Uva Bike Share Research Analysis

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Abstract

The overall goal of our project was to provide the research necessary to approve the implementation of a University of Virginia Bike Share program. Our main objectives throughout the course of the project were as follows:

1. Research the history of bike share programs at UVa and elsewhere
2. Determine the best design for a bike share implementation
3. Work with the existing programs at UVa to achieve a common goal
4. Present a sufficient amount of field research to justify the need for a bike share at UVa
5. Combine our research with the other researchers' findings to strengthen our findings
6. Successfully aid UVa Bikes in the re-funding of a University bike share

Our first objective in starting the project was to gain valuable resource information and insight from the existing groups at UVa that share a similar goal. We found that the most successful bike share systems were those established as BIXI bike systems. While these are the most expensive, they are also the most secure and easiest to maintain. Knowing the need for a large amount of funding, we needed a way to plug into the existing systems at the University level to ensure our work went toward that overall goal, and to make sure people can easily reference our findings in the future.

Our group worked mainly with UVa Bikes, alongside Rebecca White, Director of the Department of Parking and Transportation at the University of Virginia, to establish what needed to be done in order to present an acceptable amount of research for the bike share to be approved. The main deficiency of the current research being done was in the field study and transportation survey areas. Therefore, this is where we focused most of our attention. We used a grid destination system and a simple survey (Appendix C) in order to establish the most highly trafficked routes on grounds and to establish the demand, if any, for a bicycle alternative. We then had to organize and analyze our findings before sending them to UVa Bikes. We found that the weather, the existence of steep hills within a route, and the proximity to the destination were the most common factors for a person choosing not want to take his or her trip on a bicycle.

Our final goal is one for the future. It's something that we couldn't achieve in one semester; however, the work we did will help speed up the process of reaching that goal. With the added research done by volunteers from UVa Bikes, the results of the surveying should be definitive enough to determine the best way to begin the bike share system. This would conclude the pre-implementation research phase of the project. The rest of the data should continue to be collected after the initial launch of the system on grounds.

Introduction

The problem that we are trying to address is the need for an alternative method of transportation in Charlottesville. During peak hours, the university is unfit to handle bike traffic amidst the overcrowded buses and sidewalks and unruly flow of pedestrian traffic. UVa and the surrounding Charlottesville area are not fit to support large amounts of bike traffic. In a study conducted by Bike Charlottesville and the Alliance for community Choice in Transportation, 82% of people chose the lack of bike lanes as Charlottesville's most important bike-related issue. In fact, there are only 8 miles of bike lanes in the city of Charlottesville, which leaves bikers susceptible to danger in car traffic and creates a dangerous situation for the pedestrians that are forced to coexist with bikers on overcrowded sidewalks (Daily Progress). UVa is a community leader in the movement for alternative transportation and thus we have decided to focus on the issue in our own UVa community for our project. According to the President's Committee on Sustainability, 80% of students want a more environmentally friendly means of transportation on grounds (citation for website). Not only do students want more availability for biking on grounds, University departments such as Parking and Transportation, and the Office of the Architect view it as beneficial as well. There is a financial incentive to alleviating some of the stress on the UTS bus system that, when paired with the environmental benefits, have a lot of university organizations very intrigued. The operating cost for one bus on the Northline loop is approximately 210,000 dollars a year (Rebecca White). With a bike share on campus, the demand for bus usage could decrease significantly and as a result allow for a bus to be removed from the loop. A functioning bike share on campus would negate the issues of both cost and pollution. In order for a system like this to exist, the university needs to invest in the necessary infrastructure. As it stands, UVa is not equipped to handle an increase in bike traffic due to lack of sufficient bike lanes, signage, and racks.

In our efforts to assist in implementing a bike share on grounds, we are considering all of the aforementioned factors as well as all of the stakeholders affected by the impending changes. The Department of Parking and Transportation and the Office of the Architect have to invest time and money in order to complete the research necessary to implement a bike share on campus. Furthermore, the UTS bus drivers need to be educated as to how to coexist peacefully with new volumes of bike traffic on the road. Lastly, the students and faculty of UVa are impacted by the presence of alternate transportation. Their campus will appear slightly different, they will be given another option for transportation, and they may eventually be influenced by less of a presence of the bus system on campus. For all of these reasons, it is very important to consider more than one demographic when going about this project in order to please all stakeholders in the process.

In our attempt to get a bike share started at UVA, we would like to plug into the pre-existing efforts by assisting with said research. The Department of Parking and Transportation is most interested in gaining more information about the logistics behind the bike infrastructure on the grounds needed to support a bike share. UVA has lots of pedestrian traffic throughout the day; this causes congestion in certain areas of grounds.

The absence of bike lanes forces bikers to either battle with the pedestrians for the sidewalk or ride in the street uncomfortably close to road traffic. One of our research objectives is to determine where bike lanes would best serve the community and lessen traffic, congestion, and danger for students. Additionally, a bike share would require numerous kiosk locations throughout grounds from which people can pick up and drop off their bikes. We would like to investigate where these kiosks would be the most effectively located. Our research of bike traffic will allow us to determine where bike lanes and bike kiosks would be the most beneficial to the UVA community and thus assist the pre-existing bike share to advance and become a reality on grounds.

Body

I. Choosing and Developing our Solution

The overall problem as we saw it was an essential lack of sustainable transportation on grounds. To solve this, we came up with five viable transportation solutions to consider: an awareness campaign, an education and safety program, a low-cost bike share, a bike rental system, and a high-tech bike share. Each of these options had its positives and negatives, and we analyzed the possible solutions from sustainable perspectives. (Appendix D)

Initially, we didn't have high support for the awareness campaign or the education and safety program. Essentially, our group felt more comfortable creating and running a bike program, rather than advertising and educating people about it. Before we had analyzed our decision much, we knew we would be working on either a bike share or a bike rental program.

As classes passed, not much discussion revolved around the bike rental option. The concept behind the rental system was that a student would rent a bike for a year or semester. An immediate benefit is that the student would be responsible for his bike, and therefore treat it with care. Students might be more careless with a bike owned by the university. But, the rental option doesn't give the sense of community that a bike share does, and doesn't allow the rider to leave the bike at a different location. Additionally, there aren't many precedents to the rental system, and we felt students may be reluctant to pay a large fee up-front. Therefore, we felt comfortable exploring the two bike share options and were then left with some tough decisions to make.

As we researched bike shares, we found that a high-cost bike share system for UVA had been on the verge of completion last year, but did not receive the final "go" from the Department of Parking and Transportation. While none of us in the entire transportation group knew the exact reason for this, many speculated that the $600,000 price tag on the program was the issue. We had heard that the bike share program was now on a "lifeline". At this point, we didn't feel too confident in a high-cost bike share, and general attitude of the transportation group shifted towards a lower-cost system.

We then analyzed the feasibility of a low-cost system, but even the low-cost system did not look too promising. In 2001, Charlottesville began its Yellow Bike

Project. 150 new and recycled bikes, painted bright yellow, were placed throughout the city. Within a few weeks, all the bikes were gone. The city eventually gave up on the project, and accepted the yellow bike system as a lost cause. Todd Ely, an organizer for the project, explained, "A third broke, a third were taken for private use, and a third were deliberately vandalized and destroyed" (Atkins). We realized that the city of Charlottesville had done this project, not the university itself, therefore involving a different demographic. We considered setting up a similar program on university grounds, due to the existence of UVA's honor code. However, some new information regarding last year's bike share was revealed to our group, and our hopes turned to the high-cost system.

We learned that last year's bike share system was spearheaded by a student organization entitled UVA Bikes. In talks with a fourth-year, Madhav Munnaluri, who was involved heavily in the project, we learned that UVA Bikes was in a "research phase". Last November, the project did not receive official sponsorship from the Department of Parking and Transportation. The department cited a lack of research on actually implementing UVA Bikes, and therefore did not provide funding. A full year later, on December 31, UVA Bikes will be presenting another design proposal to the Department of Parking and Transportation, that the high-cost system was due for another final project proposal. In addition to this, in talking with Rebecca White, the director of the Department of Parking and Transportation, even she was optimistic about the Bike Share's completion. We decided to pursue the high-tech system already begun by UVA Bikes, and ensure that the "research phase" resulted in the actual creation of a bike share on grounds.

We got to work with UVA Bikes, and found that they intended to use the Bixi Bike system, hugely successful in Montreal, Canada, and growing other cities around the world. Within the past two years, programs have begun in Washington D.C., London, Melbourne, Minneapolis, and Washington State University in Saint Louis. In our point of view, the basis of Bixi's success has stemmed from two things, the design of the bike, and the "swipe and go" system used to remove the bike from a bike hub.

The design of the Bixi bike fits the needs of all riders, and literally fits all riders. The seats are easy to adjust, and the bike is easy to hop on due to the sheer simplicity of the frame. On the front of the bike, one finds an ergonomic-looking basket capable of carrying up to 8 kilograms. In addition, the bike has several features to protect the bike from disrepair and protect the rider himself. A chain protector keeps rider's clothing clean, and fenders are located on each wheel to protect the rider from a rainy or muddy ride. These features are important to protect the pants of students from grease, and to keep the student dry if the weather isn't perfectly sunny and dry. The brakes are internalized within the structure of the bike to keep from being tampered with, and a device keeps the chain from derailing. These two features help prevent the average college student from tampering with the bike or from being disappointed by a bike without a chain. Finally, lights are installed on both the front and back of the bike, helping the students coming home after a late night at Clemons Library.

The "swipe and go" system of claiming your bike from the bike hub is another very important aspect of Bixi Bikes. Users may simply swipe their credit card to unlock a bike from the hub, and then be on their way without much hassle. This is very convenient for college students, who can use the bike system to run to class on time instead of waiting for a bus (in light conversation, we found that many students echoed this reason for supporting the bike share). The hubs are made up of the kiosk for swiping credit cards (university ID's for UVA's bike share), the docking station for the bikes, and a solar panel to power the system. This feature is simply icing on the cake, the entire kiosk is self -sustainable, and completely off the power grid.

Over the long term of a few years, and with all costs included, UVA Bikes entire design proposal costs around $600,000. This is clearly a steep initial cost, but one that will be worth it in the long run. The program is entirely self-sustaining and, in time, will likely pay for itself given the amount of money it will save the university. For example, according to Rebecca White, the 2010/2011 cost per hour of each bus was $50.73 per hour of operation. If you multiply this cost by the number of hours the average Northline bus runs per week during the academic session, and multiply this number by the number of weeks in the academic session (36 weeks), you arrive at $210,000 saved by eliminating just one bus for a year. This is a very rough estimation, but it does give a sense of just how costly the UTS system truly is. For this reason, and among others, the bike share needs to be implemented to decreases our university's dependence on the bus system.

II. Research and Analysis

Our original intentions in partnering with UVA Bikes were to help research as much as we could and ensure that the design proposal yielded a successful grant from the university. Aside from that, we wanted to determine where the bike hubs should be placed, and where bike lanes should be placed.

Our efforts to determine location of bike hubs began with a meeting. Our group and Madhav Munnaluri, from UVA Bikes, met with the both the Director of Department of Parking and Transportation (Rebecca White) and the Director of the Office of the Architect (Andrew Greene). Our group's goal was to find out what both organizations wanted to see before they sponsored UVA Bikes. Instead, we found that both organizations were entirely on board, and engaged in the "research phase" of UVA Bikes. They were primarily interested in learning where people were coming from and going to on a daily basis, and looked to us to find this out. At the meeting, we created the Origin/Destination Survey, which became a fundamental piece to our project (Appendix C). The survey used a grid map of central grounds, to help sort the data being compiled into a letter/number code, rather than a list of locations. In addition to finding out where people were coming from and going to, a key part of the survey was asking the participant if they "had convenient access to a bicycle for this trip, would [they] take it?" We would often ask why or why not following this question, to gage qualitatively what people's feelings were on the bike share.

In carrying out the surveying, our group determined there were several locations that we wished to highlight in our own surveying: Observatory Hill Dining Hall, the Chemistry/Old Dorms bus stop, and the Garrett Hall/Monroe Hall bus stop. At the bus stops, we originally intended to survey people getting on and off the bus, but we decided to only survey people getting on buses for two reasons. The first is that it automatically helps sort the data, and the second is that it is much easier to survey someone waiting for a bus, than someone hopping off a bus. We did hesitate a bit to ignore those getting off the bus in case this data was different. However, as we surveyed, we realized that almost everyone we surveyed was either going back to dorms or apartments. Thus, intuitively, if these people had been getting off the bus, they would have been leaving form their dorms and their destination and origin would be switched. Even with this argument, we do feel that surveying those-coming-off-the-bus would have been a nice inclusion in our survey. We at the very least should have done a small bit of this surveying this demographic to confirm our assumption.

The data shown in our graphs illustrates the flow of traffic on campus. Traffic is very heavy around central grounds, and there is a reliance on the bus system to get to Gooch Dillard. Other first-year dorms are points of interest as far as a bike share is concerned, but the distance Gooch Dillard is from the rest of grounds makes the possibility of a bike share very appealing to students. O-Hill is also a central point of traffic. Overall, the vast majority of students would be open to biking as an alternative method of transportation.

Though we were pleased with the large proportion of yeses, we were disappointed with the few no's that we received. Upon asking why, we determined there were two main reasons why someone wouldn't use a bike for their daily trip. The primary culprit: hills. Most of our no's came from people traveling to Hereford or U-Heights, where the hills are simply too large for most people to bike up. Some participants who already owned bikes stated that they ride up the hills anyway, but most aren't as motivated. When going to Hereford, one participant informed us that she parks her bike at Gooch/Dillard, then walks up to Hereford, avoiding the hill altogether. This is important too note, especially since putting a bike hub at the top of a hill could lead to an unbalanced flow of bikes from the hub. Everyone would take the bikes down the hill, but no one rides them back up. Hopefully, these unbalanced hub flows can be avoided by careful location placement, but if not, a crew with a vehicle might need to be responsible for resetting bikes to even out their dispersion.

In the end, we concluded that it would be best to have bike hubs located at apartments/dorms and classes, and especially at first-year dorms. We decided our primary locations of interest would be: at large Gooch/Dillard for both Gooch/Dillard residents and Hereford residents; at O-Hill Dining Hall, for diners and upper new dorms students; at the AFC, for gym-users and lower new dorms students; a large hub at old dorms, for all the old dorm students and chemistry/psychology students across the street; the biggest hub outside Clark Hall, for those going to class; and, finally, a hub in front of Alderman library, for the libraries and Newcomb Hall. All these locations are our primary locations of interest, and they are all located along Alderman and McCormick Road. Also, in talks

with Rebecca White and Andrew Greene, they even suggested in the long-term that the McCormick Road bus stops be entirely phased out, and becoming a service-vehicle only road. Such a goal can only take place over a long period of time, and the bike share would need to step up if the bus system were to be stepped down. Alderman and McCormick Road both have a lot of student foot and bus traffic, and with first-years not having cars, a first-years first option is to take the bus. In time, the system would need to expand to North Grounds, the South Lawn, and the Corner to accommodate the needs of all UVA students, faculty, and staff.

Following the same logic as before, we concluded that bike lanes, first and foremost, should be implemented along Alderman and McCormick Road. Bike traffic is dangerous on McCormick and Alderman Roads due to the complete lack of bike lanes. (Appendix B) McCormick especially sees heavy bus use, and if a large biking community is to be established using these roads, the university must be prepared to handle the bike traffic by setting up a solid biking infrastructure. Bike lanes are an absolute must for these roads in the future. Ironically enough, a student was hit earlier this year while biking at the intersection of McCormick and Alderman Road. The university must do everything it can to keep its students safe; this includes implementing the necessary bike infrastructure to protect bikers and pedestrians.

Conclusion

The research phase of our project has gone quite well. Once UVa Bikes gets the results from other volunteers that did similar surveying and data collection, it will be easier to analyze the findings. We have developed a method to easily log, organize, and display the information collected by the surveys so that future research can just be added directly to ours.

The bike share research project has laid the foundation for a successful presentation from UVa Bikes that should get the funding it needs to reapprove launching the bike share system at UVa that had been intended for August 2010. This time, given the research added to the project, there shouldn't be any problem implementing the system on grounds. The only issue left unresolved is the amount of funding the University is willing to give the project. Once this is established, the best locations and number of bike kiosks will be easy to discern from the data collected by those working with UVa Bikes. The information that our group gathered will be shown via chart and graphically to provide the clearest presentation of the findings. This should ensure that the bike share is implemented most effectively and as quickly as possible.

Funding is still the biggest limiting factor in the implementation of the bike share. Although it was approved in the past, a lack of research kept the program from launching. Without funding from the University, launching such a large, expensive system will be practically impossible. The added research, along with an improved organization of the findings, should be more than enough to get the plan approved and the funds appropriated once again.

There are also concerns about the existing bicycling infrastructure in and around the University. Many highly trafficked areas lack properly marked bike lanes, or they do not have any at all. This must be improved before greatly increasing the number of bikes on the roadways. If the system were launched onto the existing infrastructure, we believe it could be very dangerous for pedestrians, cyclists, and vehicle traffic. It could also make bus operations more difficult, as opposed to alleviating some of the stresses on the transportation system. The data collected via the destination surveys (Appendix C) should provide sufficient information as to where the most bicycle traffic will be and where the roadways will need the most improvement.

Future Work

It will likely be necessary to do more research like what was done this semester. This will add validity to the findings and strengthen our analysis of the data. The volunteers over at UVa Bikes will continue to survey for the rest of the month. Once they turn over their results and the information is put together, a more accurate set of data should be easy to draw conclusions from for the researchers at UVa Bikes.

An important step in successfully launching the bike share is improving the bicycling infrastructure on-grounds prior to the large influx of cycling traffic that will likely follow the implementation of a bike share. As mentioned before, the areas to be targeted should become more apparent as the research being done this month is concluded and the most important roadways are marked. It will also be important to raise cycling awareness and education in an effort to make the transition of the system into the community safer and better understood by those who will be using it.

The next step will be to present the information to the University. If all goes well, then the research phase should be completed. This should allow the program to get the funding it requires for the improvement of the infrastructure and the initial launch of bicycles. This preliminary implementation of a smaller version of the full system should allow for the optimization of the rest of the system when it is ready to go in place. Once the program is launched it will be vital to continue collecting data about how it is viewed and used. The opinions of participants and critics will be the most important tools in the placement of bicycle kiosks for the full-scale launch of the program. Once it is determined where the bikes will most effectively be used, the research will be concluded. Other than deciding where and when to expand certain stations, which should become apparent through prolonged use of the system, the system should become largely self-sufficient. Maintenance will take over, and the bike share system will help offset the buses and vehicles used on-grounds.

Lessons Learned

This project has been a learning experience for us, not just about issues of sustainability and transportation, but of teamwork and problem-solving as well. Fortunately, we were able to plug into existing resources at UVa in order to enable us to have the largest impact possible on our project in only a semester. Though this collaboration was extremely beneficial to our project, it also provided a barrier at times.

For example, we assisted in conducting origin/destination surveys to determine traffic flow on grounds. We were thankful to be plugged into an existing organization for this so that we could analyze our result along with those of many others in order to glean the most accurate analysis of where biking infrastructure should be placed. Unfortunately, however, this did not work out in our favor. While the collaboration among multiple groups has been incredibly beneficial all semester, ultimately we are different groups operating on different schedules. While we were on a time crunch trying to pull together our data and analysis before our deadline of Wednesday, December 8, our cohorts' deadline for presentation of the data we have collected is not until December 31. As a result, we were only able to gain access to our own data to analyze, as the rest of it was not prepared at the time this assignment was due. While this facet of our assignment did not turn out exactly the way that we imagined, the data that we collected allowed us to formulate our own ideas about where the biking infrastructure should go. Our goals for this project were to plug into existing community resources and maintain those relationships throughout the semester, to conduct necessary research, and to analyze that research in order to determine where biking infrastructure would be most effectively placed on grounds. All of these have been accomplished throughout the course, but that does not mean that our project is over. The research that we are helping with is part of a greater project run by UVa Bikes, the Office of the Architect, the Department of Parking and Transportation, and other campus organizations. There will be a presentation on December 31 to get the bike share passed by the University to be funded and implemented on grounds. Our ultimate goal is that this happens. While this class is over, our involvement in and relationships with these various organizations are not. We have learned how to collaborate with our community partners and we hope to continue to do so throughout the bike share proposal and, hopefully, implementation. This project has been one of many ups and downs, but ultimately we perceive it to be successful.

Appendices
Appendix A: Bibliography

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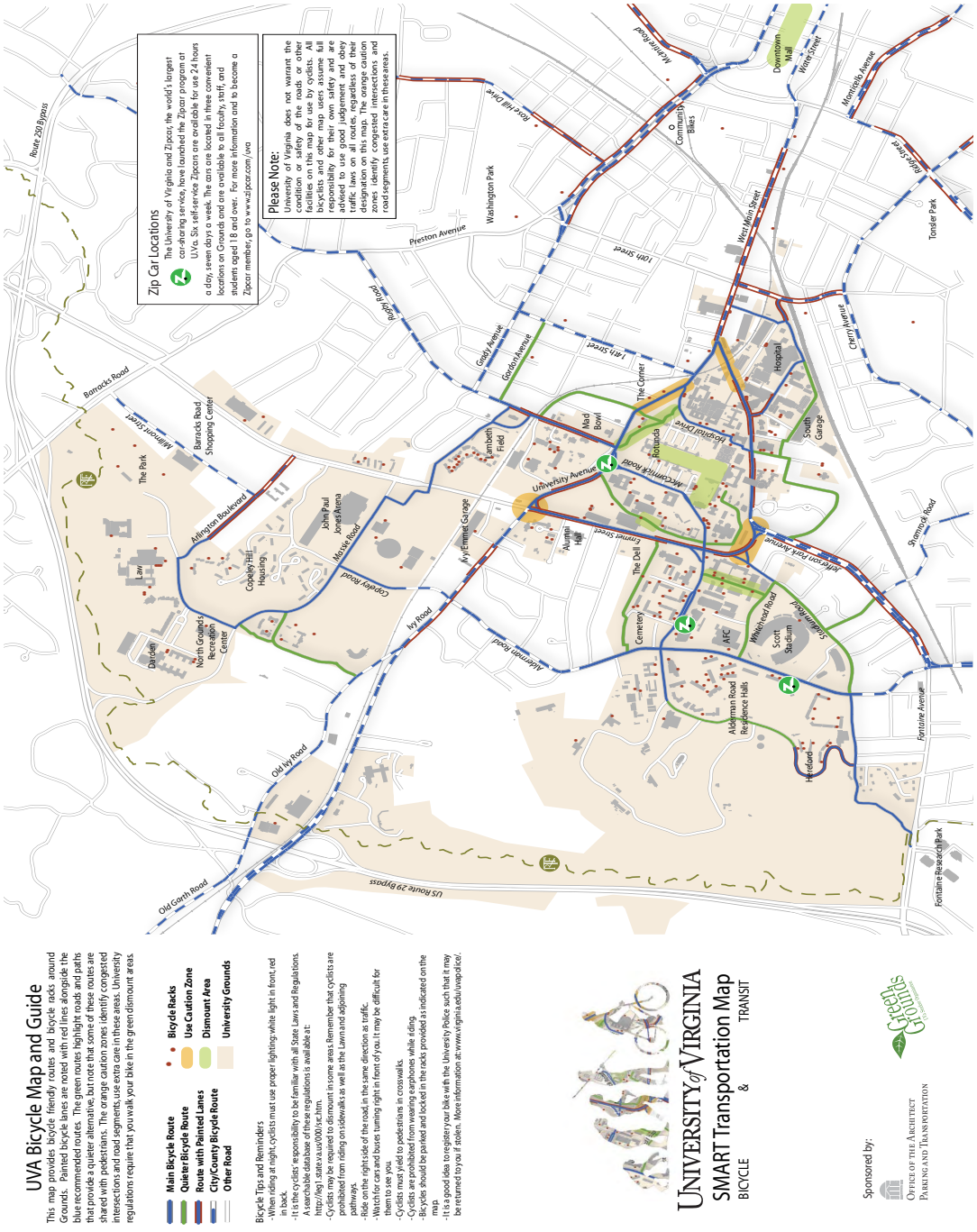
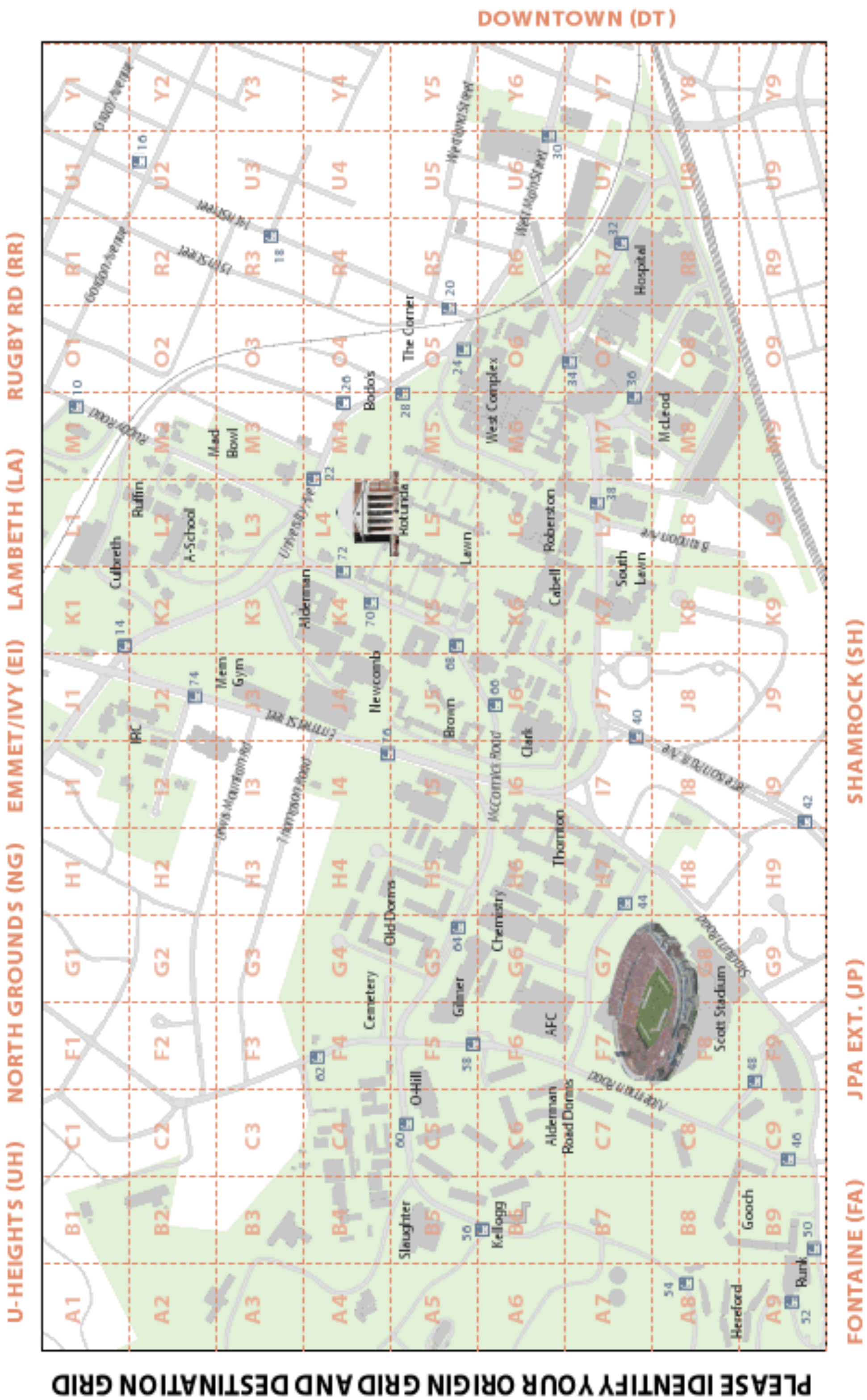
Appendix B: Bike Routes on Grounds



Appendix C: Origin/Destination Survey


DOWNTOWN (DT)
U-HEIGHTS (UH)
NORTH GROUNDS (NG)
EMMET/IVY (EI)
LAMBETH (LA)
RUGBY RD (RR)
FONTAINE (FA)
JPA EXT. (JP)
SHAMROCK (SH)
PLEASE IDENTIFY YOUR ORIGIN GRID AND DESTINATION GRID
Culbreth
Ruffin
A-School
Mad Bowl
Bodos
The Corner
West Complex
Hospital
McLeod
Rotunda
Lawn
Robertson
Cabell
South Lawn
Alderman
Newcomb
Mem Gym
IRC
Brown
Clark
Thornton
Old Dorms
Chemistry
Cemetery
Gilmer
AFC
Scott Stadium
O-Hill
Alderman Road Dorms
Slaughter
Kellogg
Gooch
Runk
Hereford

Name:

Location:

Date:

Time Period:

Origin Grid	For Bus Users: Got on Bus	For Bus Users: Got off Bus	Destination Grid

Mode: (1 or more) Walk Bike Bus Ride Car

If you had convenient access to a bicycle for this trip, would you use it? Yes Probably Maybe Unlikely No

Origin Grid	For Bus Users: Got on Bus	For Bus Users: Got off Bus	Destination Grid

Mode: (1 or more) Walk Bike Bus Ride Car

If you had convenient access to a bicycle for this trip, would you use it? Yes Probably Maybe Unlikely No

Origin Grid	For Bus Users: Got on Bus	For Bus Users: Got off Bus	Destination Grid

Mode: (1 or more) Walk Bike Bus Ride Car

If you had convenient access to a bicycle for this trip, would

Origin Grid	For Bus Users: Got on Bus	For Bus Users: Got off Bus	Destination Grid

Mode: (1 or more) Walk Bike Bus Ride Car

If you had convenient access to a bicycle for this trip, would you use it? Yes Probably Maybe Unlikely No

Origin Grid	For Bus Users: Got on Bus	For Bus Users: Got off Bus	Destination Grid

Mode: (1 or more) Walk Bike Bus Ride Car

If you had convenient access to a bicycle for this trip, would you use it? Yes Probably Maybe Unlikely No

Origin Grid	For Bus Users: Got on Bus	For Bus Users: Got off Bus	Destination Grid

Mode: (1 or more) Walk Bike Bus Ride Car

If you had convenient access to a bicycle for this trip, would

Appendix D: Approach Matrix

Criteria	Awareness Campaign	Education and Safety Promotion	Low-Cost Alternative	Rental Program	High-Tech System
Set-Up:					
A. Easily created	1	1	1	1	0
B. Cost-effective to create	1	1	1	1	0
C. Can use Local materials and labor	1	1	1	1	0
D. Can use recycled materials	0	0	1	1	0
E. Can be entirely student run	1	0	0	0	0
Practicality:					
Low maintenance	1	1	1	1	1
Attractive	0	0	0	1	1
Long-lasting	0	0	0	1	1
Self-sustaining	0	0	0	0	1
Environmentally friendly	0	0	1	1	1
Economically responsible	0	0	0	1	1
Existing Resources	0	0	0	0	1
Strong Impact	0	0	1	1	1
TOTAL:	5	4	7	9	8

Appendix E: Data Collected

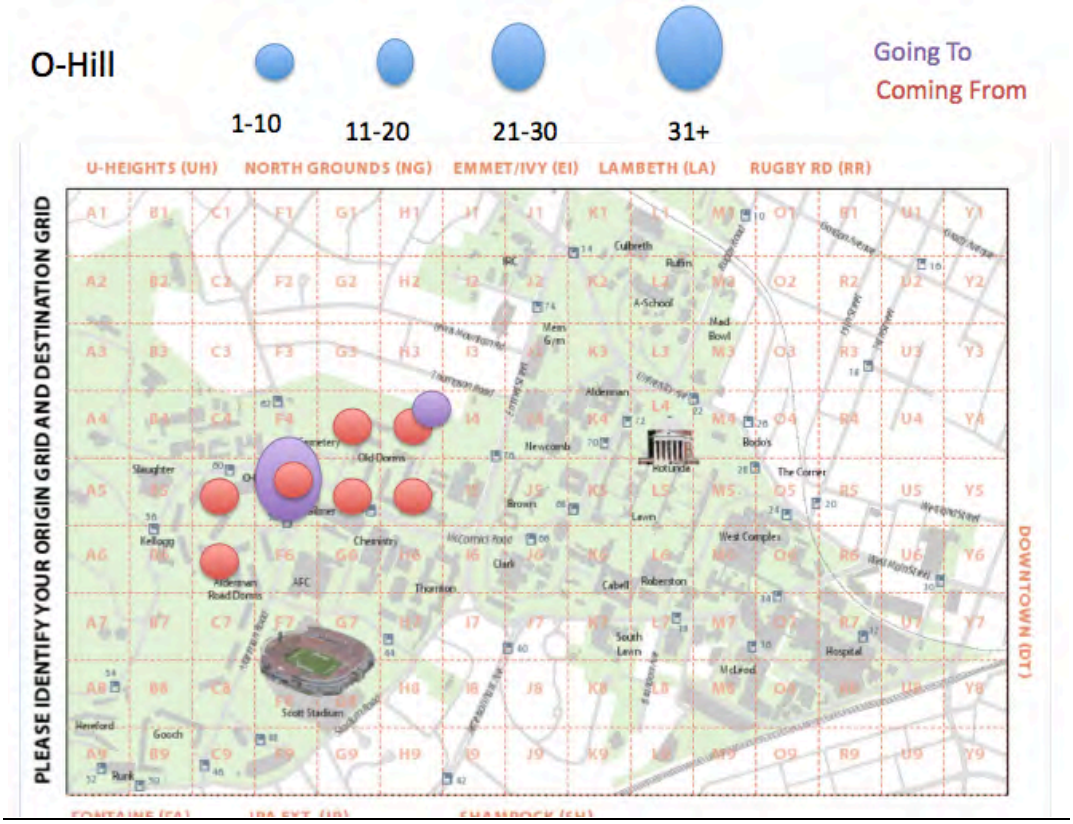
	A	B	C	D	E	F	G	H	
1	Day	Intercept	Time	Mode	Origin	Destination	On Bus	Off Bus	Bike
	Saturd								
	Sunda	O-Hill	1:20-1:40pm	walk	H4	F5			No
25	y	O-Hill	11-11:10am	walk	H5	F5			No
	Sunda	O-Hill	1:20-1:40pm	walk	H4	F5			No
26	y	O-Hill	11:20am	walk	G5	F5			No
	Sunda	O-Hill	1:20-1:40pm	walk	H5	F5			No
27	y	O-Hill	11:20am	walk	G5	F5			No
	Sunda	O-Hill	1:20-1:40pm	walk	G5	F5			No
28	y	O-Hill	11:20am	walk	G5	F5			No
	Sunda	O-Hill	1:20-1:40pm	walk	G4	F5			No
29	y	O-Hill	11:20am	walk	G5	F5			No
	Sunda	O-Hill	1:20-1:40pm	walk	C6	F5			No
30	y	O-Hill	11:20am	walk	G5	F5			No
	Sunda	O-Hill	1:20-1:40pm	walk	H5	F5			No
31	y	O-Hill	11:20am	walk	F5	F5			No
	Sunda	O-Hill	1:20-1:40pm	walk	G4	F5			No
32	y	O-Hill	11:20am	walk	F5	F5			No
	Sunda	O-Hill	1:20-1:40pm	walk	H4	F5			No
33	y	O-Hill	11:20am	walk	F5	H4			No
	Sunda	O-Hill	1:20-1:40pm	walk	C6	F5			No
34	y	O-Hill	11:20am	walk	F5	H4			No
	Sunda	O-Hill	1:20-1:40pm	walk	H5	F5			No
35	y	O-Hill	11:20am	walk	F5	H4			No
	Sunda	O-Hill	1:20-1:40pm	walk	H5	F5			No
36	y	O-Hill	11:20am	walk	C5	F5			No
	Sunda	O-Hill	11-11:10am	walk	G4	F5			No
37	y	O-Hill	11:20am	walk	C5	F5			No
38	Mond ay	Alderman Bus Stop (70)	10-10:30 am	walk	L5	K4			No
39	Mond ay	Alderman Bus Stop (70)	10-10:30 am	walk	L5	K4			Yes
40	Mond ay	Alderman Bus Stop (70)	10-10:30 am	walk	J3	L6			No
41	Mond ay	Alderman Bus Stop (70)	10-10:30 am	walk	O5	G6			No
42	Mond ay	Alderman Bus Stop (70)	10-10:30 am	walk	R5	H6			No
43	Mond ay	Alderman Bus Stop (70)	10-10:30 am	walk	K4	L5			Unlikely
44	Mond ay	Alderman Bus Stop (70)	10-10:30 am	walk/car	off map	J6			No
45	y	O-Hill	11-11:10am	walk	H4	F5			No
46	Mond ay	Alderman Bus Stop (70)	10-10:30 am	bus	J3	I7	70	40	Yes
47	Mond ay	Alderman Bus Stop (70)	10-10:30 am	bus	K4	G5	70	64	No

71	Monday	Chemistry Bus Stop	4-5pm	bus	C5	K6	64	68	no
72	Monday	Chemistry Bus Stop	4-5pm	bus	G5	K6	64	68	yes
73	Monday	Chemistry Bus Stop	4-5pm	bus	G5	K6	64	68	yes
74	Monday	Old Dorms Bus Stop	11-11:40am	bus	G6	B9	64	50	yes
75	Monday	Old Dorms Bus Stop	11-11:40am	bus	H4	A9	64	52	yes
76	Monday	Old Dorms Bus Stop	11-11:40am	bus	H5	A9	64	52	yes
77	Monday	Old Dorms Bus Stop	11-11:40am	bus	H5	A9	64	52	yes
78	Monday	Old Dorms Bus Stop	11-11:40am	bus	H6	A8	64	54	no
79	Monday	Old Dorms Bus Stop	11-11:40am	bus	G6	B9	64	50	yes
80	Monday	Old Dorms Bus Stop	11-11:40am	bus	H6	A8	64	54	no
81	Monday	Old Dorms Bus Stop	11-11:40am	bus	H5	A9	64	52	yes
82	Monday	Old Dorms Bus Stop	11-11:40am	bus	H5	A9	64	52	yes
83	Monday	Old Dorms Bus Stop	11-11:40am	bus	J3	C6	64	58	yes
84	Friday	Old Dorms Bus Stop	4-5pm	bus	G5	A8	64	54	maybe
85	Friday	Old Dorms Bus Stop	4-5pm	bus	G6	A9	64	52	yes
86	Friday	Old Dorms Bus Stop	4-5pm	bus	G5	I8	64	40	no
87	Friday	Old Dorms Bus Stop	4-5pm	bus	I5	I9	64	42	yes
88	Friday	Old Dorms Bus Stop	4-5pm	bus	I6	A9	64	52	yes
89	Friday	Old Dorms Bus Stop	4-5pm	bus	G5	A9	64	52	yes
90	Friday	Old Dorms Bus Stop	4-5pm	bus	G5	B9	64	50	no
91	Friday	Old Dorms Bus Stop	4-5pm	bus	G5	A9	64	52	no
92	Friday	Old Dorms	4-5pm	bus	G5	UH	64	UH	yes

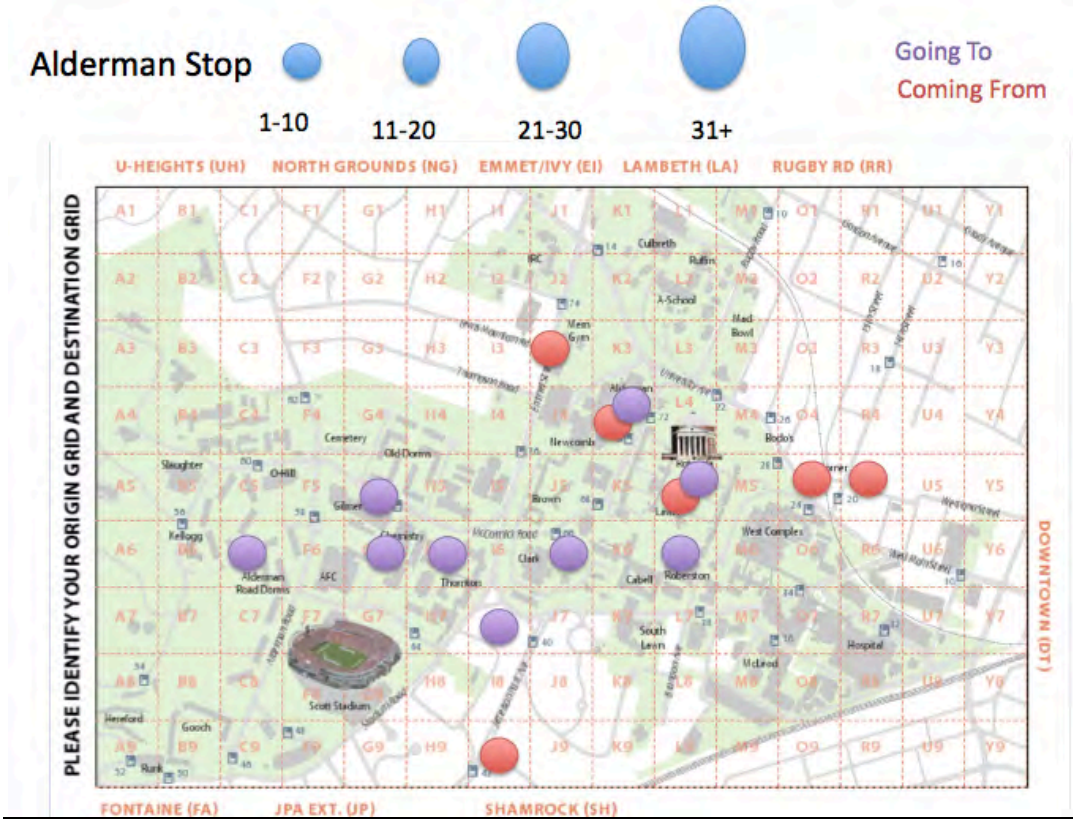
115	Tuesday	Monroe Hall Bus Stop	4-5pm	bus	K5	J7	68	40	yes
116	Tuesday	Monroe Hall Bus Stop	4-5pm	bus	K6	A8	68	54	no
117	Tuesday	Monroe Hall Bus Stop	4-5pm	bus	K6	C5	68	58	yes
95	Tuesday	Garrett Hall Bus Stop	4-5pm	bus	I7	I2	68	74	no
96	Tuesday	Garrett Hall Bus Stop	4-5pm	bus	K5	UH	68	UH	no
97	Tuesday	Garrett Hall Bus Stop	4-5pm	bus	K5	EI	68	EI	yes
98	Tuesday	Garrett Hall Bus Stop	4-5pm	bus	K5	EI	68	EI	yes
99	Tuesday	Garrett Hall Bus Stop	4-5pm	bus	J4	R3	68	18	yes
100	Tuesday	Garrett Hall Bus Stop	4-5pm	bus	K5	UH	68	UH	yes
101	Tuesday	Garrett Hall Bus Stop	4-5pm	bus	L6	LA	68	LA	yes
102	Tuesday	Garrett Hall Bus Stop	4-5pm	bus	K6	EI	68	EI	yes
103	Tuesday	Garrett Hall Bus Stop	4-5pm	bus	K6	M1	68	10	yes
104	Tuesday	Garrett Hall Bus Stop	4-5pm	bus	K5	M1	68	10	yes
105	Tuesday	Garrett Hall Bus Stop	4-5pm	bus	L5	UH	68	UH	no
106	Tuesday	Garrett Hall Bus Stop	4-5pm	bus	K6	UH	68	UH	maybe
107	Tuesday	Monroe Hall Bus Stop	4-5pm	bus	J6	G5	68	64	yes
108	Tuesday	Monroe Hall Bus Stop	4-5pm	bus	J4	B9	68	50	yes
109	Tuesday	Monroe Hall Bus Stop	4-5pm	bus	K6	A8	68	54	yes
110	Tuesday	Monroe Hall Bus Stop	4-5pm	bus	K5	A8	68	54	yes
111	Tuesday	Monroe Hall Bus Stop	4-5pm	bus	K6	B8	68	50	yes
112	Tuesday	Monroe Hall Bus Stop	4-5pm	bus	K7	A8	68	54	no
113	Tuesday	Monroe Hall Bus Stop	4-5pm	bus	K6	A8	68	54	maybe
11	Tuesd	Monroe Hall							

Appendix F: Graphs

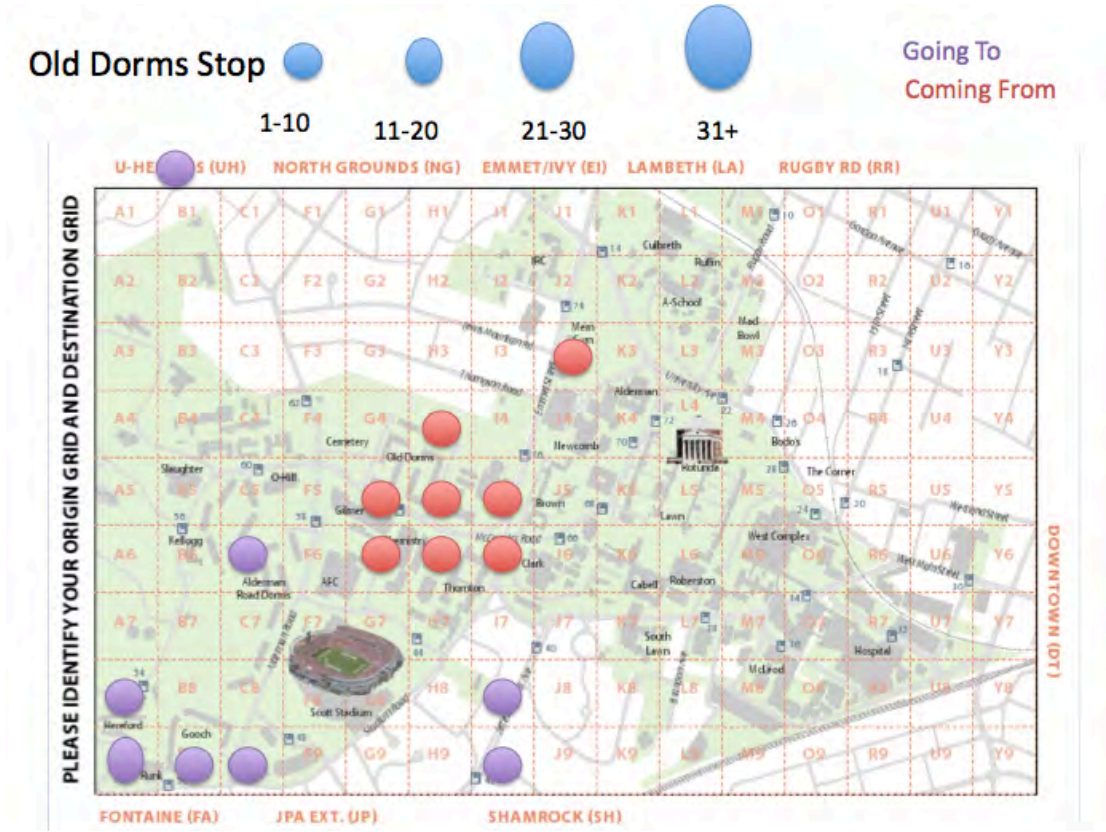
O-Hill

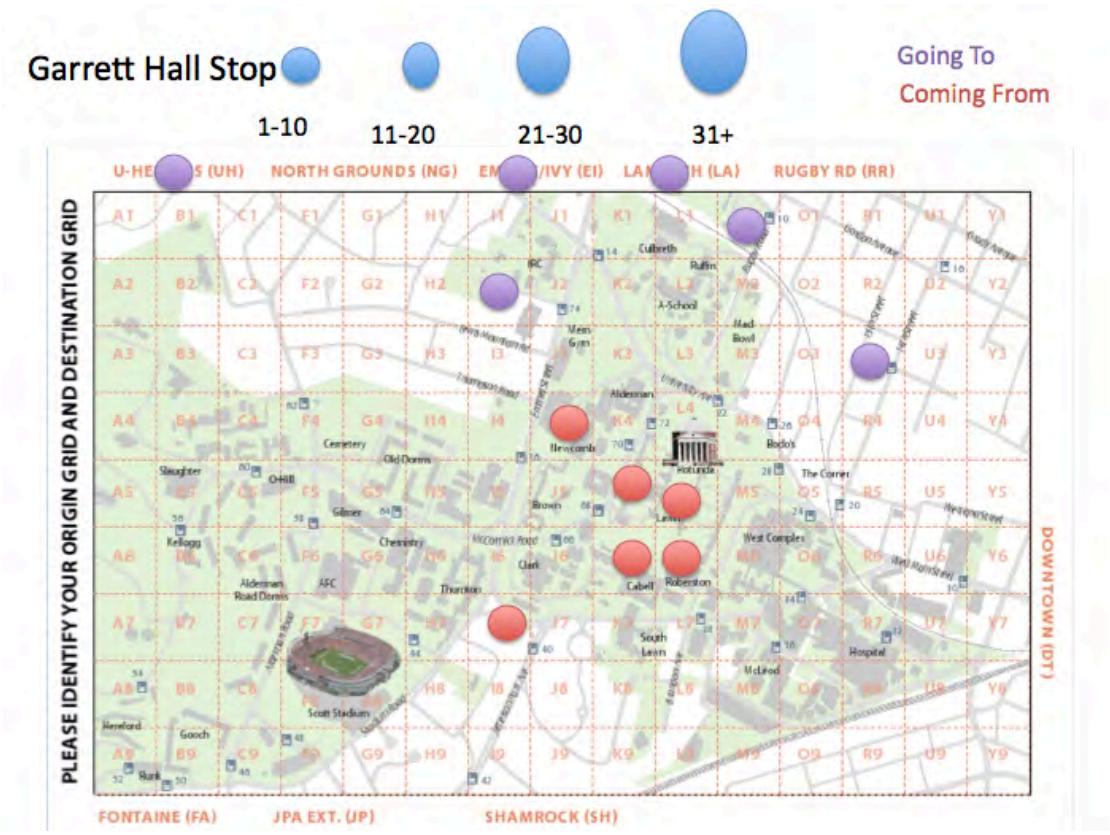


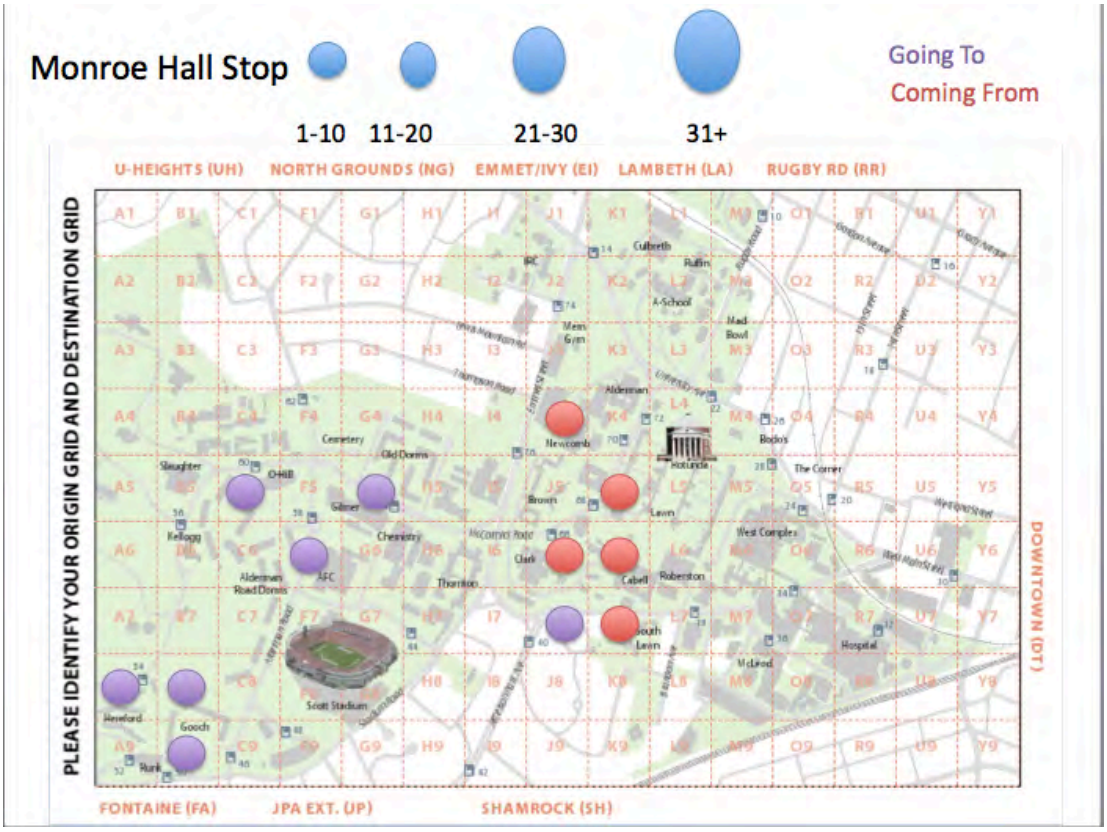
Alderman Stop

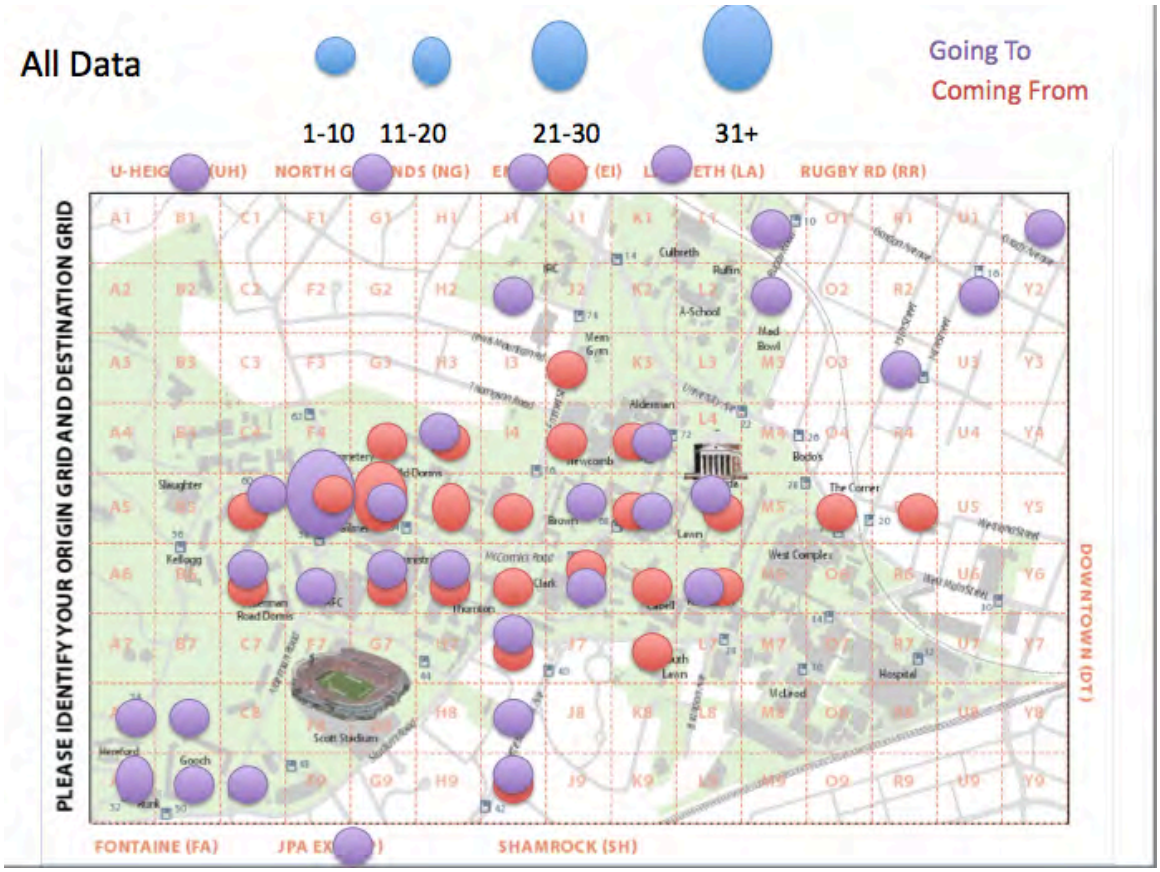



Chemistry Stop
1-10
11-20
21-30
31+
Going To
Coming From
U-HEIGHTS (UH)
NORTH GROUNDS (NG)
EMMET/IVY (EI)
LAMBETH (LA)
RUGBY RD (RR)
PLEASE IDENTIFY YOUR ORIGIN GRID AND DESTINATION GRID
DOWNTOWN (DT)
FONTAINE (FA)
JPA EXT. (UP)
SHAMROCK (SH)


Old Dorms Stop
1-10
11-20
21-30
31+
Going To
Coming From
NORTH GROUNDS (NG)
EMMET/IVY (EI)
LAMBETH (LA)
RUGBY RD (RR)
PLEASE IDENTIFY YOUR ORIGIN GRID AND DESTINATION GRID
DOWNTOWN (DT)
FONTAINE (FA)
JPA EXT. (UP)
SHAMROCK (SH)


Garrett Hall Stop
1-10
11-20
21-30
31+
Going To
Coming From
U-HEIGHTS (UH)
NORTH GROUNDS (NG)
EMMET/IVY (EI)
LAMBETH (LA)
RUGBY RD (RR)
PLEASE IDENTIFY YOUR ORIGIN GRID AND DESTINATION GRID
DOWNTOWN (DT)
FONTAINE (FA)
JPA EXT. (JP)
SHAMROCK (SH)


Monroe Hall Stop
1-10
11-20
21-30
31+
Going To
Coming From
U-HEIGHTS (UH)
NORTH GROUNDS (NG)
EMMET/IVY (EI)
LAMBETH (LA)
RUGBY RD (RR)
PLEASE IDENTIFY YOUR ORIGIN GRID AND DESTINATION GRID
DOWNTOWN (DT)
FONTAINE (FA)
JPA EXT. (JP)
SHAMROCK (SH)

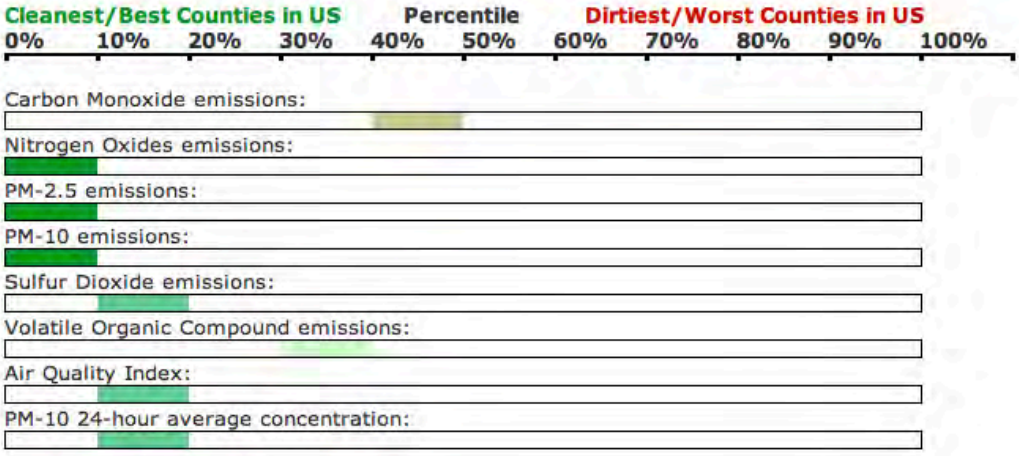

All Data
1-10
11-20
21-30
31+
Going To
Coming From
PLEASE IDENTIFY YOUR ORIGIN GRID AND DESTINATION GRID
DOWNTOWN (DT)
RUGBY RD (RR)
FONTAINE (FA)
SHAMROCK (SH)
Scott Stadium
Culbreth
Ruffin
A-School
Mud Bowl
Mem Gym
Aldermen
Bowles
The Corner
West Complex
Hospital
McCormick Road
Clark
Lawn
Brown
Slaughter
Kellogg
Gooch
Hereford

Appendices

Appendix A

Charlottesville Air Quality Ratings - Emphasis on Carbon Monoxide emissions

- **Air Quality Rankings: Health Risks, Exposure, and Emissions**



- **Exposures to Criteria Air Pollutants**

Air Quality Index:

Percentage of days with good air quality:	100
Percentage of days with moderate air quality:	0
Percentage of days with unhealthful air quality for sensitive populations:	0
Percentage of days with unhealthful air quality:	0
Maximum AQI level in 2003	41
Median AQI level in 2003	15
90th Percentile AQI level in 2003	25

Air Quality Index	
0 - 50	Good
50 - 100	Moderate
100 - 200	Unhealthful
200 - 300	Very Unhealthful
300 - 500	Hazardous

2003 Summary of Pollutant Concentrations:

Pollutant	NAAQS Standard	Highest Recorded Concentration	Second Highest Recorded Concentration	Number of NAAQS Exceedances	Stations Monitoring Pollutant
PM-10					
24-hour average	150 ug/m3	44 ug/m3	30 ug/m3	0	1
Annual arithmetic mean	50 ug/m3	17 ug/m3	0 ug/m3	0	1

[top]

- **1999 Emissions Summary of Criteria Air Pollutants**

(Expressed in tons of pollutant emitted)

	Carbon monoxide	Nitrogen oxides	PM-2.5	PM-10	Sulfur dioxide	Volatile organic compounds
Mobile Sources	4,864	221	23	25	39	315
Area Sources	4,732	295	113	816	49	1,363
All sources	9,596	516	135	841	89	1,678

Appendix B

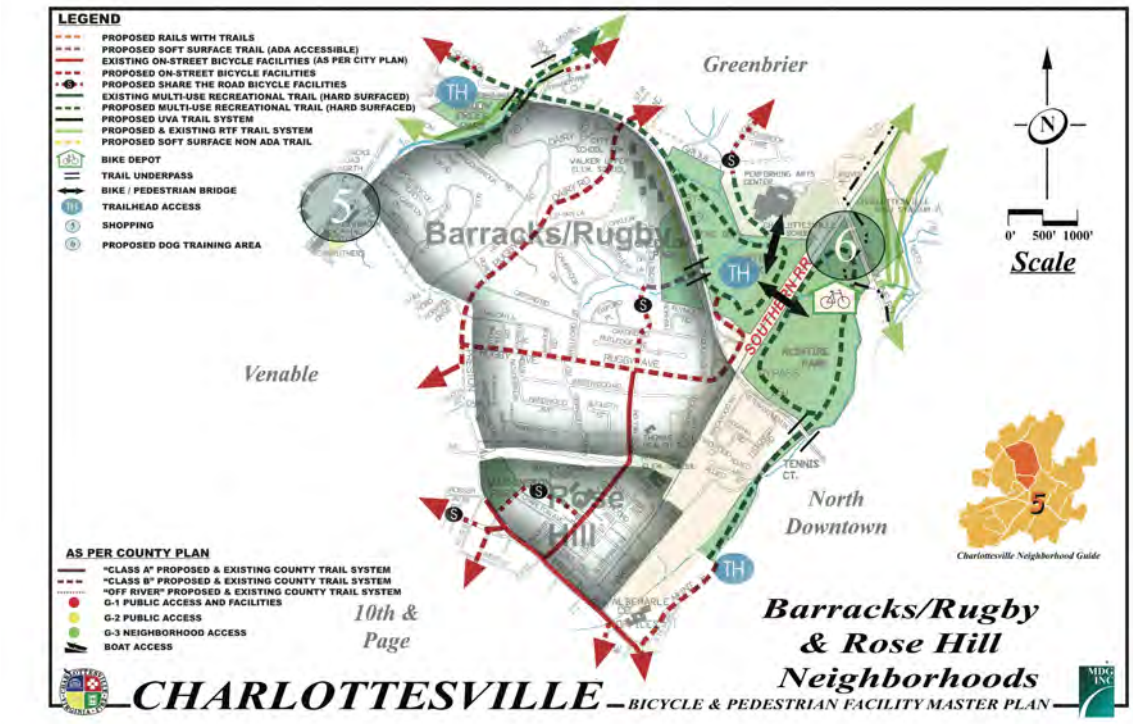
Bixi Bike Design – "The bikes, which cost $2,000 apiece, are made of aluminum and are theft-proof, according to their designers."

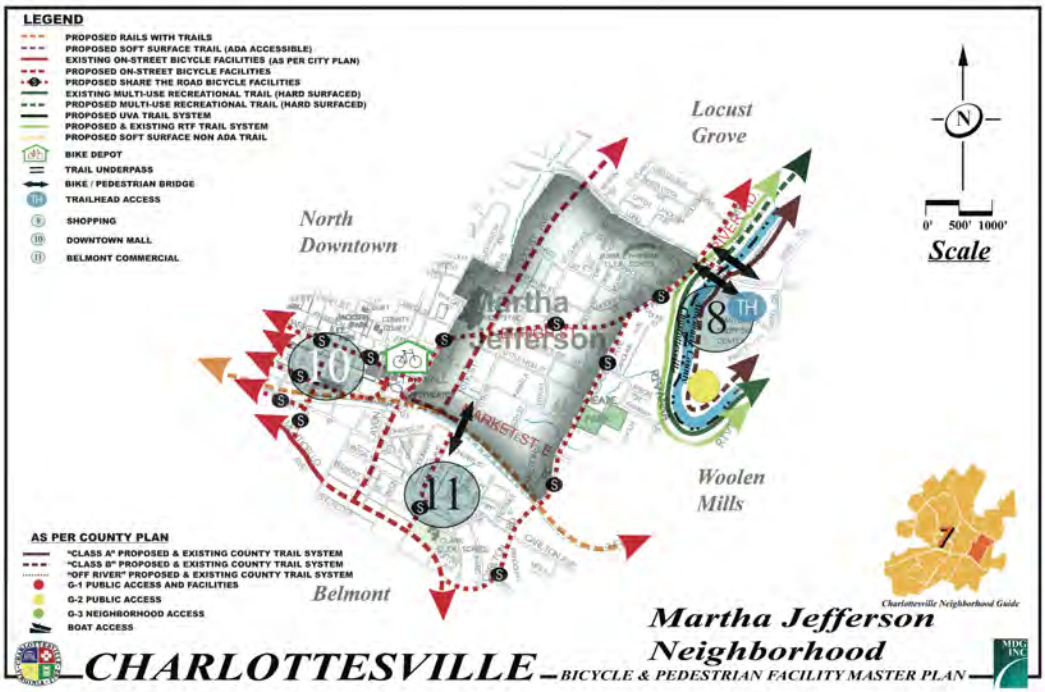
Appendix C

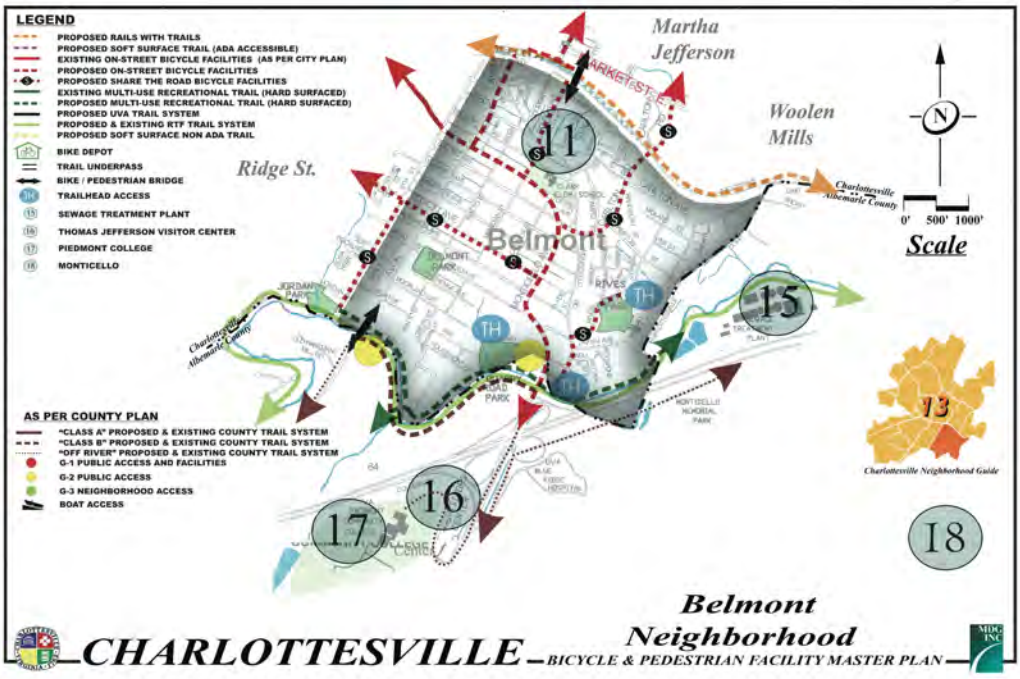
Series of photos of the bike path along West Main street. The bike path along West Main street disappears on the bridge and returns on the opposite side of the bridge, but it becomes half the size because the cyclist has to share the space with parked cars. The cyclist thus becomes sandwiched between moving cars and parked cars.

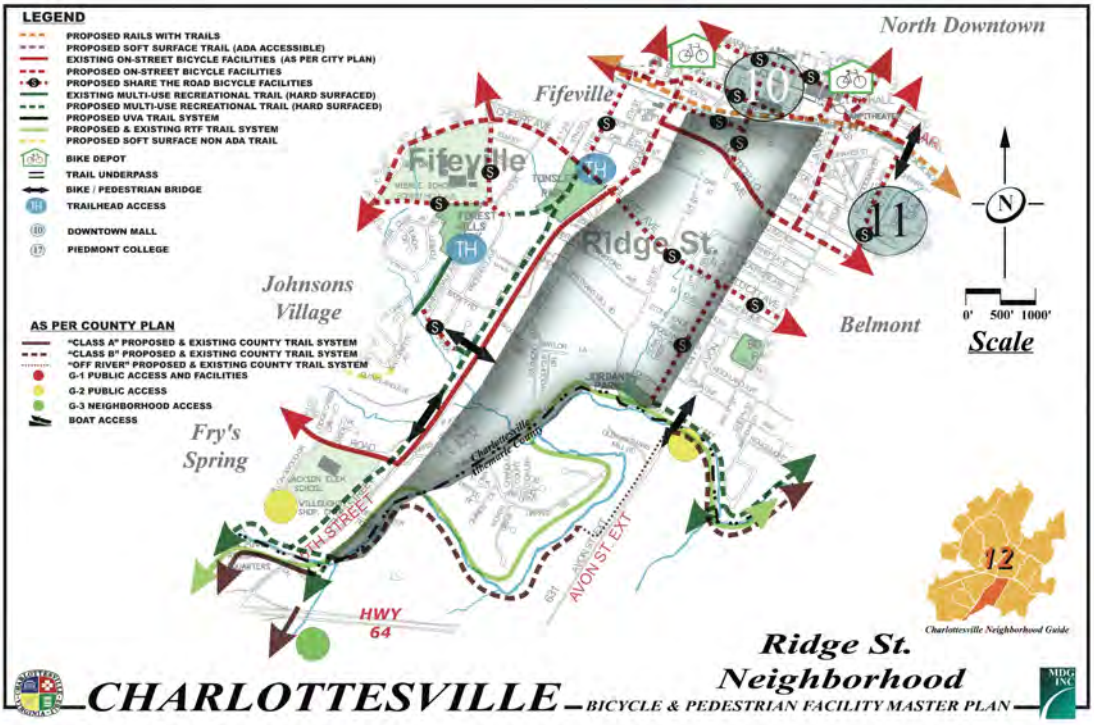
Appendix D

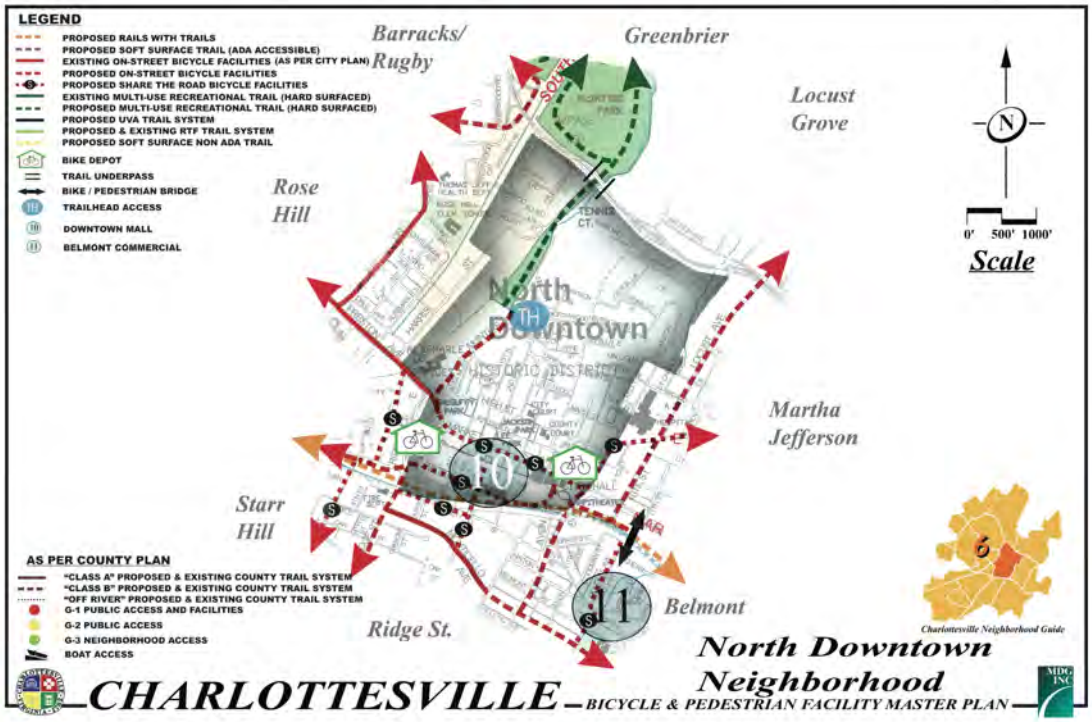
Series of Maps showing the 2003 Bike and Pedestrian Facility Master Plan proposal that shows existing bike lanes with the solid red line and proposed bike lanes with the dashed red line.




LEGEND
PROPOSED RAILS WITH TRAILS
PROPOSED SOFT SURFACE TRAIL (ADA ACCESSIBLE)
EXISTING ON-STREET BICYCLE FACILITIES (AS PER CITY PLAN)
PROPOSED ON-STREET BICYCLE FACILITIES
PROPOSED SHARE THE ROAD BICYCLE FACILITIES
EXISTING MULTI-USE RECREATIONAL TRAIL (HARD SURFACED)
PROPOSED MULTI-USE RECREATIONAL TRAIL (HARD SURFACED)
PROPOSED UVA TRAIL SYSTEM
PROPOSED & EXISTING RTF TRAIL SYSTEM
PROPOSED SOFT SURFACE NON ADA TRAIL
BIKE DEPOT
TRAIL UNDERPASS
BIKE / PEDESTRIAN BRIDGE
TRAILHEAD ACCESS
SHOPPING
DOWNTOWN MALL
BELMONT COMMERCIAL
AS PER COUNTY PLAN
"CLASS A" PROPOSED & EXISTING COUNTY TRAIL SYSTEM
"CLASS B" PROPOSED & EXISTING COUNTY TRAIL SYSTEM
"OFF RIVER" PROPOSED & EXISTING COUNTY TRAIL SYSTEM
G-1 PUBLIC ACCESS AND FACILITIES
G-2 PUBLIC ACCESS
G-3 NEIGHBORHOOD ACCESS
BOAT ACCESS
Locust Grove
North Downtown
Martha Jefferson
Woolen Mills
Belmont
MARKET ST.
10
11
8
TH
7
N
0' 500' 1000'
Scale
Charlottesville Neighborhood Guide
CHARLOTTESVILLE – BICYCLE & PEDESTRIAN FACILITY MASTER PLAN
Martha Jefferson Neighborhood
MDG INC

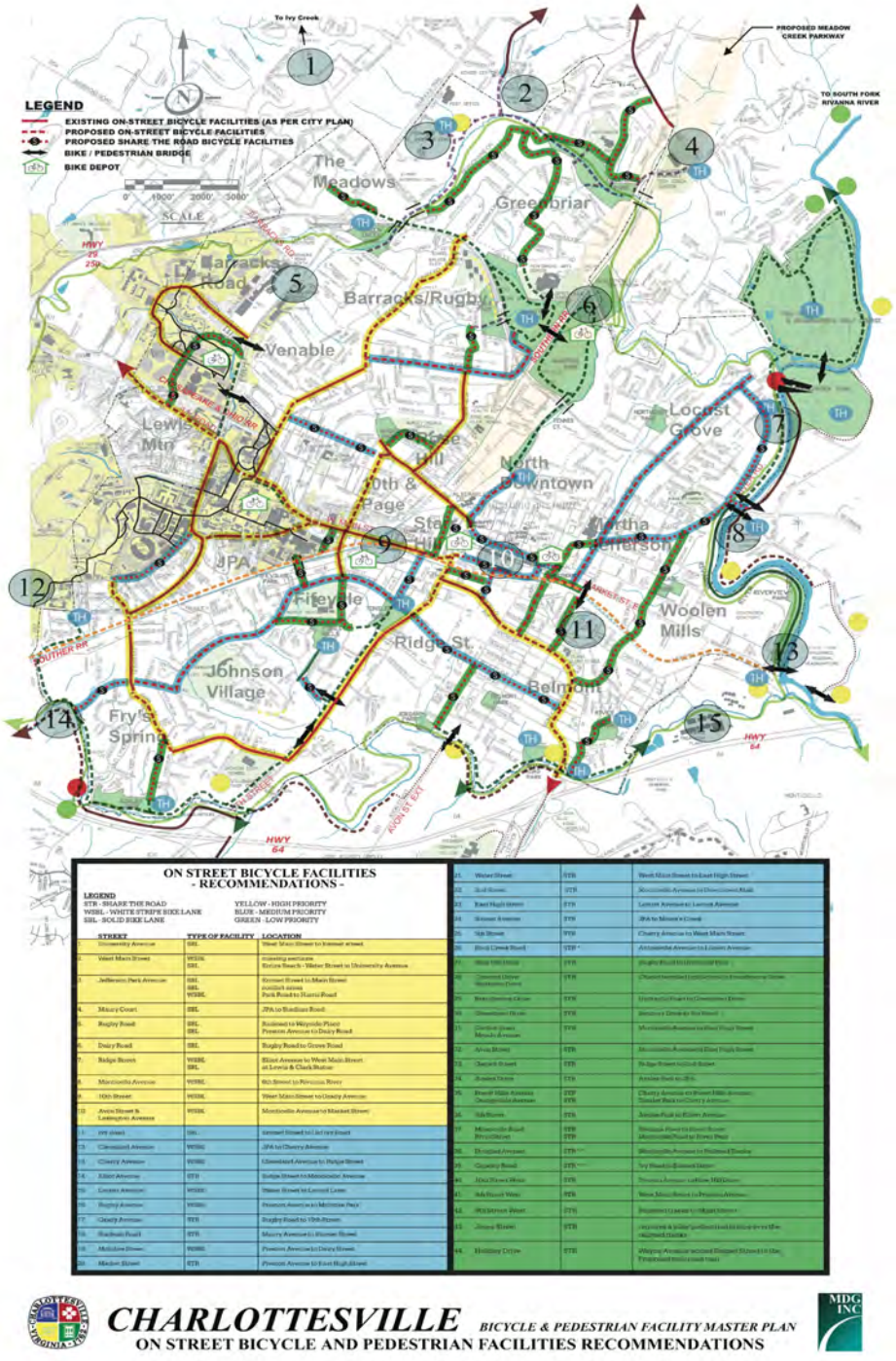

LEGEND
PROPOSED RAILS WITH TRAILS
PROPOSED SOFT SURFACE TRAIL (ADA ACCESSIBLE)
EXISTING ON-STREET BICYCLE FACILITIES (AS PER CITY PLAN)
PROPOSED ON-STREET BICYCLE FACILITIES
PROPOSED SHARE THE ROAD BICYCLE FACILITIES
EXISTING MULTI-USE RECREATIONAL TRAIL (HARD SURFACED)
PROPOSED MULTI-USE RECREATIONAL TRAIL (HARD SURFACED)
PROPOSED UVA TRAIL SYSTEM
PROPOSED & EXISTING RTF TRAIL SYSTEM
PROPOSED SOFT SURFACE NON ADA TRAIL
BIKE DEPOT
TRAIL UNDERPASS
BIKE / PEDESTRIAN BRIDGE
TRAILHEAD ACCESS
SEWAGE TREATMENT PLANT
THOMAS JEFFERSON VISITOR CENTER
PIEDMONT COLLEGE
MONTICELLO
AS PER COUNTY PLAN
"CLASS A" PROPOSED & EXISTING COUNTY TRAIL SYSTEM
"CLASS B" PROPOSED & EXISTING COUNTY TRAIL SYSTEM
"OFF RIVER" PROPOSED & EXISTING COUNTY TRAIL SYSTEM
G-1 PUBLIC ACCESS AND FACILITIES
G-2 PUBLIC ACCESS
G-3 NEIGHBORHOOD ACCESS
BOAT ACCESS
Martha Jefferson
Woolen Mills
Ridge St.
Belmont
MARKET ST.
11
15
16
17
18
13
TH
N
0' 500' 1000'
Scale
Charlottesville Neighborhood Guide
CHARLOTTESVILLE – BICYCLE & PEDESTRIAN FACILITY MASTER PLAN
Belmont Neighborhood
MDG INC


LEGEND
PROPOSED RAILS WITH TRAILS
PROPOSED SOFT SURFACE TRAIL (ADA ACCESSIBLE)
EXISTING ON-STREET BICYCLE FACILITIES (AS PER CITY PLAN)
PROPOSED ON-STREET BICYCLE FACILITIES
PROPOSED SHARE THE ROAD BICYCLE FACILITIES
EXISTING MULTI-USE RECREATIONAL TRAIL (HARD SURFACED)
PROPOSED MULTI-USE RECREATIONAL TRAIL (HARD SURFACED)
PROPOSED UVA TRAIL SYSTEM
PROPOSED & EXISTING RTF TRAIL SYSTEM
PROPOSED SOFT SURFACE NON ADA TRAIL
BIKE DEPOT
TRAIL UNDERPASS
BIKE / PEDESTRIAN BRIDGE
TRAILHEAD ACCESS
DOWNTOWN MALL
PIEDMONT COLLEGE
AS PER COUNTY PLAN
"CLASS A" PROPOSED & EXISTING COUNTY TRAIL SYSTEM
"CLASS B" PROPOSED & EXISTING COUNTY TRAIL SYSTEM
"OFF RIVER" PROPOSED & EXISTING COUNTY TRAIL SYSTEM
G-1 PUBLIC ACCESS AND FACILITIES
G-2 PUBLIC ACCESS
G-3 NEIGHBORHOOD ACCESS
BOAT ACCESS
North Downtown
Fifeville
Ridge St.
Johnsons Village
Belmont
Fry's Spring
10
11
12
TH
TH STREET
AVON ST EXT
HWY 64
N
0' 500' 1000'
Scale
Charlottesville Neighborhood Guide
Ridge St. Neighborhood
CHARLOTTESVILLE – BICYCLE & PEDESTRIAN FACILITY MASTER PLAN


LEGEND
PROPOSED RAILS WITH TRAILS
PROPOSED SOFT SURFACE TRAIL (ADA ACCESSIBLE)
EXISTING ON-STREET BICYCLE FACILITIES (AS PER CITY PLAN)
PROPOSED ON-STREET BICYCLE FACILITIES
PROPOSED SHARE THE ROAD BICYCLE FACILITIES
EXISTING MULTI-USE RECREATIONAL TRAIL (HARD SURFACED)
PROPOSED MULTI-USE RECREATIONAL TRAIL (HARD SURFACED)
PROPOSED UVA TRAIL SYSTEM
PROPOSED & EXISTING RTF TRAIL SYSTEM
PROPOSED SOFT SURFACE NON ADA TRAIL
BIKE DEPOT
TRAIL UNDERPASS
BIKE / PEDESTRIAN BRIDGE
TRAILHEAD ACCESS
DOWNTOWN MALL
BELMONT COMMERCIAL
AS PER COUNTY PLAN
"CLASS A" PROPOSED & EXISTING COUNTY TRAIL SYSTEM
"CLASS B" PROPOSED & EXISTING COUNTY TRAIL SYSTEM
"OFF RIVER" PROPOSED & EXISTING COUNTY TRAIL SYSTEM
G-1 PUBLIC ACCESS AND FACILITIES
G-2 PUBLIC ACCESS
G-3 NEIGHBORHOOD ACCESS
BOAT ACCESS
Barracks/ Rugby
Greenbrier
Locust Grove
Rose Hill
North Downtown
Martha Jefferson
Starr Hill
Belmont
Ridge St.
10
11
6
TH
N
0' 500' 1000'
Scale
Charlottesville Neighborhood Guide
North Downtown Neighborhood
CHARLOTTESVILLE – BICYCLE & PEDESTRIAN FACILITY MASTER PLAN

Appendix E

Map Shows the On Street Priorities of the 2003 Proposal where the solid and dashed red lines highlighted in yellow indicate the highest priority.



Appendix F

This image shows a bicycle donation bin specifically designed for collecting bicycles, and it is used by a group called Cleanscapes that has just recently recycled its 400th bicycle. http://www.cleanscapes.com/home.html

Appendix G

Final Matrix

Criteria:	**Bicycle Recycle**	**Volunteer Work**	**UVA Bike Share**
Classroom Use:			
A. Relevant to project focuses	1	1	1
B. Interesting to peers	1	0	1
C. Fits well into class schedule time constraints	0	1	0
D. Competition towards other groups	1	0	0
E. Insight for future students	1	1	0
F. Formulates class discussion of plausibility	1	0	1
Practicality:			
Easily Maintained	0	1	0
Small scale achievement	0	1	0
Large scale achievement	1	0	1
Weekly Time Commitment	1	1	1
Monthly Time Commitment	1	1	1
Yearly Time Commitment	1	0	1
University Advantages	1	1	1
Charlottesville Community Advantages	1	1	0
Economically Sustainable	1	1	1
Environmentally friendly	1	1	1
Creates a strong base for students to follow next semester	1	1	0

Plausible for members of the group to accomplish (individually)	0	1	0
Low cost for successful performance	1	1	0
Lower traffic through University campus	1	0	1
Produce safer roads for bikes	1	0	1
Reduces necessity for other transportation	1	0	1
Integrates Community and University	1	1	0
TOTAL:	19	15	13