

A Tale of Three Cities

Analysis of Bicycle-Motor Vehicle Crashes

Wayne Pein

All police-reported bicycle-motor vehicle crashes occurring in Gainesville, Florida (158 cases), Austin, Texas (173 cases), and Santa Barbara, California (77 cases) during the calendar year 1995 were classified according to a slight modification of a typology developed in the early 1980's by the National Highway Traffic Safety Administration (NHTSA). NHTSA's coding scheme, which is based on seminal work in crash analysis by Cross and Fisher, relies on the police report to identify 45 possible bicycle-motor vehicle crash types.

A number of variables such as bicyclist age, bicyclist roadway position and direction, roadway factors, and temporal and environmental attributes were also ascertained from the police report. These variables are essential to understanding the nature of the crashes so that appropriate countermeasures can be implemented.

Results.

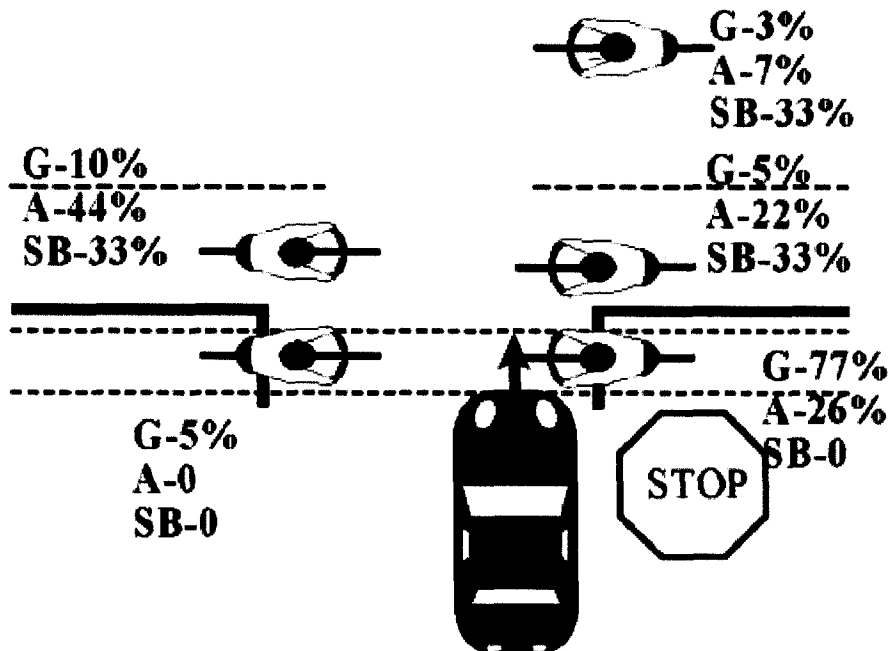
Table 1 shows in rank order the most prevalent bicycle-motor vehicle collisions in each city. The listed crashes comprise 85% of all the cases in Gainesville, and 82% of both Austin and Santa Barbara crashes. **Four crash types that are common to all three communities are color coded to more easily demonstrate their relative ranking** (there are other crash types common to all three cities but they are not among the top 10 in rank), and reveal similarities and differences in crash patterns between the cities.

Rank	Gainesville, Florida	Austin, Texas	Santa Barbara, California
1	Drive Out At Stop Sign (n=39; 24.7%)	Drive Out At Stop Sign (n=27; 15.6%)	Bicyclist Strikes Parked Vehicle (n=12; 16%)
2	Right Turn On Red (n=23; 14.6%)	Ride Out At Intersection (n=24; 13.9%)	Motorist Right Turn (n=12; 16%)
3	Drive Out At Midblock (n=20; 12.7%)	Ride Out At Midblock (n=20; 11.6%)	Drive Out at Midblock (n=10; 13%)
4	Ride Out At Intersection (n=17; 10.8%)	Motorist Left Turn- Facing Bicyclist (n=15; 8.7%)	Drive Out At Stop Sign (n=7; 9%)
5	Motorist Left Turn- Facing Bicyclist (n=11; 7.0%)	Drive Out At Midblock (n=12; 6.9%)	Motorist Overtaking (n=6; 8%)
6	Motorist Right Turn	Right Turn On Red	Ride Out At Intersection

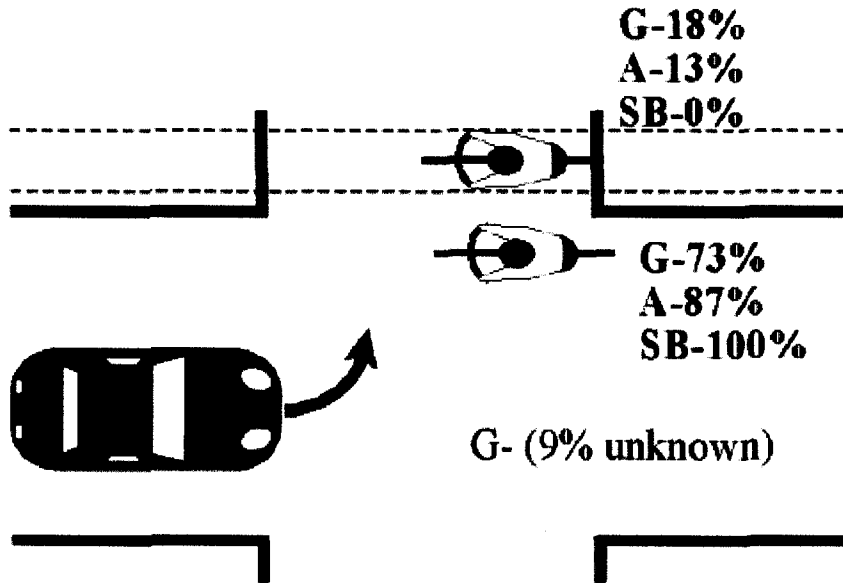
	(n=10; 6.3%)	(n=12; 6.9%)	(n=5; 6%)	
7	Ride Out At Midblock (n=8; 5.1%)	Bicyclist Left Turn In Front Of Motorist (n=10; 5.8%)	Motorist Left Turn- Facing Bicyclist (n=4; 5%)	
8	Drive Through (n=7; 4.4%)	Assault (n=7; 4.0%)	Bicyclist Lost Control (n=4; 5%)	
9		Motorist Left Turn-Bicyclist Same Direction (n=7; 4.0%)	Drive Out From On-Street Parking (n=3; 4%)	
10		Motorist Overtaking (n=7; 4.0%)	Weird (n=3; 4%)	
	n=135; 85.4% of 158 total	n=141; 81.5% of 173 total	n=63; 81.8% of 77 total	

The 15 different crash types represented in Table 1 are described and listed below in approximate descending average (among the three communities) rank order of occurrence. The top five collisions are accompanied by a diagram depicting bicyclist and motorist positions.

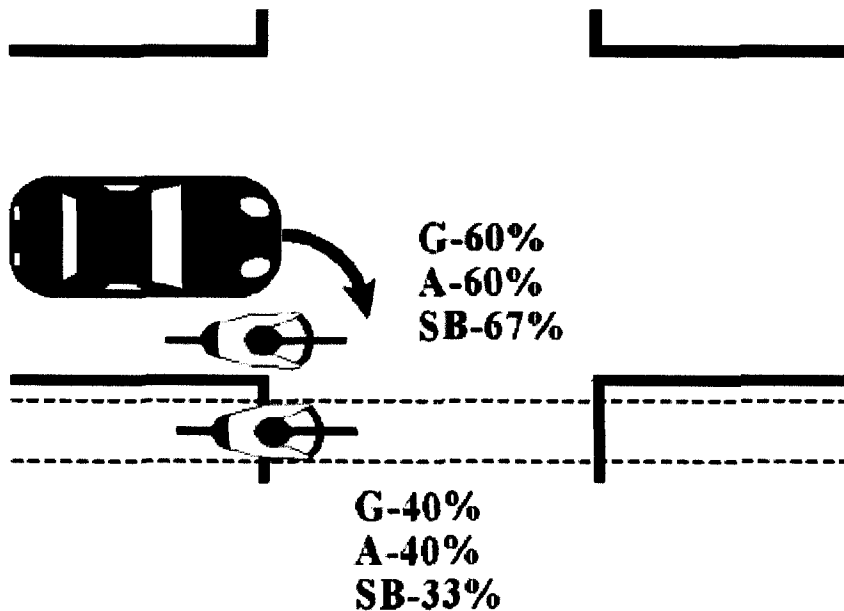
1. **"Drive Out At Stop Sign."** The crash occurred at an intersection at which the motorist was facing a stop sign. The bicyclist was on a crossing path.



2. **"Drive Out At Midblock."** The motorist was entering the roadway from an uncontrolled driveway or alley. The bicyclist was on a crossing path.

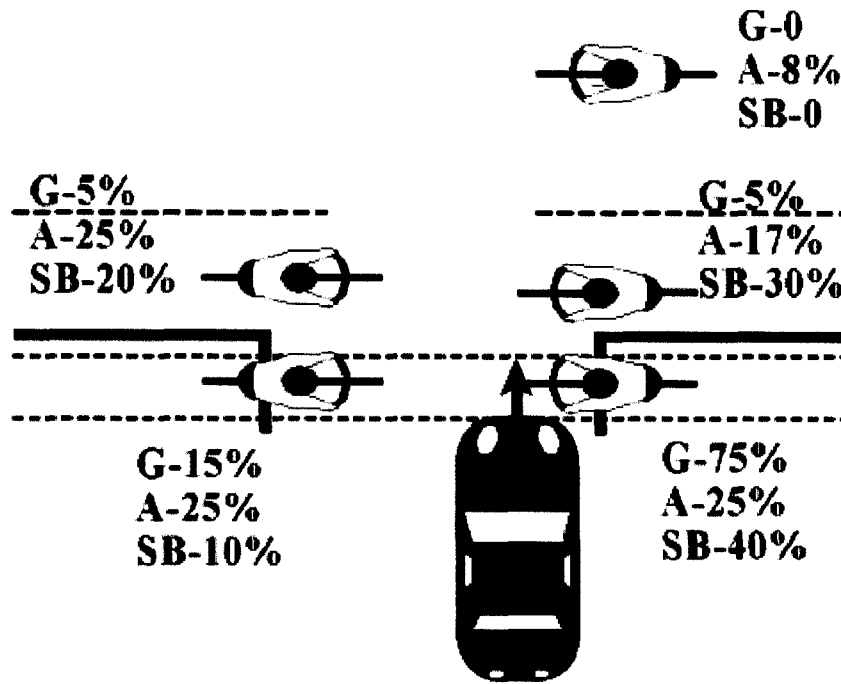


5. **"Motorist Right Turn."** The motorist and bicyclist were on parallel paths in the same direction, and the motorist was making a right turn at a roadway intersection or a driveway.

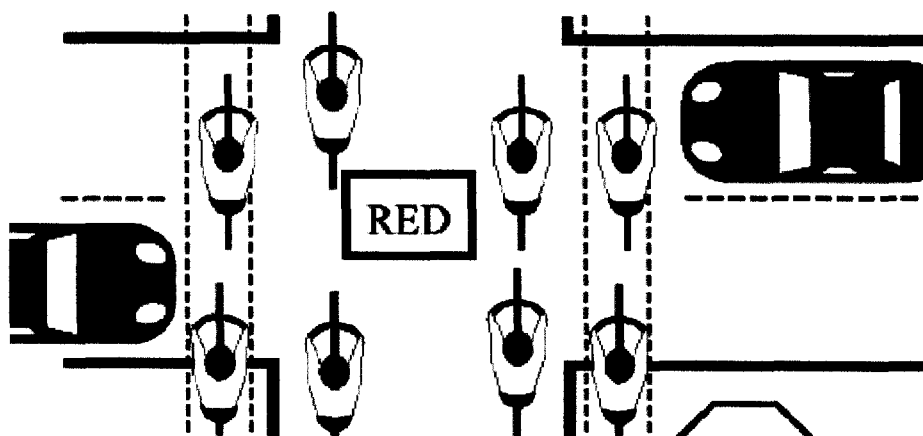


-- note no images for the following, which compose very small percentages of the accidents reported--

6. **"Right Turn On Red."** The crash occurred at an intersection at which the motorist



3. **"Ride Out At Intersection."** The crash occurred at an intersection at which the bicyclist was facing a stop sign, red traffic signal, or failed to yield at an uncontrolled intersection. The motorist was on a crossing path.



4. **"Motorist Left Turn—Facing Bicyclist."** The motorist made a left turn at an intersection or into a driveway while facing the approaching bicyclist.

was facing a red traffic signal and was attempting a right turn on red. The bicyclist was on a crossing path (typically coming off the sidewalk facing traffic).

7. **"Ride Out At Midblock."** The bicyclist was entering the roadway from an uncontrolled driveway or alley or a shoulder/curb position. The motorist was on a crossing path.
8. **"Motorist Overtaking."** The motorist was overtaking the bicyclist. No turning movements were involved. The motorist misjudged the passing space, stated that the bicyclist was undetected, or the event could not be clearly specified.
9. **"Bicyclist Strikes Parked Vehicle."** The bicyclist struck a motor vehicle parked within the roadway right-of-way. The bicyclist may have struck the driver's extended side door or the back of the motor vehicle.
10. **"Bicyclist Left Turn In Front Of Motorist."** The bicyclist made a left turn or swerve in front of an overtaking motor vehicle.
11. **"Drive Through."** The motorist was facing a red traffic signal and drove over the crosswalk before or after stopping (but not making a right turn on red), or ran the signal. The bicyclist was on a crossing path.
12. **"Drive Out From On-Street Parking."** The motorist was exiting (or entering) on-street parking and the bicyclist was riding along the roadway.
13. **"Assault."** The motorist intentionally struck the bicyclist.
14. **"Motorist Left Turn—Bicyclist Same Direction."** The motorist made a left turn at an intersection or into a driveway and the bicyclist was riding in the same direction (typically facing traffic).
15. **"Weird."** Unusual circumstances.

Discussion.

Comparing cities.

The three most frequent collisions in Gainesville comprising 82 (51.9%) crashes involve the motorist facing either a traffic control device or merging from a midblock location and the bicyclist on a crossing path. Of these bicyclists, 65 (79.3%) were riding on the sidewalk facing traffic. Four bicyclists were riding facing traffic while in the street. The driver may have failed to yield or failed to stop prior to crossing a stop line or sidewalk.

The three most frequent collisions in Austin also involve bicyclist and motorist on a crossing path. Here, however, the second and third ranked collisions, "Ride Out At Intersection" and "Ride Out At Midblock" are characterized by the bicyclist violating basic yielding requirements. Moreover, at "Drive Out At Stop Sign" there were six bicyclists riding facing traffic while in the street, another violation of traffic law (seven were riding facing traffic on the sidewalk).

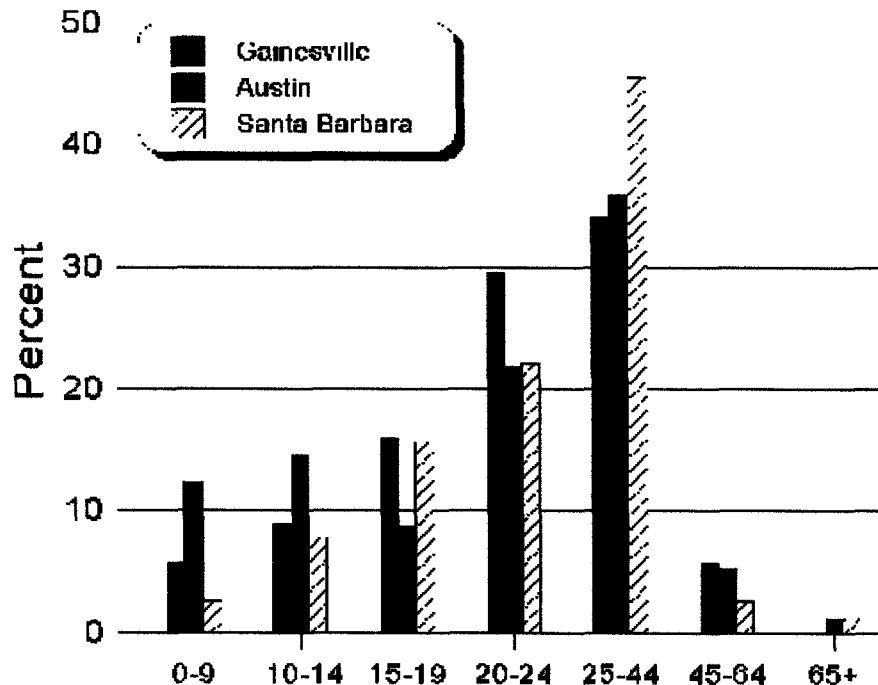
Seven "Assault" incidents, the eighth ranking collision in Austin, is extraordinarily high. Only one "Assault" was noted in Gainesville, and none was found in Santa Barbara.

In Santa Barbara, the top two collisions have the parties initially on parallel rather than crossing paths as is the case in Gainesville and Austin. Together, the five most frequent collisions in Santa Barbara involve primarily driver merging or turning actions. In some cases bicyclist

action/position is a contributing or proximal cause. The number one crash in Santa Barbara (tied with "Motorist Right Turn"), "Bicyclist Strikes Parked Vehicle," occurred only once in Austin and did not happen in Gainesville. All twelve of these events were the bicyclist striking/being struck by an open(ing) motor vehicle driver door.

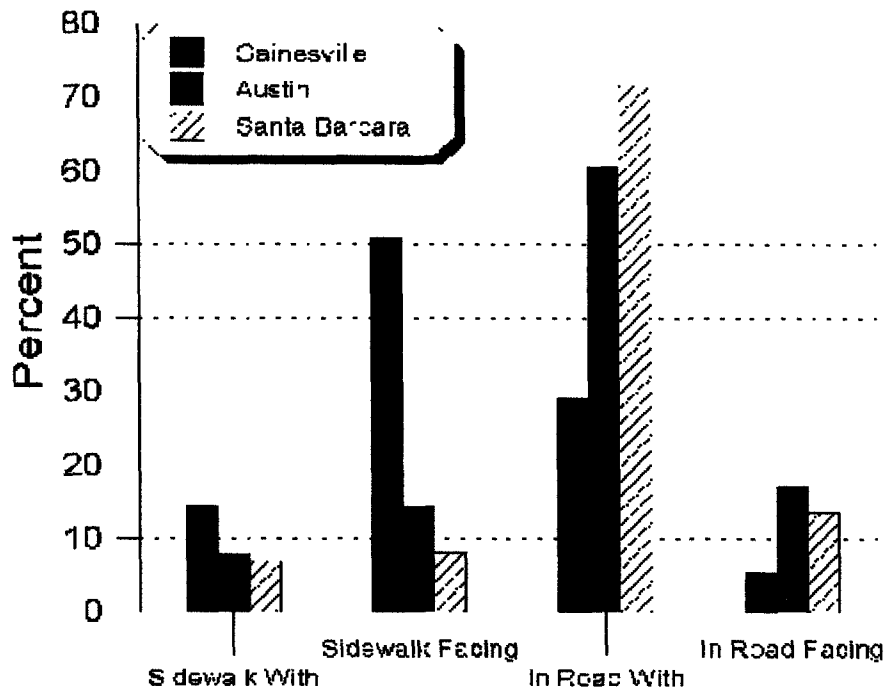
Differences in crash patterns between cities are likely in part explained by bicyclist age differences, sidewalk riding, and size of roads. These three factors are examined below. The amount of on-street parking on arterial roadways is an obvious variable, and the extent of community educational efforts also likely plays a significant role.

Age variation. Child bicyclists tend to be involved in different types of crashes as compared to older bicyclists. Children are more likely to be implicated in crashes in which they disregarded basic yielding requirements, such as when exiting a driveway. Figure 6 depicts the age distribution of involved bicyclists in the three cities.



Bicyclists ages 0-14 comprised 27.1% of victims in Austin, 14.8% in Gainesville, and 10.4% in Santa Barbara. The 0-14 age range accounted for 16 of 20 (80%) "Ride Out At Midblock" and 12 of 24 (50%) "Ride Out At Intersection" crashes in Austin, the second and third ranked collisions in that city.

Sidewalk Riding. Bicyclists were riding along the roadway (in contrast to crossing the roadway at a midblock location or being non-roadway related) in Gainesville 92% of the time, in Austin 88% of the time, and in Santa Barbara 96%. Of these, the specific location and directional distributions are shown in Figure 7.



Gainesville had substantially more total sidewalk riding among crash involved bicyclists than the other cities, particularly sidewalk riding facing the normal flow of traffic. This is at least partial explanation for the appreciable percentage of "Drive Out At Stop Sign," "Right Turn On Red," and "Drive Out At Midblock" type crashes, the three most prevalent collisions in this city. These crash types are more likely to occur as a result of riding on the sidewalk.

Size of road. The collision occurred on a multi-lane road (comprising more than two lanes) in 72% of the cases in Gainesville, 59% in Austin, and in 47% of the Santa Barbara crashes. It is possible that bicyclists in Gainesville are more likely to ride on sidewalks because of the large size and attendant complexity and voluminous motor traffic of that city's roads.

Examining the aggregate.

The collisions that occurred in the three cities are characteristic of crash types found in urbanized areas, where intersections, driveways, sidewalks, and conflicting movements with motor vehicles are abundant. The top three ranking crashes occur when the parties are on crossing paths. The fourth, "Motorist Left Turn—Facing Bicyclist," and fifth, "Motorist Right Turn," ranking crashes involve the participants on a parallel path and a driver turning movement. Both of these were over-represented on multi-lane roads. "Motorist Left Turn—Facing Bicyclist" crashes were over-represented under conditions of darkness, and were especially relevant to unlighted bicyclists. "Motorist Right Turn" included situations in which the motorist had overtaken the bicyclist, or the bicyclist was in the process of overtaking the motorist on the right.

Conclusions/Recommendations

In broad generalities, bicycle crashes in Gainesville are characterized by a large proportion of sidewalk riding, particularly facing traffic; Austin by a relatively noteworthy amount of

bicyclist violations and driver hostility, with a higher percentage of young riders; and Santa Barbara by appreciable on-street parking related episodes.

Due to the inherent conflicts at driveways and intersections, bicyclists should ride in the street and not on the sidewalk. Any riding on the sidewalk should be at a slow speed. Education and enforcement directed to reducing wrong way and sidewalk riding, is advisable. Since it is likely that sidewalk riding will be an ongoing issue, and in many cases tolerated if not encouraged, sidewalk design where bicyclists are expected should attempt to mitigate the negative consequences of sidewalk riding. Effort should also be put forth to better ensure motorist compliance with stopping at a stop limit line and prior to crossing over sidewalks or sidewalk crosswalk areas, whether marked or implied. It may be advisable to formally mark "implied" crosswalk areas.

Because of their small size, position near the right edge of the road, and relative infrequency, bicyclists are not as readily noticeable to motorists as are motor vehicles. Bicyclists should be wary of on-coming motorists turning left in front of them and pulling out of driveways and side streets. Again, an education/awareness campaign could be directed at both bicyclists and motorists. At locations where high conflict rates exist, the sites should be examined taking into account both the motorist and the bicyclist task, and appropriate countermeasure(s) implemented.

Drivers exiting their vehicles from on-street parking should be more aware of the presence of bicyclists. This can be addressed through an awareness campaign and/or "Watch For Bicyclists" signs place with on-street parking. Bicyclists should learn, again through an education effort, and/or be channelized through pavement markings, to ride beyond open door range from parked motor vehicles.

The process of crash "typing" with analysis of precipitating actions, predisposing factors and contributing circumstances is a valuable tool for those interested in reducing a community's bicycle-motor vehicle collisions. Different communities may exhibit varied patterns of crashes. By knowing in what types of crashes bicyclists are principally involved and under what context, appropriate engineering, educational, and enforcement countermeasures can be targeted.

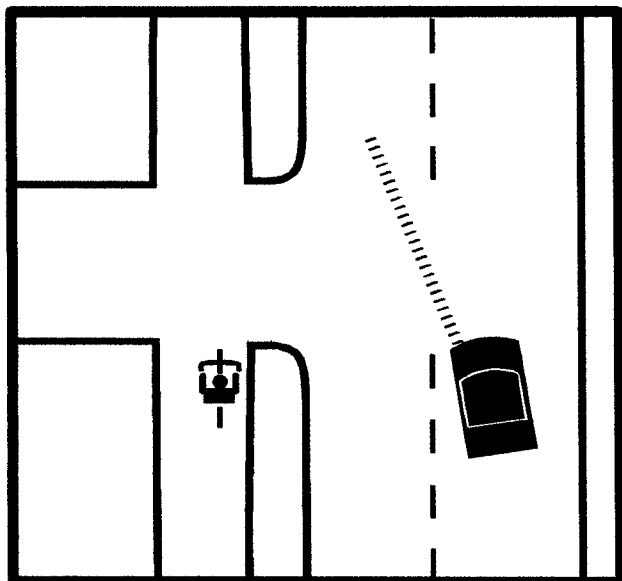
Biography.

Wayne Pein formerly was a Research Associate at the University of North Carolina Highway Safety Research Center. He has been involved in a number of Federal Highway Administration and state level bicycle and pedestrian research projects.

**Used with permission of Wayne Pein, the author, who retained the copyright upon submission to the Bicycling Life Web Site (www.bicyclinglife.com). Wayne Pein was a bicycling safety researcher for 7 years and currently operates Bicycling Maters, consulting business (wpein@bellsouth.net).

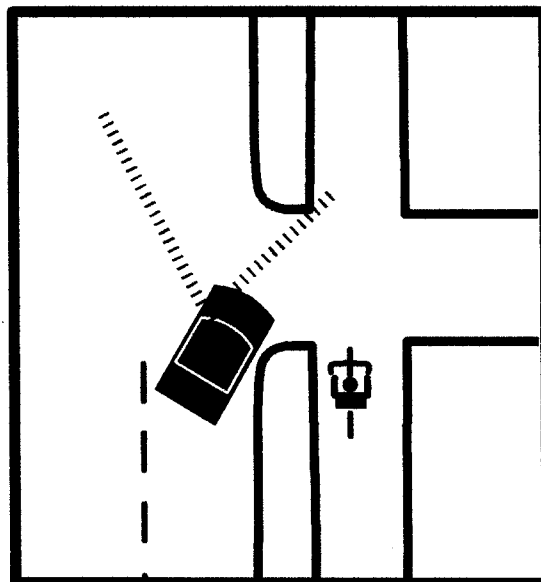
Home	About This Site	Email the Editor	Submissions	Sponsors	02/14/02
----------------------	---------------------------------	----------------------------------	-----------------------------	--------------------------	----------

Typical conflicts that occur when a separate bicycle path is placed close and parallel to a street with numerous driveways and/or cross streets.



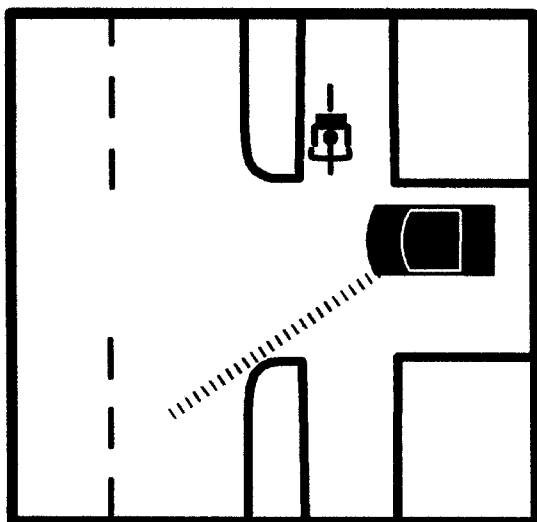
Left Turn from Main Street Conflict

Normally, traffic wanting to go straight passes left turning traffic to its right, but the path places users wanting to go straight to the left of left-turning traffic. Motorists turning left off the main street will check for oncoming traffic, not for overtaking traffic on the path to their left.



Right Turn from Main Street Conflict

Normally, traffic wanting to go straight through passes right turning traffic on its left. Motorists turning right off the main street will look for traffic ahead, not for overtaking traffic on the path to their right.



Right Turn from Side Street Conflict

Normally, road users wanting to turn right onto the main street from a driveway or side street will check to their left, where traffic normally comes from. Rarely do motorists check the sidewalk or roadway edge to their right. This is why wrong-way bicyclists have so many collisions.

Motorists will be unlikely to check for path users to their right.

Wide Outside Lanes Are Superior to Bicycle Lanes

by Wayne Pein

To make busier roads so-called "Bicycle Friendly," added space allows easier overtaking by motorists and resulting comfort for people on bicycles. On urban design roads this added space can be wide outside lanes (WOLs) or bike lanes (BLs). A WOL is a shared-use lane that is wider than a standard 12 foot lane; 14 to 16 feet is typically recommended (Figure 1). A BL is a striped and signed space exclusively for the use of bicyclists and is typically 4 or 5 feet wide (Figure 2). Envision no stripe and signs on a BL road and you have a WOL. A third option, a paved shoulder, is similar to a BL but is typically used on rural design roads without curb and gutter.

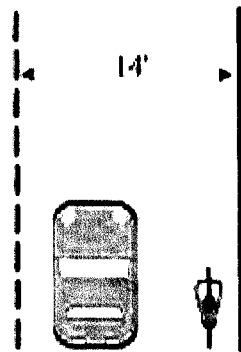


Figure 1: Wide Outside Lane

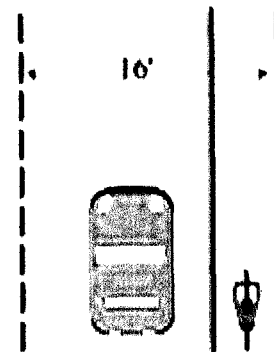


Figure 2: Bike Lane

Following are issues that should be considered in deciding whether to install WOLs or BLs.

1. Safety. BLs are often touted as increasing bicyclist safety. Surprisingly, neither BLs nor WOLs have been shown to actually increase safety as defined by reduced collisions. Both simply provide space, make passing easier for motorists and affording comfort to bicyclists. Similarly, neither has been shown to be more safe than the other. However, proving safety or lack thereof through collision studies is quite difficult.

BLs give the illusion of safety, typically reported as bicyclist comfort, presumably due to a perceived protective effect from the stripe. Ironically, BLs exacerbate certain hazards for the unwary rider, the very rider they are installed to accommodate. BLs constrain bicyclists in the position where Drive Out, Left Cross, and Right Hook (Figures 3-5) collisions are more likely, the three main risks for otherwise legally riding bicyclists, and increase the hazard from debris (item 5). These crashes occur at driveway or roadway intersections, involve turning or crossing maneuvers, and are not prevented with BLs. Note: The Figures do not reflect BL striping.

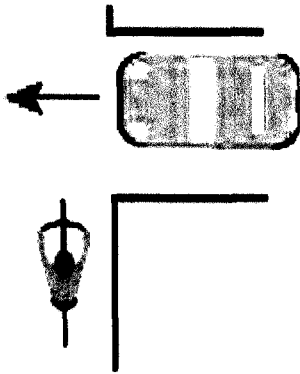


Figure 3: Drive Out Collision

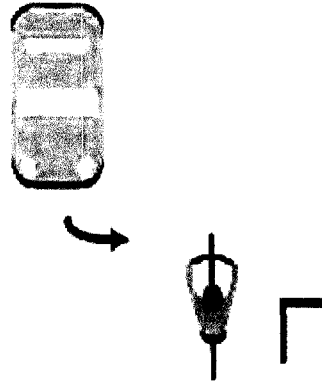


Figure 4: Left Cross Collision

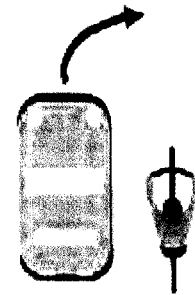


Figure 5: Right Hook Collision

The three crashes are partly a result of bicyclists being too close to the edge of the road. BLs tend to aggravate this problem because of the constraining nature of the stripe, and the physical, operational, and visual separation between motor and bicycle traffic that BLs produce. The educational countermeasure to bicyclists for these collisions is RIDE BIG - Use More Lane or Use Full Lane. This message is thwarted by BLs because of the restrictive stripe. Bicyclists might ride curbside in a WOL, but a WOL does not direct them to be in that position.

The actual main risks of bicycle-motor vehicle collisions are thus quite different from the perceived main risk which is the bicyclist being struck from behind, known as an Overtaking type crash. The demand for BLs by some bicyclists is a reaction to the perceived risk of an Overtaking collision. However, this crash is very rare, whether the road is narrow, normal, or wide, with or without BL or shoulder stripes. Motorists have little difficulty avoiding a 5 foot high by 2 foot wide bicyclist riding in the same direction, no matter what the road. The few Overtaking collisions that do occur are typically not preventable with BLs because of the circumstances under which they happen - riding unlit at night or driving with distraction are examples.

Nationwide and local level collision studies have shown that most bicycle-motor vehicle crashes are caused by errors made by the bicyclist. The more common of these errors include riding on sidewalks, failure to obey stop signs and traffic signals or yield as appropriate, wrong way riding, riding at night without lights, and failure to recognize risky situations. The way to prevent these mistakes, as well as collisions in which the motorist is largely to blame, is through education. However, many novice bicycle users think that they know all they need to know. The presence of BLs makes the task of promoting bicycle education even more difficult.

[Two separate bicycle-motor vehicle crash analyses (Bicycle-Motor Vehicle Crashes in Chapel Hill, 1993-1995 and 1996-1999) spanning 7 years have shown the three most prevalent collisions in Chapel Hill to overwhelmingly be the Drive Out, Left Cross, and Right Hook (Figures 1-3).]

2. Design Standards. Scant attention has been paid to the design speed of BLs. The AASHTO Guide for the Development of Bicycle Facilities does not address the issue. California has stated "Bike lanes are not advisable on long, steep downgrades, where bicycle speeds greater than 50 km/h (31 mph) are expected. As grades increase, downhill bicycle speeds will increase, which increases the problem of riding near the edge of the roadway." It can be argued that this specified 50 km/h is too liberal and

should be lowered. Regarding the design of separated shared use paths, the AASHTO Guide notes, "Grades greater than 5 percent are undesirable because the ascents are difficult for many bicyclists to climb and the descents cause some bicyclists to exceed the speeds at which they are competent or comfortable."

Since BLs are said to be installed for the explicit purpose of accommodating novices, high speed descents in narrow BLs should be avoided. The laws of physics make 20-40 mph gliding speed on typical descents easily achievable by all bicyclists regardless of experience or ability. At such speeds it is a breach of safety to constrain all bicyclists in a 4-5' BL at the edge of the road. Left Cross and Drive Out threats, the curb itself, natural and motor vehicle induced wind buffeting, and the ever present debris are hazards that demand the rider Use More Lane or Use Full Lane for added leeway and conspicuousness.

The purpose of a paved striped-off shoulder is to reduce the risk of run-off-road crashes by motorists and to provide greater leeway from roadside hazards. It is not for motor vehicles to drive on. Similarly, it is not safe to ride a bicycle on such a facility, a BL or paved shoulder, when there is high speed descending. WOLs or regular width lanes have no design speed limitations that bicycles typically exceed.

BLs must be on both sides of the street, conforming to the "All or None" principle. A BL on one side of the road only, the ascent of a hill for example, is not acceptable due to the great possibility of attracting wrong way riders. Thus, on a hilly road if right of way is at a premium, a WOL on the ascent can be paired with a regular width lane on the descent for even more space and cost savings (item 4).

Basic principles of the road transportation system are one set of rules (uniformity), simplicity, destination positioning (segregation by destination), and cooperation and trust by users. Segregation by vehicle type violates all these concepts. BLs segregate bicycles from other vehicles. There are inherent difficulties and compromises when designing such facilities as HOV lanes (segregation by occupant quota) and dedicated bus lanes. It is no surprise that similar and additional challenges occur when separate space is outlined for bicycling.

[The NCDOT recently determined that left lane HOV lanes are infeasible on I-40 due to the difficulty of exiting right. Similarly, right side BLs make it difficult for bicyclists to exit left at intersections or midblock driveways.]

[In Chapel Hill, the descents on virtually all main roads including Airport Rd., Franklin St., Columbia St., Estes Drive and Estes Dr. Ext., Weaver Dairy Rd., etc. lead bicyclists to routinely achieve speeds of 25 to 40 mph gliding, so BLs are not acceptable. Piney Mt Rd has WOLs on most of the ascents and narrow lanes elsewhere.]

3. Intersections. As noted in item 1. Safety, the three most common adult bicyclist crashes occur at junctions (Figures 3-5). A BL adds to complexities at intersections and roads in general, violating the simplicity principle of roadway design. A 5-lane road becomes a 7-lane road when BLs are added. A WOL does not add to the complexity of the roadway.

Novice bicyclists wishing to turn left tend to not merge to the left far enough in advance or at all, and this error is exacerbated by BLs. Depending on the situation, any bicyclist needing to turn left may have to merge left quite far in advance of the turn, as do motorists, but some motorists would take issue with a bicyclist who is not in the BL (item 7). Thus, all bicyclists, regardless of experience, are deterred from proper vehicular operation by BLs.

A BL encourages bicyclists to overtake motorists on the right side and to go to the front of the queue. Passing on the right is very risky and leads to many Right Hook collisions (Figure 5). WOLs enable bicyclist passing on the right, but it is not as formally legitimized as with BLs.

Right turning motorists turn across the BL rather than merging into it since it is not possible to merge into a 4 to 5 foot wide lane that is for bicyclists only. This can result in Right Hook collisions. Right turning drivers may also improperly, albeit courteously, wait in the through lane to allow bicyclists in a BL to overtake on their right. This obstructs following motor vehicles and creates an ambiguous situation for the bicyclists.

4. Right of Way and Funding. A 4 or 5 foot BL beside a standard 12 foot lane (16 or 17 feet total) requires more space and costs more in ROW acquisition and construction than a 14 or 15 foot WOL. Less total width of a WOL means less impermeable surface to contribute to downstream flooding.

While state and local funding programs differ around the country, bicycling specific facilities typically are funded from relatively small, dedicated sources. Thus, money is limited, and bicycling and walking projects (BLs, off road paths, sidewalks) often compete among themselves for funding.

Although BLs can in theory be funded from much larger sources, such as the Surface Transportation Program (STP) category, DOT's are often loathe to do so. WOLs need not be an identifiable bicycling facility, and thus may be more easily funded. This, in combination with the typically lower cost of WOLs compared to BLs, means WOLs can be more likely to be constructed.

[The BLs north of Homestead Rd. on Airport Rd. in Chapel Hill are about 6000 feet long and 5' wide, 1' wider than is required. Here, 15' WOLs would have saved 24,000 (2 x 6000 x 2) square feet of impermeable surface, and considerable money in ROW acquisition and roadway construction costs. Furthermore, the excessively wide BLs have predictably become riddled with debris.]

5. Maintenance and Debris. BLs collect debris, as do shoulders on any road. The sweeping action of motor vehicles results in the debris being whisked into the BL where it stays. This debris is barely noticeable to motorists, but is an ever present nuisance and hazard for bicyclists. Tree debris, trash, sand, and gravel are ubiquitous. Gravel itself can cause loss of control, but also damages tires, causing sidewall cuts (which requires costly tire replacement), possibly resulting in blowouts and loss of control. Thus, BLs require frequent and expensive maintenance, which unfortunately typically doesn't happen. Even if regular maintenance were scheduled, the time between sweepings may still be debris riddled.

WOLs require less, if any, maintenance and cost. Because WOLs are typically narrower than a regular lane with BL, and since there is no stripe to keep motorists away from curbside in the absence of bicyclists, the sweeping action of motor vehicles clears debris from WOLs continuously, pushing it closer to the edge and out of bicyclists' way. However, there should still be cleaning of WOLs on an as-needed basis.

6. Induced Riding/Perception. BLs are touted as drawing new and novice bicyclists because they report they "feel" safer or are more "comfortable." While opinion surveys are illustrative, one must reasonably question the significance of the attitudes of those who by definition are not familiar with all of the issues. Furthermore, preferences and opinions do not void the actual safety, fiscal, maintenance, and liberty (item 7) costs of BLs.

The appeal for BLs is a desire for additional road space. Novice bicyclists fear getting hit from behind, the unlikely Overtaking type of collision, or are otherwise intimidated by overtaking traffic, and so

request BLs, the only on-road accommodation they may know to exist. They don't realize the down sides of BLs nor the option of WOLs. As bicyclists gain knowledge of the actual risks of riding and how to reduce these risks, and become aware of the negative issues surrounding BLs, all of this either by experience or through education, they often no longer desire BLs on most roads.

It is argued WOLs serve existing bicyclists well but may do little to encourage would-be bicyclists who are attracted to BLs which are "advertised." However, there is no indication that BLs would induce substantially, or any, more riding than would well advertised, perhaps with signs, WOLs. WOLs could be marked with "Share the Road," "Bicycle Route," "Bikes Belong" or some similar sign in an effort to appeal to prospective riders.

It can be argued that it is not ethical to attract novice riders to potentially dangerous situations because of the mere perception of safety afforded by BLs. Comfort sometimes results in complacency and a false sense of security. A BL, especially, or a even WOL, may seem safe, but are only as safe as the bicyclist riding.

7. Sociology. BLs segregate bicycle traffic physically, operationally, visually (left turning drivers don't readily notice BLs which are much narrower than regular lanes), and socially.

§20-4.01 (49) of the NC traffic code says: "...for the purposes of this Chapter bicycles shall be deemed vehicles and every rider of a bicycle upon a highway shall be subject to the provisions of this Chapter applicable to the driver of a vehicle except those which by their nature can have no application." Thus, bicycle riders have equal rights to the road as do other vehicle operators. This means that bicycle users are entitled to use of the full lane, since no vehicle operator is required to share his or her lane. Bicyclists usually willingly share their lane with overtaking motorists, but there are many situations when the bicyclist must use the full lane.

A BL has the effect of teaching novice riders that they must remain in that space. Usually, on the right side of the lane is where a bicyclist would be riding whether there is a stripe or not. But in the situations where she must move left out of that space: to make a left turn at an intersection or mid block; create shy distance when high speed descending; avoid parked cars, pedestrians, wrong way bicyclists, debris, etc., a bicyclist may be treated as violating a rule. The threat of motorist coercion makes leaving the BL unappealing for all bicyclists regardless of experience.

A BL sends the message to motorists and bicyclists alike that bicyclists have less right to be out of the BL. Where BLs exist, the remainder of the road becomes defacto Motor Vehicle Lanes. BLs create the expectation in motorists that bicyclists will and must stay "where they belong," in the BL. At the least, a bicyclist not in the BL is considered in an unexpected position.

Some motorists make the incorrect assumption that bicyclists should be on the sidewalk. This can manifest as "Get on the sidewalk!" yells, honking, or even physical harassment. When on-road space is specifically outlined for BLs, that assumption is even stronger. "Get in the Bike Lane!" Some places have made laws requiring bicyclists to be in BLs unless there is specific justification to be out of them.

BLs are requested and prescribed for the worthy cause of making the streets "Bicycle Friendly" so that some bicyclists are more "comfortable" and perhaps more riding will result. But this is at the cost of reduced freedom of all bicyclists to use the remainder of the road, which, with BLs, has now become the Motor Vehicle Lanes. In a WOL or regular lane, bicyclists are free to ride where they choose. "They that can give up essential liberty to obtain a little temporary safety deserve neither liberty nor safety." Benjamin Franklin, Historical Review of Pennsylvania, 1759. BL proponents espouse segregation, while

WOL adherents seek integration.

It is argued that BLs are visible icons to the legitimacy of bicyclists. State law says bicyclists are legitimate on all roads (except limited access roads). Do BL proponents want to be legitimate only on BL roads? Again, WOLs or regular width roads can have "Share the Road," "Bike Route," or "Bikes Belong" signs if bicyclist legitimacy needs to be affirmed.

As previously noted (item 2), the road system is based on mutual cooperation and trust by users. The BL stripe removes any need for cooperation, resulting in closer and likely higher speed overtaking (item 9). BL proponents fundamentally mistrust other road users. WOLs, like normal width shared lanes, require and foster cooperation and trust.

8. Sidewalk and Wrong Way Riding. BLs and WOLs tend to reduce the incidence of sidewalk riding, but the strength of the effect for each is unknown and subject to local conditions. Sidewalk bicycling has been shown to have about twice the accident rate as bicycling on the roads.

BLs more readily enable wrong way riding, possibly because the BL is viewed as a safe haven. Wrong way riding in BLs and elsewhere is a significant collision threat with motor vehicles, especially those pulling out of side streets and driveways, and also with correct riding bicyclists who are in the same path. Bicyclists are not as likely to ride the wrong way in WOLs, though wrong way riding can and does happen anywhere.

While sidewalk riding should be discouraged, sidewalks will likely always be a perceived attractive place to ride by some bicyclists. For those too timid to use an available WOL, the sidewalk can be an alternative.

9. Overtaking Operations. The separation distance between overtaking motor vehicle and bicycle has been found to be about 6" less in a BL than in a WOL. It is ironic that a BL that is supposed to provide "comfort" to bicyclists from passing motor vehicles also encourages motorists to pass closer. Perhaps with a BL, as long as the bicyclist is in her lane and the motorist in his, there is little perceived need on the part of the motorist to move over.

Related, there is greater uniformity of motor vehicle tracking, and motorists are less likely to encroach on the adjacent travel lane when overtaking a bicyclist in a BL. This may be another manifestation of motorists not moving over, or moving over as far, for bicyclists in a BL. It could also be due to less total space afforded by a WOL, which could be addressed with wider WOLs. There is no evidence of motorist collisions due to overtaking-bicyclist encroachments.

Bicyclists tend to ride further from the edge of the roadway in a BL than in a WOL. This has several advantages. It is not known why bicyclists ride further from the roadway edge in a BL. It may be due to more curbside debris in the BL which forces the rider away from the edge, or the rider may be emboldened by the stripe. In any case, riding further from the edge is a positive behavior, and one which is espoused by experienced bicyclists whether there is a BL stripe, the road is wide, or narrow.

It is argued that BLs narrow the motorists' travel area so may have a traffic calming effect. However, this effect, if it exists at all, is likely to be location specific. Many narrow rural roads, for example, are quite high speed. It also may be that motorists pass bicyclists at higher speed on a BL road than in a shared lane. This is often reported by experienced bicyclists. Again, as long as the motorist is in his lane and the bicyclist in hers, there is little perceived need to slow down. Possibly the ambiguity of overtaking in a WOL encourages motorist caution, thus slower speed.

Conclusions. WOLs have been the default bicycling "facility" of the NCDOT and the Division of Bicycle and Pedestrian Transportation for more than 20 years for good reason. Providing WOLs on main roads enables bicycling by all abilities of rider at the least cost without artificially introducing complexity and problems. Many WOLs exist on North Carolina roads, but they often go unnoticed because they unglamorously do their job. Note that many conspicuous "problem" streets have narrow lanes.

[In Chapel Hill, five lane Airport Rd. and Raleigh Rd. both have 13' WOLs from gutter pan edge (virtual) to line. These function acceptably, but ideally should be 15 feet. Other streets with WOLs include Estes Dr. from the library to Curtis Rd., eastbound Franklin St. in front of University Square, Pinehurst, parts of Piney Mt. Rd., and others.]

BLs may be warranted on limited access highways which have on and off ramps, the lack of driveways and intersections, and very high speed motoring. In such situations, the absence of turning movements and cross traffic, and large speed differential makes BLs a more viable option. The BL should be a minimum 6 feet wide with ample clearance to lateral obstructions. Regular debris removal should be scheduled.

Bicycle riding is unfortunately often made out to be - by injury control professionals, the media, and bicyclists themselves - more difficult and dangerous than it actually is, requiring "elite" skill or BLs. Given the problems of BLs, it is apparent that BLs require as much or more skill than WOLs, which are simply wider regular roads.

The inherent baggage BLs bring is not worth any speculative reward of better and more bicycling beyond what can be expected by providing WOLs. The best way to make most busy roads "Motorist Friendly in the Presence of Bicyclists, Resulting in Bicycling Friendliness" is to provide WOLs. They are simple, and simply better.

**Used with permission of Wayne Pein and the North Carolina Coalition for Bicycle Driving. (<http://humantransport.org/bicycledriving/>) Wayne Pein was a bicycling safety researcher for 7 years and currently operates Bicycling Matters, consultation business. (wpein@bellsouth.net)



Excerpts from the 1999 AASHTO

Guide for the Development of Bicycle Facilities

Go to the AASHTO website at <http://www.transportation.org> for more information.

Design Highways for Bicyclists

Assume cyclists will use the roads: "All highways, except those where cyclists are legally prohibited, should be designed and constructed under the assumption that they will be used by cyclists. Therefore, bicycles should be considered in all phases of transportation planning, new roadway design, roadway reconstruction, and capacity improvement and transit projects." *Page 1*

Measuring Bicycle Demand

Bicycle counts and potential demand: "Bicycle counts can be used to identify locations of high use. However, caution should be exercised when using bicycle counts as a measure of current demand. These numbers can considerably underestimate potential users. Traffic generators along the prospective route should be evaluated as to the potential bicycle traffic they would generate, given better conditions for bicycling." *Page 9*

Consider Different Cyclist Types

Bicycle facilities for different cyclist types: "...The choice of highway design will affect the level of use, the types of user that can be expected to use any given road, and the level of access and mobility that is afforded bicyclists. For example, a four-lane divided highway with 3.6-m (12-foot) travel lanes, no shoulder and an 85 km/hr (55 mph) speed limit will attract only the most confident of riders. The same road with a 1.5-m (5-foot) shoulder or bike lane might provide sufficient "comfortable operating space" for many more adult riders, but would still not be comfortable for children or less confident adults. This latter group might only be accommodated through an alternative route using neighborhood streets linked by short sections of shared use path. If such an alternative route is provided and the four-lane

road has a continuous paved shoulder, most experienced and many casual adult riders will continue to use the shoulder for the sake of speed and convenience." *Pages 6-7*

Space Recommendations for Bicyclists

Minimum bicycle facility width: "An operating space of 1.2 m (4 feet) is assumed as the minimum width for any facility designed for exclusive or preferential use by bicyclists. Where motor vehicle traffic volumes, motor vehicle or bicyclist speed, and the mix of truck and bus traffic increase, a more comfortable operating space of 1.5 m (5 feet) or more is desirable." *Page 5*

Paved shoulder minimum width: "Paved shoulders should be at least 1.2 m (4 feet) wide to accommodate bicycle travel.... Additional shoulder width is also desirable if motor vehicle speeds exceed 80 km/h (50 mph)...." *Page 16*

Minimum width of bike lanes, no curb and gutter: "For roadways with no curb and gutter, the minimum width of a bike lane should be 1.2 m (4 feet).... A width of 1.5 m (5 feet) or greater is preferable and additional widths are desirable where substantial truck traffic is present, or where motor vehicle speeds exceed 80 km/h (50 mph)." *Pages 22-3*

Minimum width of bike lanes, with curb and gutter: "(For a) bike lane along the outer portion of an urban curbed street where parking is prohibited, the recommended width of a bike lane is 1.5 m (5 feet) from the face of a curb or guardrail to the bike lane stripe. This 1.5-m (5-foot) width should be sufficient in cases where a 0.3-0.6 m (1-2 foot) wide concrete gutter pan exists...." *Page 23*

Bike lane/shoulder maintenance and cleaning: "Regular maintenance of bicycle lanes (and shoulders) should be a top priority, since bicyclists are unable to use a lane with potholes, debris or broken glass." *Page 8*

Wide curb lanes: "Wide curb lanes for bicycle use are usually preferred where shoulders are not provided, such as in restrictive urban areas. On highway sections without designated bikeways, an outside or curb lane wider than 3.6 m (12 feet) can better accommodate both bicycles and motor vehicles in the same lane and thus is beneficial to both In general, 4.2 m (14 feet) of usable lane width is the recommended width for shared use in a wide curb lane." *Page 17*

Sidewalks and Bicyclists

Sidewalks as bike facilities: "In general, the designated use of sidewalks (as a signed shared facility) for bicycle travel is unsatisfactory. It is important to recognize that the development of extremely wide sidewalks does not necessarily add to the safety of sidewalk bicycle travel.... Sidewalk bikeways should be considered only under certain limited circumstances,

such as: a) To provide bikeway continuity along high speed or heavily traveled roadways having inadequate space for bicyclists, and uninterrupted by driveways and intersections for long distances. b) On long, narrow bridges...." *Page 20*

"Utilizing or providing a sidewalk as a shared use path is unsatisfactory for a variety of reasons. Sidewalks are typically designed for pedestrian speeds and maneuverability and are not safe for higher speed bicycle use. (Various bicycle/sidewalk user conflicts described)...At intersections, motorists are often not looking for bicyclists (who are traveling at higher speeds than pedestrians) entering the crosswalk area, particularly when motorists are making a turn. Sight distance is often impaired...." *Page 58*

"It is important to recognize that the development of extremely wide sidewalks does not necessarily add to the safety of sidewalk bicycle travel. Wide sidewalks might encourage higher speed bicycle use and can increase potential for conflicts with motor vehicles at intersections, as well as with pedestrians and fixed objects." *Page 58*

Shared Use Paths and Bicyclists

Adjacent path crossings: "...occur where a path crosses a roadway at an existing intersection between two roadways.... It is preferable that this type of crossing be carefully integrated close to the intersection so as to allow motorists and path users alike to recognize each other as intersecting traffic." *Page 48*

Shared use paths and on-road facilities: "Shared use paths should not be used to preclude on-road bicycle facilities, but rather to supplement a system of on-road bike lanes, wide outside lanes, paved shoulders and bike routes." *Page 33*

"When two-way shared use paths are located immediately adjacent to a roadway, some operational problems are likely to occur. (9 listed) ...other types of bikeways are likely to be better suited to accommodate bicycle traffic along highway corridors, depending upon traffic conditions. Shared use paths should not be considered a substitute for street improvements even when the path is located adjacent to the highway, because many bicyclists will find it less convenient to ride on these paths compared with the streets, particularly for utility trips." *Page 35*

Width of shared use paths: "Under most conditions, a recommended paved width for a two-directional shared use path is 3.0 m (10 feet)." *Page 35*

Intersections of roads and shared use paths: "For a roadway user (at a path crossing), a clear message must be presented in a location where it will be seen by that user. Traditional treatments have included (various signs), or flashing yellow lights at the crosswalk. However, signs are frequently placed at the side of the road, out of motorists' line of sight, and

historically, flashing yellow lights have also been used at non-crosswalk applications. In recent years, new applications have been developed, including...'zebra-style' or colorized pavement crosswalks, which are far more visible than traditional designs...." *Page 53*

"Traffic signals for path-roadway intersections are appropriate under certain circumstances. The MUTCD2 lists 11 warrants for traffic signals, and although path crossings are not addressed, bicycle traffic on the path may be functionally classified as vehicular traffic and the warrants applied accordingly." *Page 50*

Return to the LIB Roads and Transportation Page

[Return to the LIB home page](#)

Page created on January 25, 2001 - send comments to the [LIB webmaster](#)

**Used with permission of Al Sturges, President of the League of Illinois Bicyclists.