Bicycle Transportation at UMass

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Introduction

Over the course of this paper we will walk through our objective as well as highlight some of the various observations that we made about the bicycle transportation network at the University of Massachusetts Amherst (UMass). From there we will discuss some of the many statistical inferences that were found during our research, and provide an explanation of what it means to the UMass bicycle network. A recommended plan of action along with the associated costs will be discussed, and then a wrap up with our conclusion of what actions are necessary to ensure a healthy growth of the bicycle transportation network at UMass.

Objective

There has been a recent report released by the World Meteorological Organization which states "the top 10 warmest years have all occurred in the last 12 years…" (www.msnbc.msn.com). Though we had defined our objective much earlier than the date this report was released, it confirms our notion that global warming is real. By reducing the level of toxic emissions produced by the thousands of automobiles that drive to and from campus everyday we will be able to help slow the effects of global warming; thus our objective, to increase bicycle commuting. Increasing bicycle commuting has multiple benefits that appeal to a wide variety of the UMass population, here are just a few: shorter commute time on a bike than driving a car, multiple health benefits, drastically less pollution, no need to incur the cost of gasoline or on-campus parking, bicycles can park much closer to classrooms, and the rider has much quicker on-campus movement.

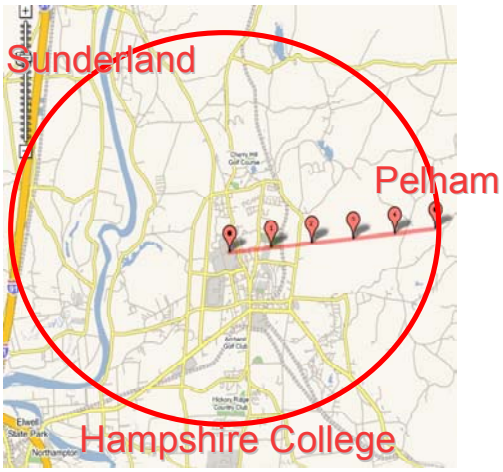
All of these benefits are fairly significant in their own respect, for example: the past three years has shown the nation that the price of gasoline is extremely volatile and can very easily double. The weight of the average American is not a new issue and has been in the media for the past several years, but there has yet to be firm institutional support for healthy lifestyles. Bicycle commuting will not only save hundreds of dollars in gym membership fees, it will also help the average UMass commuter get the exercise that is necessary to sustain a high level of general health. There is no need to go into the thousands of medical studies that show the many benefits (both immediate and long-term) of regular cardiovascular activity. Aside from swimming,

bicycling is one of the few cardiovascular activities that do not come along with the various potential joint damages from high impact exercises such as running and even walking.

Observations

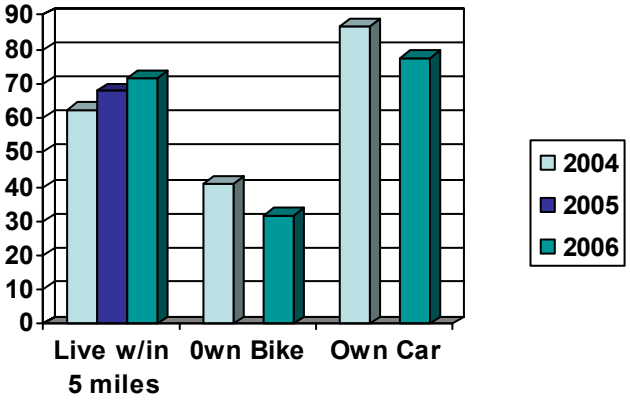
Our primary research was evaluating two main surveys, the first of which is the Project Pulse survey entitled "Transportation Survey (F04-B)", and the second is also a Project Pulse survey entitled "Survey of How Students Travel to Campus (F06-A)". We compared the results in both surveys to get a feel for the changes with regard to the general populous that may have occurred in the past two years. Some of our findings were fairly self-evident; however we were very surprised at some of the responses in the surveys and what they infer about the entire UMass population.

The Increase in Volume



We chose to focus on the population living within five miles of campus because that is the distance that we determined to be easily commutable by bike. We calculated that a typical person can average 10mph riding on a bicycle, and 5 miles at 10mph will take the rider around 20 minutes to arrive on campus. We noted that according to the 2004 survey, there were 62.3% of respondents that lived within five miles of the UMass campus compared to the 71.8% that reported to live within five miles in 2006. At this point our hopes of increased bicycle commuting seemed possible because there was roughly a 10% increase of people that live well within the commutable area, but we found this not to be the case. In 2004, 41.2% of respondents said they owned bike and in 2006 only 31.5% owned a bike; so rather than our expected increase there was actually a decrease of about 10%. Furthermore these numbers do not truly reflect the percent of people that actually use their bike to commute to campus, so we can only assume that the percentage of people whom actually use their bike for commuting is less than those who simply own a bike.

If the number of people living within five miles of campus has increased in the past two years, but the number of people commuting to school via bicycling has decreased there must be an increase in some form of commuting. Occam's razor in essence states that when given two equally valid explanations for a phenomenon, the simplest explanation is most often the right one. In American society getting a driver's license is a right of passage as is owning a car, so when we found out that more people now live closer to campus but they are not commuting via a bicycle the simplest explanation is that they are driving to school. This is not the case as we found that 86.7% of respondents owned a car in 2004 and currently in 2006, 77.5% own a car which represents almost a 10% decrease.



The Hypothesis

As we discovered more information about the users of the bicycle network at UMass we started to formulate facts driven reasons about the network. Campus enrolment has risen in the past two years by almost 1000 students. In 2004, there were 22,498.2 full-time equivalent students enrolled at UMass, and two years time showed a growth to 23,410.7. There has much discussion in recent campus news as to UMass' desire to have a total enrolment of 35,000, as this is a number achieved by only a few of the largest and well-know institutions. Whether or not UMass actually plans to reach the enrolment levels of the University of Michigan and the University of Southern California at Berkley, it is fairly evident around campus that construction is well underway. There are multiple "new dirt" projects taking place that will provide the infrastructure needed to support higher enrolment numbers.

As discussed earlier, there are a greater number of students living within five miles of the UMass campus, and bicycle commuting has declined as a means of getting to and from school. From the results of the extensive surveys and our interpretation of them, we arrive at our hypothesis. We proclaim that the condition of the network paths is the primary user cost, and therefore the condition of them will affect the level of travel demand.

Identifying the Current Paths

We identified the six major links that join the many hundreds of possible paths to the University campus. These include North Pleasant Street, Eastman Lane, Triangle Street, Lincoln Street, the UMass Bikeway, and North Hadley Road. These six represent the primary routes for entering and exiting at the perimeter of campus. Each of the above named links introduces high travel cost in the form of poor road conditions and inadequate bicycle traffic accommodations. North Pleasant Street and the UMass Bikeway should be noted as exceptions to this general rule, but they too present problems for the bicycle traveler.

Problems with Network Links

There are a few general observations that can be stated about all of the six to-campus links. For the most part, the physical condition of the road surface is atrocious. Exceptions to this are only the Bikeway and North Pleasant Street before reaching campus. In other areas there are very large potholes, uneven road patches, and no demarcated bicycle lanes. What passes for a "bicycle lane" on a few of these links is just the white line identifying the edge of the road for motor vehicle traffic. Also, we found no signage identifying bicycle routes, bicycle operating instructions, or designations of bike lanes on any of these links.

On campus the majority of bicycle traffic flows on the pedestrian sidewalks. This is due to inadequate bicycle lanes on all the roads around the campus perimeter, with the exception of North Pleasant Street. There are many problems with uncontrolled flows of both pedestrians and bicyclists on the same sidewalk and walking path routes. The expansion and building plans currently being executed by the University will likely exacerbate this problem.

North Hadley Road

North Hadley Road joins campus near the Southwest dormitories from over Route 116. There is a fairly wide shoulder on this road to the west, beyond the intersection with University Drive. However, in this shoulder the road is in extremely poor

conditions with large potholes and broken surface. Bicycle riders must also ride through the entrance and exits lanes for the RT 116 ramps. This can be particularly dangerous with traffic merging, exiting, and entering the road. When North Hadley Road joins the UMass campus the wide shoulder drops and riders must pass the intersection of traffic exiting and entering campus via University Drive. At the intersection of Commonwealth Avenue, North Hadley Road becomes Massachusetts Avenue. At this point the road is a double lane road in very poor condition, Commonwealth Avenue is the same. The bicycle traffic generally moves to the campus sidewalks at this point.

UMass Bikeway

The UMass Bikeway enters campus at the South Gate, near the Southwest Dormitories and is a connection along the length of University Drive originating from the Norwottuck Rail Trail and Route 9. This is an excellent link to connect commuters from South Hadley, Northampton, and areas south of campus. The path has separate north and south lanes wide enough for two bicycles or for bicycles to overtake pedestrians without incident. Issues with this link are few but do include crossing several, busy business and apartment driveways. Also the Bikeway joins campus at the same location as North Hadley Road, the intersection of Massachusetts and Commonwealth Avenues. Both of these roads are not bicycle friendly and cyclists coming from this link commonly tend to move to the campus sidewalks.

Lincoln Street

Lincoln Street enters the UMass campus at Massachusetts Avenue across from the area of Whitmore Administration building. This link mainly serves bicycle commuters from the residential area between UMass campus and Fearing Street, but also from downtown Amherst. This road, though residential, can have very heavy vehicle traffic as it is a "secret" route out of campus for many car commuters leaving from the Visitor Center parking lot and attempting to avoid the congestion on

University Drive. The road is understandably narrow as it was probably designed to handle only residential traffic flows. There is also no bike lane and in many locations the road surface is in extremely poor condition. Vehicles parked at the side of the road are common and obstruct both bicycle and vehicle flows. Many cyclists will move to the sidewalk on this road, but the walk is very narrow and high volumes of pedestrian traffic and a four-way intersection make this choice extremely dangerous.

When cyclists reach the campus perimeter they almost uniformly move to the campus sidewalk. There they take up position as a pedestrian, using the crosswalks to traverse Massachusetts Avenue and then on into the campus core. This presents another extreme danger as fast-moving bicycles cut across the double lanes and median of Massachusetts Ave. intent on where they are heading and paying very little attention to the vehicle flows. In our observation these cyclists assumed they had the right of way when traveling in crosswalks, an observation also noted in other campus locations. This is a poor assumption as bicycles move much faster than pedestrians and car operators do not expect a bicycle to move very quickly into their path as they prepare to cross a crosswalk area.

Triangle Street

Triangle Street is the road commonly referred to as "Frat Row" at UMass. This road is in horrific shape: broken road surface; glass and other debris litter most of the road surface; large potholes; narrow vehicle lanes with a shoulder that fades in width and location as many layers of road patch cover and distort the location of the shoulder line. The road shoulder is the worst contiguous road surface of all the links discussed here. Bicycle travelers are forced to follow an inconsistent path, moving further than acceptable into the vehicle lane and to be extremely careful with bike handling. There are also very high volumes of car and bus traffic on this link as it is the main connector to the Amherst downtown area and areas southeast of campus.

There is a sidewalk along both sides of the road, but large volumes of pedestrian traffic and awkward entrances and exits make this unviable option for cyclists timid about the road

surface. Riders must also cross a busy intersection at East Pleasant Street. Traveling east there are double lanes of traffic with a right-hand turn only lane. Heading west, toward, campus, on the other side of East Pleasant traffic must pass a road-side parking lot. At both sides of the intersection there should be a designated bike lane that vehicle traffic will expect to see bicycles in and that allows the cyclist a chance to take proper position on the road for such a crossing.

Eastman Lane

Eastman Lane enters campus at the Sylvan dormitories and the new North apartments. Commuters utilizing this link would include those coming from the north-east Amherst and Pelham areas. Many on-campus commuters also originate from these dorms and may travel on the road before moving to the sidewalks. The grade and condition of this road make it a very poor bicycle route. The surface is very broken, uneven, and there are many potholes and manhole covers that break up the line of travel. Combined with the grade of the road, the commuter who is descending the hill must be very comfortable with bike handling, braking, and riding in traffic in order to safely navigate their way into campus. Construction vehicle traffic is also very high on this route and near the Sylvan dormitories the road is not wide enough to accommodate a cyclist and dump truck in the same lane.

North Pleasant Street

North Pleasant Street enters campus from the North Amherst side and continues through the upper or east side of campus. This is by far the best road link into the campus. The road has fairly wide lanes and a shoulder that generously accommodates bicycle travelers. The road surface is in fairly new condition with few surface obstructions. There is a significant volume of vehicle traffic on the road, but with the exception

of the cyclist who needs to make a left-hand turn across the traffic lanes, the bicycles and vehicles flow together without interference. One of our researchers utilizes this link to travel to campus each day and feels very comfortable riding on the road between North Amherst and the traffic lights at the intersection with Eastman Lane and Governor's Drive.

As mentioned, North Pleasant Street continues through campus. It is the main road through the campus. There is a fair bike lane on both sides of the road with ample space for a vehicle and cyclist on the same side of the road center-line. There are serious drawbacks to this link though. The road is in very bad shape, especially in the section of the road designated as the bike lane. There are also very high volumes of vehicle, car and bus, traffic throughout the day at times of class changeovers, also the time when the most commuters are on bicycles. At times of class passing there are also multiple crosswalks with high volumes of pedestrian traffic interfering with both vehicle and bicycle flows.

In addition, there are currently several areas of construction along North Pleasant St. and the entering and exiting construction vehicles are often interfering, unknowingly, with the bicycle traffic. The three bus stops in each direction create very dangerous situations as buses stop and turn off in front of bicycles or move out in front of a moving bicycle. Also, it must be mentioned that this congestion for bicycles, pedestrians, cars, and buses can create tension and short-tempers are people become frustrated and our commuting group member frequently experiences mild "road rage" as vehicles pass closely, turn without notice and stop short in front of bicycles.

All of these conditions create a situation where what should be a bicycle lane serving the heaviest route of travel is prohibitive to all but those who are experienced, alert, and somewhat daring with the bicycle riding. The majority of bicycle commuters who need to travel the length of North Pleasant Street will move to the sidewalks when they reach campus and travel with the pedestrian traffic.

On-Campus Sidewalks and Walking Paths

The movement of bicycles and pedestrians on the same surface can be dangerous for both if there is no designation of flow direction or location. The UMass campus has no bicycle lanes or

flow designations. The result is pedestrians and cyclists moving toward and with each other in an ad-hoc manner without any structure. This leads to a dangerous and frustrating situation when pedestrians unexpectedly step out of their line of travel or move across a path in front of a fast moving cyclist. The pedestrian does not expect there to be a significantly faster traveler crossing the same space and an inexperienced cyclist is not totally alert to their speed, possible obstructions, and how to brake safely. We observed many close calls of collision between these two modes in our observations of the on-campus flows. Because there is no network structure and the physical and user-chosen paths cross in so many and in complex ways it is now nearly impossible to expect any consistency or predictability of movement for both modes. There is also the additional problem of bicycles utilizing cross-walks as if they were just "fast-moving" pedestrians with the same entitlement to arrive and move into the road at a speed that is too quick for most vehicles to react.

On-Campus Building and Expansion

There are currently several new building construction projects underway on the UMass campus. In general, it is to be expected that these new buildings and the resulting changes in the layout of sidewalks and walking paths will make the on-campus bicycle and pedestrian traffic interferences to increase. That is, if there is no purposeful layout of the links and paths in such a manner so as to avoid Braess' Paradox from occurring. Without planning, the addition of new intended and user-created paths will lead to additional path intersections and nodes that will likely intersect in a suboptimal manner when both pedestrian and bicycle traffic are using the same links.

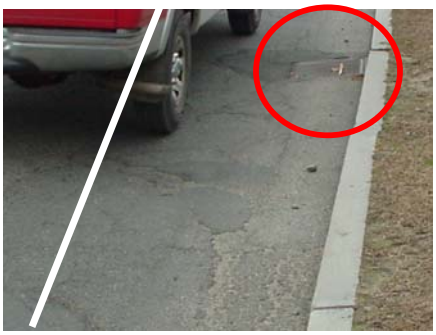
Recommendations

We have arrived at several recommendations that, once implemented, will improve the current condition of the bicycle network at UMass. These recommendations vary in both scope and cost, and we have therefore separated them into two categories. The primary improvements will have an immediate impact on the network and its users, while the secondary improvements will be most effective and provide the greatest benefit if they are implemented as a follow-up to the primary recommendations.

Primary Improvement Initiatives

As mentioned above, we have identified various options that will improve the bicycle network at UMass and help to achieve our objective of increasing bicycle commuting. The following are the improvements that will have the greatest immediate impact on the network and the user's perspective of it.

Path Conditions



The hypothesis stated that the primary user cost was the condition of the network and as described in the "Problems with Network Links" section, the physical condition of the network paths are in extremely poor condition. The first thing that the University should undertake is patching the smaller pot-holes and repaving the paths that are in the poorest conditions. One of the main reasons that users choose not to commute via bicycling is that the roads are in such bad shape it poses a serious safety issue where most riders would be risking their lives by traveling on the network here at UMass. There are many roads on campus that are very wide and the painted lines should be re-positioned so there is plenty of room for cyclists. But simply spraying down a white line is not enough; the school will also need to paint a bicycle path symbol every 200 yards so that all path users (both cyclists and drivers) are fully aware of the area designated for bikes.

The lines on a road tell the user where they should be going and what is and is not permissible, so in a sense they are acting as continuous signs. Which is the third aspect of improving the path conditions of the UMass network? There needs to be proper signage posted at

the intersections of links that tell the user what they should and should not be doing. There needs to be stop signs put in place in all intersections where two or more links intersect at a node, especially because the majority of the paths in and around campus are multi-modal links. The nature of a bicycle makes the user much more vulnerable to fatal accidents, and it is very important that all users, regardless of the mode of transportation they are using, know where they are supposed to travel and are fully aware of each other's presence on the link. This brings us to the second primary improvement that needs to be implemented.

Commuter Education

There are a multitude of programs that are currently available to all UMass students but the downfall of each of these programs is that there is very minimal awareness of their existence. The Bicycle Commuter Program currently offered by the UMass Parking Services provides commuters with a plethora of information about bicycle commuting. This program informs users of everything from general information, to maps of which paths to use; to detailed information on how to properly secure you bicycle while you are in class. The PVTA bus system has a program called "Rack&Roll" which is designed with the bicycle commuter in mind. Each PVTA bus has a rack on the front of it that allows a cyclist to secure their bike and ride the bus for part of their commute. This program is ideal for UMass commuters who live outside of the five mile radius, or are simply pressed for time and need to travel at a faster pace for part of their commute. Both of these commuter programs are very well organized and provide a much need service to the UMass commuter population, but very few users know about these programs and their respective benefits.

As a focus of the education program, it is our suggestion that there be a portion of the new student orientation that is dedicated to informing the incoming class of their possible options and the multiple resources that exist on-campus. These orientations will be the perfect opportunity for UMass to promote bicycle commuting a safe, healthy, viable mode of transportation t and from campus. The instructor can go over the cycling rules and regulations of riding a bike on campus as well as informing everyone of proper user etiquette. The University should also encourage and inform the entire student population about a designated "Bicycle Commuter Day" where everyone from the campus police to faculty to students are encouraged to ride a bike to campus. The University should also partner with the Bike Co-Op and inform users

that the Bike Co-Op offers an on-campus location to fix flat tires, repair broken chains and purchase parts so the user can stay on the road instead of in the shop.

Commuter Education to Overcome Perceived Costs

Increased awareness will only do so much as far as creating a greater demand on the bicycle network, but with regards to bicycle commuting most users have multiple perceived costs. A perceived cost that most users have is the weather: most users are afraid of bicycling to campus because they fear bad weather. One solution to this perceived cost is that the user does not have to ride their bike when the weather is poor, and a second solution to overcome the perceived cost is the user can purchase appropriate clothes and equipment that are designed to withstand bad weather.

A second perceived user cost is the amount of daylight. The majority of the school year is during months where the amount of daylight hours does not accommodate a full-time student's schedule. One solution that does away with this perceived cost is there are lights and reflectors (both for the bike itself and for the user's clothing) that are fairly cheap and easy to use. A second solution to overcome this cost is that the user can make use of the PVTA's Rack&Roll program; where the user can bike to campus in the morning and ride the bus home in the evening.

Some users have the perceived cost that they live too far from campus to use cycling as a means of commuting. To overcome this cost the user should consider multi-modal commuting by driving to an Official Satellite Parking and ride their bike the rest of the way into campus. Or the user could make use of the Rack&Roll program by taking the bus for part of their commute.

A fourth major perceived cost is that most users do not want to ride to school and have to wear the same clothes that they ride in. It is a common misconception to think that because you are riding a bicycle you are going to get sweaty, most average bicycle commuters do not get sweaty at all. If the user is still concerned with not wanting to have the possibility of wearing sweaty clothing, there are multiple showers and lockers on-campus that allow the user to refresh and change.

Secondary Improvement Initiatives

There are a number of secondary initiatives the University could undertake to increase the volume of bicycle commuter traffic after the primary objectives are accomplished. These improvements are secondary because they do not immediately contribute to the primary objective of increasing bicycle commuting. They will however encourage more participants in the bicycle commuter program.

Yellow Bike

Several universities and cities across the United States including Austin, Portland, and the University of Waterloo, have instituted free commuter bike programs. These programs are typically referred to as "yellow bike" programs because the fleet of bicycles is painted bright yellow to be easily identifiable. The bikes are obtained by collecting all personal bicycles that are left locked to bike racks and in dormitories over the summer. These abandoned bikes are painted and then put out around the university for anyone to use and deposit at their destination. This will increase the number of people who are able to commute on campus by bike and thereby raise awareness of cycling as a fun activity and transportation mode.

Official Satellite Parking for Bicyclists

For those commuters who would like to commute to campus by bicycle, but who come from a distance that is prohibitive of making the entire trip by bike, the university could establish official satellite parking areas for bicyclists. These commuters could drive to the parking area and then commute to the campus on their bike. This would decrease the overall volume of cars and congestion on campus and facilitate greater rates of participation in bicycle commuting

Covered Bicycle Parking Areas

For days when there is rain or snow precipitation it would be favorable to park your bike under some structure

that would protect it from the elements. Bicycles quickly rust and breakdown when exposed to the elements and it does take a significant amount of knowledge and time to properly care for a bicycle in order to have it always functioning properly. To reduce objections to the possibility of bikes being damaged by the weather a few sheltered parking areas could be added around campus.

Clearing Snow from Bicycle Racks

The university is a very large and complex space to clear of New England snowfalls. The bicycle racks and paths are an additional burden on the machine and man-hour capacity, but there are many cyclists who are un-daunted by commuting in snowfalls. The university currently does a commendable job clearing snow from the walking paths and up to the bicycle racks, but they often neglect to clear the snow from between the racks. As with rain, the water damage snow can cause to a bicycle can quickly deteriorate the condition of a bicycle. Also the melting and freezing of the snow around the bike racks creates a very slippery and dangerous situation for unloading and loading bicycles at the racks.

Conclusion

The observations and recommendations presented in this paper outline the as-is situation of bicycle commuting at the University of Massachusetts Amherst and the primary and secondary steps toward improving safety for bicycle commuters and the participation in the bicycle commuter program. There are certainly costs to making the improvements we suggested: adding signs, maintaining roads, adding bicycle lanes and paths, and educating the community. However these costs are certainly justified by the benefits of increased overall health among the university population, reduced vehicle congestion, and overall safety for pedestrians and bicyclists. We contend that the egregiously poor condition of the network, roads and path markers, is the primary problem and deterrent to bicycle commuting. This is resulting in decreased bicycle commuting participation. The first step to take is to improve overall safety of

traveling by bicycle. To do this the roads must be repaired and designated riding paths for bicycles must be added. Also, education programs addressing bicycle resources at UMass, riding rules and etiquette, and benefits of bicycling must be initiated. Though these initiatives will cost the University the costs can be justified by the safety and health improvements that inevitably will follow.

References

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2) Project Pulse. Transportation Survey (F04-B). Conducted By Sareo starting on Sept. 29, 2004.

3) Project Pulse. Survey of How Students Travel to Campus (F06-A). Conducted By Sareo from Oct. 4^{th} – 30^{th} 2206.