PBIC Crash Types Series
Motorist Overtaking Bicyclist

Libby Thomas
UNC Highway Safety Research Center

Ken McLeod
League of American Bicyclists

Bill Schultheiss
Toole Design Group

Monday, August 6, 2018

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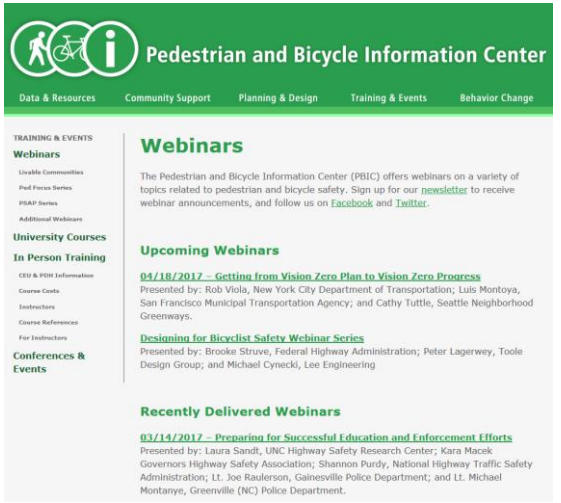

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Multiple Threat Crash

August 9, 1:00 – 2:30 PM Eastern Time

Charlie Zegeer
Highway Safety Research Center

Mike Cynecki
Lee Engineering

George Branyan
Washington, DC, DOT

Crash Animations

Developed to portray crash scenarios and support…

- Development of behavioral messages and campaigns
- Changes to roadway design
- Policy changes
- Conversations between community members and stakeholders

- Driver Education Instructors
- Law Enforcement
- General Public
- Advocacy Organizations
- Planners and Engineers
- Health Professionals

…and others

Available at www.pedbikeinfo.org/crashvideos

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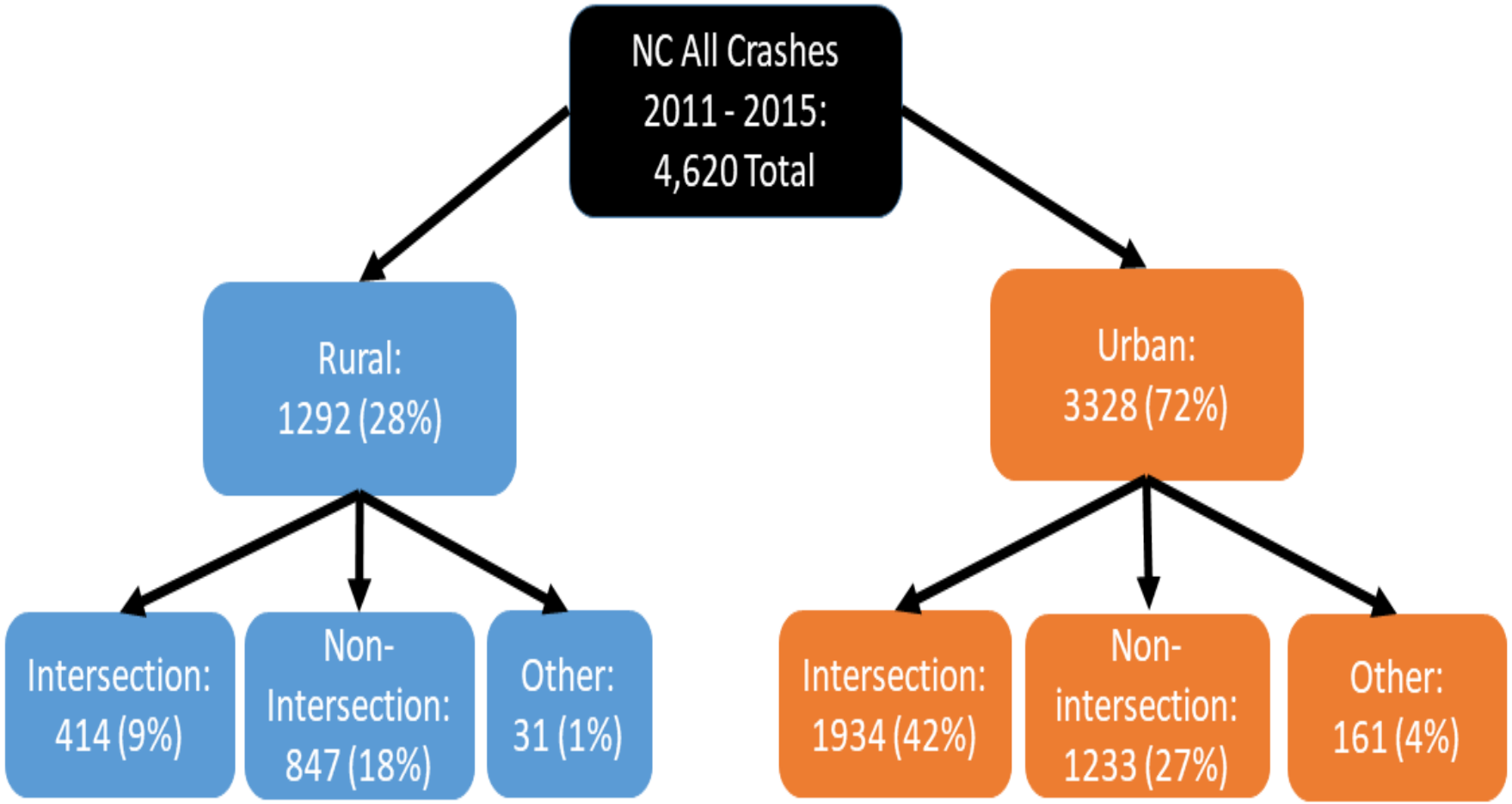
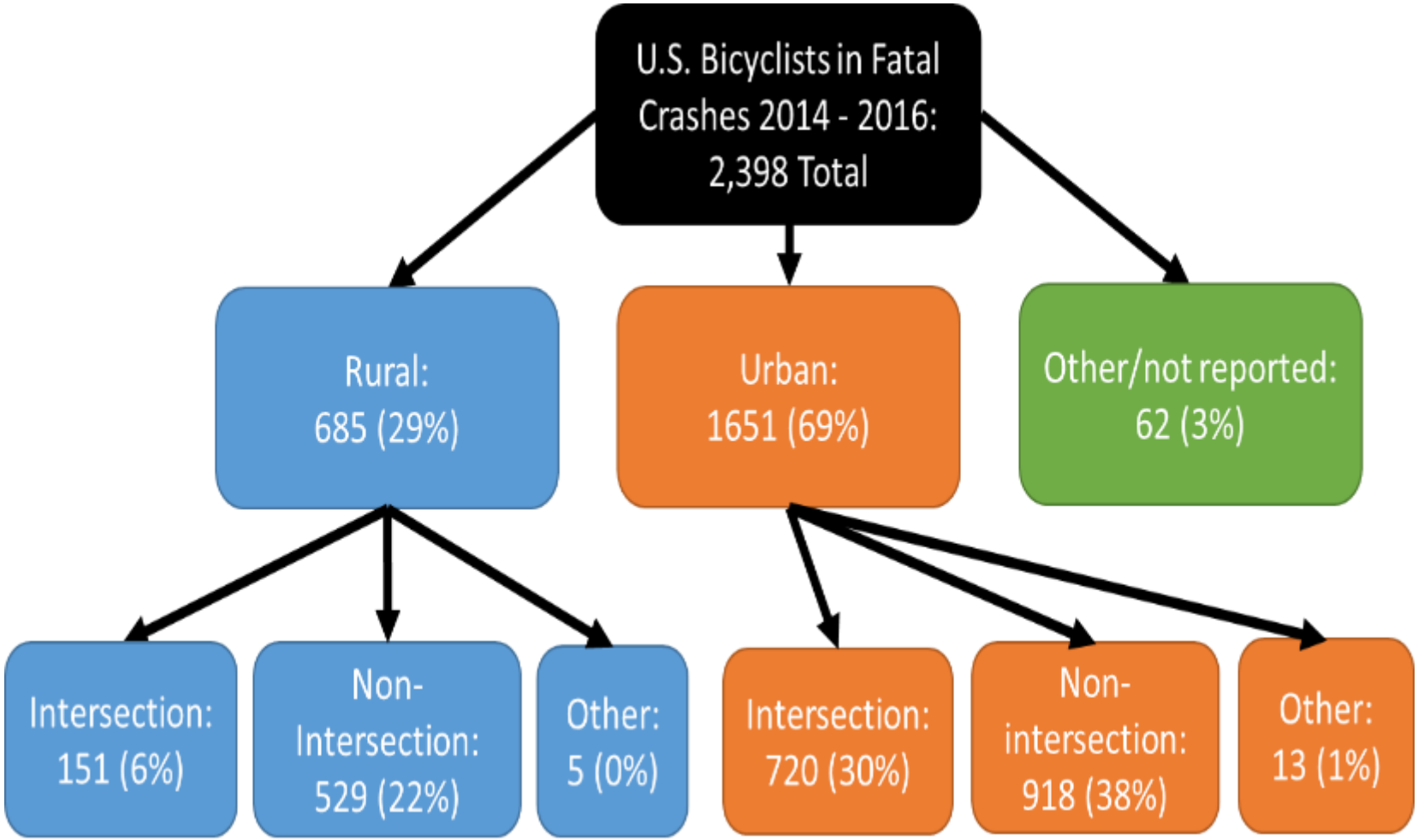
Motorist Overtaking Bicyclist Crash Type Trends

Libby Thomas
University of North Carolina Highway Safety Research Center

August 6, 2018


NC All Crashes
2011 - 2015:
4,620 Total
Rural:
1292 (28%)
Urban:
3328 (72%)
Intersection:
414 (9%)
Non-
Intersection:
847 (18%)
Other:
31 (1%)
Intersection:
1934 (42%)
Non-
intersection:
1233 (27%)
Other:
161 (4%)

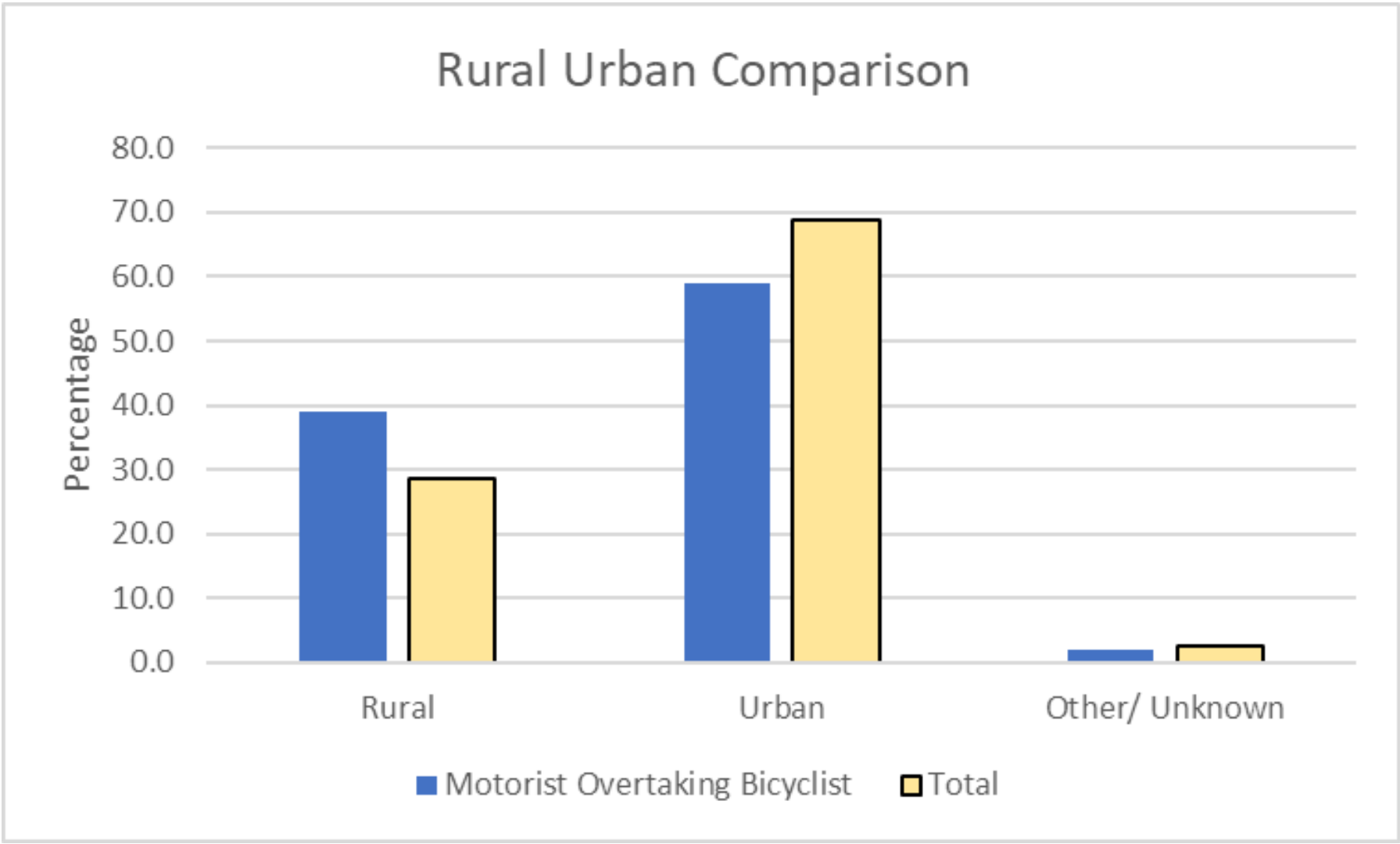


Source: Thomas, Nordback, Sanders, draft paper

US Fatal Bicycle Crash Types, 2014-16; and NC Types – all severity

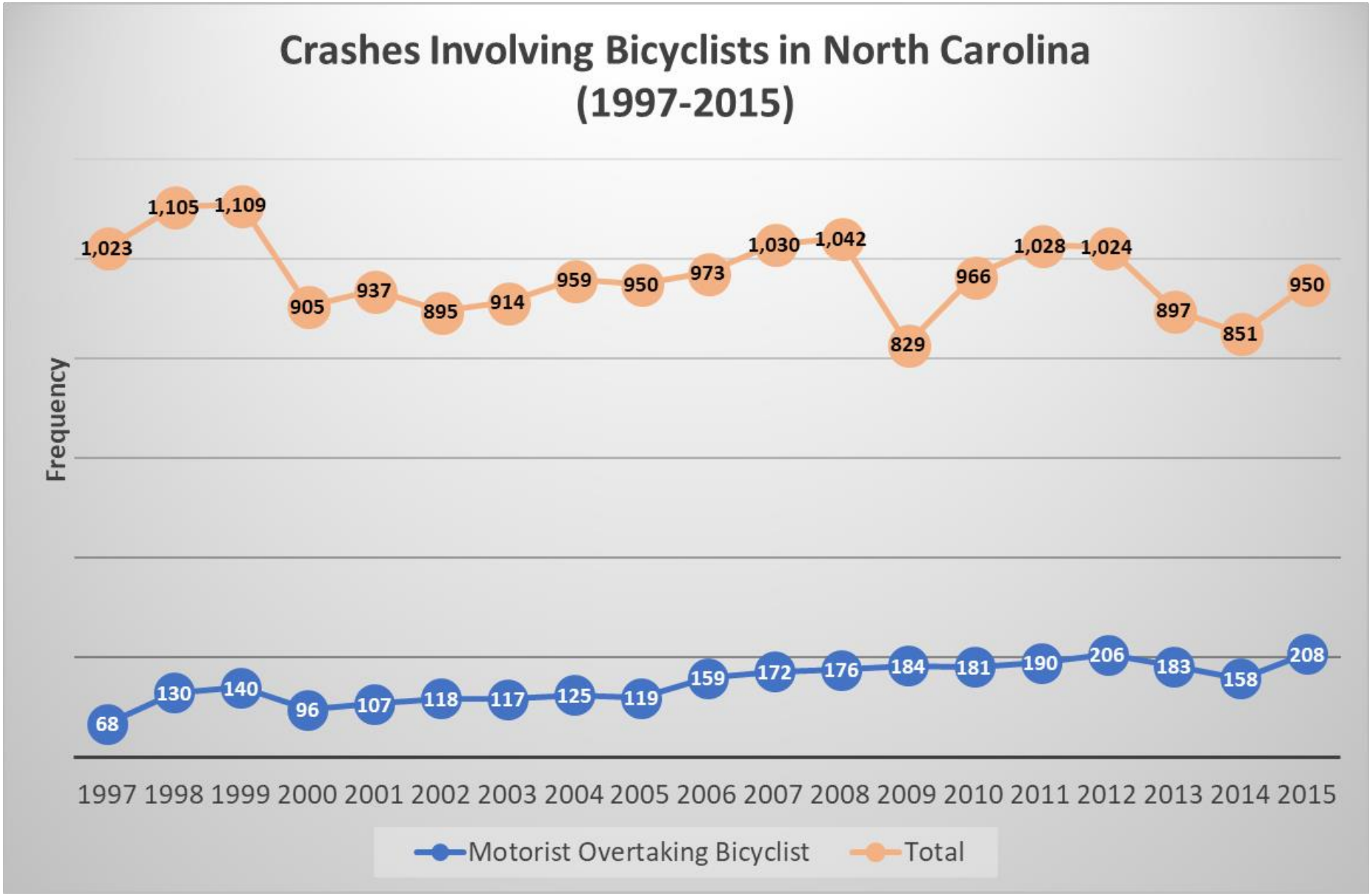
U.S. Bicyclist Fatalities 2014-16 (N = 2,392) (Source data: FARS)			NC - Fatal and Disabling Injury 2011-15 (N = 305)			NC - All Severity 2011-15 (N = 4,433)		
Crash Group	Freq.	%	Rank	Freq.	%	Rank	Freq.	%
Motorist Overtaking Bicyclist	675	28.1	1	114	37.4	1	920	20.8
Parallel Paths - Other Circumstances	207	8.6	16	2	0.7	15	85	1.9
Bicyclist Failed to Yield - Midblock	178	7.4	2	27	8.9	5	291	6.6
Bicyclist Left Turn / Merge	175	7.3	4	22	7.2	11	183	4.1
Crossing Paths - Other Circumstances	172	7.2	8	13	4.3	7	255	5.8
Bicyclist Failed to Yield - Signalized Intersection	166	6.9	7	14	4.6	8	244	5.5
Bicyclist Failed to Yield - Sign-Controlled Intersection	164	6.8	3	25	8.2	6	266	6.0
Wrong-Way / Wrong-Side (Head-On)	118	4.9	6	15	4.9	13	111	2.5
Loss of Control / Turning Error	104	4.3	10	11	3.6	10	212	4.8
Motorist Left Turn / Merge	73	3.0	5	20	6.6	3	432	9.8
Motorist Right Turn / Merge	66	2.8	12	7	2.3	9	235	5.3
Bicyclist Right Turn / Merge	50	2.1	14	5	1.6	16	46	1.0
Other / Unusual Circumstances	29	1.2	15	3	1.0	18	23	.5
Motorist Failed to Yield - Signalized Intersection	26	1.1	17	1	0.3	12	165	3.7
Motorist Failed to Yield - Sign-Controlled Intersection	21	0.9	9	11	3.6	2	439	9.9
Bicyclist Overtaking Motorist	19	0.8	18	1	0.3	14	107	2.4

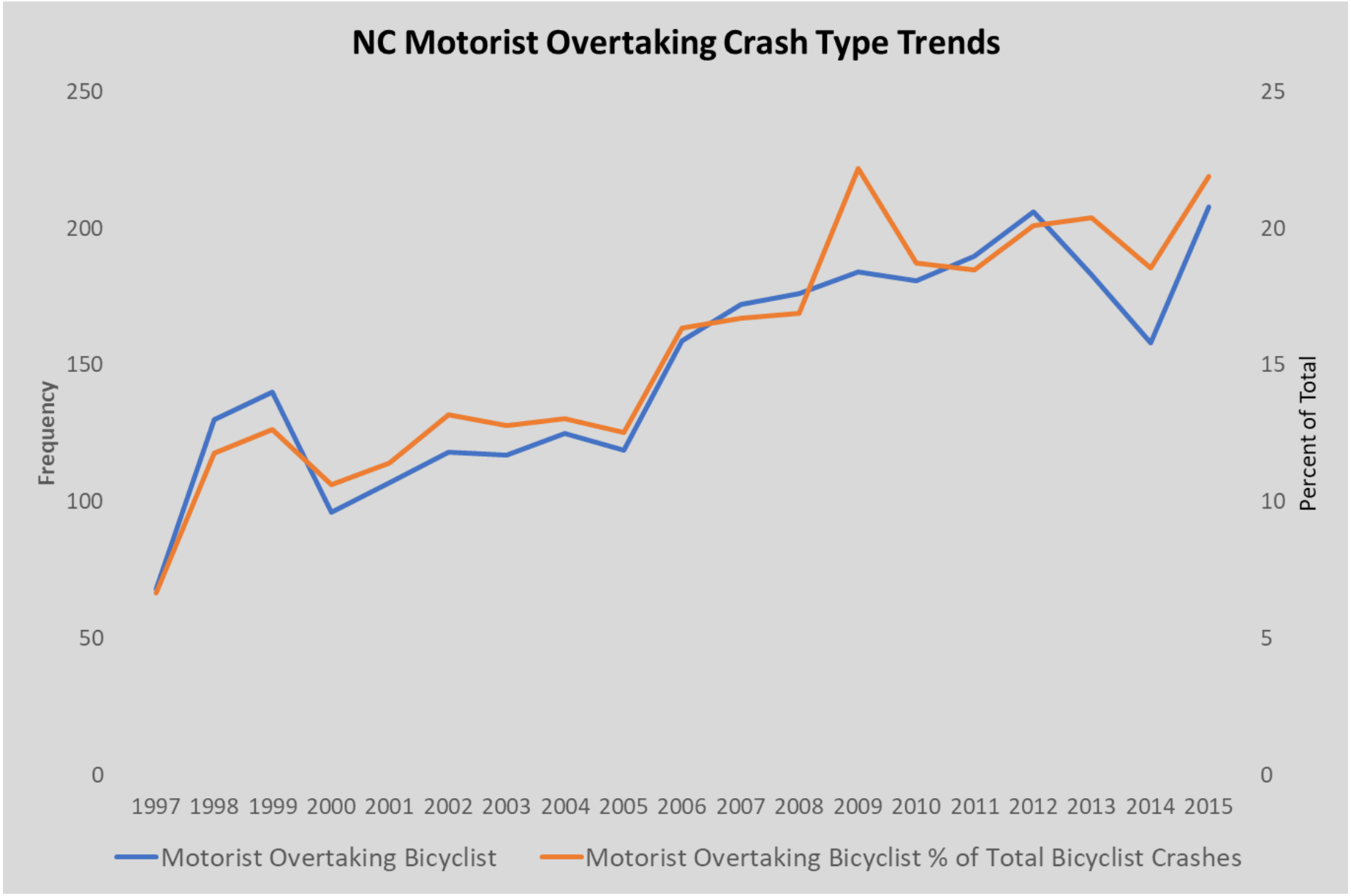
Motorist Overtaking	1990s six-state sample	U.S. Fatalities 2014-16 (FARS)	NC K + A Crashes 2011-15	NC Crashes 2011-15 All	Boulder Crashes 2008-14
Frequency Percent of total Rank	2,453 8.6 6	675 28.1 1	114 37.4 1	920 20.8 1	23 1.8 13
URBAN Frequency Percent of total Rank	n/a	397 24.0 1	36 25.5 1	409 12.3 1	23 1.8 13
RURAL Frequency Percent of total Rank	n/a	264 38.5 1	78 47.6 1	511 40.5 1	n/a
Total Fatalities or Crashes	2,453	2,398	305	4,620*	1,266


Rural Urban Comparison
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
Percentage
Rural
Urban
Other/ Unknown
Motorist Overtaking Bicyclist
Total

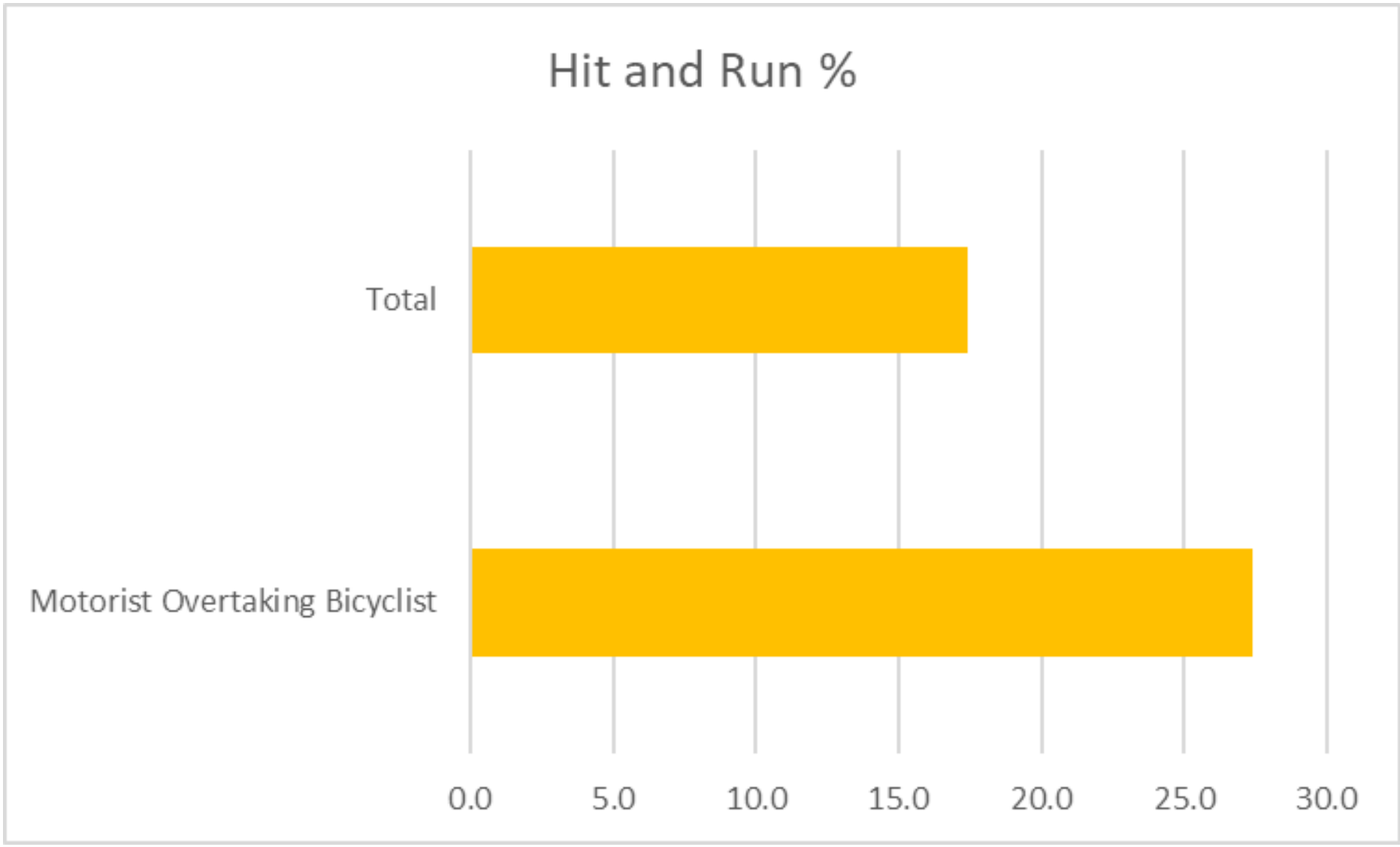
Tops Lists for Fatal and Serious Injury Crash Types

	Fatal Crashes	Motorist Overtaking % of Total
Cross and Fisher (1977, four metro areas sample)	166	37.8
Hunter, Stutts et al. (1990s study – six states, rural and urban, sample)	41	24.4
US Fatalities – census 2014-16	675	28.1
NC K + A (2011-15)	114	37.4

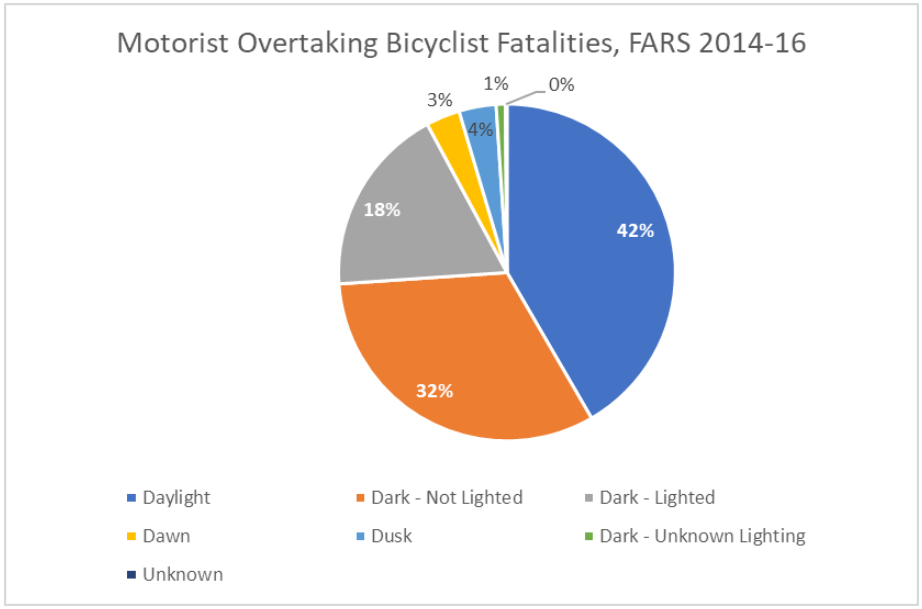

Crashes Involving Bicyclists in North Carolina
(1997-2015)
Frequency
1,023
1,105
1,109
905
937
895
914
959
950
973
1,030
1,042
829
966
1,028
1,024
897
851
950
68
130
140
96
107
118
117
125
119
159
172
176
184
181
190
206
183
158
208
1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015
Motorist Overtaking Bicyclist
Total

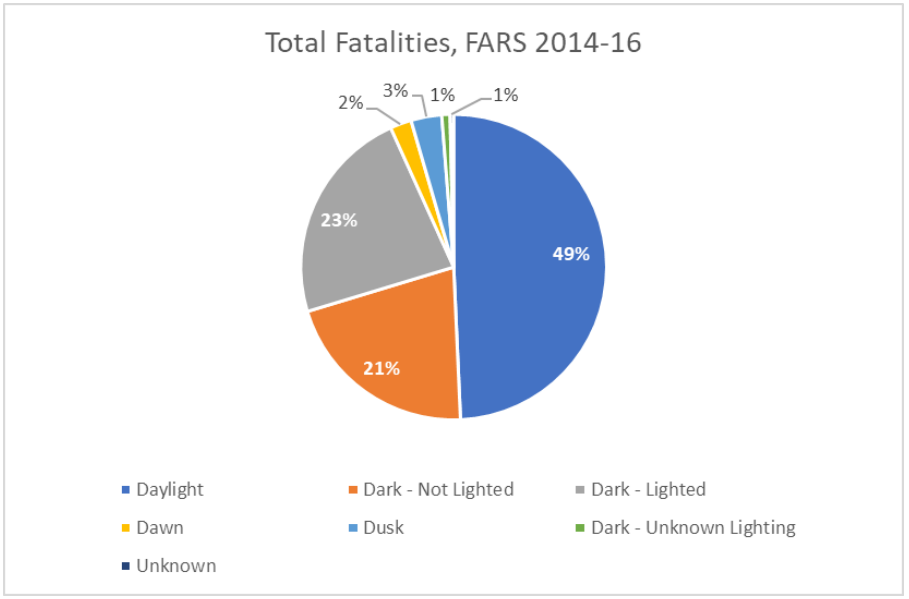

NC Motorist Overtaking Crash Type Trends
250
200
150
100
50
0
Frequency
25
20
15
10
5
0
Percent of Total
1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015
Motorist Overtaking Bicyclist
Motorist Overtaking Bicyclist % of Total Bicyclist Crashes

Bicyclist Crash Type (group)	United States Fatalities 2014-16 (Source data: FARS)					
	Total	% of Total Fatalities	Facing Traffic % of Type	% in Shared Travel Lane of Type	Non-Daylight % of Type	Bicyclist < 18 years % of Type
Motorist Overtaking Bicyclist	675	28.1	0.9	79.6	58.2	4.6
Parallel Paths - Other Circumstances	207	8.6	11.6	73.4	54.1	7.7
Wrong-Way / Wrong-Side (Head-on)	118	4.9	82.2	91.5	66.1	13.6
All others						
Total Fatalities	2,398	100	17.1	76.2	50.3	10.0


Hit and Run %
Total
Motorist Overtaking Bicyclist
0.0
5.0
10.0
15.0
20.0
25.0
30.0

U.S. Fatalities - Environmental Conditions





- Weather – Clear or Cloudy – 93%, and
- Dry Surface Conditions – 92%

U.S. Fatalities - Where Factors

- Bicyclist Position
  - Travel Lane (shared) – 80% [76% for all types]
  - Bike Lane / Paved Shoulder/Parking Lane – 19% [9.5% for all types]
  - Sidewalk/path – 0.6% [12% for all types]
- Location
  - Crash Not at Intersection – 92%
  - Intersection-related (within 50 ft./affected by queuing) – 5%
  - Intersection – 3%

U.S. Fatalities Road Types*

- Two-way, undivided – 65%
- Two-way, divided, with unprotected median – 18%
- Two-way, divided, continuous TWLTL – 8%
- Two-way, divided, positive median barrier – 7%
- Two-way, divided, continuous left turn lane – 8%
- One-way/ramps/unknown/others – 2%

*From crash reporting – not verified

U.S. Fatalities More Road Characteristics *

- Number of Lanes
  - Two lanes – 79%
  - Four lanes – 12%
  - Three lanes – 9%
  - Five or more – 8%
  - One lane – 1%

U.S. Fatalities – More Factors*

- Speed Limits
  - < / = 35 mph – 21%
  - 40 – 45 mph – 33% [30% for all]
  - > 45 mph – 43% [27% for all types]
  - Other/unknown – 3%
- Curve-related – 7% indicated

57% of all fatalities on roads with limits of 40 + mph

Summary - Motorist Overtaking Bicyclist

- Majorities occur on higher speed roads (57%), at night/low light (58%)
- 27% - Hit and Run drivers (compared to 17% of all types)
- Most cyclists (80%) riding in a shared lane just before the crash
- A majority (59%) of fatal Motorist Overtaking crashes nationwide occur in urban areas
- But 41% significant percentage occur in rural areas (compared to 29% of all types in rural areas)
- Rural/Urban – doesn't necessarily reflect 'development' intensity

POLICY SOLUTIONS FOR OVERTAKING CRASHES

Ken McLeod
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MOST COMMON SOLUTION – 3 FOOT PASSING LAWS

- Defines a safe passing distance when overtaking a bicyclist as at least 3 feet

- Addresses at least two problems:
  1. Unclear state law protections for bicyclists
  2. Lack of public knowledge and/or culture about safe passing practices

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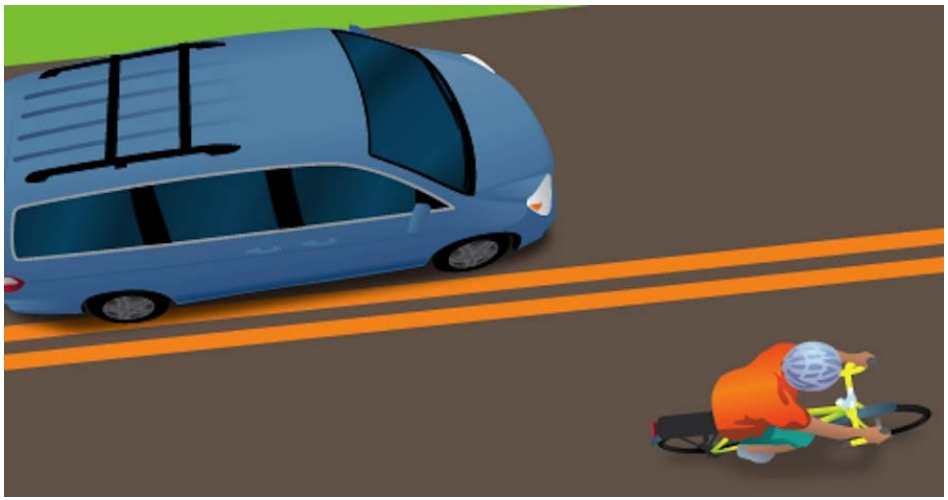
WORST CASE SCENARIO FOR POLICY

- Unclear state law protections for bicyclists in an overtaking crash

- How does that happen?
  - Bicycle not defined as vehicle
  - Safe distance law only mentions vehicles
  - Bicyclists only protected if R&D statute extends rights to them
  - Most R&D statutes refer to rights and duties “applicable to a driver of a vehicle” while many safe passing laws are written in reference to a vehicle only, not mentioning a driver

BEST CASE SCENARIO FOR POLICY



Law is:

- Clear
  - Easy to understand, can fit on a bumper sticker
- Enforceable
  - Provides a consistent basis for enforcement that officers can easily apply
- Well known statewide
  - Integrated into driver education
  - Publicized by consistent signage

BICYCLE FRIENDLY STATE

SAFE PASSING IS BROADER THAN 3 FEET

The League of American Bicyclists' Safe Passing Law Bicycle Friendly Action recognizes 3 types of laws:

1. A safe distance is defined as a specific distance in terms of feet, as in "no less than three feet;"

2. A safe distance is defined as a variable distance in terms of feet, with a minimum safe distance that may increase based upon factors such as the speed or size of a passing vehicle; or

3. A safe distance is defined as "a distance sufficient to prevent contact with the person operating the bicycle if the person were to fall into the driver's lane of traffic."

Bicycle Friendly Actions	✔ = Progress ✔ = New in 2017
Complete Streets Law / Policy	✔
Safe Passing Law (3ft+)	
Statewide bike plan last 10 years	✔
2% or more fed funds on bike/ped	✔
Bicycle Safety Emphasis Area	✔

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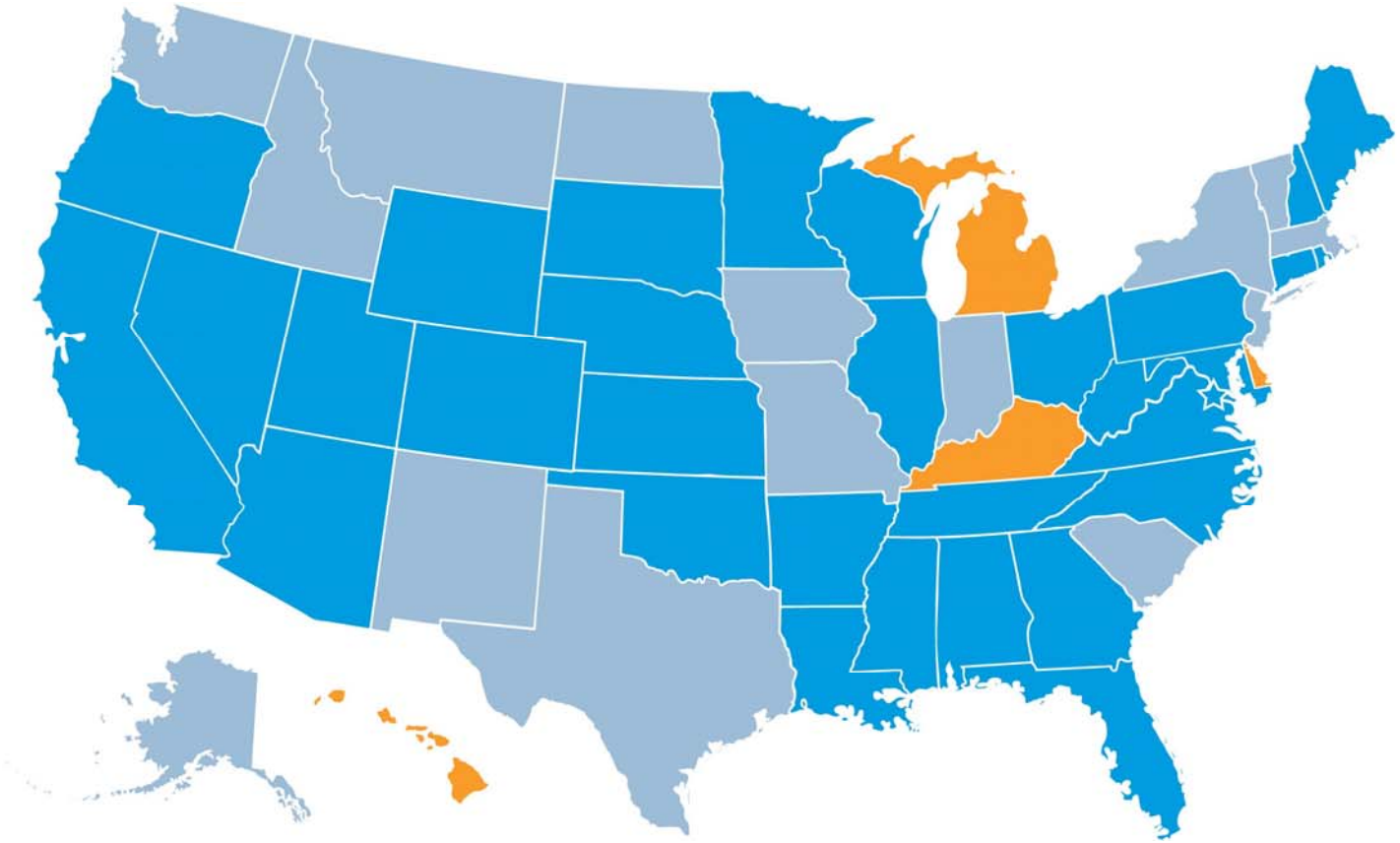
PREVALENCE OF SAFE PASSING LAWS



35 STATES have taken our Safe Passing Law Bicycle Friendly Action!

4 STATES have updated/adopted their Safe Passing Law since 2016

15 STATES lack a Safe Passing Law that meets our Bicycle Friendly Action criteria

» See Chart of State Laws at https://bikeleague.org/sites/default/files/Safe_Passing_Laws_07_2018.pdf

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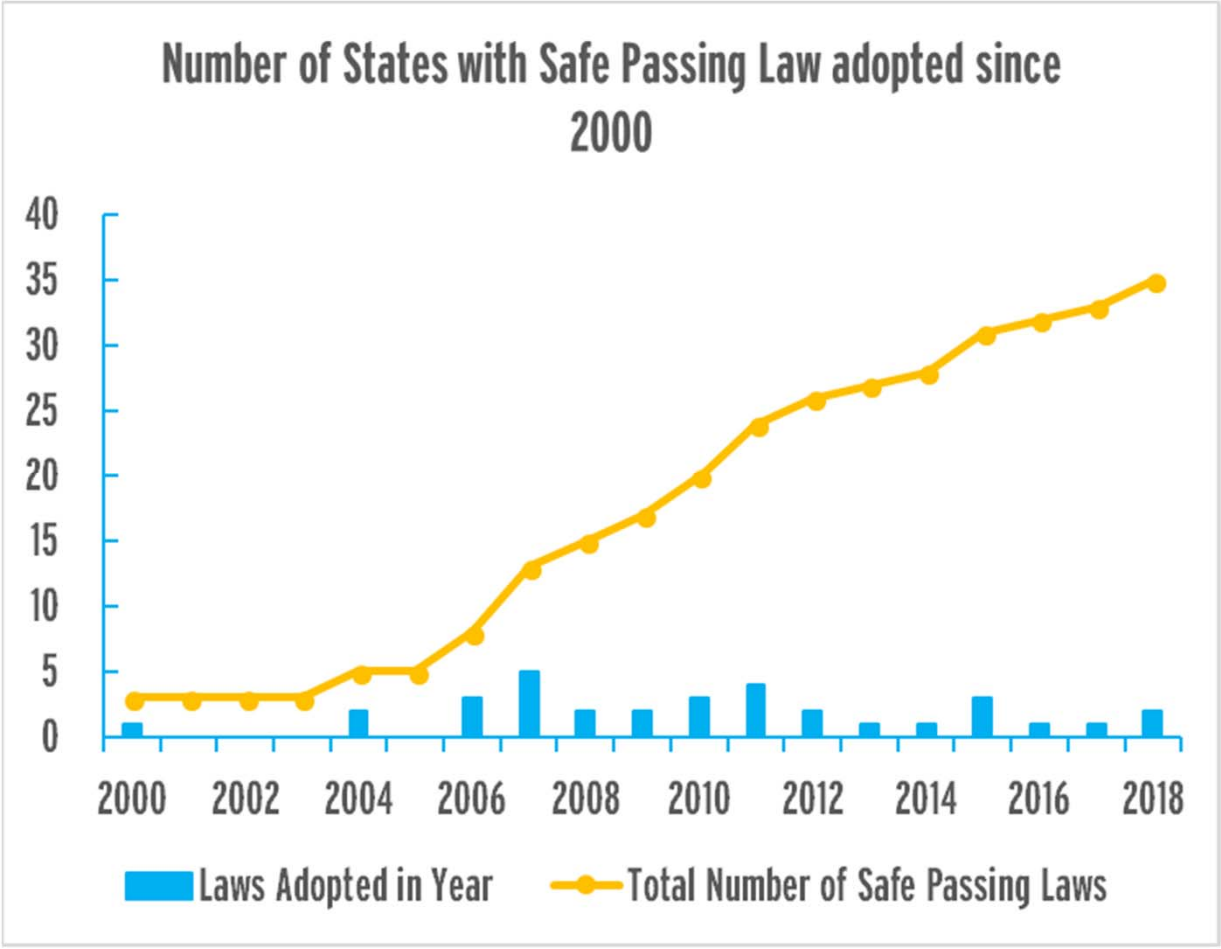
SUCCESS OF SAFE PASSING LAWS



» Since 2006, at least one state has adopted a safe passing law each year

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RECENT DEVELOPMENTS IN SAFE PASSING LAWS

- Good:
  - Change lanes to pass language
    - Nevada, Delaware, and Kentucky
- Bad:
  - Carve-outs so that law is limited to certain circumstances
    - Alabama
  - Unnecessary language that may limit law
    - California

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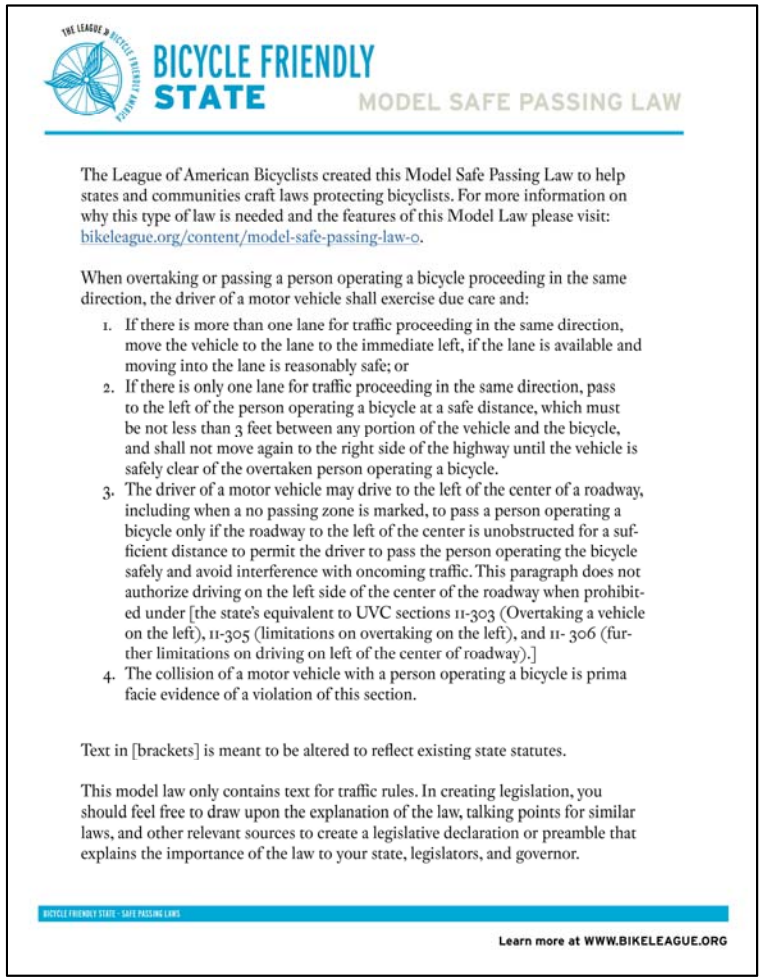
LEAGUE MODEL POLICY

» Four basic features:

1. Change lanes to pass on multi-lane roads
2. 3 foot minimum on two-lane roads
3. Allows drivers to pass in no-passing zones as long as they otherwise comply with laws
4. Provides that a crash is prima facie evidence of violation



BICYCLE FRIENDLY STATE

MODEL SAFE PASSING LAW

The League of American Bicyclists created this Model Safe Passing Law to help states and communities craft laws protecting bicyclists. For more information on why this type of law is needed and the features of this Model Law please visit: bikeleague.org/content/model-safe-passing-law-0.

When overtaking or passing a person operating a bicycle proceeding in the same direction, the driver of a motor vehicle shall exercise due care and:

1. If there is more than one lane for traffic proceeding in the same direction, move the vehicle to the lane to the immediate left, if the lane is available and moving into the lane is reasonably safe; or
2. If there is only one lane for traffic proceeding in the same direction, pass to the left of the person operating a bicycle at a safe distance, which must be not less than 3 feet between any portion of the vehicle and the bicycle, and shall not move again to the right side of the highway until the vehicle is safely clear of the overtaken person operating a bicycle.
3. The driver of a motor vehicle may drive to the left of the center of a roadway, including when a no passing zone is marked, to pass a person operating a bicycle only if the roadway to the left of the center is unobstructed for a sufficient distance to permit the driver to pass the person operating the bicycle safely and avoid interference with oncoming traffic. This paragraph does not authorize driving on the left side of the center of the roadway when prohibited under [the state's equivalent to UVC sections 11-303 (Overtaking a vehicle on the left), 11-305 (limitations on overtaking on the left), and 11- 306 (further limitations on driving on left of the center of roadway).]
4. The collision of a motor vehicle with a person operating a bicycle is prima facie evidence of a violation of this section.

Text in [brackets] is meant to be altered to reflect existing state statutes.

This model law only contains text for traffic rules. In creating legislation, you should feel free to draw upon the explanation of the law, talking points for similar laws, and other relevant sources to create a legislative declaration or preamble that explains the importance of the law to your state, legislators, and governor.

BICYCLE FRIENDLY STATE - SAFE PASSING LAWS

Learn more at WWW.BIKELEAGUE.ORG

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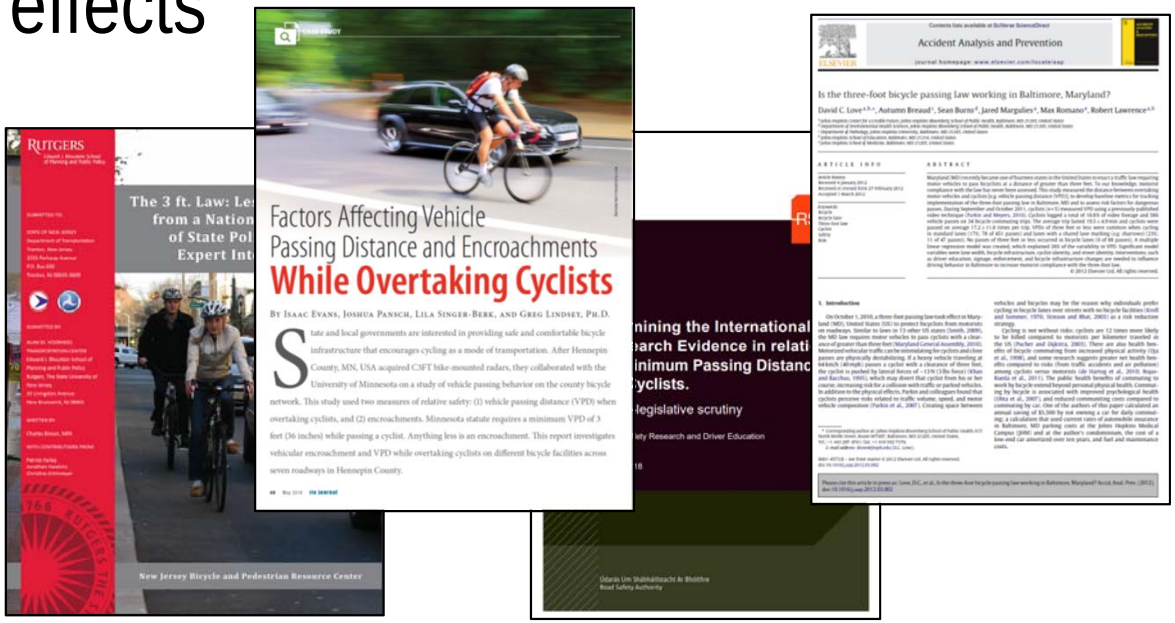
THE HARD PART – IMPLEMENTATION

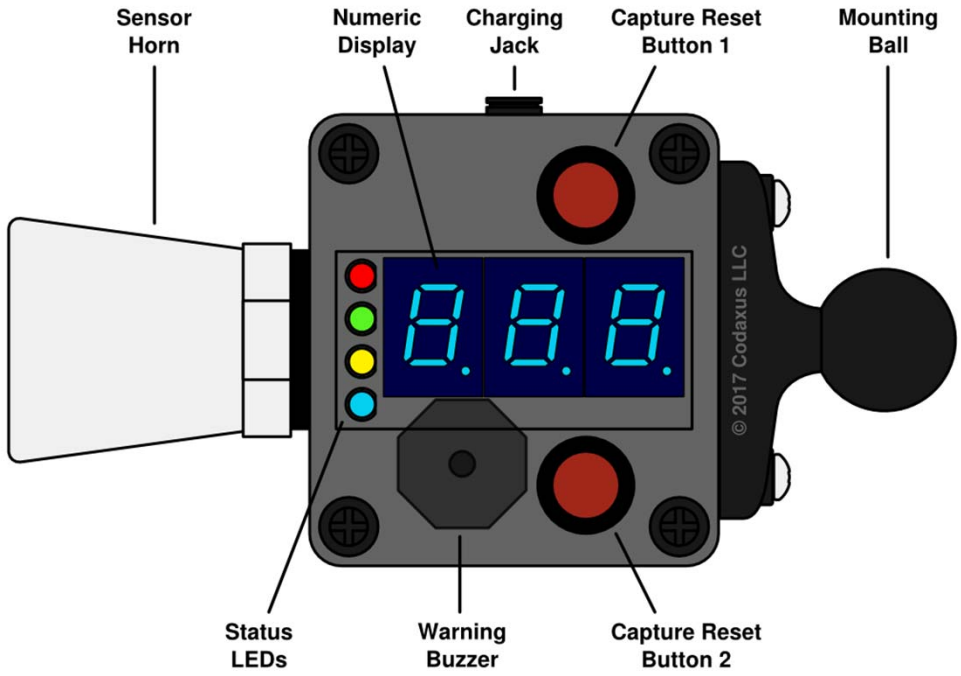
» Limited data on traffic law enforcement generally makes it difficult to do cross-state comparisons or before-after comparisons

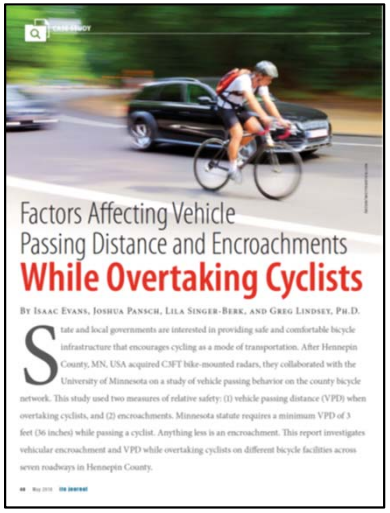
» Limited studies have suggested few discernible safety effects



EMERGING IMPLEMENTATION STRATEGY: SENSOR-BASED ENFORCEMENT

- Codaxus C3FT device
- Used in Chattanooga and Austin
- Used for and verified by research





Factors Affecting Vehicle Passing Distance and Encroachments While Overtaking Cyclists

By Isaac Evans, Joshua Pansch, Lila Singer-Berk, and Greg Lindsey, Ph.D.

State and local governments are interested in providing safe and comfortable bicycle infrastructure that encourages cycling as a mode of transportation. After Hennepin County, MN, USA acquired C3FT bike-mounted radars, they collaborated with the University of Minnesota on a study of vehicle passing behavior on the county bicycle network. This study used two measures of relative safety: (1) vehicle passing distance (VPD) when overtaking cyclists, and (2) encroachments. Minnesota statute requires a minimum VPD of 3 feet (36 inches) while passing a cyclist. Anything less is an encroachment. This report investigates vehicular encroachment and VPD while overtaking cyclists on different bicycle facilities across seven roadways in Hennepin County.

THE LEAGUE OF BICYCLE FRIENDLY AMERICA
BICYCLE FRIENDLY STATE℠

EMERGING IMPLEMENTATION STRATEGY: VIDEO-BASED ENFORCEMENT

- High quality action cameras provide ability for private observations – and potentially public enforcement
- Cyclistvideoevidence.com has promoted this strategy in California and Nevada
- Law enforcement may or may not be receptive

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EMERGING IMPLEMENTATION STRATEGY: HIGH VISIBILITY ENFORCEMENT CAMPAIGN

- NHTSA study: “Evaluating Enforcement of Bicycle Safety Laws”

- Best Outcome(s):
  - Like High Visibility pedestrian crosswalk enforcement, there is observed behavior change after intervention
  - Toolbox for law enforcement with federally-recommended best practices

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EMERGING IMPLEMENTATION STRATEGY: BETTER REPORTING

- NHTSA FARS
- MMUCC
- General traffic safety enforcement data

MMUCC CRASH REPORT

NON-MOTORIST SECTION DATA ELEMENTS

NM1. Unit Number of Motor Vehicle Striking Non-Motorist

NM2. Non-Motorist Action/Circumstance Prior to Crash

S1 Action/Circumstance

00 None
01 Adjacent to Roadway *(e.g., Shoulder, Median)*
02 Crossing Roadway
03 In Roadway – Other
04 Waiting to Cross Roadway
05 Walking/Cycling Along Roadway Against Traffic *(In or Adjacent to Travel Lane)*
06 Walking/Cycling Along Roadway with Traffic *(In or Adjacent to Travel Lane)*
07 Walking/Cycling on Sidewalk
08 Working in Trafficway *(Incident Response)*
98 Other
99 Unknown

S2 Origin/Destination

01 Going to or from School *(K-12)*
02 Going to or from Transit
97 Not Applicable
99 Unknown

NM3. Non-Motorist Contributing Action(s)/Circumstance(s) *(choose up to 2)*

00 None *(No Improper Action)*
01 Dart/Dash
02 Disabled Vehicle Related *(Working on, Pushing, Leaving/Approaching)*
03 Entering/Exiting Parked/Standing Vehicle
04 Failure to Obey Traffic Signs, Signals, or Officer
05 Failure to Yield Right-Of-Way
06 Improper Passing
07 Improper Turn/Merge
08 Inattentive *(Talking, Eating, etc.)*
09 In Roadway Improperly *(Standing, Lying, Working, Playing)*
10 Not Visible *(Dark Clothing, No Lighting, etc.)*
11 Wrong-Way Riding or Walking
98 Other
99 Unknown

NM4. Non-Motorist Location at Time of Crash

Roadway Facility
01 Intersection – Marked Crosswalk
02 Intersection – Unmarked Crosswalk
03 Intersection – Other
04 Median/Crossing Island
05 Midblock – Marked Crosswalk
06 Shoulder/Roadside
07 Travel Lane – Other Location

Bicycle Facility
08 Signed Route *(no pavement marking)*
09 Shared Lane Markings
10 On-Street Bike Lanes
11 On-Street Buffered Bike Lanes
12 Separated Bike Lanes
13 Off-Street Trails/Sidepaths

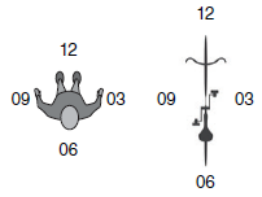
Other Facility
14 Driveway Access
15 Non-Trafficway Area
16 Shared-Use Path or Trail
17 Sidewalk
98 Other
99 Unknown

NM5. Non-Motorist Safety Equipment *(choose up to 5)*

00 None
01 Helmet
02 Protective Pads Used *(elbows, knees, shins, etc.)*
03 Reflective Wear *(backpack, triangles, etc.)*
04 Lighting
05 Reflectors
98 Other
99 Unknown

NM6. Initial Contact Point on Non-Motorist

12 Front
03 Right
06 Rear
09 Left
99 Unknown



BICYCLE FRIENDLY STATE

EMERGING IMPLEMENTATION STRATEGY: PUBLIC EDUCATION

- Signage
- PSAs/Cultural products

R117 (CA)

ENGLISH UNITS

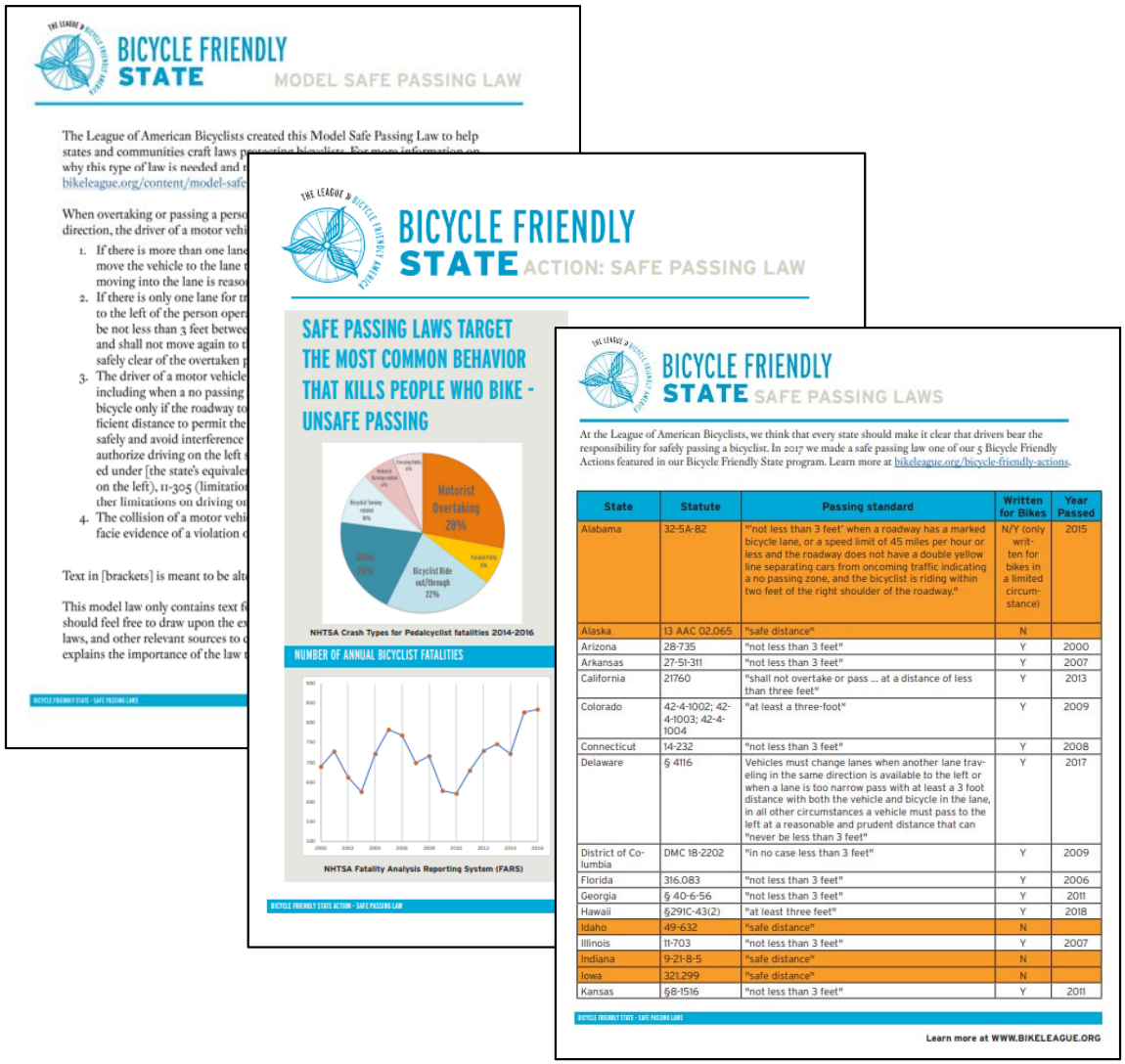
A	B	C	D	E	F	G	H	J	K
24	5E	.5	.625	2.75	4D	1.25	8.5	4C	1.5
30	6E	.5	.75	3.25	5D	1.5	10.5	5C	1.875
36	7E	.625	.875	4	6D	1.75	12.5	6C	2.25

COLORS: BORDER & LEGEND - BLACK
BACKGROUND - WHITE (RETROREFLECTIVE)

THE LEAGUE OF AMERICAN BICYCLISTS BICYCLE FRIENDLY STATE

POLICY RESOURCES

- » Model law
- » White paper
- » Bike Law University



BICYCLE FRIENDLY STATE MODEL SAFE PASSING LAW

The League of American Bicyclists created this Model Safe Passing Law to help states and communities craft laws p... why this type of law is needed and h... bikeleague.org/content/model-safe...

When overtaking or passing a perso... direction, the driver of a motor vehi...

1. If there is more than one lane... move the vehicle to the lane t... moving into the lane is reaso...
2. If there is only one lane for tr... to the left of the person oper... be not less than 3 feet betwee... and shall not move again to t... safely clear of the overtaken p...
3. The driver of a motor vehicle... including when a no passing... bicycle only if the roadway to... ficient distance to permit the... safely and avoid interference... authorize driving on the left s... ed under [the state's equivale... on the left), 11-305 (limitatio... ther limitations on driving o...
4. The collision of a motor vehi... facie evidence of a violation ...

Text in [brackets] is meant to be alt...

This model law only contains text f... should feel free to draw upon the ex... laws, and other relevant sources to ... explains the importance of the law t...

BICYCLE FRIENDLY STATE ACTION: SAFE PASSING LAW

SAFE PASSING LAWS TARGET THE MOST COMMON BEHAVIOR THAT KILLS PEOPLE WHO BIKE - UNSAFE PASSING

NHTSA Crash Types for Pedalcyclist fatalities 2014-2016

NUMBER OF ANNUAL BICYCLIST FATALITIES

NHTSA Fatality Analysis Reporting System (FARS)

BICYCLE FRIENDLY STATE SAFE PASSING LAWS

At the League of American Bicyclists, we think that every state should make it clear that drivers bear the responsibility for safely passing a bicyclist. In 2017 we made a safe passing law one of our 5 Bicycle Friendly Actions featured in our Bicycle Friendly State program. Learn more at bikeleague.org/bicycle-friendly-actions.

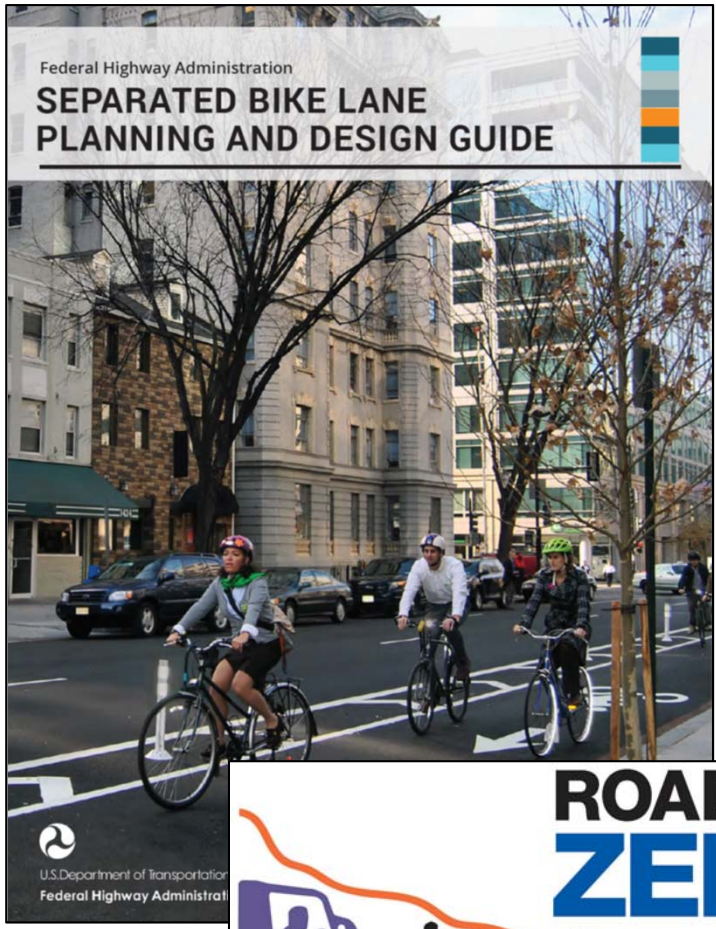
State	Statute	Passing standard	Written for Bikes	Year Passed
Alabama	32-5A-82	"'not less than 3 feet' when a roadway has a marked bicycle lane, or a speed limit of 45 miles per hour or less and the roadway does not have a double yellow line separating cars from oncoming traffic indicating a no passing zone, and the bicyclist is riding within two feet of the right shoulder of the roadway."	N/Y (only written for bikes in a limited circumstance)	2015
Alaska	13 AAC 02.065	"safe distance"	N	
Arizona	28-735	"not less than 3 feet"	Y	2000
Arkansas	27-51-311	"not less than 3 feet"	Y	2007
California	21760	"shall not overtake or pass ... at a distance of less than three feet"	Y	2013
Colorado	42-4-1002; 42-4-1003; 42-4-1004	"at least a three-foot"	Y	2009
Connecticut	14-232	"not less than 3 feet"	Y	2008
Delaware	§ 4116	Vehicles must change lanes when another lane traveling in the same direction is available to the left or when a lane is too narrow pass with at least a 3 foot distance with both the vehicle and bicycle in the lane, in all other circumstances a vehicle must pass to the left at a reasonable and prudent distance that can "never be less than 3 feet"	Y	2017
District of Columbia	DMC 18-2202	"in no case less than 3 feet"	Y	2009
Florida	316.083	"not less than 3 feet"	Y	2006
Georgia	§ 40-6-56	"not less than 3 feet"	Y	2011
Hawaii	§291C-43(2)	"at least three feet"	Y	2018
Idaho	49-632	"safe distance"	N	
Illinois	11-703	"not less than 3 feet"	Y	2007
Indiana	9-21-8-5	"safe distance"	N	
Iowa	321.299	"safe distance"	N	
Kansas	§8-1516	"not less than 3 feet"	Y	2011

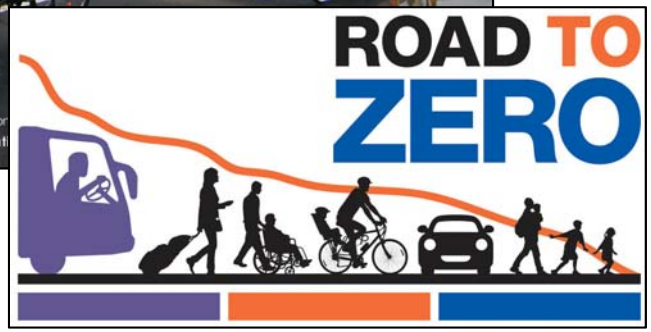
Learn more at WWW.BIKELEAGUE.ORG

BICYCLE FRIENDLY STATE℠

POLICY+

- Safe Passing Laws are a part of, not an alternative to, Safe Systems
  - Safe Systems = Crashes and fatalities are preventable
    - High-risk locations should be addressed proactively and systemically
    - Responsibility shared between users and designers
    - Multiple elements combined to create safe system





THE LEAGUE OF BICYCLE FRIENDLY AMERICA
BICYCLE FRIENDLY STATE

Thank you!

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BICYCLE FRIENDLY STATE℠

Your Presenter

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Toole Design Group
Director of Sustainable Safety

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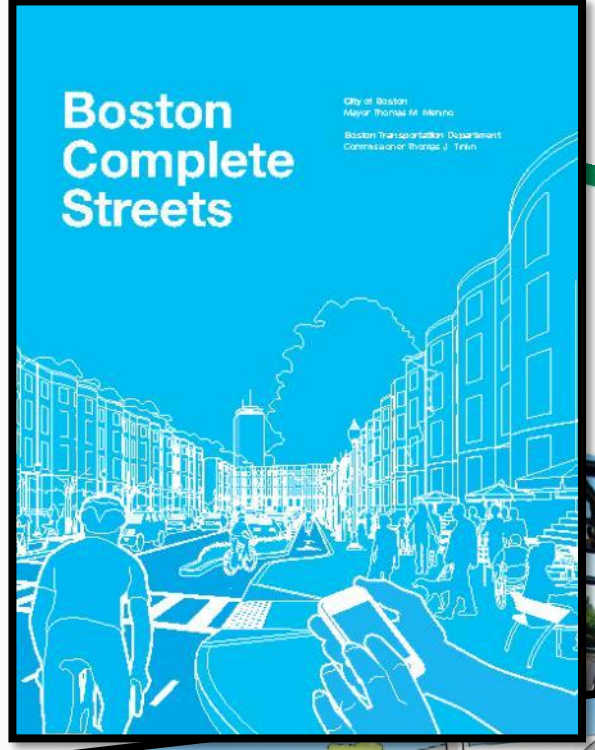
301-927-1900 x106

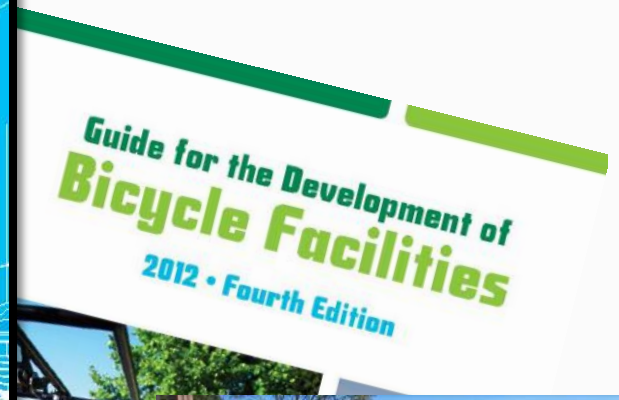
2019 AASHTO Bike Guide Author

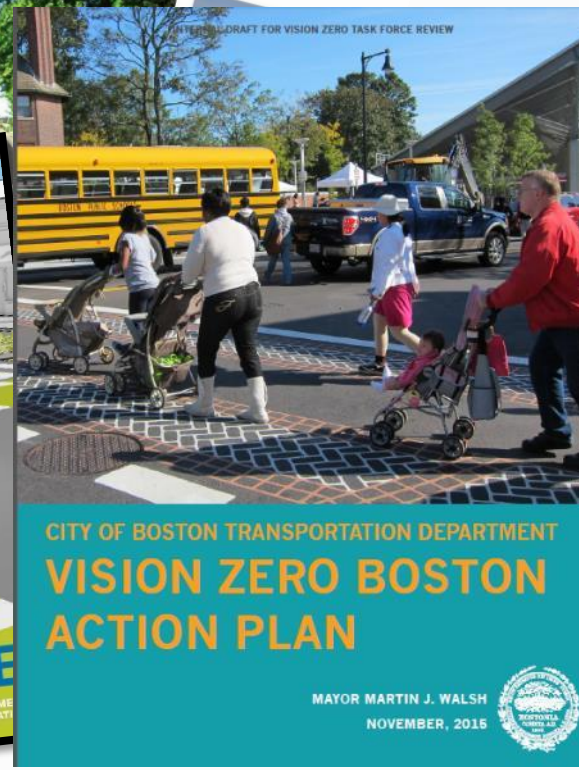
2015 MassDOT Design Guide Author

Sustainable safety & complete street expertise

Designer 300+ miles of streets, trails, & bikeways







“94% of all crashes are due to human behavior”

National Highway Transportation Safety Institute

If people obeyed traffic laws
there would be almost no crashes

Media/Police Reports

"Police believe the teen **was not wearing a helmet and had dark clothes on** when he was hit and the bicycle was thrown into the air."

17-year-old cyclist hit by car in Newton

by: Ted Daniel Updated: Aug 30, 2016 - 11:19 PM

Complex Environments

London. Source: https://www.youtube.com/watch?v=IsB2Samh8og

Improper Merging and Aggressive Driving

London. Source: https://www.youtube.com/watch?v=IsB2Samh8og

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Suburban Environments

High speed/volume roadways with minimal motorist expectation of bicyclists or pedestrians

Narrow, Urban Streets

Washington, DC

Rural Roads

Natchez Trace Parkway, Tennessee

As the two men were heard chatting and laughing Saturday morning while finishing a ride along Natchez Trace Parkway, **a car horn blared in the background**. The cyclists let one vehicle pass and then, 23-year-old Tyler Noe said, **he and his fellow cyclist**, Greg Goodman, who was filming the scene, **heard a second car attempting to speed up from behind**.

Rural Roads

Natchez Trace Parkway, Tennessee

Rural Roads

Natchez Trace Parkway, Tennessee

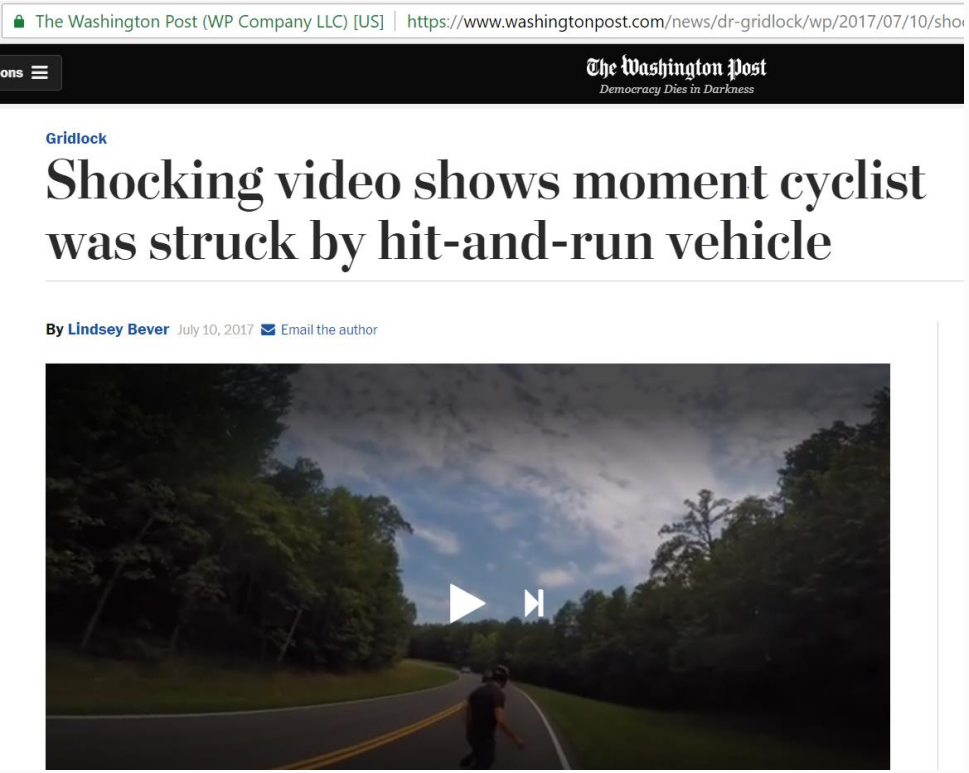
Rural Roads

Natchez Trace Parkway, Tennessee

Rural Roads

Natchez Trace Parkway, Tennessee

National Park Service Advice for Cyclists:



The Washington Post (WP Company LLC) [US] | https://www.washingtonpost.com/news/dr-gridlock/wp/2017/07/10/sho

The Washington Post
Democracy Dies in Darkness

Gridlock

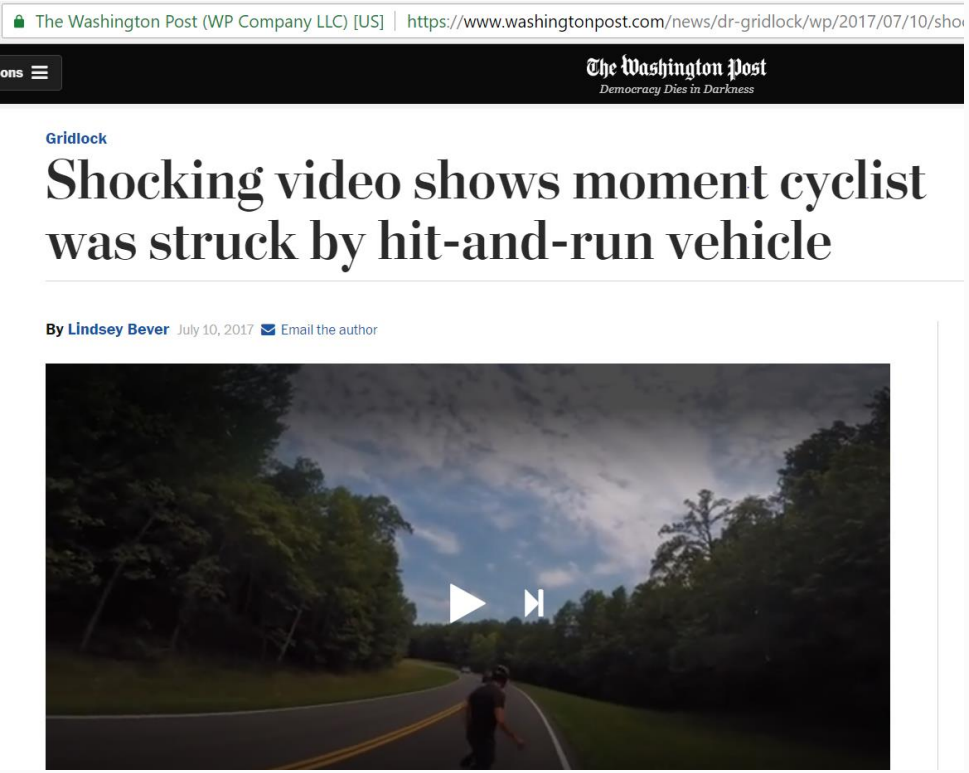
Shocking video shows moment cyclist was struck by hit-and-run vehicle

By Lindsey Bever July 10, 2017 Email the author

Source: July 10, 2017 Washington Post Article https://www.washingtonpost.com/news/dr-gridlock/wp/2017/07/10/shocking-video-shows-moment-cyclist-was-struck-by-hit-and-run-vehicle/?utm_term=.2bc25d2e4f98

- Follow the same rules of the road as motorists.
- Bicyclists have the **same rights and responsibilities** as drivers.
- **Wear brightly-colored, high-visibility clothing and a properly fitting helmet**.
- Use lights and reflectors in lowlight conditions.
- Carry identification and emergency medical information.
- Let family members know your itinerary

National Park Service Advice for Cyclists:



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- **Avoid** bicycling during weekday rush hours **due to the high volume of motor vehicle traffic**.
- Do not bicycle on **the parkway between sundown and sunup**.

Do bicyclists have the **same rights and responsibilities** as motorists?

Is bicycling a mode of transportation?

“94% of all crashes are due to human behavior”

National Highway Transportation Safety Institute

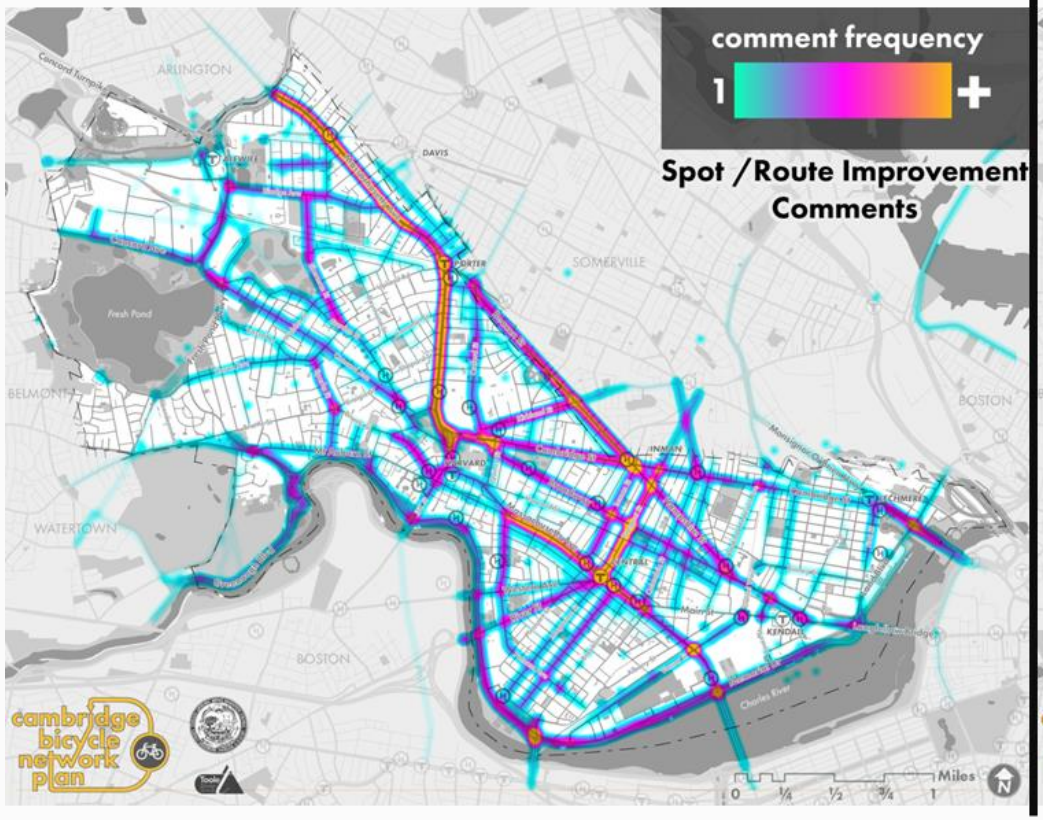
“A system that is safe only if people don’t make mistakes, is not a system that is made for humans”

Dr. Peter Furth, Northeastern University Professor in the Department of Civil and Environmental Engineering

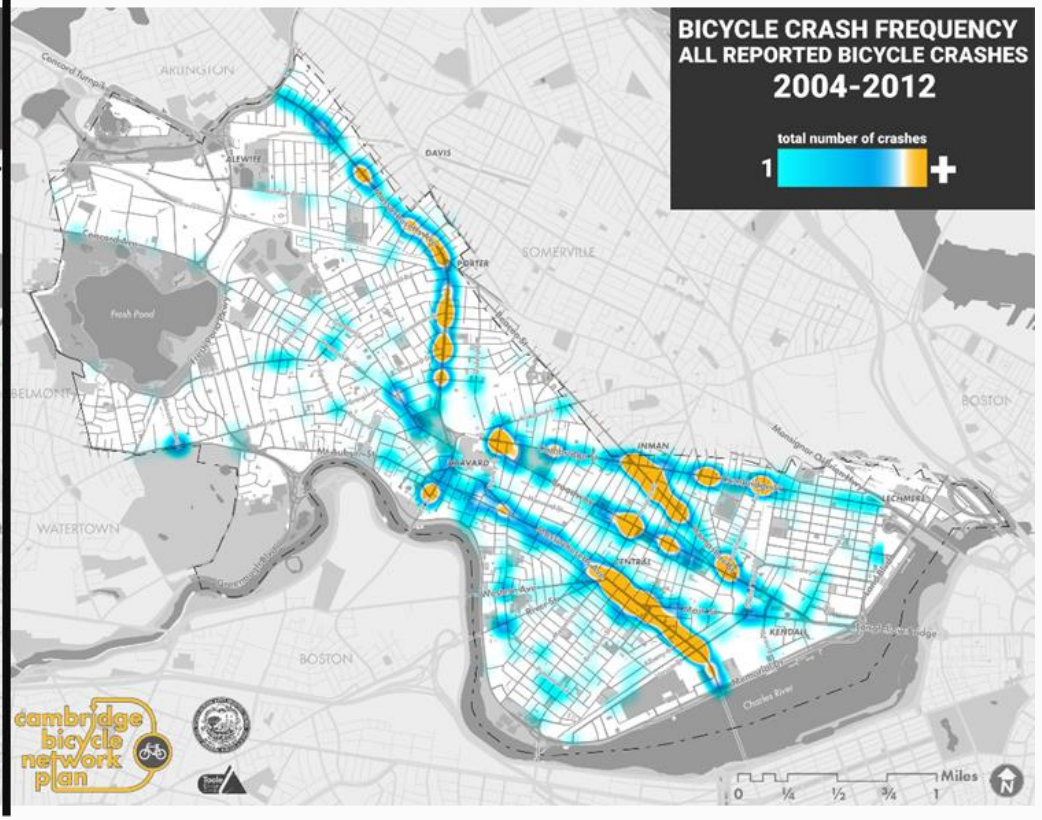
Bicycle Research – Crashes and Near Misses

Both crash and near-crash experiences influence perceived bicycling safety and comfort (Lee et al., 2015; Sanders, 2015; Aldred & Crossweller, 2015)

perceptions



reported crashes

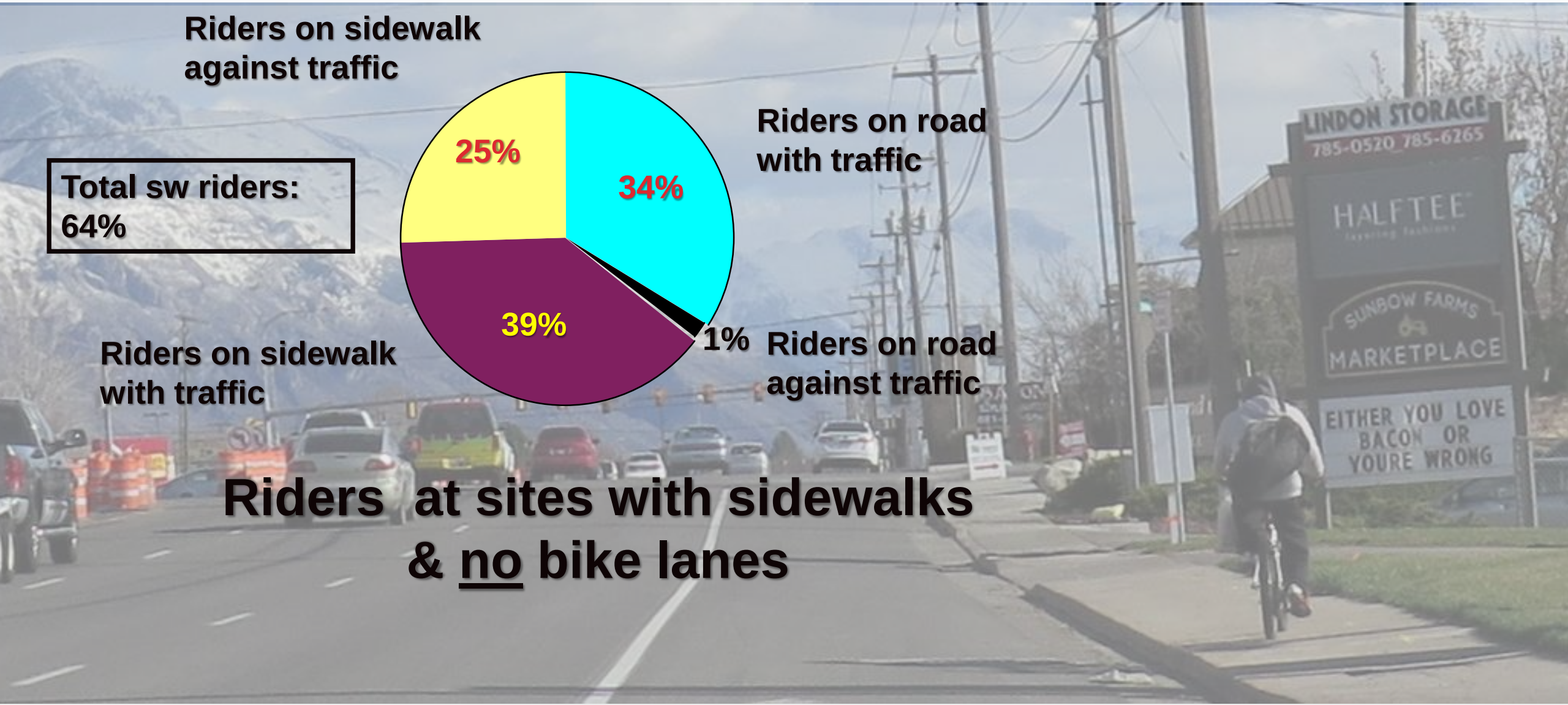


Bicycle Research - Comfort and Safety

There is a significant relationship between how safe and comfortable people feel bicycling, whether and how often they bicycle, their preferences for facility types, and the provision of those facilities.

- Sanders, R. L. We can all get along: The alignment of driver and bicyclist roadway design preferences in the San Francisco Bay Area. *Transportation Research Part A, Vol. 91, 2016*, pp. 120-133.
- Dill, D. and McNeil, N. Revisiting the Four Types of Cyclists. *Transportation Research Record 2587*. TRB, National Research Council, Washington, DC, 2016.
- Handy, S.L., Y. Xing, and T.J. Buehler. Factors Associated with Bicycle Ownership and Use: A Study of Six Small U.S. Cities. *Transportation*, Vol. 37, No. 6, 2010, pp. 967-985.
- Winters, M., G. Davidson, D. Kao, and K. Teschke. Motivators and Deterrents of Bicycling: Comparing Influences on Decisions to Ride. *Transportation*, Vol. 38, No. 1, 2010, pp. 153–168.

Traffic and Street Design
Effect on Bicyclist Position



Riders at sites with sidewalks & no bike lanes

Bicycle Research – Comfort and Safety

Bicyclist Design User Profiles

4 - 7% **Highly confident**

5 - 9% **Somewhat confident**

51 - 56% **Interested but Concerned**

lower stress tolerance

higher stress tolerance

source: Dill, J., McNeil, N. (2012). Four Types of Cyclists? Examining a Typology to Better Understand Bicycling Behavior and Potential.

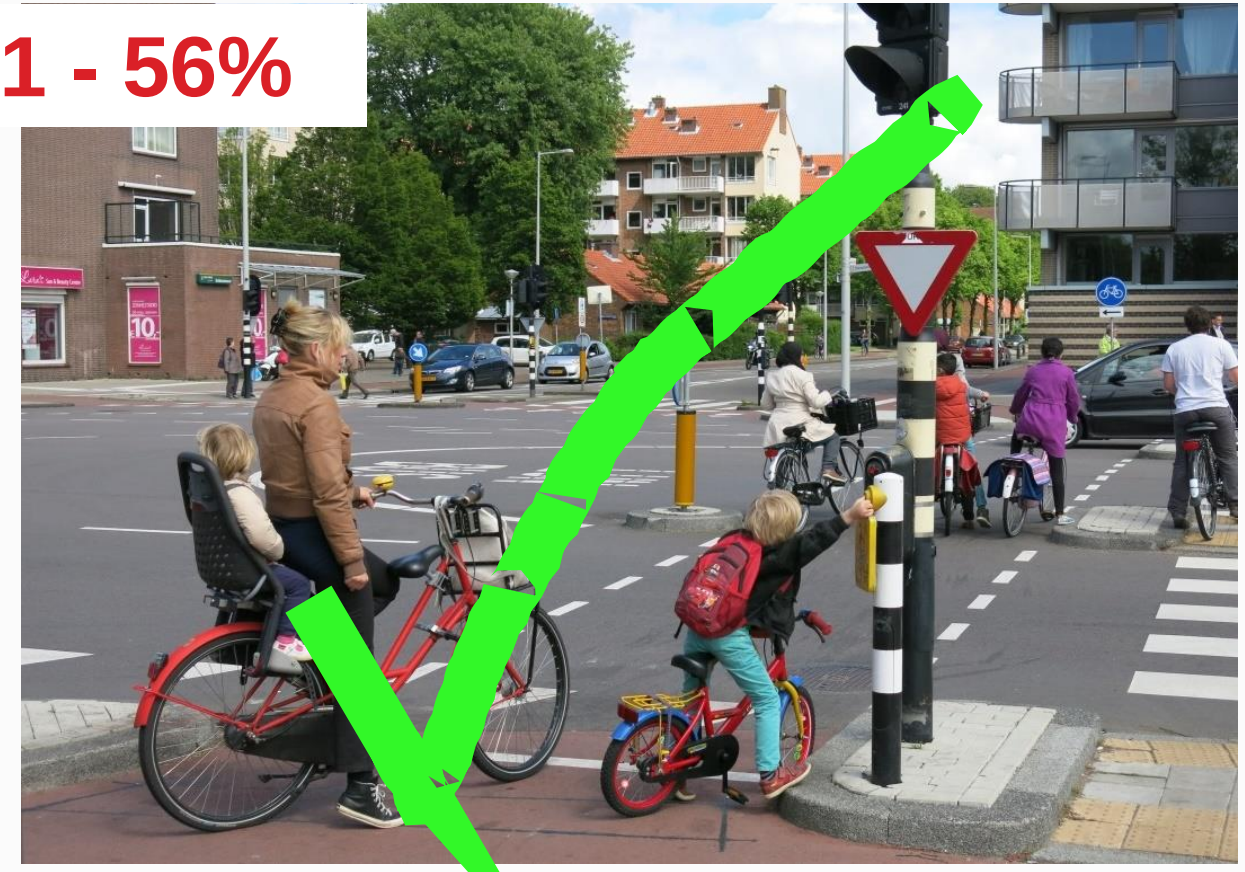
Bicycle Operation & Safety Preferred Design User Proposed for AASHTO Guide

4 - 7%

Experienced & Confident Cyclist

AASHTO 2012

51 - 56%



Interested but Concerned Cyclist

AASHTO 2018

Bicycle Networks Designed for Intended Users

~ 72% of public

Low-Stress Bicycle Network - is designed to be safe and comfortable to support bicyclists of All Ages and Abilities (~ 72% of public)

~ 4% of public

Basic Bikeway Network - consist primarily of bicycle lanes and shoulders which supports Highly Confident Bicyclists and Somewhat Confident Bicyclists (~ 16%)

Traffic Tolerant Network - all roads and paths on which bicycling is legally allowed which support Highly Confident Bicyclists (~ 4%)

A Sustainable Safety (Vision Zero) Approach

1. **Functionality of roads:** fit road to purpose and context
2. **Homogeneity:** design for uniformity of mass and/or speed
3. **Forgiveness:** humans make mistakes
4. **Predictability:** road design supports behavior
5. **Awareness:** simplify decision making

A Sustainable Safety (Vision Zero) Approach

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A Sustainable Safety Approach

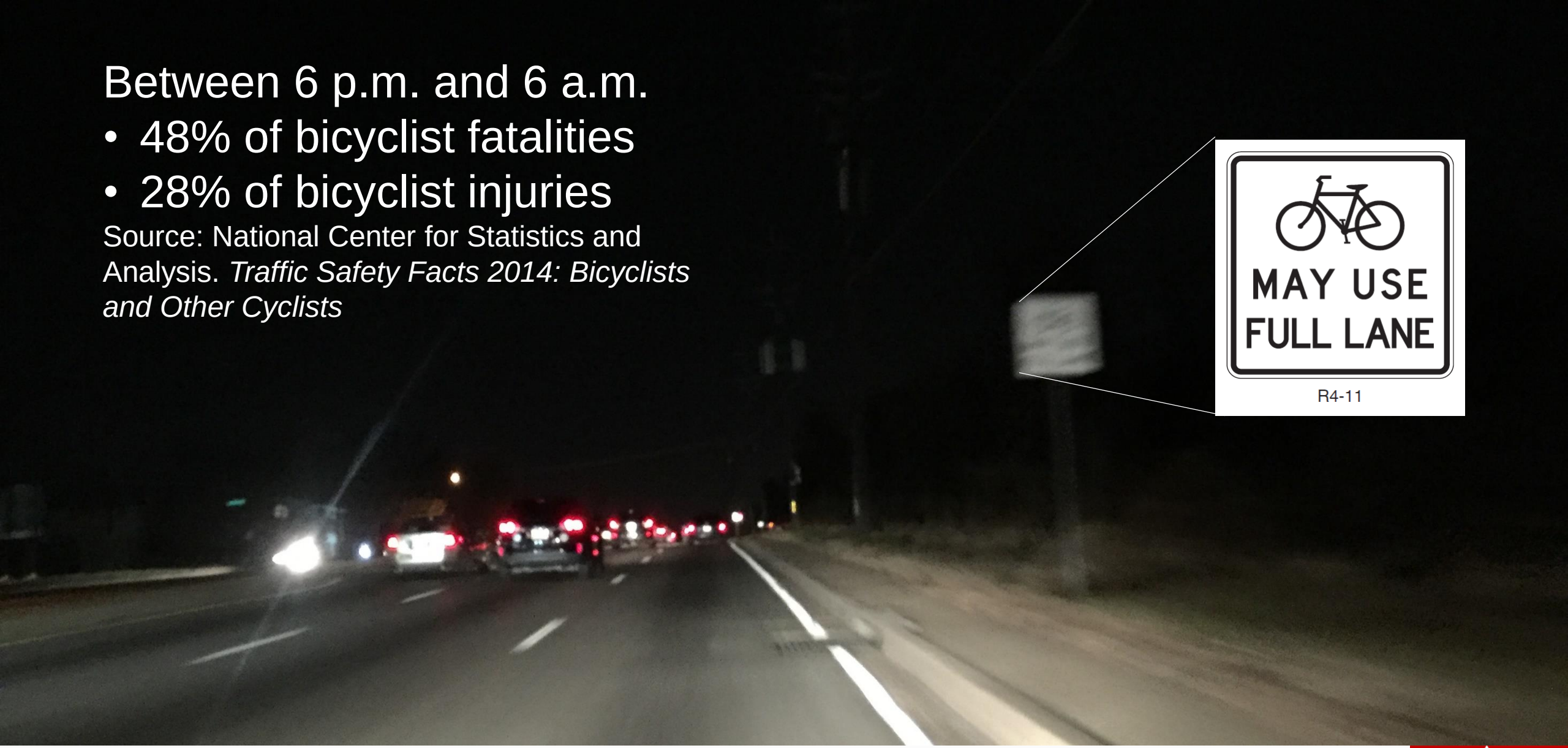
Separate Large Speed & Mass Differentials

1. **Functionality of roads:** fit road to purpose and context
2. **Homogeneity:** design for uniformity of mass and/or speed
3. **Forgiveness:** humans make mistakes
4. **Predictability:** road design supports behavior
5. **Awareness:** simplify decision making

Between 6 p.m. and 6 a.m.

- 48% of bicyclist fatalities
- 28% of bicyclist injuries

Source: National Center for Statistics and Analysis. *Traffic Safety Facts 2014: Bicyclists and Other Cyclists*



Sustainable Safety Considers Day and Night

Road posted at 40mph

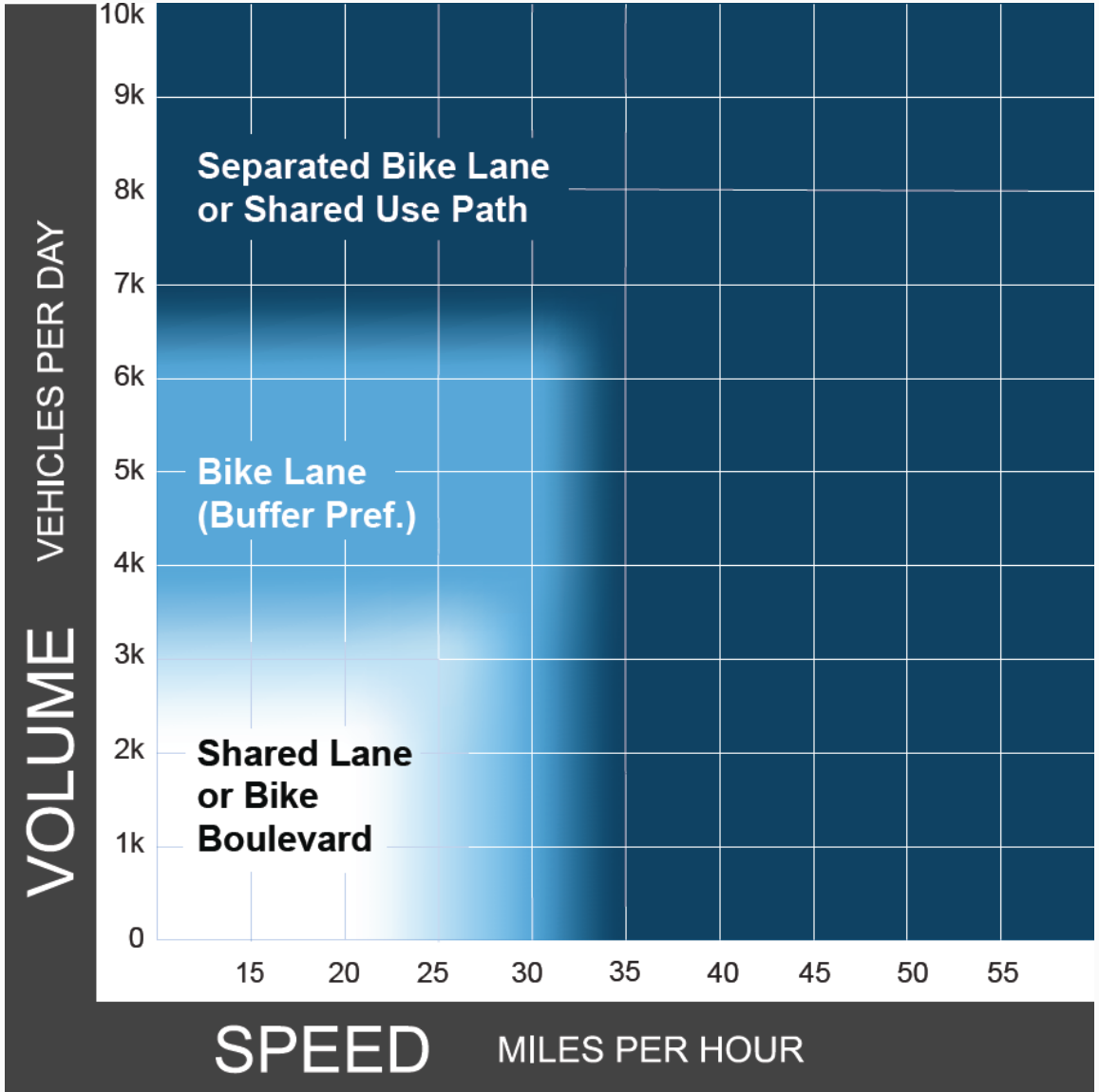
Sustainable Safety Considers Day and Night

Road posted at 40mph – bike lane weave area exceeds 1,000 feet in length

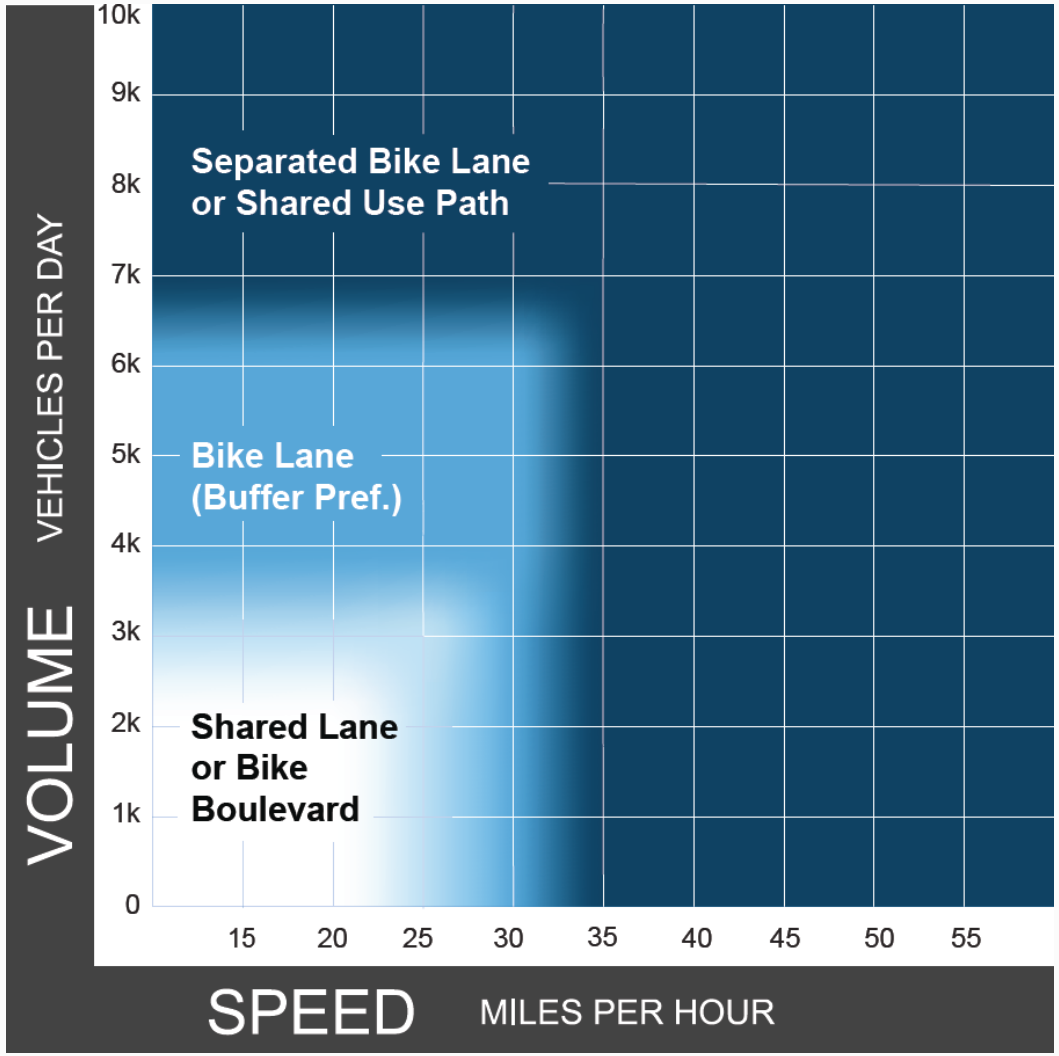
Streets in Urban, Suburban and Rural Town Contexts – Proposed AASHTO

Design User Assumption:
Interested but Concerned Bicyclist Profile

Analysis: Level of Traffic Stress following Sustainable Safety Principals



Streets in Urban, Suburban and Rural Town Contexts – Proposed AASHTO



Other Considerations:

Extreme peak hour vehicle volumes

Traffic vehicle mix (5% HV)

Parking turnover and curbside activity

Driveway/intersection frequency

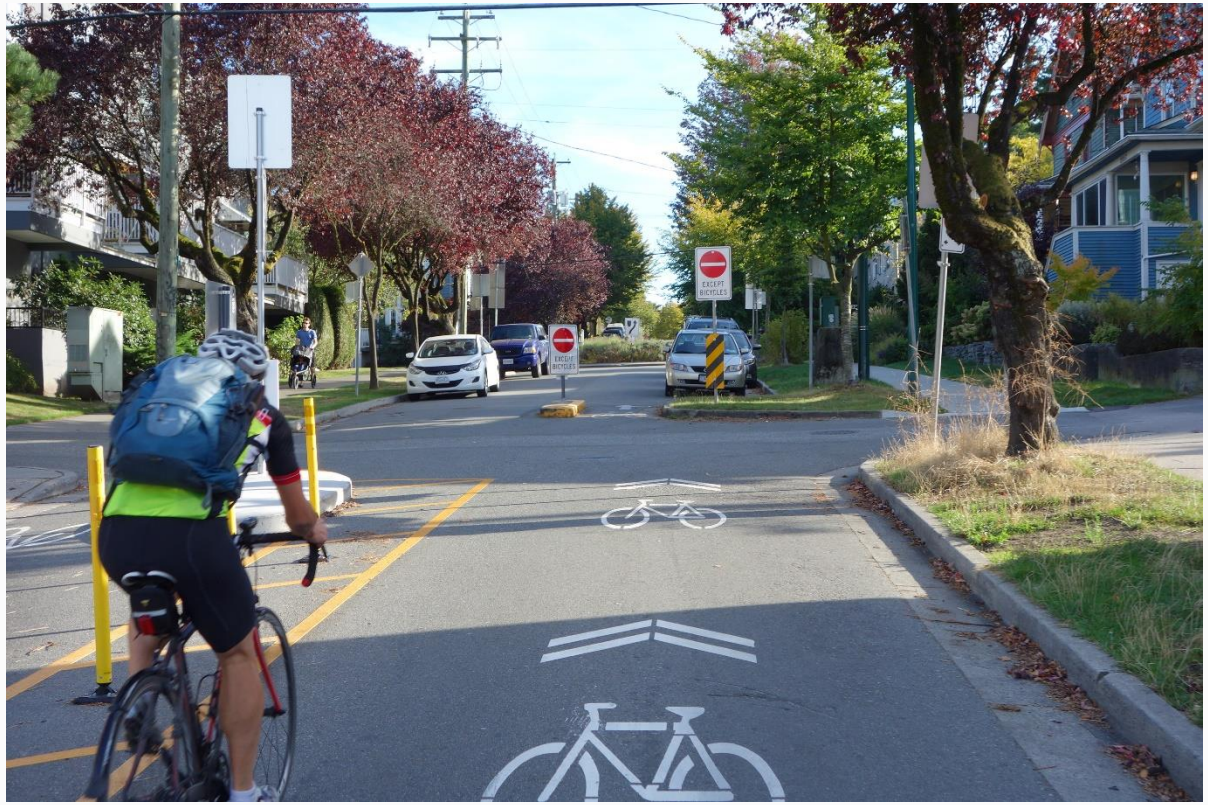
Direction of operation

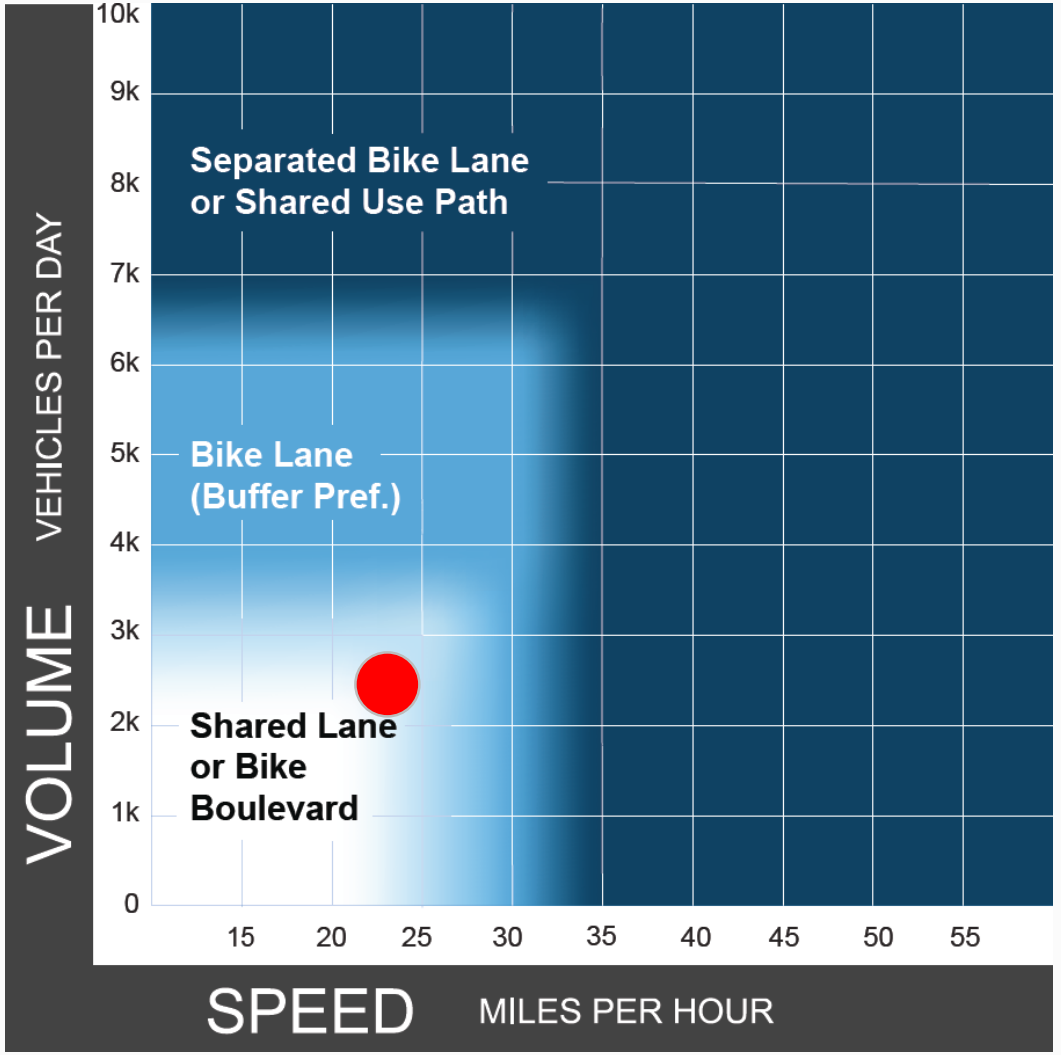
Vulnerable populations

Network connectivity gaps

Streets in Urban, Suburban and Rural Town Contexts – Example

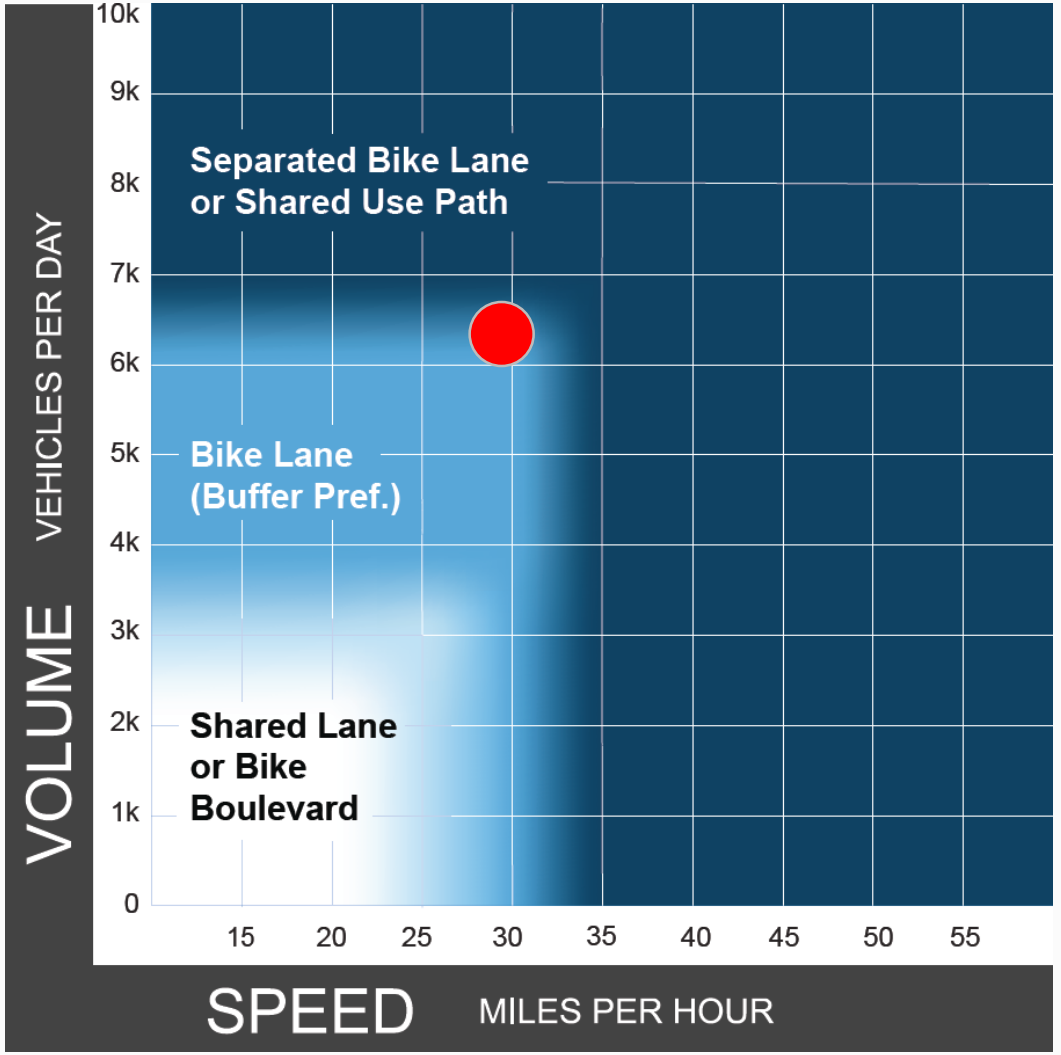
Volume = 2,800
Speed = 25 mph





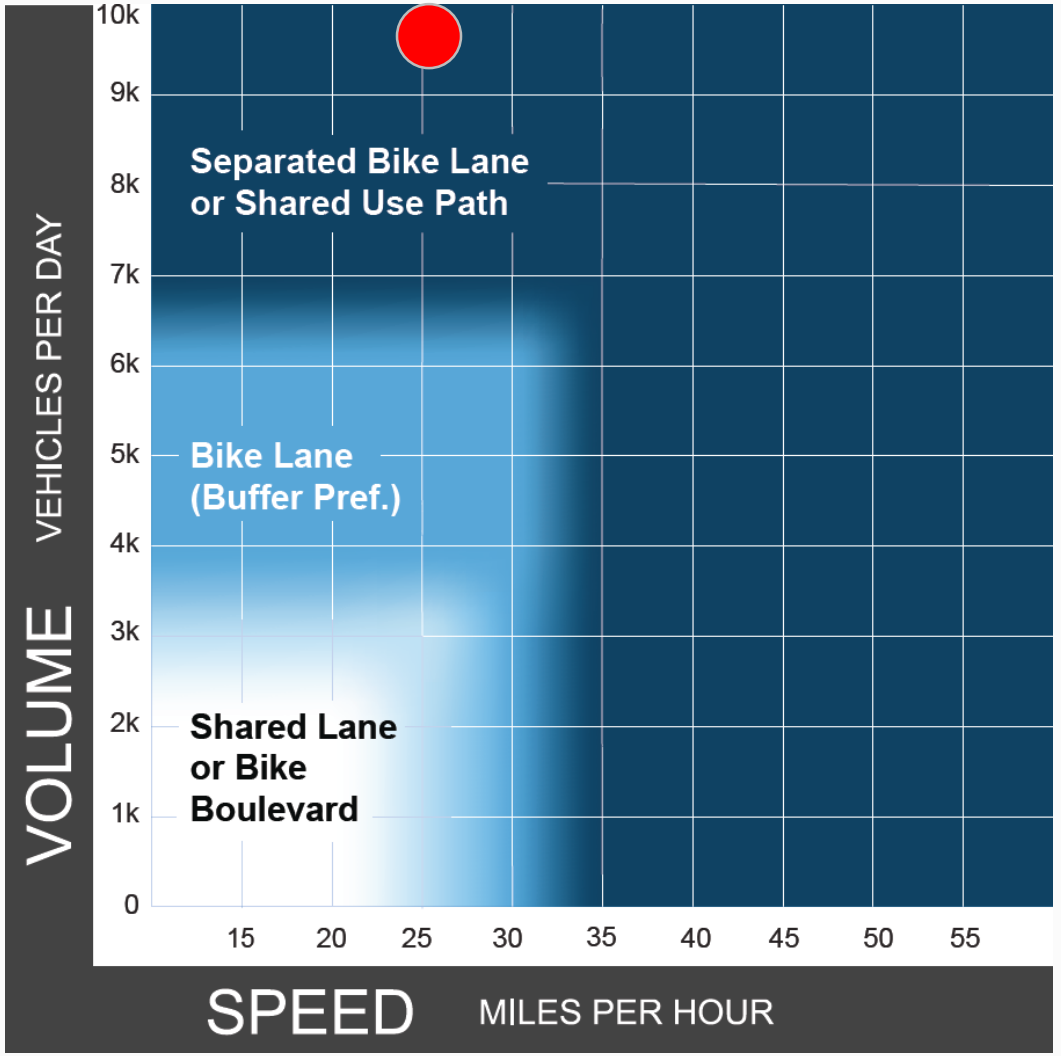
Streets in Urban, Suburban and Rural Town Contexts – Example

Volume = 6,800
Speed = 30 mph



Streets in Urban, Suburban and Rural Town Contexts – Example

Volume = 20,000
Speed = 25 mph



Choosing Between Separated Bike Lanes or Shared Use Paths

Low Volume Pedestrians
Low Conflict (LOS B or C)

High Volume Pedestrians
High Conflict (LOS E or F)

Separate Uses
Low Conflict (LOS A)

Evaluate with FHWA Shared-Use Path Level of Service Calculator

Separate pedestrians and bicyclists when:

- Pedestrians can reasonably be anticipated to be 30% or more
- Higher volumes of children, seniors, or individuals with disabilities
- Where faster bicycle speed is desired to serve regionally significant bicycle travel.
- Target score of LOS “B” or “C” in peak hours

Table 8. Correlation of trail widths and operational lanes.

Width (ft)	Lanes
8.0–10.5	2
11.0–14.5	3
15.0–20.0	4

1 ft = 0.3 m

Social Bicycling and Walking

failure to design for it results in conflicts and increases discomfort for all users

Social Bicycling and Walking

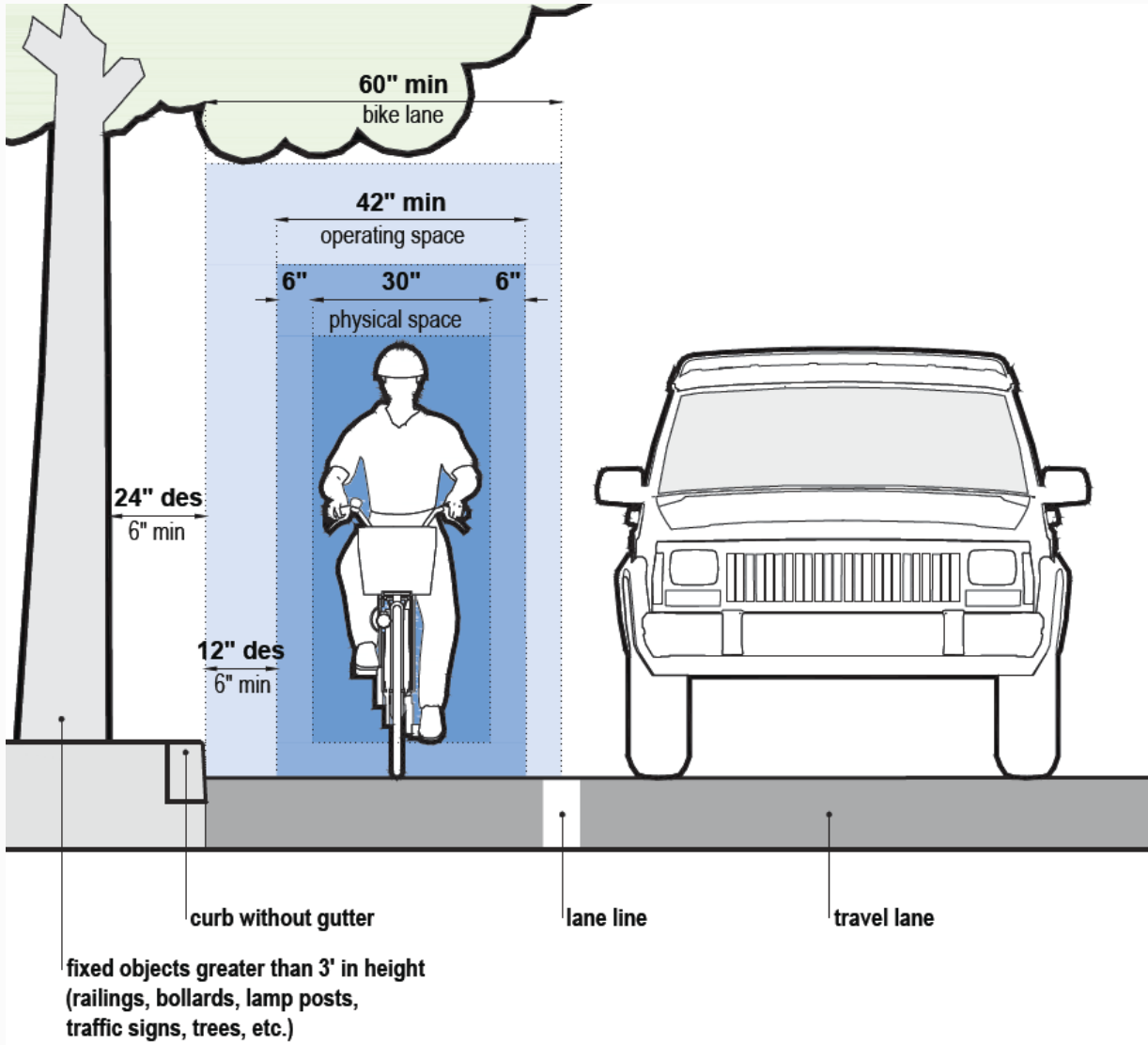
is a normal and a reasonable human behavior that should be designed for

Design Values – Operating Space

Operating Space – Physical space plus 12” to account for natural side to side motion

Shy Space improves comfort and safety:

- to traffic
- to other bicyclists
- intermittent vertical objects
- continuous vertical elements
- curbs and gutter
- vertical clearance



Design Values: Forgiveness, Predictability, Awareness

Minimum - the use of minimum values should not be considered a default for bicycle facilities

Desirable or Preferable - the use of larger values should be used to maximize the safety and comfort benefits for bicyclists

Minimum Widths – Occasional Passing

Desirable Widths – Side By Side Riding

Sidewalk Bicycling

Should be anticipated where streets are uncomfortable for all ages and abilities

- 10 ft = minimum width
- 11 ft is needed for passing
- 10-14 ft width is typical

- 6 foot buffer recommended

- AASHTO

Sidepaths

Inadequate buffers and surfaces can limit usefulness and safety

Bike Lane Width

Inadequate Width – Insufficient Ridable Surface

Bike Lane Width

Minimum 4 foot width adjacent to curb with no gutter

Bike Lane Width

Minimum 5 foot width next to parking

Bike Lane Width

Buffered bike lane adds comfort and improves safety

Raised Bike Lane

Minimum 5 foot width adjacent to travel lane

Curb Separated Bike Lane

Minimum 5 foot width does not allow passing. 6.5 foot minimum width for passing.

Parking Separated Bike Lane

Minimum 8 foot width with 2 foot minimum buffer to parking. Photo Aaron Naparstek

Intermediate Level, Curb Separated Bike Lane

A 2 inch vertical elevation difference preferred between sidewalk and bike lane

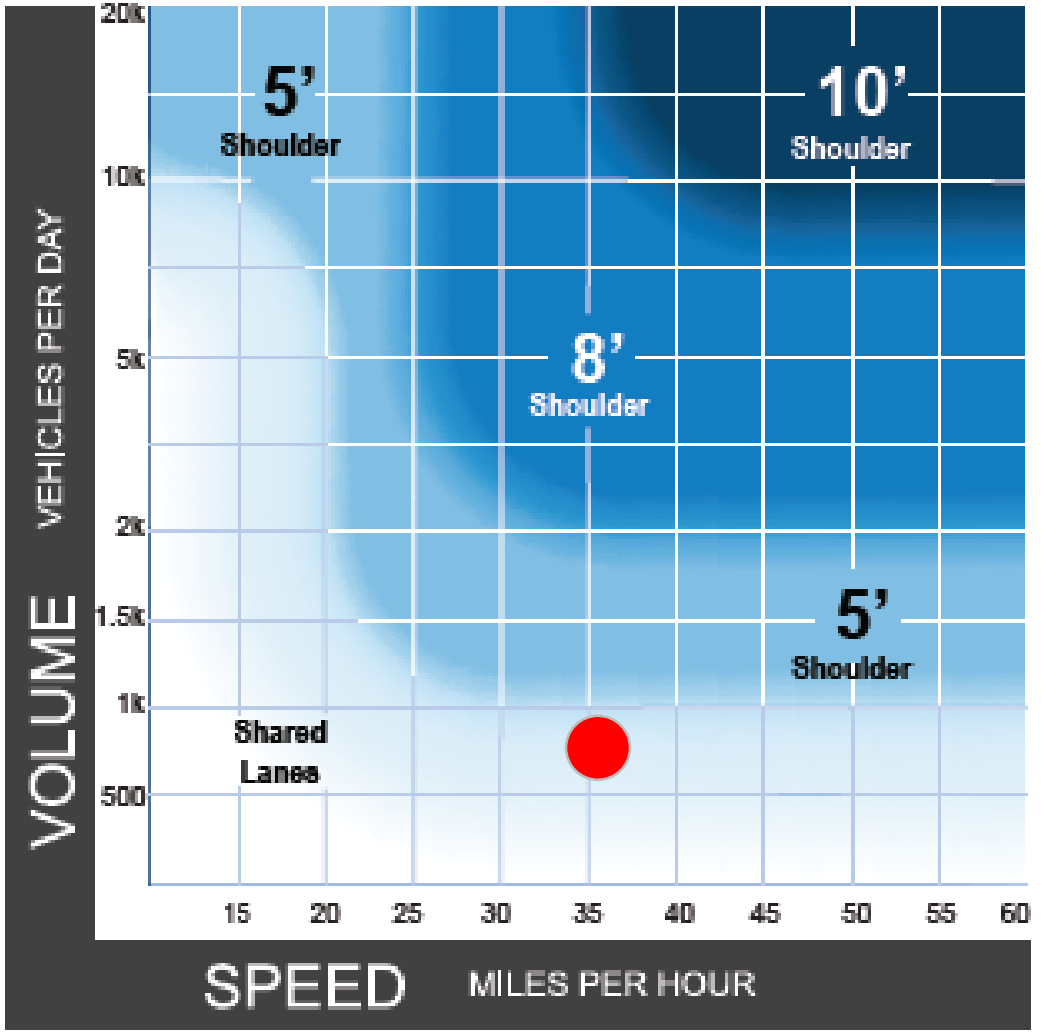
Sidewalk Level Separated Bike Lane

Western Avenue – Cambridge, MA

Rural Roadways – Proposed AASHTO

Design User Assumption:
Highly Confident or Somewhat Confident Bicyclist Profile

Analysis: Bicycle Level of Service



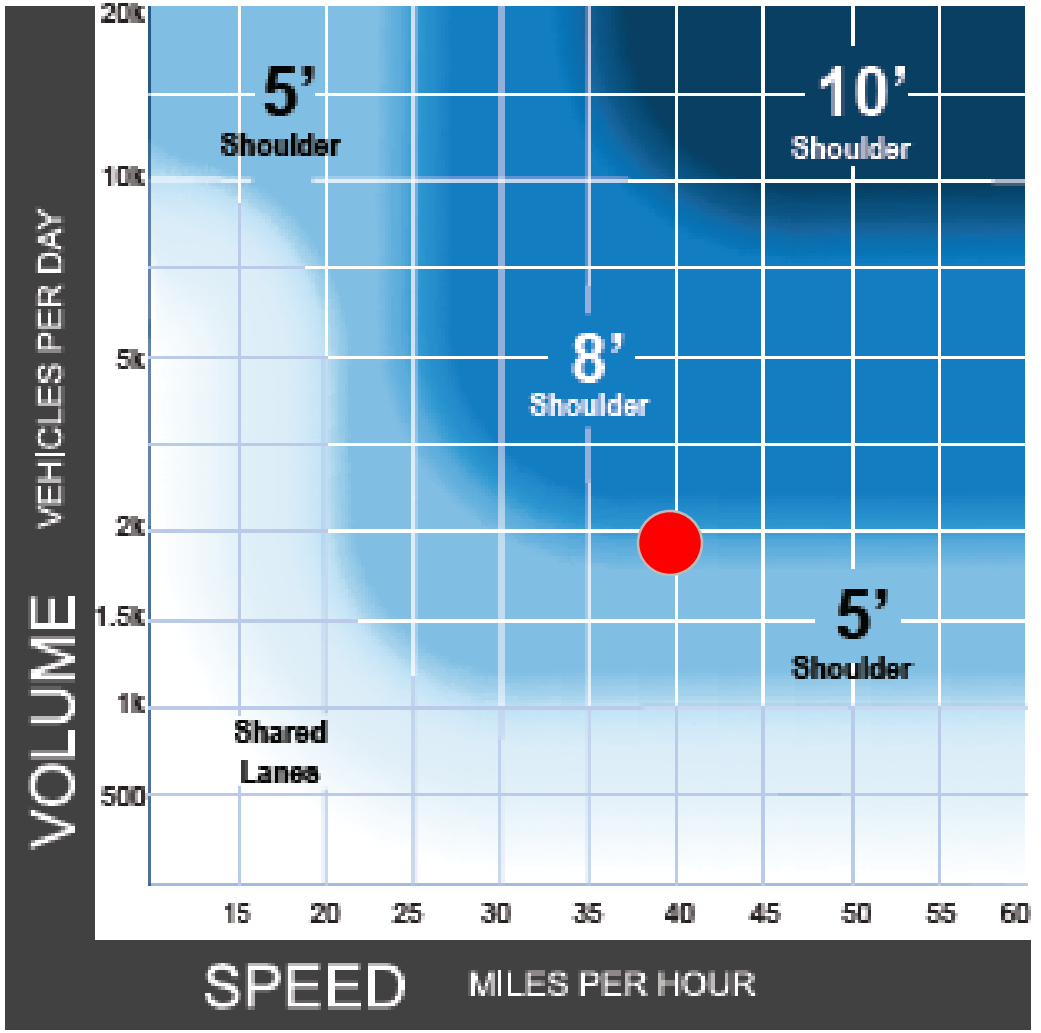
Notes

1. This chart assumes the project involves reconstruction or retrofit in constrained

Rural Roadways – Proposed AASHTO

Design User Assumption:
Highly Confident or Somewhat Confident Bicyclist Profile

Analysis: Bicycle Level of Service



Notes

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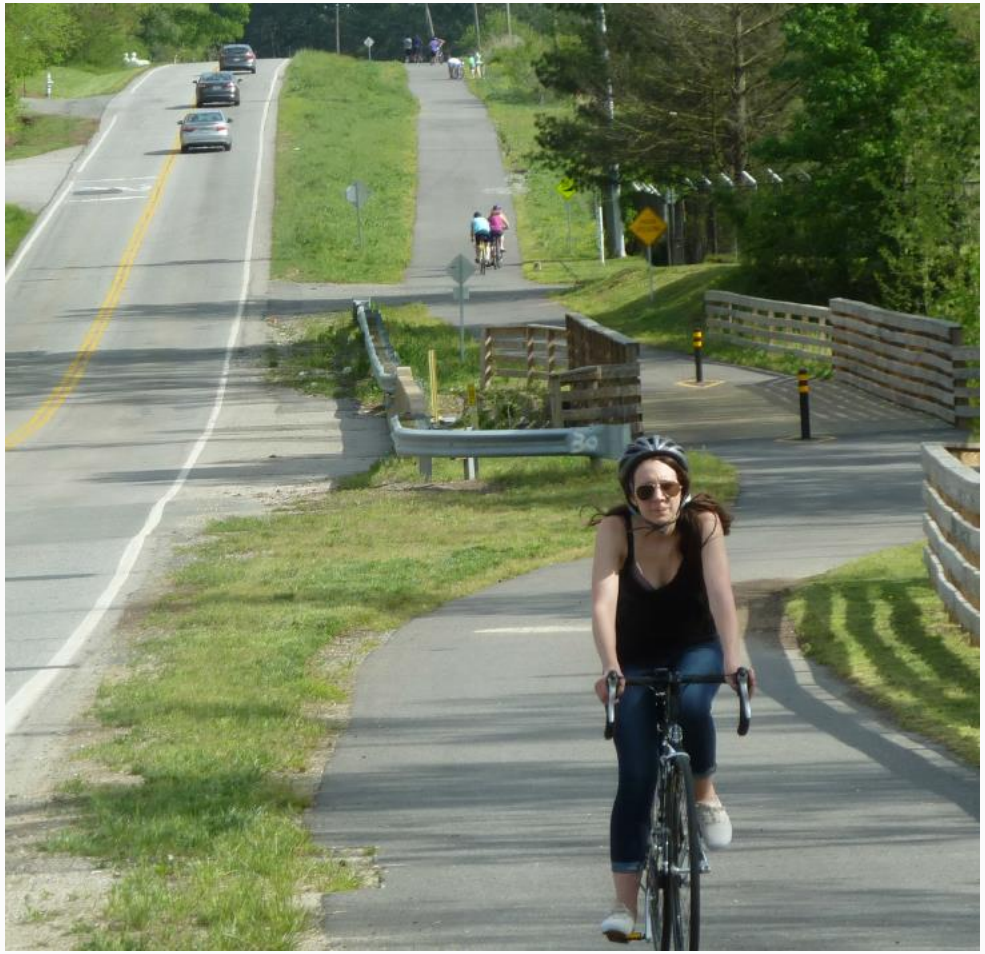
Rural Roadways – Proposed AASHTO



Other Considerations:

it may be preferable to provide a shared use path separated from the road:

- in locations with larger volumes of bicycling
- between key bicycle destinations
- for routes serving families and children
- To accommodate all ages and abilities

Guidance for Paved Shoulders

paved shoulders beneficial on roads with:

- inadequate sight distances for the typical operating speed
- grades in excess of 5%
- heavy vehicles > 10%

Rural Roadways

Spot Shoulder Widening

Rural Roadways - Paved Shoulders

"when sufficient width is available to provide bike lanes or paved shoulders, they are the preferred facilities on major roadways" – AASHTO

4 foot minimum
5 - 7 foot desirable

Rural Roads - Paved Shoulders

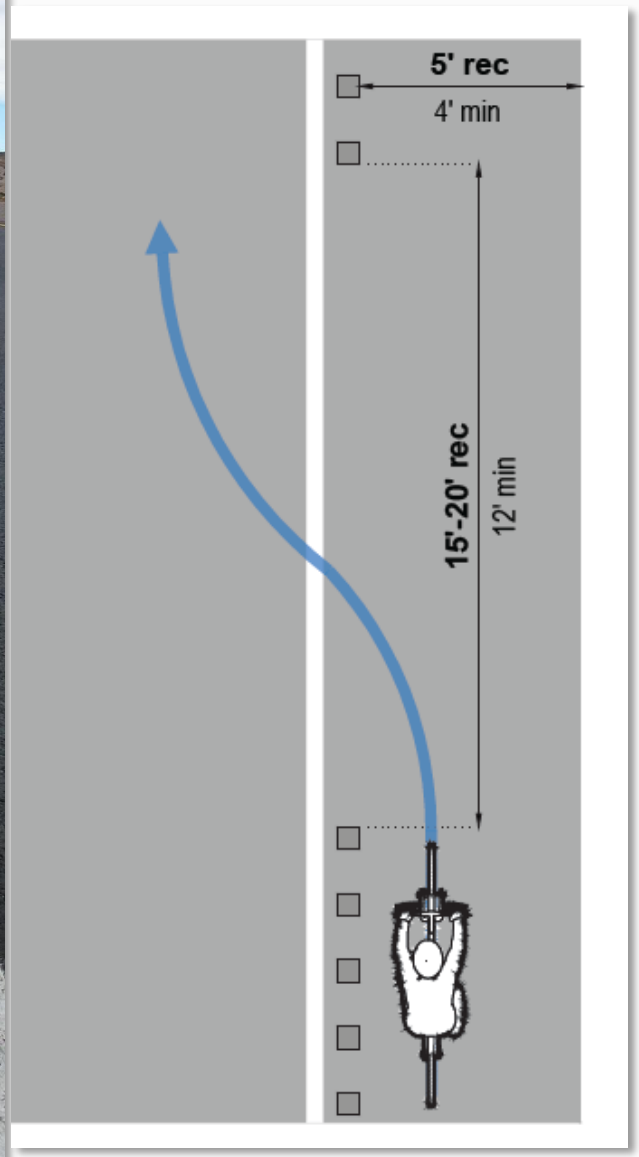
"when sufficient width is available to provide bike lanes or paved shoulders, they are the preferred facilities on major roadways" – AASHTO

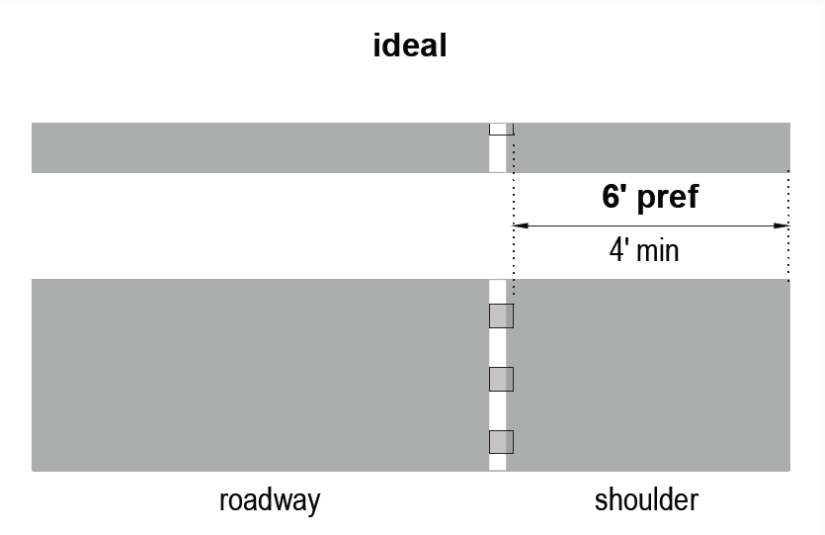
4 foot minimum
5 - 7 foot desirable

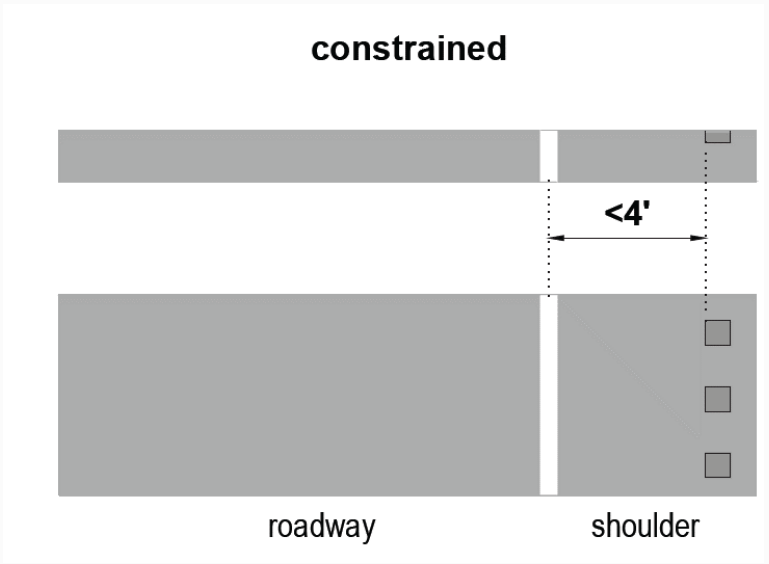
Rural Roadway Edge Lines

MUTCD provides guidance for line width

Rumble Strip Placement and Design





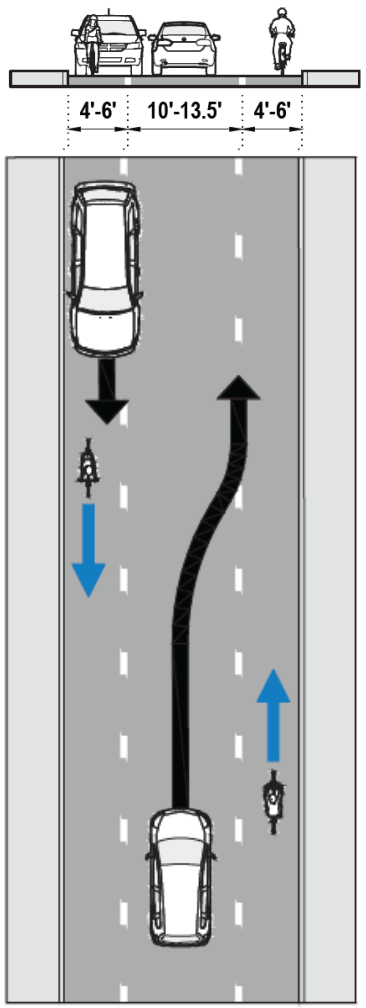


Center line rumble strip considerations

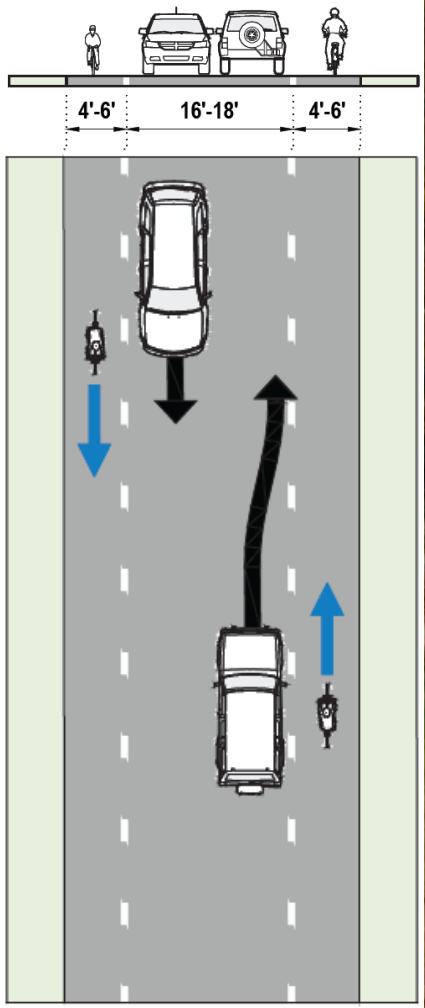
Center line rumble strips reduce motorist crossing therefore:

- shoulder rumble strips should only be used where shoulder with ridable surface is ≥ 6 ft
- Where shoulders are <6 ft wide, raised pavement markings, which motorists are more likely to cross, should be used instead of rumble strips

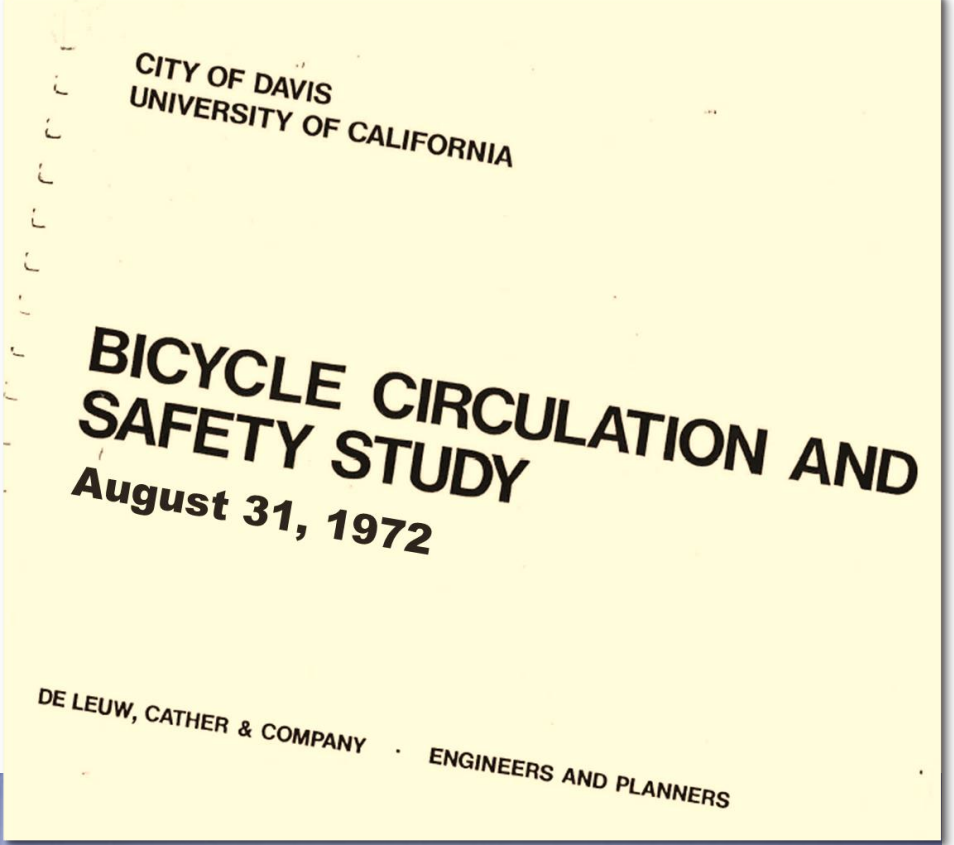
Advisory Shoulders (Experimental)



central lane suitable for one vehicle



central lane suitable for two vehicles



1972 DeLeuw Cather Bike Lane Research

findings consistent with modern-day research on bicyclists' preferences and safety:

- bicyclists & motorists prefer separation
- bike lanes safer than shared lanes
- bicyclists crash risk increases when bicycling facing traffic (wrong way)
- bicyclists operated at speeds of 7 -15 mph averaging 10 -11 mph
- Motorists would sometimes park or stop in unprotected bike lanes

Sidewalk and Sidepath Research Summary

- same or lower crash risk compared to streets without bike lanes where cyclists ride with traffic
- 2- 6 times higher crash risk were cyclists ride facing traffic (wrong way)
- higher potential for crashes caused by objects in path (signs, poles, etc.), deficiencies in width, or collisions with other users

Separated Bike Lane Safety Research Summary

Reduced injury risk compared to standard bike lanes and shared lanes

(Lusk et al., 2013; Lusk et al., 2011; NYCDOT, 2014; Winters et al., 2013)

SBL preferred over striped or shared lanes by both cyclists and motorists

(Monsere et al., 2014; Monsere et al., 2012; Sanders, 2014)

One-way generally safer than two-way

(Schepers et al., 2011; Thomas & DeRobertis, 2013)

Two-way SBLs on one-way roads, preferable on right side

(Schepers et al., 2011; Zangenehpour et al., 2015)

Discussion

- Send us your questions 
- Follow up with us:
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