

Spring 2015

College of Charleston: Assessment of Campus Bike Parking



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Spring 2015

Acknowledgements

I would like to recognize the following individuals for their help and contribution to this project:

- Office of Sustainability Interns Morgan Larimer, Craig Bennett, Cara Lauria, Dan Carney, and Corey Klawunder
- Public Safety Officers Kia Rodgers and Madeline Sloan
- Representatives from Grounds, Housing and Residence Life, The Honors College, New Student Programs, and Fire and EMS
- Steve Osborne and Business Affairs

Executive Summary

Providing end of trip infrastructure such as showers and bike parking is integral to helping individuals switch their commuting modes to more active commuting such as walking or cycling. Given the costs associated with adding more parking spaces for automobiles, and as a downtown campus with limited space to grow, the College of Charleston should explore ways to begin improving these end of trip facilities in both its current built environment as well as in future construction and renovation projects.

With the help of the College's Department of Public Safety and Office of Sustainability, I have begun this process by assessing the current state of campus bike parking. With the help of Office of Sustainability interns I have inventoried and mapped bike racks both on and near campus have been mapped and inventoried to provide a picture of the current state of campus bike parking available to on campus residents and commuters.

Through this process, areas of congestion have been identified, and through stakeholder meetings with campus departments including the Office of Sustainability, Public Safety, Grounds, Housing and Residence Life, Fire and EMS, the Honors College, and New Student Programs both short and long term solutions have been developed that included moving underused bike racks to these areas when possible, purchasing new racks that meet the standards of the Association of Pedestrian and Bicycling Professionals, and changing the College's bike registration policy to distinguish between commuters and on campus residents.

This report also explores future policy recommendations that can help the College of Charleston become a more bike friendly campus moving into the future. These recommendations include:

1. Utilize the League of American Bicyclists 5 E's as guidelines to improve cycling at the College of Charleston. Specifically with the goal of applying to be a Bike Friendly University within 3 years.
2. Restructure of bicycle registration process used by public safety to help identify commuter vs. resident bikes with the goal of a more efficient use of existing bike parking.
3. Improve Signage and Mapping of Campus Bike Racks to better instruct both residents and commuters of where bike parking is available.
4. Create a College of Charleston Cycling Committee to address future bike issues.
5. Integrate Association of Pedestrian and Bicycle Professionals recommended bike parking principals into all new campus construction and renovation projects starting with the Rita Hollings renovation.

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Alternative Transportation Goals Outlined by the College of Charleston Campus Master Plan:

Design campus spaces and buildings to reinforce the convenience of automobile alternatives.

Educate the campus community about available alternatives to driving to campus.

Introduction

Encouraging alternative modes of transportation such as biking and walking are integral to the future of the Charleston region given the expected growth over the next several decades. As a major stakeholder located in downtown Charleston, the College of Charleston has a significant role to play in creating an environment conducive to pedestrian and biking activity. The College's Master Plan indicates that encouraging alternative transportation is vital to the future success of the College given the dense, urban nature of the campus and the physical and fiscal limits of spatial expansion. Providing the appropriate infrastructure for alternative modes such as cycling is critical part of this process. This project assesses the current state of bike parking at the College by identifying the type and location of bike racks around campus and the number of bike parking spots available. Two goals specifically mentioned by the Master Plan that my project will seek to advance are:

- Design campus spaces and buildings to reinforce the convenience of automobile alternatives (p. 91)
- Educate the campus community about available alternatives to driving to campus. (p. 107)

Through meetings and interviews with different campus community members, areas with high bike parking congestion are identified and immediate and long term solutions to remedy these issues are explored through means such as identifying areas where additional bike racks could be added and identifying current areas with available bike parking that are underutilized and to which nearby traffic could be diverted. Policy approaches such as altering the campus Public Safety bike registration model, and the formation of a Campus Bicycle Advisory Committee are also explored.

Altering the mode of transit that commuters use is a difficult task (Delmelle et al., 2012) but it is one that can and should be on the agenda of both campus and city planners due to the many benefits that are derived from active and alternative forms of transportation (Thoma, 2010; Shannon et al., 2006).

Background

The College of Charleston is a mid-sized institution located at the heart of historic downtown Charleston, South Carolina. As of the fall semester 2014, the College has a student population of 10,873¹, and according to the most recent data for faculty and staff the College employs 2,243 full and part time staff members and 547 faculty members.² Currently, the majority of campus community members commute to campus by automobile and 44% exclusively drive to campus alone (Fisher & McAdams, 2011). Altering the mode of transit that commuters use is a difficult task (Delmelle et al., 2012) but it is one that can and should be on the agenda of both campus and city planners due to the many benefits that are derived from active and alternative forms of transportation (Thoma, 2010; Shannon et al., 2006). Despite these benefits, and the cost and spatial requirements of car parking, the literature shows that, up until recently, colleges and universities have not given bicycles and pedestrians the appropriate level of consideration in the strategic planning process (Toor & Havlick, 2004; Balsas, 2003).

Interestingly, the College of Charleston already has a significant amount of the student population that utilizes alternative modes of transportation such as cycling and walking, since approximately 35.6% of students live within an average commute of 1.8 miles to campus.³ This proximity to campus allows many students and other campus community members to forgo the automobile and walk or bike to class or work. The College of Charleston also currently subsidizes CARTA fares for all students, faculty, and staff further incentivizing alternative transportation modes over cars, and despite the lack of many separated bike lanes in the city, there is a strong bike culture and bike commuting presence. The region already has the Ravenell Bridge which has a bike and pedestrian path linking the peninsula with Mt. Pleasant, and a

¹ Total includes undergraduate and graduate students.

² Employee data comes from the College's fall 2013 personnel roster and faculty data comes from the fall 2012 faculty roster.

³ According to the 2013 Commuter Survey Data. Data is currently unpublished

bike and pedestrian path is planned to be installed over the Legare Drawbridge over the Ashley River, increasing the connectivity between West Ashley and downtown. The region's level terrain and climate are also conducive to year round cycling. However, the area does have its issues, flooding and hot, humid weather in the summer can deter commuters from switching modes to cycling. While these issues may act as deterrents to cycling, they also help to show the importance of end of trip facilities such as workplace showers, lockers, and bike parking in order to help encourage individuals to switch their modes of transit.

The commuting habits of the College of Charleston reflect many of the conclusions in the literature. As of 2011, 44% of campus commuters surveyed relied solely on driving to campus alone for their campus commute (Figure 1).⁴ While 29% of survey respondents indicated that they only used non-motorized transportation such as walking or biking, making it the second highest modal split amongst respondents. When breaking down that 29% a significant portion of that is made up of students. 41% percent of students indicated they commute to campus using only non-motorized modes of transit compared with only 11% of faculty and staff. Approximately one-third of those students bike to campus exclusively while approximately half of the 11% of faculty and staff bike exclusively, meaning that the majority of non-motorized campus commuters are either pedestrians or use a combination of biking and walking. This larger proportion of non-motorized student commuters is likely due to the higher number of students living in a closer proximity to campus.

⁴ All numbers and figures from this section come from the 2011 Campus Transportation Study

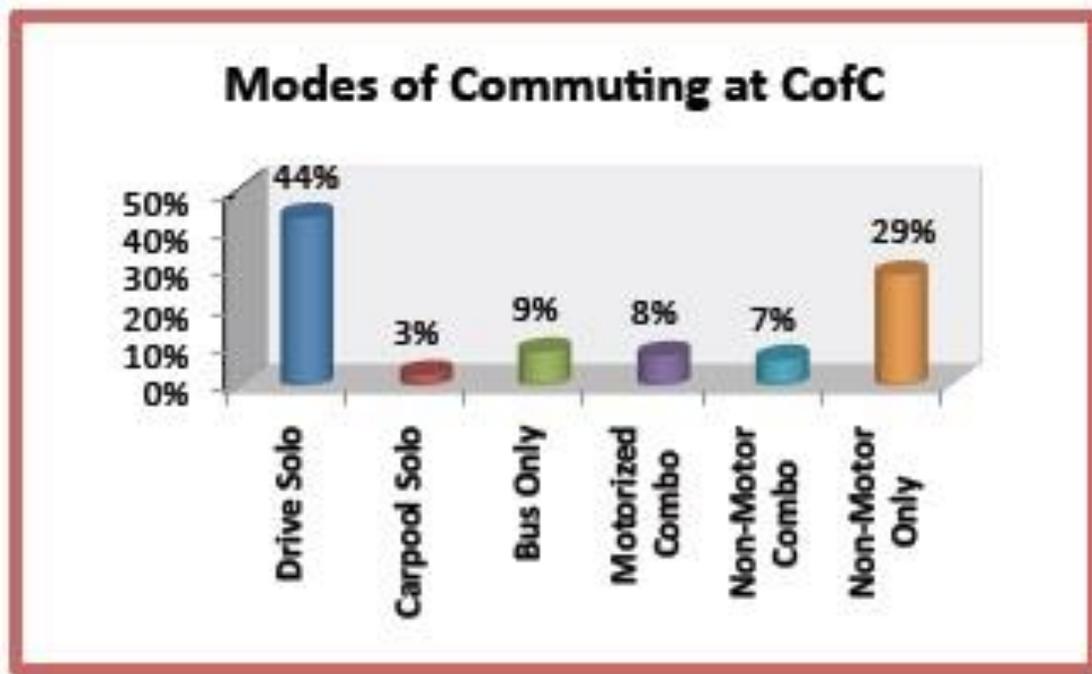


Figure 1: Breakdown of College of Charleston Campus Commuting Modes. Source: College of Charleston 2011 Campus Transportation Study.

According to the literature, given the location of the College's main campus in a downtown, urban area and its high number of students who live either on or in close proximity to campus, it is already predisposed to have a higher number of cyclists than the average college campus, in addition to having many of the situational factors that promote active forms of commuting such as a temperate climate and level terrain (Buehler, 2012; Tolley, 1996). This is indicated by the commuting habits of campus community members where, as seen in Figure 1, non-motorized commuting such as cycling and walking has the second highest mode share of all the different transit modes, second only to driving solo. Given these facts, the College should not only begin to promote more cycling and pedestrian activity through policies and the built environment, but it also should begin to cater to the large number of individuals who already commute to campus by cycling or walking through

If it is too inconvenient and time consuming to squeeze bikes into the space and attach a lock, cyclist will look for an alternative place to park or use one rack element per bike and reduce the projected parking capacity by 50% - Association of Pedestrian and Bicycle Professionals: Bicycle Parking Guidelines

better end of trip facilities like bike parking. Bike parking racks represents an easy starting point since unlike other end of trip facilities such as showers and lockers, bike parking is the bare minimum hardware required to help facilitate commuting by bicycle and is provided by many cities as well as college campuses. A simple initiative such as shifting or moving underused bike racks to heavily trafficked areas can be used in the short term to alleviate some of the congestion issues as well as to build momentum amongst campus community members to support long term solutions such as purchasing additional bike racks and creating specified high density bike parking areas around campus.

While the College of Charleston has a significant amount of bike parking, and a variety of bike rack styles around campus, many of them are not efficient in terms of maximizing space which in many cases helps to increase bike parking overflow. As the Bicycle Parking Guidelines published by the Association of Pedestrian and Bicycle Professionals states, “If it is too inconvenient and time consuming to squeeze bikes into the space and attach a lock, cyclist will look for an alternative place to park or use one rack element per bike and reduce the projected parking capacity by 50%.” Additionally, an issue with many of the congested areas on campus is the tension created by the lack of long term bike parking options available to students living in on campus housing. Areas where bikes are parked long term that take up spaces ideally utilized by commuters creates congestion and overflow, resulting in bikes parked on trees and other structures not intended for bike parking. Addressing this issue will take a collaborative effort from a variety of campus stakeholders, but as Figure 2 indicates, more and better bike parking has been listed by surveyed commuters as an incentive that would encourage a modal change towards biking and walking amongst campus commuters.

**Top Three Incentives Mentioned by Respondents to Encourage Behavioral Change,
by Mode of Transportation (2011)**

Encourage More Biking or Walking	Encourage Greater Carpooling	Encourage Greater Use of CARTA	Financial Incentives	Educational Programs	Other
Increased the amount, location and safety of bike lanes	Carpool matching program/network	Increase the amount of bus stops	General financial incentives	Increase awareness of the importance of non-motorized travel (esp. to change attitudes toward cyclists)	Services that would provide transportation in case of emergency, in inclement weather or at night
Increase the number of bike racks, including covered bike racks	Discounted parking for carpoolers	Increase the frequency of bus trips/changed bus schedule	Food, drink or prize incentives	Informational programs regarding CARTA's services and schedule	Reduce the need to commute to campus as often (i.e., flexible work schedules and online classes)
Increased security of one's person and property	Priority parking for carpoolers	Increase the reliability of CARTA	Programs designed to reduce the cost of living downtown	Bike safety/legal programs	

Table 1: Top Incentives Listed by Campus Community Members Surveyed for the 2011 Campus Transportation Report to Help Encourage Behavioral Change. Increasing Bike Racks Ranks Second Amongst Increasing Biking or Walking. Source: College of Charleston 2011 Campus Transportation Study.

Table 2: Current Bike Rack Styles Located on Campus

Rack Type & Description	Image
<p>Comb Racks: Black and gray comb style racks are the most prevalent racks found on or near campus comprising 75% of all bike racks, and just over 86% of all available bike parking spaces. Rack capacity varies by length of the rack, but depending on the length, these racks hold between 6-12 bikes comfortably.</p>	
<p>Wave Racks: Gray and black wave racks make up only 8% of bike racks on or near campus. Similar to comb racks, their capacity varies by length and can hold between 4-10 bikes depending on their length. However, according to the Association of Pedestrian and Bicycle Professionals (APBP), wave racks are not recommended due to the propensity for users to lock up their bikes improperly, thus limiting the rack's parking capacity.</p>	
<p>Unconventional Inverted "U": Only two of these style racks are available on campus and both are located outside of Admissions Hall. These style racks can accommodate approximately 6 bikes depending on the length. The APBP recommends this style of bike parking.</p>	
<p>Post Racks: Limited to 2 spaces per post, these racks have the smallest capacity of any racks found around campus. They are also some of the least prevalent, and are found only at a few specific spots.</p>	
<p>Unconventional Racks: This series of racks located behind the Education Center are an example of unconventional designs that can be utilized as bike parking. While these structures are designed to hold up to 4 bikes, they are often not utilized properly thus limiting their capacity.</p>	

Table 3: City Bike Rack Styles Located Adjacent to Campus

Rack Type & Description	Image
<p>Inverted “U” or Staple Racks as a moveable bike corral: The City of Charleston has recently increased the number of bike corrals in place on King St., adding additional corrals between Calhoun St. and Market St. In addition to their placement, the City has also instituted an ordinance confiscates and fines owners of bikes who are parked illegally on King St.</p>	
<p>Inverted “U” or Staple Rack: A singular inverted “U” these staple racks can hold 2 bikes and can be found along Marion Square, the King St. and Calhoun St. intersection, and along Vanderhorst St.</p>	
<p>Vertical Wall Hooks: These unconventional vertical wall hooks can be found inside of the parking garage near the St. Philip St. and George St. intersection.</p>	

Current College of Charleston Bike Parking Infrastructure

The College currently has approximately 175 bike racks located either on or nearby campus that provide just under 1500 spaces that could be utilized by students for their bike parking needs.⁵ Tables 1 & 2 provide information about the types of racks available to members of the campus community such as the rack type and number of bikes the rack can hold at capacity.

Currently the only map of campus bike racks available to campus commuters is located on bike.cofc.edu, a website that serves as an information outlet for cyclists and skateboarders at the College than is operated by the College's Office of Sustainability.

Currently the only map of campus bike racks available to campus commuters is located on bike.cofc.edu, a website that serves as an information outlet for cyclists and skateboarders at the College that is operated by the College's Office of Sustainability. To map the locations of campus bike racks, a personal GPS was used, and over the course of two weeks during the summer of 2014 interns from the Office of Sustainability performed a campus walkthrough taking waypoints at the location of each campus bike rack. For this campus bike rack inventory, bike racks provided by the city or private businesses that are located nearby campus were included based on their proximity to campus and the likelihood that they could feasibly be used by members of the campus community for College activities.⁶ Once GPS waypoints were collected for each bike rack, they were downloaded onto a spreadsheet which was then uploaded into a Google Spread Sheet in order to make the data compatible with a Google Fusion Table which allows for the waypoints to be plotted onto Google Maps.

Below is an image of the resulting Google Maps display that can be found on the bike.cofc.edu website. Bike racks are color coordinated by their type and when clicked on, each point provides a summary of the rack type, location,

⁵ The exact number of spaces available is estimated at 1487. This number includes spaces both on and off campus.

⁶ This inventory does not include the new bike corrals installed on King St. South of Calhoun or the bike racks at the College's Harbor Walk location.

Despite the amount of bike parking currently available on campus, many of the racks are not utilized in ways that maximize their available space efficiently, and when used incorrectly the capacity of the rack is lower than expected.

the approximate number of parking spots it can hold, and a link to a picture of the type of bike rack that can be found there. This method of mapping was chosen due to the ease and availability of the Google software and the interactive nature of the Google Maps display once embedded in the website. However for future mapping projects more in-depth GIS mapping needs to be explored since GIS is a more robust software that can be utilized in many different ways and integrated with additional data sets that would be beneficial in a larger scale bicycle planning project.



Figure 2: GPS Locations of Campus Bike Racks as of Summer 2014. Colored Dots Indicate the Locations of Bike Racks. Interactive map available at bike.cofc.edu

Despite the amount of bike parking currently available on campus, many of the racks are not utilized in ways that maximize their available space efficiently, and when used incorrectly the capacity of the rack is lower than expected. According to the Bicycle Parking Guidelines from the Association of Pedestrian and Bicycle Professionals (APBP), the rack element, or the part of the bike rack that supports one bicycle should:

- Support the bicycle upright by its frame in two places
- Prevent the wheel of the bicycle from tipping over
- Enable the frame and one or both wheels to be secured

While the College is home to a significant number of bike parking spaces, the majority of them do not meet the professional standards outlined by the Association of Pedestrian and Bicycle Professionals.

- Support bicycles without a diamond shaped frame with a horizontal tube (e.g. a “step through” or “mixte” frame)
- Allow front-in parking: a U-lock should be able to lock the front wheel and the down tube of an upright bicycle
- Allow back-in parking: a U-lock should be able to lock the rear wheel and the seat tube of the bicycle

While the college is home to a significant number of bike parking spaces, the majority of them do not meet the professional standards outlined by the APBP. The majority of campus bike racks are either comb or wave style racks that only support bicycle frames in one place that limit the ability of commuters to properly lock their bikes to the rack, decreasing security, and increasing the chance that a bike can easily fall or be tipped over, potentially damaging the bike as well as decreasing the available parking space on the rack. In addition, a bike that has fallen over can create a tripping hazard by blocking sidewalks or roads result in potential hazards for pedestrians and vehicles. Given this information it is evident that many of the bike racks currently available around campus are not ideal in terms of efficient or effective bike parking since most racks currently do not meet the recommendations of the APBP. When bike commuters perceive the available bike parking to be both ineffective and inefficient it increases the likelihood that they will lock their bike to an unconventional structure such as a parking meter or tree, which is often the case around campus.



Figure 3: Example of a bike that has fallen over on a wave style rack due to the rack element only supporting a bicycle in one place. This rack is located outside of the School of Sciences and Mathematics Building on the College of Charleston’s campus.

According to the College’s department of Public Safety, as of April 2012 when the College began its own internal bike registration program, there have been 2,436 bikes registered on campus. However, this number does not reflect the actual number of bikes currently on campus. This number does not take into account students who have graduated since that time nor the bikes owned by students and campus community members who have not registered their bikes with Public Safety. In order to gain a more accurate number of the number of bikes currently on campus, I examined the data from the most recent campus commuter survey.⁷ According to the data, 14% of respondents reported biking to campus at least one day per week as their mode of commuting. When applying this number to the total campus population from the College demographic information provided above (10,873 students, 2,243 full and part time staff members, and 547 faculty members) it yields a total of 1,913 people who commute to campus at least one day per week by bike. Assuming these individuals each own their own bike, this is likely a more accurate representation of

⁷ 2013 Commuter Survey Data. Data is currently unpublished

Biking and walking are active forms of transportation that promote healthy lifestyles, they give off zero green house gas emissions, and bike and pedestrian infrastructure are more space efficient and inexpensive when compared to cars (Shannon et al., 2006; Thoma, 2010; Tolley, 1996; Toor & Havlick, 2004).

the number of bikes currently on campus. However, this number still does not take into account the number individuals who have left or joined the campus community since that time.

Also of note is the College's expansion to the Harbor Walk location. The campus is pushing bike commuting as an efficient means to make the commute between main campus and Harbor Walk, potentially resulting in a higher number of bikes on campus starting this past fall. Despite these concerns, for the purposes of this project the number derived from the commuter survey data will be the number used as the best estimate of the number of bikes currently on campus. Taking this number and the number of bike parking spaces available on or near campus, there are approximately 28% more bikes on campus than parking spaces. The limited number of bike parking spaces compared to the number of bikes on campus has naturally lead to bike parking congestion and overflow and several areas on campus. The main goal of this project is to assess the current state of bike parking on the College of Charleston's campus and identify areas that are either are more heavily trafficked than others or due to space constraints have a limited amount of bike parking currently available. These issues often combine to create areas that are not friendly or convenient to bike commuters. Through a series of stakeholder meetings we have begun to identify these locations and immediate and long term solutions to begin alleviating these issues.

Literature Review

The movement of people to and from their homes to places of employment has long been the impetus behind transportation planning in cities, and due to our country's high automobile dependence, transportation infrastructure and policy decisions have long been driven by the car (Balsas, 2003). Altering these policies and the choices people make in terms of their commute is a difficult task, but it is a task that many cities and colleges are undertaking because of growing populations and limited space, especially amongst urban campuses (Toor & Havlick, 2004). Institutions of higher education play key role in this and many other processes

This is important because institutions of higher education also typically have a higher percentage of its members, usually students, who cycle to campus, which should encourage colleges and universities to help to facilitate and promote this behavior (Pucher et al., 1999).

because of their unique status as societal microcosms that bring together highly educated and innovative people across different demographics in different environments (Toor & Havlick, 2004; Balsas, 2003). Increasing the level of non-motorized commuting is seen as important for a variety of reasons that make it attractive to many different stakeholders. Biking and walking are active forms of transportation that promote healthy lifestyles, they give off zero green house gas emissions, and bike and pedestrian infrastructure are more space efficient and inexpensive when compared to cars (Shannon et al., 2006; Thoma, 2010; Tolley, 1996; Toor & Havlick, 2004).

However despite all of the inherent benefits to biking and walking, the infrastructure and incentives still need to be in place in order to support these modes of transit. In the past these alternative modes of communicating have not been given a significant level of consideration in campus planning leading to car oriented spaces that increase the convenience of cars while de-prioritizing bike and pedestrian spaces (Balsas, 2003). Though recently, institutions of higher education have been attempting to facilitate commuting through various strategies that are beginning to flip the script of past methods, increasing the convenience and focus on alternative modes of transit and decreasing the convenience and increasing the cost of commuting by car (Noland et. al, 1995; Toor & Havlick, 2004). This is important because institutions of higher education also typically have a higher percentage of its members, usually students, who cycle to campus, which should encourage colleges and universities to help to facilitate and promote this behavior (Pucher et al., 1999).

While the availability of safe commuting infrastructure such as bike lanes are integral to encouraging commuters to switch modes, also important to the process, specifically when talking about cycling, are the linkages between end of trip facilities such as available and safe bike parking, lockers, and showers, and a commuter's willingness to switch transportation modes (Xing et al., 2010). While these may seem like small additions, they are important because these

are infrastructural additions which are largely under control of the institution and can be added without collaborating with a city or municipality who may have jurisdiction over campus streets.

College campuses across the country have already begun to address these concerns through various strategies and they can provide examples for the College of Charleston to follow. One strategy that is being followed by many universities is the integration of the League of American Bicyclists 5 E's approach to bicycle friendly planning. The 5 E's as outlined by the League are:

- **Engineering:** Creating a safe and convenient places to park and ride
- **Education:** Giving the people of all ages and abilities the skills and confidence to ride
- **Encouragement:** Creating a strong bike culture that welcomes and celebrates bicycling
- **Enforcement:** Ensuring safe roads for all users
- **Evaluation and Planning:** Planning for bicycles as a safe and viable transportation option.

The League of American Bicyclists is the oldest national bike advocacy group in the country (Sweeny, 2012) and in 2010 they launched the Bicycle Friendly Universities Program which takes the 5 E's and evaluates any college or university that applies based off their ability to integrate these categories into their campus bike and pedestrian planning. The application process is extremely comprehensive, and on many occasions has provided focus and defined areas of improvement for many colleges and universities to integrate bike and pedestrian planning into their campuses. For example, the University of Wisconsin–Milwaukee (UWM), which has recently earned a bronze Bicycle Friendly University award, has fully integrated the 5 E's into their bicycle planning and have formed a Bicycle Advisory Task Force comprised of various campus stakeholders to create short and long term plans for the university. Similar to the College of Charleston, their campus is located in a dense, downtown urban area and their plan mentions the importance

The 5 E's as outlined by the League of American Bicyclists are:

- **Engineering:** *Creating a safe and convenient places to park and ride*
- **Education:** *Giving the people of all ages and abilities the skills and confidence to ride*
- **Encouragement:** *Creating a strong bike culture that welcomes and celebrates bicycling*
- **Enforcement:** *Ensuring safe roads for all users*
- **Evaluation and Planning:** *Planning for bicycles as a safe and viable transportation option.*

of increasing cycling commuting for many of the reasons that are explored in the literature.

In more comprehensive plans, such as those found at the University of Southern California (USC), University of California Davis (UC Davis), and the University of North Carolina Greensboro (UNC Greensboro), the ideas found in the 5 E's are taken to greater levels through the identification of dangerous campus intersections for cyclists, exploring how cycling commuting behavior can be improved through education and safety classes, identification of current bike friendly campus infrastructure, and future planning to add more complete streets and bike lanes to improve commuter safety. Similar to improving the campus' bike parking issues, adapting these strategies and best practices into the College of Charleston's planning efforts can only help to improve the percentage of campus community members who choose to commute using bicycles or other alternative modes of transportation.

Data and Methodologies

The data and methodologies for this assessment of campus bike parking include the observation and recording of campus bike rack locations for mapping purposes as well as to gain an approximation for the number of bike parking spaces currently available on campus. Prolonged observation and interviews with different campus departments were also utilized to identify areas of campus that have a higher ratio of bikes to bike parking that result in bikes being unconventionally locked to other structures such as trees, benches, street signs, and other bikes. Finally a series of meetings between campus stakeholders is being undertaken in order to begin the discussion to identify both short and long term solutions to this issue. Representatives from eight different campus departments have been present including the Office of Sustainability, Public Safety, Fire and EMS, Housing and Residence Life, the Honors College, Grounds, New Student Programs, and the College's Physical Plant.

Analysis

Goals for This Assessment

- 1) Identify areas of Campus with heavy traffic with bikes and bike parking congestion
- 2) Begin to identify solutions to alleviate bike parking congestion through:
 - a) Re-arrangement of current bike racks in a way that doesn't interfere with pathways or grounds.
 - b) Identification of nearby areas with under-used bike racks.
 - c) Identification of nearby areas that could accommodate additional bike racks.

Identified Problem Areas:

1. BellSouth Building
2. McAlister and Berry Hall
3. Education Center
4. Liberty St. (J.C. Long, Tate, and Beatty Center)

For this report I will be focusing on the areas of campus above Calhoun St., which include the BellSouth Building and McAlister and Berry Halls, because their bike parking issues are linked, and this has been the first area addressed by the group of stakeholders involved in the meetings leading up to this report. Pictures of the bike parking issues found at the other identified problem areas can be found in Appendix A. I hope to continue this work and analysis for the remaining identified areas in the near future, once the issues at BellSouth, Berry, and McAlister have been addressed.

BellSouth Building

Issue: There is not enough bike parking to accommodate building traffic. Currently six black comb racks are located outside of the main entrance to the building allowing for a maximum of 72 bike parking spots. However given their propensity to be used improperly, the total number of bikes that can actually be parked there is likely much lower. Additionally there is no Space to add additional bike racks at the building.



Figure 4: Bike Crowded the Bike Racks Located Outside the Bell South Building.

The BellSouth Building is located directly across the street from Berry Residence Hall, which as mentioned above, is also an area of campus with an insufficient amount of bike parking. I believe that these two areas are linked. Observation and meetings with campus public safety officers has indicated that the racks located outside of the building are rarely empty, unlike the racks located around other classroom buildings not located near residence halls. This leads me to believe that much of the bike parking located at the BellSouth building is being utilized for long-term bike storage by residents of Berry Hall. The close proximity of the BellSouth bike racks to the entrance of Berry Hall and the limited amount of bike parking around Berry Hall are other likely causes of this issue.



Figure 5: Bikes Illegally Parked to a Railing on the Side of the BellSouth Building Due to Limited Bike Parking Located in Front of the Building.

Potential Solutions: Because of the limited space around the building, adding additional bike parking to the area is difficult. In order to begin freeing up space on bike racks outside of the BellSouth Building, addressing the potential issue of long term bike storage on the building's bike racks needs to be addressed. This can be done through:

- Designating a section of the racks outside the building as commuter only racks and changing the policies of Public Safety's bike registration program to
- Distinguish between commuters and campus residents/long term storage.
- Providing additional, long term bike parking elsewhere for the residents of Berry and McAlister Halls and encouraging them to utilize the new racks.

Berry and McAlister

Issues: Insufficient amount of bike parking for the area which is highly trafficked. The area is home to two residence halls, two major classroom and office buildings (BellSouth Building and the Lightsey Center), and a campus dining hall (City Bistro). Similar to the BellSouth building issues, limited long term bike storage for Berry Hall residents is also potentially affecting the area.

Along the side of and behind Berry and McAlister Halls, bikes are routinely locked to benches, trees, and sometimes other bikes as noted by Stephanie Auwaeter, Director of New Student Programs, whose office is located in the area behind Berry and in front of McAlister Hall.⁸ She has also noticed that there appear to be more bikes in general this year in the area. This could be due to a number of different factors ranging from Berry Hall become a co-ed residence, the relocation of Honors College and Living/Learning Communities to Berry Hall, classes at the new Harbor Walk building which is separated from main campus and easily accessed by biking, and more apartments being built on the peninsula that increases density of students further out who commute by bike.⁹

⁸ S. Auwaeter, Personal Interview, November 5th, 2014

⁹ S. Auwaeter, Personal Interview, November 5th, 2014



Figure 6: Due to Limited Bike Parking in the Area, Bikes Are Being Locked to Trees and Benches As Seen Above Along the Side of Berry Hall.

Potential Solutions: Unlike the area around the BellSouth building, there is space available to increase the number of bike racks in this area. Simply adding underused bike racks from other parts of campus can serve as an immediate solution. As seen in Figure 7, many bikes are already being locked to benches so moving the benches to other locations in the area and replacing them with bike racks can help to relieve some of the parking overflow onto trees. Several underused racks have already been identified through the stakeholder meetings and include racks around the Rita Hollings Science Center which is currently undergoing renovations and racks located behind the Sorority Houses on St. Philip St. This is a quick and easy first step that I hope to accomplish between the fall and spring semesters with the help of Public Safety and the College's Physical Plant.

A longer term solution identified through the stakeholder meetings is the addition of new racks in spaces that could serve as longer term parking for Berry Hall and

McAlister Hall residents. Two such spaces are shown below in Figures 7 & 8.

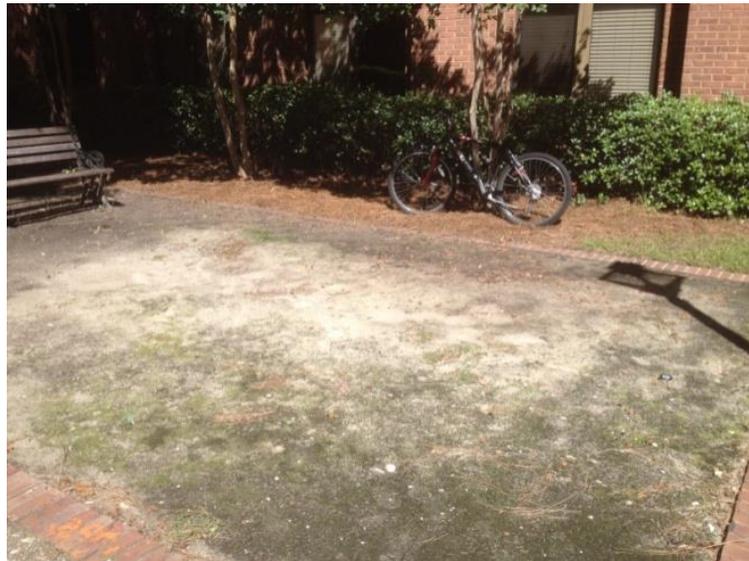


Figure 7: An Unused Courtyard Outside of Berry Hall Could Be Utilized As Additional Bike Parking Space.



Figure 8: This Covered Area Behind Berry Hall Provides Excellent Cover and Security For Potential Long Term Bike Storage.

Due to its downtown location, climate, and level terrain the College of Charleston is in a prime location to attract forms of active transportation such as walking and biking. Encouraging these modes of transit is mentioned in the College's most recent Master Plan as integral to the future growth of the institution due to the limited space and costs associated with automobile parking downtown.

I would recommend that any new racks brought for these locations meet the guidelines for bike parking suggested by the APBP. Examples and prices of suggested racks can be found in Appendix B.

Conclusions

Due to its downtown location, climate, and level terrain the College of Charleston is in a prime location to attract forms of active transportation such as walking and biking. Encouraging these modes of transit is mentioned in the College's most recent Master Plan as integral to the future growth of the institution due to the limited space and costs associated with automobile parking downtown. Critical to the process of encouraging campus community members to change their commuting habits to walking and biking is providing those commuters with the appropriate end of trip infrastructure such as showers, lockers for clothing and personal items, and bike parking. The focus of this assessment was to analyze the current state of bike parking at the College of Charleston, inventory the types of bike parking currently available, identify areas of campus where additional bike parking is needed, and to provide short and long term solutions to address these issues.

After gathering with a group of key stakeholders for the locations analyzed above we have created some possible solutions to help alleviate the bike parking congestion that exists around the BellSouth building and the Berry and McAlister residence halls. Solutions ranged from moving bike racks from underutilized locations such as the Rita Hollings building which is currently undergoing renovations to altering the College's bike registration system to distinguish between commuters and on campus residents. While this initial assessment is a step in the right direction for the College, more can be done in order to make the College of Charleston a more bike and pedestrian friendly campus. I hope to continue working with this group of stakeholders that has come together to address these issues to analyze the remaining areas of campus and to address other bike and pedestrian commuting issues that arise in the future.

Policy Recommendations

- 1. Utilize the League of American Bicyclists 5 E's as guidelines to improve cycling at the College of Charleston. Specifically with the goal of applying to be a Bike Friendly University within 3 years:** I recommend starting a more formal assessment of campus bike infrastructure and policies using the League of American Bicyclists Bike Friendly University Application with a goal of applying within 3 years. Even without getting an award, the LAB provides specific feedback to each applicant that can help be a road map towards becoming a more bike friendly campus.
- 2. Restructure of bicycle registration process used by public safety to help identify commuter vs. resident bikes with the goal of a more efficient use of existing bike parking:** This is a recommendation that originated from meetings with Public Safety dealing with areas of campus that are near large residence halls and classroom buildings such as the BellSouth Building and Berry Hall. Distinguishing between commuters and residents will help to identify those bikes that are being kept for long term storage on campus versus those commuting in for class or work. Reserving specific racks for commuters near classroom buildings and providing new parking options to residents who requiring long term storage is key to ensuring the success of this recommendation.
- 3. Improve signage and mapping of campus bike racks to better instruct both residents and commuters of where bike parking is available:** As mentioned above, currently the only map of campus bike racks is located on the website bike.cofc.edu. After relocating several racks from Rita Hollings to the Berry McAlister area this map needs to be updated and made more widely available to the campus community. In addition to better mapping, bike rack signage needs to be improved in order to help facilitate the above recommendation of distinguishing between commuter racks and racks for long term

storage. These efforts will be part of a larger educational effort to the campus community to inform them of where they can park their bikes whether commuting to campus or keeping it near their place of residence.

4. **Create a College of Charleston Cycling Committee to address future bike issues:** Use the network of stakeholders identified in this analysis as the foundation for a committee similar to the Bicycle Advisory Task Force from the University of Wisconsin Milwaukee that will be able to address future bike issues at the College.
5. **Integrate bike parking into all new campus construction and renovation projects starting with Rita Hollings renovation:** As mentioned previously, the College has stated in its master plan that it needs to encourage alternative modes of transportation as it moves into the future. While only so much can be done with existing infrastructure to improve the available bike parking. New construction and renovation projects provide clean slates in which efficient and effected end of trip infrastructure such as showers and bike racks that meet APBP standards can be built into the buildings and surrounding areas.

APBP standards indicate that, the rack element, or the part of the bike rack that supports one bicycle should:

- Support the bicycle upright by its frame in two places
- Prevent the wheel of the bicycle from tipping over
- Enable the frame and one or both wheels to be secured
- Support bicycles without a diamond shaped frame with a horizontal tube (e.g. a “step through” or “mixte” frame
- Allow front-in parking: a U-lock should be able to lock the front wheel and the down tube of an upright bicycle
- Allow back-in parking: a U-lock should be able to lock the rear wheel and the seat tube of the bicycle

Update: Spring 2015

Since the first draft of this report, some of the short term recommendations for addressing bike parking congestion have been implemented around the Berry and McAlister Residence Hall area of campus. One of the biggest changes can be seen on the walkway between the two residence halls where additional racks were brought in from underutilized areas of campus to address the location's bike parking needs. In addition, these racks were turned 90 degrees where they now are set perpendicular to the building, increasing the amount of bikes that can be locked onto each rack thus increasing their efficiency. Figure 9 shows a before and after shot of the location between Berry and McAlister Residence Halls.



Figure 9: Before and After Picture of the Walkway between Berry and McAlister Residence Halls with Additional and Repositioned Bike Racks. Due to the Additional Parking Bikes are Less Likely to be Locked Up to Improper Structures such as Benches and Trees.

The additional bike racks have received positive responses from campus community members who live, work, and attend classes in that area. According to Denny Ciganovic, the Director of the Career Center located in the Lightsey Center, "I walk thorough that section every day and the additional

racks are full and we no longer have bikes attached to trees and benches.”¹⁰

In addition to the racks added above, over the course of the College’s winter break several other racks were relocated largely due to the help of Public Safety Officer Kia Rodgers and the Physical Plant. The racks repositioned are as follows:

- The Stern Center now has two additional bicycle racks
- Berry has two additional bicycle racks in the rear of the building
- McAlister has two additional bicycle racks on the side of Berry
- Simons Center has two additional racks in the front courtyard area giving more options for commuting students
- Additional bicycle racks have been placed in the area of the Greenway and College Way intersection
- Liberty Residence Hall and McConnell Residence Hall each have one additional rack
- The bicycle racks at Addlestone Library have been placed in a centralized location on Rivers Green
- The BellSouth Building has one additional rack

I have also worked with the City of Charleston to remove abandoned bikes from the existing bicycle storage areas at the GG Garage on St. Philip Street. This location can serve as additional bike parking for nearby areas such as the Liberty St. corridor, the Education Center, and the George St. apartments.

¹⁰ D. Ciganovic, January 23rd, 2015

References

- Balsas, C. J. . (2003). Sustainable transportation planning on college campuses. *Transport Policy*, 10(1), 35–49.
- Becoming a Bike Friendly University. Retrieved November 25, 2014, from <http://bikeleague.org/content/5-es>
- Bicycle Parking Guidelines. (2002). Association of Pedestrian and Bicycle Professionals. Available Online: http://c.ymcdn.com/sites/www.apbp.org/resource/resmgr/publications/bicycle_parking_guidelines.pdf
- Buehler, R. (2012). Determinants of bicycle commuting in the Washington, DC region: The role of bicycle parking, cyclist showers, and free car parking at work. *Transportation Research Part D: Transport and Environment*, 17(7), 525–531.
- Campus Mater Plan. (2012). College of Charleston. Available Online: <http://masterplan.cofc.edu/images/2012%20Campus%20Master%20Plan.pdf>
- Delmelle, E. M., & Delmelle, E. C. (2012). Exploring spatio-temporal commuting patterns in a university environment. *Transport Policy*, 21, 1–9.
- Fisher, P.B. (2013). College of Charleston Campus Commuter Survey Data.
- Fisher, P. B., McAdams, E. (2011). College of Charleston Campus Transportation Study: Analysis of Commuting Habits and Recommendations. Available Online: <http://sustainability.cofc.edu/documents/commuter-report-final.pdf>
- Noland, R. B., & Kunreuther, H. (1995). Short-run and long-run policies for increasing bicycle transportation for daily commuter trips. *Transport Policy*, 2(1), 67–79.
- Pucher, J., Komanoff, C., & Schimek, P. (1999). Bicycling renaissance in North America? *Transportation Research Part A: Policy and Practice*, 33(7-8), 625–654.
- Shannon, T., Giles-Corti, B., Pikora, T., Bulsara, M., Shilton, T., & Bull, F. (2006). Active commuting in a university setting: Assessing commuting habits and potential for modal change. *Transport Policy*, 13(3), 240–253.
- Sweeny, T. (2012). Learning with Bicycles: Current Methods and New Concepts for Bicycle Education at Universities (Undergraduate Thesis).
- The Essential Elements of a Bicycle Friendly America: The 5 E's. Retrieved November 25, 2014, from <http://bikeleague.org/content/5-es>

- Thoma, T. G. (2010). Commentary: can we increase bicycle use rates in the United States safely? *Annals of Emergency Medicine*, 56(4), 426–8.
- Tolley, R. (1996). Green campuses: cutting the environmental cost of commuting. *Journal of Transport Geography*, 4(3), 213–217.
- Toor, W., & Havlick, S. (2004). *Transportation and sustainable campus communities: Issues, examples, solutions*. Island Press.
- University of California Davis Campus Bicycle and Transit Network Study. (2009). Available Online: <http://cpcr.ucdavis.edu/btns/cbtn-study.html>
- University of North Carolina Greensboro Transportation Plan Update. (2012). Available Online: http://parking.uncg.edu/docs/UNCGFINAL_web2012.pdf
- University of Southern California Bicycle Master Plan. (2012). Available Online: <http://bikeusc.tumblr.com/>
- University of Wisconsin Milwaukee Bicycle Advisory Task Force. (2012). Recommendations for a Bike-Friendly Campus. Available Online: http://www4.uwm.edu/bicycle/upload/UWMRecommendation-for-a-Bike-Friendly-Campus_FINAL.pdf
- Wenrich, N (Photographer). (2010). Spin City [article], Retrieved November 23, 2014, from: http://charlestonmag.com/features/spin_city
- Xing, Y., Handy, S. L., & Mokhtarian, P. L. (2010). Factors associated with proportions and miles of bicycling for transportation and recreation in six small US cities. *Transportation Research Part D: Transport and Environment*, 15(2), 73–81.

Appendix A

Images of bike racks near other identified congestion areas

1. Education Center and George St. Garage

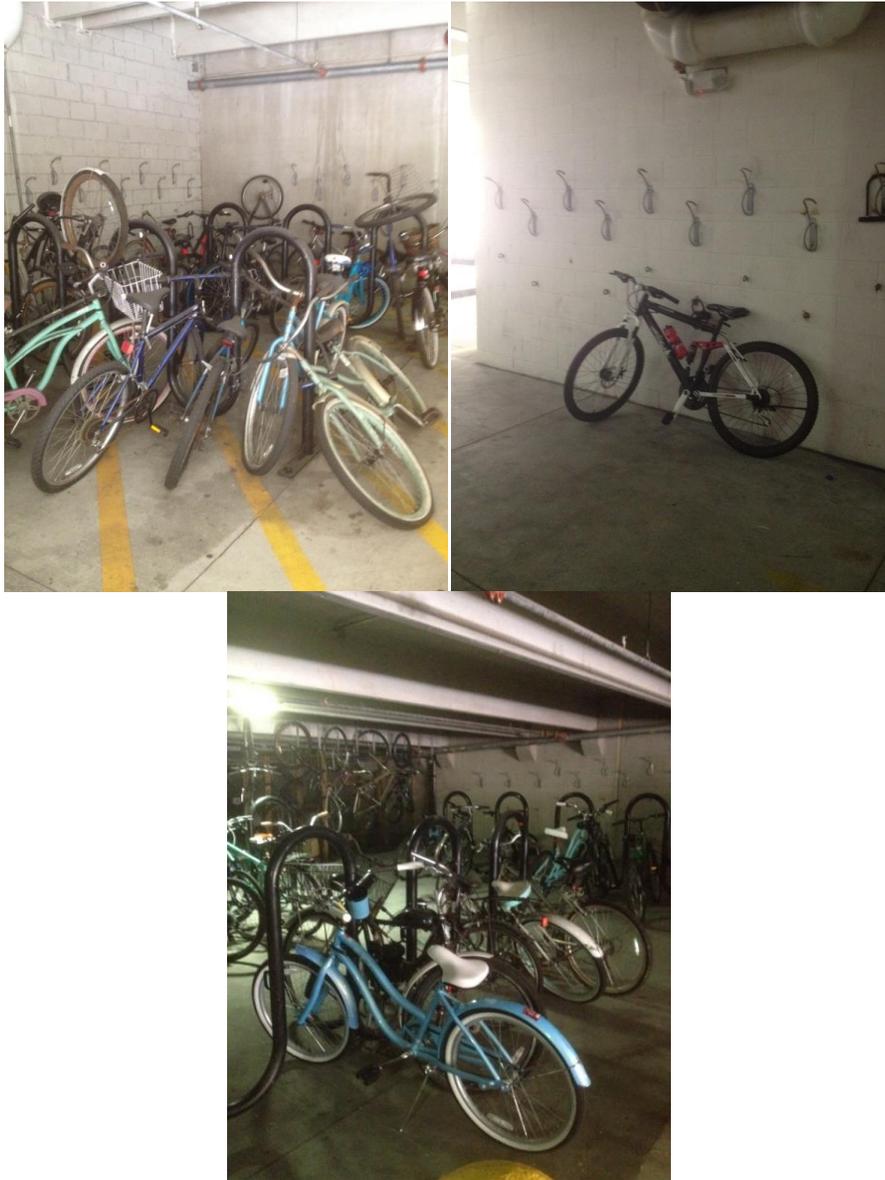
Crowded Racks Outside of Education Center and Craig Hall



Underutilized bike racks behind Education Center



Bike Parking Inside of George St Garage - Under Utilized and Crowded with Abandoned Bikes



2. J.C. Long, Tate, and Beatty Center

Crowded bike racks and bikes parked to parking meters and trees due to lack of available parking





Appendix B

Examples of quotes from email correspondences with employees from other universities on their experience using vertical style racks on their campus. Links to alternative bike parking structures including examples of vertical style racks that could be placed behind Berry Hall are provided along with before and after pictures of vertical racks being used in a space at Clemson University are also included.

- “We use vertical racks quite a bit - outside, in bike rooms inside buildings and in secure cages in parking facilities. We usually try to have traditional racks nearby for those who can't lift their bike into position.” – Steve Sanders, Alternative Transportation Manager, University of Minnesota on January 28th, 2015
 - Type of vertical rack used: <http://www.dero.com/product/ultra-space-saver/>
- “We have some vertical in our Residence Halls. They are mostly used correctly but the challenge is that many people struggle with mounting the bike properly due to either height or strength issues which results in the bikes being secured improperly. Enforcement will sometimes correct this problem. Preferably a sign or signs detailing the proper way to park the bike may help more.” – Michael Levenood, Bicycle Coordinator, University of Maryland on January 28th, 2015
- “At Clemson University, we've had success with students using the Dero Ultra Space Saver racks at a few residential halls. The students picked up on how to use and correctly lock the bikes to the fixtures, and they work very well. It's not a solution for all parking issues, but it provides some great covered space in within an existing building envelope where previous floor-mounted racks cluttered the space and did not provide an adequate parking solution.” – Tonya DeOliveira, Planner, Clemson University on January 28th, 2015
 - Type of vertical rack used: <http://www.dero.com/product/ultra-space-saver/>

Potential Vertical Bike Racks: Prices are provided when available.

<http://ameribike.com/pdf/Ultra-Space-Saver-SINGLE.pdf>

http://huntco.com/images/cut-sheets/Wall%20Mount%20with%20Locking%20Bar%20Bike%20Rack_86.pdf

<http://www.urbanracks.com/highdensityrack.html>

<http://www.parkabike.com/offset-vertical-bike-rack-VR2>

<http://www.dero.com/products/uss-single/> (\$73)

<http://www.dero.com/product/ultra-space-saver/>

<http://www.etrailer.com/Bike-Storage/Saris/SA6006.html> (\$80.99)

Figure 10: Example of Vertical Bike Racks installed in a Space at Clemson University



Appendix C

Email correspondence on November 7, 2014 with Philip Overcash a Planner for the City of Charleston regarding the bike racks used for the King St. Bike Corrals.

Hi Aaron

The City has been purchasing racks from a couple different vendors but the last couple of large orders came from Madrax (who subcontracts with Thomas Steel). Racks that we install by themselves (single racks) we order powder-coated (black) before they are shipped. The bike corrals like the ones on King Street are U-racks that we receive unpainted and welded to C-channel rails by City construction crews and then painted. Madrax and other vendors do offer racks already attached to rails, but the shipping costs are higher and we lose flexibility in how we group them in specific locations. If we had unlimited funds, I would probably get them pre-built by the manufacturer because the powder-coat finish they can put on would be more durable than the paint finish the City uses.

There are a lot of very nice bike racks on the market that we've considered but ultimately we use the City's standard U-rack in public rights-of-way for several reasons:

1. They are extremely durable and fairly maintenance-free
2. they are very secure (the pipe diameter and thickness deter theft very well)
3. they are compact (don't take up much space in our very constrained public rights-of-way)
4. they are purposefully understated in their design and hue as to not detract from the historic nature of our downtown streets yet there are enough of them now that people know their purpose
5. they are versatile (we can imbed them, surface mount them on a variety of materials or gang them on rails)
6. they are cost effective (because of their simple design, we can get two or three racks from our meager bike parking budget for the price of one of the fancier styles).

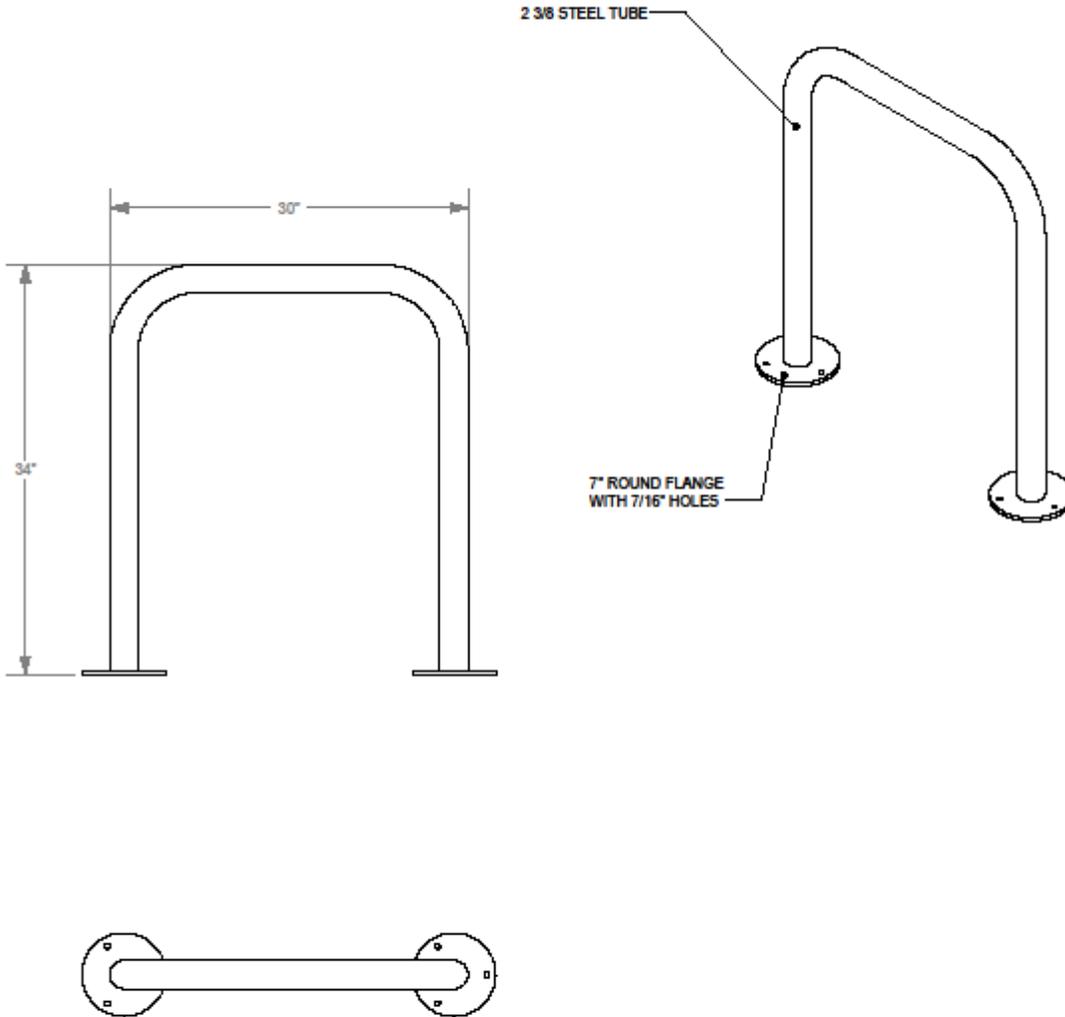
When looking at racks that hold multiple bikes we determined the U-rack (we currently use) to be the most efficient use of space. It is really the footprint of the bike(s) that determine where we can and can't fit a rack and we've not found a style that holds more than two in a small space, looks good, is economical, and easy to use.

I'm happy to help further if you have any other questions about the City racks. Thanks

--Philip



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PRODUCT: U238-SF
DESCRIPTION: U BIKE RACK, 30" LONG, BLACK
2 BIKE, SURFACE MOUNT
DATE: 7-26-12
ENG: SMC

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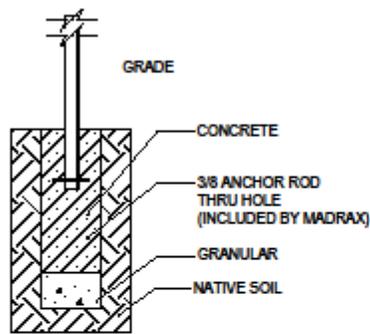
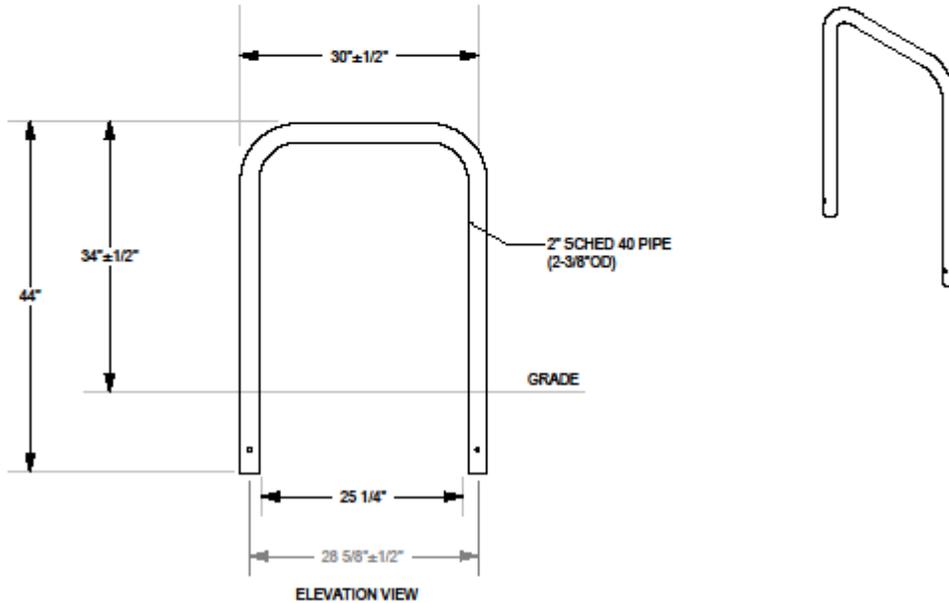
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 2 BIKE, IN GROUND MOUNT
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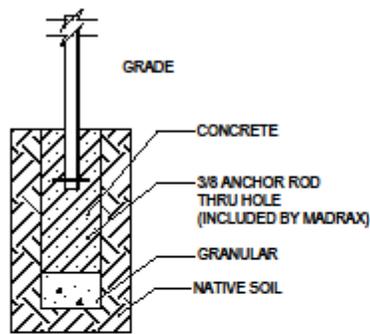
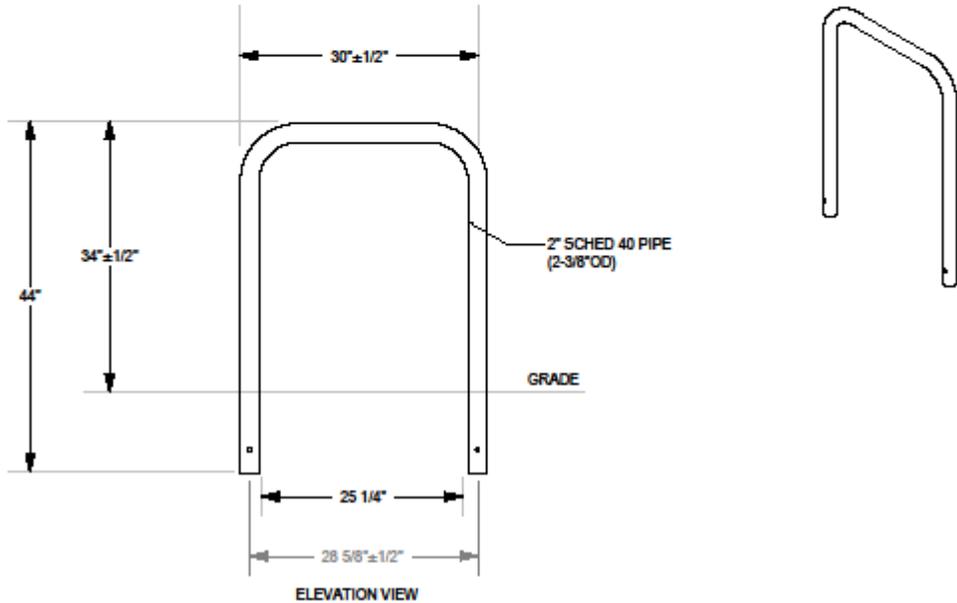
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