INSTITUTE FOR SUSTAINABILITY REPORT # 3

CSUN Bicycle Report

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CSUN Bicycle Report

EXECUTIVE SUMMARY

CSUN, located in the heart of the San Fernando Valley, is a commuting campus. A 2010 campus commuting survey of faculty, staff, and students2 showed that 74% of respondents commute to campus via single occupancy vehicle. Only 8% commute via public transport (3% train, 5% bus) and 7% carpool. Most of the remaining 11% walk, skate, or bicycle to campus. However 40% of commuters who drive to CSUN alone state that they would bicycle if the circumstances were right. This report summarizes the results of follow-up studies which were conducted to assess the bicycling infrastructure at CSUN and to identify the elements of the physical environment needed to make the campus more bicycle friendly. These studies aim to inform decisions on design and location of new bicycle parking areas, lanes, and paths on university grounds.

Bicycling has many benefits to both the campus and the cyclists. It is a healthy, low cost, low maintenance, pollution-free form of transport that provides point to point service and is well-suited to typical commuting distances. (Thirty percent of the campus population commute less than five miles.) Although there are costs associated with providing bicycle infrastructure and parking, these are small in comparison to those associated with the accommodation of vehicles. As the campus has grown in the last fifteen years the number of students has increased by thirty-six percent, and has caused an increasing demand for parking spaces. In the past decade the campus has built three new parking structures (B3, B5 and G3) which together provide 4,900 vehicle parking spaces at a cost of approx. $12,000 per space. According to the campus Master Plan, another parking structure is slated for construction in the next few years. Bicycling infrastructure provides a low cost alternative to such capital "improvements".

The findings of our studies indicate that commuting safety is a concern for 50% of the bicyclists at CSUN. 45% find the lack of bicycle paths to be a problem and 61% say there is too much traffic around campus. The most concentrated street used by cyclists was determined to be East University Dr. (Lindley Ave.) with 107-117 cyclists traveling per hour. The highest concentrations of cyclists sharing paths with pedestrians (52-62 bicycles per hour) were Matador Walk, Jacaranda Way, and the pathway on the east of the library between the Oviatt Library and Sequoia Hall. The next most heavily used circulation paths by cyclists (41-51 bicycles per hour) are the areas north of Redwood Hall connecting Plummer St. to Zelzah Ave., north of the USU, and within the USU.

Campus bicyclists expressed concerns over the strength and security of current bicycle racks and the importance of parking under shade or within crowded areas. The most utilized bike racks are located around the Sierra Complex, Manzanita Hall, Redwood Hall, USU, Oviatt Library, and Bayramian Hall. Almost 50% of bike racks at CSUN are well used, 19% of bicyclists find inadequate number of parking spaces as a problem on campus. Of the sampled bicyclists 84% chose to park their bicycles closest to their destination.

Based on our research and studies, we are making recommendations for improvements to bicycle infrastructure and parking at CSUN. As the City of Los Angeles launches its own ambitious plan to improve bicycling infrastructure within the city over the next the next thirty-five years, in which it plans to expand bikeways from the existing 334 miles to a total of 1,684 miles, now would be an excellent time for CSUN to launch its own bike plan.

Several bicycle hubs should be established, each of which could hold approximately 200 bicycles parked under cover and information on bicycle related events and resources should be provided at these hubs. These should be located along streets most frequently used by bicyclists, with adequate signage for directing cyclists, and positioned so as to alleviate the chaotic interaction between pedestrians and

bicyclists which occur in the campus core on pedestrian pathways. Hubs should be close enough to key destinations (within 120 ft) in order that they are utilized.

Current bicycle racks are deficient in a variety of respects. New bicycle racks should be one of two kinds – either Peak racks or inverted-U racks. These are currently the only two types of racks that allow front-end or rear-end parking, allow the cyclist to lock both the frame and wheel of the bicycle, and hold the bicycle upright while it is being locked. It is important for the racks to be installed with sufficient spacing from walls and from each other so that the full capacity of racks can be utilized. (Rack and mounting recommendations are provided in Appendix B of this report.)

Improvement of bicycle education at CSUN is important. The campus should publish its own bicycle map that indicates recommended bicycle routes on campus and neighboring streets, provides bicycle parking locations, and gives information on basic maintenance, safety and the vehicle code. This information should also be posted at bike parking locations, together with basic maintenance tools such as bike pumps and wrenches. In addition, the campus should host cycling events and workshops on pedestrian and bicycle safety to improve cycling awareness and ridership within the CSUN community.

It is recommended that an integrated bicycle network that travels both on and around the campus be constructed. Designated lanes will not only reduce the challenge CSUN cyclists identified as they share space with pedestrians and traffic, but also increase ridership. As the city of Los Angeles expands its bicycle network, the following streets have the potential to connect with the City's existing and planned bicycle network: East University Dr./Lindley Ave. (could connect with Devonshire St. and Plummer St.), West University Dr. /Etiwanda Ave. and North University Dr./ Plummer St. (could connect with the existing bicycle route along Plummer St.). Since Matador Walk and Jacaranda Walk connect with Prairie St. and Vincennes St. respectively, these two university pathways are the most appropriate for bicycle paths (separating cyclists and pedestrians), and in fact this semester (Spring 2012) the Jacaranda Walk bike path was installed. Bicycle lanes (separating cyclists and traffic) should be added to Prairie St. and Vincennes St., the east-west connection to Reseda Blvd. In addition signage should be installed to help cyclists, pedestrians and motorists navigate safely within the network.

Street intersections on the perimeter and within the university are designed to accommodate and maintain automobile and pedestrian traffic and present problems for cyclists. On the streets, the most problematic intersection identified by cyclists is the Cleary Walk/ Lindley Ave. intersection, followed by Jacaranda Walk/ Lindley Ave. Other problematic intersections are the Matador Walk/ Lindley Ave., Matador Walk/ Etiwanda Ave., and Etiwanda Ave. in front of the B4 parking lot. All streets from the exterior of the university passing through the university should have Class 2 bicycle lanes. Those streets that border pedestrian pathways that lead into the core of the university should transition from Class 2 bicycle lanes to Class 1 bicycle lanes entering alongside the pedestrian pathways. Plummer St. should extend its Class 2 bicycle lane through campus until reaching Lindley Ave.; Lindley Ave. should transition into a Class 1 bicycle path running north-south for students traveling to and from campus housing.

A roundabout would aid cyclists riding south from the dorms, and west from Plummer St. who want to transition onto Lindley Ave. or Plummer St.; since Lindley Ave. is the most utilized street within the campus with more than 100 cyclists traveling every hour. This method of intersecting Class 1 and Class 2 bicycle lanes should also be implemented along all intersections on Etiwanda Ave., Vincennes St. and Lindley Ave. Cleary Walk intersections with Etiwanda Ave. and with Lindley Ave. should be designed as dismount zones due to high bicycle traffic on the pathways close to those intersections.

We recommend that the campus adopt a bicycle plan which includes the recommendations made here. Such a plan should be incorporated into the CSUN Master Plan.

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Introduction

CSUN, located in the heart of the San Fernando Valley, is a commuting campus. Based on the number of parking permits purchased in Spring 2010, more than eighty percent of its students commute by car[1]. As enrollment has increased, so has the demand for parking; this has resulted in the construction of parking structures in recent years to meet that demand. Since parking spaces are limited and it is costly to build parking structures (approx. $12,000 per space) alternative modes of transportation should be explored. One alternative and attractive mode of transportation is bicycling. Bicycling promotes healthy living, is pollution-free, low maintenance, low cost and provides point to point access. Increasing gasoline prices and awareness of human impacts on the environment are resulting in greater numbers of bicycle commuters to the university and throughout the region.

A 2010 campus commuting survey of 2,264 randomly selected faculty, staff, and students, completed by the CSUN Institute for Sustainability[2], showed that 74% of respondents commute to campus via single occupancy vehicle. Only 8% of respondents commute via public transport (3% train, 5% bus) and 7% carpool. Most of the remaining 11% walk, skate, or bicycle to campus. However 40% of commuters who drive to CSUN alone state that they would bicycle if the circumstances were right. Based on the outcome of this survey, other studies were conducted to research the bicycling infrastructure at CSUN – two addressed the accommodations provided for bicycles and bicycle parking[1 3] and another was conducted with an urban design course to identify the elements of the physical environment needed to make the campus more bicycle friendly[4]. These studies aim to inform decisions on design and location of new bicycle parking areas, lanes, and paths on university grounds. In this report, the outcomes of the studies are summarized with reference to bicycle plan principles of cities and other campuses in California.

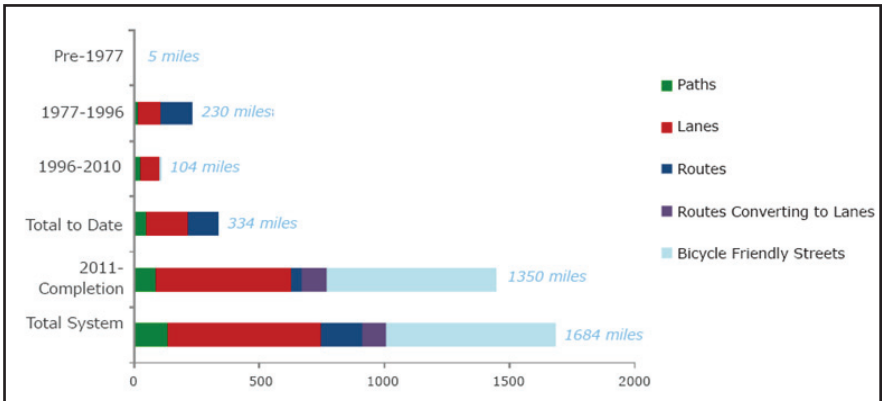
1. Cities and Bicycle Accommodations

This section summarizes the bicycle planning principles and guidelines in the cities of San Diego, Los Angeles, Santa Barbara, Davis and San Francisco, which were reviewed in addition to the California Department of Transportation bicycle codes, laws and regulations.

1.1. Bicycle Networks in Cities

The bicycle networks of cities are vital to the advancement of bicycle usage. Bicycle networks are defined as the connectivity of bicycle paths, lanes and corridors within a given community and the overall city. Plans to improve bicycle networks include signage, dimensions of streets, usage of the lanes, and speed limits. Caltrans has specified certain characteristics for the types of bicycle facilities, bike paths, lanes and shared roads. These design guidelines are given as a framework for cities. The California Streets and highways code defines the classifications of bikeways and their usage within a city[6].

The San Diego Plan aims to create an interconnected street network within and between communities and includes pedestrian and bicycle access while minimizing landform and community character impacts. It states that the maintenance and improved quality, operation, and integrity of the bikeway network and roadways regularly used



Existing and planned expansion of bikeways in Los Angeles[32].

by bicyclists are key to increase ridership of the bikeways. The 2010 Los Angeles bicycle plan aims to establish a citywide bikeway network (Appendix A). Figure A2 shows the ambitious plan for the city in which it will add 1,350 miles of bikeways over the next 35 years.

Various city reports indicate that on average only 0.9% of the commuting population occasionally use a bicycle as a form of transportation throughout the year[7 8]. Women are the segment of the population which is increasing most significantly in the number of cyclists, and are also those who most strongly encourage bicycle safety[8].

A survey conducted by the San Diego City Planning Department found that 64.2% of the 2,133 respondents report that the addition of more bike lanes on major streets would influence their decision to ride, followed closely by more paved (off-street) bike paths and increased maintenance of bikeways[7]. Studies conducted in Santa Barbara and San Diego have shown that promotion and an increased number of designated bike lanes can increase the number of cyclists. Funding is required to implement these infrastructure changes, and the Safe Routes to School grant has been useful for providing such a mechanism within San Francisco, San Diego, Davis, Santa Barbara and Los Angeles. This funding provides for improvements to encourage bicycling through the improvement of bicycling safety. These cities are also enhancing bicycle networks throughout metropolitan and inner city areas.

1.2. Bicycle Facilities in Cities

Parking, bike lockers, showers, adequate shelter (shade from sun and rain) and aesthetic appeal are all important in the selection of bicycle facilities, which are crucial in developing good bicycle networks. Secure bike parking and end of trip facilities encourage the use of bicycling. The Santa Barbara Plan states that bicycle parking should be maintained and promoted [11], and the cities of Davis and Los Angeles state that maintaining an inventory of bikeways and facilities will assist in providing a more cohesive network [8 9]. San Diego's Bicycle plan aims to "provide safe, convenient, and adequate short- and long-term bicycle parking facilities and other bicycle amenities for employment, retail, multifamily housing, school and colleges and transit facility uses" [7]. The San Diego Plan also recommends the expansion of the bicycle locker program at transit stops, public buildings, city parks and other strategic locations, including businesses. Public and private merchants should provide showers, changing and storage areas, and lunchrooms for bicycle commuters when appropriate[7]. All destinations with high foot traffic are good targets for the placement of bicycle

Dero bicycle shelter[33]

Bicycle locker with door open by Ross Mayfield[34]

infrastructure. The provision of sufficient, secure bicycle parking reduces the likelihood of theft. Bicycle registration also helps; the cities of Los Angeles, Santa Barbara and San Diego are hoping to reinstate their bicycle registration program to deter bicycle theft[7].

1.3. Bicycle Education in Cities

Bicycle education, in addition to bicycle facilities and networks, is crucial for increasing the number of cyclists. There are many ways to educate the public about bicycling. The city of Los Angeles has a website that provides information to cyclists about bicycle laws and cycling events. The cities of San Diego and Davis are creating websites, developing public service announcements, and providing information to local media outlets about bicycle education and safety[7 9]. Public transportation venues, such as buses and bus stops, are widely used for advertising, allowing more than a million riders a month to get a look at announcements about the happenings within their community and city. The city of San Diego conducted a study on the usage and commuting pattern of their local cyclists which showed that more people will ride if bicycle related information, such as maps, are more visible[7]. The cities of San Diego, Santa Barbara and San Francisco are collaborating with schools and local community groups to acquire funding to integrate bicycle education into the existing curriculum[7 9 10]. To inform and encourage biking, cities have organized events, such as bicycle tours, recreational rides and a summer ride series[8]. One way to bring in a greater audience is to hold an annual forum to educate the public on the features and benefits of the bicycle program and solicit input on possible improvements[9].

1.4. Bicycle Regulations and Safety in Cities

The rules and regulations imposed in each city guard the safety of cyclists and influence cycling and automotive culture. Proper signage aids bicycle safety[7 8 9 10] and includes the following:

- Shared lane marking or "Sharrows"
- "Bike boxes"
- Colored bike lanes
- Traffic-calmed streets

Shared lane markings or "Sharrows" encourage motorists to share the road with cyclists on narrow roads where passing may be difficult and raises awareness amongst motorists. "Bike boxes" establish waiting areas for cyclists at intersections at the front of traffic to increase cyclists' visibility and to avoid right turn collisions. Colored painting of bike lanes helps their visibility and improves awareness among motorists. Traffic-calmed streets use a variety of methods to reduce traffic speed and volume, including reduced speed limits, addition of speed humps, roundabouts at intersections, and curbs which extend out into the street at intersections to narrow the crossing distance[19]. In addition to these measures, proper street maintenance and improvement of infrastructure, lane width, cleanliness, tree trimming and street traffic maintenance are necessary to allow safe bicycle movement through and throughout the city network connections[7 8 9 10 11].

Safety is also improved by increasing the number of police officers riding bikes. The Officer Enforcement Program in Los Angeles is one such program that reminds individuals that regulations and code violations apply to cyclists as well as motorists [7 8]. Providing adequate lighting is another key to safety and important for night cyclists and evening commuters. San Diego has proposed the implementation of a program that offers bicycle safety training as an alternative to regular traffic school for motorists and bicyclists cited for traffic violations[7].

2. Campuses and Bicycle Accommodations

Certified bicycle-friendly universities such as UC Davis, UC Santa Barbara, UC Los Angeles and Stanford prove that a cycling culture can thrive at universities, and demonstrate that bicycling can be a sustainable means of transportation for students and faculty.

The city of Davis and UC Davis have worked together to provide thousands of cyclists with a bicycle friendly environment. Wide streets, well-marked bike lanes, inviting pathways, gentle terrain, mild climate, and an attitude of mutual respect between cyclists and motorists have resulted in a community

with the most bikes per capita of any in the nation. For over forty years UC Davis has taken the approach of encouraging and accommodating maximum bicycle use, and is currently ranked a gold bicycle-friendly university (BFU) by the League of American Bicyclists. UC Santa Barbara is another campus with a gold ranking and one that is a national leader when it comes to human-powered commuter trips; a large percentage of the campus community bicycle, skateboard, and walk between their home and the campus. The university has accommodated cyclists for decades with its dedicated bicycle lanes integrated throughout the campus. Just as at Davis, Santa Barbara's terrain and weather make it ideal to commute by bicycle – attributes shared by Stanford University. The number of Stanford students who commute by bicycle is rapidly increasing and the university has altered the campus significantly to meet that demand, gaining them a rating of a platinum bicycle-friendly university by the League of American Bicyclists [14]. UCLA, a university just 15 miles from CSUN, is working to accommodate the ever-increasing number of cyclists who commute to the campus. Unlike UC Davis, UC Santa Barbara and Stanford University, who have a long history with cycling and related infrastructure, the cycling culture is relatively new to UCLA which created its first bicycle master plan in 2006. Because UCLA is geographically similar to CSUN and is relatively new to the cycling culture, it can serve as a good model.

Not only are climate and terrain important factors in sustaining a cycling culture, the infrastructure surrounding the university is crucial as well. Establishing cycling infrastructure within the city is just as, or more, important than establishing it within the university. Infrastructure surrounding universities affects ridership because it is an essential part of commuting. Such external factors make bicycling challenging for the UCLA and CSUN communities as the terrain of Los Angeles County is difficult and infrastructure is under-developed in some areas, and simply lacking in others. Because the region lacks a cycling culture, mutual respect between cyclist and motorists has been a challenge, but that is changing.

Roundabout at UC Davis[35]

2.1. Bicycle Circulation on Campuses

Bike paths, bike lanes, and other bikeways at UC Davis are mostly wider than the minimum standards because of the large volume of bicycles operating daily. New bikeways are constructed with excess width to accommodate expected future traffic volume. Since the early 1970s, UC Davis has made use of roundabouts to improve the flow of traffic at bike path intersections as well

Roundabout at UC Davis[36]

as at core area roadway/bike path intersections. Currently there are more than a dozen such treatments on campus. Roundabouts have proven to be very effective in maintaining a steady flow through intersections

One of many roundabouts that accommodates pedestrians and cyclists at UC Santa Barbara[37]

especially during peak traffic periods such as class breaks.

Many campus bike paths are paralleled by separate pedestrian facilities - the preferred and recommended design standard[16]. Signs and markings on campus bike paths generally follow Caltrans Traffic Manual designs, but are often smaller in size. In addition, signs and pavement markings are used to designate bike parking areas and areas where bike parking is prohibited.

At UCSB, the unique pattern of separate bicycle paths was developed and funded during the intensive capital construction era of the 1960's. That plan integrated a system of paths with grade separations and roundabouts that separated motorists and pedestrians from bicyclists. Now there are 10 miles of Class I bicycle paths and 7 bicycle roundabouts.

One of the many bike paths at UCSB[38]

Stanford University constructed this roundabout in summer 2007 at the notorious bicycle-pedestrian cross-roads known as the Intersection of Death[39]

At Stanford University bicycles are the principal mode of travel for the majority of students on campus, and for much of the campus community. While the 20,000 bicycles on campus are not currently precluded from any area, they can present a significant safety hazard to pedestrians and to themselves. Where feasible, Stanford is developing bike circulation routes that are contiguous but separate from pedestrian walkways, and is routing bicycles into clearly defined corridors where feasible[18]. Roundabouts have improved safety and traffic flow, and ground-painted traffic signs help guide bicyclists properly through them. Sidewalks separate pedestrians from the steady stream of bicycles through Stanford's most congested area.

Although UCLA does not currently have established bike paths throughout campus, many students are demanding safer bike paths. Early in 2010, students

spoke out through their student newspaper, the Daily Bruin. The news article reported that UCLA tried to address bike safety problems in 2006 with a bicycle master plan, but according to student complaints, the changes have not been satisfactory. UCLA's transportation planning and policy manager, Dave Karwaski, told the Daily Bruin that the school has taken several measures to improve cyclist safety and encourage the use of bikes, including an increase in the number of bike racks on campus and updating bike parking. "It's not like we weren't expending effort," says Karwaski, who told the paper that the number of cyclists at UCLA has doubled since 2006[20]. UCLA has established a dismount zone that prohibits the riding of bicycles, skateboards, scooters, and roller blades.

BikeLid in Northridge, California[40]

2.2. Bicycle Parking on Campuses

At UC Davis, many cyclists use their bikes to travel between campus destinations throughout the day, even where distances are relatively short[16]. The intent at UC Davis is to site parking conveniently near to building entrances and in high visibility areas, where possible, to discourage theft. The campus standard for bike racks is based on several design factors including theft-preventing features, ease of use, cost, durability and appearance. There are a few lockers at UC Davis which are used by regular bicycle commuter who want a secure place to store their bike while at work or in class. Two sets of lockers are sited close to shower facilities to accommodate out-of-town bike commuters. The campus standard for bike lockers is an all-steel locker chosen for its theft resistance, durability and ease of maintenance. The campus also has twelve "BikeLid™" lockers in four campus locations.

Bicycle parking using Peak Racks at UCSB[41]

These are available to cyclists on a "first come, first served" basis. There is no rent or fee associated with their use, but they are for short-term use only[16].

The Sustainability Implementing Guidelines for the Sustainable Practices of Bicycle Paths and Parking Improvements[17] at UC Santa Barbara have been in effect since 2010. The policy ensures appropriate infrastructure improvements through budgeting to increase the numbers of cyclists as UCSB moves away from a single occupancy vehicle-dependent culture. The current policy is effective from July 1, 2010 through June 30, 2012, and states that all campus projects are required to provide areas for bicycle racks and secured bicycle parking. Bicycle parking lots shall have high visibility with immediate proximity to major entry points and self orienting layouts with an adequate capacity. In the event that it is not feasible for them to be placed in clear view of the building entrance, signage must be posted directing cyclists to the

Bicycle parking with inverted U bicycle racks at UCSB[42]

parking area. The design shall be clearly defined by a stable surface (permeable and non-slip) which is easily maintained, durable, and includes landscaped borders to improve appearance and reduce visual impacts. Whenever feasible, a tree canopy shall be included or retained to reduce the heat gain and all bicycle parking lots shall have adequate lighting. A requirement for any new construction or renovation project is that sufficient bicycle parking be provided for 25% of the building population, defined as the faculty, staff, and student occupants, plus a minimum of 60% of the classroom capacity. Bicycle parking ratios related to building capacity will be periodically refined based upon future commuter mode-split surveys and bicycle usage statistics. If an increase in demand for bicycle parking is identified during site programming, increased parking must to be accommodated by the building project. Secured bicycle parking shall be installed for 5% of the building occupants or two bicycle lockers (each with two spaces) whichever is greater[17]. Bicycle lockers should be placed close to the building entrances in the dedicated bicycle parking areas; the rentals of these are managed by the UCSB Transportation Alternatives Program (TAP). There are currently more than 10,000 secure bicycle parking spaces in bicycle racks at UCSB, 40 secure bicycle lockers, and free showers for bicycle commuters[15].

At Stanford, thousands of secure bike racks (most in landscaped compounds) have been added to the campus in the last decade [18]. Each new and renovated building is analyzed for its anticipated bike parking demand and accommodated accordingly. Along with the established bicycle racks, as of 2010 there were 12 bike locker compounds located on the campus with capacity for over 180 bikes. Three bike cages located in Parking Structure 2 (in front of Stanford Hospital), Parking Structure 5 (Stock Farm), and the Beckman Center provide additional safe storage. The bike locker rental fee is $24 annually with a refundable $25 key deposit[21].

At UCLA there are currently 707 bike racks, 2,966 bicycle parking spaces, 30 lockers, and 5 shower and locker facilities. Students have free access to showers and lockers and employees can purchase a “Commuter Passport” which provides shower and locker access for a nominal fee. The 2006 Bike Plan states that the number of bicycles parked at campus racks has increased considerably, possibly due to the provision of more racks but likely, due to other contributing factors, such as the higher cost of gas and the higher percentage of students living in close proximity to campus.

2.3. Bicycle Regulation and Safety on Campuses

The University Police and Transportation & Parking Services (TAPS) enforce bicycle use on campus at UC Davis. Rules, regulations and good signage are not sufficient to generate and maintain safe and legal cycling behavior. With so much cycling activity on campus, regulations pertaining to bicycle operation, equipment and parking must be enforced in order to ensure a safe bicycling environment[16]. Campus cyclists are subject to the California Vehicle Code and the UC Davis Traffic and Parking Code. University police record and investigate bike thefts, respond to bicycle crashes, and maintain theft and crash statistics. Bicycle registration is mandatory for all bikes used on campus, and licenses are available on campus and at three local bike shops in Davis. TAPS oversees the program which makes use of the California Bicycle License system managed by the California Department of Motor Vehicles. Registration aids in the recovery of stolen bicycles and is also useful in managing the large numbers of bikes as it allows for the identification of their owners in cases of abandoned and illegally parked

bikes, and for removing locks for owners who have lost their keys[16]. In order to maintain a safe and orderly cycling environment, all local and state laws pertaining to bicyclists are strictly enforced in Davis; both the city and university employ officers to enforce bicycle ordinances. All persons who enter university grounds are expected to have knowledge of the provisions of the UCD Traffic and Parking Code and are subject to penalties for violations of such provisions[23].

At UC Santa Barbara, pedestrian crossings of bicycle paths (with high volumes of pedestrians and/or bicycles) include a pedestrian refuge zone with tactile warning markers at walkways[17]. Turning refuges and safe dismount zones connecting the path to a bicycle parking area are provided in areas with high bicycle flow rates. Bicycles must be licensed with a California State Bicycle License, which may be obtained through the Community Service Organization (CSO), which is responsible for ensuring bicycle safety and maintaining the bicycle registration program. Bicycle registration dramatically increases the recovery rate of stolen bicycles on campus and registered bikes that have been stolen have a recovery rate of over 30%, largely due to the fact that the CSO spends time searching the bike racks on campus for stolen bikes. Registration also provides proof of ownership, which is important if someone else tries to claim a bike as their own. The registration fee is $6 for three years. CSO officers are responsible for bicycle safety education, and bicycle violation citations which include illegal parking. Additionally, verbal warnings or citations may be issued if students use bike paths inappropriately or pose a danger to other students. The most common infractions are riding on the sidewalk, two people riding one bike, riding with no hands, and skateboarding or walking on the bike path . Students serve as CSO employees and work with the campus Police Department to serve the community[24]. Daily bicycle patrols allow them to be visible when assistance is needed whether it be a lock-cut, response to an accident or suspicious circumstances. Frequently operating at a peer level, CSO officers are often in a position to keep a situation from escalating into a potentially unmanageable incident. The UCSB Police Department is charged with the task of keeping bicycle racks clean around campus. Every year, as students graduate, hundreds of bikes are left behind. These “abandoned” bicycles take up valuable rack space so CSO officers tag bicycles that are potentially abandoned with bright orange tape. At various times throughout the year - usually during major breaks - CSO officers impound bicycles that appear to be abandoned, and have been tagged by orange tape. All impounded bicycles are brought to Public Safety for processing, and are held for a minimum of 90 days before they are released for online auctioning. The impound release fee is $24 dollars and impounded bicycles must be registered prior to release. During this time, owners are contacted through the bicycle registration system. The Bicycle Abatement Program is specifically charged with clearing racks on campus, around the residence halls, and in off-campus university-owned housing and is conducted in accordance with University policies as well as California laws. The abatement process ensures that the campus is not cluttered with abandoned bicycles and/or bicycle parts and helps maintain an adequate number of secure parking spaces throughout the year[24].

All bicycles operated on the Stanford University campus must be registered through the University’s Parking and Transportation Office bicycle registration program. For a fee of $3.50 per license (lasting 3 years), the bicycle is registered with Santa Clara County and if lost or stolen the owner can be identified and contacted. The registration requirement applies equally to students, faculty and staff. Improperly parked bikes will be removed and impounded by the Department of Public Safety, which tag abandoned bicycles with a warning notice. A bicycle is determined to be abandoned when it is found in the same location over an extended period of time (generally two weeks or more) with any combination of missing parts, dust/cobwebs, flat tires, or rusted chain. Once tagged if the bicycle is not removed within fourteen days, the department will impound it. If an abandoned bicycle is not registered, the Department of Public Safety will dispose of the bicycle after holding it for ninety days otherwise the registered owner will be contacted. This

The Associated Students' Bike Shop at UCSB[43].

abatement process is performed in student residential areas and other areas of campus on an ongoing basis[27].

As in most urban areas, bicycle thefts are a concern at UCLA. According to UCPD records nearly 500 bicycles were reported stolen from campus from between 2002 and 2006. Many more bicycles have likely been stolen and simply gone unreported. There are currently 18 bicycle patrol officers at UCLA with whose help there has been a 50% reduction in bike thefts during 2010, the recovery of a number of bikes, and arrests of bike thieves[22]. Bicycles that are not parked in designated on-campus parking areas may be impounded by Parking Enforcement or UCPD[28]. Whenever possible, an illegally parked bicycle will be tagged for 72 hours prior to impound. Once impounded, bicycles are stored for at least 90 days, during which time a bicycle can be reclaimed for a $50 impound fee. If bicycles are not reclaimed during this period, they are sent to auction. UCPD produces a brochure on bicycle safety that provides valuable information on bicycle rules and regulations, as well as bicycle tips and advice on locking and parking bicycles [28].

2.4. Bicycle Education on Campuses

At Davis, the best source of bicycle education is its bike map[16]. The free map shows all the bikeways in the city and on campus, including all streets marked with bike lanes. It also shows bike shop locations, tire air sources, and a variety of other conveniences to bicyclists. The reverse side of the map provides bike riding tips, safety and security information, and a list of local resources for cyclists. TAPS also distributes a flier that is directed at new students, staff and faculty, which provides the basic information necessary to be a successful cyclist at Davis. As well as being distributed to all students who will be living in the residence halls, it is made available at many events and campus locations. A 19 minute video, "How to Avoid Face Plants" is a production filmed in Davis and geared toward the college student population. It is used in the TAPS bike traffic school, shown on campus closed circuit TV and in a variety of presentations on campus. The TAPS Bicycle Coordinator gives bike safety talks to student and staff groups, and as a certified League Cycling Instructor with the League of American Bicyclists, has taught classes in cycling and cycling skills. Bicycle repair classes are offered regularly at the ASUCD Bike Barn through the ASUCD Experimental College. Hundreds of students and community members have learned to repair, overhaul and maintain their bikes through these courses over the years [16].

At UC Santa Barbara, Community Service Officers are responsible for teaching cycling safety to cyclists on campus. The university also has an Associated Students' Bike Shop which has been serving students, faculty, staff, and alumni since 1974. It is a student-funded non-profit organization dedicated to education, service, and safety.

At Stanford bike safety presentations are offered as a part of SUDPS' Bike Diversion Program. These presentations are mandatory for those with a bicycle violation. Bike repair clinics are offered at the campus bike shop, and a few repair

Bike repair stands at Stanford[44]

stands located on campus enable bicyclists to make minor repairs and pump up their tires without charge. Multiple tools are securely fastened to the repair stations, which also double as bike stands.

The UCLA Bicycle Shop is a basic service bike shop that provides tools as well as technician support for students and staff interested in repairing their bikes. The bike shop hosts quarterly safety and maintenance workshops, and also provides maintenance for the Bruin Bikes Program[22]. This program is funded by the UCLA Green Initiative Fund and provides 50 operating bikes which students can rent for $35 per quarter. Community involvement has been a critical element to the bicycle planning effort at UCLA, and public outreach meetings have included requests such as "obsolete and damaged bicycle racks be replaced with new racks" and "bicycle racks be permanently affixed when installed so that they cannot be moved around by weekend skateboarders"[28]. It was noted that bicycle parking placement is critical and must always be incorporated into new campus construction, and there has been considerable support for ordering bicycle lockers for the campus[22].

3. Bicycle Use and Accommodations at CSUN

In the past year, three separate studies have analyzed cycling conditions at CSUN. These studies help to inform the design and location of new bicycle parking areas and new bicycle lanes and paths within the campus.

3.1. Methodology

The first study, "Bicycle Commuting Assessment at California State University, Northridge", was carried out by a geography student as her senior project and focuses on bicycling at CSUN during the Spring 2010 semester[1]. This study incorporates the results of a survey of a hundred bicyclists which asked their opinions on safety, bicycle infrastructure and parking. Tivasuradej mapped and assessed bicycle racks to evaluate their condition, capacity, and utilization, and whether distribution meets demand.

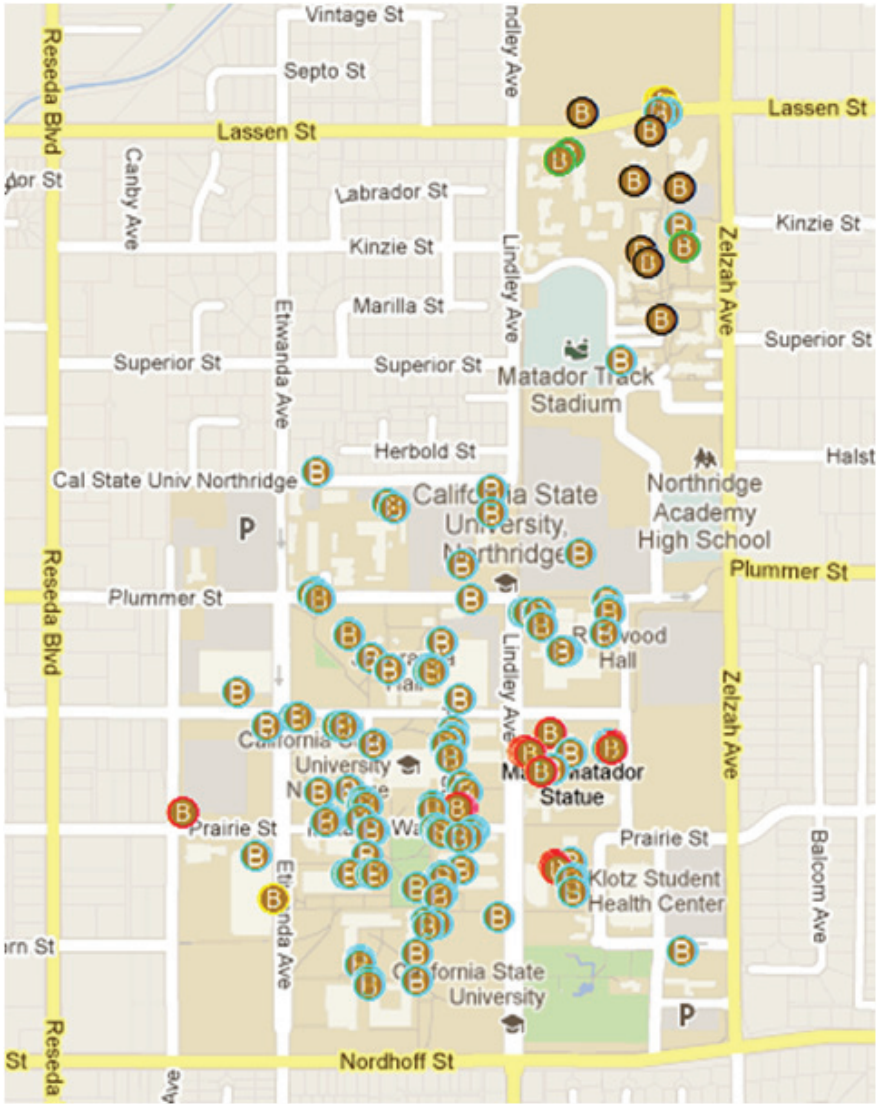
The second study, entitled "California State University, Northridge South Campus Bicycle Plan", was performed in Fall 2010 by the URBS 440 Community Based Urban Design class. This report developed findings based on interviews conducted with 214 cyclists on the CSUN campus in October 2010, and on 20 hours of behavior mapping of cyclists on weekdays between 11 am and 1 pm on campus in September 2010[4].

A third study entitled, "California State University, Northridge Campus Bicycle Parking Solution", was performed in Spring 2011 by mechanical engineering student Dennis D'Alfonso[3]. The report focuses on the bicycling facilities at CSUN, and on bicycle parking racks in particular with analysis of their features and positioning (see Appendix B). With information from prior studies, and proven research from established cycling associations and organizations, the report concludes with recommendations for improvement.

3.2. Findings

3.2.1. Bicycle Circulation at CSUN

Commuting safety was found to be a concern for 50% of the bicyclists at CSUN. Also, 45% found the lack of bicycle paths to be a problem, 61% said there was too much traffic around campus, and 26% said it was too dark to ride at night[1]. The most



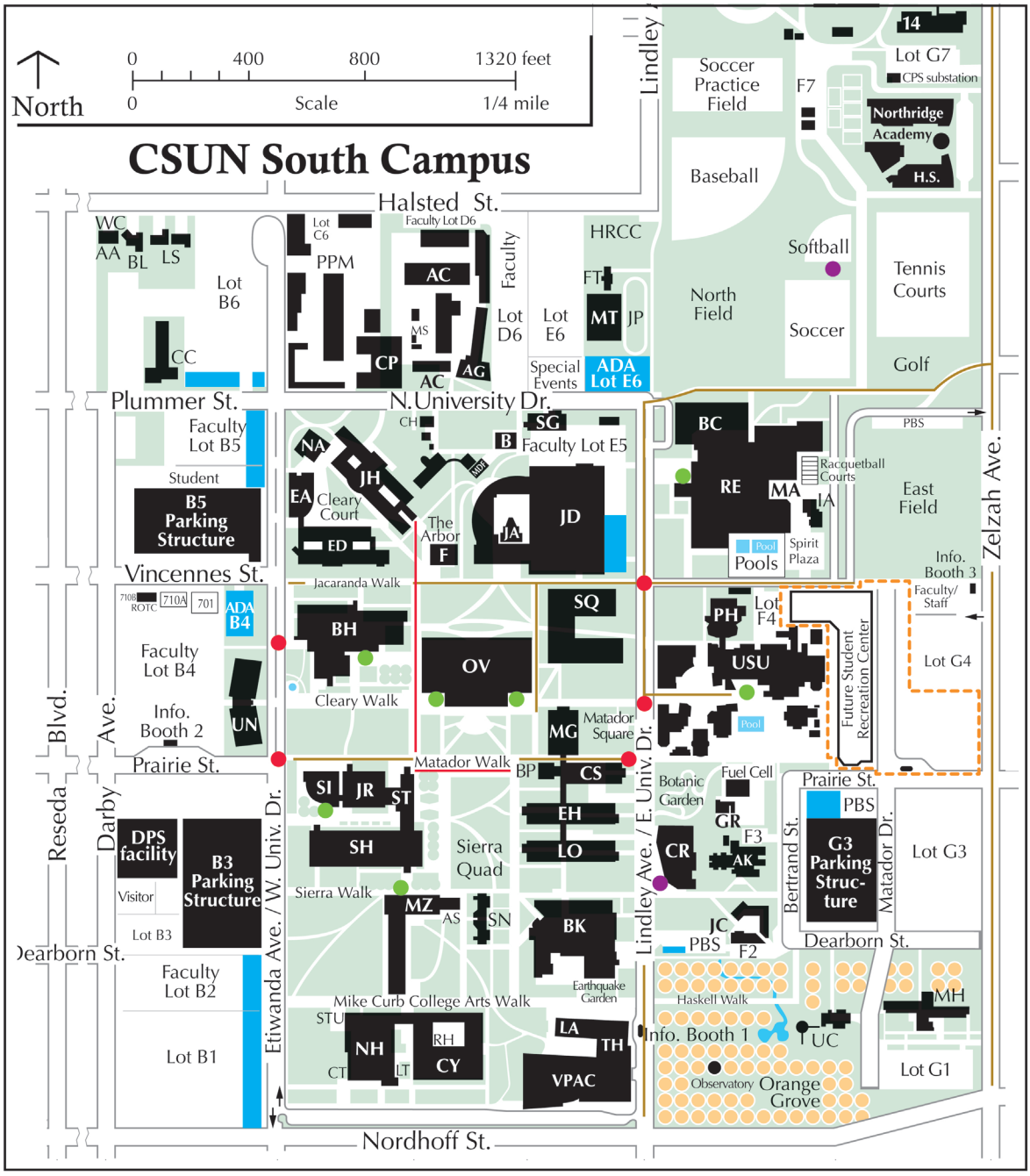
Map showing number and locations of bicycle racks at CSUN[45]

heavily used paths and bicycle parking areas are concentrated in the center of campus[4] and the most frequently used streets are Lindley Ave. (26%) and Zelzah Ave. (25%)[1]. Thirty-five percent of bicyclists find their main challenge on campus is sharing paths with pedestrians and seventeen percent find sharing paths with vehicles as a problem on campus[4]. In Toker's class study, the most concentrated street used by cyclists was determined to be East University Dr. (Lindley Ave.) with 107-117 cyclists traveling per hour. The highest concentrations of cyclists sharing paths with pedestrians (52-62 bicycles per hour) were Matador Walk (south of the Oviatt Library), Jacaranda Way (north of the Oviatt Library), and the pathway on the east of the library (between the Oviatt Library and Sequoia Hall). The next most heavily used circulation paths by cyclists (41-51 bicycles per hour) are the areas north of Redwood Hall (connecting Plummer St. to Zelzah Ave.), north of USU, and within the USU.

3.2.2. Bicycle Parking at CSUN

Data on where cyclists park their bicycles are instrumental in determining the location of future bicycle parking areas. Almost 50% of bike racks at CSUN are well used[1]. Of the sampled bicyclists 84% chose to park their bicycles closest to their destination[1 4]. The bicycle compound located in the B3 parking structure is not used by 96% of bicyclists; 24% of cyclists are unaware of the facility and 23% said the compound is in an inconvenient location[4]. Bicyclists expressed concerns over the strength and security of current bicycle racks and the importance of parking under shade or within crowded areas. The most utilized bike racks are located around the Sierra Complex, Manzanita Hall, Redwood Hall, USU, Oviatt Library, and Bayramian Hall[1 4]. Areas where bicycles are parked in undesignated areas are west of Chaparral Hall and under the bleachers at the entrance to the softball field[1].

There are currently 132 bike racks with a total capacity of 1098 bikes on the southern part of campus; fewer than 15% are under shade or rain covers and approximately 70% have no protection. On rainy days, 38% of cyclists chose to walk to campus rather than bicycle, 26% chose to drive instead, and



CSUN South Campus Map of Bicycle Problem Areas[46]

The CA MUTD Code R9-6 sign may be used where a bicyclist is required to cross or share a facility used by pedestrians and is required to yield to the pedestrians.

The Shared-Use Path Restriction (R9-7) sign may be installed on facilities that are to be shared by pedestrians and bicyclists. The symbols may be switched as appropriate.

The BICYCLE LANE sign shall be placed at the beginning of each designated Bicycle Lane and along each bicycle lane at all major changes in direction.

Core signage for use in a bicycle-friendly network[42]

25% still cycled to campus[1]. It was determined that at least 25% of bicyclists do not use the shower facilities on campus and 19% of bicyclists find inadequate number of parking spaces as a problem on campus[4].

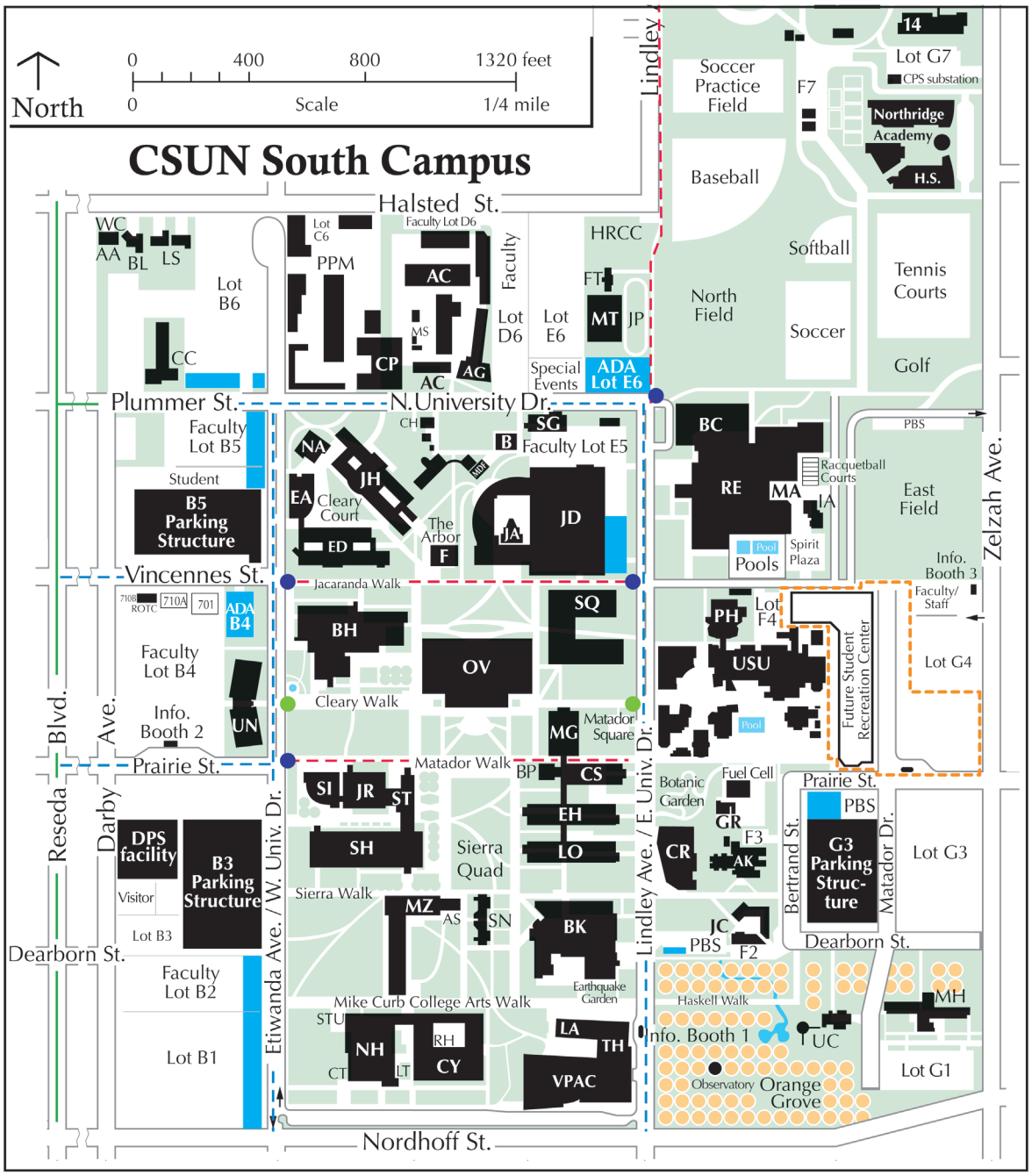
4. Recommendations for Improvements at CSUN

Based on studies conducted at CSUN, it is recommended that several bicycle hubs be established, each of which could hold approximately 200 bicycles parked under cover, and that information on bicycle related events and resources be provided at these hubs. These should be located on the periphery of the campus alleviating the chaotic interaction between pedestrians and bicyclists which occur in the campus core on pedestrian pathways. The hubs should be along streets most frequently used by bicyclists, with adequate signage for directing cyclists. Since some streets are too narrow for addition of a bike lane, unique solutions for problematic areas should be implemented. The core campus bicycle parking should be improved by replacing problematic bike racks with more functional and secure bike racks to improve capacity and safety. These infrastructure improvements should be accompanied by a program in which campus users are educated on the use of designated and shared spaces for different modes of transport.

4.1. Bicycle Circulation-Related Recommendations

In order to promote cycling as a safe, healthy, and sustainable mode of transportation, bicycle infrastructure must be incorporated within and around vehicular infrastructure. The five city bicycle plans reviewed for this report reported that designated bicycle lanes increase the number of cyclists, and the successful campus bike plans discussed here also underline the importance of a bicycle circulation network with designated bicycle lanes.

There are very few streets near the university that include bicycle lanes. As of October 2011, Plummer St. which passes through the campus was partially striped for a designated bicycle lane (running part way into campus from the intersection of Reseda Blvd.). This is the only designated lane for bicyclists



CSUN South Campus Map of Recommended Bike Infrastructure[46]

within or on the perimeter streets of CSUN. However, Reseda Blvd. is the closest major arterial road (with north-south orientation) which has a designated Class 2 bicycle lane.

It is recommended that an integrated bicycle network that travels both on and around the campus be constructed. Designated lanes will not only reduce the challenge CSUN cyclists identified as they share space with pedestrians and traffic, but also increase ridership. As the city of Los Angeles expands its bicycle network by closing the gap on Devonshire St. and making Prairie St. and Lindley St. bicycle friendly, the following streets have the potential to connect with the City's existing and planned bicycle network: East University Dr./Lindley Ave. (could connect with Devonshire St. and Plummer St.), West University Dr. /Etiwanda Ave. and North University Dr./ Plummer St. (could connect with the existing bicycle route along Plummer St.).

A traffic route within the University that hosts 52-62 bicycles per hour is the pathway east of Sierra Tower running north-south along Sierra Quad. Other heavily trafficked streets with 40-51 cyclists per hour are Plummer St. and Vincennes St. Since Matador Walk and Jacaranda Walk connect with Prairie St. and Vincennes St. respectively, these two university pathways should be considered for bicycle paths (separating cyclists and pedestrians). Bicycle lanes (separating cyclists and traffic) should be added to Prairie St. and Vincennes St., the east-west connection to Reseda Blvd. This will allow the bicycle network of CSUN to be integrated with the bicycle network of the City of Los Angeles (Appendix A).

In addition signage should be installed to help cyclists, pedestrians and motorists navigate safely within a bicycle network. Examples of core signage that were used within the 5 cities are shown above.

4.1.1. Recommendations for Intersections (Core and Perimeter)

Street intersections on the perimeter and within the university are designed to accommodate and maintain automobile and pedestrian traffic. A cyclist who enters intersections within this framework resorts to using one of the two infrastructures: pedestrian or vehicular. Results show that 17% of bicyclists find sharing paths with vehicles a problem on campus[4].

On the streets, the most problematic intersection identified by cyclists is the Cleary Walk/ Lindley Ave. intersection, which is followed by Jacaranda Walk/ Lindley Ave. Other problematic intersections are the Matador Walk/ Lindley Ave., Matador Walk/ Etiwanda Ave., and Etiwanda Ave. in front of the B4 parking lot[4].

On the pathways, Matador Walk on the north of Sierra Quad is the most problematic circulation route. West of the Library and west of the Arbor Grill Court are also problematic.

Many bicycle-friendly universities and cities have shown that bicycles can be integrated into the design of routes. At UC Santa Barbara, an integrated system of 10 miles of Class 1 bicycle paths with grade separations and roundabouts separate motorists and pedestrians from bicyclists. Class 1 bike lanes are paths designated for bikes and pedestrians only; Class 2 bike lanes are marked bike lanes on roads; and Class 3 bike lanes are not always marked where bikes share the road with motorists. Roundabouts have proven very effective in maintaining a steady flow of movement through intersections[19]. UC Davis, Stanford University and UC Santa Barbara have made use of roundabouts to improve the flow of traffic at bike path intersections as well as core area roadway/ bike path intersections. Stanford is developing bike circulation routes that are contiguous, but separate from pedestrians [18]. Ground-painted traffic signs help guide bicyclists properly through the roundabouts[19].

All streets from the exterior of the university passing through the university should have Class 2 bicycle lanes. Those streets that border pedestrian pathways that lead into the core of the university should transition from Class 2 bicycle lanes to Class 1 bicycle lanes entering alongside the pedestrian pathways. Plummer St. should extend its Class 2 bicycle lane through campus until reaching Lindley Ave.; Lindley Ave. should transition into a Class 1 bicycle

Campus peak rack[47].

path running north-south for students traveling to and from campus housing.

A roundabout would aid cyclists riding south from the dorms, and west from Plummer St. who want to transition onto Lindley Ave. or Plummer St.; since Lindley Ave. is the most utilized street within the campus with more than 100 cyclists traveling every hour. This method of intersecting Class 1 and Class 2 bicycle lanes should also be implemented along all intersections on Etiwanda Ave., Vincennes St. and Lindley Ave.

Signs and pavement markings should be used within intersections to direct and caution pedestrians and cyclists; these should follow Caltrans Traffic Manual designs. Core and perimeter intersections and streets should comply with the city of Los Angeles' proposed 825 mile Neighborhood Network and 719 mile Backbone Network that includes over 60% of improved and installed bicycle lanes. The City of Los Angeles has proposed the Neighborhood Bicycle Network to foster traffic calming on the streets where there are fewer cars and more pedestrian presence[8] (Appendix A).

Within the campus it was noted that once cyclists enter the university pathways, conflict with pedestrian foot traffic increases. Stanford is developing bike circulation routes that are contiguous, but separate from pedestrians and is attempting to funnel major bicycle circulation into clearly defined corridors[18]. At UC Santa Barbara, pedestrian crossings of bicycle paths (with high volumes of pedestrians and/or bicycles) include a pedestrian refuge zone with tactile warning markers at walkways[17]. At UC Santa Barbara pedestrians must yield to cyclists to keep the flow of cyclists through campus as efficient as possible. UCLA has established dismount zones in which bicycles, skateboards, scooters, and roller blades cannot be ridden.

Cleary Walk intersections with Etiwanda Ave. and with Lindley Ave. should be designed as dismount zone, due to high bicycle traffic on the pathways close to those intersections.
The pedestrian pathways most used by cyclists should be accompanied with Class 1 bike paths. At pathway intersections, pedestrians should yield to cyclists within a pedestrian refuge zone. Signage to alert pedestrians of the intersection should be visible, both on the ground and eye level. The bicycle paths, bike lanes, and other bikeways should be wider than the minimum standards with expectation that bicycle traffic volume will increase in the future.

4.2. Bicycle Parking-Related Recommendations

Bicycle parking facilities at CSUN should be improved. Newly installed wave racks on campus do not meet the specifications for distance from walls[3]. The grid bicycle racks make it difficult to use a U-lock to secure the frame and wheels properly because they support only one wheel of the bicycle, not the frame. These conditions leave bicycles vulnerable to theft and damage. Inverted U-racks and Peak racks are two types of bicycle rack that enable the secure and proper locking of a bicycle. Details of these and their installation are given in Appendix B. Temporary grid racks at CSUN should be replaced with a combination of these[3].

There are currently 132 bike racks with a total capacity of

1098 bikes for the southern part of campus and almost 50% of bike racks at CSUN are well used[1]. Also, 19% of bicyclists find an inadequate number of parking spaces a problem on campus[4]. Almost all current bicycle racks on campus serve fewer bicycles per rack than the stated capacity by the rack manufacturer due to poor siting whereby bicycles cannot be parked from both sides. The bicycle rack capacity of 1098 cannot be met with the installation positioning of existing racks. Bicycles are commonly locked to objects other than the bicycle racks for both reasons of convenience and greater theft protection.

In cities such as Los Angeles and San Diego, inverted U-racks are recommended and currently used for short term (a 2 hour holding period) bicycle parking. Bicycle lockers are recommended for longer term parking[7 8] and should be considered for long term parking at CSUN. Inverted U-racks and lockers should be installed in groups creating large bicycle parking areas that serve one building or more; these are designed as "Hubs".

Bicycle plans for the cities of Los Angeles and San Francisco describe implementation of corrals and hubs that offer protection from weather elements such as extreme sun exposure and rain[8]. Sheltered parking also helps to reduce corrosion and cracking that can occur on some bicycle components especially the saddle when exposed to moisture and heat[3]. Shelters should utilize roofs to accommodate solar panels for charging storage that can power lighting at night where possible. Flood lighting in shelters will decrease theft, aid the cyclist when locking and unlocking, and create a comfortable and safe environment for cyclists attending evening classes[3].

Signage should be employed throughout the campus to direct cyclists to parking areas within the university and should be in compliance with current university signage specifications. At each large bicycle parking area, a map of the campus should be displayed.

4.2.1 Bicycle Parking Location Recommendations

At CSUN, 84% of bicyclists surveyed stated that the choice of where to park their bicycles was determined by proximity to their destination[1 4]. Considering the distance of the B3 bicycle compound from most buildings in the core of campus, 23% said the compound is in an inconvenient location[4]. Bicycle parking needs to be visible, accessible, easy to use, convenient, and plentiful. If any of these criteria are missing, there is a good chance cyclists will not use what is provided and will park wherever they think their bike will be safe.

The location of a rack area in relationship to the building it serves is extremely important[3]. The League of American Bicyclists and the 2010 Los Angeles Bicycle Plan [15 8] recommend that racks be placed by a main entrance where they are not only convenient for bicyclists, but also visible and central[8 14]. Providing parking raises awareness of bicycling possibilities amongst others and invites business to the corridor[8 14]. The rack area should be no more than a 30-second walk (120 feet) from the entrance it serves and should preferably be within 50 feet. In general, multiple buildings should not be served with a combined, distant rack area[29], and it is preferable to place smaller rack areas in locations that are more convenient. Racks should not be placed so that they block the entrance or inhibit pedestrian flow in or out of the building[29], and as noted in the Caltrans Technical Design Handbook, bicycle infrastructure should not impede or obstruct foot traffic on business corridors. Large rack areas of high use should have more than one entrance to facilitate the arrival and departure of cyclists and pedestrians.

At CSUN, the most-utilized bike racks are around the Sierra Complex, Manzanita Hall, Redwood Hall, the USU, the Oviatt Library, and Bayramian Hall[1 4]. Bicycle hubs should be assigned to each of these areas.

4.3. Bicycle Education Related Recommendations

Many riders at CSUN are unaware of how to properly lock their bicycles, and of the location of bike facilities and local networks. 24% of cyclists surveyed do not use the bicycle compound located in B3 parking structure because they are unaware of its existence[4]. There is a need to increase bicycle knowledge at

CSUN.

The League of American Bicyclists in the cities of Los Angeles, San Diego, Santa Barbara and Davis suggest that schools and universities collaborate to educate and promote cycling. By working together an integrated system can be created to provide access inside and outside campuses incorporating bike lanes and end of trip facilities. The City of Davis bicycle map is an excellent example of educational material that includes information on the integration of bikeways and facilities within the city and university.

It is important to accommodate cyclists of all levels of experience and enthusiasm by generating a safe and comfortable cycling environment on campus. Training should be provided for beginners to build rider skills and confidence.

Bicycling is a relatively safe activity, but the perception that it's dangerous is a major obstacle to increasing ridership. The cities of Los Angeles, Santa Barbara and San Diego report that bicycle perception influences ridership and bicycle acceptance[7 8 11]. The decision one makes with regards to cycling on the streets is largely based on how the street infrastructure is implemented and the knowledge of current bicycle laws[7 8].

In the city of Santa Barbara when fault was assigned in collisions involving bicyclists, bicyclists were found to be the cause of 60% of the reported collisions. Two of the most common vehicle code violations for bicyclists at fault in collisions are riding on the wrong side of the street and failure to stop at a signal or stop sign. During 2000-2005 the city of San Diego contracted an organization called Safe Moves to conduct workshops on pedestrian and bicycle safety in public elementary schools, and bicycle rodeos for elementary, middle and high school students. These were designed to improve bicycle skills and safety.

UC Santa Barbara, UC Davis, UC Los Angeles, and Stanford University all offer on-campus bicycle shops where students can get their bicycles repaired. UC Davis also offers classes through their bicycle shop where students and community members can learn to repair, overhaul and maintain their bikes. Hundreds have been served by these courses over the years[16]. At UC Santa Barbara, the Associated Students Bike Shop is a student-funded non-profit organization dedicated to education, service, and safety.

Los Angeles's successful CicLAvia events, which close down some L.A. streets to car traffic, opens them up to cyclists and pedestrians, and connects the community by making the streets safe for people to walk, skate, play and bicycle. In doing so CicLAvia brings attention to the benefits of active transportation and demonstrates the feasibility of getting around Los Angeles in a healthy, safe, and fun way.

At CSUN, a collaborative approach, in which different organizations promote alternative modes of transportation, is recommended. Collaborating with cycling organizations allows for broader support of CSUN's initiatives to become a bicycle-friendly campus. A good source of education and outreach is the CSUN Bicycle Collective, which runs bi-monthly clinics on campus throughout the year to help campus cyclists identify mechanical hazards on their bikes, educates them on how to repair their own bicycles, and creates a venue for community gathering. The Collective also distributes free LA Metro Bike maps that show all the current bikeways and bicycling facilities throughout Los Angeles County and surrounding areas[31]. CSUN should publish its own bicycle map that focuses on the campus and neighboring streets. In addition, cycling events and workshops on pedestrian and bicycle safety could increase cycling awareness and ridership within the CSUN community, and lead to better understanding among the shared users of the road. As the leaders in promoting cycling as a sustainable means of transportation, the CSUN Bicycle Collective is working towards the establishment of a bicycle cooperative on campus with a dedicated space from which to operate. This would allow for increased educational opportunities and a permanent place to house bicycle maintenance operations for the campus community.

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46. Base map taken from http://www.csun.edu/maps/

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APPENDIX A:
LA City Bicycle Plan

The City of Los Angeles has launched an ambitious plan to improve bicycling infrastructure within the city over the next the next thirty-five years, in which it intends to expand the bikeways from the existing 334 miles to a total of 1,684 miles (Figure A1).

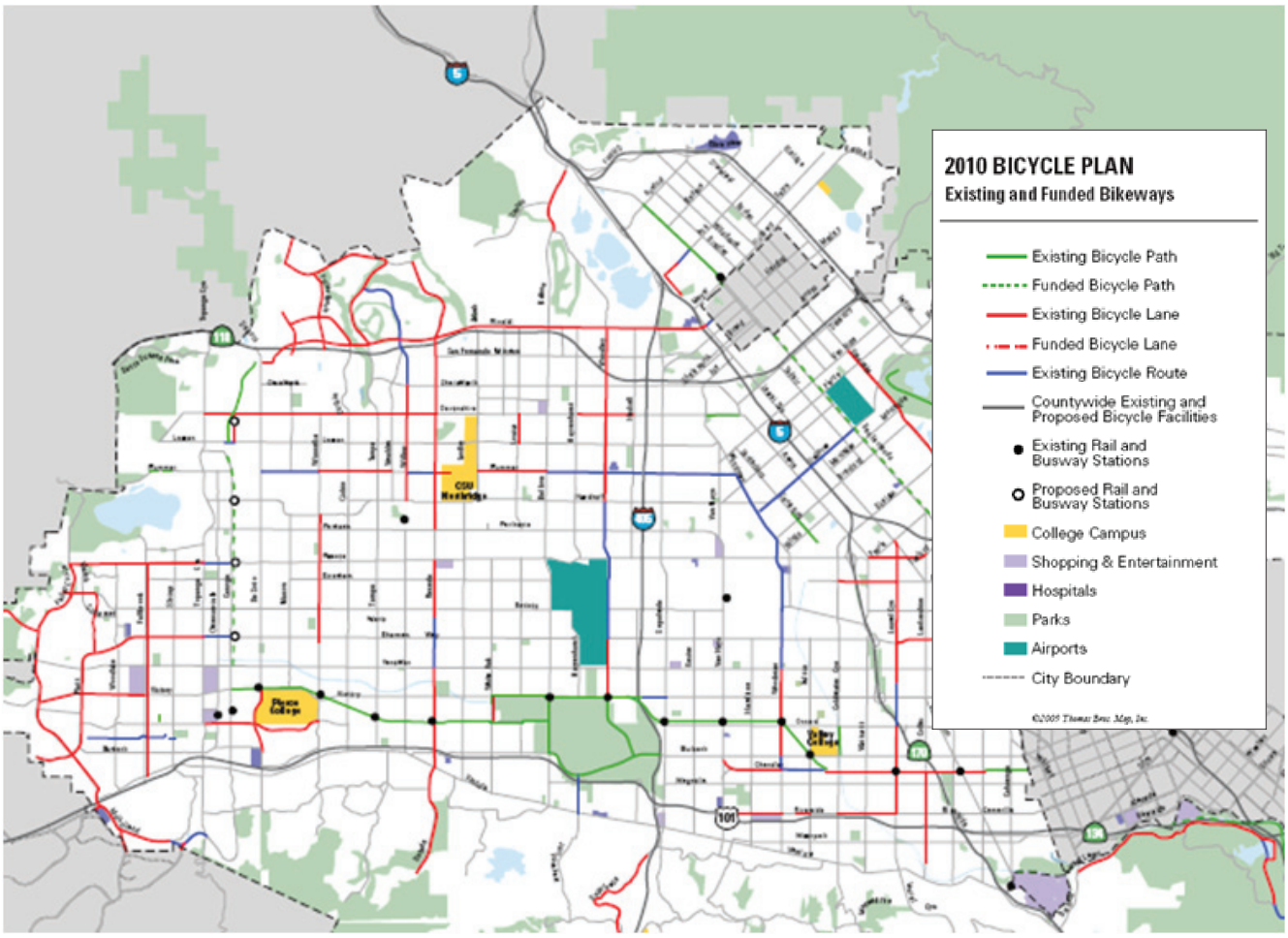

Figure A1 Existing and funded bikeways in the west San Fernando Valley[48]

All 1,684 miles, including the existing bikeways, will be distributed between one of three new bikeway networks - the Backbone Network, the Neighborhood Network, and the Green Network. The 719-mile Backbone Network (188 existing, 531 future miles) is comprised primarily of bicycle lanes, and will enable access to major employment centers, transit stations and stops, and educational, retail, entertainment, and other open space and recreational resources. The 825-mile Neighborhood Network (96 existing, 729 future miles) is comprised primarily of Bicycle-Friendly Streets (on Local and Collector Streets) which are characterized by low traffic volumes and slower speeds. The 139-mile Green Network (49 existing, 90 future miles) enhances access, through bicycle paths and shared-use paths,

to the City's green open spaces particularly river channels like the Los Angeles River. Figure A1 shows existing bikeways located in the west San Fernando Valley within easy riding distance of CSUN, and Figure A2 shows the planned expansion of these under the 2010 city bike plan.

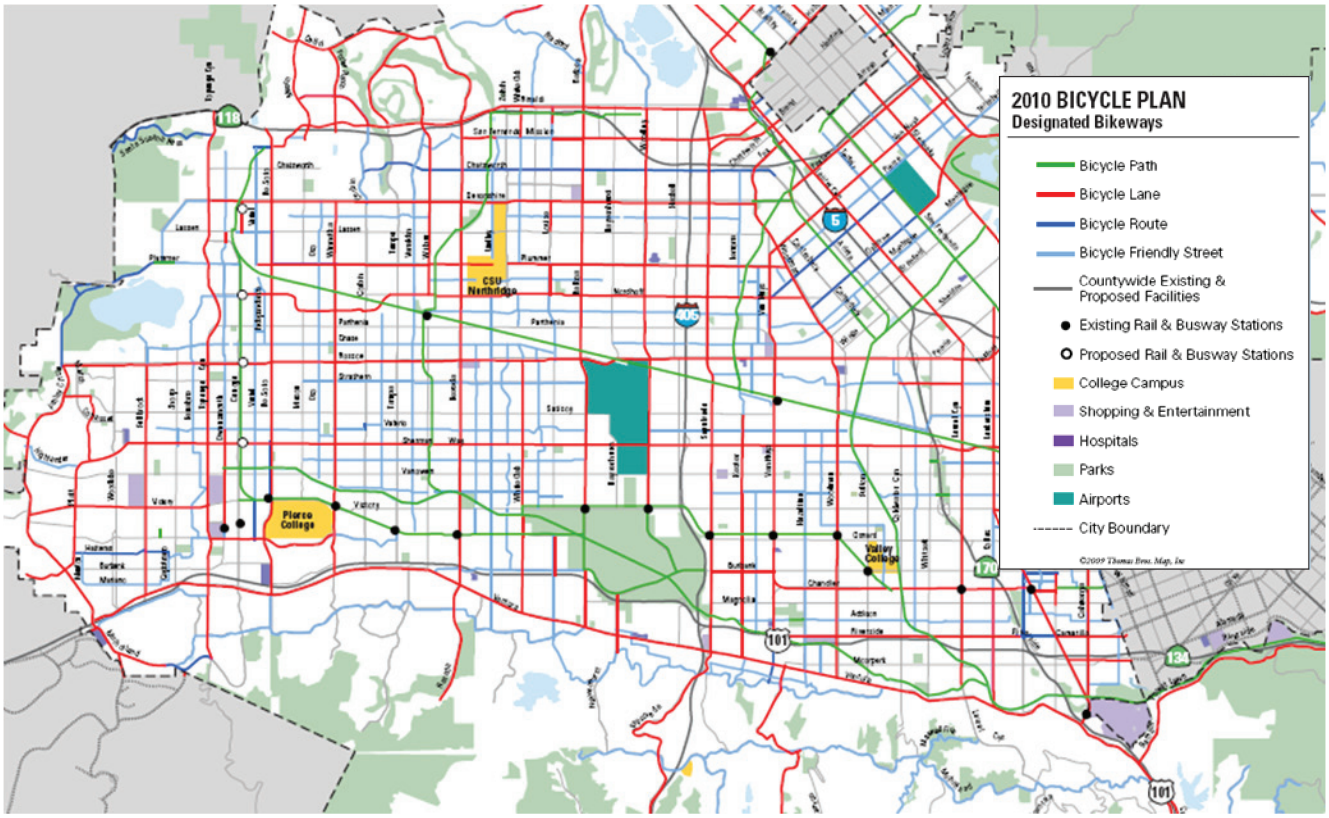

Figure A2. Designated bikeways in the west San Fernando Valley under 2010 L.A. City Bicycle Plan[49]

APPENDIX B:
Recommended Bicycle Racks and their Installation

1. Inverted U

As shown in Figures B1 and B2, inverted U-rack elements mounted in a row should be placed a distance of 31”(center to center) apart. This allows enough room for two bicycles to be secured to each rack element. Normally, the handlebar and seat heights will allow two bicycles to line up side-by-side if one of them is reversed. When there is a conflict, the bicycles can be placed slightly offset from one another as shown. If the racks are placed too close together, it becomes difficult to attach two bikes to the same rack. If it is too inconvenient and time consuming to squeeze the bicycles into the space and attach a lock, cyclists will look for an alternative place to park or use one rack per bike and reduce the projected parking capacity by 50%.

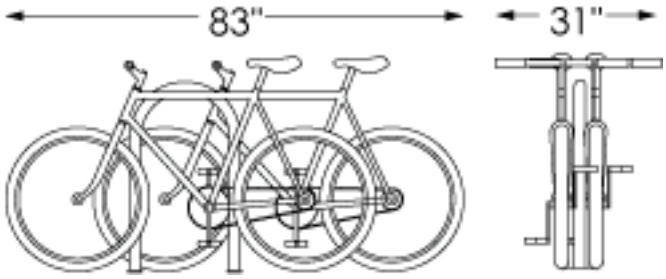

Figure B1. Recommended rack separation[50]

Aisles should separate the racks. These provide the pathway for cyclists to enter and exit the area. The minimum separation between aisles as measured from tip to tip of the bike tires across the space between racks should be 48”(Figure B2). This provides enough space for one person to walk one bike. A depth of 72”-75” should be allowed for each row of parked bicycles. Conventional upright bicycles are just less than 72”long and can easily be accommodated in that space[29].

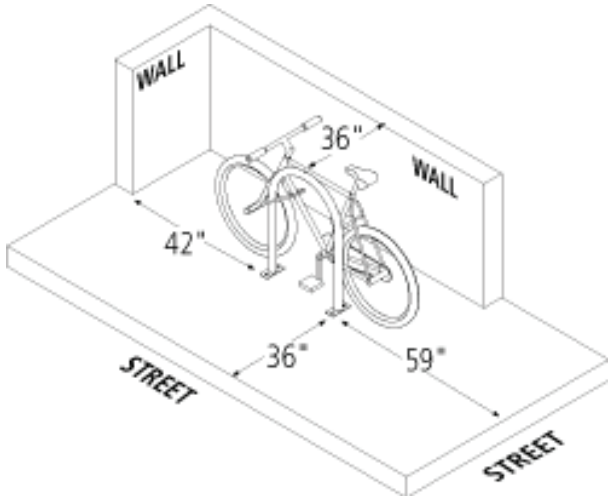

Figure B2. Recommended aisle width[51]

Inverted U-rack pipe diameters should preferably not exceed 1.66” outside diameter (OD). Rack OD greater that 1.66” will not accommodate smaller U-locks for front-end parking, and make back-end parking more difficult. This size U-lock is preferred by most commuters. An inverted U-rack with a 1.66” OD is no less effective at preventing theft than a thicker one.

Depending on the location of the bicycle parking areas, inverted U-racks are manufactured to either be used in newly poured concrete foundations or existing foundations by bolting or core holes. When installed in existing foundations bolts should have tamper resistant bolt heads to prevent theft.

2. Peak Racks

Peak racks, shown in Figure 18, are similar to standard low profile racks, but are designed to allow front-end or rear-end parking. Each parking slot has a designated arm that extends towards the bicycle frame allowing the cyclist to lock both the frame and wheel of the bicycle. These racks also have slots for one of the bicycle wheels that keep bicycles upright while locking. Slots stagger each other, preventing any handlebar conflict that may occur.

Peak racks are available as single- or double-sided depending on whether the rack is against or away from a wall. Figure A4 shows the minimum space use required depending on the number of bicycles per rack unit. If there is more than one row of Peak racks, aisle widths should be 48” as for inverted U-racks. Peak racks should be fastened to concrete with tamper resistant bolts.

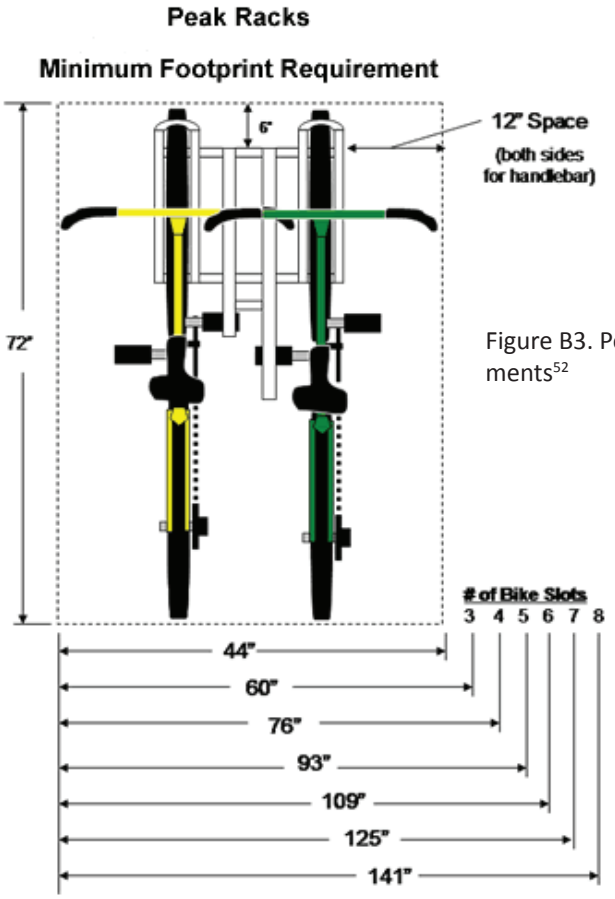

Figure B3. Peak rack space requirements[52]

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