

Chapter 1 – The Big Picture



Land Use and Bicycling

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How Bicyclists are Affected by Motor Vehicle Traffic Volume and Speed

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Bicycling is one of the oldest forms of human transportation, yet the modern-day cyclist faces problems related to suburban living and motor vehicle speed and traffic volume, among others. The various kinds of facilities needed to maintain bicycling as a viable transportation mode have been frequently overlooked in the building of modern transportation systems. This situation has been changing in recent years, and now people want more ways to get around their communities and elsewhere via bicycle. And they want to be able to make these bicycling trips in a safe and enjoyable manner.

The bicyclist is a vulnerable road user, and creating a safer bicycling environment involves more than striping a bike lane or re-striping motor vehicle travel lanes to accommodate a wide curb lane or even building a separated path. A truly viable bicycling network involves both the big picture and the smallest details—from how a community is built and connected, to the maps that indicate safe bicycling routes, to the surface materials on the bike path. Bicycling facilities should be accessible to various types of users, and information should be provided about the level of skill necessary on a certain route.

Because most of the work that will be done involves retrofitting existing roads, streets, and trails, improving the bicycling environment will likely start at the community level. It is not only important to identify bicycling corridors within a community and determine if improvements need to be made, but also to examine overall connectivity within the community.

LAND USE AND BICYCLING

The nature of the built environment is important not only for walking but also for bicycling. Community characteristics that foster bicycling include: having destinations close to each other; choosing sites for schools, parks, and public spaces appropriately; allowing mixed-use developments; having sufficient densities to support transit; creating commercial districts that people can access by bicycle (or foot and wheelchair); providing adequate, visible, secure parking, and so on. About 57 percent of bicycling trips are less than 3.2 km (2.0 mi).¹ When residents are segregated from sites such as parks, offices, and stores, there will be fewer bicycling trips because destinations are not close enough for bicycling. While mixed-use developments with sufficient density to support transit and neighborhood commercial businesses normally make bicycling a viable option for residents, single-use, low-density residential land-use patterns can discourage bicycling, especially if the con-



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Bicycling on local streets can be an enjoyable form of transportation and recreation.

necting roads to other destinations have high speeds and traffic volumes and inadequate bicycle facilities.

The connection between land-use planning and transportation planning is critical but all too often ignored. Integrating land-use and transportation planning allows new developments to implement these strategies from the onset. Communities that support balanced transportation systems make bicycling an attractive option.

In established communities, many of these goals can be met with “in-fill development” to increase density and community viability. In addition, providing appropriate bicycling facilities between desirable destinations will result in more bicycle trips.² The facility may be as simple as a normal-width shared lane on a street with low traffic volumes and slow motor vehicle speeds. Sometimes low-volume, slow-speed streets become bicycle boulevards through neighborhoods. As motor vehicle traffic volume and speeds increase, providing space for bicyclists through bike lanes or wide curb lanes becomes more important. Sometimes providing a separated bicycle path may be nec-



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essary to provide a link between areas that have no streets suitable except for the most experienced bicyclists.

ASSUME THAT PEOPLE WILL BICYCLE

Bicycles are vehicles and are able to travel on a wide variety of roadway types. It should be assumed that bicyclists will want to ride, and plans should be made to accommodate them. The Federal Highway Administration (FHWA) has encouraged routine accommodation for bicyclists (and pedestrians) for many years, and the concept has been embraced by many state and local departments of transportation (DOTs). More detail on routine accommodation is available at <http://www.fhwa.dot.gov/environment/bikeped/guidance.htm>.

The bicycle can be used to commute to work, to run errands, to visit neighbors, to go to local stores, to transport children, to get exercise, or for recreation. Skill levels among bicyclists will vary, and novices may only feel comfortable on slow-speed, neighborhood streets or off-road paths. The experienced bicyclist will tend to feel comfortable on higher-speed, higher-volume streets if adequate *space* is provided. The space usually results from facilities such as bike lanes, paved shoulders or wide curb lanes.

Bicycling can also be encouraged by retrofitting existing streets on corridors bicyclists are known to frequent. Retrofitting could involve such things as removal of parking, narrowing of travel lanes to slow motor vehicle speeds, and using the space added from lane narrowing to accommodate bike lanes, paved shoulders or wide curb lanes.

Communities interested in promoting bicycling need to know where bicyclists ride, as well as where they want to ride. Once desired corridors are identified, inventory can be taken to identify on-street deficiencies. Deficiencies appear in many forms, including poor pavement quality, narrow streets with not enough space to share a lane with motor vehicles, inadequate space on bridges, problem intersections, etc. Deficiencies can often be improved, but sometimes right-of-way is a problem, and a separate trail or path may be needed to fill a gap.

Besides facility improvements, it is also beneficial to provide a pleasant and interesting bicycling environment. The built and natural environments are therefore important components of a pleasing bicycling environment. The environment may also be improved in part through landscape design elements, which can improve aesthetics,



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Besides providing a pleasant place to ride, a separated trail can provide a desired connection.

offer a sense of visual narrowing, and perhaps slow traffic speeds. Proper use of serpentine or other traffic calming measures can accomplish the same thing.

Bicyclists also want to ride in an environment where they feel safe, not only safe from motor vehicle traffic, but also safe from crime or other concerns that can affect personal security. Lighting and other security measures should be considered in certain locations.

Traditionally, traffic safety problems have been addressed by analyzing police crash reports and improvements have been made only after they were shown to be warranted by crash numbers. However, planners, engineers and other practitioners should consider problem-identification methods such as interactive public workshops, surveying bicyclists and drivers, and talking with police to identify safety problems in an area before crashes occur. These measures may help proactively identify locations for bicycle safety improvements and will involve citizens in the process of improving safety and mobility in their own communities.

TRANSIT AND BICYCLING

Bicycling and transit are complementary. In many communities, bicycle racks are provided on buses, enabling what might be a long bicycling trip to be shortened by using transit for part of the journey. Once bicyclists get used to placing their bikes on the racks, the process tends to flow easily. Friendly and comfortable transit stops are also a plus. Some consideration needs to be given to the on-street riding conditions around transit stops frequented by bicyclists making use of bus racks. It may be relatively easy to implement minor changes that make the bicycling part of the trip to or from the transit stop much

safer and comfortable. Feeling unsafe on the bicycle for even a short distance may discourage use of a combined bike-bus trip.

It is also the case that carrying a bicycle onto a train is much more common than in the past. For example, Caltrain in the San Francisco area has become very accessible for bicyclists. Such access is yet another way to combine bicycling with another mode of transportation.

HOW BICYCLISTS ARE AFFECTED BY MOTOR VEHICLE TRAFFIC VOLUME AND SPEED

A bicycle can be ridden on almost any kind of roadway, yet certain traffic conditions create a sense of discomfort, even for the skilled bicyclist. A high volume of traffic is one of those conditions and can inhibit a bicyclist's feeling of safety and comfort. This is particularly true when no bicycle facilities exist on these roadways.

Motor vehicle traffic speed is equally critical to bikeability and safety. Though bicyclists may feel comfortable on streets that carry a significant amount of traffic at low speeds, faster speeds increase the likelihood of bicyclists being struck and seriously injured. At higher speeds, motorists are less likely to stop in time to avoid a crash. At a mere 49.9 km/h (31 mi/h), a driver will need about 61.0 m (200 ft) to stop, which may exceed available sight distance. Reducing speed limits and subsequent motor vehicle speeds should improve bicycle safety. A driver traveling at 30.6 km/h (19 mi/h) can stop in about 30.5 m (100 ft).³

Unfortunately, many of our streets are designed to accommodate higher motor vehicle traffic volumes and



High motor vehicle traffic volume can create a sense of discomfort for bicyclists when they don't have space.



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If done properly, slowing speeds through traffic calming measures such as speed humps can improve safety for bicyclists, as well as pedestrians and motorists.

speeds in an attempt to better handle peak hour congestion. Most bicyclists will try to avoid these streets if possible, but a problem exists if these same streets are part of a bicycling corridor. Fortunately, there are tools that can improve the speed profile, primarily by redesigning streets through traffic calming measures. However, care must be taken to ensure that the traffic calming method is suitable for bicycling. New streets can also be configured with lower design speeds without a great sacrifice in capacity. Speed reductions can increase bicycling safety considerably. The safety benefits of reduced speeds extend to motorists and pedestrians as well. On slow speed city streets and lightly traveled roadways, bicyclists may safely operate in the normal traffic lanes. However, on heavily traveled streets, bicyclists need *space* to operate and to provide room for overtaking motorists. Space can be provided through the use of bike lanes, paved shoulders, or wide curb lanes (although wide curb lanes may not be the best choice for a high-speed and high-volume combination), and these facilities can often be created through the narrowing of traffic lanes through remarking, or what has come to be known as “road diets” (e.g., reducing traffic lanes from 3.7 m (12 ft) to 3 or 3.4 m (10 or 11 ft)). More detail about traffic calming and road diets is provided in later sections.

COMPLETE STREETS

A movement called “Complete Streets” has been actively growing since about 2001. This builds on the previous concept of routine accommodation for bicyclists and pedestrians. “Complete Streets” is meant to convey a win/win for all parties who use the street. A statement of philosophy is contained on the America Bikes Web site:

Complete streets provide choices to the people who live, work and travel on them. Pedestrians and bicyclists are comfortable using complete streets. A network of complete streets improves the safety, convenience, efficiency and accessibility of the transportation system for all users. Every road project should create complete streets.

Completing the streets means routinely accommodating travel by all modes. This will expand the capacity to serve everyone who travels, be it by motor vehicle, foot, bicycle, or other means. A complete street in a rural area may look quite different from a complete street in a highly urban area. But both are designed to balance safety and convenience for everyone using the road.

The Complete Streets concept promotes changing the way designers think about the street. Instead of curb to curb, they should think more completely, such as building face to building face. Besides improving safety for bicyclists and pedestrians, completing the streets should encourage more people to bicycle and walk. States that have incorporated this type of thinking into their design policies include New Jersey and California, both of whom have new guidebooks promoting flexibility in design of main streets.^{4,5} The Thunderhead Alliance has developed a report with information about “Complete Streets” laws, policies, and plans in the United States.⁶



This street comfortably accommodates all users.

OPTIONS TO IMPROVE BICYCLING

There are many ways to improve the conditions for bicycling. The following chapters provide information on general factors related to bicyclist-motor vehicle crashes (Chapter 2), and analysis of crash types and selecting appropriate countermeasures (Chapter 3). Chapter 3 also provides information on selecting treatments for more general performance objectives. Chap-

ter 4 describes the features of BIKESAFE and how to use the Web or CD-based applications. Descriptions of countermeasures, organized into general categories, are included in Chapter 5. Chapter 6 contains over 50 case studies describing implementation tips, and additional resources are documented in Chapter 7.

The Web application also allows the user to explore many countermeasure (or treatment) choices based on particular crash problems or performance objectives. For example, a crash problem might involve overtaking motorists striking bicyclists from the rear on a busy corridor with inadequate space. A performance objective might be to provide safe intersections for bicyclists.

These bicycling improvements represent the current best thinking of the authors and expert panel. Some of the improvements have been formally evaluated and are referenced within this document. The remainder have been implemented in a number of locations across the United States and around the world and are felt to be worthy of use. Carrying out carefully conducted evaluations and publishing the results are vital steps to improving the safety of bicycling.

