

Bicycling and On-Street Parallel Parking

with Critiques of 2 Related Documents

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Introduction

This report, while recognizing the utility, demand for, and political implications of on-street parking, focuses on informing the reader of its impacts on bicycling, and discusses mitigating the effects of parallel parking given its existence.

Discussion

On-street parking is detrimental to bicycling for several operational reasons.

1. The space occupied by parked private vehicles in the public right-of-way is potentially useful for bicycle travel. Parking narrows the available travel corridor, reducing motorist overtaking space and causing some bicyclists to feel less comfortable.
2. Parking turnover, the pulling into and out of spaces, can be a hazard to bicyclists.
3. On-street parking can reduce sight lines at intersections and driveways, increasing the likelihood of right angle collisions (motorists also have this problem).
4. The extended door, sometimes suddenly, of disembarking occupants is a hazard to bicyclists who, in error or instructed and constrained by poorly designed Bike Lanes, ride within a door's width, in the "Door Zone," of the parked vehicles.

In urban areas with substantial on-street parking, so-called "Dooring" collisions are heavily overrepresented. A study of car-bike collisions in the Boston metropolitan area (Plotkin and Komornick, 1984) revealed a high incidence of bike-hitting-car-door crashes, 5.3% of all crashes compared to 0.8% in the seminal 1977 Cross and Fisher study. The most frequently occurring crash in Santa Barbara, CA in 1995 (tied with "Motorist Right Turn"), was "Bicyclist Strikes Parked Vehicle," comprising 16% of the total collisions (Pein, 1996). All were Dooring events. For more statistics see <http://www.bikexpert.com/bikepol/facil/lanes/dooring.htm>

Dooring has long been a recognized hazard. Typical bicycling education programs, whether taught formally or briefly described on maps or elsewhere, instruct bicyclists to ride more than a door's width from parked cars. It is understandable then that Bike Lanes — structures installed to channelize motorists and bicyclists and to induce bicycling by artificially increasing bicyclist comfort, including among novices — that are located within the Door Zone are cause for alarm.



Figure 1. Door Zone Bike Lane, Massachusetts Avenue, Cambridge, MA. Dana Laird fatality, July 2, 2002. Photo by Robert Winters, Cambridge Civic Journal.

Two recent documents endorse Door Zone BLs, *An Evaluation of Bike Lanes Adjacent to Motor Vehicle Parking* (Hunter and Stewart, 1999) and the *Bike Lane Design Guide* of Chicago (2002), deemed by the federally supported Pedestrian and Bicycle Information Center (www.bicyclinginfo.org) as a “best practice.” These reports are critiqued in Appendices A and B. Egregiously, neither document discusses lateral clearance requirements to obstructions, in this case extended, sometimes suddenly, motor vehicle doors.

Extensive effort is undertaken in transportation engineering standards to provide lateral clearance from obstructions, and adequate stopping sight distance. For examples, Section 2A.19 of the *MUTCD* has the standard for sign placement that “The minimum lateral offset from the edge of the shoulder (or if no shoulder exists, from the edge of the pavement) to the near edge of a roadside-mounted sign shall be 1.8 m (6 ft).” Further, “The minimum lateral offset is intended to keep trucks and cars that use the shoulders from striking the signs or supports.” The *AASHTO Roadside Design Guide* is an entire manual devoted to enhancing the safety of the roadside for motorists who leave the traveled way. The *AASHTO Guide for the Development of Bicycle Facilities* provides standards for these parameters in the design of multi-use trails.

Contrast the great effort to provide clearance from objects **off the traveled way**, with the practice of installing BLs within the Door Zone, in which case the fixed obstacle is actually **within the traveled way** of invited bicyclists and which may suddenly appear without warning, affording near zero stopping sight distance.

The necessary spacing from parked vehicles that bicyclists require can be easily calculated. It must be assumed that motor vehicles will be parked with their tires at least as far left as the longitudinal parking line, and that open doors will extend 45" beyond this, the longest measured door (Table 1). Bicyclists should be positioned so that their right side is 48" from the parking line to provide lateral clearance from an opened door. A bicycle is about 24" wide. Therefore, the bicycle tires should track a minimum of 60" (5') from the parking line.

Table 1. Selected open door extensions.

4 door	2 door
1996 Saturn wagon, 35"	1988 Chevrolet C1500, 37"
1997 Ford Taurus, 35"	1994 Geo Metro, 39"
1998 Town & Country van, 35"	1996 GMC 3/4 ton, 39"
1999 Subaru Legacy wagon, 36"	1990 Tempo, 44"
2001 Honda CRV, 36"	1991 LeBaron, 44"
2001 Escort, 36"	1996 Chevrolet Z28, 44"
1995 Honda Civic, 37"	1996 Monte Carlo, 45"
1999 Jeep Gr. Cherokee, 39"	1999 Cavalier, 45"
1995 Nissan Maxima, 40"	
1995 Lincoln Town Car, 40"	

“Parking Crosses” (Figure 2) can be used to mark a parking lane, delineate individual stalls, and visually and tactically communicate to bicyclists, and motorists, the necessary 5' of clearance from parked vehicles. If thermoplastic is used, the 5' extensions create a rumble strip effect, deterring operation in the Door Zone.

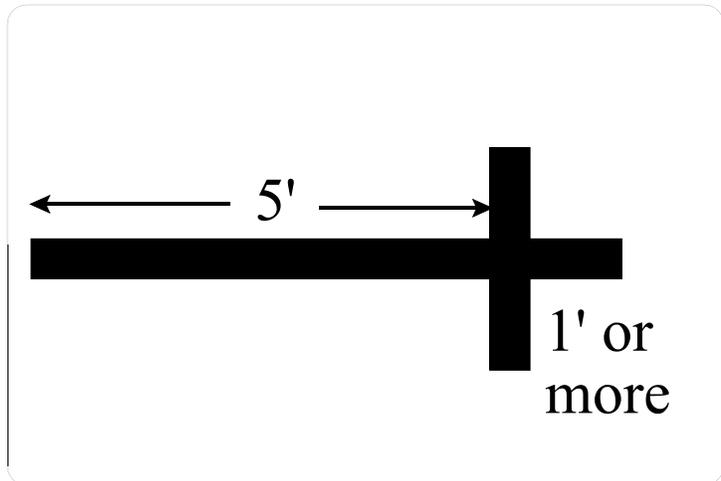


Figure 2. Parking Cross dimensions.

Figure 3 depicts two alternative marking schemes. The intent of Parking Cross installation to discourage bicyclists from riding in the Door Zone is consistent with typical obstruction marking and educational practice. This is in polar opposition to Door Zone BLs which attract bicyclists into the Door Zone.

The width of the traveled way to the left of the Parking Cross extension should be a function of traffic intensity and desired performance. A narrow width may induce traffic averse bicyclists into the Door Zone, while a wide area enables easy overtaking by motorists of lane sharing bicycle drivers.

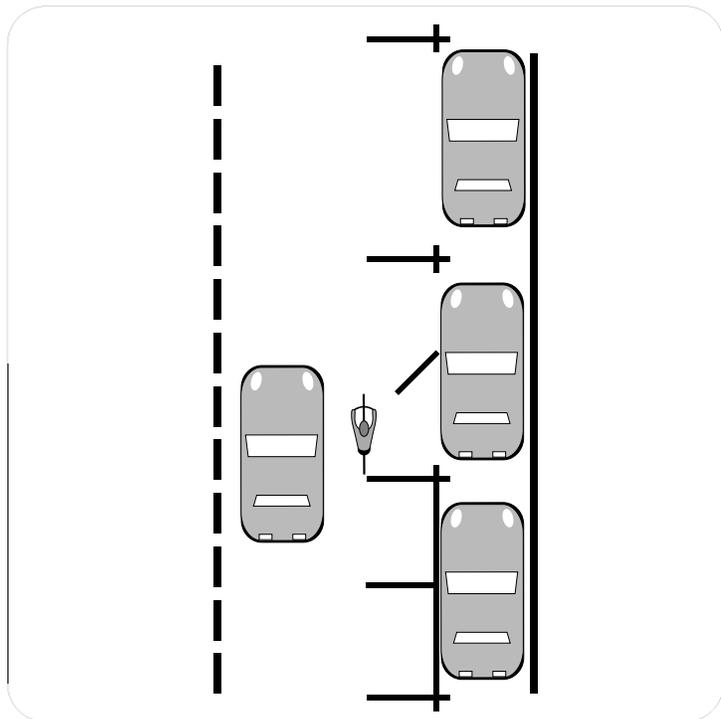


Figure 3. Parking Cross installation.

Conclusions

People using bicycles should expect an obstacle free travel way, as do motor vehicle operators. Bike Lanes which invite and constrain users to ride in the Door Zone create an unacceptable hazard with a potentially suddenly appearing fixed object. Marking BLs within the Door Zone is either a breach of safety by the unaware, or a negligent act by those who are mindful of the hazard. Educational interventions and engineering practice must be targeted in concert to result in bicyclists operating outside of the Door Zone.

References

Allen, John. 2003. <http://www.bikexpert.com/bikepol/facil/lanes/dooring.htm>

Bike Lane Design Guide. <http://www.bicyclinginfo.org/de/bikelaneguide.htm>

Hunter, William W. and Stewart J. Richard. 1999. *An Evaluation of Bike Lanes Adjacent to Motor Vehicle Parking*. University of North Carolina Highway Safety Research Center. Prepared for the Florida Department of Transportation Pedestrian/Bicycle Safety Section
http://www11.myflorida.com/Safety/ped_bike/ped_bike_reports.htm#Bike Lanes and Parking

Pein, Wayne E. 1996. *A Tale of Three Cities. Analysis of Bicycle-Motor Vehicle Crashes*,
<http://www.bicyclinglife.com/Library/TaleOfThree.htm>

Plotkin, Wendy and Komornick, Anthony, 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.
<http://www.bikexpert.com/research/ctps/index.htm>

Open door length data provided by Fred Oswald, Richard Moer, Ken Clark, and Wayne Pein.

Appendix A. Critique of *An Evaluation of Bike Lanes Adjacent to Motor Vehicle Parking*.

William W. Hunter and J. Richard Stewart. 1999. University of North Carolina Highway Safety Research Center. Study Prepared for the Florida Department of Transportation Pedestrian/Bicycle Safety Section.

http://www11.myflorida.com/Safety/ped_bike/ped_bike_reports.htm#Bike Lanes and Parking

This study examined the separation distances and conflicts at Bike Lanes (BLs) next to on-street parking on A1A in Ft. Lauderdale and Hollywood Blvd in Hollywood Florida. The authors also stated, “This evaluation compares roadways in Ft. Lauderdale and Hollywood, FL that have bicycle lanes (BLs) next to motor vehicle parking.” However, since the roadways were not matched on any variable, a strict comparison is invalid.

Figure 4 shows that the parking lane is quite narrow at approximately 6-7', not much wider than the parked vehicles or the 5' BL. A1A is similar. Apparent too is that most of the BL is within the so-called “Door Zone” of the parked vehicles since a typical door extends 3-3.5'. Thus, since bicyclists typically position themselves in the center of the BL (also confirmed by the study), they are at risk of being struck/striking a suddenly opening door.

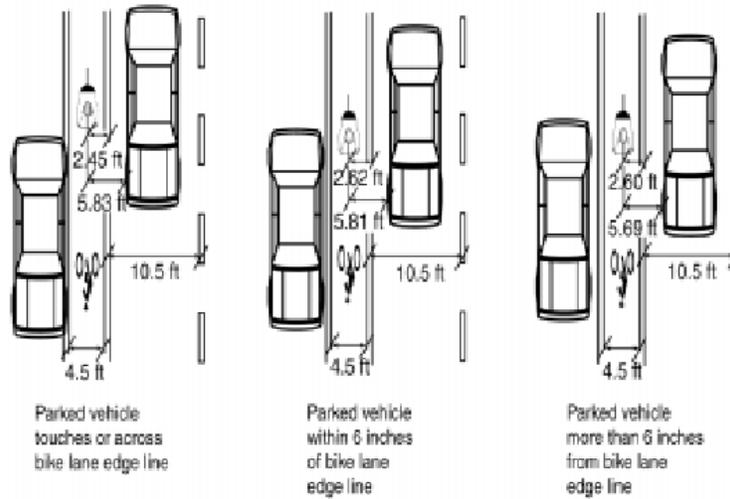
The study makes no mention of providing adequate lateral clearance to roadside obstructions, in this case suddenly opening doors actually within bicyclists' traveled way. This is especially surprising since the lead author is also the author of *Future of Real World Roadside Safety Needs* (Hunter, W.W. and F.M. Council, 1996), a report that predates the present effort by 3 years.

The actual spacing distances are shown below in Figure 5. The BLs are 4.5' wide (inside to inside) at A1A and 5' at Hollywood Blvd, and the adjacent lane widths are 10.5' and 12' respectively. Parking lane widths are not given. As can be seen in Figure 5, a condition “Parked vehicle touches or across bike lane edge line” occurred. The report does not specify the extent of this encroachment on the BL, nor does it give the distribution of parked vehicles or bicyclists riding under the other two parking distance conditions, “Parked vehicle within 6 inches of bike lane edge line,” and “Parked vehicle more than 6 inches from bike lane edge line.”



Figure 4. Hollywood Blvd.

A1A - Fort Lauderdale, Fl



Hollywood Blvd - Hollywood, Fl

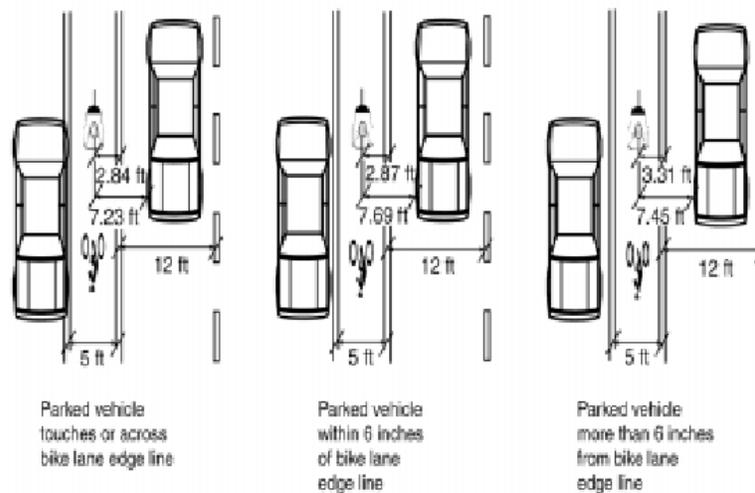


Figure 8. Mean distance from bicycle tire to outside of BL stripe and mean separation distance between bicycle tire and passing motor vehicle tire for three different parking positions.

Figure 5. Spacing distances.

Some of the study's notable conclusions are:

- “• There were few conflicts between bicyclists and motorists, pedestrians, and other bicyclists at either site, and all were minor. Conflicts per 100 bicyclists were 2.5 and 1.6 at the Ft. Lauderdale and Hollywood sites, respectively.
- Bicyclists tended to center themselves in the middle of the BL in the presence of a parked motor vehicle in both locations. There was a slight tendency for the bicyclists to ride a bit farther away from the edge of the BL stripe when the parked motor vehicle was closer to the curb.
- Bicyclists in both locations tended to ride farther away from the outside BL edge stripe in the presence of a passing motor vehicle, regardless of the position of the parked vehicle. The mean distances were greater on Hollywood Boulevard, most likely due to less parking turnover, less opening of doors, etc..
- For the three parking conditions, the mean spacings of bicyclists from passing motor vehicles were greater on Hollywood Boulevard by 1.4-1.9 feet. This difference basically amounts to the difference in the width of the BL and adjacent traffic lane on Hollywood Boulevard.”

The report also says, “The Ft. Lauderdale site was certainly far busier, with twice as much traffic and 10 times the parking turnover, but the cyclists using the BL seemed to accommodate to the situation quite easily. Their position in the BL and awareness of parking turnover was such that encounters with opening motor vehicle doors were almost nonexistent.” It is unclear specifically what the authors mean by this since data is not reported on the extent to which bicyclists altered their course from straight ahead or otherwise made accommodation such as braking, except those maneuvers deemed a “conflict.” A conflict was defined as “one of the parties having to *suddenly* change speed or direction to avoid a collision, a rather stringent definition.” The report found that bicyclists bisected the BL, which would put them squarely in the Door Zone, indicating that some must have altered course or braked even if it wasn't defined as *suddenly*.

The authors further say, “Perhaps the most important outcome was that spacing from motor vehicles was never less than 3 feet at the narrow-traffic-lane site, an amount generally deemed to be quite acceptable by cyclists.” It is unclear how the authors determined that the 3ft overtaking clearance is “quite acceptable by cyclists,” especially since the typical spacing afforded by overtaking motorists is approximately twice that amount (Harkey and Stewart, 1997). They concluded by stating, “The overall conclusion is that the narrowing of the traffic lane to retrofit the BL and parallel parking has been successful.” However, since a “before” evaluation without a BL was not conducted (A1A previously had angle parking. This was not formally examined, though there can be little doubt that the removal of angle parking is a positive change for bicyclists. More important, the condition of parallel parking without a BL was not evaluated.), there is no basis for comparison, and thus the declaration of a successful change is unfounded.

Critique Conclusions.

The BLs examined in this study are nearly wholly within the dangerous Door Zone of parallel parked vehicles. Bicyclists ride down the center of the BL, clearly within door striking range, and therefore must alter course or brake to avoid collision with a door that may suddenly open. There is insufficient clearance to lateral obstructions. In fact, the obstruction is within the traveled way onto which bicyclists are attracted and constrained by the BL markings and signs.

The condition of parallel parking without a BL was not examined, nor was the before condition of angle parking. This breach of proper research protocol invalidates the statement that the current condition of a Door Zone BL is a success.

It must be concluded that these and other Door Zone BLs are a government sanctioned known hazard for bicyclists. Bicycling advocates should make it known that Door Zone BLs are unacceptable. Traffic engineers should not install BLs that have inadequate clearance to lateral obstructions, and certainly not with fixed obstructions that may without warning appear in the traveled way.

References

Harkey, D.L. and Stewart, J.R. "Evaluation of Shared-Use Facilities for Bicycles and Motor Vehicles," *Transportation Research Record 1578*, 1997, pp. 111-118.

http://safety.fhwa.dot.gov/fourthlevel/design_b.htm

Hunter, W.W. and F.M. Council, "Future of Real World Roadside Safety Needs," *Transportation Research Circular Number 453*, Transportation Research Board, Washington, D.C., 1996, pp 38-54.

Appendix B. Critique of Bike Lane Design Guide.
<http://www.bicyclinginfo.org/de/bikelaneguide.htm>

This report is an amalgam of a design guide with detailed drawings for providing for Bike Lanes with on-street parking, and an advocacy pitch for BLs enumerated in an “FAQ.” The report is endorsed by the Pedestrian and Bicyclist Information Center, the Association of Pedestrian and Bicycle Professionals, the City of Chicago, and the Chicagoland Bicycle Federation.

Figure 6 shows a typical drawing from the Guide. I have modified the drawing by removing a BL stripe and adding the commentaries “Without BL, bicyclist is free to operate outside of “Door Zone,” and “With BL, bicyclist is constrained to ‘Door Zone.’”

Also in Figure 6, the parking lanes are 7' wide, just slightly wider than a typical passenger vehicle. Thus, an open door must extend into the BL, as is depicted.

The City of Chicago Department of Transportation created the drawings. Surely the attendant engineers realized that the BLs do not afford sufficient lateral clearance to the parked vehicles, and that a potentially suddenly opening door extends into the BL, creating an obstruction and hazard in the traveled way of bicyclists. The reviewers at the Pedestrian and Bicyclist Information Center, the Association of Pedestrian and Bicycle Professionals, and the Chicagoland Bicycle Federation should also have realized the inherent hazard the designs in the Guide create.

Safe Bicycling in Chicago, an educational booklet endorsed, produced, and freely distributed by the City of Chicago, the Dept. of Transportation, and the Chicagoland Bicycle Federation contains the message to ride in the middle of the traffic lane when “...(c) you’re avoiding potholes or the doors of parked cars.” These entities apparently ignore the disconnect between this proper educational intervention and the hazardous BLs that they engineer.

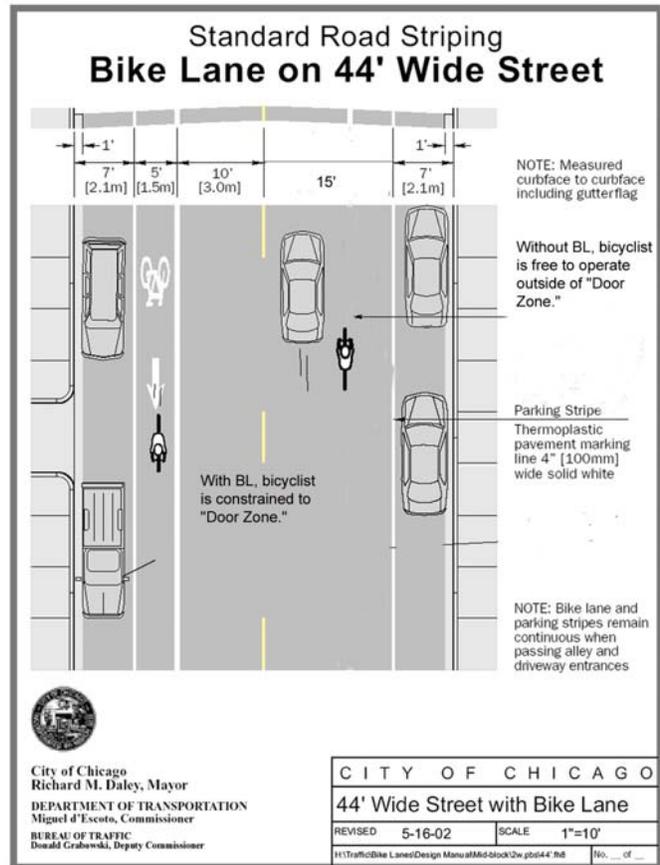


Figure 6. A drawing from the Guide, modified by the removal a Bike Lane stripe.

Note the striking similarity between the photos in Figure 7 from Chicago and Figure 8 from Cambridge, MA, another city that has embraced Door Zone BLs.



Figure 7. Bike Lane on Halsted in Chicago. From *Bike Lane Design Guide*.



Figure 8. Massachusetts Avenue, Cambridge, MA. Dana Laird fatality, July 2, 2002. Photo by Robert Winters, Cambridge Civic Journal.

Critique Conclusions.

Dooring is a recognized hazard. Door Zone BLs are counter to long standing educational interventions which instruct bicycle operators to ride at least a door's width from parked motor vehicles. Having been made aware of the hazards, those governmental and non-governmental agencies which endorse and create BLs within the Door Zone of parking must be liable for any collisions that occur.