3. BICYCLE SYSTEM DESIGN FACTORS

This chapter discusses the major factors to be considered when designing a bicycle system. The chapter describes the relatively recent typology describing bicycle riders, and the typical needs of commuter and recreational cyclists. The chapter then defines standard bikeway classifications and lists resources and references of design guidelines that are leading the practice today. Lastly, the chapter summarizes constraints and opportunities for increasing the number of people who bicycle for transportation in Humboldt County and the number of automobile trips they replace with bicycle trips. {Public comments to be updated after public review.}

Five things bicyclists want:

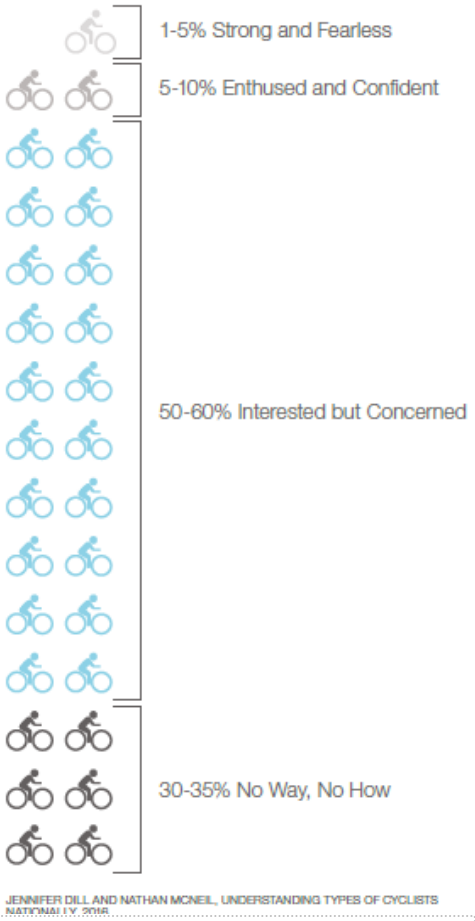
- Space
- Low vehicle speed
- Low traffic volume
- Smooth surfaces
- Minimal conflicts at intersections

– Local Government Commission

TYPES OF RIDERS

Roger Geller, the Bicycle Coordinator for the Portland Bureau of Transportation (Oregon), circa 2006 began developing a typology to describe how people feel about riding a bicycle for transportation (Geller, 2009). The typology and data were based on surveys of Portlanders, and has been corroborated with national and international data. The typology describes people's typical willingness to bike as a mode of transportation (not recreation). The four categories are:

- **"Strong and Fearless"** – Experienced riders who prefer direct routes. They tend to like riding relatively fast; therefore, they typically choose more direct roadway connections over shared-use paths or other separated bicycle facilities.
- **"Enthused and Confident"** – People who are fairly comfortable riding on all types of bikeways; they tend to prefer riding on low-traffic streets or shared use paths when available. Includes people who bike for commuting, recreation, racing, and utilitarian trips.
- **"Interested but Concerned"** – People who ride on low-traffic complete streets and multi-use trails built "for all ages and abilities." They are discouraged from riding more often due to safety concerns; they opt not to ride in traffic, or in wet or cold weather. People who



Types of Bike Riders in the U.S.

Image source: Caltrans 2017

are "Interested but Concerned" may become "Enthused & Confident" given more encouragement, education and experience.

- **"No Way, No How"** – People in this category do not ride bicycles and will likely never ride. They are not interested for various reasons, such as they are not physically able to bike, they do not enjoy riding a bicycle, or they do not feel safe riding under any conditions.

BICYCLE TRAVEL NEEDS

COMMUTER NEEDS

Bicycle commuters include people who ride to work or school, either daily or occasionally. Commuter bicyclists have obvious and straightforward needs that primarily concern safety, with comfort and convenience being close (if not interrelated) seconds. Common concerns of commuting cyclists are: inclement weather (rain, high winds), riding in the dark, personal safety, and bike security (e.g. from theft). Approaching and riding through unprotected or high-volume, multi-lane intersections is a concern for most, if not all, bicycle riders.

Key commuter needs include the following.

- **TRIP RANGE** – Bicycle commuting requires shorter distances than motorized commuting. For bicycle commuting to be viable and appealing, the cyclist's residence needs to be relatively close to the work place, commercial areas, other services, and recreational places. Viable bicycle commute distances can be problematic when land use and transportation policies support the construction of sprawling neighborhoods that are far apart from employment centers. It is also a problem for bicycle commuting when neighborhoods connect only via wide roadways that are built for large traffic volumes and high speeds. Most bicycle commute trips in Humboldt County are local rather than regional. Most bicycle commuters' trips are less than five miles (eight kilometers). However, many cyclists commute between Arcata and Eureka, a distance of at least six miles.

- **MULTI-MODAL COMMUTING** – Bicycle commuters can extend their trip range by combining bicycling with public transit and carpools/vanpools. Bike-transit trips are more convenient, appealing, and perhaps more feasible when bicycles are allowed on public transit, and when there are bicycle lockers and changing facilities at transit stations. Bike-carpool trips can be encouraged by providing park-and-ride lots with bike lockers and changing facilities.

- **PREFERRED COMMUTE ROUTES** – Bicycle commuters typically seek the most direct and fastest route available. Most would prefer to have bike lanes or wider curb lanes on a direct route than

be directed to side streets. Traffic signals and imbedded detectors at busy intersections also tend to be favored, as do routes where the pavement is in good condition and regularly maintained (e.g, even and swept). However, if the route is shared with high volumes of traffic and car speeds it is less appealing, particularly to people who are "Interested but Concerned" about riding.

- **BIKE-TO-SCHOOL ROUTES** – Routes to school must accommodate younger riders, who should not be expected to choose arterial or collector streets without separated bikways. It is generally acceptable for children and youth to ride on sidewalks where there are not many pedestrians and where driveways are easy to see. If parked cars, landscaping, or structures block views of cars pulling out of driveways, sidewalk riders may be at greater risk for colliding with cars. Youth who ride at speeds over 10 mph should be directed to ride on the street wherever possible.

-

- **BICYCLE STORAGE** – Commuters also need bicycle parking and, ideally, bicycle storage and showers at their destinations. A safe place to store bicycles is important to all bicycle commuters. Unfortunately, bicycle commuters are not regularly provided with secure, covered bicycle racks that are conveniently located. Showers and lockers for cyclists are even more rare.

- **SAFETY EDUCATION** – Students riding the wrong direction down the street are involved in many reported accidents, which indicates a need for effective bicycle education programs.

RECREATIONAL NEEDS

Recreation is a major part of the lifestyle in Humboldt County and one of the top attractions for tourists. While we emphasize bicycling for transportation in the *Regional Bicycle Plan*, we still cover bicycling for recreation, as some infrastructure serves both purposes. Moreover, developing a robust regional network will benefit from integrating recreational bicycle trails. (Recreational bike trails are covered more fully in the *Humboldt County Regional Trails Master Plan* (HCAOG 2010) than here.) Additionally, the major source of state grant funding for bicycle projects, California's Active Transportation Program (ATP), is the source for recreational trails grants.

Studies have identified tangible benefits that come to communities that provide recreational opportunities. Local access to recreation generally increases property values, often boosts tourism, increases local recreation expenditures and destinations, and can spur new business opportunities. Recreational paths also provide additional transportation choices.

Recreational bicycling covers those who bicycle for exercise, for sport, or make longer bicycle touring trips. Recreational users range from mountain bikers to Sunday riders, from children to senior citizens. Each group has its own abilities, interests, and needs, such as:

- For recreational bicycling, directness of route is typically not as important as routes with fewer traffic conflicts, greater visual interest, shade, wind protection, or moderate grades (except for hardy mountain bikers who like steep hills).
- Bicyclists exercising or touring often prefer a loop route rather than having to backtrack.
- Mountain bikers, a fast growing segment of recreational users, prefer off-road trails. Developing long-distance trails between cities will satisfy many off-street needs.
- Bicycle touring is popular on the Pacific Coast Bike Route in Humboldt (predominantly southbound) and, increasingly, statewide. Bicycle touring packages for groups is a growing tourism business, and self-contained touring is a growing eco-tourism offering. Campsites and rest stops are important amenities for touring cyclists.

Humboldt County offers several excellent recreational bicycle routes for different types of bicycle riders. For less experienced riders, there are bike paths such as the Class I Hammond Trail. For more experienced and long-distance riders, there are scenic back roads such as Westhaven Drive and Scenic Drive in the Westhaven-Trinidad area, Fickle Hill and Maple Creek Road in the Arcata-to-Korbel area, and Old Arcata Road in Arcata-Bayside-Eureka. For touring cyclists, there is the Pacific Coast Bicycle Route, including the Avenue of the Giants.

The region's recreational offerings for bicyclists can be expanded upon. Two apparent deficiencies are (1) the public's lack of awareness of bicycling opportunities, and (2) poor connectivity to regional recreation facilities such as parks and rest stops. Also, many roads outside of developed areas lack shoulders or sufficient width for bikeways which inhibit most riders other than the "Strong and Fearless" or "Enthused and Confident."

Humboldt residents have expressed their demand for additional bike paths where families, children, and others can ride close to home without having to worry about motorized traffic. To serve their needs, HCAOG member agencies have to create better local and regional connectivity and more Class I multi-use paths. Two common issues on multi-use trails are (1) conflicts between bicyclists, equestrians, walkers, skaters; and (2) interfaces where the trail and roadways intersect. When a multi-use trail will exceed 200 people per hour, the trail can be designed to diminish conflicts with appropriate design, signage, and adequate enforcement. Regardless of the design, however, many experienced cyclists choose not to use multi-use trails because of the unpredictability of other users. (In fact, studies have shown that the incidence (although not the severity) of most bicycle-related accidents involve other bicyclists or pedestrians rather than automobiles. As such, multi-use trails should be designed to separate users as much as possible and the system should not depend on multi-use trails for critical connections to serve all riders.

FACTORS FOR BICYCLE FRIENDLINESS

What is "bicycle friendliness"? It could be explained by repeating how the FHWA defines an active transportation network in their "Strategic Agenda for Pedestrian and Bicycle Travel": having "interconnected pedestrian and bicyclist transportation facilities that allow people of all ages and abilities to safely and conveniently get where they want to go" (FHWA, 2016b). The hallmarks of effective, connected networks that support safe, convenient, and attractive non-motorized travel include the following characteristics:

> "If we are to meet the goals of doubling the current levels of bicycling and walking in the United States while decreasing by 10% the number of crash-related injuries and deaths, coordinated and committed effort must be put forth at every level of government."
>
> *- Federal Highway Administration, 1994*

- **Accessibility:** How well does the network accommodate travel for all users, regardless of age or ability?
- **Cohesion:** How well does the network connect to a concentration of destinations and link together paths and routes?
- **Directness:** Does the network provide direct and convenient access to destinations?
- **Alternatives:** Is only one transportation option available, or does the network enable a range of mode and/or route choices?
- **Safety and Security:** Does the network provide routes that minimize risk—real or perceived—of injury, danger, or loss of property?
- **Comfort:** Is the network appealing to a broad range of age and ability levels? Is consideration given to user amenities? (Ibid).

We can answer these questions to analyze gaps and evaluate the overall bicycle network.

☑ BICYCLE NETWORKS

To function properly, a bikeway network must connect neighborhoods and communities so that people feel safe biking from home to their destination, and the distances must not be too great (most utilitarian bike trips are one to three miles). Typical bikeway destinations include:

- downtowns, commercial districts, and shopping centers
- civic buildings, libraries, hospitals, medical offices
- schools, universities, and colleges
- employment centers
- transit hubs and transfer points for multi-modal trips
- residential neighborhoods
- parks, beaches, and other recreational destinations.

Ideally, long-range regional planning can enable local jurisdictions to design bicycle infrastructure at four levels, in the right order:

1) network
2) road sections/corridors
3) intersections
4) road surface
5)

Developing networks in this order, generally speaking, will achieve the best bicycle networks for the end user, and for cost savings and land use efficiency. Key factors for successful bike facilities, at all levels, is having routes that are direct in terms of both distance and time, and that users feel safe from traffic hazards and threats to their own safety. Other key design factors include:

Network level:

- Bikeways avoid conflicts with cross traffic, especially with motorized vehicles.
- Where it is undesirable or unfeasible to segregate cars and buses from bikes and pedestrians, physical elements serve to reduce speeds wherever different modes share the same infrastructure. And vice versa: where speeds and/or volumes of motorized traffic cannot or should not be reduced, different modes are physically separated (e.g., by means of paths, underpasses, overpasses, or physical barriers).

Road section/corridor level:

- Bike facilities separate cyclists from other vehicles where there are high traffic volumes and major speed differences.
- Designated routes do not expose cyclists to a lot of noise, debris, or fumes, especially from trucks, buses.

Intersection level:

- Where modes interact, appropriate design brings speeds down to reduce motor vehicles' speed.
- Where different modes inevitably meet each other, maneuvers are designed to be simpler, not more complicated.
- Stops and wait times are minimized.
- Cyclist are always visible to motorists.
- Curves are designed to reduce motorized traffic speeds where bicyclists/bicycles and motor vehicles will be close to each other.

Road surface level:

- Pavement/paving is even; surfaces are swept.
- Bike facilities are spaced appropriately from rumble strips, grooves, and other uneven surfaces. (ICE and GTZ, 2009)

W.A. Leaf and D.F. Preusser, "Literature Review on Vehicle Travel Speeds and Pedestrian Injuries Among Selected Racial/Ethnic Groups," US Department of Transportation, National Highway Traffic Safety Administration (1999).

☑ SAFETY

There is a myriad of strategies to harness for increasing the safety of bicycling. As with other active transportation planning, we promote a "6 Es" approach to improving bicycle safety: Engineering, Education, Encouragement, Enforcement, Evaluation, and Equity. The following discusses approaches and factors that influence bike safety.

Engineering, **Infrastructure:** When sharing the road, cyclists are vulnerable because they are sharing space with motorized traffic despite major differences in mass and speed (and protective covering). Although bicycle infrastructure cannot eliminate this inherent vulnerability, it can address and influence these physical discrepancies to create safer conditions for bicycling. A key point is that where there are significant differences in speed, encounters should be avoided as much as possible by means of a separation in time or space. Thus, where there are significant differences in speed, different types of vehicles should be physically separated to eliminate the conflict. Where this is not feasible, motorized traffic speeds should be reduced at potential conflict locations to ensure that, if a crash occurs, the severity of the injury is likely to be lower.

Bicycle safety also depends on infrastructure being maintained in good condition. Disrepair such as broken or uneven surfaces, paths blocked by branches, roots or overgrowth, and poor lighting create potential hazards.

Education, Enforcement: Unsafe driver, bicyclist, or pedestrian behavior causes unsafe conditions. When any user fails to obey the rules of the road it causes hazards for all. Unsafe driver behavior includes operating vehicles aggressively or negligently, such as speeding and driving or stopping too close to other users. Unsafe bicyclist behavior includes riding the wrong way on streets and ignoring stop signs. Driving or bicycling while impaired is obviously unsafe, as is driving, walking, or bicycling while distracted by texting or dialing. Breaking people of these bad habits can be reinforced with traffic enforcement as well as education. Education works in school programs as well as general public campaigns.

One recent advancement for education and enforcement is the California 3-foot passing law, which applies specifically to motor vehicles passing bicyclists from behind. The Three Feet for Safety Act (2014) improved the State vehicle code, which had required drivers to pass bicyclists at a "safe distance," by enacting a clear and distinct three-feet minimum passing distance.

☑ BICYCLE LEVEL-OF-SERVICE CONCEPT

Generally, cyclists choose their routes—or whether to ride at all—based on how they perceive hazardous conditions. (For some local perspectives, see *Humboldt Bay Area Bicycle Use Study*, RCAA

1999). Therefore, one strategy for increasing bicycle ridership is to prioritize projects that will eliminate or minimize perceived hazards to bicyclists.

In the transportation field, it is common practice to evaluate roadway traffic conditions based on the "level of service" concept, or LOS. For automobiles, the LOS "grade" (A to F) indicates the typical delay a driver would experience on a particular roadway or intersection. Practitioners and stakeholders in the transportation field are interested in ways to evaluate the level of service for bicyclists, i.e. the "bicycle friendliness" or "bikability" of a facility. Bicycle LOS modeling helps predict what conditions a a cyclist would experience in a given bikeway facility, such as the speed of bicycles and motorized vehicles, and density of users.

Table 3.1. Level of Service (LOS) Characteristics for Bikeways

Bicycle Level of Service						
Characteristics	**A**	**B**	**C**	**D**	**E**	**F**
Flow Rate[a] (bikes/minute/feet)	<4.4	4.4–6.6	6.7–10.0	10.1–11.9	12.0–13.2	Variable
Density (bikes/square feet)	<0.005	0.005–0.007	0.008–0.012	0.013–0.017	0.018–0.025	>0.025
Cycling Speed	≥11.0	10.5 –11.0	9.5–10.4	8.0–9.4	6.0–7.9	<6.0

[a] Minimum bike path or bike lane width for which these figures apply are: LOS A-8.0 ft; LOS B-7.5 ft; LOS C-3.5 ft; and LOS D-3.2 ft. The greater widths shown for LOS A and B are necessary to allow free overtaking.

Source: *Fundamentals of Traffic Engineering*, 13th Edition. Institute of Transportation Studies, University of California, Berkeley.

Bicycle Compatibility Index (BCI)

The Bicycle Compatibility Index (BCI) is another model for measuring conditions for bicyclists. The BCI methodology uses variables such as curb lane width, traffic volume, and vehicle speeds to assess the "bicycle friendliness" of a roadway. Appendix C has detailed information (excerpted from FHWA reports) on how to develop and implement the BCI model for bicycle level of service.

Bicycling Level of Traffic Stress

The Bicycling Level of Traffic Stress (LTS) evaluation tool is used to measure bicyclists' level of discomfort or stress on subject routes or facilities of a bicycle network. The goal is to design low-stress bicycle networks, i.e. where bicyclists can ride without having to use any "unacceptably stressful links" to reach their destinations. The LTS method was developed by the Mineta Transportation Institute (San José, CA) based on Dutch standards for bicycle facility design. It can also be used for evaluating pedestrian and multi-modal networks.

The LTS method classifies streets and intersections from a rank of one to four. "LTS 1" is for facilities that offer the lowest stress to use; LTS 1 streets are suitable for children, for example. On the other side of the spectrum, LTS 4 streets will usually have no designed or designated bike facility, and are generally suitable only to bicyclists who fit the "strong and fearless" rider type. The design standard for typical streets in the Netherlands is LTS 2, which has been shown to increase

bicycling rates in the overall population. The typical standard for bike facilities in U.S. is LTS 3 (Fehr and Peers).

Classifications of Level of Traffic Stress (LTS) with 1 being lowest stress:

LTS 1	LTS 2	LTS 3	LTS 4
- Physically separated from traffic or low-volume, mixed-flow traffic at 25 mph or less. - Bike lanes 6 feet wide or more. - Intersections easy to approach and cross. - Comfortable for children.	- Bike lanes 5.5 feet wide or less, next to 30 mph auto traffic. - Unsignalized crossings of up to five lanes at 30 mph. - Comfortable for most adults.	- Bicycle lanes next to 35 mph auto traffic, or mixed-flow traffic at 30 mph or less. - Comfortable for most current U.S. riders.	- No dedicated bicycle facilities. - Traffic speeds 35-40 mph or more. - Comfortable for "strong and fearless" riders.

Source: http://asap.fehrandpeers.com/wp-content/uploads/2014/08/MMLOS-Tool-Level-of-Traffic-Stress.pdf

For more discussion of LTS, see "Report 11-19: Low-Stress Bicycling and Network Connectivity" by the Mineta Transportation Institute at the College of Business, San José State University, San José, California (authors: M. C. Mekuria, P. G. Furth, and H. Nixon), May 2012.

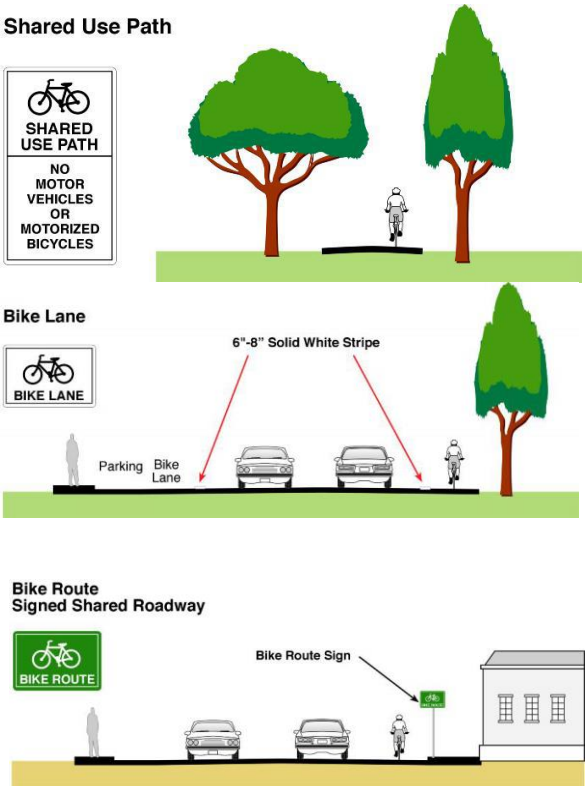
TYPES OF BIKEWAYS

Caltrans classifies bikeways into four primary classifications, described below.

SHARED USE PATH (Class I Bikeway) – Shared use paths, also called multi-use paths, are shared by bicyclists and pedestrians, and in some cases equestrians. They are paved and separated from streets and highways, and motor vehicles are prohibited.. They are popular with novice cyclists; experienced bicyclists may avoid these paths to avoid conflicts with multiple users.

BIKE LANE (Class II Bikeway) – Bike lanes dedicate an area specifically for one-way bicycle travel on a street or highway. The lane must be painted with lane stripes and "Bike Lane" on the pavement. When properly designed, bike lanes make motorists more aware of bicyclists.

BIKE ROUTE (Class III Bikeway) –_Bike routes are signed to indicate that bicyclists share the roadway with motor vehicles, and sometimes



pedestrians (not recommended). Designated Bike Routes are recommended if a Class I or II facility is not possible, especially to connect gaps between existing bikeways.

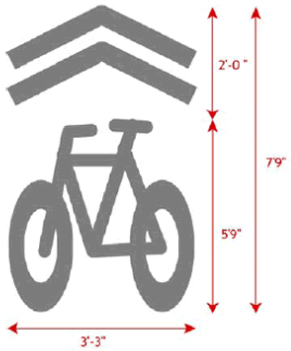
In addition to Caltrans' standard Class III bikeway design, the Bike Plan proposes two modified classifications for Class III bike routes, one "enhanced" and one "rural route."

ENHANCED BIKE ROUTE (Enhanced Class III Bikeway) – Enhanced bike routes augment the standard "Bike Route" (Class III) signs with pavement markings and/or additional signage. Roadway space requirements are the same as for other Class III facilities. Pavement marking might be, for example, fog lines, which are painted between the edge of the travel lane and the parking zone or shoulder. Fog lines visually constrict the travel lane, which makes some drivers slow down. Another pavement marking is the *shared-use arrow* (commonly called "sharrow") in the roadway painted outside the parked cars' "door zone." Enhanced signage might be "Share the Road" signs.

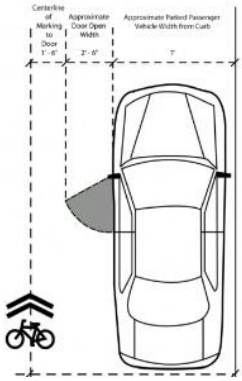
Fog lines striped on 11th Street in Arcata

RURAL ROUTE CLASS III BIKEWAY – This augmented Class III Bikeway is intended for rural, two-lane roads that cyclists frequently use, but whose width and/or sight distances make them poor candidates for a standard designated bike route. Placing "Bike Route" signs on these roads can potentially attract more cyclists where engineering cannot improve roadway conditions to accommodate more bicycle traffic. In these cases, "Share the Road" signs can be installed to increase motorists' awareness that cyclists are riding on the roadway.

SEPARATED BIKEWAY or CYCLE TRACK (Class IV Bikeway) – The Class IV bikeway (sometimes called "protected bikeway") was added to the *California Streets and Highway Code* in 2014. They "provide a right-of-way designated exclusively for bicycle travel adjacent to a roadway and which are protected from vehicular traffic" (Assembly Bill 1193, Ting). That is to say, a bike lane physically separated from motor vehicle travel lanes, parking lanes, and sidewalks. These bikeways may be grade-separated from motorized traffic, or may be separated by flexible posts, inflexible physical barriers, or on-street parking, for example.



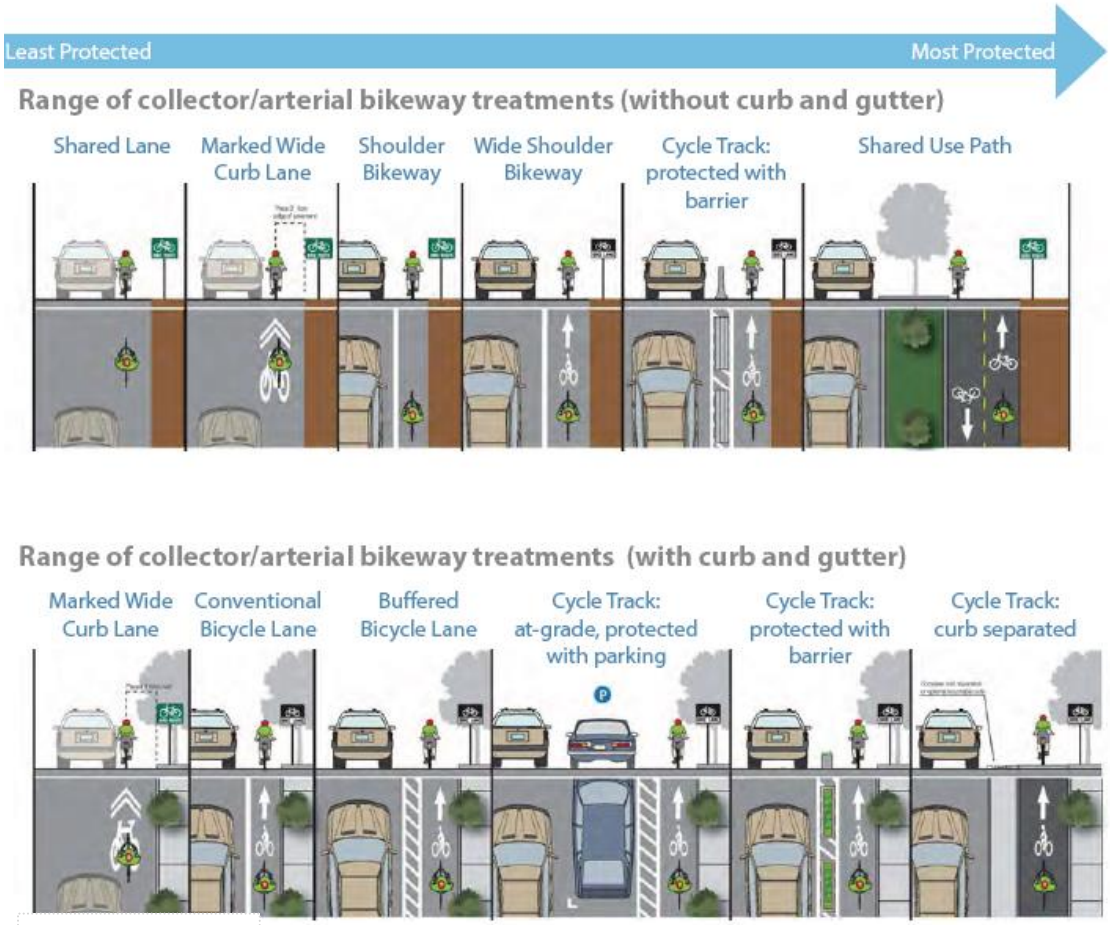
A standard image for a shared use arrow ("sharrow").



Sharrows are painted on the road, outside of the "door zone."

BICYCLE BOULEVARD – Bicycle boulevards are designated and designed to give priority to bicycle travel. Bike Boulevards are installed on streets with low volumes and low speeds of motorized traffic. They are designed to maximize

insert photo of Arcata's B.B.



Source: GOBike Buffalo

convenience for bicycle riders over automobiles, and to discourage motor vehicles from making through trips on these routes. Bicycle Boulevards use signs, pavement markings, and traffic calming designs to create routes that bicyclists will prefer.

PATHS AND TRAILS – Jurisdictions have the option to construct bike paths that do not conform to Caltrans standards. If a pathway is intended primarily for recreational use and will not be built using State or federal transportation funds, it may be constructed to meet local conditions and needs.

When a path or trail project will serve *both* transportation and recreation needs, funding opportunities can be sought for both uses.

SHOULDERS & TRAFFIC LANES – Where there is no bikeway, bicyclists ride on the roadway's shoulder or in the traffic lane. On streets with limited motorized traffic (often the case in residential neighborhoods), bicycling in the street can be comfortable and safe. In these instances, installing a bikeway is not necessary. In Humboldt County, often a wide shoulder on high-traffic streets or highways is the best (only) option for a bicyclist. This is the case when topography, narrow rights-of-way, or other physical features leave no room for a class I, II, III, or IV bikeway.

DESIGN GUIDELINES

The Bike Plan provides recommended design standards and guidelines for developing a uniform and consistent regional bikeway system. The recommendations include standards set forth by the Federal Highway Administration and Caltrans, and, by reference, the NACTO and AASHTO design guides. The Bike Plan also incorporates the recommended *Countywide Bicycle Parking Guidelines: Recommended Policies and Requirements*, developed by HCAOG (2015).

On a case-by-case basis, local agencies may seek design exceptions to established State and Federal standards, based on local conditions and environmental and economic issues. All projects must be approved by the community's Public Works Department, and in some cases Caltrans.

> "Let's not design to minimum standards. Let's propose, design, and build to optimal dimensions and reduce only when absolutely necessary to meet constraints."
>
> – Brett Gronemeyer, public comment on *2012 Bike Plan*

California Department of Transportation Manuals

All of the Bike Plan's recommended projects will adhere to Caltrans' *Highway Design Manual* design guidelines and the *California Manual on Uniform Traffic Control Devices* (MUTCD), as applicable, for developing on-street and off-street bicycle facilities. The following bicycle treatments have interim approval for experimental use:

- Buffered bicycle lanes (Bike lanes with added feature of buffer space separating the bicycle lane from the adjacent motor vehicle travel lane and/or parking lane. Buffer pavement is painted with diagonal cross hatching or chevron markings.)
- Contraflow bicycle lanes (Bike lanes wherein bicyclists can ride in the opposite direction of the flow of motorized traffic.)
- Bicycle boxes (An area for bicyclists at the head of a traffic lane at a signalized intersection that allows bicyclists to be at head que during the red signal phase. Designated by pavement markings.)
- Bicycle lane extensions through intersections
- Two-stage turn queue boxes (An area, designated with pavement markings, to hold queuing bicyclists and formalize two-stage turns.
- Bicycle signal faces (at right)

- Green-colored pavement for bike lanes

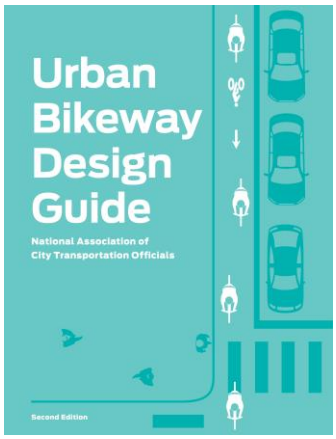
- Green sharrows Share the road arrows, an icon of a bicycle with chevrons above (pictured above).
- Alternative design for U.S. bicycle route sign (shown at right)

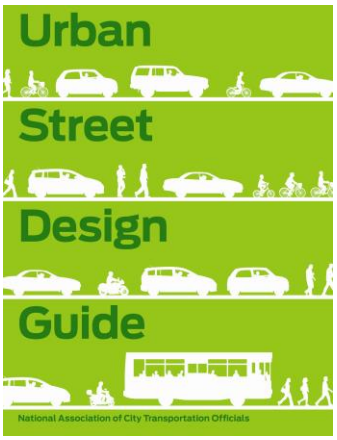
National Association of City Transportation Officials (NACTO) Guides

The Smart State Transportation Initiative (SSTI) team produced the report "California Department of Transportation: SSTI Assessment and Recommendations" (January 2014) after studying and interviewing Caltrans' management, organization, and operations. It recommended that the "department should support, or propose if no bill is forthcoming, legislation to end the archaic practice of imposing state rules on local streets for bicycle facilities." The report specifically recommended that Caltrans adopt "modern guidance as laid out in the NACTO Urban Street Design Guide" (AB 1193 Bill Analysis). Caltrans officially endorsed the NACTO guidelines in April, 2014. AB 1193 allows local jurisdictions to follow NACTO for local bikeways, as long as the jurisdiction has been explicit in the public record that the NACTO guidelines will serve as their design standards, and has given the public an opportunity to comment.

NACTO released the *Urban Bikeway Design Guide* (2nd Edition) in 2012. The Guide provides design standards for "innovative treatments for bike boulevards, signs, pavement markings, and intersections." NACTO states,

> Most of these treatments are not directly referenced in the current version of the *AASHTO Guide to Bikeway Facilities*, although they are virtually all (with two exceptions) permitted under the *Manual on Uniform Traffic Control Devices*.[1]

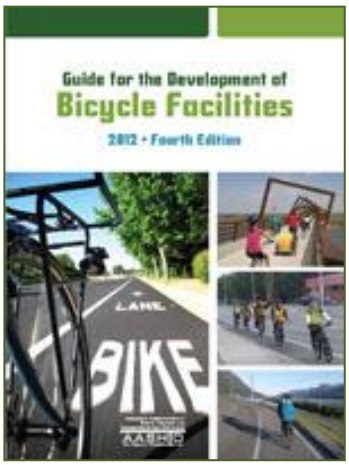




NACTO released the *Urban Street Design Guide* in September, 2013. It covers design for streets, intersections and design controls. (It is available free online at nacto.org/usdg).

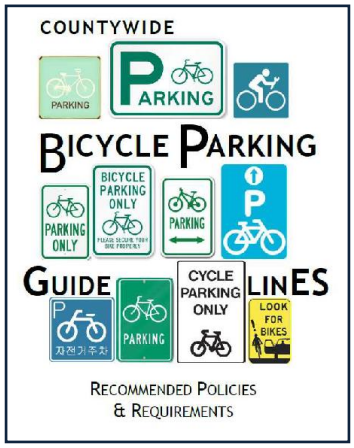
[1] http://nacto.org/publication/urban-bikeway-design-guide. Accessed February, 2017.

American Association of State Highway and Transportation Officials (AASHTO) Guide



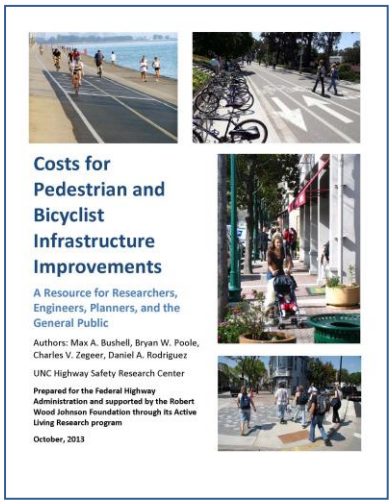
AASHTO's fourth edition of the *Guide for the Development of Bicycle Facilities* came out in 2012.

HCAOG Bicycle Parking Guidelines



HCAOG's "Countywide Bicycle Parking Guidelines: Recommended Policies and Requirements" show recommended requirements for bike parking site locations, dimensions, and clearance, as well as bike racks. The Guidelines also discuss bike parking for large events. The guidelines are born from HCAOG's *Bike Parking Sourcebook: Sample Policies, Municipal Codes & Programs*, which references the "APBP Bicycle Parking Guidelines" (2nd edition, Association of Pedestrian and Bicycle Professionals) for comprehensive, detailed design requirement. The Sourcebook was developed as part of implementing the *Regional Bicycle Plan Update 2012*. HCAOG staff developed both the Sourcebook and Guidelines with direction from the ad-hoc Bicycle Advisory Committee in 2015. (Available at www.hcaog.net/library or (707) 444-8208.)

Costs for Pedestrian and Bicyclist Infrastructure Improvements



The "Costs for Pedestrian and Bicyclist Infrastructure Improvements: A Resource for Researchers, Engineers, Planners, and the General Public" (October, 2013) was prepared for the FHWA and supported by the Robert Wood Johnson Foundation through its Active Living Research program. The authors are professionals from the University of North Carolina Highway Safety Research Center. The guide is available on the Pedestrian and Bicycle Information Center (PBIC) website.
http://www.pedbikeinfo.org/data/library/details.cfm?id=4876 or
http://www.pedbikeinfo.org/cms/downloads/Countermeasure%20Costs_Report_Nov2013.pdf

CONSTRAINTS AND OPPORTUNITIES

There are numerous constraints that impact bicycling and bicycle planning activities in Humboldt County:

- Limited local funds for bicycle facilities
- Limited dedicated bicycle facilities/routes
- Limited inter-city routes for bicycle travel
- Limited number of suitable roadway shoulders
- Frequent roadway failures resulting from extreme weather conditions
- Mountainous terrain outside of the County's coastal zones

Despite the challenges, Humboldt County has an opportunity to increase the number of people who bicycle to work and school by taking advantage of the following:

- The increasing availability of dedicated non-motorized funding sources.
- Access to competitive source non-motorized funds.
- Collaborative efforts to plan and implement multi-jurisdictional bicycle projects.
- Active and supportive public and elected officials.
- Existing corridors in the county where off-street bicycle paths (Class I facilities) could be located. Some of the best opportunities for off-street, long-distance, multi-use trail systems are in unused railroad corridors. The Hammond Trail is a successful rail-to-trail project. Other railroad rights-of-way with potential for trail use are: the Annie & Mary rail corridor between Manila and Arcata; the rail corridor along the South Fork of the Eel River; and the North Coast Railroad Authority railroad corridor along the Humboldt Bay (between Arcata and Eureka).

Constraints and opportunities were also identified by Humboldt County residents, as described in the following section.

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