Primer: Designing Safe, Convenient And Stress-Free Bike Networks

Sharrows exist on Menlo and University Avenues in Menlo Park.

Good network design is made difficult by the number of variables, issues, trade-offs, and uncertainties that must be considered about all the users of city streets, the physical environment, and possible technical solutions. For example, what is the current mix of bike riders? How will this mix change? What are the most popular destinations? How does a community fairly balance the needs and preferences of users of all modes of transportation whenever they evaluate specific bike network improvements? Community decision-making is further complicated because residents often have competing needs, visions, ideologies, beliefs, biases and knowledge. This document is intended to help Menlo Park residents acquire a better understanding of some of the issues surrounding network design.

How cyclists choose routes to their destinations.

Cyclists generally have a number of options for travelling from points of origin to destinations, and each one includes a different sequence of streets and street segments. The relative appeal of these options depends on both a cyclist's personal perceptions of convenience, comfort and safety and the trade-offs one views as acceptable. Convenience refers largely to the relative distance or travel time for completing a trip, comfort refers to either the physical difficulty or psychological stress of riding on specific streets, and safety refers to the likelihood of completing a trip without an accident.

Why bike-motor vehicle accidents happen.

Both the design and management of transportation facilities and human behavior impact the frequency and severity of accidents. Sharing streets, roads and highways creates an intrinsic danger, one that can be mitigated to varying degrees by the design of streets, intersections, and bike facilities, e.g. marked bike routes, bike lanes, buffered bike lanes and physically separate bike paths. However, human error is the cause of most accidents. Both motorists and cyclists face a continuous stream of potentially dangerous and dynamic "pop up" situations where safety depends on alertness, anticipation, responses and skills. Unfortunately, motorists and cyclists often are impatient, distracted, vengeful, discourteous, ignorant of the rules of the road or simply disregard them, lack suitable skills to avoid accidents, and poorly judge risk.

Where most bike-motor vehicle accidents occur.

Most accidents involving bicyclists and motorists occur where they cross paths, at intersections and public driveways. Few occur on stretches of streets or roads between them, even when there are lightly used private driveways, regardless of the speed of vehicle traffic. Alpine and Portola Roads are excellent examples where vehicles travel over 35 mph next to bike lanes. Accidents rarely occur except at intersections, highway ramps and driveways.

Why intersections are dangerous places.

The following are a few examples of situations where accidents are more likely to occur.

Both are approaching an intersection from the same direction and <u>the motorist makes a right hand turn in front of the cyclist</u> who intends to travel thought the intersection. The motorist should yield.

Both are approaching an intersection from the same direction and <u>the motorist merges into either a bike lane or shared lane prior to making a right hand turn</u>. The motorist should yield and merge behind the cyclist and can do so within 200 feet of the intersection.

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Both are approaching an intersection from the same direction and <u>both want to use a left turn lane.</u> The cyclist must yield to vehicle traffic when crossing multiple vehicle lanes and the motorist must yield to a cyclist when they make their turns.

There are many factors that can either aggravate or mitigate the safety of intersections.

- When vehicles travel faster than 15 mph speed it is more difficult for either party to judge clearances and successfully make last second moves to avoid accidents. Intersections can be designed to reduce vehicle speeds.

- Intersections with stop signs and signals are safer than uncontrolled ones, and busy public driveways are the least safe.

- When bicyclists suddenly appear at an intersection, ride through a stop sign and continue within a crosswalk. (This is illegal, as the DMV requires cyclists to comply with the same rules as motorists.)

- Riding in the dark without appropriate lights.

Why Busy Public Driveways are dangerous spots.

Public driveways differ in ways that make them more dangerous than intersections.

They lack traffic signals and generally do not have street markings or merge lanes.

Cyclists are more likely not to anticipate vehicle crossings.

Motorists often make last second decisions to enter a public driveway.

Motorists entering the street must successfully gauge the safety of entering the flow of both vehicles and cyclists and often quickly.

The Factors That Shape A Cyclist's Level of Comfort Riding On A Street

Less than a decade ago bike network designers focused on the skill and experience level of cyclists when defining and rating the "readability" of individual streets and bike routes. A sea change occurred in 2012 when cities began to adopt a new methodology that shifted the focus to how different road designs and bike facilities impact the stress (discomfort) different types of cyclists perceive when they choose a street or route. The best way to understand how this works is to read the cyclist stress analysis for El Camino Real in Menlo Park that is published on Re-Imagine Menlo Park at http://mpcdforum.com/the-menlo-park-bike-network/. There is a high correlation between actual safety and perceived stress for most adult riders.

Bike Rider Categories

Contemporary network designers place riders into different categories based on their tolerance of potential stressful riding environments. The Mineta Transportation Institute suggests there are three primary rider types, and it assumes that one-third of an "average" total population consists of "no way, no how" individuals who simply avoid cycling. The following compares the percentages of cyclists and residents.

- Strong & Fearless (< 1.5% of cyclists)
- Enthused & Confident (< 10.5% of cyclists)
- Interested but Concerned (< 90% of cyclists)
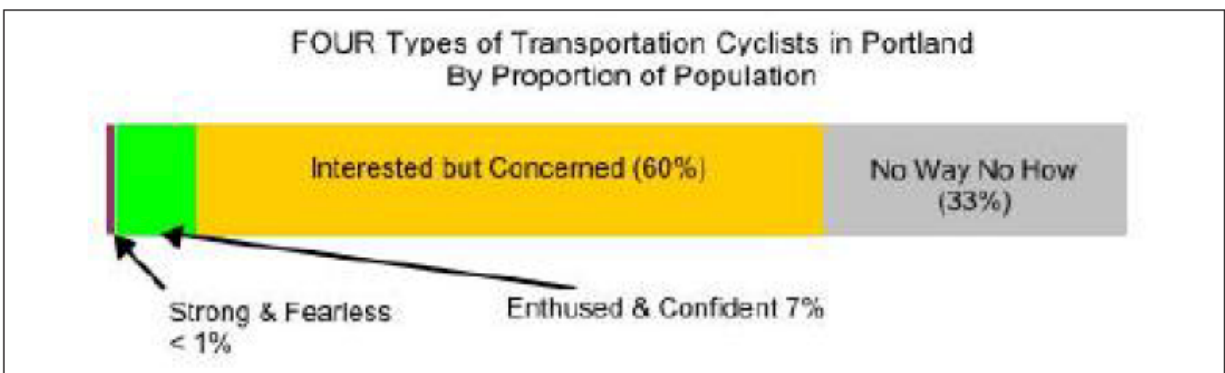
Types of Bike Facilities

There are three types of official bike facilities. (See photos at the end of this document) The table on the next page compares their primary attributes and provides examples of existing ones in Menlo Park. It is important to recognize that the actual and perceived safety of an implementation depends greatly on the setting and network design, e.g., all bike lanes are NOT equal. The value of a bike lane is diminished by frequent "gaps" at intersections and busy public driveways where bikes and autos cross paths or share turn space.

A *Class 1 Bikeway* (Bike Path/Cycle Track) provides a physically separate right-of-way and is designated for the exclusive use of bicycles (and possibly) pedestrians with vehicle and pedestrian cross-flow minimized.

A *Class II Bikeway* (Bike Lane) provides a restricted right-of-way designated for the use of bicycles with a stripped lane on a street or highway. Bicycles are generally five (5) feet wide. Adjacent vehicle parking and vehicle and pedestrian cross-flow are permitted.

A *Class III Bikeway* (Bike Route) provides a right-of-way designated by signs and sometimes pavement markings for <u>shared</u> use with pedestrians and motor vehicles.

There are several variations of the above and they are often used to where the streets, roads and highways lack the space to install one of the primary types.

A *buffered bike lane* uses a marked space rater than a stripped line to provide greater separation of vehicles and bikes and this space is often two-feet wide. The total width of the riding space is the sum of the bike lane and buffer.

A *two-way bike lane* – buffered or not – provides side-by-side bike lanes on one side of a street and is used when there is not sufficient space to install standard bike lanes on both sides.

Shared lanes are street markings ("sharrows") designed to assist cyclists and motorists. These markings point out where cyclists should ride on a street and remind motorists that they will likely encounter cyclists and must safely share a vehicle lane.

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Bike Facility	Exclusive Bike Space	Traffic Separation	Parking Separation	Vehicles & Bikes Cross Each Other*	Visual Aids**	Two-Way Bike Space	Menlo Park Examples
Bike Path (Class I)	Yes	Yes	Yes	Infreqently / Frequently	Signage At Crossings	Option	None / None
Bike Lane (Class II)	Yes	2-3 Foot Buffer / No Buffer	Yes / No	Infreqently / Frequently	Pavement Markings / Lane Striping / Signage	Option***	Santa Cruz Avenue / Sand Hill Road / Ravenswood (Between EL Camino and Laurel)
Bike Route (Class III)				Infreqently / Frequently	Signage (required) / Striping (optional)	No	
Sharrows	No	No	No	Infreqently / Frequently	Pavement Sharrows / Share the Road Signage	No	Menlo & University

Preferred Use:
Unfavorable Use :

* At intersections and busy public driveways where sharing space is either required or permitted
** Bike signals may be desireable
*** Where narrow street width prevents on-way bike lanes.

Types of Menlo Park Bike Facilities

There are no Class II bike paths and none are proposed in the city Specific Plan.

Unbuffered Class II bike Lanes are the most common bike facility and additional one are recommended in the Specific Plan.

There are buffered Class II bike lanes only on Santa Cruz Avenue between Olive St and University Avenue. No others are recommended but some of the recommended bike lanes might be buffered.

There are no Class III bike routes but some are recommended in the City's Specific Plan, e.g., Middle Avenue.

There are shared lane sharrow markings on University between Middle Avenue and Menlo Avenue and on Menlo Avenue. Bike lanes are recommended in the city's Spe Plan.

Middle Avenue between Olive Street and University is designated as a School Bike Safety Route with a stripped line and a few signs. It does not have the frequent stre markings or signs provided by bile lanes. Bike lanes are recommended in the city's Specific Plan.

The Menlo Park Bike Network

Two different views of the Menlo Park bike network follow.

- Existing bike network and popular routes

- Specific Plan recommendations

Existing bike network and popular routes

Blue dashed lines => existing segments

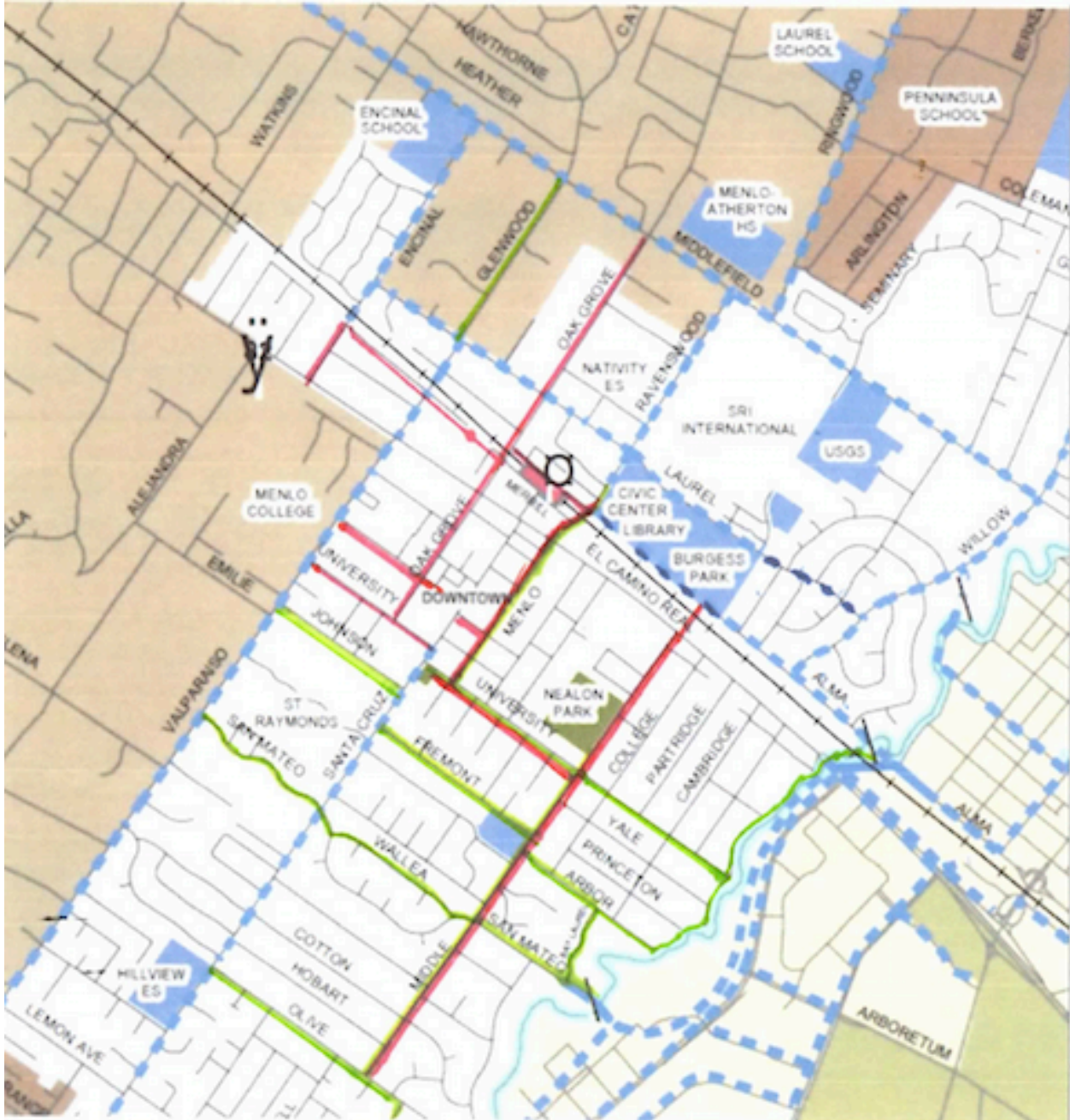Green solid lines => popular routes that lack true bike facilities.

Note: There is also a popular route from the east end of Middle Avenue to Menlo Avenue that runs thru Nealon Park, and uses several short street segments in-between.

Existing, Popular And Specific Plan Recommendations

Red solid lines => Specific Plan

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Raised Bike Path/Cycle Track

SIDEWALK — RAISED CONCRETE CYCLE TRACK — WHITE BUFFER LINE

FLAT MANHOLE COVER — CONCRETE MOUNTABLE CURB

GREEN LINE — CATCH BASIN

1.8m

Conventional Bike Lane

Buffered Conventional Bike Lane

Two-Way Protected Bike Lane

Shared Lane Markings (Sharrows)

Additional Information:

- National Association of City Transportation Officials Urban Bikeway Design Guide

  http://nacto.org/publication/urban-bikeway-design-guide/bike-lanes/

- A Cyclist Stress Analysis: **Would New Bike Facilities On El Camino Real Appeal To Many Cyclists?**