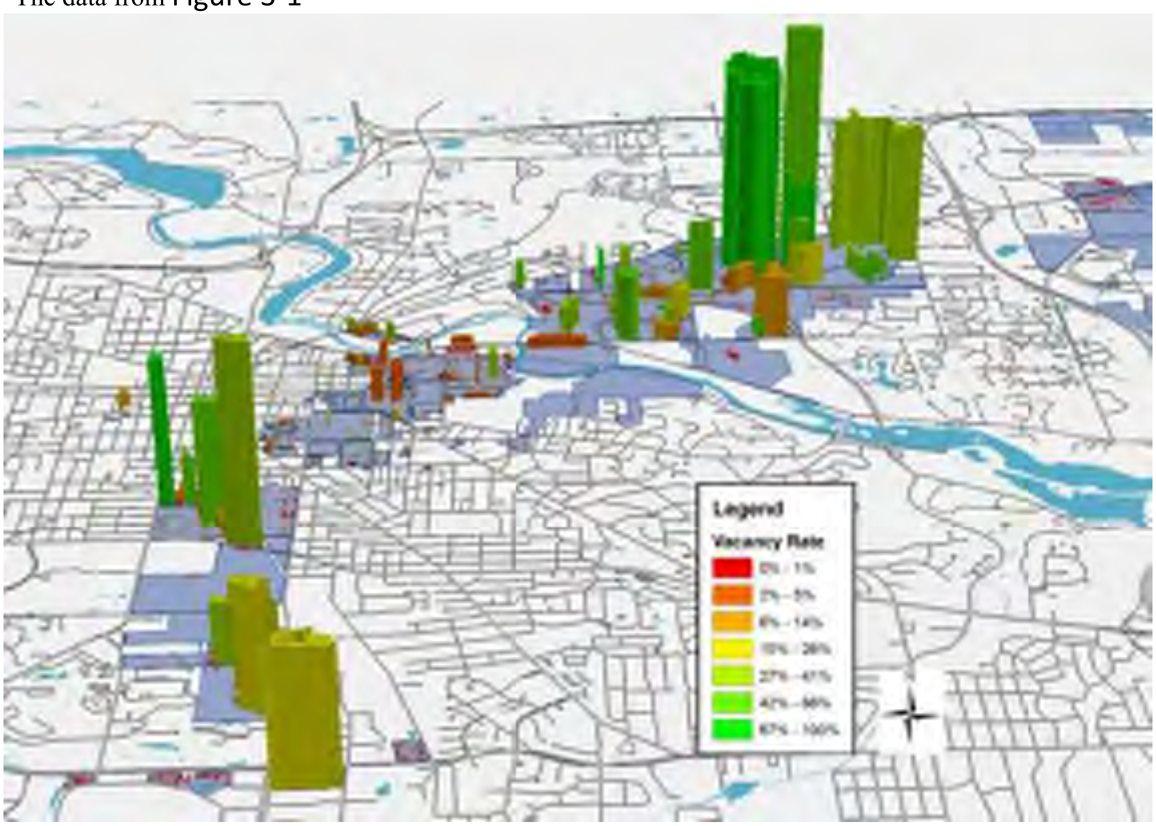
Campus	Drive Alone	Carpool	Bus	Bicycle	Walk
East Medical Campus	84%	11%	1%	0%	1%
North Campus	74%	8%	5%	1%	11%
Central+Medical Campus	59%	11%	9%	3%	18%
South Campus	58%	15%	3%	3%	18%

3.1.1 Technical Guidance

3.1.1.1 Parking Vacancy Analysis

A snapshot of the current parking situation on the University of Michigan campuses (Figure 3-1) reveals a distinct pattern of parking vacancies on the central and medical campuses, with ample vacancies in many (though not all) areas of North and South campuses[1]. This is reflected both in the differences in vacancy rates between the central and peripheral areas (represented in the red-to-green color scale) and in total spaces available (represented by the heights in the figure). Whereas Central and Medical Campus structures are virtually at capacity, vacancies on North Campus, South Campus, and the North Campus Research Complex (NCRC) range between 20% and 67% (Table 3-2). Over 2,500 spaces go unused in these more peripheral locations; this total goes to 4,300 when physical parking spaces at NCRC that have not yet been incorporated in the U-M parking system are included. By comparison, the average central campus parking structure contains about 650 spots.

[1] The data from Figure 3-1



are replicated in Figure 3-2 where columns replace the shape of the parking facilities' footprint; this is to emphasize that height, rather than volume represent parking vacancies.

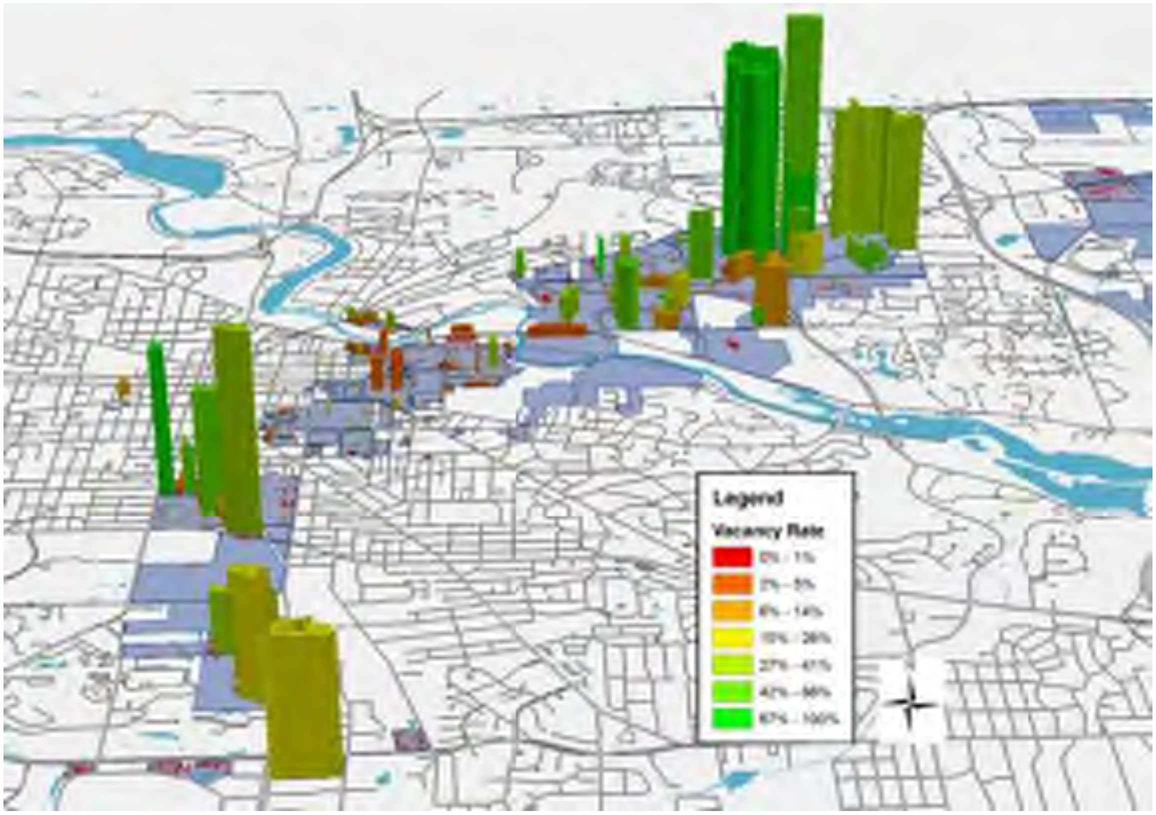


Figure 3-1 Parking Vacancy by Location at the University of Michigan, September-October 2010. (Heights represent total vacancies at the site; color represents vacancy rates)[iii].

At one level, the heavy demand for central parking is not surprising. The Central and Medical campuses contain the highest density of U-M employment, and drivers seek to park close to their destinations. But this result is not merely a function of location but of prices as well. Ann Arbor residents are familiar with the phenomenon of homeowners within walking distance of the Michigan Stadium selling parking in their front yards on football game days. The market price for parking drops with distance from the Stadium; even a remote location will fill up if its operator prices according to its distance. The University of Michigan parking system has taken steps toward distance-sensitive pricing of parking. Parking lots are priced according to color tier (gold, blue, yellow, orange) with the closer-in parking tending to be more expensive than that at more peripheral locations. Nevertheless, price differences are not enough to avoid the phenomenon of excess demand at the center coupled with unused supply at the periphery. In part this is a function of the relative flatness of the pricing structure. For example, Fletcher Structure, near the heart of Central Campus, is mostly rated "blue" and averaged about 2.6% vacancy rate in September 2010. The Hoover Street lot on South Campus, lying over one mile southeast of the Diag, is also rated "blue" and is hence priced identically to the Fletcher Structure. The combination of its "blue" price and peripheral location leads to a vacancy rate of over 43%.

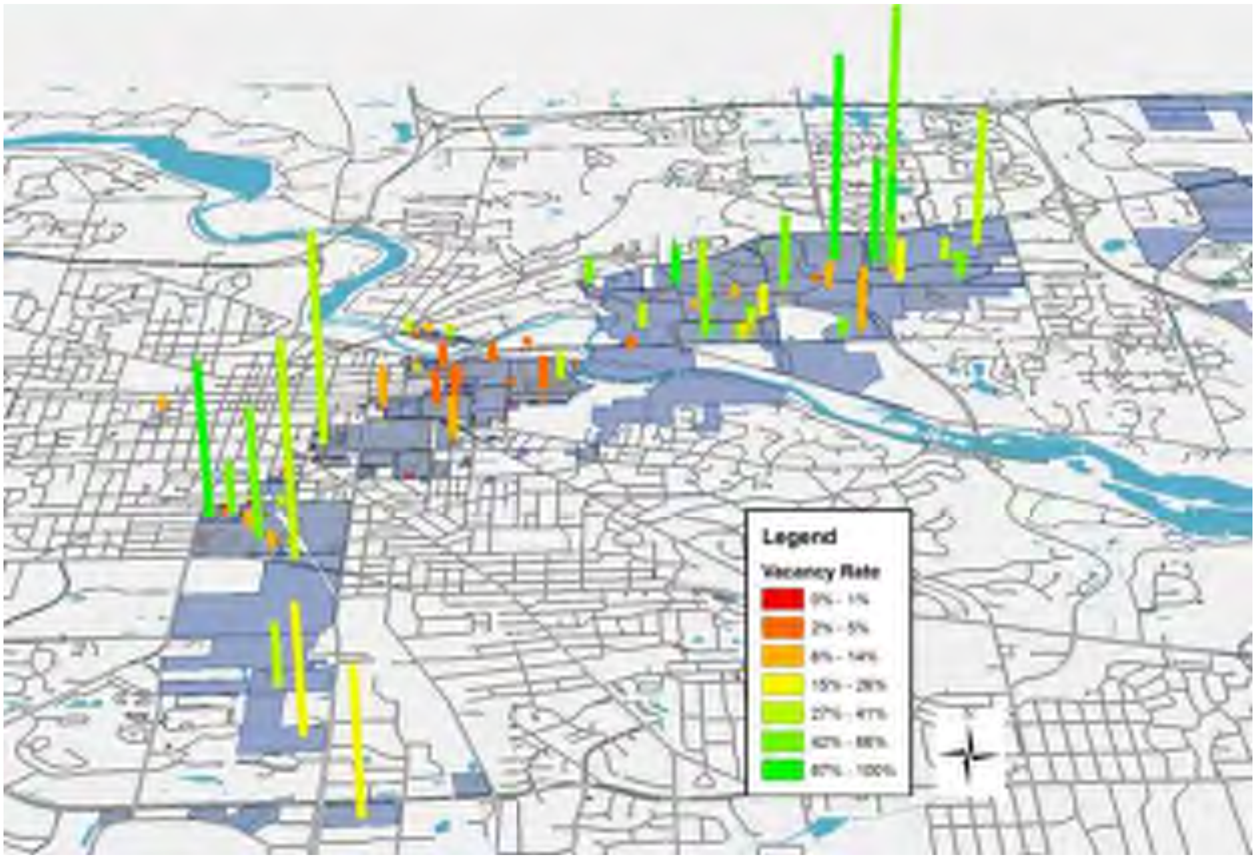


Figure 3-2: Parking Vacancy by Location at the University of Michigan, September-October 2010. (Heights represent total vacancies at the site; color represents vacancy rates).[iii]

Table 3-2: Vacant Spots at in University of Michigan Parking Facilities, Sep-Oct 2010.

Campus	Total Spots Counted	Vacancy Rate	Vacant Spots	Vacancy Rate July, 2010
Central Campus	4334	11%	462	20%
Medical Campus	6122	4%	243	9%
South Campus	3351	28%	949	30%
North Campus, excluding NCRC	4339	20%	874	34%
NCRC	1141	67%	763	No data
Total Vacant Spots outside of Central and Medical Campus			2586	

Likewise, the Space Research building lot near Hayward and Draper on the North Campus, at a distance of 2.5 miles from the Diag, is also rated “blue”; its average vacancy is nearly 53%. There are currently plans for expansion of University activities in many of the areas of underused parking supply; thus many of the vacancies observed in 2010 may diminish over time. Some capacity will also be used for remote patient parking for the Medical Center. Given the magnitude of vacancies, however, it is likely that an imbalance in occupancy across the U-M parking system will continue into the future.

Part of this imbalance is expressed in heavy pressure on Central and Medical Campus parking, in terms of daily demand, difficulty of finding a spot for midday parkers, and notably pressure to construct parking structures. —We are in the midst of a parking structure building boom that the University has not seen since the 1960's," stated the (then) Director of Parking and Transportation Services in 2006[iv] (Senate Assembly minutes, April 12). The result was a major structure project virtually every intervening year since 2006. The financial cost of these structures has been high. Construction costs in for parking structures have increased much faster than inflation; the currently planned structure at Fuller Road is estimated to cost $44,000 per spot ($43 total construction costs between U-M and the City of Ann Arbor, 977 spaces planned).[v]

Parking expansion entails significant sustainability impacts as well. By design, parking structure expansion expands the number of cars traveling to central areas of campus. University parking bordering neighborhoods tends to exert negative local environmental impacts together with significant controversy. And heavy reliance on parking capacity expansion as a transportation policy tends to reduce the attractiveness—both relative and absolute—of walking, cycling, and transit use as means to reach the University of Michigan campuses; the attractiveness of all these modes is enhanced when more travelers choose them.

3.1.1.2 Parking Net Revenue Analysis

The continued pressure on Central and Medical Campus parking is, in large measure, a function of the subsidies and cross-subsidies implicit in the University of Michigan parking policy. These are analyzed in the following section.

Table 3-3: Estimated Annualized Costs of Parking Provision in U-M Lots and Structures[vi].

	Lot		Structure	
	BRW Estimate 1995	In 2010 Dollars	BRW Estimate 1995	In 2010 Dollars
Land Area and Value	$143 (=$1400 capitalized at 8% for 20 years)	$166	$122 (=$1200 capitalized at 8% for 20 years)	$194
Construction Costs	330	$518		$1,743
Operation & Maintenance	50	$68		$204
Direct Costs/Spot/Year		$ 752		$ 2,141

In 1995 the consulting firm BRW prepared a report on U-M parking issues, providing estimates of the annualized cost of providing parking in U-M lots and structures. Costs used in the following analyses are costs reported in the BRW report, rendered in 2010 dollars. These probably represent a very conservative estimate of the true cost of the U-M parking system; the BRW study reported the construction cost of space in a parking structure to be under $15,000 when rendered in 2010 dollars, considerably lower than the $44,000 costs reported above for the planned Fuller Road structure[2].

Using the conservative figures reported in Table 3-3, parking permit prices, occupancy rates, and the ratio of permits sold to spots available, it is possible to calculate net revenues for each parking facility within the U-M system. This is the equivalent of imagining each parking facility as its own independent profit (or loss) center. This enables an analysis of the subsidies and cross-subsidies implicit in the current pricing structure. The analysis is conducted in three steps:

- Unit contribution treated as revenue to the parking system, land costs excluded. When a U-M faculty or staff member purchases an annual parking permit (of any color level), his or her unit is billed $142 on top of the amount that the individual pays.[3] Thus the entire parking system revenue equals the individual contribution plus the unit contribution ($629+$142=$771 for an annual blue permit, the most common). Figure 3-3 depicts net revenues by parking facility while treating the $142 as revenue to the parking system and not accounting for the cost of land. In the figure color represents the net revenue per spot, and the height of the bars represents total net revenue (whether positive or negative) for the facility.

- Several phenomena are observable in this figure. First is the significant cross subsidy implicit in the current structure of parking charges. Centrally located structures are associated with significant negative net revenue; this is partly offset with positive net revenues from heavily used peripheral lots. Thus in general, parkers in more peripheral lots are subsidizing structure parkers in more central locations. Second, even remote lots can show negative net revenue when they have high vacancy rates, as is the case with some of the lightly used remote lots of North and South Campuses. Third, even under the conservative cost assumptions used here, net losses are greater than net gains for the parking facilities in the U-M system.

[2] Partly countervailing the inflation in construction prices has been a decline in the cost of capital reported at 8% in the 1995 report.

[3] This practice is mandated by U-M Standard Practice Guide 601.21 C.

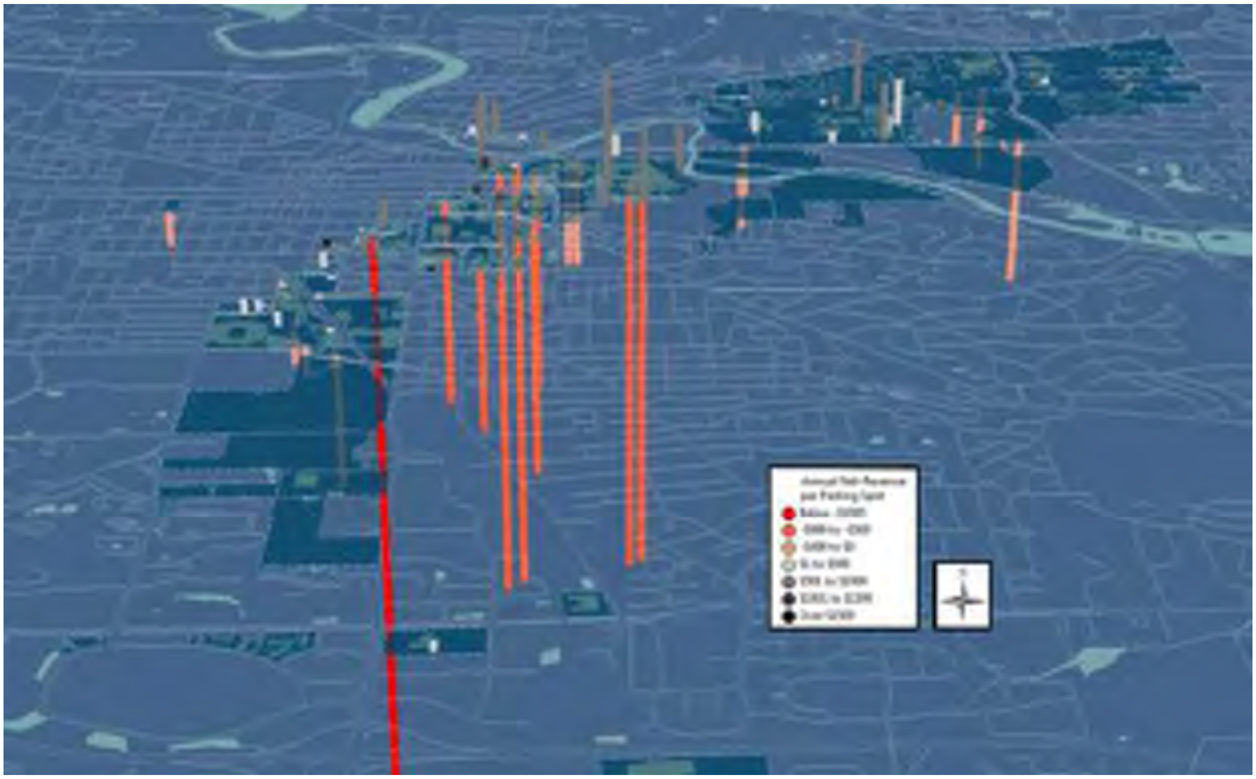


Figure 3-3: Net Revenue of U-M Parking Facilities, 2010 ($142 unit subsidy treated as parking revenue, land costs excluded)

- Unit contribution treated as cost to the University, land costs excluded. Figure 3-4 depicts net revenue per facility when the $142 unit contribution is treated not as revenue to the parking system, but as a subsidy to the individual's permit—and hence a cost to the University. Land is still treated as costless in this figure. Not surprisingly, the magnitude of the net losses increases when compared to Figure 3-3.

- Unit contribution treated as cost to the University, land costs included. The analyses above do not account for the cost of land, in line with the budget model of the University of Michigan. Figure 3-5 seeks to account for the opportunity cost of land devoted to parking uses; this analysis sends most U-M parking facilities further into the red.

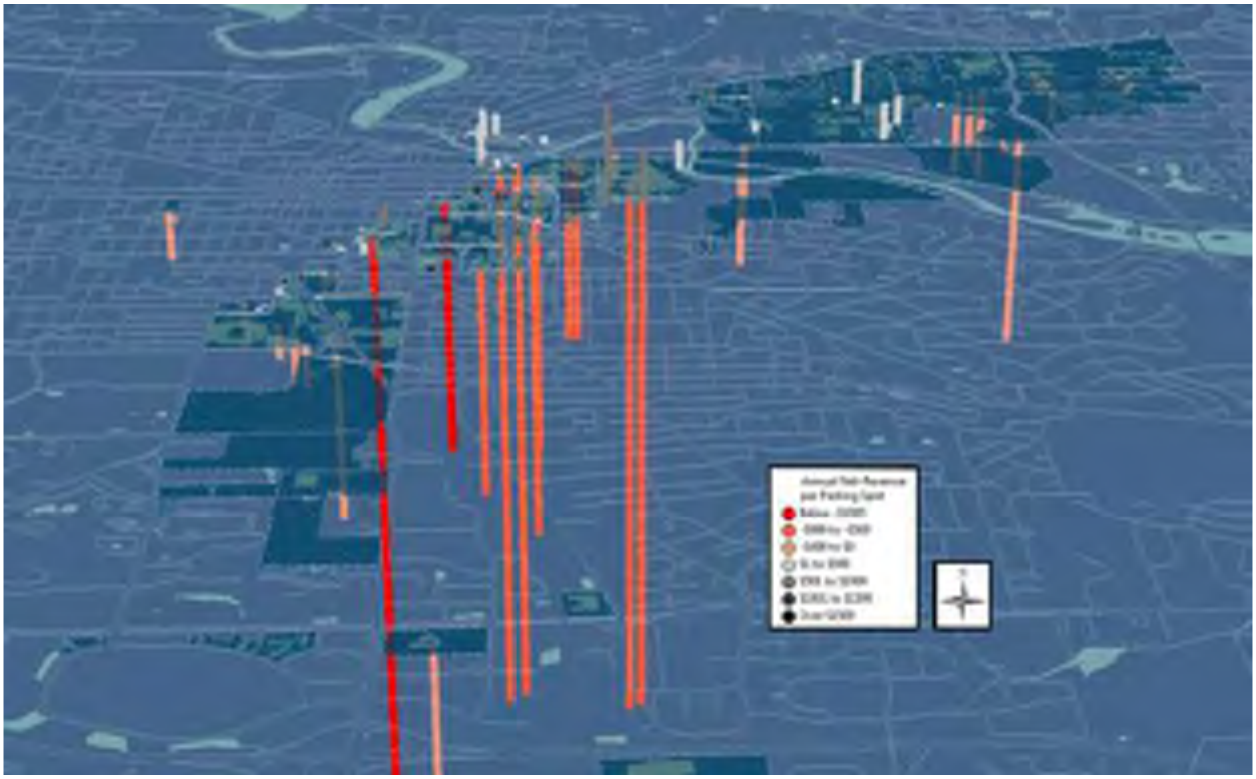


Figure 3-4: Net Revenue of U-M Parking Facilities, 2010 ($142 unit subsidy treated as cost to U-M, land costs excluded)

In sum, there are at least three subsidies to parking within the U-M system:

- The mandated $142 unit contribution to each annual parking pass;
- No accounting for the opportunity cost of land. (This holds across academic and facilities functions at the University but is especially significant with land-intensive uses like parking);
- Cross-subsidies flowing from parkers in peripheral lots to parkers in central structures.

The analyses above suggest a fourth implicit subsidy as well. Figure 3-3, which does not account for the cost of land and treats the $142 unit contribution as revenue to the parking system still shows net losses (of over $5m annually) to the U-M parking system as a whole. With a functional life of 30-40 years,[vii] the early parking structures at the U-M campus will be due for replacement in the near term. The above analysis suggests that, particularly with the rapid increase in the costs of construction, the University will be hard-pressed to finance the replacement of older structures from revenues generated from the parking system alone.

Both total number of parkers at the University of Michigan and their distribution over space is in part a function of these subsidies. Revision of the subsidy policy, whether incremental or comprehensive, could simultaneously ease parking shortages in central areas, facilitate regular or occasional commuting by non-automotive modes, and make better use of the parking capacity that the University has already developed. Perhaps most significantly, by easing pressure for further development of parking structures in central areas, such adjustments can allow, in a more fiscally sustainable fashion, for the further development and growth of the University without increasing car commuting to campus. The following section discusses options for the reform of U-M parking policy to seek to achieve these goals.

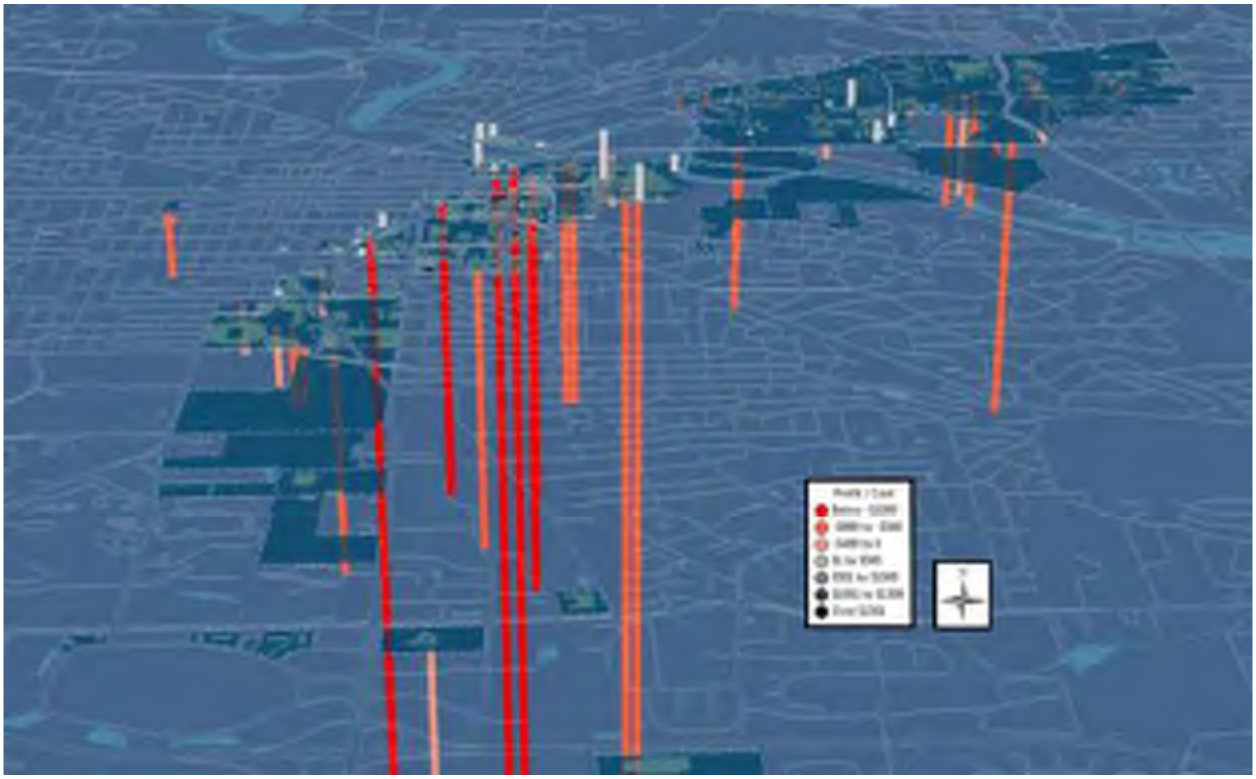


Figure 3-5: Net Revenue of U-M Parking Facilities, 2010 ($142 unit subsidy treated as cost to U-M, land in included in costs)

3.1.2 Costs and Benefits

Potential benefits of the reforms to parking policy below include:

- Better utilization of existing parking capacity as an alternative to the construction of new capacity;
- Providing for growth of the University while minimizing growth in vehicle-miles traveled for the University commute;
- Reducing barriers to occasional transit use, walking, or cycling by car commuters;
- Ensuring that trips that prioritize close-in parking have such parking available when needed.
- Cost savings associated with any parking structures forgone or parking subsidies reduced.

Depending on which option or combinations of options below are chosen, implementation costs could include:

- Outfitting of more parking facilities with automatic vehicle identification systems for both parking payment and provision or real-time information on available spots;
- Short-term disruptions as parkers adapt to the new system;

Possibly greater volumes of commuters on the campus bus system as more choose remote parking options. This may necessitate additional bus service. Peak demand on the campus bus system is at 9:00 am and 3:00 pm, however (Figure 3-38); this may leave some excess capacity for morning and afternoon commuters.

3.1.2.1 <u>Policy Options</u>

Following are possible policy directions to promote these four goals. The directions described below are consistent with each other and could be combined for more comprehensive reform.

3.1.2.1.1 <u>Policy #1: Increase Parking-Rate Differentiation</u>

The purpose of the multi-tiered system of faculty and staff parking instituted in the 1990s was to provide faculty and staff with a range of parking choices: higher-priced close-in parking, and lower-priced remote parking. Some of the remote parking is walking distance from major campus destinations; other requires a ride, often on the U-M campus bus system. The system worked remarkably well in spreading parking volumes away from the central areas and making better use of existing parking capacity in peripheral areas. But the fee differentiation that was introduced was not sufficient to spur utilization throughout the system; moving towards that would require greater differentiation in parking pass rates as one moves from higher volume areas in the core to areas of lower demand in the periphery. This could be accomplished in part under the current structure of annual or continuous parking payment with a revision in the rates for each tier (and possibly some reclassification of parking facilities into tiers). In the extreme, some remote lots currently showing very low parking volumes might be converted to free park-and-ride lots for faculty and staff. This conversion would offer the side benefit of an easy option for occasional parking for people who usually commute by other modes.

It may be, however, that price differentiation adequate to spread parking volumes throughout the system will also requires price increases in central areas. One rule of thumb is to set parking prices at a level that generates 85% occupancy.[viii] This ensures both that parking is available where it is needed and that drivers do not need to search for parking in multiple locations, a common behavior that can add significantly to congestion and emissions in urban areas.

Another possibility is to provide greater non-price incentives for selecting remote parking. For example, some units have purchased a ―blue pass" for the department; this is used by people who park remotely (or do not buy a parking pass at all) on days when their work requires easy access to blue lots. This could be a publicized program and could even be structured as an incentive: for each X employees purchasing a yellow or orange pass (or possibly foregoing parking permits altogether) the unit receives a ―departmental blue pass" for sharing among its faculty and staff.

3.1.2.1.2 <u>Policy #2: Reduce Parking Subsidies</u>

Subsidies are often thought of as a tool to encourage particular behaviors, and the subsidies described above surely encourage drive-alone commuting at the U-M campuses. If encouraging driving is not seen as consistent with the University's sustainability goals, reducing these subsidies can be an appropriate policy response. The most clear and obvious subsidy is the mandated $142 unit contribution. This may be reduced or eliminated, or alternatively may be retained for certain classes of parking (presumably in more remote locations) and may be scaled back for central areas where volumes exceed capacity.

The policy option of eliminating or reducing the mandated $142 unit contribution would lead to savings to the unit. The U-M parking system as a whole needs to maintain current revenue levels in order to provide for the upkeep and debt service of existing structures; elimination or reduction in the unit contribution could lead to some declines in revenue as some previous pass holders decline to purchase the pass. One possibility would be for deans and unit heads to guarantee parking system revenue after the elimination of the mandated unit contribution; presumably this could be accomplished with a portion of the unit savings from the elimination of the contribution.

3.1.2.1.3 Policy #3: Shift from Monthly or Annual Parking Payment

Most U-M faculty and staff parkers currently purchase unlimited campus parking automatically each month. This system has its advantages: revenue to the parking system is regularized; individuals find the mode of payment convenient in that they can set it up and then forget about it. But continuous payment for unlimited parking has significant disadvantages as well. It discourages occasional commuting by walking, cycling, or public transit; once the pass has been purchased, rational commuters may simply drive every day in order to get their money's worth out of their investment; the marginal cost of parking becomes zero. By contrast, daily or hourly parking payment would remove that barrier to mix-and-match commuting; when the commuters prefer to park they have that option available, but on days when other modes are feasible for them, they can save money by choosing transportation alternatives. Thus the decision on how to travel is broken up from an annual decision into a series of daily decisions.

For drivers, this can extend to the decision on where to park. Some days demand close-in parking because of schedule, load, need for midday access to one's vehicle, or other reasons. On other days, remote parking is perfectly acceptable and might be chosen if the money savings were sufficient. Currently one chooses one's parking priority for the year—whether Gold, Blue, Yellow, or Orange. A shift to daily or hourly payment for parking allows assignment of priority flexibly to the trip, rather than to the commuter in a fixed fashion. Thus a person who usually likes to save money by parking remotely may, on a particular day, need easy car access; daily or hourly parking payment can readily accommodate that need. The reverse is also true: current Gold or Blue pass holders may have some trips for which lower priority parking is adequate. When parking is paid for by the year, individuals lack the incentive to adjust their parking locations to their needs for that day; as a consequence spots can be unavailable even for people who have urgent parking needs. In this way, daily or hourly payment for parking can reduce barriers to an efficient match between one's daily parking needs and parking locations.

An additional benefit of daily or hourly parking payment is the ability to differentiate parking rates between on-semester and off-semester times. Parking vacancies vary significantly between these two times (Table 3-2); this implies that the cost of serving a parking need during the school year is significantly higher than during the summer. Differentiating prices between on- and off-semester times would have the additional benefit of lowering average parking prices for staffers who commute daily throughout the year compared to many faculty who curtail their commuting to campus during summer and vacation times.

3.1.3 Barriers to Implementation

The most significant obstacle to any of these reforms is anticipated faculty and staff resistance to changing parking arrangements, and in particular to reducing subsidies. The benefits would need to be carefully conveyed: faculty and staff can have a spot where they want when they need it; they can save money by parking remotely or using transportation alternatives, whether occasionally or frequently; and the reforms can promote both the environmental and fiscal sustainability of the University. It may be, however, that a small-scale demonstration project can serve both to expand the U-M's base of experience and begin to build faculty and staff support. For example, one structure or lot on each campus could be devoted to daily parking—perhaps a facility currently experiencing relatively high vacancy rates. Daily rates would be set to be comparable to the daily cost of parking for permit holders in the same tier. Commuters who drive to campus on a daily basis would not be likely to choose such an option, but many less-than-daily parkers would find it worthwhile. Such a demonstration could begin to convey to a subset of the faculty the benefits of a greater range of transportation options at U-M.

Another approach to overcoming the political obstacle would be to gauge potential faculty and staff acceptance of a package of parking reforms with a survey. The survey would need to be carefully structured as a series of tradeoffs; for example pairing any costs to the individual with benefit in terms of increased range of choice, increased certainty of finding a spot when it is needed, or improved quality of non-automotive transportation options.

A shift to daily or hourly parking payment could lead to greater day-to-day variations in the numbers of parkers seeking to park at any given facility. In particular, winter-weather days when school is in session already demonstrate greater parking demand than others; these fluctuations could increase if all faculty and staff had equal access to parking on these days. This could be seen as a benefit of daily parking payment; the regular pedestrian or cyclist to campus may be at least as deserving of access to parking as the auto commuter on such days. But parking structures would likely fill up earlier in the day than they do currently; the danger is that later arrivals expecting a spot in their usual structure might find none. One approach to this problem would be price differentiation; prices could be set in such a way that these commuters would find a premium (and premium priced) spot available in their usual structures; should they wish to avoid the cost of a premium spot, they will find more economical parking at remote locations. This process could be facilitated with web-based data on real-time parking availability throughout the U-M system.

Reductions in subsidies to the parking system threaten to affect lowest-paid staff more than others. Apart from their low incomes, they may have factors that impede adaptation to increasing parking prices including inflexible job schedules, household duties, and long-distance commuting. Other universities have geared parking pricing to salaries, with lower paid individuals paying less for parking than their higher-salaried counterparts. This has the desirable effect of concentrating subsidies where they are needed, leaving the institution freer to recoup parking costs from higher-paid individuals and to structure payment in ways that encourage efficient use of the system.

Another negative consequence of some of these shifts could be greater faculty and staff parking on Ann Arbor city streets to avoid parking charges, thus potentially exacerbating town-gown frictions. The City of Ann Arbor has effectively implemented zonal parking systems in the area of the University in response to just this possibility; if need be, these could be broadened to forestall the threat of university parkers in Ann Arbor neighborhoods. Moreover, the severest town-gown conflicts may be those over the development of parking structures themselves; to the extent that effective utilization of existing capacity reduces the pressure to expand parking structures in central areas, it may avoid conflicts of this nature.

3.1.4 Uncertainties

In any shift in parking pricing it will be impossible to predict the precise response of commuters. Such was the case when the current tiered system was put into place; it succeeded in shifting many commuters to more remote lots, but the results were not known until the reforms were put into place. In any future reform, prices may need to be adjusted after a trial period that reveals the extent of commuter response to the shift.

3.2 Prioritized Recommendation B: Optimize Campus-oriented Transportation and Land Use to improve the alternatives to automobile reliance

3.2.1 Implementation Idea #1: Increase U-M Bicycle Mode Share

3.2.1.1 Benefits and Costs

Increasing bicycling is a cost-effective strategy to increase the economic efficiency, environmental sustainability, and human health benefits of the U-M transportation system. U-M lags peer institutions in bicycle mode share, and the limited bicycle facilities it currently provides are inadequate to meet existing demand. Based on the experience of other campuses, the development and implementation of a bicycle master plan—including bikeways, parking, service facilities, and a bicycle-sharing program—would significantly increase the amount of U-M bicycle travel within 10 years. This mode shift would derive primarily from local trips (under 5 miles, and especially those from 1 to 3 miles) otherwise made via transit, cars, and walking.[4]

Shifting local trips to bicycling from transit and single-occupancy vehicles would provide a range of benefits to U-M. Reduced demand for additional parking facilities and bus service would generate direct savings for U-M, reducing capital and operating costs for U-M Parking and Transportation Services (PTS). Since bicycling offers an accessible form of moderate regular exercise, increased bicycling can also improve community health and reduce health care costs for community members. Mode shift would also reduce carbon emissions and other air pollution.

A bicycle master plan would guide focused spending on phased, mutually reinforcing strategies for increasing bicycling. Larger long-term investments could be preceded, as necessary, by initial short-term measures designed to demonstrate demand. Establishing a bicycle service center might, for example, cost $200,000,[5] but this step could be preceded by a contract with the Common Cycle bicycle repair nonprofit, which currently provides similar services at an off-campus location. A policy on incorporating bicycle parking into new construction could be instituted in the short term at no expense, while retrofits of existing parking facilities could be pursued over the long term. Development of an intercampus bikeway network of bike lanes and off-street paths would proceed through gradually connecting existing facilities on City streets and U-M properties, as described in the 2009 PTS ―Building a U-M Bikeway Blueprint: An Outline for the U-M Bicycle Master Plan[ix].‖ The following table suggests one possibility for a comprehensive, phased U-M bicycle investment strategy, which could be implemented in stages as demand is demonstrated and funding identified.

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[4] Bicycle sharing systems in four major European cities caused mode shift from transit (34-65% of shift), walking (20-37%), and personal motor vehicles (6-10%). Since Ann Arbor's transit systems are less developed, mode shift to bicycling might derive more heavily from the walking and personal vehicle modes. City of Portland (OR), ―Portland Bicycle Plan for 2030,‖ January 2010, 78.

[5] Michigan State University established the MSU Bikes Service Center in an existing facilities building for less than $200,000. Chris Machielse, interview with Tim Potter, MSU Bikes.

Phase	**Capital Investments**	**Approximate Cost**
Short-term (0-1 years)	Develop campus bicycle master plan, contract for bicycle services, expand parking facilities	$100,000-$200,000
Mid-term (1-3 years)	Open bicycle service center, institute bicycle rentals	$200,000-$500,000
Long-term (1-10 years)	Develop intercampus bikeway network, open card-swipe bicycle sharing system	$2,000,000-$10,000,000

While the capital costs for an intercampus bikeway circulation network would substantially exceed previous U-M spending on bicycle transportation, many of these costs could be shared in cooperation with other entities. In the past, the City of Ann Arbor and U.S. federal government, in addition to U-M, has funded bicycle infrastructure in the campus area. It is likely that federal funds could provide a majority of capital funding for U-M bicycle infrastructure, especially an intercampus bikeway network. Operating costs would be limited, consisting primarily of periodic maintenance and bicycle service center operation. With the potential to serve tens of thousands of commuters daily, at minimal operating costs and capital costs only a fraction of U-M parking facility construction expenditures, bicycle investments are likely U-M's best local transportation buy.

3.2.1.2 Technical Guidance

Implementation of a bicycle master plan offers substantial returns because current U-M bicycle infrastructure is underdeveloped, and current bicycle use is accordingly low. A comparison of bicycle commute mode share data from leading peer institutions with 2000 U.S. Census data for the U-M Central and Medical Campus (

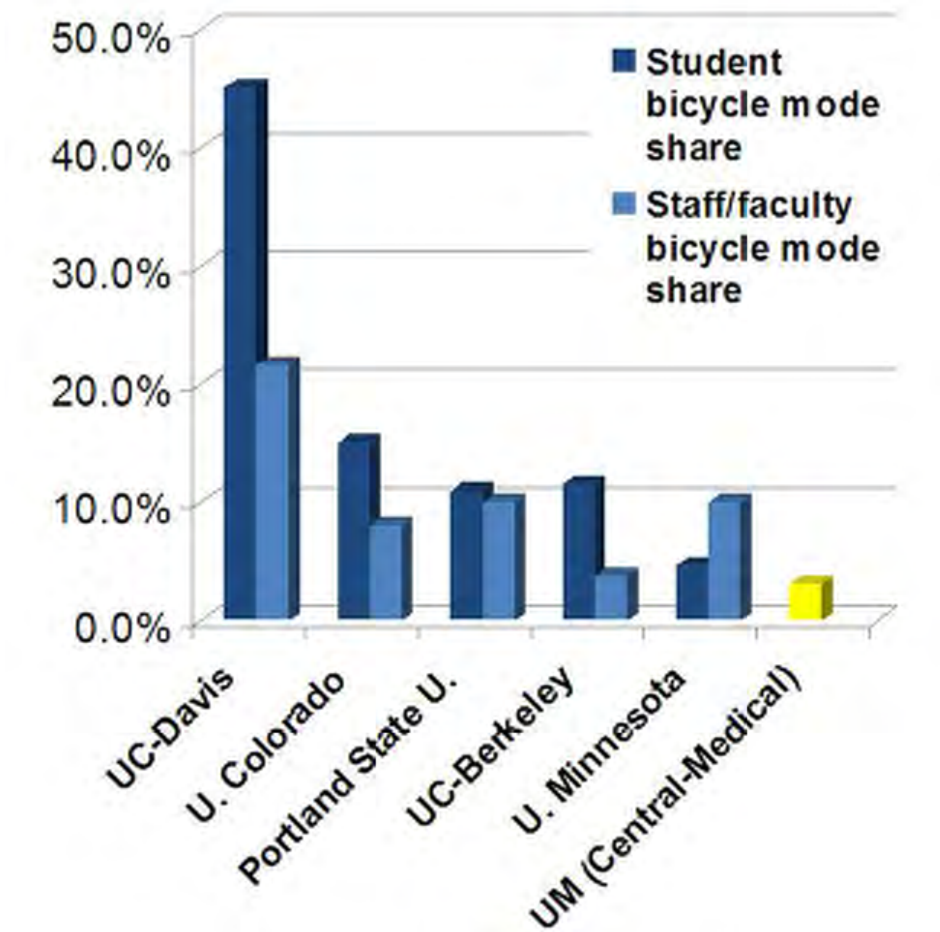


Figure 3-6) indicates that U-M substantially lags these peers, all major state universities in urban settings, in the proportion of commuters who travel by bicycle. (The Census does not differentiate between student and staff commuters.) Climate is not the major determinant of bicycle commute rates, as the discrepancy between rates at the nearby Davis and Berkeley campuses of the University of California suggests, and the Minnesota and Colorado data indicates that less temperate winters are not responsible for the much lower U-M figure. Rather, the most important factor is the institutional support for bicycle transportation on campus and in the surrounding municipality. Comparison of U-M with a larger set of bike-friendly peer institutions shows that U-M lacks most of the bicycle policies, facilities, and services that they employ (Table 3-4). U-M could significantly increase bicycle mode share through coordinated investment in these areas and synergy with the City bikeway system. Best practices at peer institutions can provide a guide for a U-M campus bicycle master plan to implement bicycle circulation, parking, service and rental facilities

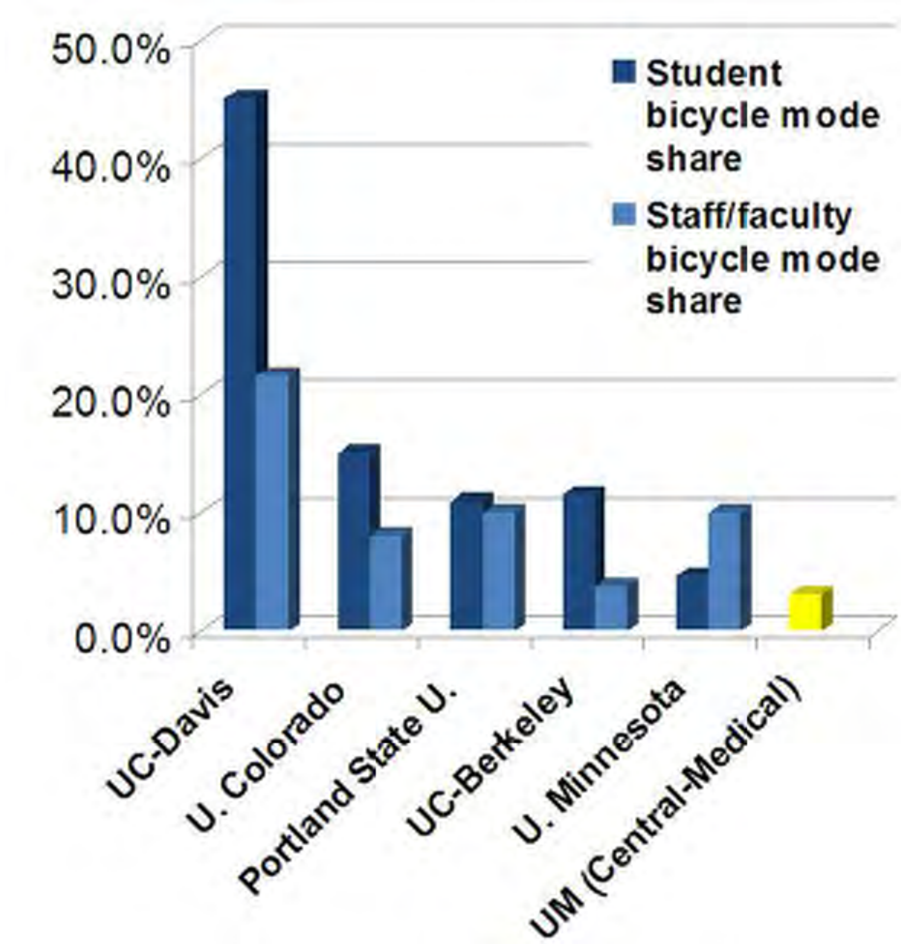


Figure 3-6: Campus bicycle commute modeshare for U-M and bike-friendly peers (c. 2000s). U.S. Census data does not differentiate between student and staff U-M commuters.

3.2.1.2.1 <u>*Planning*</u>

As with any transportation initiative, a comprehensive planning process for bicycle improvements can ensure the most efficient use of resources. Peer institutions undertake coordinated bicycle improvements by integrating bicycles into ongoing master planning or through a stand-alone bicycle master plan (UC-Berkeley, University of Texas-Austin, Michigan State). A stand-alone bicycle master plan is necessary in many cases because past planning has not addressed bicycle transportation. While recent U-M campus plans have considered ―non-motorized connections," they have not specifically addressed bicycle transport as distinct from pedestrian travel, a basic prerequisite for effective bicycle transportation strategies.[x] [xi]A bicycle master plan could focus on bicycle improvements spanning multiple campuses. Planning would be substantially assisted by regular surveys of community travel patterns (see Section 3.3). Because U-M has not previously planned systematically for bicycle circulation, a bicycle master plan would offer the surest route to efficient prioritization and phasing of campus bicycle investments.

3.2.1.2.2 <u>Circulation Facilities</u>

To provide convenient access to destinations, transportation infrastructure must take the form of a comprehensive network, not a disconnected set of isolated facilities. Despite some recent improvements, bicycle facilities surrounding U-M still take the latter form. Development of a comprehensive bicycle circulation system, based on an intercampus bikeway connecting the U-M campuses, would likely form the most critical component of a U-M bicycle master plan. It would also present the greatest challenges, including substantial capital costs. However, these could be shared with other government units, and the development of a comprehensive bikeway system would enable a shift in commuter traffic from the more costly single-occupancy vehicle and transit modes, ultimately reducing U-M transportation expenditures.

The City of Ann Arbor has begun development of a bikeway system, but this remains fragmentary, and U-M has yet to do likewise, severely limiting bicycle access to the U-M campuses. In 2007, the City of Ann Arbor adopted a plan for a comprehensive bicycle circulation network comprised of on-street bicycle lanes and off-street paths, and lanes have now been added to a number of City streets. However, as shown in the figure below, none of these streets provide full connections between the U-M campuses. Moreover, since U-M has not adopted a similar plan, its campuses remain islands within the City of Ann Arbor network. As a result, bicycle access to U-M campuses is possible only for the limited number of commuters willing to bicycle on streets and sidewalks already crowded with cars and pedestrians.

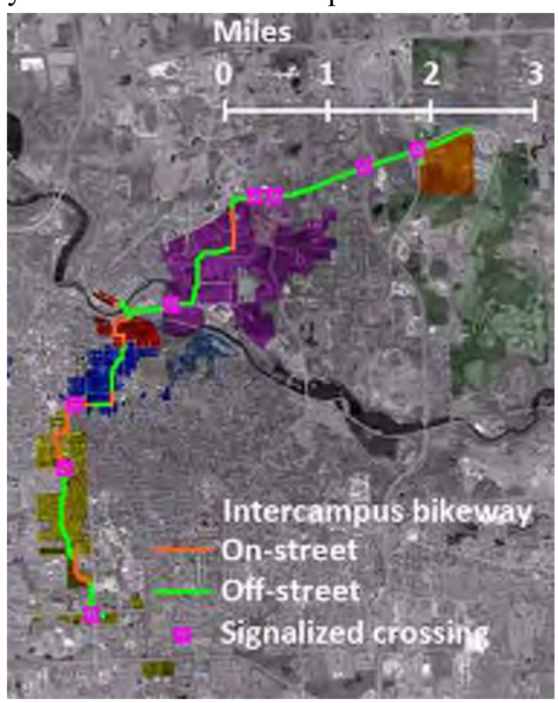


Figure 3-7. (Left) Existing bicycle facilities in the U-M area are fragmentary, and separated bikeway facilities connecting the campuses are notably absent. Shown are on-street lanes and major off-street paths.
Figure 3-8. (Right) Potential intercampus bikeway proposed in 2009 PTS report. Such a bikeway would provide a valuable –trunk line” in the larger local bicycle transportation system.

The absence of comfortable separated bikeways, and in particular the resulting competition with cars for road space, is a powerful deterrent to bicycle travel. Sidewalk-riding bicyclists surveyed by the Ann Arbor Downtown Development Authority (DDA) in 2010 –always or frequently cited fear of riding in the roads due to cars traveling at high speeds,” as well as –poor bike lanes." A majority of all respondents, street-riding and sidewalk-riding, described ―a need for additional bike lanes and improved, well-maintained bike lanes."[xii]

In addition, by pushing bicycle traffic to sidewalks, the absence of separated bicycle facilities impedes pedestrians as well as bicyclists. In 2003, after members of the DDA Citizen's Advisory Council grew ―increasingly frustrated and alarmed" by conflicts between bicyclists and pedestrians on sidewalks, the DDA commissioned a study to resolve these conflicts. It concluded by noting the importance of separated U-M bikeways in providing an effective solution to the problem: ―As the city continues to move in the direction of separate facilities for bikes and pedestrians, the gap between what is expected behavior from bikes and pedestrians on campus as opposed to what is expected in town will continue to widen…To alleviate this problem, it is recommended that the University pursue a policy of separation of facilities, not only to provide continuity between the City and the University, but for the safety of bicyclists and pedestrians on campus as well." Although U-M has since worked with the City to add bicycle lanes on some local streets, it has not yet pursued bicycle-pedestrian separation where no lanes exist.

Figure 3-7 (Left) the absence of separated bicycle facilities promotes sidewalk riding on South State Street.
Figure 3-8 (Center) Bicycle-pedestrian conflicts are not limited to the areas of densest pedestrian travel.
Figure 3-9 (Right) Even where bicycle lanes exist, the lack of a comprehensive circulation system generates unpredictable behavior, leading to conflicts as seen here on S. University Ave.

By filling in the gaps in the current bicycle circulation network with on-street lanes and off-street paths, in cooperation with the City, U-M can seamlessly integrate campus bicycle transportation with the City network and make bicycling the most attractive mid-range (1-3 mile) transportation option for a broad range of community members. A 2009 outline for a U-M bicycle master plan prepared for Parking & Transportation Services built on the study by proposing the connection of existing facilities to form an intercampus bikeway network.[xi] Two corridors meriting particular attention are Glen and Fuller Road, connecting the U-M Central, Medical, and North campuses, and South State Street, the major north-south corridor on Central Campus. It is likely that improved off-street paths providing for bicycle-pedestrian separation would best facilitate bicycle travel on Fuller, a four-lane boulevard. Two-lane State Street would benefit from on-street facilities, which U-M, the City, and the Downtown Development Authority could work together to provide. Removing on-street parking from one side of State would allow for on-street lanes, and the development of a State Street transit and bicycle mall could be considered as a long-term opportunity.

Figure 3-10 South State Street.

Figure 3-11 Fuller Road.

Whatever the precise outline of a U-M bicycle circulation system, it would require separation of bicyclists and pedestrians in high-traffic locations. Walking and bicycling are different modes, which cannot mix effectively in such areas. The absence of separated bicycle facilities encourages sidewalk-riding behavior, which endangers pedestrians and bicyclists, –frustrat[ing] and alarm[ing]" residents.[xiii] Not all bicycle traffic can be separated, but separated bikeways on major corridors would significantly speed bicycle circulation and divert it from pedestrian spaces. In conjunction with an intercampus bikeway network, U-M could designate the Diag a peak-hour bicycle dismount zone, as peers have done in their central pedestrian spaces. However, such restrictions on bicycle traffic are unfeasible without effective bypass routes.

3.2.1.2.3 <u>Parking Facilities</u>

Although bicycle parking has been the focus of past U-M bicycle investments, existing bicycle parking capacity is often inadequate to meet existing demand, especially on Central Campus. Provision of bicycle parking has been uneven and sometimes absent in major recent U-M building projects. Secure and sheltered parking is under development, and bicycle lockers have been provided for some time on request, but the vast majority of U-M bicycle parking is fully exposed to rain, snow, and theft. A cohesive bicycle parking policy and program would do much to ensure appropriate facilities throughout the system.

An October 2010 campus-wide survey of bicycle parking found that while bicycle parking volumes vary among campuses, dozens of Central Campus locations experience shortages of bicycle parking, and others are deficient in other respects, as indicated by an October 2010 campus-wide survey (Figure **3-13**). To encourage use of this mode, bicycle parking should meet peak demand. Its absence impedes bicycling and mars campus aesthetics, as bikes are locked to trees, poles and other landscape elements, and its installation might be a short-term U-M priority. Basic bicycle parking is inexpensive, but its effective provision may require a centralized system by which building managers and users can report deficiencies and see them rapidly addressed through a dedicated bicycle-parking fund. However, any new parking would need to conform to intended bicycle circulation patterns as established in a master plan. Adopting uniform bicycle parking standards for new construction, as done by the City of Ann Arbor and the University of Oregon, would significantly reduce the need for costly retrofits. While most recent U-M construction includes bicycle parking facilities, these have not always been sufficient to meet demand, or been optimally sited. The City of Ann Arbor bicycle-parking ordinance would provide a useful model for U-M.[xiv]

Figure 3-12 Informal overflow bicycle parking mars campus beauty and can block walkways.

U-M can also realize significant short-term gains by exploiting opportunities for covered bicycle parking. Since bicycles‘ moving parts are exposed to the elements, bicycle parking should be sheltered from rain and snow where possible to prevent damage. Shelter is particularly important for long-term residential parking (Class C in the City of Ann Arbor typology). U-M can leverage existing building overhangs as sites for inexpensive sheltered parking, as recently done at the Hatcher Graduate Library. Elsewhere, additional covered shelters and secured facilities may be constructed over the long term. Michigan State University also offers warehouse bicycle storage over winter and summer breaks.[xv] [xvi]

However expansive, bicycle-parking facilities will not be effective if they are not properly maintained. Bicycle impoundment is currently the task of a single U-M DPS officer; so many months often pass before abandoned bicycles are removed, impeding others from parking there. U-M could benefit from exploring a new bicycle impoundment protocol empowering building managers to report and/or remove abandoned bicycles after appropriate notification.

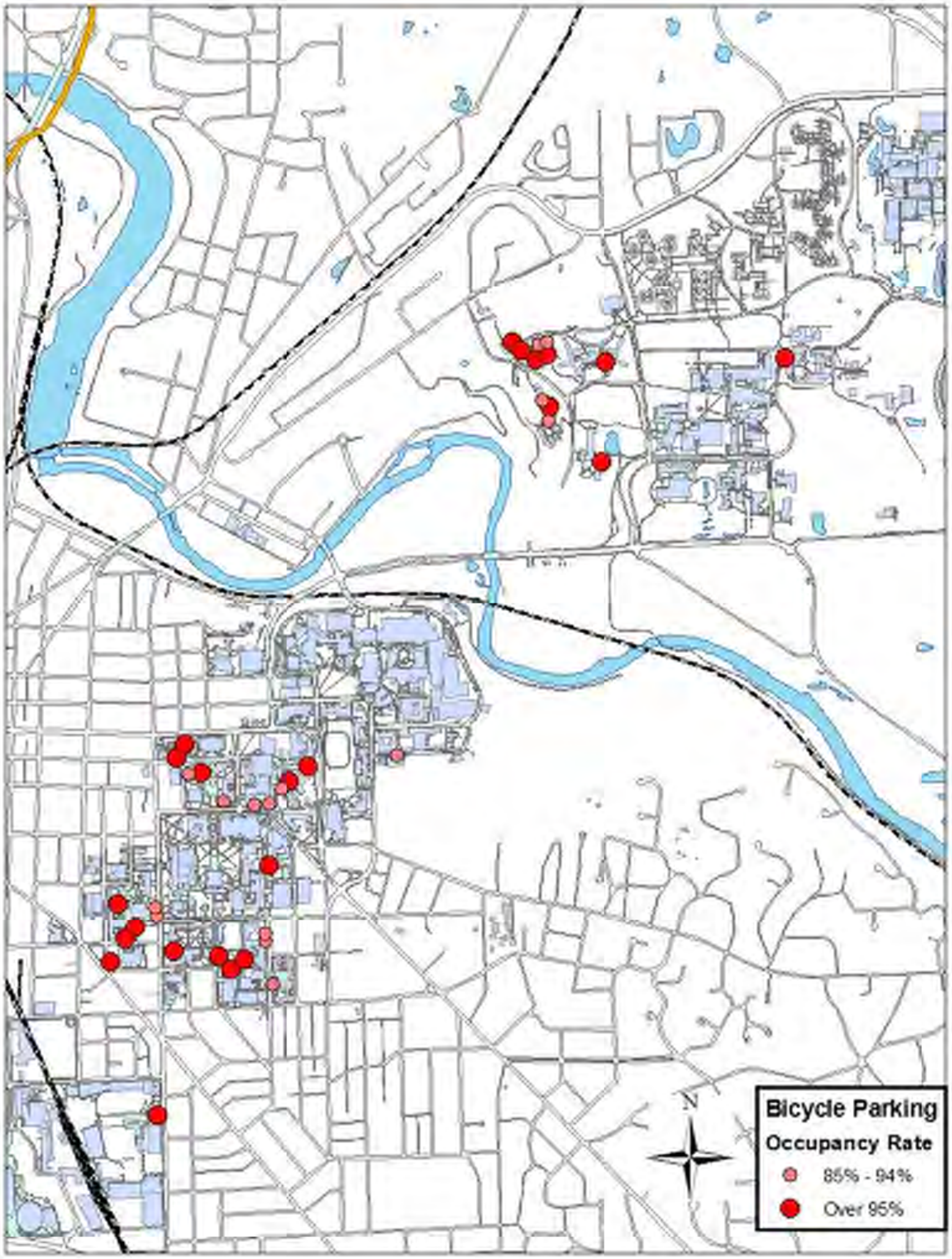


Figure 3-13 An October 2010 campus-wide bicycle parking survey found that demand exceeded the recommended 85% of capacity at dozens of locations, concentrated in areas of Central Campus and the North Campus Baits Houses.



Figure 3-14 When exposed, bicycle parking is vulnerable to the elements, as well as theft.
Figure 3-15 Some U-M bicycle parking is improperly installed, impeding use.
Figure 3-16 Newly installed Graduate Library bicycle parking beneath building overhang.

3.2.1.2.4 Other Services

In addition to bicycle circulation and parking facilities, peer institutions offer a range of other bicycle services. In particular, bicycle service centers and modern bicycle rental systems can significantly expand the accessibility of bicycle transportation. As with bicycle circulation and parking facilities, implementation of bicycle services and rentals can be phased to ensure the most effective use of funds.

Bicycle-supportive transit buses can also significantly expand the accessibility of bicycle transportation. Over the past decade, they have become the standard in American cities and universities. By allowing more effective bicycle and transit trip linking, they significantly expand the utility of both modes. The U-M bus garage is too small to house full-size buses with front-mounted bicycle racks, preventing their installation on U-M buses.[xvii] However, U-M could add racks to the smaller hospital shuttles as an interim solution. Because of the limited capacity (2-3) of transit bicycle racks, bicycle-sharing systems as described below can facilitate linked trips far more effectively, but transit bicycle racks would represent a significant improvement nonetheless.

An increasing number of US universities operate bicycle service facilities for community members, including 7 of the 10 bicycle-friendly peer institutions detailed in Table 3-4. Like other vehicles, bicycles require periodic maintenance and repair. Many commercial bicycle businesses primarily serve high-income customers, putting their services beyond the reach of students. A U-M bicycle service facility could provide affordable service and maintenance for U-M bicyclists without competing in the bicycle retail market.[6] Some university-sponsored bicycle service centers resemble a traditional bicycle shop, charging a fee for services rendered, while others charge a flat membership fee, providing both repair services and a workspace so members can perform their own repairs if desired. The second option might be preferred by U-M because of the proximity of other bicycle shops, its reduced staffing requirements, and resulting potential for financial self-support.

Demand clearly exists for a facility at U-M. During its 2008-9 period of operation, the East Quad Bike Co-op—run by student volunteers on a $120 budget from an 8 x 12‘ basement room—repaired between 250 and 400 bicycles[xi]. While EQBC‘s leaders have graduated, Ann

[6] Portland State University‘s downtown service center, the PSU Bike Hub, ―has received positive support from area bike shops, and looks forward to maintaining these mutually beneficial relationships.” Both the PSU Bike Hub and the MSU Bikes Service Center also refer users to local bicycle retailers; Potter, Tim, MSU Bikes Service Center Manager, telephone interview with Chris Machielse, 2010.

Arbor's Common Cycle nonprofit bicycle repair program will likely show greater longevity. U-M staff and other Ann Arbor residents in addition to students run EQBC, and it has serviced more than 400 bicycles and raised over $5,600 since its 2010 founding[xviii xix]. U-M could immediately introduce bicycle services to campus by contracting with Common Cycle to bring its mobile repair stand to campus on a periodic basis. The University of Texas at Austin uses a similar mobile bicycle service trailer[xx]. Over the long term, U-M might partner with Common Cycle to provide more extensive services, and construct a permanent repair facility at a Central Campus location.



Figure 3-17 (Left) MSU Bikes Service Center front desk. *msubikes.org*
Figure 3-18 (Center) U-M East Quad Bike Co-op (EQBC).
Figure 3-19 (Right) Common Cycle mobile service center. *CommonCycle.org*

Portland State University's service center also originated as a student initiative, and might provide an instructive example. Unlike EQBC and Common Cycle, it received university support from its founding. Over the past six years, it became a full-service membership-based workshop that gained 1,100 members and more than $100,000 in sales in its first six months, and it is expected to be self-supporting by 2012[xxi]. The new service center was built in to a new campus recreation center, so initial capital costs are difficult to assess, but MSU's conversion of a 2000-square-foot facility required an investment of under $200,000.[xxii]

Bicycle rental programs are also an increasingly common among American universities. Most of the leading bike-friendly peer institutions compared offer long-term or short-term bicycle rentals, often through a bicycle service center. Rentals may be as long as one semester or as short as one hour. Impounded bicycles often provide a ready source of bicycles and components for these programs, and once a bicycle service center is established, U-M could successfully pursue these relatively inexpensive opportunities in the short term.

Over the long term, a modern ―bicycle sharing" system, using computerized bicycle docking stations for short-term rentals, could significantly accelerate an increase in U-M bicycle mode share. The system remains among the more costly potential U-M bicycle investments, but also among the most potentially transformative. While costly, such a system could eventually handle a large proportion of the U-M commuter population.

Saint Xavier University in Chicago has implemented modern bicycle sharing, and the University of Minnesota is now served by the Twin Cities bicycle sharing system, however, the large initial investment presents a barrier. Michigan State University opted for restricting rental service locations to the MSU Bikes Service Center itself rather than initiate a $500,000 system[xxii]. In relative terms, however, this expenditure is equivalent to the cost of a single new hybrid-electric bus, or 20 new structured parking spaces[xxiii xxiv], and it could also take advantage of federal transportation funding. Moreover, the U-M campuses are uniquely suited for bicycle sharing. U-M consists of two major nodes, Central and North Campus, connected by a high-capacity transit corridor. As suggested by the heavily used bicycle parking at U-M‘s Central Campus Transit Center[xxv], many community members already link bicycle and transit trips. The availability of bicycles at both ends of this commute would enhance both modes. The absence of secure or sheltered parking facilities for privately owned bicycles at most on-campus and off-campus housing provides another advantage to bicycle sharing. However, the system would be most effective in conjunction with a cohesive circulation network as described above.

3.2.1.2.5 Education and Outreach

Many peer institutions provide bicycle education for community members, often through a bicycle service center. Neither U-M student orientation sessions nor the DPS currently provide information on bicycle safety. U-M could provide regular courses on safe riding and effective maintenance through a bicycle services center. Since women and people of color have been historically underrepresented in the US bicycle commuter community, special attention might be given to encouraging their participation, in part through a diverse bicycle service staff.[xxvi] For example, the PSU Bike Hub offers a regular, well-attended women‘s bicycle repair night.[xxvii]

3.2.1.3 Barriers to Implementation

The chief barrier to development and implementation of a bicycle master plan is funding. Although bicycle facilities are far less costly than transit and automobile infrastructure, U-M lacks a dedicated funding source, although U-M Parking and Transportation Services has sometimes set aside funding for bicycle parking facilities in the past.[xvii] At peer transportation units and the general fund have financed bicycle facilities. Numerous opportunities exist for federal funding of bicycle infrastructure in cooperation with the City of Ann Arbor. A bicycle program might also require additional staff to aid implementation.

3.2.1.4 Uncertainties and Concerns

Development and implementation of a U-M bicycle plan should significantly increase bicycle mode share. However, the precise magnitude and nature of the mode shift is unknown, especially as limited data is available on current U-M transportation patterns. U-M does not conduct a regular survey of faculty and staff transportation patterns, and U-M has not previously surveyed student transportation patterns. Based on the experience of other universities, however, and U-M‘s currently low bicycle mode share, a substantial increase of bicycle mode share in ten years appears reasonable given full implementation of the bicycle system described above, including modern bicycle sharing facilities. A regular transportation survey would be an essential tool for tracking progress towards these goals.

Table 3-4 Bicycle Programs at U.S. Universities: U-M and Leading Peer Institutions

	UOE	UCD	UM	MSU	PSU	UTA	UCB	UWM	UC	UV	U-M
Policies											
Transport survey		X	X	X	X	X	X		X	X	
Bicycle planning	X	X	X	X	X	X	X			X	
Bicycle staff	X		X	X	X	X		X			
Circulation Facilities											
On-street lanes	X	X	X	X	X	X	X	X	X	X	X
Dismount zone(s)	X	X	X			X	X			X	
Off-street lanes	X	X	X	X					X		
Parking Facilities											
Basic parking	X	X	X	X	X	X	X	X	X	X	X
Bicycle lockers	X	X	X		X	X		X			X
Secure parking	X	X			X		X	X			2011
Services											
Transit bike racks	X	X	X	X	X	X	X	X		X	
Service center*	X		2011	X	X	X		X	X		
Bike rental/sharing	X		X	X		X			X		
Bicycle education	X	X		X	X						

*Staffed centers only.

UOE – University of Oregon-Eugene
UCD – University of California-Davis
UM – University of Minnesota, Twin-Cities
MSU – Michigan State University
PSU – Portland State University
UTA – University of Texas, Austin
UCB – University of California, Berkeley
UWM – University of Wisconsin-Madison
UC – University of Colorado at Boulder
UV – University of Virginia

3.2.2 Implementation Idea #2: Enhance Pedestrian Facilities

Pedestrian circulation is the most sustainable local transportation mode. Central Campus is among the most pedestrian-friendly environments in the region and a key asset to U-M. However, deficiencies persist, and U-M campuses lack sidewalks in a number of locations. To improve the safety and attractiveness of pedestrian circulation, U-M can complete its basic pedestrian system and explore opportunities for enhancing pedestrian travel on major through streets, as well as encouraging pedestrian travel through building design. Because pedestrian trips are typically shorter than bicycle trips, and U-M‘s pedestrian circulation system is substantially complete in high-volume areas, opportunities to shift transit and car trips to pedestrian travel are more limited than for bicycle travel.

3.2.2.1 <u>Costs and Benefits</u>

Pedestrian circulation is the most efficient and sustainable mode of local transportation (0.5 miles or less), since it generates no pollution, involves physical activity, and imposes minimal capital and operating costs. The U-M Central Campus is among the most pedestrian-friendly environments in the region and a key asset to U-M. Other U-M campuses, however, are far less pedestrian-friendly environments, since available services in and around them are few and far between. The almost total dominance of automobile-based transportation at the U-M East Medical Campus (95%; see Table 3-1), located in an exurban environment outside the Ann Arbor city limits, offers a dramatic illustration of the role of land use in transportation patterns. To increase and enhance pedestrian travel, U-M can gradually plan and implement land use changes that put more diverse services within walking distance of the campus community, especially on the North Campus. In the short term, it can enhance the safety and comfort of pedestrians throughout its campuses by improving and expanding pedestrian facilities.

Adopting a plan for a greater diversity of land uses on North Campus would impose no additional capital costs on the University, instead providing a guide for future U-M investment that could make the best use of investments in buildings and other facilities. Pedestrian improvements to the campuses could be phased, and those involving City streets would require development in cooperation with the City and Downtown Development Authority, creating opportunities for funding from additional sources. The following table suggests a potential guide for phased implementation. It should be noted that the full value of Central Campus as a pedestrian-friendly environment is challenging to calculate using current methods.

Phase	**Capital Investments**	**Approximate Cost**
Short-term (0-1 years)	Initiate planning process for diversifying land uses; begin adding sidewalks, ADA-compliant curb ramps	$200,000-$500,000
Mid-term (1-3 years)	Continue planning process, complete sidewalk network, improve street crossings	$500,000-$3,000,000
Long-term (1-10 years)	In cooperation with City, consider ped. extensions and transit mall development	$5,000,000-$10,000,000

3.2.2.2 Technical Guidance

Pedestrian travel is affected by a number of factors. Land use patterns are perhaps the most critical element; where nearby places to go do not exist, pedestrian travel will invariably be limited. Provision of basic infrastructure, the presence of bicycle and motor vehicle traffic, and building design are also important factors, as are building design.

3.2.2.2.1 Diversifying Land Use

Pedestrian commute rates on the Central Campus are nearly double that of the North Campus area and eighteen times that of the East Medical Campus area. In large part, the discrepancy reflects the fact that central Ann Arbor features a wide diversity of land uses where places of work, school, residence and consumption are concentrated within walking distance of each other. This diversity is a consequence of the central city's evolution in the 19th century, before other transportation modes became easily accessible. The U-M North Campus, by contrast, was planned in the mid-20th century. It reflects that era's emphasis on single-use zoning that separated residential, commercial and office uses, and its prioritization of rapid motor vehicle circulation over pedestrian travel. As a result, North Campus is a less pleasant place to live and work, and many needs of campus community members—particularly those for food, leisure, and household goods—can only be satisfied by trips of one mile or greater, usually made via bus or car. Although improved transit and bicycle networks can facilitate access to more distant locations, a more efficient, sustainable, and livable North Campus requires diversifying land uses in conjunction with efforts to connect the campus to its surroundings.


Figure 3-20 (Left) Central Campus: a vibrant pedestrian environment adjacent to local retail uses, and encouraging lingering and interaction. (Right) North Campus gateway: a four-lane boulevard engineered for speed, not lingering, and distant from other uses.

U-M has recognized this problem for some time. The 2008 North Campus Master Plan Update emphasized the need to ―make North Campus a vibrant, around-the-clock destination for the broader community," rather than an isolated enclave almost exclusively dedicated to academic and residential uses.[xxviii] Accordingly, it outlines increases in campus density and a more fine-grained network of streets, which will aid pedestrian circulation. However, a greater mix of uses on North Campus is required to put more destinations within walking distance.

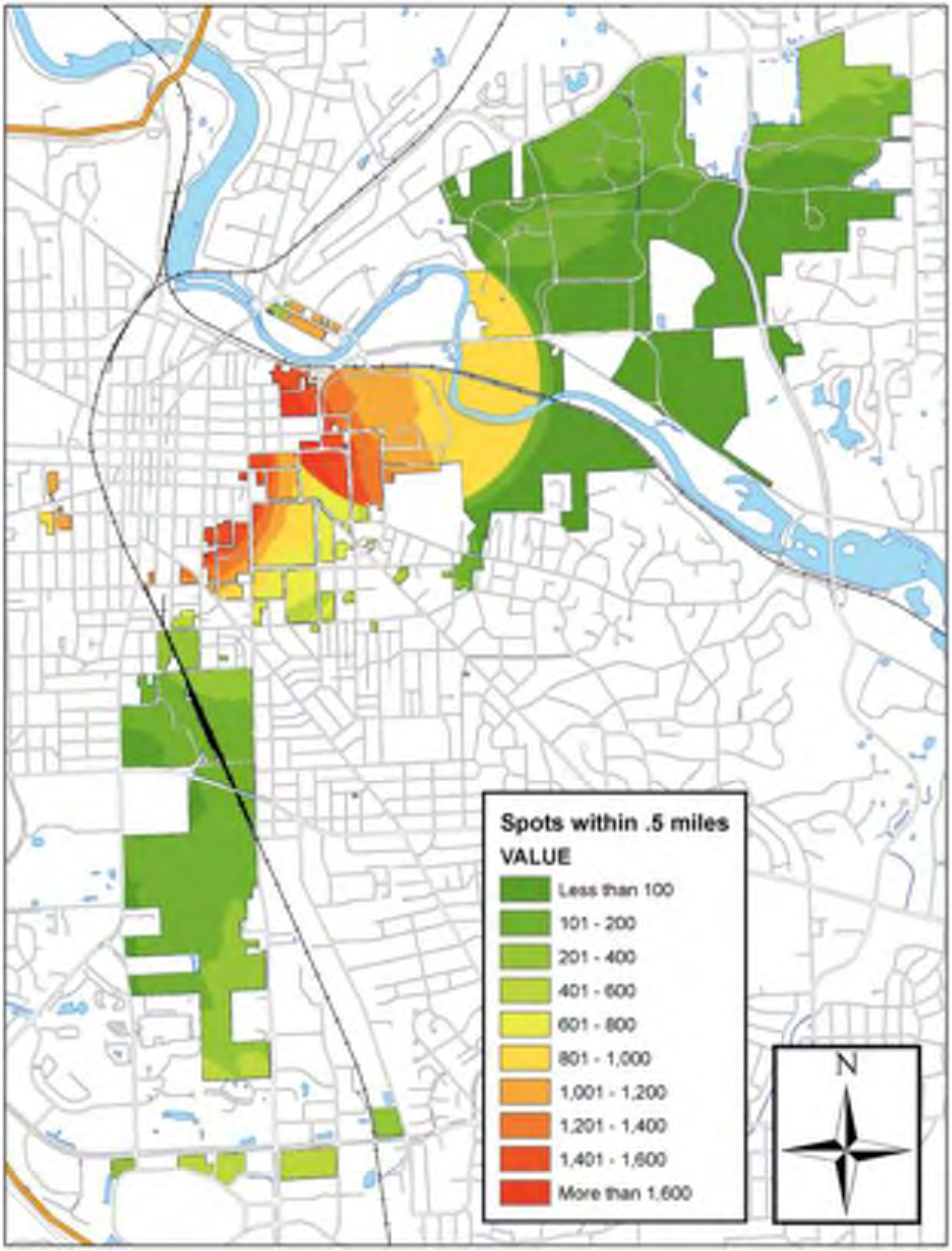


Figure 3-21. Walkability Analysis: Walkability to all commercial spots within 0.5 miles. The VALUE indicates the number of commercial spots within 0.5 miles (walking distance).

Figure **3-21** displays the dramatic contrast in local commercial destinations between the U-M North Campus and Central Campus. Most areas of Central Campus enjoy access to five to fifteen times as many local commercial destinations within the typical walking distance of 0.5 miles. This contrast results from the absence of commercial destinations within North Campus or in the surrounding area, with the exception of the Pierpont Commons on campus and the retail areas on Plymouth Road adjacent to campus at Murfin and Nixon, both of which are greater than 0.5 miles from the North Campus Diag.

Increasing access to commercial destinations and enhancing pedestrian travel on North Campus requires diversifying land uses on North Campus itself. In contrast to the Central Campus, which expanded gradually with successive U-M purchases of land, the North Campus consists of a single, far larger tract. As a result, retail development adjacent to the North Campus is beyond the usual range of pedestrian travel from the North Campus core, and adding new retail on campus is the only viable option for enhancing local access. Clearly, these changes in the built environment can only be implemented over a period of years and decades. The nature of campus development demands a long-term implementation strategy to overcome the current economy and strategies to control non-university community parking on campus. Peer institutions can provide guidance for U-M action.

The University of Wisconsin is beginning to explore public-private partnerships to foster redevelopment on university-owned property[xxix]. To help revitalize the eastern half of its campus, Cornell University replaces buildings that have reached the end of their usable life with mixed-use, higher-density developments, thus intensifying use while retaining its existing footprint[xxx]. Further investigation into campus planning on North and South campus is needed to increase walkability in areas highlighted in green in the analysis above. While these changes cannot occur overnight, and it is unlikely that North Campus will ever match the Central Campus and downtown for their diversity of eating, entertainment, and other retail options, planning in the present is essential to enhance the sustainability of North Campus, and improve the quality of life there for future generations.

3.2.2.2.2 Improving Pedestrian Infrastructure

Local destinations are the precondition for pedestrian travel, the absence of pedestrian circulation facilities is a substantial deterrent even where local destinations exist. Basic pedestrian infrastructure includes circulation facilities, street crossings, and lighting. Such facilities are generally ubiquitous on the U-M Central Campus, but often absent in other areas. A number of North Campus streets lack sidewalks on one or both sides. U-M is gradually filling these gaps in the pedestrian network, but accelerating this process would enhance the safety and attractiveness of the pedestrian mode. On North Campus and elsewhere, many high-volume U-M pedestrian crossings lack striping, curb ramps, and other facilities. Additional crossing facilities at intersections, mid-block crossings, and speed tables could be considered at a number of locations. ADA-compliant curb ramps should be the U-M standard. Adequate lighting is essential for nighttime pedestrian circulation, and U-M might consider installing pedestrian lighting along the Fuller Road corridor in cooperation with the City in conjunction with other projects.

Figure 3-22 Basic pedestrian deficiencies on the U-M campus and adjoining streets include the absence of sidewalks, crosswalk striping, ADA-compliant curb ramps, and adequate lighting.

Appropriate maintenance of pedestrian facilities is critical to their success, especially in winter. The U-M fleet of snow removal vehicles performs superbly in many areas, but others are less well maintained. Since pedestrian travel to campus often involves City sidewalks, U-M could consider partnering with the City to plow major pedestrian corridors adjacent to campus, such as streets near the downtown, where private property owners fail to do so.

Figure 3-23 The U-M fleet of snow removal vehicles effectively removes snow from campus pedestrian routes, but U-M pedestrian travel would benefit from similar maintenance of nearby corridors, both on and off the campuses.

3.2.2.2.3 <u>*Street Conversions*</u>

Over the long term, more substantial pedestrian improvements could be considered at a number of locations in cooperation with the City and Downtown Development Authority. Conversion of sections of Ingalls Street and East University Ave. into pedestrian malls has created some of the University's most iconic pedestrian spaces. The Ingalls Mall, in particular, has become a highly desirable location for community events from the Ann Arbor Art Fairs to the Ann Arbor Summer Festival. With careful planning community-wide planning, other streets too could be enhanced for pedestrian circulation, as well as transit and bicycle travel.

Figure 3-24 Ingalls Mall, formerly Ingalls Street, during the Ann Arbor Summer Festival. ***Let's Save Michigan***

On South University, North University, and portions of State Street, pedestrian volumes greatly exceed automobile volumes, causing congestion at peak hours (Figure 3-26) and frequent crashes (Figure 3-27). Since they bisect the U-M campus, serve as major transit routes, and present significant problems for motor vehicle circulation, consideration might be given to optimizing them for pedestrian, bicycle, and transit circulation, and limiting non-local motor vehicle traffic. Such a program could be approached through a phased implementation process, including the creation of ―festival streets” or ―shared space” at grade with adjoining sidewalks. In the short term, portions of State Street might be closed to non-local motor traffic during U-M football games, as currently being considered for Main Street.[xxxi]

Figure 3-25 (Left) High pedestrian volumes on State Street bisecting Central Campus. (Center) Pedestrian traffic at Hill and State on game day. (Right) Private motor vehicles impede pedestrian and bicycle traffic on South University.

Figure 3-26 Pedestrian circulation dominates motor vehicle circulation at Central Campus intersections (red).[xxxii]

The effect on motor vehicle traffic would require careful evaluation, but the availability of alternate high-capacity corridors (the Fifth and Division couplet, Huron, and Washtenaw) suggests that improvements could be pursued without significant adverse effect. Due to high pedestrian volumes, three intersections on South State Street currently receive an automobile level-of-service (LOS) grade of ―F,” the only intersections in downtown Ann Arbor to receive a failing grade (Figure 3-26). The segment of State Street between Liberty and Hill already experiences moderate to severe daily congestions, and city transportation planners forecast that this will continue in any event.[xxxiii] Pedestrians already dominate these streets, though motor traffic continues to endanger pedestrians along them (Figure 3-28). Some on-street parking would be lost in such changes, but Ann Arbor and the University already possess off-street parking facilities, and the storage of empty vehicles may not be the optimal use of major pedestrian corridors.

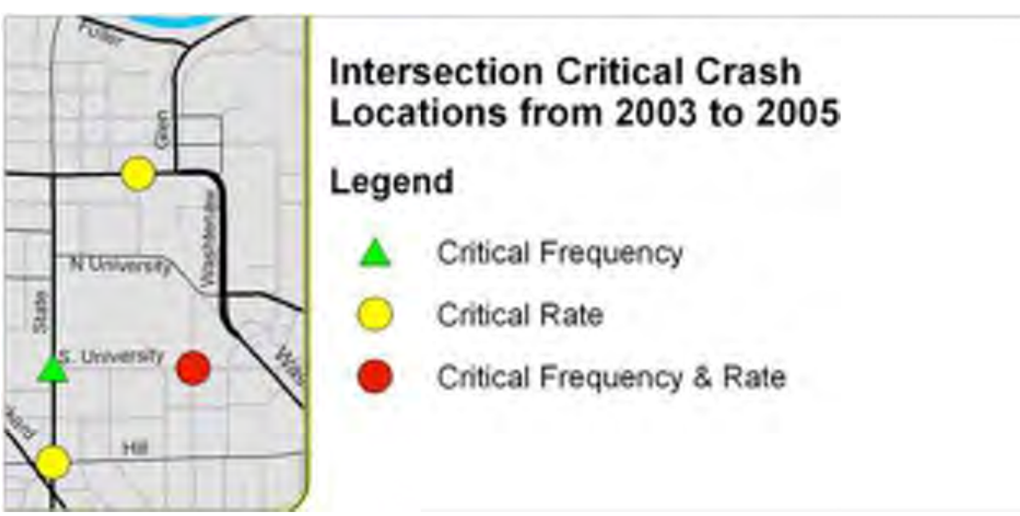


Figure 3-27 From 2003-5, South State experienced 21 crashes at South University and 57 at Hill, making it among the highest-crash corridors in the City. Church Street at South University saw 39 crashes.[xxxiv]

Figure 3-28 Despite their greater volumes, pedestrians remain vulnerable to automobiles on primary streets bisecting campus.[xxxv]

Peer institutions have successfully converted campus through streets into corridors for pedestrian travel, bicycle traffic, service vehicles, and local motor vehicle traffic. Similar action offers U-M an opportunity to enhance community safety and strengthen already robust pedestrian travel. As described above, the establishment of separated bicycle facilities would also reduce conflicts between bicyclists and pedestrians and allow for the creation of dismount zones protecting U-M's central pedestrian spaces from fast-moving vehicle traffic.

Figure 3-29 (Left) The University of Oregon in Eugene has restricted motor vehicle access on 13th Avenue to service vehicles and local traffic, turning a major through street into a "shared space" for pedestrians, bicyclists, service vehicles and local traffic. (Right) The former East University Street, now a pedestrian mall.

Figure 3-30. Diag. Pedestrians are the lifeblood of the U-M campus. Central pedestrian spaces would benefit from limitations on all types of vehicle traffic, including bicycles.

3.2.2.2.4 Crossings of Major Arterial Streets

U-M pedestrian travel would also be enhanced, and campus safety significantly improved, by improving crossings of major streets. Three high-speed, high-volume arterial streets merit particular attention for the hazards they pose to pedestrians on campus: Huron-Washtenaw, Plymouth, and Fuller. In cooperation with the City, U-M should review opportunities for safer crossing facilities to avert future pedestrian injuries and deaths.

Controlled by the Michigan Department of Transportation (MDOT), the Huron-Washtenaw portion of the I-94 ―business loop" is engineered as a small urban freeway, creating a hazardous pedestrian environment bisecting the U-M campus. U-M has constructed two elevated pedways across the road. However, these fail to capture all pedestrian travel, and access from Central Campus to the student housing areas north of Huron remains especially problematic. Improvements to the existing crossings at Ingalls, Fletcher and Glen should be considered in cooperation with MDOT and the City.

Plymouth Road, the five-lane arterial dividing North Campus from retail and residential areas to the north, was in 2003 the scene of a pedestrian-car crash in which two U-M students were killed attempting to cross the road to campus.[xxxvi] Following the incident, U-M and the City cooperated to add two mid-block pedestrian crossing islands, install a new traffic light, and re-engineer pedestrian paths on Nixon between Bishop and Nixon. However, new private retail and residential development has increased pedestrian volumes near the Plymouth-Murfin intersection to the west, and a number of pedestrians now cross the road east and west of the signalized intersection crosswalk. To prevent a recurrence of the 2003 tragedy, U-M should consider partnering with the City to study pedestrian crossing patterns at the intersection and take appropriate action to facilitate safe crossings.

Fuller Road, the four-lane boulevard/ five-lane arterial connecting the North and Central campuses, also presents problems for pedestrians. It is likely that the shape of the roadway will eventually be transformed by a future high-capacity transit system. In the short term, however, U-M and the City should consider additional mid-block crossings near the parking lots east of Cedar Bend Drive. The intersection with East Medical Center Drive and Maiden Lane, near the hospitals, also requires a redesign to enhance pedestrian, bicycle, and transit circulation.

Figure 3-31 Pedestrian crossing Huron St. by U-M Bioscience Research Building.

3.2.2.2.5 *Building Design*

In concert with land use diversity and infrastructure, building design also affects the attractiveness of pedestrian travel, and U-M could consider means to promote pedestrian-friendly building frontage. Pedestrian traffic is significantly affected by building design. Frequently spaced doors connecting buildings to surrounding pedestrian networks are vital. Buildings with active exterior faces, including windows and all-day uses such as cafes, study spaces, and other conveniences, provide a more pleasant pedestrian environment during the day. At night, such active spaces are indispensable for comfortable pedestrian travel, since they provide ―eyes on the street" (or path) and correspondingly enhanced safety. The need for guaranteed rides and safe walking services for nighttime travelers could be reduced if U-M adopted policies encouraging active faces on buildings fronting major pedestrian circulation routes. In new construction, special attention might be given to maintaining pedestrian line-of-sight. Open spaces, easily visible from multiple angles, as opposed to cul-de-sacs and underpasses beneath buildings, do much to promote pedestrian comfort and safety at night.

Figure 3-32 Inactive building faces make pedestrian travel unpleasant, while active faces provide visual interest and enhance safety and comfort of pedestrians at night.

3.2.2.3 Barriers to Implementation

As with bicycle facilities, implementation of pedestrian facilities requires identifying funding. Short-term measures, such as sidewalks, require relatively little planning. Long-term diversification of land uses, by contrast, requires substantial planning but no additional capital investments. The current economy does not favor new real estate investments, and parking from non-University users would require further controls. Building design retrofits are necessarily carried out over the long term, with other major renovations. Street conversion and arterial crossings are a challenging task, requiring the full cooperation and consent of multiple stakeholders, including the City and Downtown Development Authority.

3.2.2.4 Uncertainties

The effect pedestrian improvements and land use diversification can have on pedestrian mode share is difficult to quantify. The timeline for multi-use land-use development is unknown, and much is contingent on national and state economic trends. Yet improving the safety, comfort, and attractiveness of pedestrian travel on U-M campuses can increase its attractiveness as a transportation option. The proliferation of food options at the Plymouth-Murfin intersection suggests the strong demand for pedestrian-accessible retail near North Campus. Surveys of the North Campus community could do much to suggest possibilities for enhancement.

3.2.3 Implementation Idea #3: Further Integrate Campus Transit

"I like taking the bus. It makes me feel like a real commuter." (Overheard on Central Campus)

Ann Arbor currently has two transit operators whose service is largely uncoordinated: the Ann Arbor Transportation Authority and the U-M. The goal of transit policy should be to provide seamless transit mobility both between the Ann Arbor campuses and between campus and the rest of Ann Arbor and Washtenaw County.

Improving efficiencies in existing alternative transportation is crucial to increased use. Transit planning should focus simultaneously on the problem of moving people between campuses and moving people from town to campus. This implies integrating town-to-campus movements with the high capacity corridor (AA Connector[xxxvii]) currently under consideration in the ―Connector Study" sponsored by U-M, the Ann Arbor Transportation Authority, and the Downtown Development Authority. Technologies that improve movement between town and campus (as well as intercampus travel) should be preferred over those primarily oriented towards shuttling passengers between campuses. A high-capacity busway could allow numerous lines throughout the AATA system to utilize the premier level of service such facility would offer, whether they use the entire facility or just segments. By contrast, rail based technologies will offer high-quality service along the corridor but will necessitate transfers to other destinations[xxxviii xxxix].

The U-M should also consider the best institutional design for achieving the goal of integrating intercampus transit movements with transit access between town and campus. Campus bus service got started at the University of Michigan before the founding of the Ann Arbor Transportation Authority. It may be that the two-system design is no longer optimal to serve the needs of transit users to the U-M campuses. Several universities have responded the challenge of integrating transit movements by engaging the municipal provider to provide campus service as well; this integration can lead to spillover benefits, as described below. This integration is consistent with the Washtenaw County Transit Master Plan, which in reference to the Connector states that ―[t]he service being studied would likely replace a number of existing U-M and TheRide bus services, and would encourage further integration of the two operators."[xl]

3.2.3.1 Costs and Benefits

Improving the effectiveness of public transit between town and campus can reduce the share drive-alone alone commuting to the U-M campuses (particularly in concert with other policies referred to in this report) and thereby the environmental impact of the U-M commutes. While the U-M is not a municipal transit provider, its decisions can significantly affect the efficiency of transit movement between town and campus. These decisions include the technology for the high-capacity corridor currently under study, and the extent of institutional transit integration between town and campus.

While transit provision is costly, the options that serve these goals best are not necessarily the costliest, and may entail cost savings. For example, the Ann Arbor Transportation Authority enjoys a significant capital subsidy from the Federal government for buses and the infrastructure needed to support them—a subsidy to which the U-M does not have access. Greater integration of service could imply Federal subsidy for transit infrastructure that is currently borne by the U-M alone. With regard to the high-capacity Connector corridor, bus rapid transit may be lower cost than the rail-based options and, by accommodating bus routes from other parts of Ann Arbor and Washtenaw County, can improve transit mobility throughout the system.

Increasing the appeal and usefulness of the U-M transit system should increase the relative share of public transportation in the U-M commute. More people in the transit system means buses run more full more of the time, which leads to less CO_2 emissions per passenger mile surpassing even car- and vanpools. Since city transit systems have access to federal transportation funding, the extra expense the positive effect on emissions could be increased further simply through continued funding for hybrid and fuel cell buses (see Energy Section). U-M has purchased hybrid buses this year through the Clean Air Coalition funding but only covers these particular purchases.[xli] City-campus integration would allow regular federal funding for expanding hybrid bus passenger miles further reducing CO_2 per passenger mile by 30%[xlii].

Furthermore, reputational benefits could be gained in marketing the integration plan by demonstrating the sustainability benefits mentioned above. AATA and U-M integration would also aid in funding a high capacity transit route in Ann Arbor and across U-M. Integration will make AATA much larger and more eligible for increased federal funding for a high capacity transit route. The similar ridership volumes of AATA and U-M means U-M will have a key role to play in the planning but the economic success of any high capacity transit in Ann Arbor will depend on both AATA and U-M benefiting.

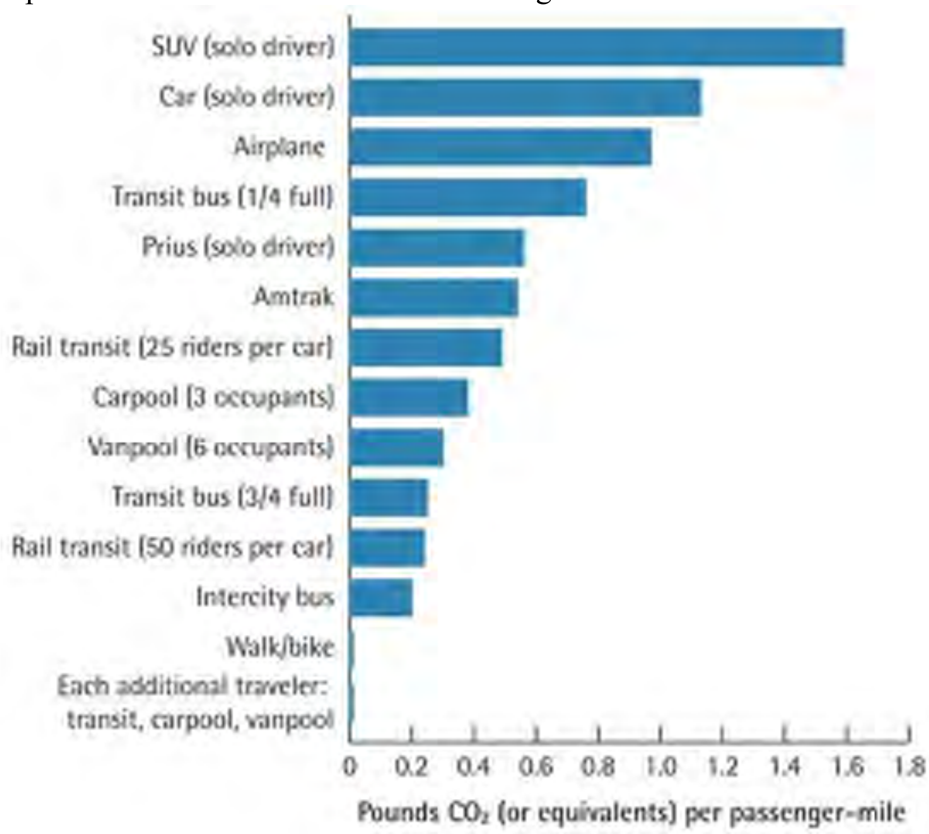


Figure 3-33 Different modes of transportation incur different amounts of emissions per passenger-mile with walking and biking the best and a full transit bus being one of the lease impactful per passenger-mile. (Source: Sight Line Institute)[xliii]

3.2.3.2 Technical Guidance

Improvements in transportation efficiency may be found in combining campus and city systems, perhaps working as a single provider. A transportation planning study points out at the University of Colorado: —students have very different schedules than the working public. Most student trips do not take place during peak hours, so adding students to the system does not force the transit provider to put additional buses on the road. Instead, students fill buses that otherwise are well below capacity during off peak hours. Thus, a substantial number of student riders can be absorbed at no cost to the provider, while helping with transit agencies' biggest PR problem- empty buses during off peak hours.”[xliv] Figure 3-38 shows the average ridership by hour, indicating that this may also be true in Ann Arbor. U-M buses reach their peak at nine and eleven in the morning and continue throughout the day. AATA experiences a peak at eight in the morning and dips in the later morning and early afternoon.

Two peer universities should be referred to in any future analysis of integration: the University of Wisconsin-Madison (UWM) and Michigan State University (MSU). Both schools place in their hometowns is similar to that of U-M, in that they are major economic contributors and represent a large portion of local transit ridership. UWM represents an example of sustained transit system use since Madison Metro/its predecessor was founded before a university system was needed, while MSU could provide many lessons in the smooth transition from a university-run system to a wholly city transit-run system.

The University of Wisconsin-Madison has boasted a city-integrated system maintained for over thirty years. The city buses are run by Madison Metro (a utility of the city) and, therefore, receive a mix of local/state/federal transit funding and fare-box revenue. The University is a major employer in the area, so these routes are well used and very productive for Madison Metro. The current integrated system pass for each UWM community member is currently valued at about $660 per year[xlv], which upon further investigation shows that varying levels of subsidy are used to fund the ‗free-to-rider' integrated system. UWM is a model to look to for after integration and a comparison in the planning improvements over their system.

The Associated Students of Madison (ASM, student government) provides —free” bus passes to students, Transportation Services provides —free” passes to employees of the university, and the UW Hospital (also located on campus) provides —free” bus passes to their employees. The ASM pass is paid for with student fees ($53.76/student). The Transportation Services pass is paid for with parking revenue while the UW Hospital pass is paid for by hospital revenue.[xlvi] Furthermore, the UWM —campus” bus is paid for 50% from parking revenue and a little less than 50% by student fees. A small percentage is also paid by housing to run a peak express bus to family student housing. Similar distributed transit funding could encourage various U-M departments to more fully utilize services available but this requires further study to finalize. Information gained from UWM, MSU and a pilot program at U-M will make clear the cost or savings associated with an integrated system vs. the current system at U-M.

Peak times are often over capacity. Currently the system handles about 1.5 million rides per year on the five campus-bus routes from the 42,000 students and the UWM+UWM Hospital employees take a little over a million (roughly 17,000 UWM + 3,500 UWM Hosp employees). These ridership levels are also growing every year. Approximately fifteen percent of both students and UWM employees take the bus to campus daily but only eight percent of the hospital employees. Furthermore, the employee pass program may be unsustainable, currently, however, and the university is anticipating the need for a nominal fee for the passes, perhaps $50-$150.

We have presented this information to inform decisions made on transit integration on the strategies and concerns present at peer institutions.

The benefits of a single system serving both town and campus are evident from the Madison route map. Some of the routes serving the campus corridors also extend into the city as shown in Figure 3-34. Routes 11, 27, 28, 38 and 44 should be specially noted because they serve both major on-campus and off-campus transit traffic. By contrast, U-M campus routes serve campus

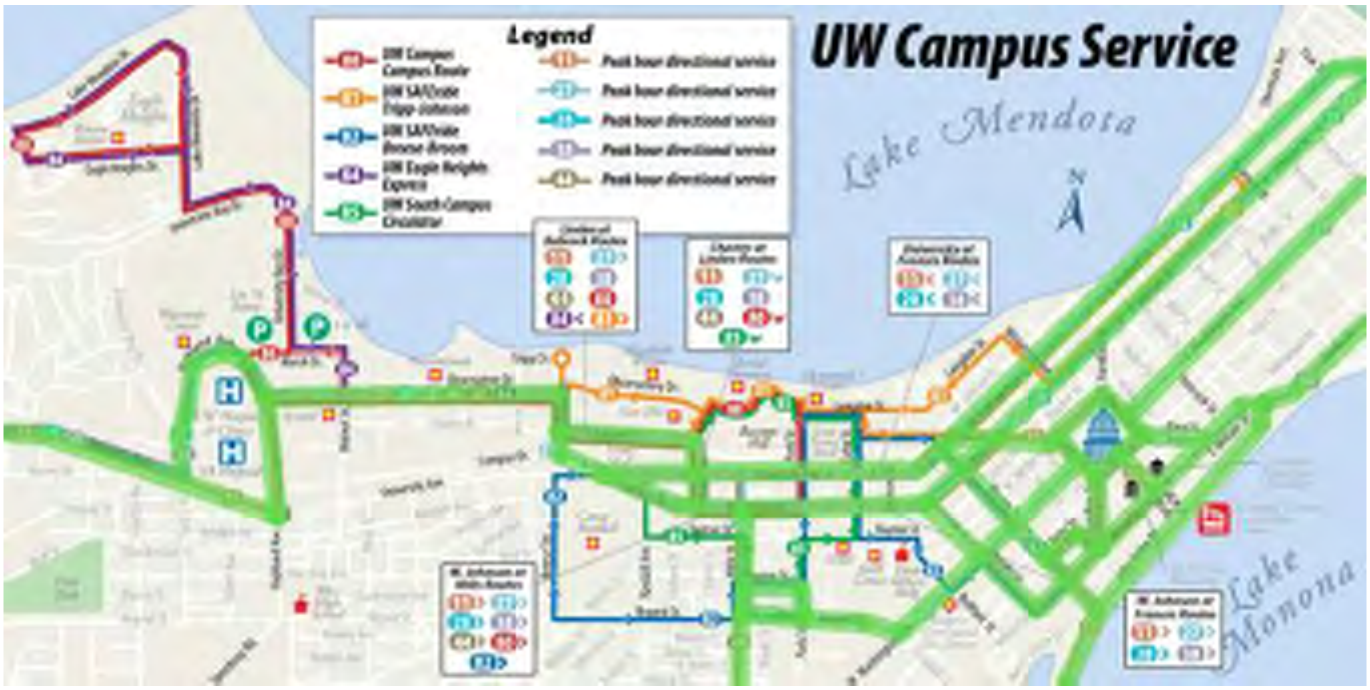
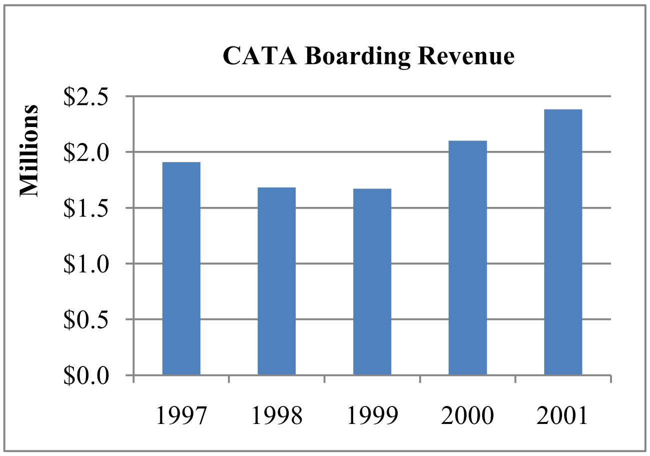


Figure 3-34 Current UWM / Madison Metro service map. Green highlights all routes that pass through campus and city. All routes numbered in the 80s are dedicated campus routes but all other routes on the map extend into the City of Madison, Wisconsin.[xlvii]

territory nearly exclusively (Figure 3-25) thus reducing the potential for transfer-free through movements.

While UWM shows the continued successful of an integrated system, MSU could serve as an example how to make the transition. In August 1999, the Capital Area Transportation Authority (CATA) in East Lansing, Michigan began a regional partnership with Michigan State University, which integrated bus services in the MSU community, East Lansing and Meridian Township. CATA offers all-campus fixed route bus service 24-hour service during the fall and spring semesters in addition to greater Lansing area.[xlviii]

The switchover significantly increased CATA's boardings, trips and passenger miles (Figure 3-35). The process involved a lot of stakeholder engagement including how to appropriately transform union university drivers to city drivers (student drivers were let go). Table **0-1** in the Appendix goes into specific detail of the changes before and after the integration. Figure 3-36 shows how some of the campus routes were integrated into the larger CATA system and expanded service within the campus.



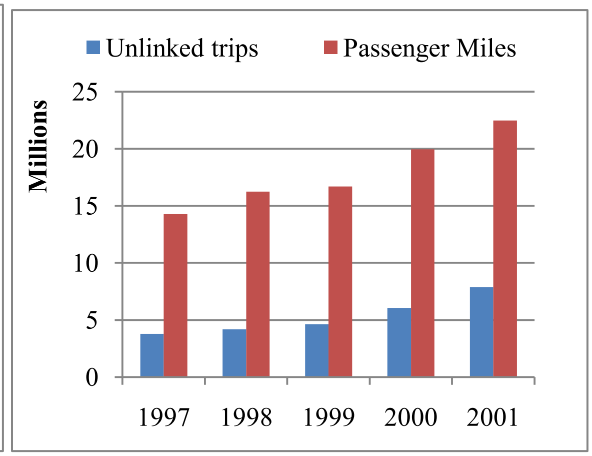


Figure 3-35 Michigan State University Integration occurred in 1999. Integration of MSU campus bus routes into CATA system is shown here with both fares and passenger use; both increased significantly.[xlix]

The experience of these two peer universities and the fact that several other peer institutions use city transit partnerships suggests that there could be major benefits for further integrating AATA and U-M routes. Currently, the MRide program provides good transit access for the U-M community but the transportation team envisions improved economic, environmental and social sustainability through further integration. Figure 3-37 shows both AATA and U-M bus routes. Notably, the overall routes overlap significantly, with multiple buses running along parts of Ann Arbor. In some cases multiple lines serving overlapping segments are needed; in other cases there may be foregone potential for system integration to support seamless transit mobility between town and campus.

Considering both Figure 3-36 and Figure 3-37, the overlap of AATA and U-M buses is even greater than MSU on-campus suggesting there may be many opportunities for combining routes in order to provider higher ridership per bus. Furthermore, taking ridership patterns into account, as shown in Figure 3-38, some bus routes could see a more stable utilization across an average day. Greater utilization across more hours of the day also means greater carbon dioxide and other emissions savings per passenger-mile.

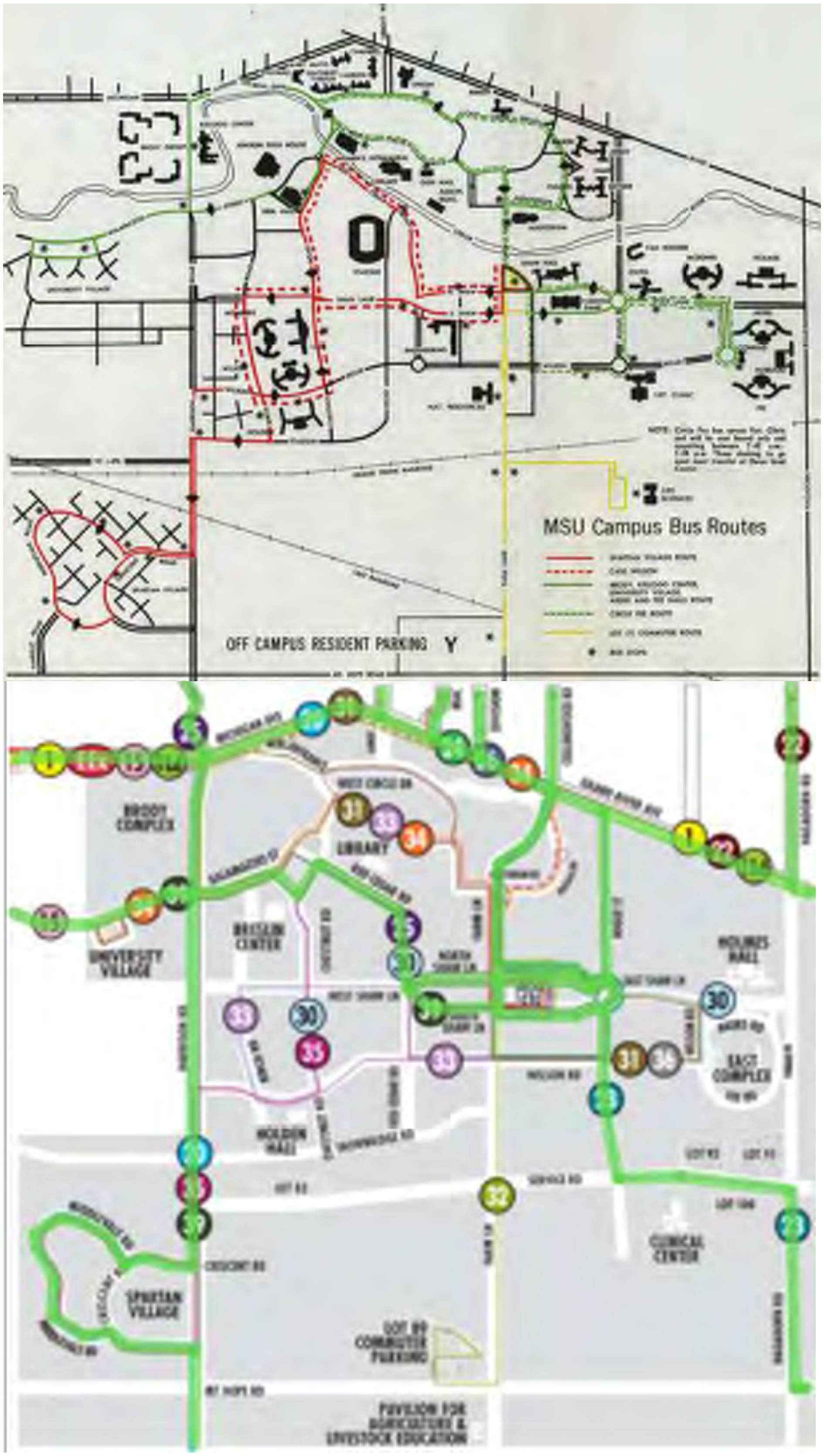


Figure 3-36 MSU transit pre- and post-integration. Green highlights show CATA lines that continue off campus.

Note: MSU-routes are 30-39 and CATA/MSU routes are 1-29. Spartan Village/ Case Wilson Routes split and gained coverage in 30, 35 & 39; Brody Route split among 34 & 39; Circle Fee Route expanded by 31, 33, 36; Lot Y Commuter Route covered by 32.

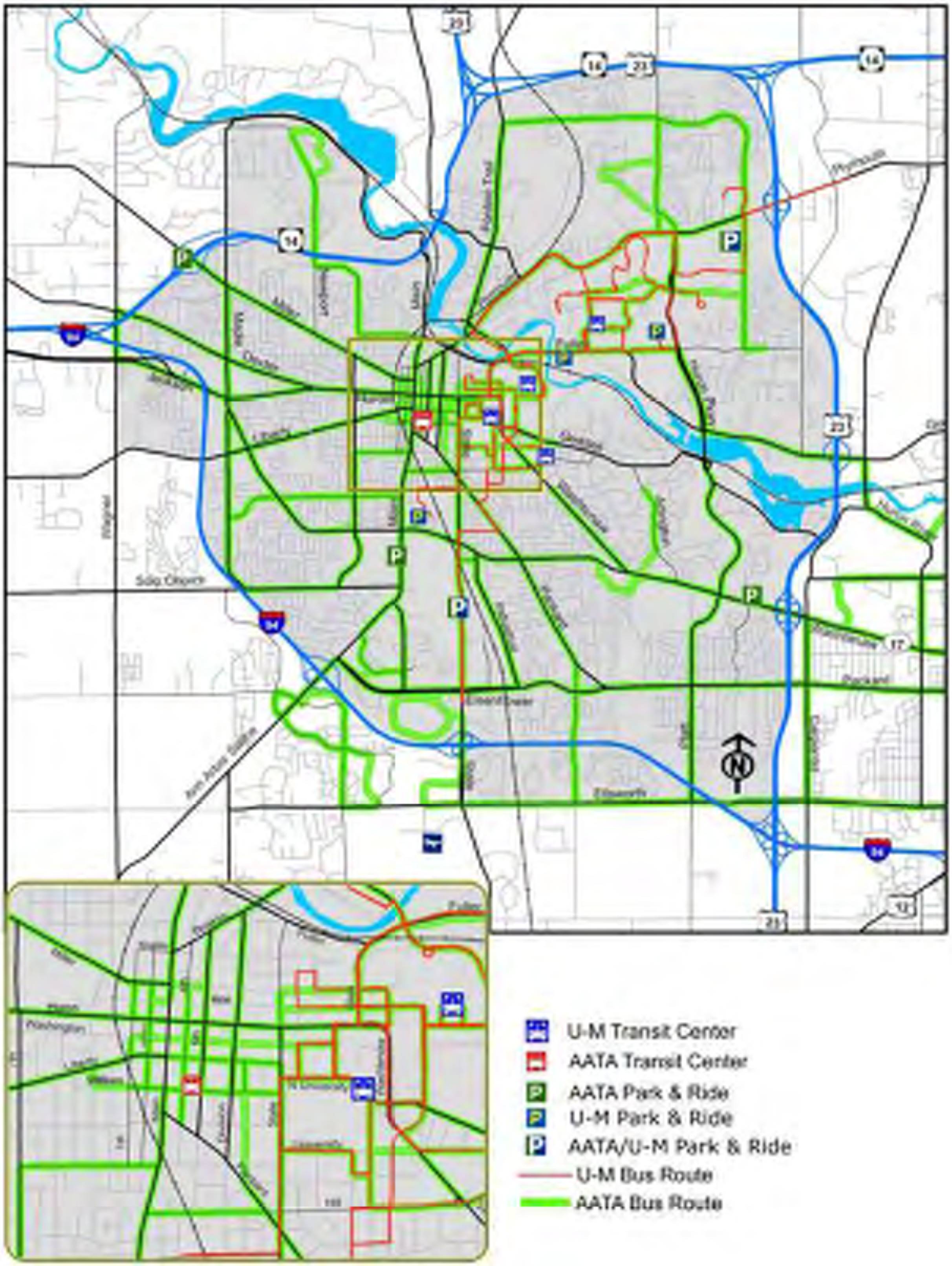


Figure 3-37 Map depicting both AATA and U-M bus routes along with Transit Centers and Park & Ride lots.[1] Notably, the routes overlap significantly. Most importantly, Medical Campus routes overlay AATA routes for a major of their run.

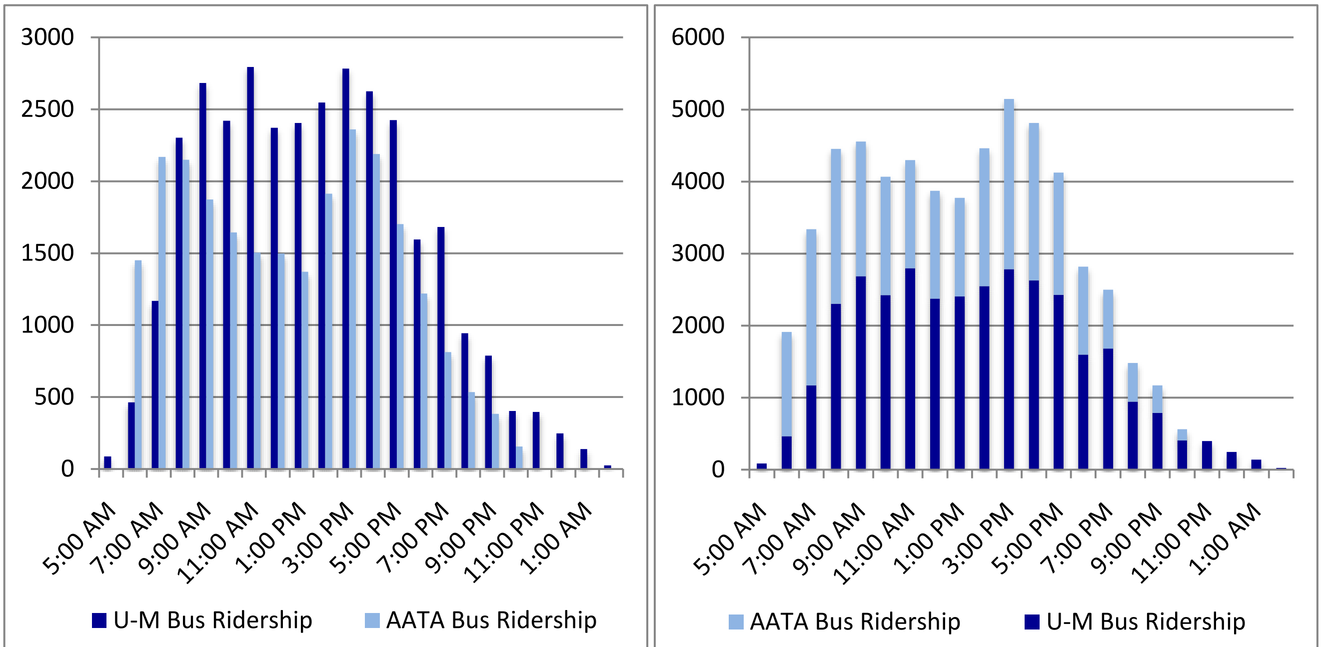


Figure 3-38 (Left) U-M bus[li] vs. AATA bus average ridership by hour[lii, liii] (Right) Estimated integrated U-M bus/AATA bus average ridership by hour

Pilot AATA, U-M transit integration on one route by 2013

Routes with especially low ridership and AATA overlap could be targeted to pilot AATA integration. The Mitchell-Glazier route meets these requirements; therefore, some amount of discussions should be arranged with Chris White at AATA. Discussions would address how AATA would best integrate the stops and traffic into their network without compromising rider experience for either hospital or AATA riders.

Fully integrate U-M transit into AATA (time frame based on pilot programs)

Change low ridership lines to AATA to increase route ridership and integrate on campus routes to go further into the community minimizing transfers during commutes. Considering the routes and current utilization of buses, U-M routes such as the Commuter North/South, North Campus, KMS, Mitchell-Glazier and Intercampus[liv] could all be incorporated into the AATA system with only minor adjustments to current AATA routes along those paths (further study will be needed with information gained from a survey like that in Section 3.3). Other U-M routes would need to remain on-campus-only loops due to rider saturation for those routes. To accomplish this transition, Parking and Transportation Services and AATA Service Development would need to work together to develop a comprehensive plan including route development, employee transition, bus transition, stakeholder engagement and marketing to make this plan work. Some general MSU transition points are listed in Table **0-1**, which should be considered in conjunction with lessons learned in a pilot program.

3.2.3.3 <u>Barriers to Implementation</u>

University of Michigan's current shuttle system functions fairly well, therefore, changing a system that does not seem to be broken may be seen as problematic. However, if the goal is reduce automobile miles traveled and congestion on campus, then a more seamless system between campus and city will allow and encourage transit utilization through convenience, federal funding and economies of scale. Furthermore, there remains possibility for union opposition to the switch over. The U-M hospital system pays for their shuttles between medical campuses; these are lightly used but demanded by the U-M health system.[lv] Some attempts were made by the health system to offer cabs, van-rides, etc. for trips between medical campuses but hospital staff opposed any moves to eliminate the dedicated health system bus routes despite unsustainably low ridership levels.[lvi]

3.2.3.4 Uncertainties

Both MSU and UWM represent analogous situations to that in Ann Arbor in that they are major contributors to the economy of their home cities and constitute a major portion of the transit use. However, the University of Michigan is a much bigger institution with higher ridership than either. Therefore, some uncertainty exists regarding total costs and benefits, and what routes would be most advantageously combined or eliminated to streamline traffic in those areas. However, other peer institutions schools (Table 3-5) regularly integrate their transit needs into the broader transit system for a variety of reasons including economies of scale and smoother connections to the city and other transport options such as the airport (Section 0 Implementation Idea #5: Simplify Campus-Airport Transportation). Furthermore, the MSU example suggests that integration can carry payoffs in terms increased use of transit system-wide.

Table 3-5 A list of U-M peer institutions that use public transit as primary campus-to-campus and campus-to-city connection, all other peer institutions have in-house services.

Peer University	Campus Transit System
University of Chicago	CTA + Limited Campus service between downtown & main campuses
Cornell University	Tompkins Consolidated Area Transit
Michigan State University	Capital Area Transit Authority
University of North Carolina at Chapel Hill	Chapel Hill Transit
New York University	Metro + Med Campus Shuttle
University of Wisconsin-Madison	Madison Metro

3.2.4 Implementation Idea #5: Simplify Campus-Airport Transportation

The generation of vehicle miles travelled and greenhouse gas emissions related to U-M are not limited to the geographic boundaries of campus. Students, faculty, staff, and potential students travel to and from campus. In Southeast Michigan, no comprehensive regional mass transit authority exists, and currently, there is no transit link from U-M to the Detroit Metro Airport (DTW).

Establish a direct campus or downtown to airport link by 2014

The University of Michigan has an opportunity currently to work with local and regional transit providers to enable an affordable, convenient link to Detroit Metro Airport via mass transportation. This is needed to bring the University of Michigan up to a regional transit baseline met by a large majority of its competitor institutions: a public transportation link between the campus and the metropolitan airport (Table 3-6). Out-of-state students are frequent airport users; easy transit connections between airport and campus can send them a message of welcome, particularly during crucial exploratory visits to campus. The proximity of a major international hub airport significantly raises the accessibility of the University of Michigan to the out-of-state student; improved campus-airport transit connections could fill in the missing link.

AATA is currently considering service between Ann Arbor and Detroit Metropolitan Airport (DTW), and is in discussion with Michigan Flyer, a private company that currently provides eight roundtrips daily between the south end of Ann Arbor and DTW for possible expansion of service. U-M could become a key player in these discussions, extending current MRide privileges to university travelers to the airport, and influencing the location and frequency of any future airport service.

3.2.4.1 Costs and Benefits

While plane flights contribute significant greenhouse gas emissions (Figure 3-33), it is important to recognize that members of the U-M community (particularly faculty on business travel and out-of-state students) will travel via plane so long as it is an economically cheap, and fast way to travel long distances. In the meantime, the lack of a transit link from U-M to DTW must be addressed.

AATA has estimated the costs of running an airport service to be roughly $1.6 million annually.[lvii] This estimate is for a service that would run by AATA with hourly frequency from 2 a.m. through 10 p.m. daily; however, it is also possible that AATA would instead choose to offer the service via subcontract with Michigan Flyer, a private operator that is currently providing airport service from the south end of Ann Arbor. Because U-M would not be the provider of the service, capital costs would likely be minimal. If the University of Michigan, however, became the primary user of such a service, it would likely be responsible for a large portion of the operating costs, but it would also reap substantial benefits.

Compared to existing service offered by Michigan Flyer, a service born from cooperation between the University and AATA, and possibly run by Michigan Flyer, would increase the daily frequency from 8 to 18 trips. The integrated service would likely have multiple stops in Ann Arbor, whereas the Michigan Flyer currently stops only at Wolverine Tower. Increased frequency combined with more stop locations greatly improves convenience of motorcoach transportation. If students, faculty, and visitors to the University were able to more quickly and more easily access a transit link between campus and Detroit Metro Airport, they would be more likely to choose mass transit over taxis and private vehicles. For each rider that chooses public transportation, traffic congestion on and around campus will be reduced and aggregate vehicle miles travelled will decrease. Emissions related to travel between campus and the airport would be greatly reduced, representing an improvement to climate health.

Despite the financial costs of partial support for an airport transit link, working with local and regional entities to establish transit between Ann Arbor and Detroit Metro Airport would also offer the University the potential for cost savings. A bulk buy agreement would reduce the marginal cost of round-trip University ridership to $0. If volumes were high enough, the averaged fixed costs of a bulk buy could become less than the existing marginal costs of reimbursing a faculty member for a taxi ride ($49 round-trip[lvii]) or a private vehicle trip (50 cents per mile[lviii] plus at least $8 per day for parking[lix]) to the airport when faculty are travelling on University business.

Increased promotion of campus-airport transit by 2012
The community would also see spillover benefits from this service. U-M would be able to promote community awareness regarding mass transportation through its actions. An integrated airport service would benefit not only University traffic, but also citizens of Ann Arbor who are unaffiliated with U-M that use the service. When compared to its peer institutions, U-M falls behind in airport transit. The majority of U-M's peer institutions are accessible from the airport via some form of mass transportation, and a significant portion of these schools promote these easy-to-use transit links on admissions and recruiting webpages (

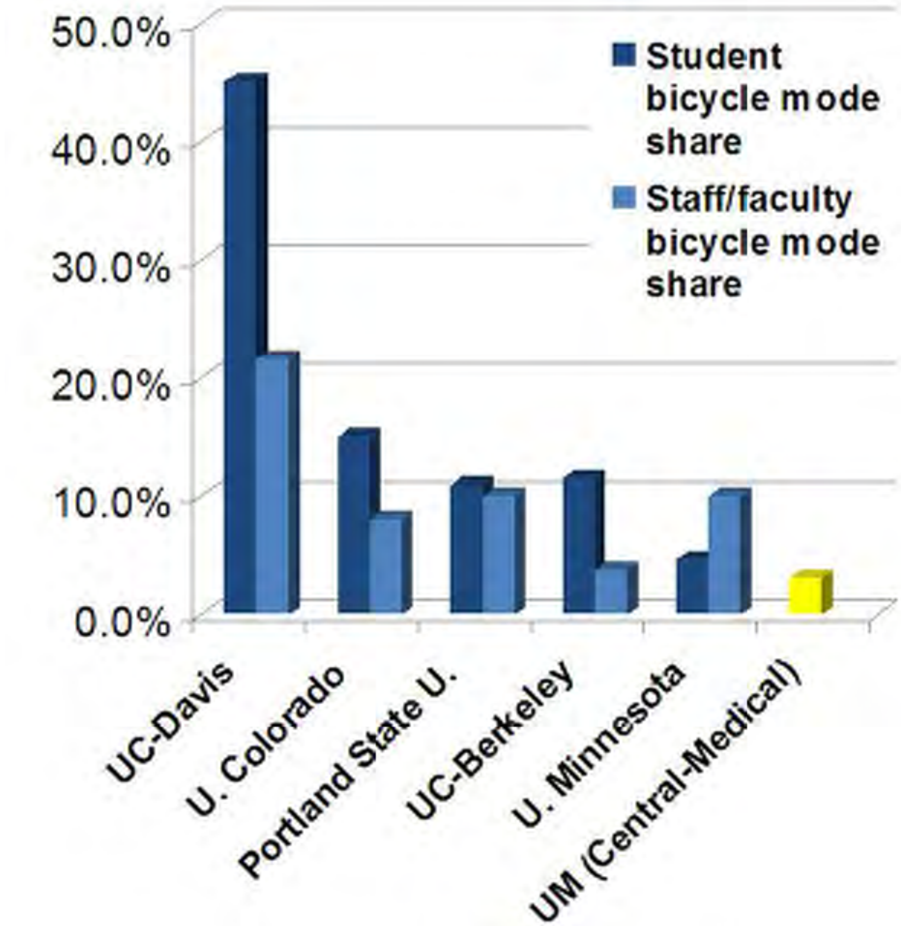


Figure 3-6). Taking the lead on creating a seamless, popular transit route between campus and the airport would also provide U-M a reputational benefit. Reductions in cost, vehicle miles travelled, and carbon emissions will benefit not only U-M and its visitors, but also Ann Arbor at large.

3.2.4.2 Technical Guidance

Establish a direct campus or downtown to airport link by 2014
The MSA airBus has proven to be a success among students travelling to the airport before breaks. Annual ridership rose from 2663 in 2002-03 to 11,659 in 2006-07 as services were extended and operational procedures were improved.[lx] The airBus has proven to be effective at marketing and informing students about the services it offers. In addition, the operations of airBus have incorporated cooperation with the Michigan Union Ticket Office (MUTO) for

ticketing and Student Financial Operations (SFO) for charging fares to student accounts. This cooperation among various units makes the experience for the airBus's customer base more convenient and serves as a model for streamlined operations that promote convenient, affordable transit for students.

Integrate a U-M to airport link into U-M transit

The University of Michigan already has experience with successful mass transit systems. The MRide program is an existing contract between U-M and AATA, which allows faculty, staff, and students to ride on fixed-route AATA buses free by showing a valid MCard. The $1.8 million per year contract is funded both by U-M and by federal funds U-M earns through transit operations.[lxi] This relationship has proven to be mutually beneficial for U-M and the City of Ann Arbor, as U-M affiliates are given free access to local transit and AATA saw increased ridership, which reduces the parking demand, congestion, and pollution related to motor vehicle traffic. Much like MRide, U-M's position as an anchor tenant of an airport service could provide to be a mutually beneficial relationship.

Table 3-6 Comparison of top universities' connections to airport through transit options. Criteria: Airport Mass Transit Exists is defined affirmatively only when a mass transit system is in place that allows members of the respective schools' communities to travel from a nearby or major airport without having to transfer into a different transit system. Transit listed on U website is defined affirmatively if mass transit exists and it is promoted as a way to travel to or visit on prospective student or admissions webpages.

Rank[lxii]	School	Location	Airport Mass Transit Exists	Transit on U website	Comments
1.	Harvard University	Cambridge, MA	Yes	Yes	Served by subway from Logan Airport and from South Station for $2 fare.
2.	Princeton University	Princeton, NJ	Yes	Yes	NJTransit/Amtrak trains can take visitors from Newark Airport to Princeton.
3.	Yale University	New Haven, CT	Yes	Yes	CT Transit bus service G-Route stops at Tweed-New Haven Airport and stops downtown within walking distance of the Yale campus.
4.	Columbia University	New York, NY	Yes	Yes	M60 bus route from LaGuardia goes to campus for $2.
5.	Stanford University	Stanford, CA	Yes	Yes	Caltrain connects Stanford to airports in San Jose & San Francisco
5.	University of Pennsylvania	Philadelphia, PA	Yes	Yes	SEPTA Airport Line Regional Rail stops the University City Station
7.	California Institute of Technology	Pasadena, CA	Yes	Yes	Flyaway bus service from LAX to Union Station in downtown LA. Then requires a light rail transfer and then another transfer to a bus. Shuttle vans from LAX.
7.	Massachusetts Institute of Technology	Cambridge, MA	Yes	Yes	Can get from Logan Airport to MIT by using MBTA subways and/or buses.

9.	Dartmouth College	Hanover, NH	No	N/A	Rental cars & car service only.
9.	Duke University	Durham, NC	Yes	No	Triangle Transit offers bus service from Raleigh-Durham Airport to Duke.
9.	University of Chicago	Chicago, IL	Yes	Yes	Access from Midway & O'Hare to downtown Chicago via train, bus, or shuttle.
12.	Northwestern University	Evanston, IL	Yes	Yes	Service from Midway & O'Hare to campus via the El. O'Hare also enables bus service.
13.	Johns Hopkins University	Baltimore, MD	Yes	Yes	Many public transportation links listed for visitors. Link to MTA allows trip planning, which yields a trip to campus from BWI via light rail and subway.
13.	Washington University in St. Louis	St. Louis, MO	Yes	Yes	MetroLink provides access from Lambert-St. Louis International Airport to campus.
15.	Brown University	Providence, RI	No	N/A	RIPTA bus from TF Green Airport stops several blocks away from campus, and Peter Pan motorcoach from Logan Airport stops several blocks away from campus as well. Not within walking distance for people carrying luggage.
15.	Cornell University	Ithaca, NY	No	N/A	Airport taxi & limousine services only.
17.	Rice University	Houston, TX	Yes	No	Rice recommends using a van service or renting a car. There is Metro bus service from George Bush Intercontinental Airport to campus (1 transfer), but the journey takes 90 minutes to go about 24 miles.
17.	Vanderbilt University	Nashville, TN	Yes	No	Nashville MTA bus routes go to Vanderbilt with one transfer. Driving directions only on VU website.
19.	University of Notre Dame	South Bend, IN	No	N/A	Taxi & rental car only from South Bend Airport. Bus only from O'Hare.
20.	Emory University	Atlanta, GA	Yes	Yes	Train from airport to MARTA, transfer to bus.
22.	University of California – Berkeley	Berkeley, CA	Yes	Yes	BART system allows visitors to get to campus from Oakland International Airport.
25.	University of California – Los Angeles	Los Angeles, CA	Yes	No	Big Blue Bus routes serve LAX and UCLA, but University website directs visitors to drive and take the 405 from LAX. Bus routes with service to UCLA are listed, but not in a visitor-friendly manner.
25.	University of Virginia	Charlottesville, VA	No	N/A	Van services and taxis only from Charlottesville Airport. Driving directions heavily promoted.
29.	University of Michigan	Ann Arbor, MI	No	No	Michigan Flyer offers bus service from DTW, but Ann Arbor stop is out of walking distance

					to campus. Requires transfer to AATA Route 36, which only operates on weekdays. A link to this service is hidden on the Campus Information Centers website.
30.	University of North Carolina	Chapel Hill, NC	Yes	No	Triangle Transit offers passage with one transfer from Raleigh-Durham International Airport, but visitor websites only offer driving directions.
33.	New York University	New York, NY	Yes	Yes	From any of NY's major airports, campus is accessible via routes utilizing bus and subway.
45.	University of Texas	Austin, TX	Yes	Yes	Capital Metro Airport Shuttle route runs between campus and Austin-Bergstrom International Airport.
45.	University of Wisconsin	Madison, WI	Yes	No	Metro Transit bus routes service Dane County Regional Airport and UW-Madison campus. Coach USA offers 10x/day service between O'Hare Airport and Madison.
56.	University of Maryland	College Park, MD	Yes	Yes	Itinerary and fare information listed for visitors arriving via Reagan National, BWI, and Dulles Airports.
64.	University of Minnesota	Minneapolis, MN	Yes	No	Driving directions only promoted; Minneapolis Hiawatha Light Rail and bus system provide transit from MPS Airport to campus.

3.2.4.3 Barriers to Implementation

Having convenient, affordable mass transportation to Detroit Metro Airport will likely require an agreement that includes AATA, Michigan Flyer, Indian Trails, and U-M. Cooperation and negotiation must be undertaken by each of these entities if this frequent transit link is to come to fruition.

Additionally, a culture that favors the convenience of taxis and private vehicles for airport transportation exists on campus. For airport transit to be successful, community support will be required as there may be come economic impacts to the local community vendors such (taxis, etc.) and as U-M seeks to eliminate another $120 million in spending by 2017[lxiii], faculty taking stake in airport service becomes even more critical. There is a potential for cost savings to U-M if faculty travelling on business use this service in lieu of private vehicles and taxi rides, but if the service is implemented and faculty continue to be reimbursed for private vehicle trips to Detroit Metro, the financial costs of transportation to U-M will only increase.

3.2.4.4 Uncertainties

The actual financial cost of operating an 18-trip-daily airport mass transportation link is unknown. AATA's $1.8 million per annum represents a rough estimate. If this figure is close to the actual costs, how the service would be funded is uncertain. U-M would likely be responsible for a large portion of these costs, but the size of this portion is unknown, as is the method used to determine U-M's share of the costs (e.g. bulk buy or unlimited access agreement versus per-use reimbursement).

Additionally, a projected ridership for this service is unknown. Michigan Flyer reports that approximately 27.5 passengers use their existing service between Ann Arbor and the airport daily.[lvii] Increased frequency and better location would likely increase ridership, but a significant increase in ridership would be required for financial sustainability. The extent to which U-M faculty and staff would be willing to use this service for business travel is a critical but unknown piece of information.

A route featuring stops pleasing to both the clientele of both AATA and U-M must be developed before airport transit is implemented. The route must make multiple stops within Ann Arbor, and at least one of these stops should have accommodations for park and ride customers. Where the best stop locations are and how passengers could be accommodated at these locations remain undetermined.

3.2.5 Implementation Idea #4: Unify Goods Movement

The movement of goods at the University of Michigan is currently a decentralized system. Each individual unit within U-M determines how best to procure courier services or how personnel should handle needs to move parcels and letters around campus. The result is a system that in aggregate consists of dozens of parallel efforts. The University of Michigan should create a consolidated courier service operated by Mail Services. A centralized service would be accessible to all units, and would have the potential to create an enormous gain in efficiency of money and resources.

3.2.5.1 Costs and Benefits

Under the current, by-unit system, redundancies in personnel and equipment (mainly vehicles) are created. A consolidated service would remove these redundancies, saving U-M money in aggregate. Because one entity would be responsible for the needs of the entire campus, it would create economies of scale, thus decreasing operating costs; these savings could be passed down to various departments and units that previously used decentralized courier services. Additionally, departments would not be forced to make the decision of whether to engage courier services in general, but rather whether they need courier services on a per-parcel or per-letter basis. (An important distinction, as a department that already has leased a vehicle solely or largely for meeting courier needs then becomes more likely to use this vehicle to deliver its mail, adding to the total vehicle miles travelled on campus.)

When each department is using its own courier, there is no coordination with the courier practices of other units. Rather than having one unit handle the courier needs for the entire campus, each department instead sends an individual or hires a service for its needs, which constitute only a small proportion of the aggregate need of U-M. Thus, couriers who are working under different employers create redundant trips and extra VMT. A consolidated service would end this lack of coordination, thus reducing vehicle miles travelled and traffic volumes (and emissions) related to mail and courier services on campus. Vehicles currently leased for courier services on campus could also be repurposed for academic uses, lowering the opportunity cost of courier services, and reducing the materials footprint of courier transactions on campus.

Departments that currently operate without a dedicated courier could also see rises in staff efficiencies. Sending a staff member out with the sole task of delivering one item fails to employ the synergies or multitasking that would be practiced by a consolidated campus service. Instead, the campus service could pick the item up and deliver it, eliminating the need to send the staff member out to deliver the item.

3.2.5.2 Technical Guidance

Existing Campus Mail services already delivers over 10,000 pieces of campus mail daily.[lxiv] Parcels delivered to campus addresses via USPS are also routed through Mail Services' sorting facility, which reduces the amount of traffic on campus by eliminating the need for USPS drivers to deliver parcels throughout campus.

Establish the level of current courier-use by 2012.

Campus Mail could carry out a survey of departments to assess the total need for courier services. Taking this information an appropriately sized program could be put in place. The survey would also inform the level a savings or efficiencies to be gained.

Integrate courier service into campus mail service by 2015

While significant changes would have to be made to the operations of Mail Services, particularly in the area of prioritizing and sorting mail by time sensitivity, Mail Services is currently the best equipped entity to handle a consolidated courier service because of its existing sorting facility and experience coordinating campus deliveries. For general mail delivery, software has been used to ensure that current delivery practices and routes are efficient, and the same principle could be applied to courier services. Many detailed decisions on building an integrated courier service will need to be based on the courier survey mentioned above.

3.2.5.3 Barriers to Implementation

Mail Services would have to expand beyond centralized service for general mail into the field of immediate-need courier services. There would likely be initial investment costs related to building new capacity and expertise for Mail Services. New software and personnel that are not needed for centralized mail delivery may be required for courier delivery.

Additionally, without a widely distributed survey with a high return rate among department heads, it is difficult to assess the volume of courier services that are currently used on campus. The shared courier service would have to meet the needs of the diverse units at U-M and be more cost efficient when compared with third party vendors or hired work study students to be widely adopted by U-M departments, as mandates are not politically feasible.

3.2.5.4 Uncertainties

The reality of what currently occurs on campus is unknown. Detailed information regarding courier uses and needs would be required to model an effective system, but this information does not currently exist, thus, information gathering will be critical to planning a shared service, as the needs of different departments regarding time sensitivity of shipments and final destinations must be determined. U-M current mail service could be modified to allow for in-house courier services but further investigation of departmental expenditures will be needed to determine a payback period for this project, though once running, a centralized service would almost assuredly decrease operating costs and traffic on campus when compared to the current decentralized systems.

3.3 Prioritized Recommendation C: Track Transportation Habits of Campus Stakeholders

Effective transportation system planning requires data on transportation patterns and trends. Despite the magnitude of the transportation system it operates, U-M does not regularly collect information on community members' transportation patterns, making the task of planning difficult. Examples from peer institutions suggest how an annual or biennial U-M transportation survey might be conducted, enabling data-driven planning and significant cost savings.

3.3.1 Benefits and Costs

U-M's regularly updated sources of transportation data consist primarily of parking system utilization data and the U.S. Census. As a result, limited information exists on student, faculty or staff ―mode split," the proportionate use of different means of transportation. In addition, information on trip origins exists only at the county level. The result is that U-M has limited knowledge on where community members are commuting from and how they are commuting. U-M's transportation expenditures are significant long-term investments in fixed physical infrastructure, so transportation system development conducted with limited knowledge of current and future trends comes at a heavy cost. A regular transportation survey could avert tens of millions of dollars in unnecessary spending at a minimal cost.

3.3.2 Technical Guidance

An annual or biannual community survey would provide an invaluable aid for charting U-M transportation trends. At peer institutions, these surveys are typically administered over e-mail by the university transportation and parking department, sometimes in conjunction with academic units in the transportation field. A graduate student conducts the University of California at Davis campus travel survey.[lxv] At U-M, such a partnership would likely involve Parking and Transportation Services (PTS) and the Taubman School of Architecture and Urban Planning, and/or U-M Transportation Research Institute (UMTRI). A random sample of students, faculty and staff would be required. At Portland State University, separate biannual surveys of students and faculty/staff are conducted in alternating years.[lxvi] Commute surveys can also be combined with other surveys, as in the University of California at Berkeley's transportation and housing survey.[lxvii]

The two most critical survey areas are trip-to-campus mode and trip origin (residence address). Together, these make possible a detailed analysis of community transportation patterns. To capture the rationale for existing patterns, and facilitate a shift to more sustainable transportation modes, additional questions on the reasons for mode choice would be useful as well. A U-M graduate student under the supervision of faculty and staff would perform appropriate analysis of results. Past surveys from the University of California-Davis, Michigan State University, and Portland State University can provide more detailed guidance. A sample of potential survey questions is provided below. Additional questions specific to the U-M parking system might be useful as well.

<u>Sample Transportation Survey</u>

1. How far is your residence from your major place of work or class on campus?
   (less than 0.5 miles, 0.5-1 miles, 1-1.5 miles, 1.5-2 miles, 2-3 miles, 3-5 miles, etc.)
2. What was your major means of transportation *to campus* each day *last week*?
   (live on campus, drove alone, motorcycled, was dropped off, carpool, U-M bus, AATA bus, bicycled, walked, used U-M park and ride, used AATA park and ride, other)
3. What was your major means of transportation *on campus* each day *last week*?
   (drove alone, motorcycled, was dropped off, carpool, U-M bus, AATA bus, bicycled, walked, used U-M park and ride, used AATA park and ride, other)
4. By *term* (winter, spring, summer), how do you usually travel *to* campus?

5. By *term* (winter, spring, summer), how do you usually travel *on* campus?
6. If you drive alone, check up to three reasons why.
   (Saves time, need car at work, weather unpleasant, no transit where I live, etc.)
7. If you use transit, check up to three reasons why.
   (Saves time, saves money, don‘t own car, can read or work during commute, etc.)
8. What is your residence address?

3.3.3 Barriers to Implementation

Survey design and administration would require cooperation between the U-M units involved. If a student is hired to administer the survey, some additional funds would be necessary as well. However, the task would not require more than a one-semester part-time position each year.

3.3.4 Uncertainties and Concerns

Determining trip origins can be a particular challenge, since some people are reluctant to provide their home address on request. In one Portland State University survey, fewer than half of respondents provided it[lxviii]. However, even this low response rate provided sufficient information for substantial analysis, and U-M could consider incentives to promote full responses.

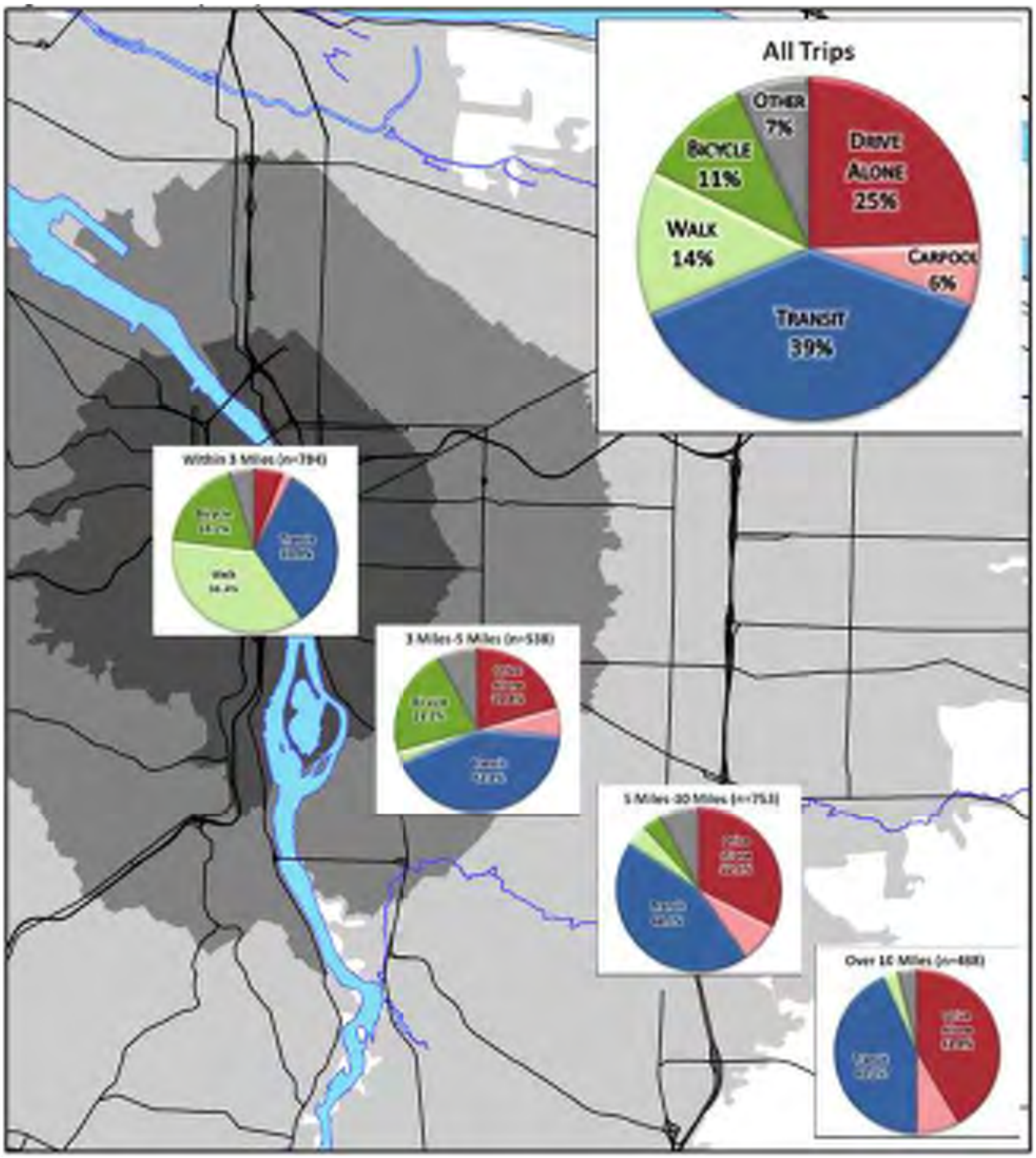


Figure 3-39 An example of information that could be gained by an annual survey, PSU's Mode Split by Distance. Portland State University

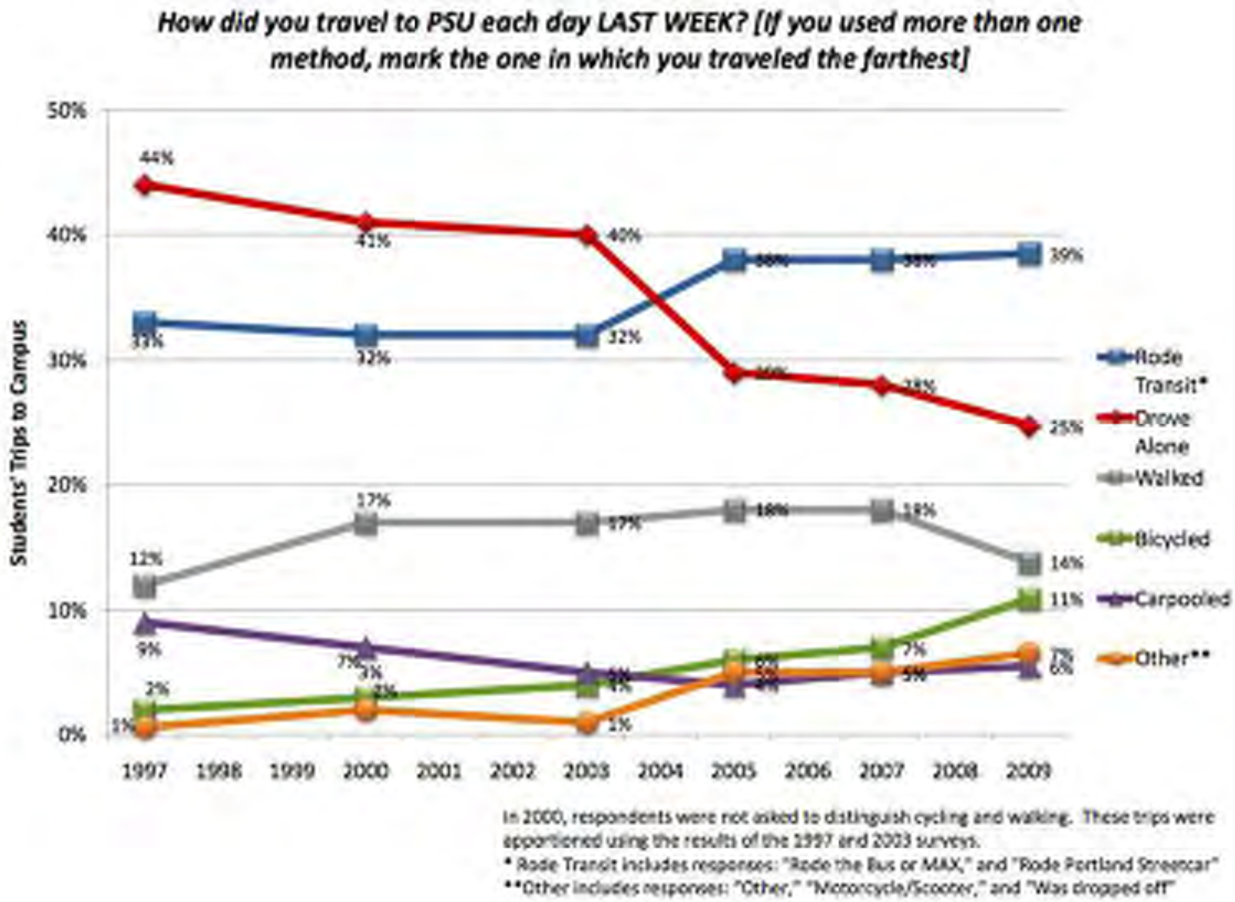


Figure 3-40 Regular surveys can provide invaluable information on commute patterns. *Portland State University*

4 Integration and Conclusion

During Phase II it became obvious that although we were working on the transportation mode choices and land use options, some of our ideas coincided with the energy team's investigation of energy technologies. Our take on the some of the energy team's contributions simply looks at the utilization of technologies to cause a reduction in environmental effects. For example, the energy team looked at utilizing more hybrids in the vehicles, while we looked at how to encourage people to use hybrids or other modes of transportation that could also reduce U-M's impact. For many points made in this report, that relates to some complex solutions that may need for examination or pilot programs to fully implement. If further investigations or pilot programs give encouraging results we hope it will make sense to continue towards more ambitious goals.

Economic Aspects

Capital Costs

- The capital costs of all three parking options are very attractive because increasing parking-rate differentiation and reducing parking subsidies could work inside the systems already in place. Furthermore, reducing parking subsidies could, in fact, raise parking

revenue initially. Shifting from monthly or annual parking payment may require installation of card readers at each parking lot but this remains relatively lower than other transportation options covered in this report.
- The development of a campus bicycle master plan, contracts for bicycle services and expansion of parking facilities ranks somewhere fairly favorably in capital costs in comparison to other options. More expensive bicycle facility options such as a bicycle service center or rentals could prove more less favorable to other options at $200,000-$500,000. Development of an intercampus bikeway network and open card-swipe bicycle sharing system could prove to be one of the more expansive options we have covered at $2-10 million.
- Initiating the planning process for diversify land uses, adding sidewalks and ADA compliant curb ramps should remain about equal in capital costs as our bicycling first step but still more expensive than other measures. Continuing the planning process and completing the sidewalk network and improving street crossings may prove slightly more expensive or significantly more expensive than the first pedestrian option depending on the need but still more expensive than other options. Finally, pedestrian extentsions and transit mall development may prove to be the most ambitious in capital costs.
- Transit integration is one of our better options in transportation because there will be savings in paying a flat rate to AATA instead of buying new buses for replacement or expansion.
- Simplifying good movement will require further investigation to determine the amount, if any, of the capital costs.
- Off-campus travel options are not currently projected to require any capital investment since connections to the airport will be handled by systems already in place.
- A transportation habits survey of the will require the least capital investment out of the options we have suggested since it does not require any new equipment and could simply added to programs that are already in place.

Operating Costs

- Similar to the capital costs, all three parking options are very attractive because some increasing parking-rate differentiation will not change operations much, reducing parking subsidies will bring in more revenue and once installed, card readers will not have high operating cost to carry out the shift from month or annual parking payment.
- The operating cost of all our bicycle options will prove more attractive than the capital cost involved because bicycle services will not require significant funding and parking facilities require even less funding. An on campus service center could sustain itself through maintenance fees but bicycle rentals could require some funding but some could come from the service center. A bikeway network would not need more upkeep than is currently spent on pedestrian walkways and an open card swipe bicycle sharing system could prove self-sufficient.
- All pedestrian options could prove very minimal for operating costs therefore most of the cost involved will come from capital investment.
- Transit integration is one of our better options in transportation because there will be savings in paying a flat rate to AATA instead of paying fluctuating fuel prices and maintenance.

- Simplifying good movement will require further investigation to determine the operating costs.
- Establishing any kind of direct campus to airport connection will require some new operating expenses to attract private shuttle companies to make a stop on-campus, therefore, we have ranked operating costs of these options to be lower on the list. However, the more minor marketing of current systems would have a very low operating cost since this would primarily involve updating PTS‘s website.
- A transportation habits survey would also require very little up keep, cost-wise, since it could be interwoven into other annual information gather such as the Annual Environment Report performed by Occupational Safety & Environmental Health

Payback

- All parking options are meant to reduce automobile traffic coming to campus; therefore, some level of parking reduction is intended with all the mention parking options. Cost savings associated with any parking structures forgone or parking subsidies reduced should counteract this effect or even increase parking revenue for a time.
- Payback for all the bicycle options mentioned will be one of the best options in transportation. In the short term, payback may only come in the form of attracting students to the campus through the ease of bicycle use. However, in both the mid- and long-term plans, there remains room for operations to go beyond attracting students by becoming financial self-sufficient or even contributing to further improvements.
- Payback for all the pedestrian options will come in the form of a more attractive and enjoyable campus, which could attractive more competitive students.
- The payback period for a transportation integration program may not be as good as some of our other options because true difference between a flat rate and the variable cost involved cannot be predicted without further investigation. The pilot program involving one-route integration will give some better idea of the savings and payback period.
- Simplifying good movement will require further investigation to determine the payback.
- Establishing any kind of direct campus to airport connection will require some new operating expenses to attract private shuttle companies to make a stop on-campus, therefore, we have ranked payback period of these options to be lower on the list. However, the more minor marketing of current systems may have a much quicker payback since this would primarily involve updating PTS‘s website.
- The payback for a transportation habits survey would come through future campus planning officials having more information on the nature of commuting to and around campus. Planning can then react to more comprehensive information allowing for more educated decisions concerning land use and transportation.

Environmental Aspects

Climate

- Since all three parking options are meant to encourage alternative means of commuting to campus, each option should yield some amount of automobile related carbon emissions as well as reduce carbon emissions associated with building the infrastructure (lots and structures). Parking-rate differentiation will offer the least carbon savings while reducing

subsidies and shifting monthly or annual payments will offer more savings. These should remain the one of the most effective options for climate.
- All the bicycle mode options suggested in this report enhance an emissions-free commute. Simply by improving the infrastructure for bicyclists, gains in this mode choice could be seen. If any riders shift from driving to biking then that eliminates almost all emissions (save for some in upstream manufacturing), therefore this is one of the best transportation options for climate.
- All the pedestrian options suggested in this report enhance an emissions-free commute. Simply by improving the infrastructure for pedestrians, gains in this mode choice could be seen. If any shift from driving to walking for any of their daily activites then that eliminates almost all emissions (save for some in upstream manufacturing for infrastructure), however, since walking will only replace the shortest of trips, other options may make more significant gains.
- More people in the transit system means buses run more full more of the time, which leads to less CO_2 emissions per passenger mile surpassing even car- and vanpools. Since city transit systems have access to federal transportation funding, the extra expense the positive effect on emissions could be increased further simply through continued funding for hybrid and fuel cell buses
- Unifying goods movement requires more investigation to determine the true impacts on the climate. Logically, if private courier services are primarily using automobiles to move time-sensitive materials around campus then integrating this into a centralized on-campus system using either delivery vehicles already en-route or bicycles will have less carbon emissions than automobile use per package.
- Any of the proposed simplification the U-M campus-airport connection solutions would provide similar benefits to increased bus utilization but remain benefits remains lower than other options because of the shorter mileage involved annually.
- The transportation survey will have only indirect effects, therefore, not rating was given.

Ecosystem Health

- Since all three parking options are meant to encourage alternative means of commuting to campus, each option should yield some amount of automobile related pollutant emissions as well as reduce pollutant associated with building the infrastructure (lots and structures). Parking-rate differentiation will offer the least improvement while reducing subsidies and shifting monthly or annual payments will offer further improvements. These should remain the one of the most effective options for ecosystem health.
- All the bicycle mode options suggested in this report enhance an emissions-free commute. Simply by improving the infrastructure for bicyclists, gains in this mode choice could be seen. If any riders shift from driving to biking then that eliminates almost all emissions (save for some in upstream manufacturing), therefore this is one of the best transportation options for ecosystem health.
- All the pedestrian options suggested in this report enhance an emissions-free commute. Simply by improving the infrastructure for pedestrians, gains in this mode choice could be seen. If any shift from driving to walking for any of their daily activites then that eliminates almost all emissions (save for some in upstream manufacturing for

infrastructure), however, since walking will only replace the shortest of trips, other options may make more significant gains.
- More people in the transit system means buses run more full more of the time, which also means less infrastructure upkeep (and related emissions), other fossil fuel emissions and less tire-wear particulates moving into water ecosystems. This is somewhere in the middle on our priority list because transit still involves all those infrastructure emissions, fossil fuel emissions and tires even though it is lower than automobiles
- Unifying goods movement requires more investigation to determine the true impacts on the climate. Logically, if private courier services are primarily using automobiles to move time-sensitive materials around campus then integrating this into a centralized on-campus system using either delivery vehicles already en-route or bicycles will have fewer pollutants than automobile use per package.
- Any of the proposed simplification the U-M campus-airport connection solutions would provide similar benefits to increased bus utilization but remain benefits remains lower than other options because of the shorter mileage involved annually.
- The transportation survey will have only indirect effects, therefore, not rating was given.

Materials Footprint

- Conversely to the parking options' effects of other environmental aspects, these are not expected to have as significant effect on materials footprint. The options may eliminate the need to build new parking lots or structures but will, likely, not significantly reduce the materials footprint of transportation at U-M directly.
- If any shift from driving to biking then that eliminates almost all materials associated with operating and, prolongs or eliminates the need to purchase a vehicle, therefore this is one of the best transportation options for improving materials footprint.
- If any shift from driving to then that eliminates almost all materials associated with operating and, prolongs, the need to purchase a vehicle, however, since walking will only replace the shortest of trips, other options may make more significant gains.
- More people in the transit system means buses run more full more of the time, which also means less infrastructure upkeep (and related materials), less automotive parts and tires per commuter. This is somewhere in the middle on our priority list because transit still involves all those infrastructure materials, parts and tires even though it is lower than automobiles
- Unifying goods movement requires more investigation to determine the true impacts on the climate. Logically, if private courier services are primarily using automobiles to move time-sensitive materials around campus then integrating this into a centralized on-campus system using either delivery vehicles already en-route or bicycles will have less infrastructure materials than automobile use per package.
- Any of the proposed simplification the U-M campus-airport connection solutions would provide similar benefits to increased bus utilization but remain benefits remains lower than other options because of the shorter mileage involved annually.
- The transportation survey will have only indirect effects, therefore, not rating was given.

Social Aspects

Human Health

- The transportation team does not expect significant human health gains from parking policy changes because alternative commuting methods do not necessarily involve more exercise. Furthermore, we expect many drivers will continue driving for most of their commuting needs.
- Bicycling can significantly improve daily activity levels; therefore, any person who begins to bike more will gain all health benefits associated with more exercise. This makes bicycle improvements one of the best options for human health
- Walking can significantly improve daily activity levels; therefore, any person who begins to walk more will gain all health benefits associated with more exercise. This makes pedestrian improvements one of the best options for human health
- Any improvement in transit mode choice could result in more walking since transit often does not arrive directly at a person‘s destination. Unfortunately, this may not improve exercise levels significantly.
- Unifying goods movement will not change activity levels; therefore, no rating was given.
- The campus to airport connection will not change activity levels for travelers; therefore, no rating was given.
- The transportation survey will have only indirect effects; therefore, no rating was given.

Community Awareness/Reputation Benefits

- Parking fee adjustments will need the correct marketing to become a reputation benefit or improve community awareness of environmental sustainability efforts.
- Like other aspects of our solutions, the marketing involved in the program will really be the indicator of the community awareness and reputation benefits of transit integration efforts. However, with appropriate marketing, an improved transit system could give some good benefits but not the best out of our options.
- Any improvements in the enjoyment of getting around on campus and commuting to campus will have reputation benefits simply by making U-M more enjoyable to bikers. Community Awareness depends on the marketing of bicycle improvements but could prove a great opportunity for sustainability awareness.
- Any improvements in the enjoyment of getting around on campus and commuting to campus will have reputation benefits simply by making U-M more enjoyable to walkers. Community Awareness depends on the marketing of pedestrian improvements but could prove a great opportunity for sustainability awareness.
- We do not believe that unifying goods movement will have all that much community awareness/reputation benefits due to the low-profile nature of courier services, unless otherwise specifically targeted by sustainability marketing.
- Simplifying the U-M Campus-Airport Connection could result in significant reputation benefits since ease of transportation to U-M could positively influence visiting prospective students and other guests.
- Having a published survey with results published online like the Annual Environment Report could give the university and various groups or departments a basis on what they could improve on. Future programs would be able to quantify improvements on transportation mode choice. For example, a bike commuter program for students would be able to have competitions for choosing bicycles over cars.

Learning/Research Opportunities

- Parking fee adjustments will give many research opportunities for Urban Planning, transportation engineering and other departments concerned with behavioral changes.
- Bicycle infrastructure improvements of any kind could serve as great learning opportunities both on how to ride and maintain and on sustainability issues in transportation. Learning opportunities exist for urban planning, transportation engineering, etc. to track the changes made versus mode choice switching (dependant on the transportation survey).
- Pedestrian infrastructure improvements of any kind could serve as great learning opportunities on sustainability issues if marketed appropriately. Learning opportunities exist for urban planning, transportation engineering, etc. to track the changes made versus mode choice switching (dependant on the transportation survey).
- Since transit integration has not been done to a large extent, fairly large research and learning opportunities exist with several departments including Urban Planning and transportation engineering.
- We do not believe that unifying goods movement will have all that much learning or research opportunities since such systems are currently already utilized elsewhere.
- A transportation habits survey could provide a lot of information on the current state of U-M but also how decisions affect the habits of U-M community members. Not only is this a learning opportunity for campus planners and members but also a research opportunity for a variety of departments such as Urban Planning, Sociology, Engineering, etc.

Table 4-1 Transportation Team's Prioritization Matrix

Transportation Team Recommendations	Economic Aspects			Environmental Aspects			Social Aspects		
	Capital Costs	Operating Costs	Payback	Climate	Ecosystem Health	Materials Footprint	Human Health	Community Awareness/ Reputational Benefit	Learning/Research Opportunities
Increase Parking-Rate Differentiation	4	5	5	3	3	2	2	3	4
Reduce Parking Subsidies	4	5	5	4	4	2	2	3	4
Shift from Monthly or Annual Parking Payment	3	5	5	5	5	3	2	4	5
Bicycle master plan, services, facilities	4	3	4	5	3	5	5	5	4
Bicycle service center, rentals	3	4	5	5	3	5	5	5	5
Bikeway network, bicycle sharing system	2	4	5	5	3	5	5	5	5
Diversified land use, sidewalks, ADA	4	5	3	3	3	3	5	4	4
More diversified land use, sidewalks, crossings	3	5	3	3	3	3	5	4	4
Pedestrian extensions, transit mall development	2	5	3	3	3	3	5	5	5
Pilot AATA, U-M transit integration	4	4	2	4	4	3	3	4	3
Fully integrate U-M transit into AATA	3	4	2	5	5	4	3	5	5
Increased promotion of campus-airport transit		5	4	2	2	3		4	
Direct campus or downtown to airport link		3	2	2	2	3		4	
Integrate a U-M to airport link into U-M transit		3	2	2	2	3		4	
Establish the level of current courier-use								3	2
Integrate courier service into campus mail				2	2	3		3	3
Transportation Habits Survey	5	5	5					5	5

*Darkest green means more favorable while lighter green means less favorable, white even more so.

5 Appendix I

Phase 2 Operations Staff Meetings Record:

Oct. 15, 2010

- Sue Gott (Campus Planner)
- Steve Dolen (PTS)

Nov. 19, 2010

- Tom Forest (Mail Services)
- Melaku Mekonnen (Housing)

Dec. 10, 2010

- Tom Forest (Mail Services)
- Steve Dolen (PTS)
- Andy Berki (OCS)
- Katie Lund (GESI)

Appendix II

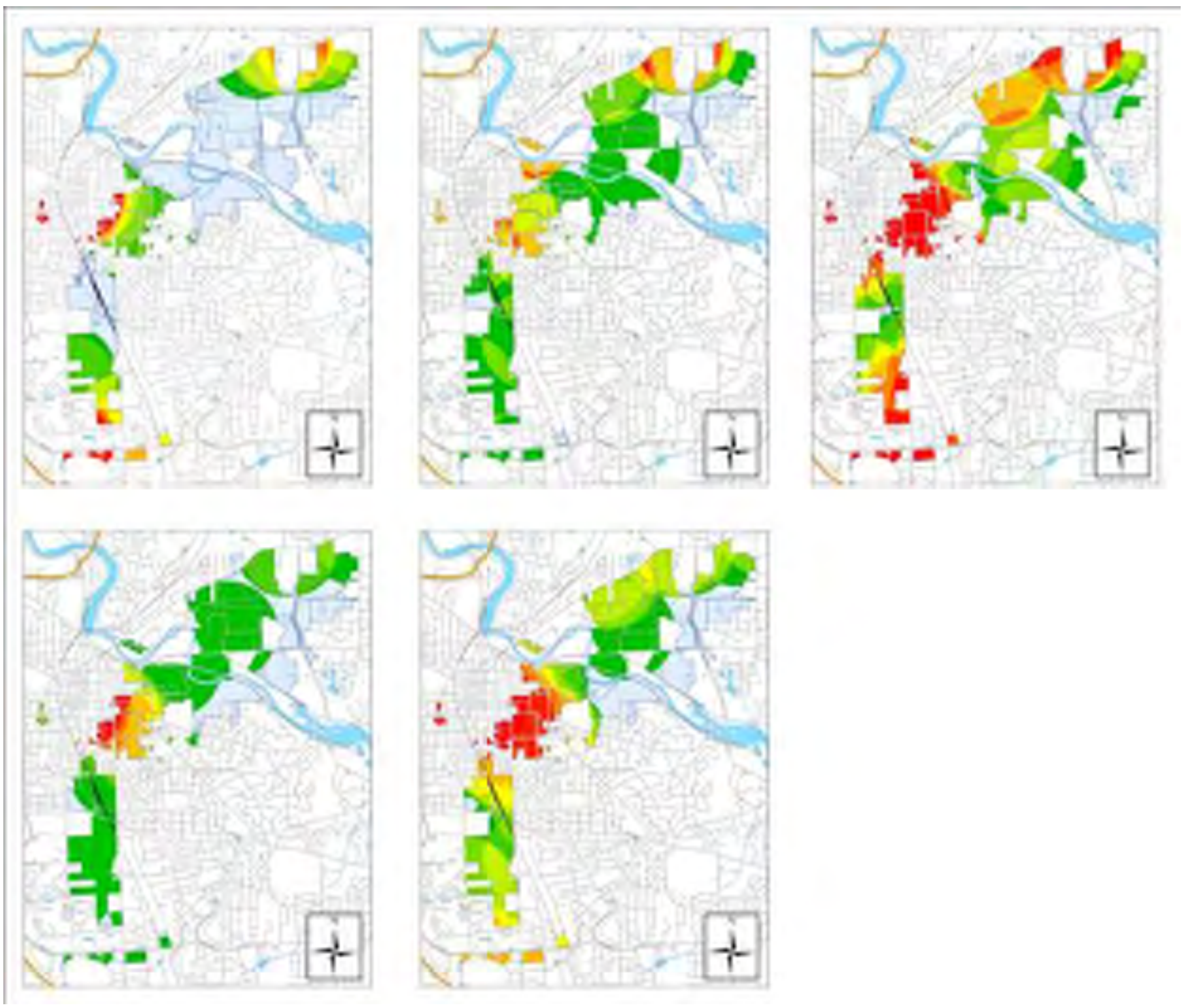


Figure 0-1 Walkability to different category of commercial spots. Categories from left top to right bottom: Bank, Grocery, Service, Retail, Food & Catering service. Red zones represent a higher accessibility than the green zones. Pale blue areas indicate that there are no nearby commercial spots can be accessed within 0.5 miles.

Table 0-1 A comparison of before and after MSU transit integration policies in 1999.[lxix]

Initial Integrated CATA/MSU Bus Service	MSU Bus Service Pre-Integration
• Student cash fare of 25 cents, same fare as the past 4 years, with pledge to keep the student cash fare below the MSU fare, plus inflation, for the duration of our long-term contract with MSU. • Student $40.00 semester and $12.50 monthly passes • Access to entire 110 square mile Greater Lansing area.	• Student fare of 60 cents, must use pre- paid ticket, no cash allowed. • $40.00 semester and $65.00 annual pass – limited to MSU buses only • No monthly pass available
Students who use service designed for people with disabilities will pay the same fare as all other students, currently at 25 cents.	60 cents per ride or pass.
24 hour Parking Shuttle	24 hour Parking Shuttle
Nite Rider will continue and Dial-a-Ride will be replaced with expanded Parking Shuttle service, from 10:00pm to 2:30am, 7 days per week that will provide the same quality service for the MSU customers.	Dial-a-Ride and Nite Rider available from 10:00pm -- 2:30am, 7 days per week.
CATA will add over 10,000 hours of new service from off-campus areas such as East Lansing, Haslett, and Okemos at no cost to MSU, providing greater frequency of buses on-campus.	NA
Qualified MSU bus drivers will be offered jobs with either CATA or MSU.	NA
CATA would invest millions of dollars in buses with bike racks, shelters, and bus stops for MSU using federal and state funds not available to MSU.	NA
CATA will provide all special services, such as shuttles for MSU football and basketball games.	Same

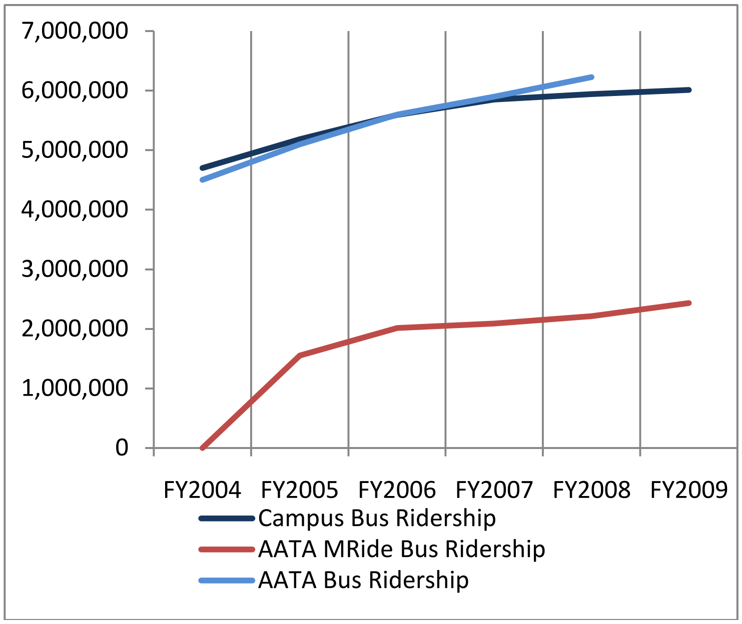


Figure 0-2 Figure 7 Campus[li], AATA[lii] and MRide[liii] Annual Bus Ridership

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