

The image features a scenic background of a paved path curving through a grassy field at dusk or dawn. The sky is a mix of soft pinks, oranges, and blues, with distant mountains visible on the horizon. A semi-transparent orange rectangle is centered over the path, containing the project title in a black serif font.

UC Santa Cruz
Campus
Bike Parking
Project

Introduction

The goal of the Campus Bike Parking Project is to identify areas on the UC Santa Cruz campus where more bike parking is needed and where existing parking needs to be moved or improved. When people decide to bike to school/work, safety for both themselves and their bikes is a top priority. The 2017 Campus Travel Survey notes that about 20% of students and 15% of faculty commute by human-power (bicycle). Given the size of the student population in comparison to faculty and staff, there is greater potential for more students to commute by bicycle. Additionally, when analyzing preliminary commuter survey data, it was found that the majority of faculty members park their bikes inside their office for safety purposes. Therefore, this report focuses on student commuters and the locations on campus where they park their bikes. Having enough bike parking in safe locations provides necessary infrastructure that may inspire more people to commute to campus via bicycle. Competing with cars is not easy, but providing safe, easy, and free parking for bikes makes cycling much more appealing. This report includes: sampling results of the current UCSC bike parking infrastructure and survey results from bike shuttle riders followed by recommendations on bike rack designs and placement, additional parking needs and potential bike share locations.

Background

To thoroughly analyze UCSC's current bike parking infrastructure, we chose to sample all non-residential bike parking, targeting areas where commuters frequently park. 77 bike parking areas within the vicinity of 23 academic areas were surveyed over the course of three days during peak hours, 11:30 AM to 1:30 PM. This time slot was chosen due to the last departure of the bike shuttle which leaves at 11:30 AM; commuters who bike up the hill are most likely on campus by this time as

well. We recorded the total capacity of the racks, how full they were, their condition and whether they were convenient to access. In order to be thorough, we travelled the campus by foot and by car in search for all bike racks near academic buildings. Shown below are the different types of racks found throughout the campus:



Current Infrastructure

Capacity and Fullness

Figure 1 shows every location sampled and the total capacity of each rack. Of the 77 racks sampled on campus, the locations with the most bike parking spots are Engineering, OPERS, the Quarry Plaza and McHenry. **Figure 2** illustrates the fullness of each rack. We found that of the 23 academic locations

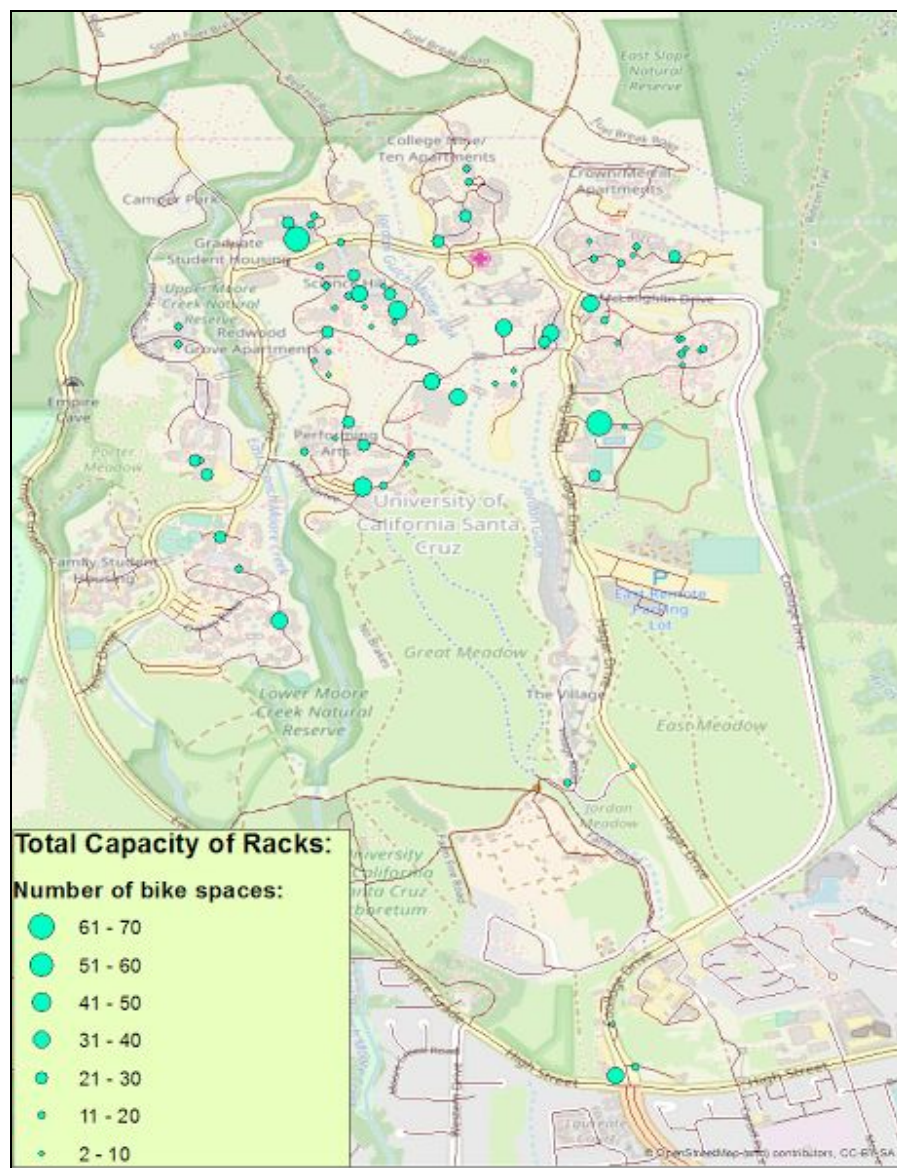


Figure 1. Total Capacity of Racks

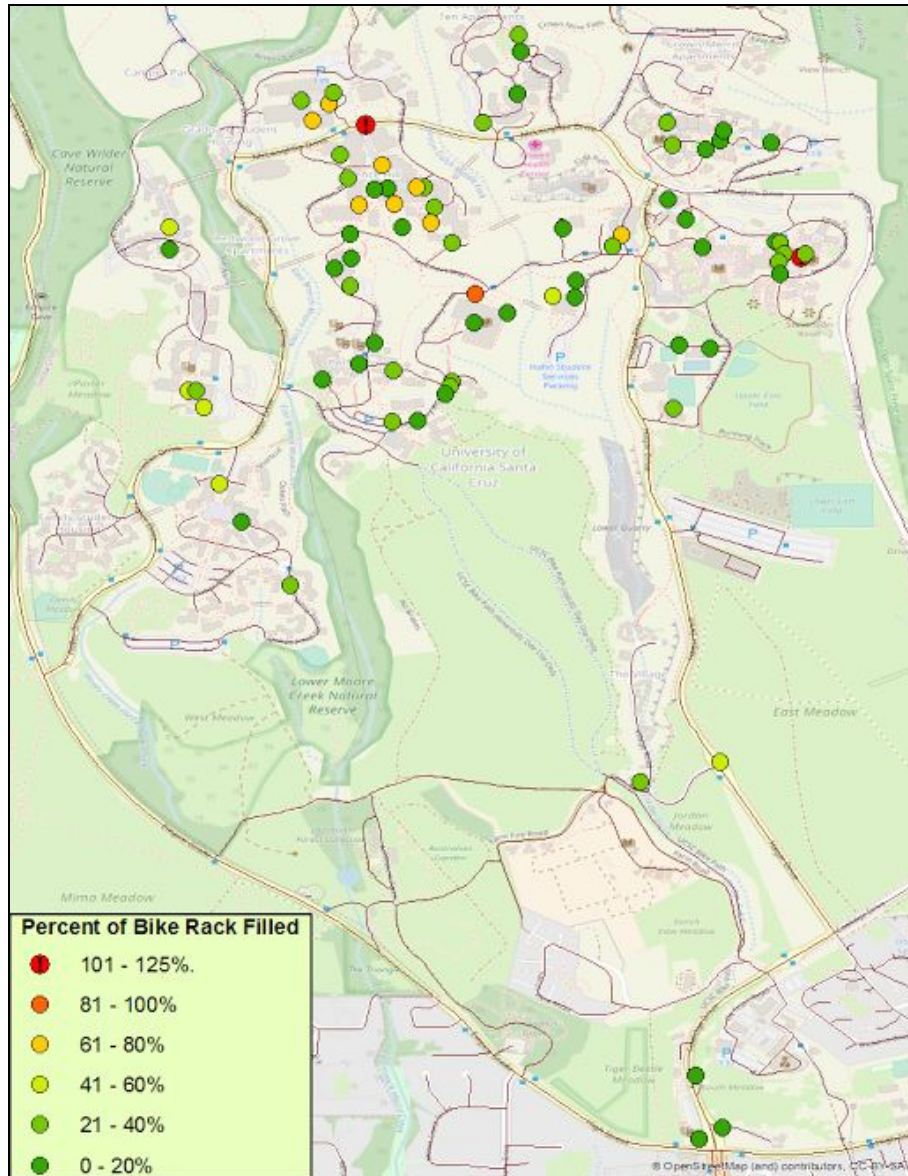


Figure 2. Percent of Racks Filled at Each Location

sampled, 4 were at/over 50% capacity and of the 77 bike parking spots sampled, 9 were at/over 70% capacity. **Figure 3** shows the aggregate data of each general location since there are multiple racks within each given area and **Figure 5** illustrates the 9 locations that were over 70% capacity. One of the areas experiencing notably high fullness is Science Hill, represented in **Figure 4**. This could be due

Percent of Racks Filled vs. Location

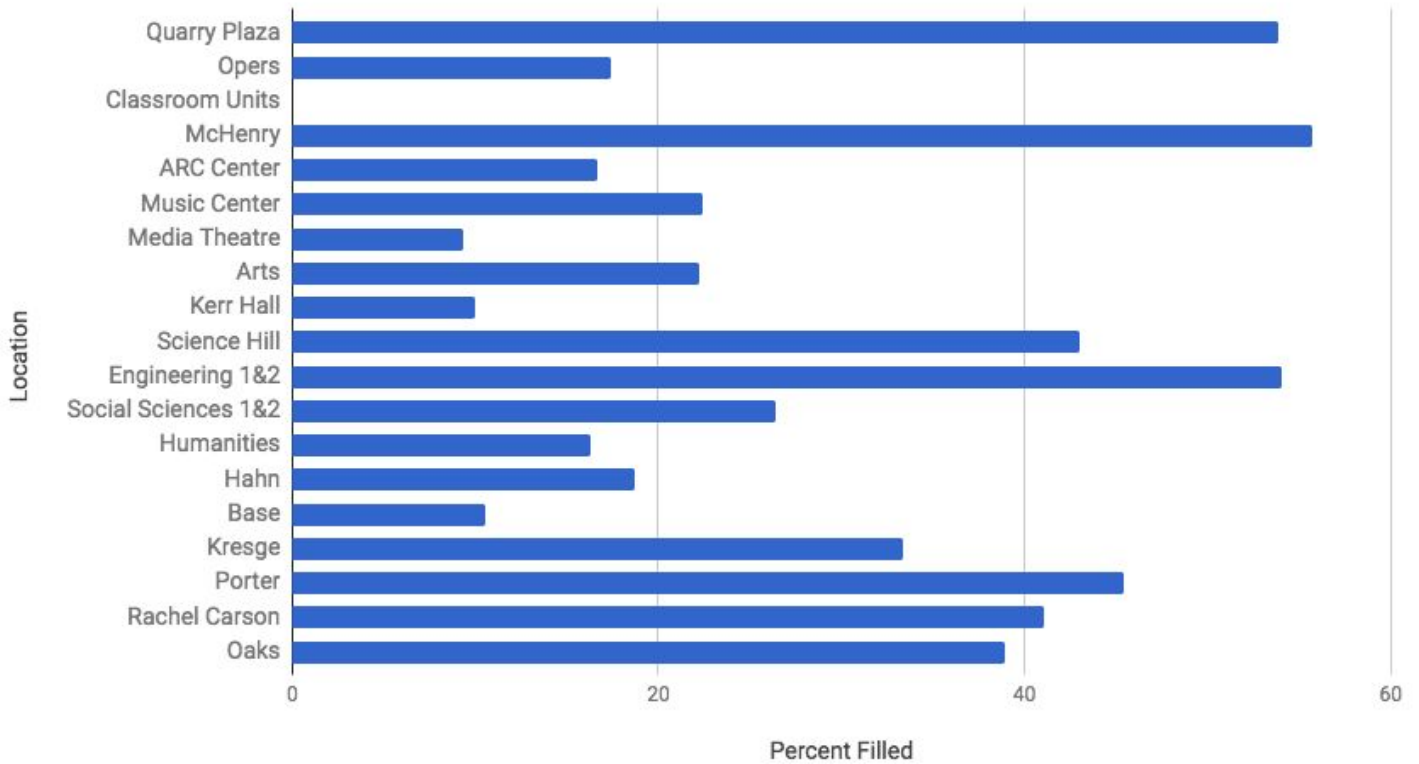


Figure 3. Percent of Racks filled at Each Location

to the fact that this is the highest part of campus so people may leave their bikes there all day to avoid having to lug it up the hills from one class to the next. There are also many labs, offices, and classrooms on Science Hill which may be another reason it has the highest density of bikes parked. One area that had zero bicycles were the racks by Classroom Unit 1 & 2. Though we have seen bikes parked there before, there were none on the day we took data. This may be due to the fact that the classroom units are uphill from Quarry Plaza, therefore, people might be parking their bikes at the plaza instead of hauling it uphill to their classroom.

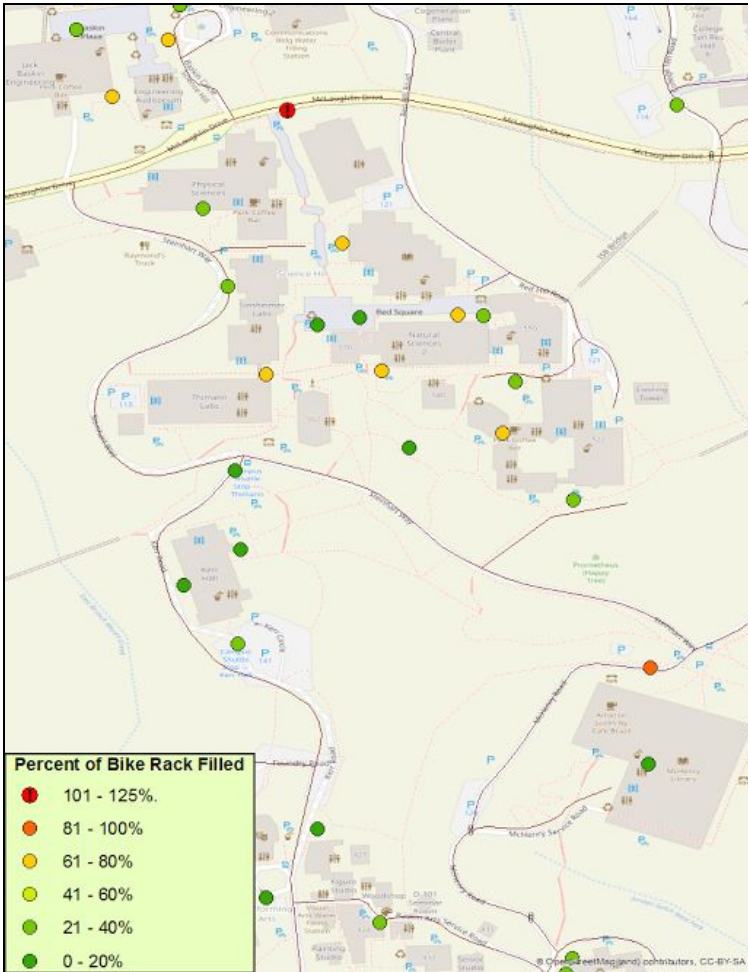


Figure 4. Percent of Bike Racks Filled: Science Hill

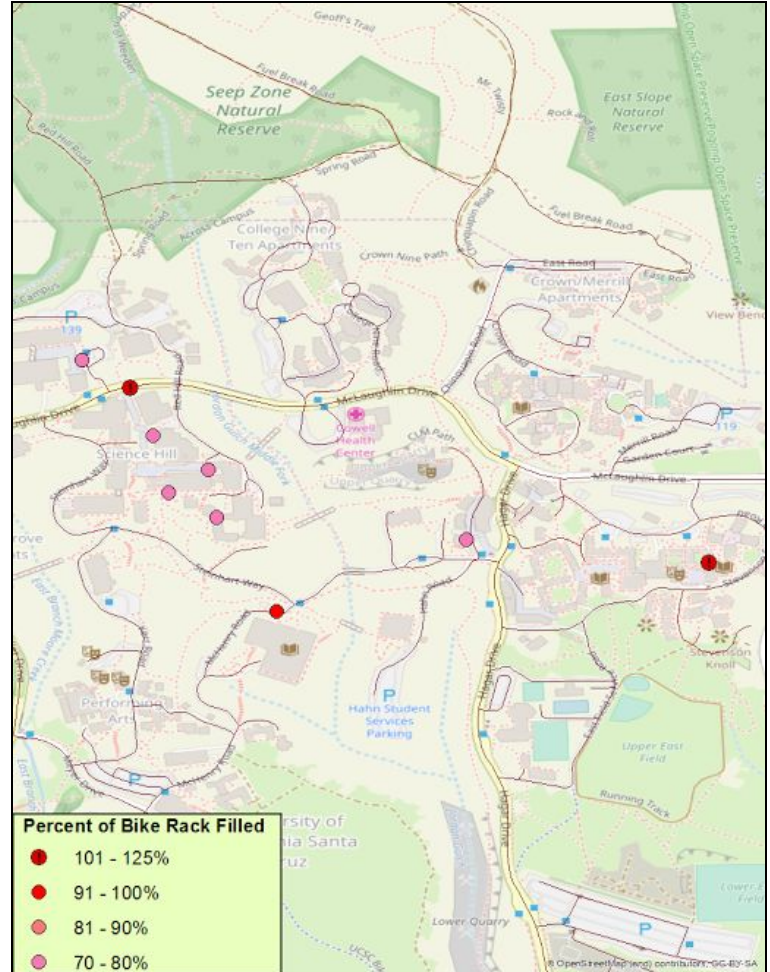


Figure 5. Percent of Bike Racks Filled Above 70%

Quality of Bicycle Racks

Aside from capacity, other factors such as poor location, poor design, and poor condition influence the easiness and comfortability of parking a bike. **Figure 6** explains the conditions a rack must be in to be considered one of the factors listed above. **Figure 7** identifies the areas on campus where these factors are prevalent as well as the places that have bikes with missing parts. The areas with “dead” bikes are indicators of where theft may be more prevalent, which were mostly near classrooms by the colleges. These areas most likely have less foot traffic and therefore may be more susceptible to theft.

Quality:	Description:
Poor Condition	-Racks are Rusty or Cracked
Poor Design	-Rack is located in an inaccessible location -Racks are located too close to one another -Racks are poorly designed, making them inefficient to use
Poor Location	-Racks are located in hidden locations -Racks are located in an underlit location
Dead Bikes	-Remnants of bicycles, indicating that theft occurred there

Figure 6: Criteria for Quality of Rack Classifications

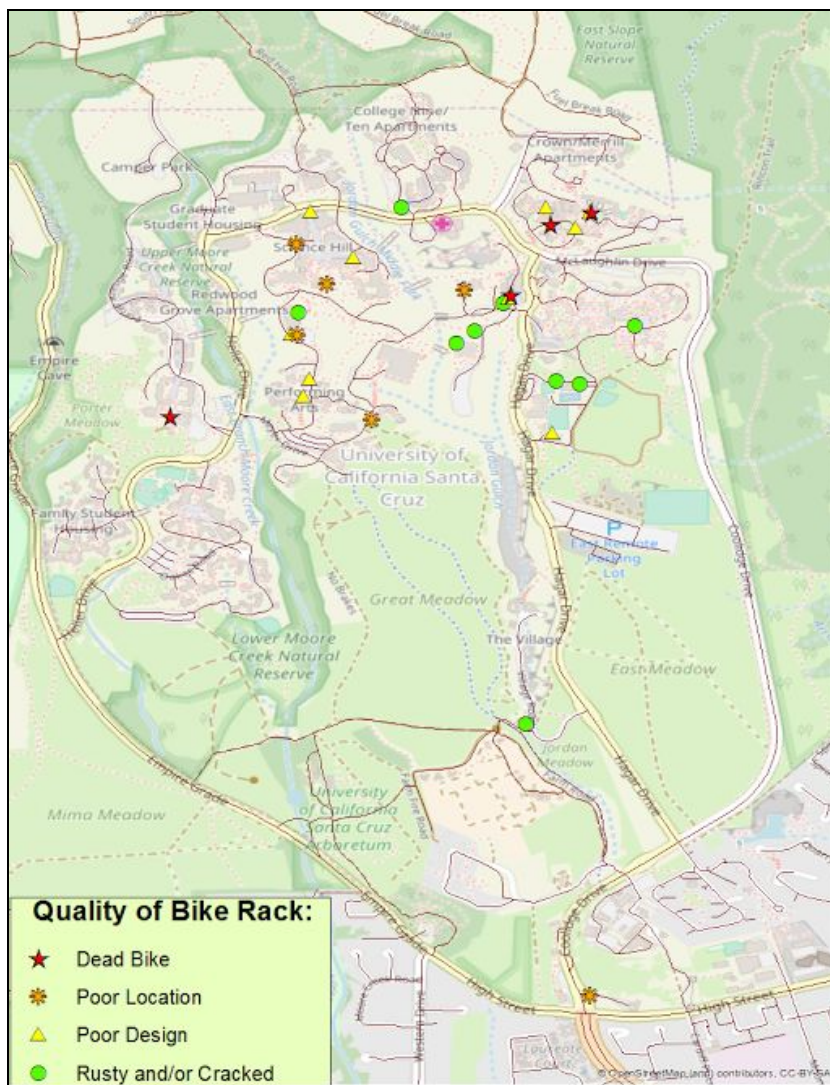


Figure 7: Quality of Bike Rack Map

There were 6 racks in poor locations; places that were hidden or close to the road. **Figure 8** shows lightning-bolt racks under the staircase of Classroom Unit 2 which are completely hidden, making it both dangerous and not easily accessible for someone to park their bike. Areas with less foot traffic,



Figure 8: Example of Poor Location (Classroom Units)

especially those that are hidden or in dimly lit areas, are more vulnerable to theft. There were 10 racks that were classified as having poor design because of their placement near other racks and lack of proximity to pathways. **Figure 9** shows an example near Vivas (Merrill) where a jail cell rack and lightning bolt rack are too close to each other. Two bikes were taking up two spots on each rack because of their adjacent positioning. The lightning bolts are also placed on a ledge, making it difficult to use the rack altogether. Another example of poor design can be seen in **Figure 10**, where two bike corrals by Kerr Hall are blocked by the handrail. In order to lock a bike to it, someone would have to lift their bike over the rail which is a hassle and inconvenient. About 22 racks were either rusty,



Figure 9: Example of Poor Design (Vivas)



Figure 10: Example of Poor Design (Kerr Hall)

cracked, tattered, or bent which classified them in poor condition (**Fig. 11**). Only a fraction of the racks in poor condition are displayed on the map because some locations had more than one problem; if a location has multiple issues, the most pressing and crucial issue was presented on the map. The inverted-U stalls were the only ones that appeared to be “cracked,” meaning that the rack itself was not cracked but the padding around it was (**Fig.12**). Aside from this aspect, poor condition was not related to a specific rack type. Though they were not aesthetically pleasing, it is unsure whether their condition compromises their safety and the safety of the bikes locked to them. Altogether, there are a range of bicycle parking improvements that need to be made to the UCSC campus in order to encourage cycling as a convenient and safe mode of transportation.



Figure 11: Example of a Rusty/Tattered Rack



Figure 12: Example of a Cracked Rack

Additional Observations

- Some bikes were parked incorrectly. Two bikes were improperly locked to some hitching posts, making it very easy for a potential thief to take them. The inverted-U stalls and some lightning bolts were also being used incorrectly.
- There were only two specific locations where bikes were found unattached to a rack or attached to an object other than a rack (e.g. a light post). The first of the locations was outside of the Kresge Food Co-op where two bikes were laid on the ground instead of locked to a rack. There were two corrals located across the path that could be moved closer to the co-op. The second location was at the corner of McLaughlin Dr and Chinquapin Rd; since there are no academic buildings by here, one can assume the person was headed into the wildlife/restoration area. We do not find it necessary to add bike racks in this location because it is not a common destination.
- We contacted the UCSC Police Department to see if there was a trend or hot-spot where bikes usually get stolen. The data spanned the past three years and showed that the majority of bike theft reports were in the residential areas on campus. Since there were no primary academic areas where theft occurred, the data was not useful to this project.

Commuter Survey

The bike shuttle commuter survey was created to identify which types of bike racks people preferred and if there were specific places on campus that they felt theft was more prevalent. In the locations that need more racks or are poorly designed, we wanted to know commuters' preference. Bikes with missing parts provided some indication of areas that may be more prone to theft, but the data does not show it all. Using survey responses and our own observations, we were able to cross-reference areas that are more risky. Unfortunately, at the time the surveys were conducted we were unaware that Jail Cell Racks were on the UCSC campus; therefore the survey only asked about five of the six rack types found throughout campus. Of the 42 responses, the majority of people preferred the corral style and the lightning bolt style (**Fig. 13**). Though we asked about 50 people, several of them said they brought their bikes into their offices and therefore did not use the bike racks. When asked if they felt uneasy leaving their bikes in a specific area on campus, most respondents said no. Some people thought remote areas, residential areas, and bike racks by the road were areas of concern with theft (**Fig. 14**). A handful of people said that anywhere on campus is prone to bike theft and that parking your bike on campus is a gamble. One woman mentioned how her bike was stolen outside of the BioMed building by the road. Though she was eventually able to retrieve the bike, she now brings it inside her office. Despite this, most respondents felt relatively safe about leaving their bikes on campus, however, there were some who thought the positioning and lighting of the area played a big role in theft prevalence.

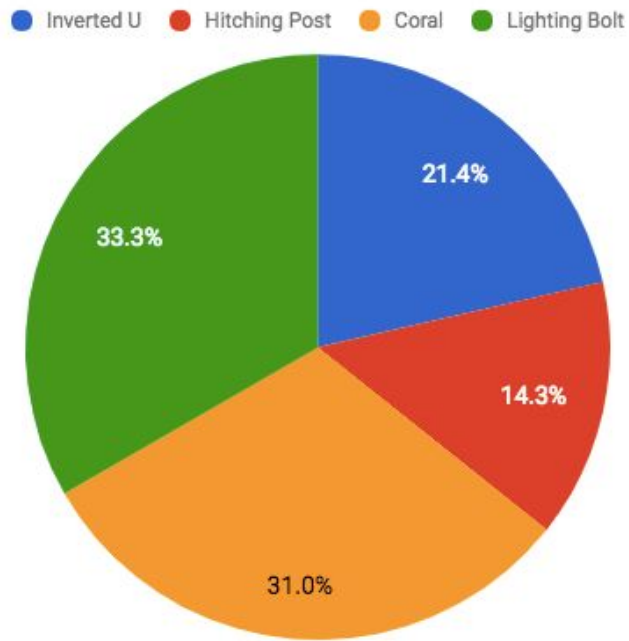


Figure 13: Preference of Rack Type

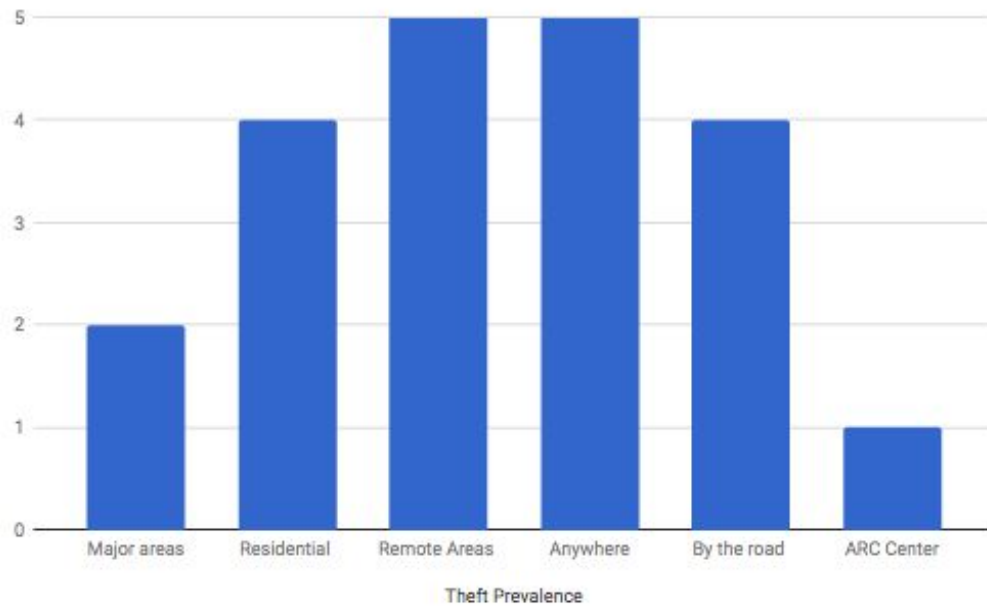


Figure 14: Area Respondents Thought Were More Theft Prevalent

Key Findings

For the most part, the current bicycle parking infrastructure on campus is adequate. Our data shows that there are areas that need improvement, especially in order to encourage bicycling as a way to commute to campus. Some of our key findings include:

- About 12% of bike racks reached between 70%-100+% capacity at peak hours
- There are several bikes with missing parts still locked to the racks in various locations
- 6 bike racks are in poor locations where theft may be more susceptible
- At least 10 locations have poorly designed bike parking; they are either inaccessible (for the sake of convenience) or they are positioned too closely to other racks
- 20+ locations have rusty or slightly damaged racks
- Bike commuters prefer lighting-bolt and corral style racks
- Commuters noted that any location is prone to bike theft, especially remote areas

Many of the issues we identified have solutions, some may be more difficult to address than others.

Our commuter survey data is somewhat limited due to the lack of direct responses for theft prevalent areas. More definitive data is needed to confirm areas we believe to have high theft prevalence.

Recommendations

Below are recommendations for bike parking improvements and potential areas for bike share. Within each recommendation are a series of best practices according to the National Association of City Transportation Officials (NACTO) Street Design Guide along with several case study cities. These elements are pertinent to creating an efficient bike parking system.







Part 1: Design Oriented Recommendations







Bike Parking Best Practices:


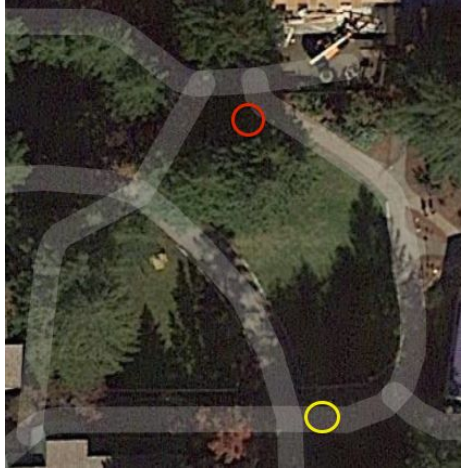



Bicycle parking is considered to have a good design if it meets the following criteria:






- If multiple racks are in a given area, they must be spaced at least 3 feet apart¹
- There should be enough room between adjacently parked bicycles²
- Parking should be located in well-lit areas in full view of sidewalks and pedestrian paths¹
- A clear zone is provided around the bicycle parking to avoid impeding traffic, including near transit vehicle doors, on adjacent sidewalks, and through long-term storage facilities¹
- Comb (Jail Cell), Toast, Schoolyard, and other wheeling bending racks that provide no support for the bicycle frame are NOT recommended²
- The rack should keep the bike upright, supporting the frame in two places and allowing one or both wheels to be secured²
- The rack resist being cut or detached using common hand tools, such as bolt cutters, wrenches, and pry bars²


Below are a list of areas that do not meet the criteria and therefore need improvement. The yellow circles represent where the rack is currently and the red circles represent where they should be moved to.



Location	Problem	Image	Proposed Action
1. Opers	Bike corral is on uneven ground, individuals must lift bike to park		Relocate to a more suitable location: 
2. Kerr Hall	Bike parking is not located along a path, individuals must lift bike over a rail or a stoop in order to park		Relocate to a more suitable location: 
3. Media Theatre	Bike parking is elevated off the ground on ledges, individuals must lift bikes over a large ledge in order to park		Relocate to a more suitable location: 

<p>4. Media Theater Near Classroom</p>	<p>Bike parking is elevated off the ground on ledges, individuals must lift bikes over a large ledge in order to park</p>		<p>Relocate to a more suitable location:</p>  <p>Metal Studio at UC Santa Cruz</p>
<p>5. Crown Classrooms</p>	<p>Bike parking is not located along a path, individuals must carry their bikes down a set of stairs in order to park</p>		<p>Relocate to a more suitable location:</p> 
<p>6. ISB</p>	<p>Racks are placed too close to wall for optimum usage</p>		<p>Relocate to a more suitable location:</p> 

<p>7. Merrill Classrooms</p>	<p>Racks are placed too close to wall for optimum usage</p>		<p>Relocate to a more suitable location:</p> 
<p>8. Merrill (By Vivas)</p>	<p>Racks are placed too close to one another for optimum usage</p>		<p>Relocate to a more suitable area:</p> 
<p>9. Baytree Bookstore</p>	<p>Racks are placed too close to one another for optimum usage</p>		<p>Increase space between current racks.</p>

<p>10. Science Hill (Top)</p>	<p>Racks are located too close to one another for optimum usage</p>		<p>Increase space between current racks.</p>
<p>11. Area outside of the Bike Co-op</p>	<p>Very tattered, rusty</p>		<p>Replace with either lightning bolt or inverted-U style.</p>
<p>12. Bottom of Earth and Marine</p>	<p>Very tattered</p>		<p>Replace with either lightning bolt or inverted-U style.</p>
<p>13. ARC Center</p>	<p>Hidden under trees, located in a low trafficked area</p>		<p>Relocate to a more suitable area:</p> 

<p>14. Classroom Units</p>	<p>Rack is hidden, not in a well lit area, and not in full view of sidewalks/paths</p>		<p>Relocate to a more suitable location</p> 
<p>15. Base of Campus (By sign)</p>	<p>Racks are hidden beneath trees and to the side of the bus stop</p>		<p>Relocate to a more suitable location:</p> 
<p>16. Kerr</p>	<p>Racks are hidden under trees and near dumpsters</p>		

<p>17. Science Hill</p>	<p>Racks are hidden under trees and elevated on high stoop making them extremely inaccessible</p>		<p>Remove racks, no need to replace since this is an inconvenient area.</p>
<p>18. Rachel Carson, Kresge, Porter, Oaks, Merrill Classrooms & Ming Ong Computer Lab</p>	<p>Contains jail cell bike racks, creating low quality bike parking</p>		<p>Remove jail cell racks and replace with lightning bolts or inverted-U. <i>See Figure 15 below for exact locations of jail cell racks on campus</i></p>

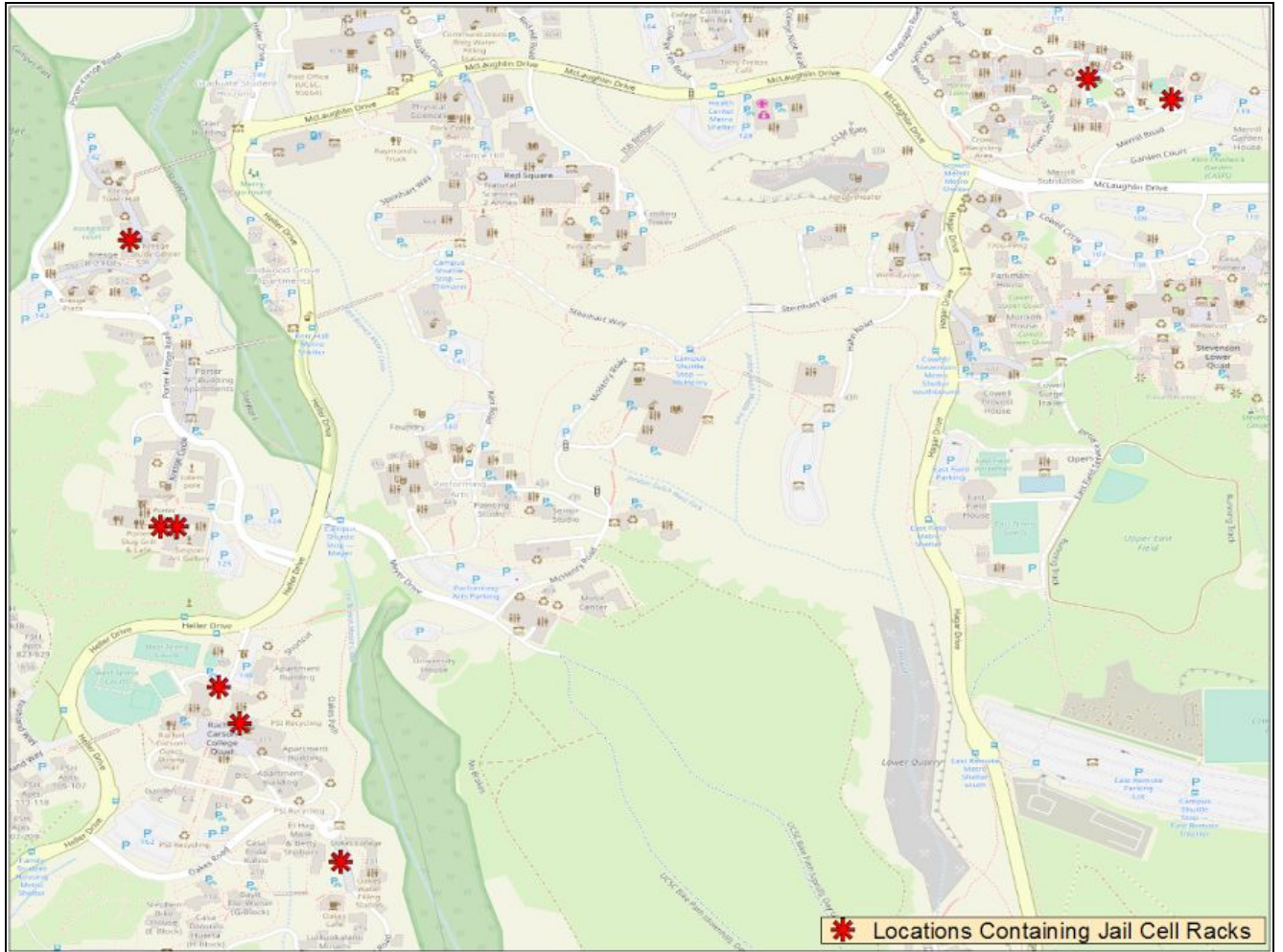


Figure 15: Locations on the UC Santa Cruz Campus that Contain Jail Cell Racks

Proposed Actions:

These 18 locations exhibit poorly designed/located bicycle parking. The five main actions we propose to improve design are:

- 1) Relocating bicycles racks to more suitable locations to provide better accessibility
- 2) Increasing space between current racks to allow individuals to park their bikes comfortably

3) Removing jail cell racks and replacing with a better model (i.e. lightning bolt racks or inverted-U racks)



4) Replacing racks in extremely poor condition



5) Moving racks that are hidden to an area with better visibility and pedestrian traffic





The first proposed action alleviates the necessity to lift bikes over rails or stoops to park. The second proposed action ensures that the racks can be used to their optimum capacity. In some locations, there is already sufficient space surrounding the area to space the racks out in; in others, the rack will need to be moved entirely to a nearby location with more space. The third proposed action was decided based on the fact that at each jail cell rack sampled on campus, bikes were unsupported, tipping over or improperly parked. This observation combined with the recommendations from the NACTO bicycle parking guide demonstrate that jail cell racks have significant design flaws and should not be used on the UCSC campus. The guide and our commuter survey data also show that any new racks implemented on campus should be the lightning bolt style or inverted U style. These two racks support bikes the best and are easy for cyclists to use. The corral style rack was also favorable among respondents, however, we have noticed that it is difficult to lock/unlock a bike when there are more than three bikes locked to it. The fourth proposed action targets the racks that are in severely bad condition and need to be replaced. Though many racks on campus are rusty, these are the priority. Though rusty racks should be improved overall, other proposed improvements hold precedence. The fifth proposed action is intended to improve the safety and visibility of racks that are hidden. These design improvements are intended to make all bicycle parking on campus easily accessible and comfortable to use by all.




Part 2: Additional Parking Recommendations

The locations listed below are in need of additional bike parking:

Location	Fullness	Reasoning for Additional Parking	Proposed Area For Additional Parking
1. Stevenson (Near classrooms)	125% Full (5/4)	High Percentage of Fullness	Add adjacent to current bicycle parking: 
2. Top of Science Hill	118.75% Full (19/16)	High Percentage of Fullness	
3. McHenry (Front)	94.74% Full (36/38)	High Percentage of Fullness	Add an additional row of inverted-U racks behind current inverted-U racks:

			
<p>4. Science Hill (Bottom of Nat. Sci.)</p>	<p>80% Full (4/5)</p>	<p>High Percentage of Fullness</p>	
<p>5. Science Hill (Earth and Marine- near cafe entrance)</p>	<p>75% Full (3/4)</p>	<p>High Percentage of Fullness</p>	<p>Add adjacent to current bicycle parking:</p>

			
6. Engineering Near Road	75% Full (9/12)	High Percentage of Fullness	
7. Baytree Bookstore	70.27% Full (26/37)	High Percentage of Fullness	Add adjacent to current bicycle parking: 
8. Science Hill (Back of ISB)	80% Full (12/15)	High Percentage of Fullness	Add adjacent to current bicycle parking: 

			
<p>9. S&E Plaza</p>	<p>72% Full (18/25)</p>	<p>High Percentage of Fullness</p>	<p>Add adjacent to current bicycle parking:</p> 
<p>10. Crown Classrooms (Outside of Banana Joes)</p>	<p>N/A</p>	<p>Area noticeably lacking enough bike parking</p>	

11. Cowell Classrooms	N/A	Area noticeably lacking enough bike parking	
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Proposed Actions:

To address the lack of bike parking in some areas of campus, we propose to add bike parking to regions that fit the follow criteria:

- 1) Locations with bicycle parking at a high level of fullness
- 2) Locations with insufficient bicycle parking to support the UCSC population

As explained in “Part 1: Proposed Actions”, the NACTO guide in conjunction with our commuter survey demonstrated that the most favorable and fitting bike rack style for the UCSC campus is either lightning bolt racks or inverted-U racks. Therefore, any additional bike parking implemented on campus in the near future should consist of these two types of racks.

We also found that the platinum and gold level rated bicycle colleges, like UC Davis, Oregon State University, and Portland State University, all have an abundance of bike parking given their respective student population sizes; UC Davis has 30,000 bike parking spots for a population of 36,000 students. UC Santa Cruz only has 1300 bike parking spots for its population of 18,000; this illustrates that bike parking on the UCSC campus is lacking in comparison to other universities. Adding more racks to

areas throughout campus will encourage more individuals to bike as they will be confident they can park anywhere conveniently.

Part 3: Bike Share Recommendations

Using NACTO Bike Share Siting Goals, the following criteria was used to determine what locations on campus would be ideal for installing bike share:

- Accessible and convenient: Stations should be easy for pedestrians and cyclists to locate at any time of the day³
- Designed for safety: Stations should be located in areas with relatively high volumes of pedestrian traffic and good lighting³
- Operationally feasible: Stations should have adequate sun exposure, if using solar power, and be accessible to rebalancing and maintenance vehicles³
- Enhance the pedestrian realm: Stations should be placed in areas that enhance the surrounding environment³
- Part of the streetscape hierarchy: Stations should not impede major, permanent streetscape elements such as hydrants, bus/ transit stops, and loading docks³

Proposed Application:

Using the criteria listed above and data from the current bike parking infrastructure, the following sites were chosen as bike share locations:

Location	Proposed Area	Image
1. Baskin Engineering		
2. Baytree Bookstore/Quarry		
3. Parking lot by Music Center		

These 3 areas have high levels of pedestrian traffic, are easily accessible by cars (to redistribute bikes), have adequate sun exposure, and would aesthetically enhance the region. The locations were strategically chosen to accommodate people travelling to/from the top of campus, the east side, and the

west side. Though the current bike parking infrastructure data shows Engineering, Quarry Plaza, and McHenry Library as having the most bike occupancy, McHenry was ultimately not chosen because it is not as accessible to people in all areas of campus and it does not have adequate sun exposure for solar charging. The area by the Music Center/Media Theatre would be easily accessible for students and staff at Oaks, Rachel Carson, Porter, and maybe Family Student Housing. It is also an area surrounded by large lecture halls, has adequate sun exposure throughout the day, and is very close in proximity to the bike path.

Concluding Remarks

Safe, convenient and abundant bike parking is one of many factors that influences an individual's decision to commute by human power. It is integral to provide extensive parking infrastructure to foster a bike-friendly commuter network. In conjunction with parking, improved bike lanes, well-lit paths and future bike share hubs will encourage students to shift their current mode of transportation. The recommended improvements for UCSC's bike parking are the first step to enhance this network and promote a culture of sustainability on campus.

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