Rethinking Bike Lane Design Standards:
The Importance of an Operating Concept
(Derived from “Understanding Bicycle Transportation” Workshop)
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Presentation Topics

A. Types of bike lane crashes we can minimize with an Operating Concept for design

B. Why AASHTO *Bike Guide* and MUTCD bike lane guidance doesn’t minimize crashes

C. Bike lane designs that reflect bike lane Operating Concept
A. Bike Lane Crashes We Can Minimize

1) Right Hook – Right turning drivers collide with through bicyclists

2) Left Cross – Left turning drivers collide with oncoming bicyclists

3) Drive Out – Driver exits driveway/alley without yielding

4) Dooring – Vehicle occupant opens door into bicyclist without yielding
73% of car-bike crashes are due to crossing movements.
1. Right Hook Crash Risk vs Road Position

Narrow curbside bike lanes don’t minimize right hook crashes

Source: Dan Gutierrez/Understanding Bicycle Transportation Workshop
Two Elements of Right Hook Crashes

Motorists fail to merge into narrow bike lane before right turn

Cyclists in bike lane stay at edge at intersection

Source: D Gutierrez/Understanding Bicycle Transportation Workshop
2. Left Cross Crash Risk vs Road Position

Narrow bike lanes next to curbs don’t minimize left cross crashes

Source: D Gutierrez/Understanding Bicycle Transportation Workshop
3. Drive Out Crash Risk vs Road Position

Source: D Gutierrez/Understanding Bicycle Transportation Workshop

Narrow bike lanes don’t minimize drive out crashes
Position further to left minimizes right hook, left cross, & drive out crashes.
4. Doorin Crash Risk – 12’/7’ Bike Lane

Source: www.iamtraffic.org
Impossible to Avoid Door Zone in 12’/7’ Bike Lane

Source: Vinny R, English Wikipedia Project

12’/7’ striping per AASHTO Bike Guide
Operating Concept For Bike Lanes

1. *Design for bicyclists with less confidence/crash avoidance skills.*

2. Apply traffic lane design principles

3. Minimize exposure to hazards:
   - turning, drive out, door zone
   - road surface, debris

4. Induce safe behavior: yielding, merging into bike lane to turn

Photos: D Gutierrez Understanding Bicycle Transportation Workshop
Rethinking Bike Lane Design Standards

A. Types of bike lane crashes we can minimize with an Operating Concept for design

B. Why AASHTO *Bike Guide* and MUTCD bike lane guidance doesn’t minimize crashes

C. Bike lane designs that reflect bike lane Operating Concept
30” Cyclist Needs 4-5’ Operating Space
Doesn’t include “shy distance” to objects
No guidance on clearance to traffic

Fig 4-14 Typical Bike Lane Cross Section
Bike Lane and Parking Width – To Scale

- Shows open door
- Vehicle 1’ from curb
- 1’ shy distance between cyclist edge and door edge

From: Truewheelers.org
AASHTO Bike Guide – Bike Lane Shifts Left for RT Lane

The scenario is the least preferred option and should be avoided where practicable. In this situation, the “BEGIN RIGHT TURN LANE YIELD TO BIKES” sign should not be used, since bicyclists are the users who need to yield as they are weaving across the path of motor vehicle traffic.

Is Bike Guide correct?
Through bicyclists merge left, turning motorists merge right
Who should yield? It’s ambiguous
Bike Lane Shifts For Right Turn Lane

Failed attempt to rectify yielding ambiguity

Source: D Gutierrez/Understanding Bicycle Transportation Workshop
MUTCD - Bike Lane Striping at RTOLs

MUTCD Fig 9C-4

- Dotted lines are optional

- RIGHT LANE MUST TURN RIGHT
  R3-7R

MUTCD Fig 9C-5

- Dotted lines are optional

- RIGHT LANE MUST TURN RIGHT
  R3-7R

- BEGIN RIGHT TURN LANE
  YIELD TO BIKES
  R4-4 at beginning of right turn only lane
MUTCD Bike Lane Striping Figures

MUTCD Fig 9C-6
Two-way road

Example of application where parking is prohibited
Normal width solid white line

Example of application where parking is permitted
Normal width solid white line (optional)

Signalized intersection

MUTCD Fig 9C-1
One-way road

No standards or guidance for striping or parking setback from corner
Driver Fails to Enter 6’ Bike Lane Next to Parking

Need MUTCD guidance for “no parking” setback from corner to induce drivers to merge into bike lanes before turning

Source: Google Earth
Bike lane encourages cyclist to stay in right hook position

Source: Understanding Bicycle Transportation Workshop

Do drivers recognize narrow bike lane as right turn lane?
Bike Lane Next to Parking - 13/8’ Bike Lane too Narrow

Entire bike lane in hazard zones

Door Zone

80” Wide SUV, Van or Truck; 40” door

Shy 1.5’

Close Pass Zone

Source: D Gutierrez/Understanding Bicycle Transportation Workshop
**13/7’ Bike Lane Per Bike Guide Recommendation**

- Is riding on the bike lane stripe the Operating Concept?

- Where should a bicyclist with a child trailer operate?
Bike Guide - Recommended “Wider” Bike Lanes

14’/8’ Striping

14’/9’ Striping

BL stripe at 14’ is still a door zone bike lane

Source: D Gutierrez/Understanding Bicycle Transportation Workshop

Source: www.labreform.org
A. Types of bike lane crashes we can minimize with an Operating Concept for design

B. Why AASHTO Bike Guide and MUTCD bike lane guidance doesn’t minimize crashes

C. Bike lane designs that reflect bike lane Operating Concept
15'/11’ - Out of Door Zone But Not Enough Clearance to Traffic

parking stripe at 11’ from curb guides cyclist out of door zone.

not enough clearance to traffic

80” Wide SUV, Van or Truck; 40” door

Close Pass Zone

shy 1.5’

Derived from D Gutierrez/Understanding Bicycle Transportation Workshop
16’/11’ Should Be The Minimum Next to Parking

Cyclist has clearance on both sides

80” Wide SUV, Van or Truck with door 40” wide

Derived from D Gutierrez/Understanding Bicycle Transportation Workshop
16’/11’ Should Be The Minimum Next to Parking

Bike Lane - 5' wide

Parking "T"

Note: All dimensions measured from curb

Source: D Gutierrez/Understanding Bicycle Transportation Workshop

Redondo Beach, CA
Bicyclist is clear of door zone anywhere in bike lane
Right Buffer Warns Bicyclist of Dooring Hazard

Adequate Door zone buffer

18’ curb to stripe

Source: D Gutierrez/Understanding Bicycle Transportation Workshop
Move Buffer From Left of Bike Lane to Door Zone

Source: D Gutierrez/Understanding Bicycle Transportation Workshop
Right Buffer Where Parking is Prohibited

Source: D Gutierrez/Understanding Bicycle Transportation Workshop
Left Buffer Can Increase Turning and Drive Out Crashes

- Induces motorist to merge late or turn across cyclist's path
- Induces cyclists to stay far to the right

Source: D Gutierrez/Understanding Bicycle Transportation Workshop
“Curb Diving” Left Buffered Bikeway

Bike lane hugs curb instead of maintaining a consistent lateral position, forcing bicyclists to keep shifting position.

Source: D Gutierrez/Understanding Bicycle Transportation Workshop
Right Buffer Applies Operating Concept

Source: D Gutierrez/Understanding Bicycle Transportation Workshop
- Increases visibility of cyclists
- Brings entire bike lane out of the gutter, away from crash hazards
- Allows cyclist to control clearance to traffic lane

Source: D Gutierrez/Understanding Bicycle Transportation Workshop

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Right Side Buffer - Midblock

Constant Lane Width

Right Side Buffer

Source: D Gutierrez/Understanding Bicycle Transportation Workshop
4’ buffer is too narrow to mistake for parking lane
Intersection Approach – Right Buffer

- Buffer is dropped for right turns from bike lane
- Bike markings on left to show position for through travel
- Add sign to MUTCD?

Source: D Gutierrez/Understanding Bicycle Transportation Workshop
Bike Lane Dropped for Right Turn Lane

Yielding Ambiguity

Source: D Gutierrez/Understanding Bicycle Transportation Workshop
Compare to Wide Bike Lane at Intersection

- Encourages merge into BL for right turns
- Adequate clearance from adjacent traffic lane
- Consistent/continuous travel path, aligns with bike lane on far side
- Minimizes drive out crash risk
- Bicyclist more visible to oncoming left turning traffic

Source: D Gutierrez/Understanding Bicycle Transportation Workshop
Right Buffered Bike Lane – Near Side & Far Side

San Pedro, CA

Source: D Gutierrez/Understanding Bicycle Transportation Workshop
Compare 3 Intersection Design Options

BL drops for RTL

POOR

RTL, exception for through bikes

BETTER

Continuous wide BL

BEST

Wide BL Applies Operating Concept

Source: John Ciccarelli

Source: D Gutierrez/Understanding Bicycle Transportation Workshop
A Preferential Use Lane is designed with the same consideration given to bus and HOV lanes.

- Must provide adequate operating space and clearance from vehicles in adjacent lanes.
- Must offer the same vantage as the drivers of other vehicles (outside exclusion zone).
- Intersection design must encourage right turning drivers to merge into—not turn across—the lane.

If there is not enough space to do this, then full use of a regular 10-12 ft travel lane should be encouraged.
A. We can minimize bike lane crashes with an Operating Concept for bike lanes

B. Improve AASHTO Bike Guide and MUTCD guidance with a sound bike lane Operating Concept

C. You can use bike lane designs that apply an Operating Concept now