The Dilemmas of Bicycle Planning

Paul Schimek

Massachusetts Institute of Technology

Department of Urban Studies and Planning

and

U.S. Department of Transportation

Volpe National Transportation Systems Center

55 Broadway, DTS-49

Cambridge, MA 02142 USA

schimek@volpe.dot.gov

Revised: March 2, 1999

An earlier version of this paper was presented at the Association of Collegiate Schools of Planning (ACSP) and Association of European Schools of Planning (AESOP) Joint International Congress, July 27, 1996 in Toronto, Canada.

Abstract

Since the 1970s, the bicycle has been a motherhood issue for U.S. transportation planning. At least in the abstract, everyone is in favor of increased use of these non-polluting, energy-efficient, quiet, and fitness-promoting vehicles. However, when one begins to investigate the use of bicycles for transportation, one finds that there are a number of dilemmas facing bicyclists and the bicycle planner. The first dilemma is that the public has many misconceptions about bicycling, including the skills required, which places are safe for riding, and the rights of bicyclists to use public roads. Second, professionals have often ignored bicycling, failing to consider bicyclists in roadway design or traffic enforcement. Third, the locations where bicycling is the most useful for transportation are also some of the most challenging, especially for the beginner. Fourth, the bicycle is not generally a "design vehicle," so roads are not routinely designed with bicyclists in mind. Fifth, transportation funding emphasizes capital spending over maintenance, although the latter is often more important to cyclists. Sixth, traffic enforcement officials in many localities routinely ignore even the most flagrant and dangerous violations by bicyclists. Seventh, designated bicycle facilities often do not serve the purposes their advocates propose, and sometimes can create dangerous conditions. Eighth, bicycle education has not yet become available on a wide scale, in part because advocates, funding programs, politicians, and public opinion focus on building facilities. Getting beyond these dilemmas requires a focus on changing public opinion through advertising, politician and celebrity endorsement, making the bicycle a design vehicle, and widespread availability of bicycle training programs.

Introduction

Since the 1970s, the bicycle has been a motherhood issue for U.S. transportation planning. At least in the abstract, everyone is in favor of increased use of these non-polluting, energy-efficient, quiet, and fitness-promoting vehicles. However, when one begins to investigate the use of bicycles for transportation, one finds that there are a number of dilemmas facing bicyclists and the bicycle planner. This paper reviews

eight dilemmas regarding bicycling. Anyone interested in planning for bicycling should be thoroughly aware of these dilemmas. Recently, some localities have taken steps to get beyond these dilemmas; these and other suggestions for improvements are listed in the final section of the paper.

Dilemma #1: Perceptions of Bicycling Don't Fit the Facts

Common but flawed perceptions about cycling are at the heart of many of the problems surrounding bicycle planning. These include the amount of skill required to ride a bicycle, the risk involved in bicycling and the sources of risk, and the legal status of bicyclists on public roads.

1.1 Skills Required

Many Americans think they know how to ride a bike, but many lack even very basic bicycling skills. They often do not know what they don't know. They believe that once you learn how to balance and steer on a bicycle, you know how to ride a bicycle. However, bicycling is more like swimming or skiing: at least a minimum of instruction in technique and safety precautions is necessary to be safe and effective. Because many people do not know this, they do not seek out instruction, and continue their dangerous habits. Because parents lack these skills, they do not teach them to their children. The bicycling instruction occasionally offered by schools is typically incomplete, misleading, or even erroneous (see Dilemma #2).

What skills do bicyclists need to know? Basic bicycle handling includes getting off the seat before stopping; picking the right gear; stopping by using both brakes; and scanning for traffic behind (looking over the shoulder) without swerving. Basic traffic skills include changing lanes; lane positioning depending on the speed of traffic and the width of the travel lane; lane positioning based on destination at intersections; and yielding and stopping when required by traffic rules. There are other skills which are helpful: quick turns and quick stops, riding in bad weather and at night, climbing and descending, and roadside bicycle repairs (*1*).

1.2 Source of Danger

The idea of bicycling on streets produces fears of being struck by a motor vehicle approaching from behind. These fears stimulate a preference among the public to bicycle in areas where motor vehicles are not allowed, such as sidewalks, recreational paths, fire roads, and hiking trails. Although they can be very serious when they occur, overtaking collisions are rare, particularly in urban areas in daylight. From data collected by Cross and Fisher, Forester calculates that 85% of all car-bike collisions take place in urban areas, and 89% of these involve turning and crossing movements, and only 7 percent involve cars overtaking bicycles (Forester 1994 p. 47). More recently, researchers from the University of North Carolina's Highway Safety Research Center (HSRC) found that 8.6% of car-bicycle collisions in their sample of 3,000 from eight states involved motorist overtaking (Hunter et al. 1996). This figure includes rural areas where overtaking collisions are more common. As in the earlier data, this study also found that turning and crossing situations accounted for the vast majority (76.9%) of collisions (*2*).

While they are afraid of being hit from behind, novice bicyclists are insufficiently afraid of other common dangers, and often act in a way that increases these dangers. First, they are insufficiently afraid of cross traffic. Intersections are known to be the greatest source of danger—they are the areas where driver's intended paths frequently intersect. Riding on the sidewalk or in the wrong direction places the cyclist outside the flow of traffic and into positions where they are not visible or not expected. A bicyclist riding at speed on the sidewalk may suddenly appear in an intersection at the moment a motorist on the parallel roadway is turning right into a side street. In such cases the motorist has the impression that the bicyclist appeared "from nowhere." A motorist waiting at a stop sign to make a right turn looks to her left for traffic. When there is none, she will proceed to turn right—directly into the path of a wrong-way bicyclist approaching from the right. Bicycling against traffic increases accident risk by 360%, bicycling on the sidewalk increases accident risk by 180%, and bicycling the wrong way on the sidewalk increases accident risk by 430% (Wachtel and Lewiston 1994). Between one quarter and one third of all bicycle-car crashes occur when the cyclist is riding against traffic (Hunter et al. 1996; Plotkin and Kormornick 1984).

The paths and trails favored by inexperienced cyclists have their own dangers. Roadway crossings can be hazardous because of insufficient sight distance and confusion about who has the right of way. Given the presence of pedestrians, roller skaters, child cyclists, and equestrians, paths are often too narrow to accommodate bicycling at speeds even novices are capable of. Some older paths were built with sharp curves and steep slopes that are difficult to navigate on a bicycle.

Finally, bicycling on unpaved areas, although popular in part because of the lack of motor vehicle traffic, can increase the risk of falls, principally because of poor surface conditions. The injury rate per mile is highest on unpaved surfaces, although these crashes tended to result in minor injuries (Moritz 1998).

Inexperienced bicyclists are also insufficiently afraid of riding at night without a headlight. Many avoid riding at night, but are occasionally caught after dark unprepared. Some believe that lights are unnecessary, either because they believe that street lights illuminate them or because they believe that federally-mandated reflectors are sufficient. Front reflectors are insufficient because they do not alert traffic in front to the bicyclist's presence. The headlights of an automobile waiting on a side street do not illuminate a bicycle's front reflector; if the street is dark, the motorist sees no approaching traffic and may turn directly into the bicyclist's path. Every U.S. state requires bicyclists to use headlights at night, but very few jurisdictions enforce this rule. Federal regulations require that all new bicycles must be equipped with a complete set of reflectors. These regulations may contribute to the persistence of the belief that reflectors are sufficient for night cycling (see Forester 1994, 169-180).

1.3 Are Bicyclists Legal Road Users?

On one level, the answer to this query is simple: all U.S. states treat bicyclists by law as drivers of vehicles and grant them rights and responsibilities accordingly. However, the public often believes otherwise. Motorists often feel that bicyclists have no right to be on the road, especially if a bicyclist's presence requires the motorist to wait before overtaking. Some motorists become vigilantes, telling cyclists to get off the road. The frequency with which many bicyclists disobey traffic law contributes to public attitudes that bicyclists operate outside the law and therefore do not deserve the same treatment as other roadway users.

Bicyclists often feel that they should not block traffic. They think travel lanes are "car lanes" and try to keep out of them as much as possible. As a result, bicyclists often ride too far to the right of the road, despite the presence of hazards such as road debris, broken pavement, drain grates, and opening doors of parked vehicles. Forester remarks ironically: "most cyclists are too cautious to be safe on the road" (Forester 1994, p. 41). Because motorists who are not cyclists do not always recognize these hazards, they may believe that bicyclists unnecessarily block the road when they could be traveling further to the right.

The root of these perceptions is the idea that bicyclists are not really drivers. If bicyclists were drivers (as the law states), than the basic principle of traffic flow applies: first come, first served. If a driver is traveling in the roadway, an approaching driver must overtake only when it is safe to. The driver has to make it easy for another driver to overtake, but only to the extent that traffic and road conditions make overtaking possible. A motorist's perception of safe passing space may be different from a cyclist's. Motorists may not understand that a cyclist may need to "block" (ride in the middle of) a travel lane when the cyclist decides that there is insufficient room for sharing a lane.

A second key rule for drivers is that intersection positioning depends on one's intended destination. A driver must move as far to the right curb as possible before turning right, and as far to the center line as possible before turning left (except where there are exclusive turning lanes). Motorists sometimes ignore this rule in passing a bicyclist and turning right at the same time. Driver training apparently fails to emphasize that one should slow and merge behind a bicyclist before turning right. Some right-turning drivers end up stopping in the middle of the road waiting for the cyclist they have just passed to pass on their right. This is unsafe, slow, and avoidable by the simple expedient of waiting first, then turning. Bicyclists who ignore the intersection positioning rule put themselves in conflict with the flow of traffic, for example, by remaining in a right turn only lane when they intend to continue straight.

Laws in many U.S. states which require bicyclists to be "as far to the right as practicable" may contribute to public confusion on this issue. Such laws also contribute to motorists' complaints that bicyclists are in "the middle of the road"—even when the cyclist is making a left turn. The "as far right as practicable" rule frequently conflicts with the "bicyclists are vehicle drivers" principle. Some states have modified the requirement for bicyclists to stay to the right to provide exceptions (e.g., for approaching intersection or avoiding obstacles). Nevertheless, the specific requirement for bicyclists to stay right, beyond the duty of *all* drivers to facilitate overtaking by staying right when slower than other traffic, places the burden of proof on the cyclist to justify any straying from the rightmost edge.

1.4 Bicycling is Inherently Dangerous

A final problem of public perception is the belief that cycling on the road is inherently dangerous. Cycling can be dangerous, but much more so when the traffic rules are ignored. This belief may deter some from cycling, and may encourage others to take illegal and discourteous actions toward cyclists on the road, on the theory that such cyclists deserve what they get. When cyclists are injured or killed, people often think of the inherent risk of cycling, rather than errors committed by cyclists or motorists hitting them.

Dilemma #2: Professional Neglect

Bicycling has long been neglected by professionals entrusted with roadway design, maintenance, and operation. This neglect has produced two related problems: (1) failure to address cyclists' concerns and (2) uneven quality of publications relating to bicycle transportation. The first problem manifests itself in a failure to consider the bicycle as a design vehicle in the road design process (see Dilemma #4) and the failure to stop bicyclists committing traffic violations (see Dilemma #6).

The lack of interest, and research funding, for issues concerning bicycles has meant that there is a very small community of scholars in this area. Many authors write reports and papers without a thorough understanding of the issues raised by previous work (for example, the relative risk of car bike collisions, the laws concerning bicycling).The problem then feeds on itself when such papers are published and are used by others.

Some bicycle safety efforts sometimes provide misleading and occasionally erroneous information. For example, although bicyclists are always told to use hand signals, they are rarely told in such sources to merge left before making a left turn, and to ensure that it is safe to do so by looking behind before signaling left. In past decades, some bicycle safety instruction taught children to ride against the flow of traffic. A bicycle safety campaign placed a full-page advertisement in *The Boston Globe* in 1995; bicyclists were reminded to use reflectors at night, but no mention was made of the necessity, and legal requirement, of having a front headlight.

Dilemma #3: Necessary Routes are Difficult and Uncomfortable

3.1 Cyclists Need to Use Arterials

Cyclists often prefer to avoid heavy automobile traffic, but in most U.S. metropolitan areas to use a bicycle for transportation one often needs to travel on highly used roads. Cycling for transportation is usually most practical in urban areas because destinations are relatively close together and bicycle travel is often as fast or faster than auto travel because of traffic congestion. Major arterials are preferable routes for urban bicycle travel because they are direct, easy to follow, and have signal priority at intersections. In some communities arterials may be the only through routes between neighborhoods.

3.2 Arterials May Be Inhospitable to Cycling

Urban arterials generally have heavy traffic. To accommodate this traffic, road designers often stripe such roadways with many narrow lanes (less than 3.7 m [12 ft.]), and often the shoulder is sacrificed. A

standard width lane is typically too narrow for comfortable lane sharing if traffic moves fast or there is a high volume of truck traffic (large vehicles create a wind blast in passing which can cause a cyclist to lose control). In a narrow lane on a multilane street, a cyclist should ride in the middle of the lane to prevent overtaking drivers from squeezing by in the same lane (Allen 1988). Although such a maneuver is legal, it is often resented by motorists, and cyclists do not prefer doing it (Forester 1994, p. 237). Cyclists may instead either ride too close to parked cars, or on the sidewalk, both of which substantially increase their risk of injury.

3.3 Improving Arterials for Cycling is Not Always Politically Feasible

Widening the outside travel lane on urban arterials is thus an important step to accommodate cycling. However, this is frequently a difficult undertaking in practice because of a series of constraints. The right of way for the road is typically fixed in urban areas because of the placement of buildings. Sidewalks only occasionally can be narrowed. If there are street trees it is impossible to move the curb line without cutting them down. The number of traffic lanes is usually determined by the need to accommodate peak hour traffic volume without much delay. Traffic lane widths must accommodate trucks; in Massachusetts, the Highway Department will not allow lanes narrower than 3.4 m (11 ft) for this reason. That leaves parking lanes. Eliminating just one lane of on-street parking is sufficient to provide additional width for bicycles on both sides of the street if the roadway is restriped. However, on roadways where on-street parking is permitted, it is likely to be in high demand. Removing on-street parking will be strongly resisted by abutting merchants and residents.

In more recently developed areas in the suburbs and in the Sunbelt, arterials are not nearly so constrained by existing lot lines. On the other hand, such roads tend to carry a high volume of traffic at high speeds, and every lane appears to be essential for providing road capacity. These major arterials therefore often lack a usable shoulder. However, there is often some opportunity to widen the outside lane and/or make room for a paved shoulder (marked as a bicycle lane or not) in such circumstances.

Dilemma #4: Bicycles are Not Design Vehicles

4.1 Highway Design Manual: Bicycles are Design Vehicles When They are Designed For

Bicyclists are legally allowed to use almost every road in the US, but engineers have not used the bicycle as a design vehicle for these roads. Since it is not a design vehicle, there is no need for engineers to consider the special needs of bicyclists using the public roads. The major reference work for street design in North America is the American Association of State and Highway Transportation Engineers (AASHTO's) *Policy on Geometric Design of Highways and Streets* (AASHTO 1994) (also known as the "Green Book"). The guide says, "Design vehicles are selected motor vehicles with the weight, dimensions, and operating characteristics used to establish highway design controls for accommodating vehicles of designated classes." This definition refers only to motor vehicles even though non-motorized vehicles are legal highway users. The 1994 edition of the guide adds, "In addition, where provision is made for bicycles on a highway, the bicycle should also be considered a design vehicle" (p. 19). This formulation suggests that if a designer does not provide for bicycles, then bicycles are not a design vehicle and do not have to be provided for. The more logical and ethical position is that bicycles should be design vehicles wherever they are permitted. Later the guide adds, "To provide adequately for bicycle traffic, it is necessary to be familiar with bicycle dimensions, operating characteristics, and requirements," but fails to specify what these are.

4.2 Narrow Lanes on Major Roads

There are several key deficiencies in roadway design which reveal the lack of consideration of bicycle traffic. A bicyclist generally moves more slowly than traffic, but can be passed in the same lane if the lane is wide or a paved, usable shoulder is provided. Insufficient width for "lane sharing" is a common problem, especially on high-speed, high-volume arterials. The Green Book calls for wide outside lanes (4.2 m minimum) where there are no shoulders to "enhance a route's safety and capacity for bicycle traffic" (AASHTO 1995, p. 104), but wide lanes are not generally required. The guide also states, "Where

bicyclists are to be accommodated, a minimum shoulder width of 1.2 m should be utilized." Again the implication is that bicycles need only be accommodated at the discretion of the designer.

4.3 Drain Grates

A common design mistake is the use of parallel bar drain grates that can catch a bicycle's front wheel and send the rider headfirst onto the pavement. The danger of such grates has been known for some time, and it seems that few jurisdictions are currently installing them, except on limited access roads. However, many still exist on the road.

4.4 Traffic Signal Actuation and Timing

Another widespread problem is traffic signals that are not designed with bicyclists in mind. First, many traffic signals are actuated by buried loop detectors, and many of these are not sensitive to bicycles, even though bicycle-sensitive designs are readily available (Hamm and Woods 1992). This deficiency results in situations where cyclists must endanger themselves by disobeying traffic signals that will never change. Second, some traffic signals do not provide enough green time for bicyclists to clear a multilane intersection, occasionally placing them in the middle of an intersection when the light changes (Wachtel, Forester, and Pelz 1995).

Dilemma #5: Focus of Transportation Funds is Capital Spending

5.1 Construction Projects Emphasized over Road Maintenance

The Federal Government in the U.S. plays a large role in transportation funding through its role in distributing Federal gasoline tax revenues to the states. This money generally can only be used for construction, not for operating expenses such as enforcement and maintenance. This arrangement gives states an incentive to overbuild and undermaintain roads, and contributes to the prevalence of road pavement problems. The transportation planning process largely revolves around capital funding decisions, not on policies. Expensive bicycle projects such as conversion of disused railroad lines into trails receive more prominence in this process than efforts to accommodate bicycles as incidental features of road construction projects.

5.2. Big Increase in Bicycle Projects in the 1990s, Mostly For Paths

The 1991 highway act ("ISTEA") created a requirement that 10% of the funds allotted to the Surface Transportation Program (STP) be spent by states on "enhancement" projects. By creating a set-aside, the amount of spending on bicycle projects has dramatically increased, since such projects only have to compete with the specific types of projects authorized under this program, such as landscaping, historic transportation facilities, and historic preservation. Over the six-year life of ISTEA (1992-97), $972 million of federal enhancement funds were programmed for bicycle projects, versus a mere $41 million in federal funds for pedestrian and bicycling projects combined in the 20 prior years. Most (86%) of the bicycling expenditures under ISTEA were used for off-highway paths and trails, with 13% for on-road bicycle facilities, and 1% for bicycle parking or bicycle connections to public transit (Rails-to-Trails Conservancy 1998).

ISTEA also permits states to use STP and Congestion Management funds on "bicycle transportation" projects, which specifically include "nonconstruction safety projects." Although some CMAQ funds have been used for bicycle parking, states have generally not chosen to fund bicycle projects from these categories. The apparent reason is that such spending would require moving some funds from other projects, and bicycle interests are not strong enough at the state level to accomplish this. Moreover, most of the bicycle advocates' attention has been focused on building trail and path projects from the Enhancements set-aside.

The 1998 highway act, "TEA-21," continued and expanded the Enhancements and CMAQ set-asides. Bicycle safety education was added to the list of eligible categories for the Enhancements program.

Funding for a national bicycle safety curriculum was established.

Dilemma #6: Lack of Enforcement

6.1 Little Police Interest

Many bicyclists operate their vehicles in a dangerous or unlawful manner, but few law enforcement agencies cite these violators. There are several reasons why police in many areas permit these violations. First, bicyclists are not taken seriously, and are a low priority for police activity. Second, some bicyclists object to enforcement on civil libertarian grounds. There is some justification for these fears, given that some jurisdictions have chosen to harass bicyclists for riding on roads where bicycling **is** permitted.

6.2. Not Always a Priority of Advocates

Bicycle advocates are often quick to add that it is more important to increase enforcement of motorists' wrongdoing. While violations by motorists are often ignored (e.g., exceeding posted speed limits, running red lights), motorists are sometimes stopped for violations, whereas in some places bicyclists are never stopped, no matter how brazen the violation. Motorists could be made more aware that bicycles are legal road vehicles and that bicyclists have the same rights as other road users. This is particularly true with regard to the two traffic rules cited earlier. Motorists must leave a safe passing distance and should slow and follow if road or traffic conditions prevent safe passing. When turning right, motorists should slow and merge behind bicyclists, not pass in front and turn at the same time.

Some bicycle advocates believe that bicyclists should not be cited for traffic violations until "safe facilities" are built. They argue that disobeying traffic rules is a rational response. In their 1995 report for the Federal Highway Administration, Clarke and Tracy of the Bicycle Federation of America take this point of view. "Riding on the sidewalk, riding against traffic, and failing to signal become part of the necessary repertoire of skills and actions necessary to survive and make the trip practical. This suggests that until road conditions and the riding environment become more conducive to bicycling, bicyclists will continue to ride as they see fit, rather than as the law requires of them. Thus, efforts to enforce laws that require cyclists to behave otherwise will have limited and short-lived success" (Clarke and Tracy 1995, p. 124).

The "facilities before enforcement" argument suggests the *status quo* of little or no enforcement should be continued. It suggests that directing attention at bicyclists' violations is "blaming the victim." The statistics suggest otherwise: motorists were solely at fault in only 28% of car-bike collisions, cyclists solely in 50% of collisions, and both were at fault in 14% (Hunter et al. 1996) (*3*). Changing bicyclist's behavior can be particularly effective because a few high-risk behaviors (e.g. wrong-way riding) are the causes of a large number of crashes. Although many moving violations by motorists are ignored, there is generally a certain chance of being ticketed. In some areas bicyclists, are never ever ticketed for violating traffic rules—to the point where some cyclists almost believe that they are not subject to traffic laws.

Dilemma #7: Bicycle Facilities Can Have Unintended Effects

The major goal of many bicycle advocates is building bikeways, meaning bicycle paths and bicycle lanes. While both types of facilities, if properly designed and located, can improve conditions for bicycling, their usefulness is much more limited than many advocates believe. Moreover, if improperly designed and located, they can be dangerous, and in some cases worsen bicycling conditions.

7.1 Bicycle Paths

The safety hazards of bicycle paths have already been mentioned. They are often too narrow for bicycle use, and much too narrow given their use by pedestrians, roller skaters, and other non-bicyclists. The AASHTO *Guide for the Development of New Bicycle Facilities* gives minimum specifications that are extremely narrow (AASHTO 1991). The preferred width of a bicycle path is given as 10 feet, and the minimum 8 feet. In this author's experience, 12 feet is the minimum necessary for comfortable sharing

with pedestrians and roller skaters, and 16 feet is preferable (*4*). In-line skaters have become a large group of path users, and they need considerably more width than a bicyclist. Although paths of the 1990s have been built wider than the 6 to 8 feet paths that were common in the 1970s and 1980s, many are built to the AASHTO standard of 10 feet, not the 12-16 feet that is preferable given the current composition of path users.

The other potential hazard of paths is intersections with roadways. The ideal bicycle path runs along a river, canal, or shore line with only grade-separated or fully signalized intersections. Few alignments are available that meet these conditions, and constructing bridges or tunnels for full grade separation is an expensive proposition. Although flat and straight, rail lines often cross roadways at odd angles, and sometimes near road intersections, resulting in insufficient sight distance. Such an intersection may be safe for infrequent train traffic, especially when coupled with automatic signals and gates, but may be altogether unsuitable for a steady stream of pedestrians and bicyclists. If the road crossing is a marked crosswalk, drivers are legally obliged to give the right of way to pedestrians in the crosswalk. But bicyclists do not always have this legal protection unless they dismount and become pedestrians. Adding traffic signs can clarify who has the right of way. Typically it is the path users who are given a stop sign, even where a private driveway crosses the path.

A bicycle path immediately adjacent to a roadway but separated from it ("sidepath") is increasingly recognized as a dangerous type of facility. Cycling on such a path has most of the dangers of using a sidewalk. When the path is on one side of the road only, half of the bicyclists will be riding against traffic, making intersections even more hazardous. The AASHTO Guide to Bicycle Facilities presents a long list of the problems of sidepaths but stops short of recommending against them.

Although bicycle advocates sometimes believe that path construction is vital for getting more people, especially parents and children, interested in bicycling, path use does not build the skills necessary for bicycling in traffic (Forester 1994). Many path users put bicycles on automobiles and drive to the path, ride back and forth, and go home. They feel confined to the limits of the path. If they leave the path they may in fact put themselves at risk because they do not know basic traffic skills.

7.2 Bicycle Lanes

Bicycle lanes can be dangerous to the extent that they encourage bicyclists to remain to the right at intersections, regardless of their intended destination. Traffic law requires drivers to move into the lane position closest to their destination before turning. A bicycle lane striped to the stop line of an intersection clearly encourages bicyclists to stay right and motorists to stay left, rather than merging before turning. As bicycle lane proponents began to recognize the problem of motorists turning across bicycle lanes and colliding with straight-through bicyclists, they proposed that lanes be dashed before intersections, indicating that drivers on either side of the line may merge. Dashed lines at intersections are encouraged in the 1991 AASHTO Guide, although some jurisdictions, such as the State of Oregon, still allow solid lines (Michael Moule, Oregon Bicycle and Pedestrian Program, personal conversation, July 1996). Although dashing may reduce the problem, the existence of any dividing line at an intersection discourages proper merging maneuvers. Drivers are used to merging into a lane, not straddling a lane line (the dashed bicycle lane).

The debate over the merits of bicycle lanes will continue. Proponents believe that "designated facilities" are necessary (and sufficient) to encourage a lot more bicycling. They tend to believe that the existence of a lane stripe is the most important factor because they believe *the lane stripe protects cyclists from traffic approaching from behind.* Without it, they believe, the mass of inexperienced bicyclists simply will not ride. Therefore such advocates tend to ignore concerns about bicycle lanes encouraging riders to remain too close to parked cars and discouraging drivers (both motorists and cyclists) from merging at intersections (*5*).

It is difficult to produce good data about the safety of bicycle lanes. The safety of bicycle lanes depends on the accident risk of a bicycle lane relative to not having that lane, all else being equal. Measuring accident risk requires knowing both the number of accidents and the number of bicyclists. Accidents are

typically underreported and are relatively rare events subject to random fluctuations. Establishing the number of bicyclists requires performing special counts. A good test of bicycle lanes would compare the *number of conflicts* between bicyclists and motorists before and after installation, and also include a "control" location where no measures were taken, in order to monitor the background level of change over time. Providing additional width is an improvement for cyclist, but one which does not logically require striped bicycle lanes. The before case, then, should be a road with lanes wide enough for lane sharing with the test treatment being application of a bicycle lane stripe.

Many cyclists remain resolutely opposed to bicycle lanes. In part this is because of the safety problems cited above. Instead of seeing bike lanes as legitimizing bicycle use of the road, they see lanes as confining bicyclists to only a small portion of the roadway—and a portion which may well not be the safest place to be, depending on traffic conditions, obstacles, and where one is going. Some states and localities require cyclists to use bike lanes where they are available. One wonders whether bicycle lanes are really installed for cyclists' benefit if lane use is *mandatory*, or whether part of the motivation is to get cyclists out of the way.

Dilemma #8: Who Supports Education of Cyclists?

8.1 Bicycle Advocates Believe That Creating Special Bicycle Facilities is Much More Important than Improving Skills

Bicycle advocates have a tendency to focus first on building facilities and hardly at all on measures to improve the skill and knowledge of bicyclists. The Bicycle Federation of America, a major U.S. bicycle advocacy group, has produced a classification of bicyclists that has been widely cited (Wilkinson, Clarke, Epperson, and Knoblauch 1994). Group A bicyclists are "experienced riders who can operate under most traffic conditions." Group B bicyclists are "casual or new adult and teenage riders who are less confident of their ability to operate in traffic without special provisions for bicycles." Group C bicyclists are "pre-teen riders whose roadway use is initially monitored by parents."

Wilkinson et al. argue that group B and C riders "will be best served by identifying key travel corridors (typically served by arterial and collector streets) and by providing designated bicycle facilities on selected routes through these corridors." It is important that the facilities be "designated," otherwise these riders will not feel safe and will not ride, according to the authors.

This classification system ignores two facts of cycling in the US. First, some cyclists ride on the roads for many years but still fail to acquire basic bicycle and traffic skills, although skills do tend to increase with experience. Second, an even larger group, consisting of many "group B" bicyclists, operate on roads occasionally, and frequently make major errors such as ignoring traffic signals, riding against the flow of traffic, going straight from a right-turn only lane, or turning left improperly.

Even with a large number of "designated facilities," group B cyclists will need to use the current street network to get to many destinations. Bicycle lanes will only exist on a minority of streets for the foreseeable future. There is no substitute for having the basic skills and knowledge necessary to ride on ordinary roads. Bicycle paths do not develop these skills (since they do not follow the rules of ordinary roads), and the presence of bicycle lanes does not substitute for knowing how to operate in traffic. These statements do not imply that no roadway improvements are needed, or that bicycle paths should never be built. As we noted, increasing road lane width to accommodate side-by-side lane sharing, and building wide, well-located recreational paths along rivers can provide benefits for cyclists.

8.2 Is There an Audience for Bicycle Education?

Wilkinson et al. (1994) believe that skilled riders are a small, elite group, and they imply that changing B riders into A riders on a mass basis is an impossibly difficult task. Their estimate of the difficulty of learning safe and efficient cycling techniques is overstated. Safe bicycle operation follows the same basic rules as safe motor vehicle operation, rules which are familiar to virtually all adults. The major skill required, checking for traffic by looking over one's shoulder, does take practice but seems to be well

within average capabilities. Making a vehicular-style left turn on a multilane street with high traffic volume does requires more skill, but cyclists who are not confident with this maneuver always have the option of making a pedestrian-style left turn.

Although the difficulty of learning skills has been overstated, there are obstacles to providing better bicycle education. The challenge of cycling education is not so much the material to be taught but getting beyond popular beliefs that (1) traffic is dangerous to bicyclists, (2) bicyclists do not have to follow traffic laws, and (3) once you learn how to balance you know how to ride a bicycle. People who are afraid of riding in traffic might be persuaded to take a training class which helps them gradually build their confidence. It may be more difficult to reach those who already ride but in a dangerous manner. Traffic enforcement is the way to change their behavior. Permitting a cycling education class in lieu of payment of a traffic fine another way to reach these cyclists.

9. Getting Beyond the Dilemmas

Many of the dilemmas described above have been around for many years. Bicycle advocates have begun to make improvements in some of these areas, but very few communities have appropriate education, enforcement, and roadway design policies in place.

9.1 Change Public Opinion

A key task for bicycle planners is to change public opinion about bicycling. All road users should know that it is legal and respectable to bicycle on the road. Political leaders, sports figures, and other celebrities who bicycle can be an effective tool in legitimizing bicycle use. The most dramatic changes in city and state policy seem to occur when top officials are also cyclists. Television could be a very effective medium to broadcast messages that bicyclists must obey traffic laws and motorists' must respect bicyclists' right to use the roads. A necessary step is to instructing the police neither to ignore bicyclists who violate traffic laws nor motorists who interfere with bicyclists' rights (see below).

9.2 Train Bicyclists

A central activity for bicycle promotion and safety is to help bicyclists overcome their fear of riding in traffic and teach them basic skills. This can be accomplished through formal education, peer contacts, group rides, cycling clubs, bicycle user groups, and distribution of guide books such as John Allen's *Street Smarts* (1988). Formal instruction is available from the League of American Bicyclists' Effective Cycling (EC) program and the Canadian Cycling Association's CAN-BIKE program.

9.3 Enforce the Traffic Laws Even-Handedly

Enforcement directed at cyclists is a necessary ingredient in improving bicycle safety. It is impossible to exhort cyclists to obey the law if they know police never issue tickets to cyclists. Wrong-way riding, lack of lights at night, riding on sidewalks, and failure to obey traffic signs and signals are probably the most important infractions to enforce. It is also helpful to target behavior that is threatening to pedestrians, such as weaving through a crowded crosswalk (on a red signal) and riding on sidewalks. With a little enforcement, word gets out that police will not tolerate activities such as riding on sidewalks. Increased compliance with traffic law can have a positive and self-reinforcing effect among bicyclists, just as currently new bicyclists learn by imitation to violate traffic laws. Although bicyclists should not be ignored when they disobey traffic rules, neither should they be singled out for "crackdowns." Getting the police to change their behavior requires training of police in why and how to enforce the traffic law.

9.4 Improve Road Design

Although many U.S. roads are safe and comfortable to bicycle on as they are, others are unpleasant even for the most experienced cyclists. This is particularly true on urban arterials, which can be both the least pleasant for riding and also the most necessary for transportation purposes. As discussed above, widening the outside lane of such roads to create enough room for side-by-side lane sharing between bicyclists and

motorists will make such roads much more hospitable for cyclists. Adding a bicycle lane stripe may worsen the situation if it increases the number of improper merges at intersections. Yet bicycle activists often insist that such a stripe is essential. One proposal is to put a bike stencil on a wide outside lane, thereby providing the encouragement and legitimacy sought by bike lane advocates (Zehnpfennig et al. 1993).

Where narrow lanes prevent comfortable lane sharing, motorists are more likely to harass bicyclists for being in the way. Some jurisdictions have started to post "Share the Road" signs in such locations. While road widening or paving shoulders is probably a better solution where there is any significant volume of motor traffic, such signage may prove to be an effective and inexpensive solution, and has already been used by many states.

Endnotes

These techniques are discussed in Allen 1988, Forester 1992, Franklin 1997, or any of the various works of Van der Plas (for example, 1997 and 1999).

[2] The remaining collisions were as follows: bicyclist overtaking, 2.7%; wrong-way bicyclist (head on), 2.5%; other parallel path collisions (including operator loss of control), 2.7%; and other or unknown, 7%.

[3] In the remaining 8% of collisions, culpability was unknown or unclear.

[4] A 10 foot wide path may be suitable if there are very low volumes of users, especially non-cyclists (pedestrians and roller skaters). However, if use is low, the cost of building a separate path may exceed its benefits.

[5] In countries where such bike lanes are common, drivers are trained to stop and look right before turning. However, such a maneuver is physically difficult and contrary to the normal rules of the road. It is doubtful that American motorists will learn this new behavior. Moreover, such lanes may be dangerous in other countries. For example, Germany is beginning to recognize that bicycle paths marked on sidewalks increase the risk to cyclists. While this does not mean that German bicycle lanes are necessarily dangerous, it does suggest that facilities can be in place for many years before their danger is realized.

References

Allen, John. 1988. *Street Smarts*. Emmaeus, PA: Rodale Press.

American Association of State and Highway Transportation Officials (AASHTO). 1995. *A Policy on Geometric Design of Highways and Streets*, 1994 Edition. Washington, DC: AASHTO.

American Association of State and Highway Transportation Officials (AASHTO). 1991. *A Guide for the Development of New Bicycle Facilities*. Washington, DC: AASHTO.

Clarke, Andy and Linda Tracy. 1995. *Bicycle Safety-Related Research Synthesis*. Federal Highway Administration. U.S. Department of Transportation. April. FHWA-RD-94-062.

Forester, John. 1994. *Bicycle Transportation: A Handbook for Cycling Transportation Engineers*. Second Edition. Cambridge, MA: The MIT Press.

Franklin, John. 1997. *Cyclecraft*. Second Edition. The Stationery Office, London.

Hamm, Robert A. and Donald L. Woods. 1992. Loop Detectors: Results of Controlled Field Studies. *ITE Journal*. November. pp. 12-16.

Hunter, William W., Jane C. Stutts, Wayne E. Pein, and Chante L. Cox. 1996. *Pedestrian and Bicycle Crash Types of the Early 1990s*. U.S. Department of Transportation. FHWA-RD-95-163.

Moritz, William E. 1998. Adult Bicyclists in the United States—Characteristics and Riding Experience.

Transportation Research Board. 77th Annual Meeting.

Plotkin, Wendy and Anthony Komornick, Jr. 1984. Bicycle-Motor Vehicle Accidents in the Boston Metropolitan Region. A Study of Reported Accidents Occurring within Route 128 in 1979 and 1980. Boston, MA: Metropolitan Area Planning Council.

Rails-to-Trails Conservancy. 1998 Transportation Enhancements by the Numbers: A National Overview. Draft, January 13.

United States General Accounting Office (GAO). 1996. Transportation Enhancements: Status of the $2.4 Billion Authorized for Nonmotorized Transportation. GAO/RCED-96-156.

Van der Plas, Rob. 1999. *Buying a Bike*. Van der Plas Publications; ISBN: 1892495171.

Van der Plas, Rob. 1997. *The Bicycle Touring Manual*. 2nd edition. Motorbooks International; ISBN: 0933201877.

Wachtel, Alan, and Diana Lewiston. 1994. Risk Factors for Bicycle-Motor Vehicle Collisions at Intersections. *ITE Journal*. September. pp. 30-35.

Wachtel, Alan, John Forester, and David Pelz. 1995. Signal Clearance Timing for Bicyclists. *ITE Journal*. March. pp. 38-45.

Wilkinson, W.C. III, A. Clarke, B. Epperson, and R. Knoblauch. 1994. *Selecting Roadway Design Treatments to Accommodate Bicycles*. Federal Highway Administration. U.S. Department of Transportation. January. FHWA-RD-92-073.

Zehnpfennig, Gary H. and Design Ventures, Inc. with James Cromar and Sara Jane Maclennan. 1993. Measures to Overcome Impediments to Bicycling and Walking. *National Bicycling and Walking Study*, FHWA Case Study No. 4. Federal Highway Administration. U.S. Department of Transportation.