PBIC Webinar

How to Create a Bicycle Safety Action Plan: On-Road Bicycle Facilities

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Oct. 16, 2014, 2 pm

Today's Presentation

- **Introduction and housekeeping**
- **Audio issues?**
  Dial into the phone line instead of using "mic & speakers"
- **PBIC Trainings and Webinars**
  www.pedbikeinfo.org/training
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  pedbikeinfo.org/webinars
- **PBIC News and updates on Facebook**
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- **Questions at the end**

Ongoing Activities

U.S.Department of Transportation
Federal Highway Administration

- Pedestrian and bicycle assessments
- Network documentation and promotion
- Pedestrian and bicycle data initiatives
- Road Diet Guide
- *Separated Bike Lane Planning and Design Guide*

www.pedbikesafe.org/BIKESAFE

Ongoing Activities

U.S.Department of Transportation
Federal Highway Administration

- Guidebook for Evaluating, Establishing, and Tracking Pedestrian and Bicycle Performance Measures
- Multimodal Conflict Points
- Flexibility in Pedestrian and Bicycle Facility Design
- Global Benchmarking on Delivering Safe and Connected Pedestrian and Bicycle Networks
- Workbook for Building On-Road Bike Networks through Routine Resurfacing Programs
- NHI Pedestrian Facilities Design Course Update

Strategic Agenda for Pedestrian and Bicycle Transportation

- Data
- Research
- Training
- Design Guidelines

For project updates, funding information, policy background, etc., visit: www.fhwa.dot.gov/environment/bicycle_pedestrian

U.S. Department of Transportation
Federal Highway Administration

Pedestrian and Bicycle Information Center

On-Road Bicycle Facilities

Planning for Safety

Presented by:

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and

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October 16, 2014

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Outcomes

At the end of this series, you will be able to…

- Recognize a bicycle-friendly network of roads and trails will increase cyclists' safety.
- Describe how planners and engineers develop bicycle plans that directly address safety.
- Recognize bicyclists are a diverse subset of travelers with wide ranging skill and tolerance of traffic stress.
- Identify good practices and effective Countermeasures to enhance bicycle safety and accessibility.

October 2014

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
				2	3	4
				9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

1: Planning for Bicycle Safety

2: On-Road Bicycle Facilities

3: Off-Road Facilities

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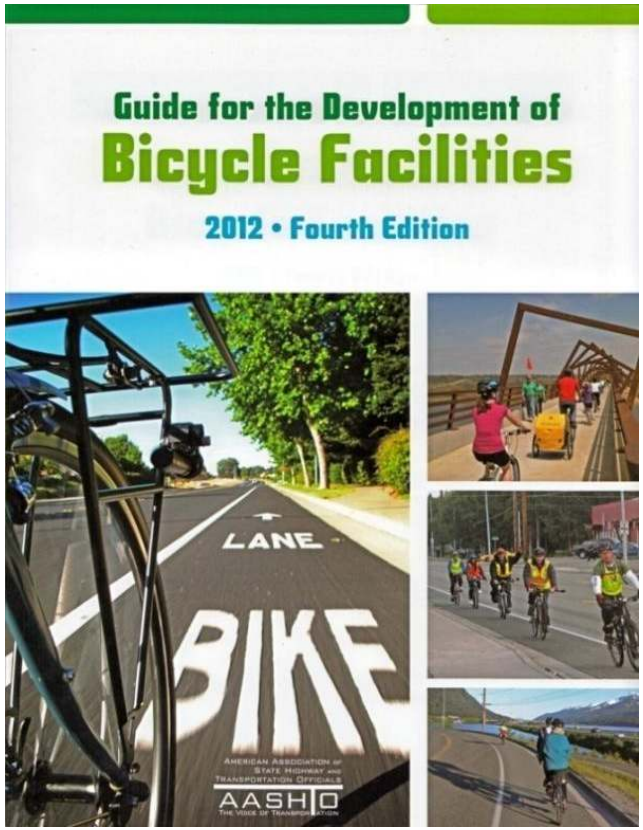
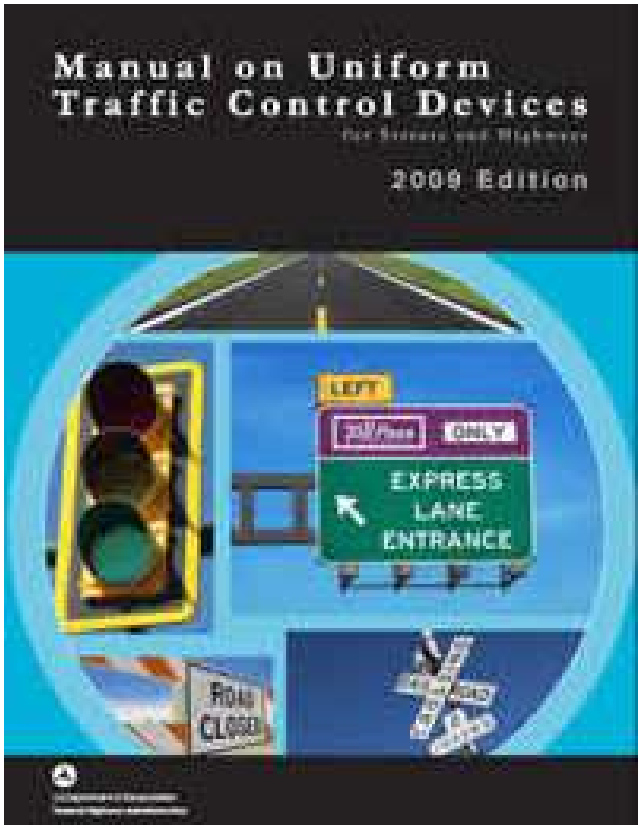
Pedestrian and Bicycle Information Center

Section 1

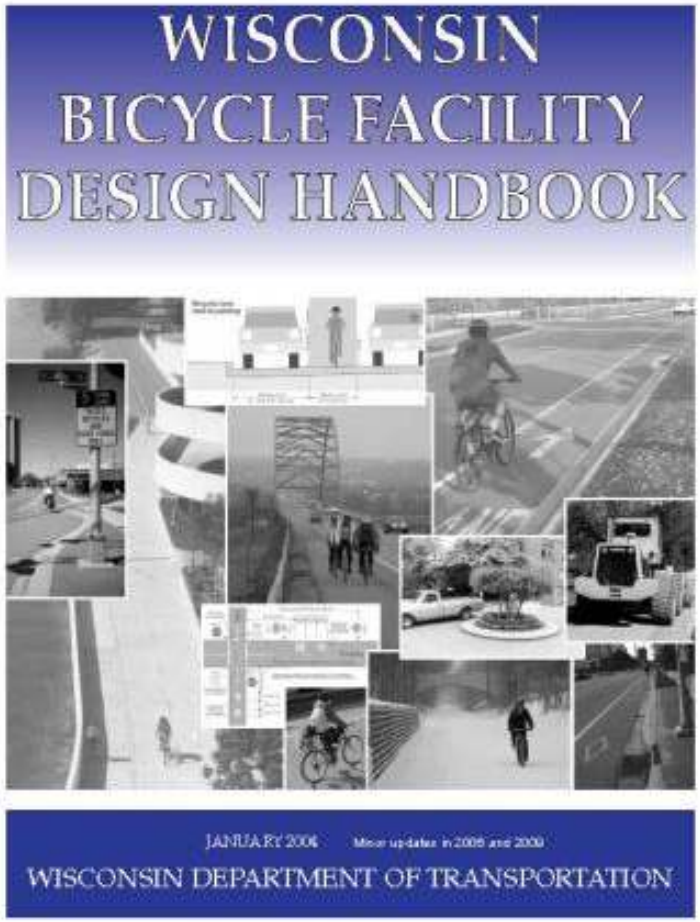
Resources & Safety Analyses Approaches

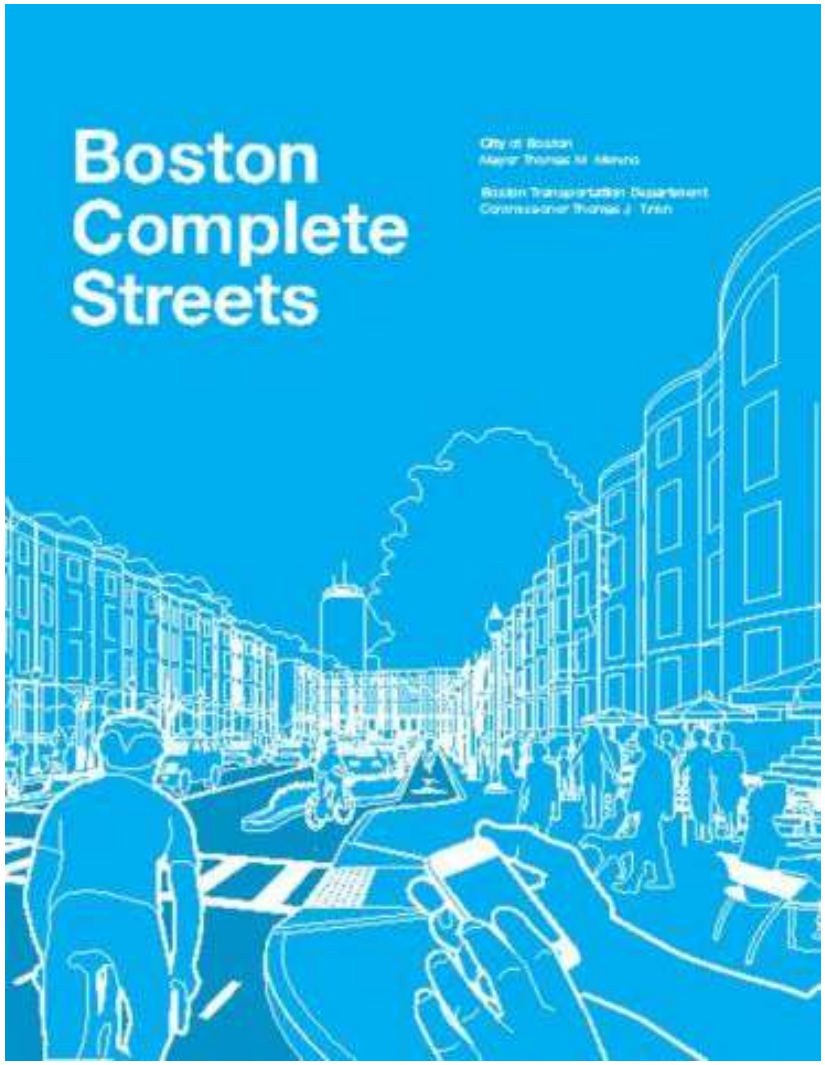
National Design Resources





Local Design Resources





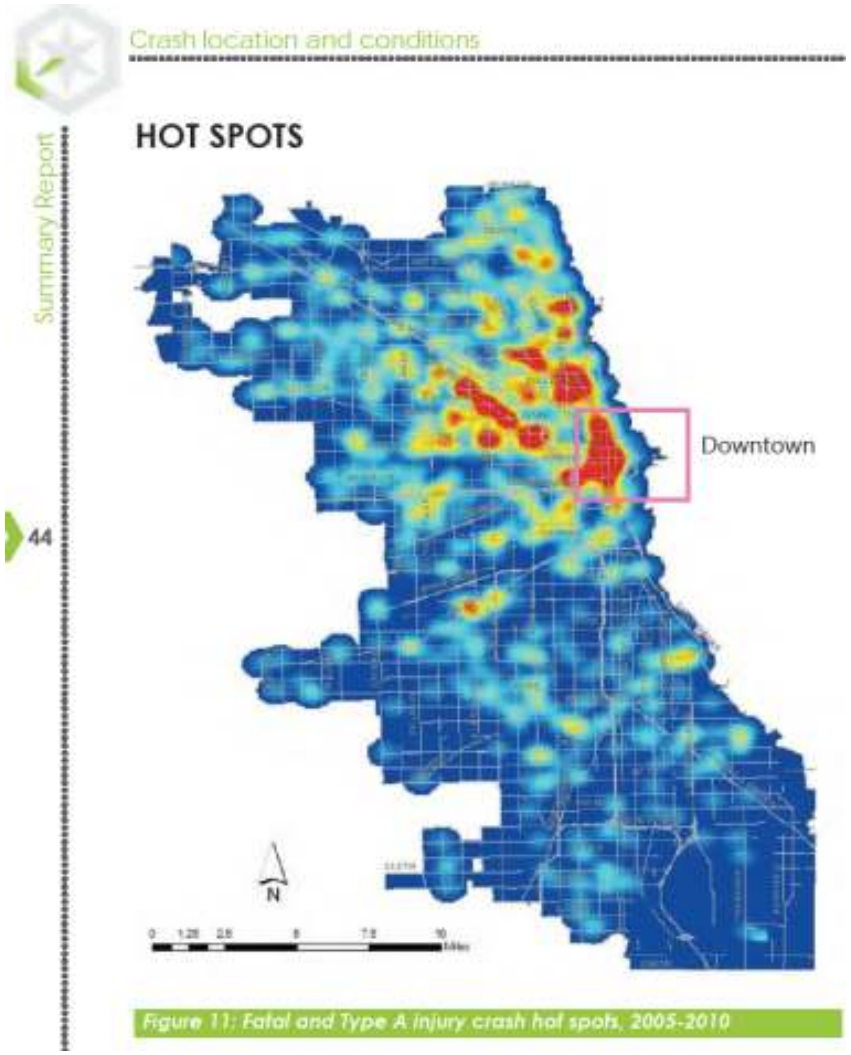
Crash Data Analysis

- 5 year minimum
- Review police reports
- Review emergency room or 1st responder data
- Identify:
  - hot spots & corridors
  - major crash types
  - demographics

Crash Data Analysis

Crash data analysis can:

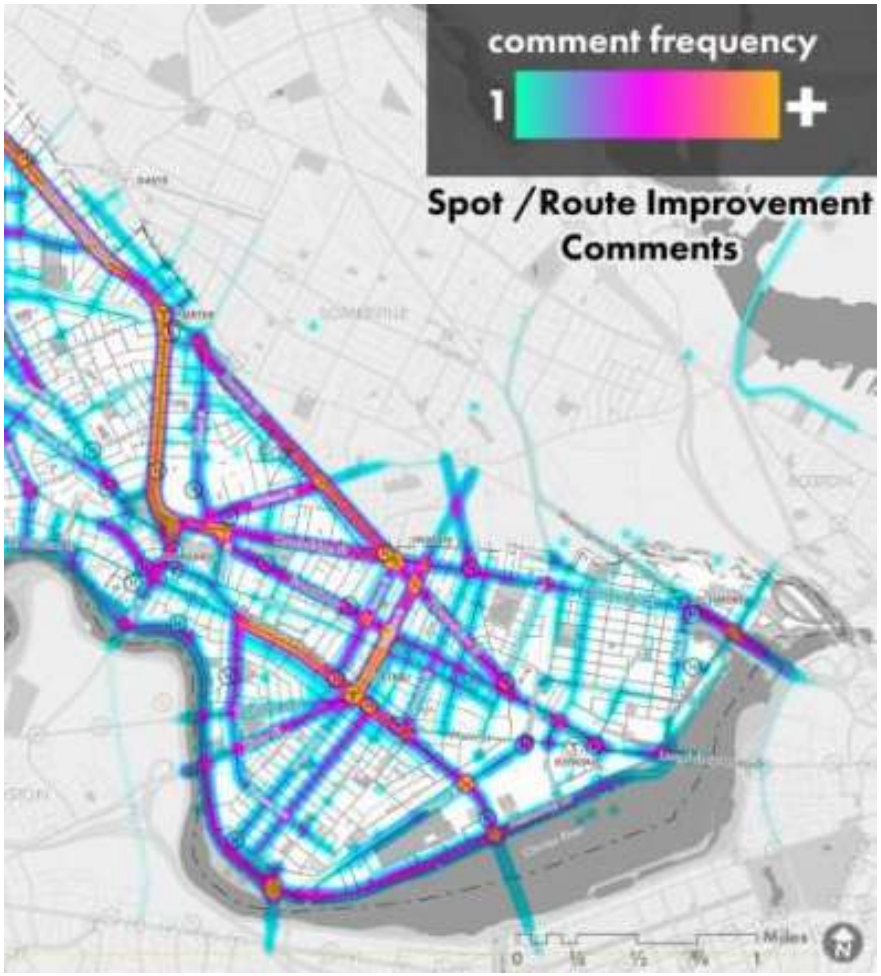
- Discover prevalent crash types and behaviors
- Target specific areas
- Inform selection of bicycle facility



Crash Data Analysis

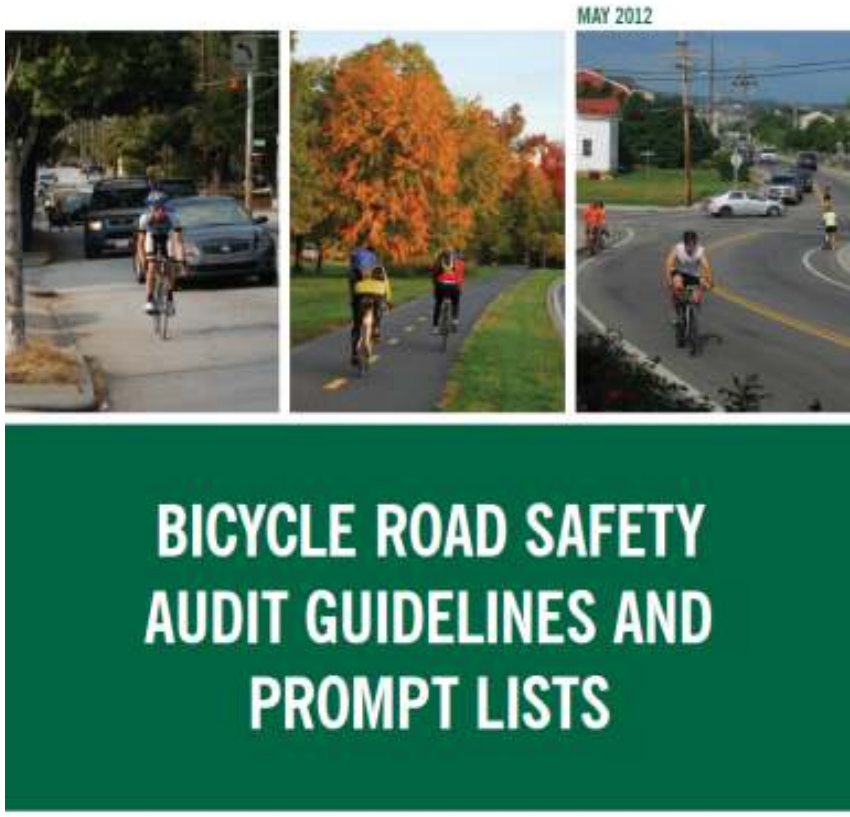
Understand the limitations:

- crashes are usually dispersed
- Crash data does not include “near-misses”
- The public may perceive locations without crashes to be less safe
- Crash data may be incomplete or inaccurate



Road Safety Audits

1. Identify location
2. Select RSA team
3. Start-up meeting
4. Field review
5. Findings & report
6. Present findings
7. Respond to findings
8. Implement improvements

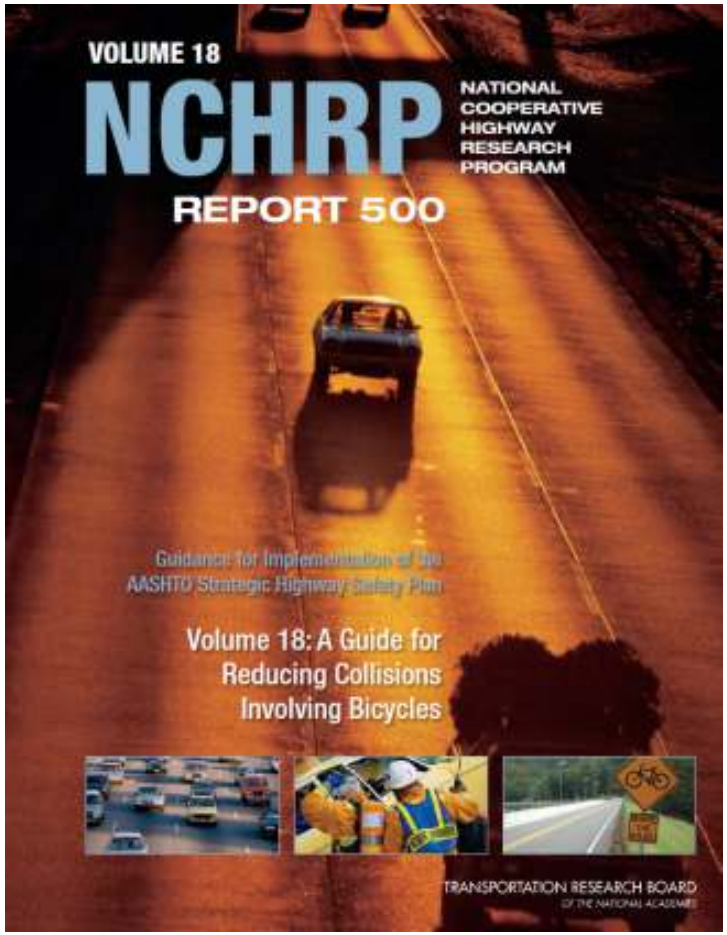


http://safety.fhwa.dot.gov/ped_bike/tools_solve/fhwasa12018/

Road Safety Audits

	RSA Zones				
	A. Street or Path	B. Structures	C. Intersections, Crossings, and Interchanges	D. Transitions	E. Transit
7. Continuity & Connectivity					
	Are bicycle accommodations continuous? Do bicycle accommodations provide adequate connectivity to major destinations?	Are bicycle accommodations continuous, or do they end abruptly at bridge/tunnel crossings?	Are bicycle accommodations continuous, or do they end abruptly at crossings/ intersections/ interchanges?	Is there a safe way for cyclists from both directions to access connections or continue to other destinations along the street network?	Are crossings convenient and free of potential hazards for cyclists?

Crash Countermeasure Resources

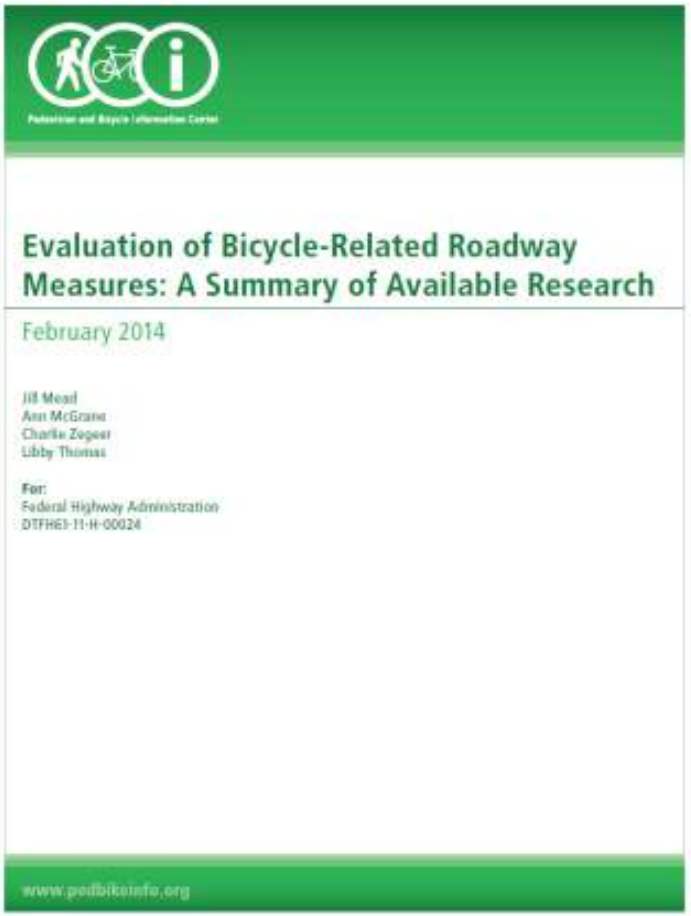


http://www.pedbikesafe.org/BIKESAFE/

http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_500v18.pdf

Crash Countermeasure CMF

- Crash Modification Factors (CMF) are limited
  - Limited before/after data
  - Insufficient bike counts
- Lit review of countermeasure research available on BIKESAFE



Crash Context

Section 3

Overview of Bicycle Safety Problem

In 2012:

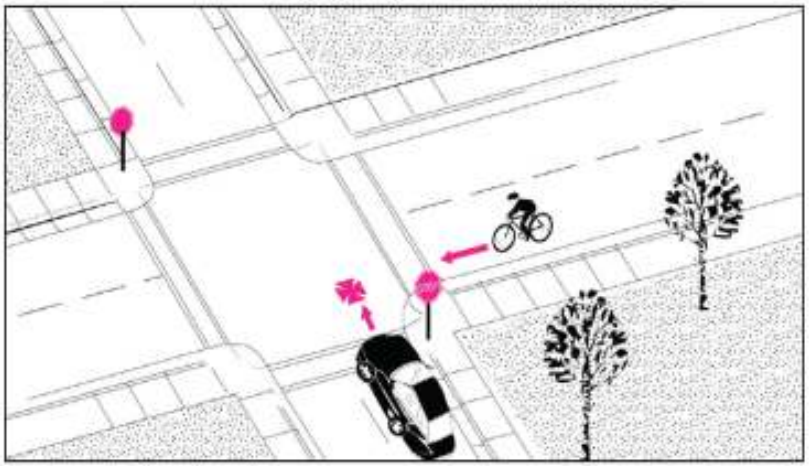
- 726 killed
- 49,000 injured
- Cyclist account for over 2% of all traffic deaths and injuries

...but are only 1% of all traffic

Types of Bicyclists

Types of Bicyclists

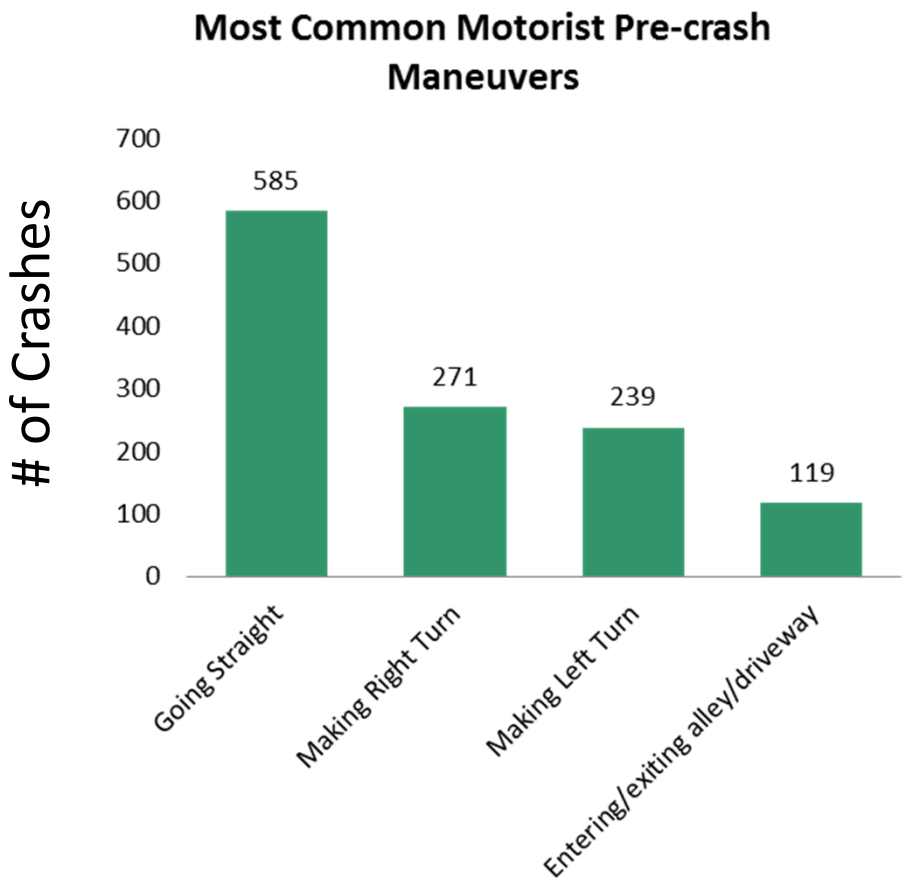
Common Crash Factors

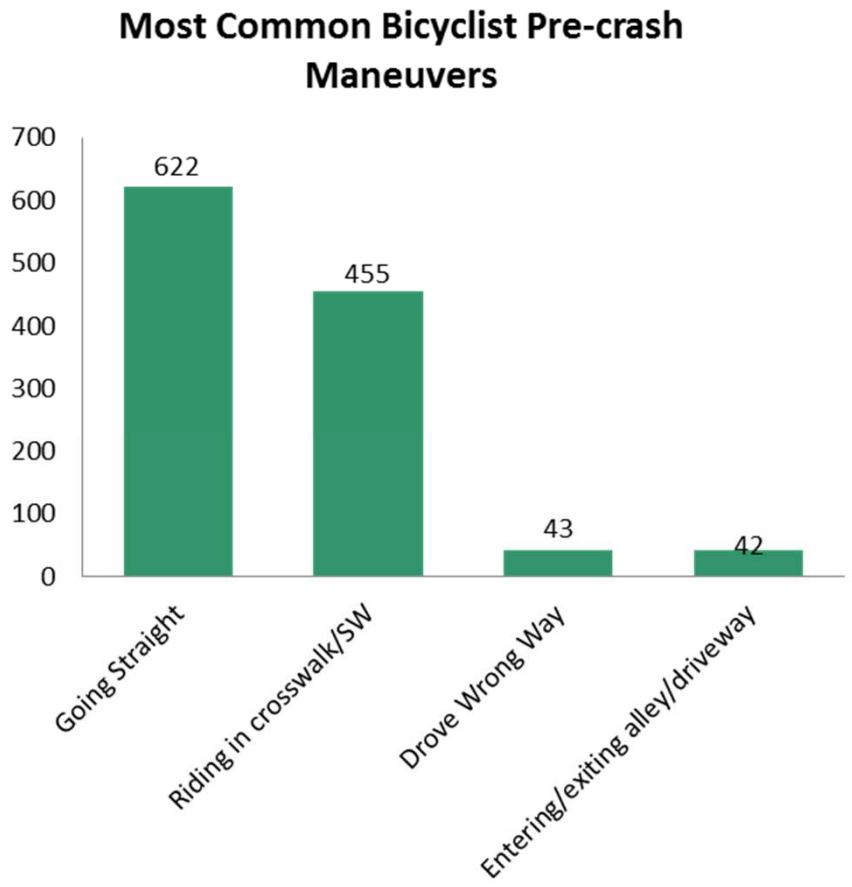


Bicycle Crash Type Groups	Percentage of Crashes			
	FHWA (early '90s)	North Carolina Urban ('04-'08)	North Carolina Rural ('04-'08)	Orlando Metropolitan Area ('03-'04)
CROSSING PATHS				
Motorist failure to yield – intersection	14.4	13.9	5.5	14.0
Bicyclist failure to yield – intersection	16.8	15.3	7.9	14.0
Bicyclist failure to yield – midblock	11.7	8.6	10.8	9.3
Motorist failure to yield – midblock (driveway/alley)	6.9	8.5	3.0	10.1
Turning errors – bicyclist and motorist	1.4	1.5	1.7	2.7
Bicyclist failure to clear intersection	1.4	1.3	0.2	0.0
Crossing Path Total	**52.6**	**49.1**	**29.1**	**50.1**
PARALLEL PATHS				
Motorist turned/merged into path of bicyclist	12.1	13.2	6.9	8.1
Motorist overtaking bicyclist	8.6	8.9	29.3	8.1
Bicyclist turned/merged into path of motorist	7.3	6.8	16.9	5.4
Bicyclist overtaking motorist	2.7	1.6	0.7	0.6
Operator wrong side/head-on (motorist or bicyclist)	2.8	2.1	5.6	2.5
Motorist loss of control	0.6	0.3	0.5	0.3
Bicyclist loss of control	1.8	2.2	1.3	1.0
Parallel Path Total	35.9	35.1	61.2	26
Total for Common Crash Types Listed	88.5	84.2	90.3	76.1

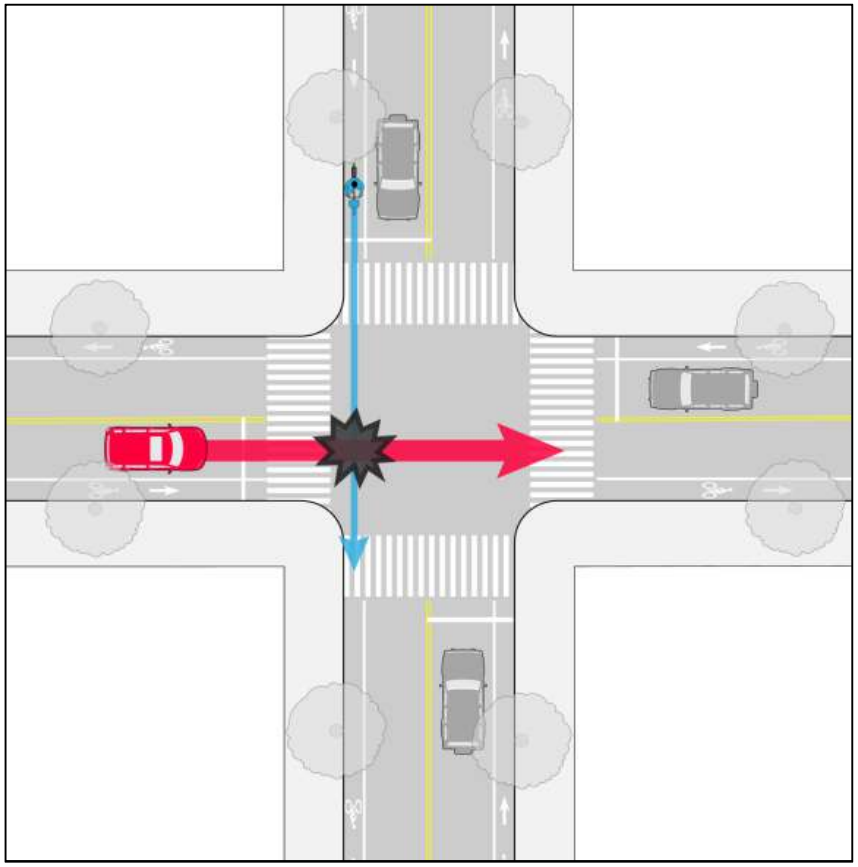
Source: FHWA Bicycle Road Safety Audit Guideline

Pre-crash Maneuvers

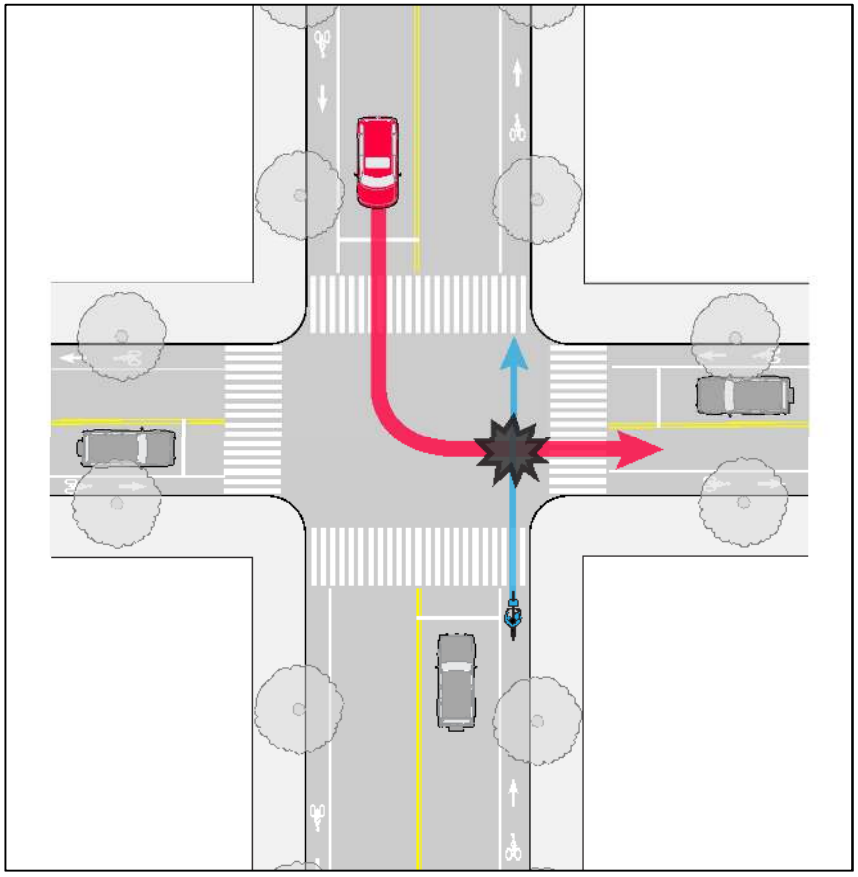




Source: City of Denver Bicycle Crash Study



Broadside from the Right



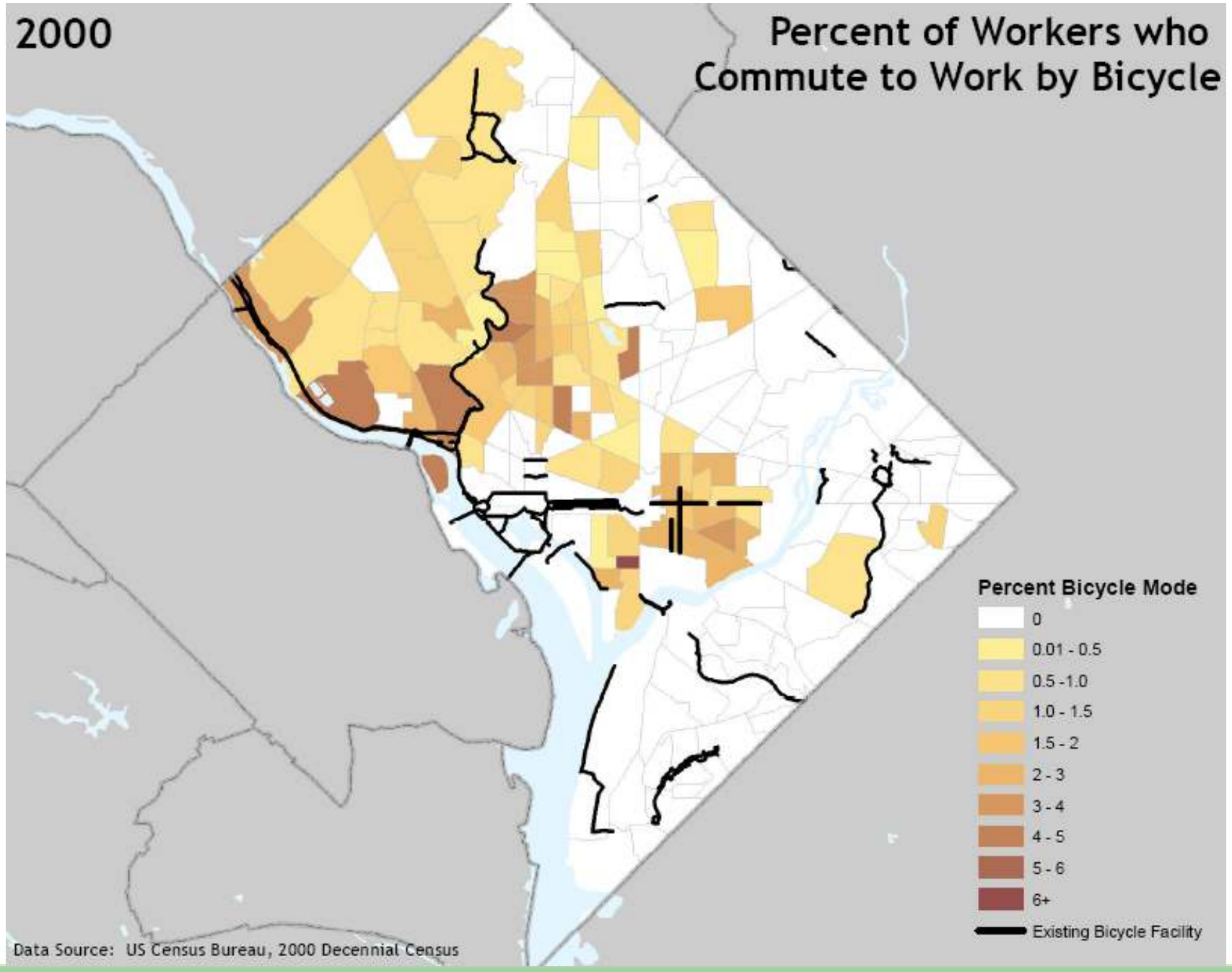
Left Hook

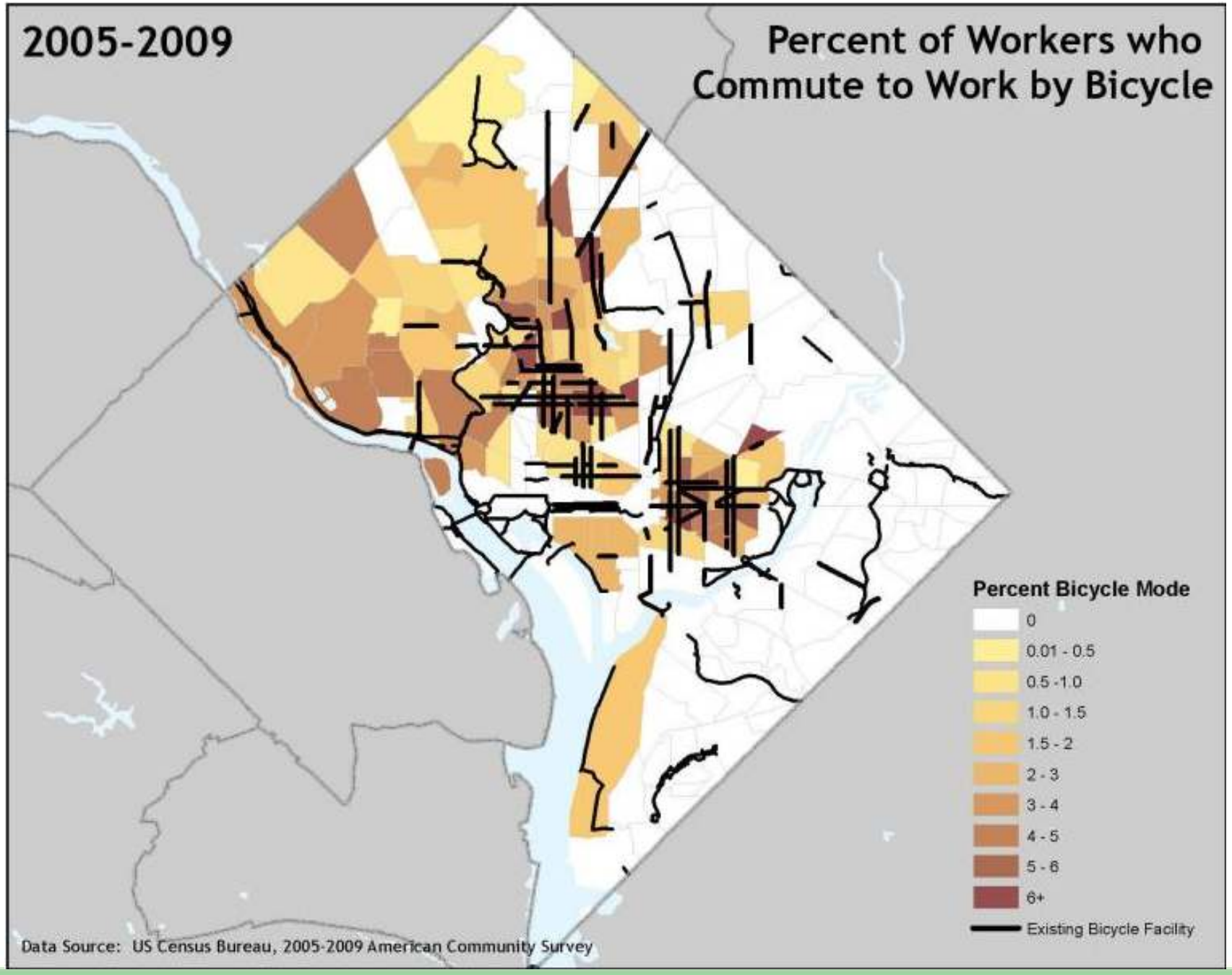
On-Road Bicycling Infrastructure Crash Reduction Countermeasures Network Approach

Section 4

Network Solutions

- Direct
- Seamless
- Fine grained
- Comfortable
- Connected


2000
Percent of Workers who Commute to Work by Bicycle
Percent Bicycle Mode
0
0.01 - 0.5
0.5 - 1.0
1.0 - 1.5
1.5 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6+
Existing Bicycle Facility
Data Source: US Census Bureau, 2000 Decennial Census


2005-2009
Percent of Workers who Commute to Work by Bicycle
Percent Bicycle Mode
0
0.01 - 0.5
0.5 -1.0
1.0 - 1.5
1.5 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6+
Existing Bicycle Facility
Data Source: US Census Bureau, 2005-2009 American Community Survey

Facility Selection

Using the Bicycle RSA Prompt Lists

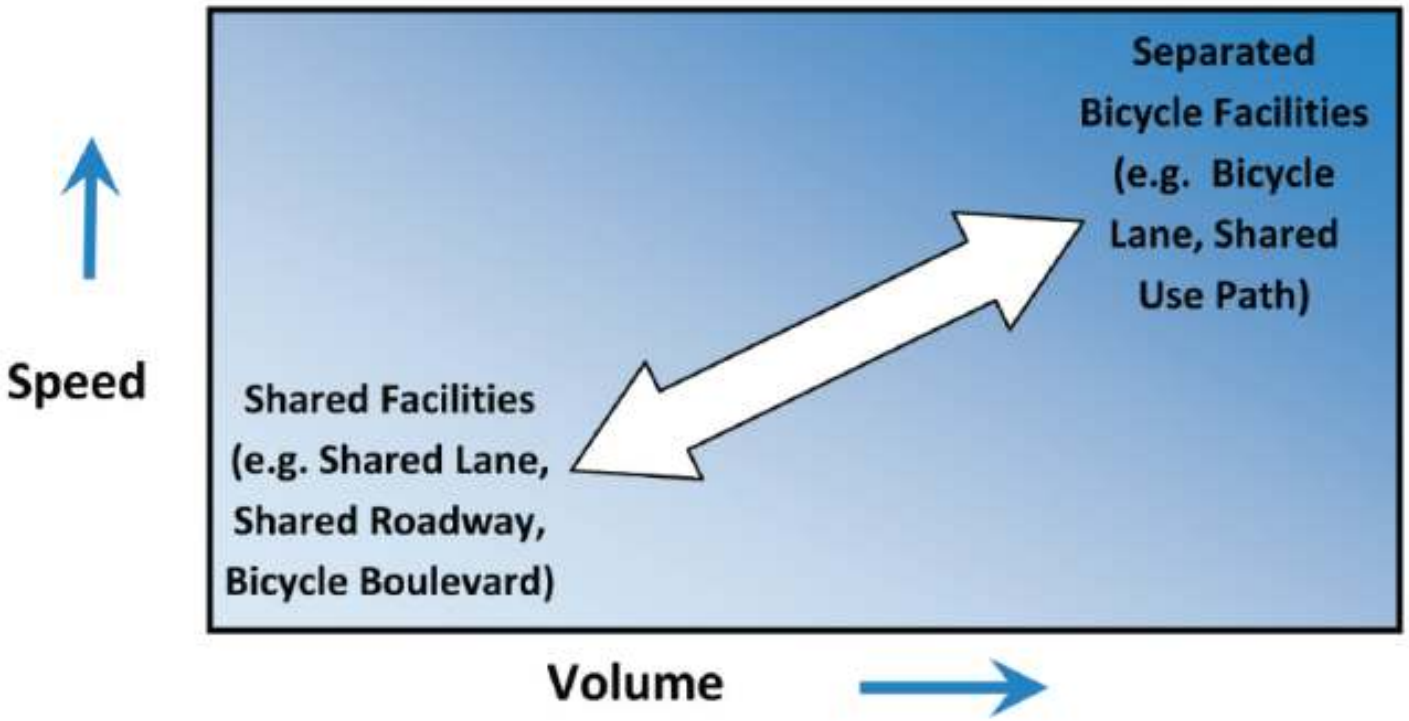


Figure 17. General Bicycle Facility Utilization Given the Context of Vehicular Traffic Volume and Speed.[27]

On-Road Bicycling Infrastructure Crash Reduction Countermeasures Street Segment Approach

Section 5

Shared Lane Safety Challenges

Wrong Way Riding

- 32% of <u>all</u> crashes involve wrong way riding
- 42% of all intersection crashes involve wrong way riding
- (NCHRP Report 500)

Wrong Way Riding Countermeasures

- Shared lane markings:
  - Reduce sidewalk riding
  - Improve rider positioning
  - Reduce wrong way riding
  - Improve motorist passing behavior

One-Way Street Wrong-Way Riding

One-Way Street Countermeasures

Contra-flow bike lanes

- Correct design leads to correct use
- Signs, signals, and markings add clarity for all modes

Sidewalk Riding

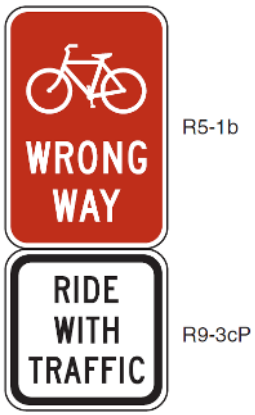
Sidewalk Riding

From City of Denver Crash Study

- 34% of all crashes involved a bicyclist riding on the sidewalk. Of these crashes…
  - 66% of bicyclists riding on the sidewalk were riding against traffic
  - 53 percent were riding on an arterial sidewalk where there was no parallel bicycle lane or path.
- Bicyclists riding on the sidewalk are less visible to motorists and more vulnerable to crashes

Sidewalk Riding Countermeasures

- Separated bicycle lanes (cycle tracks)
- Bicycle lanes
- Shared lane markings



Sidewalk Riding

Inadequate infrastructure won't be used as intended…

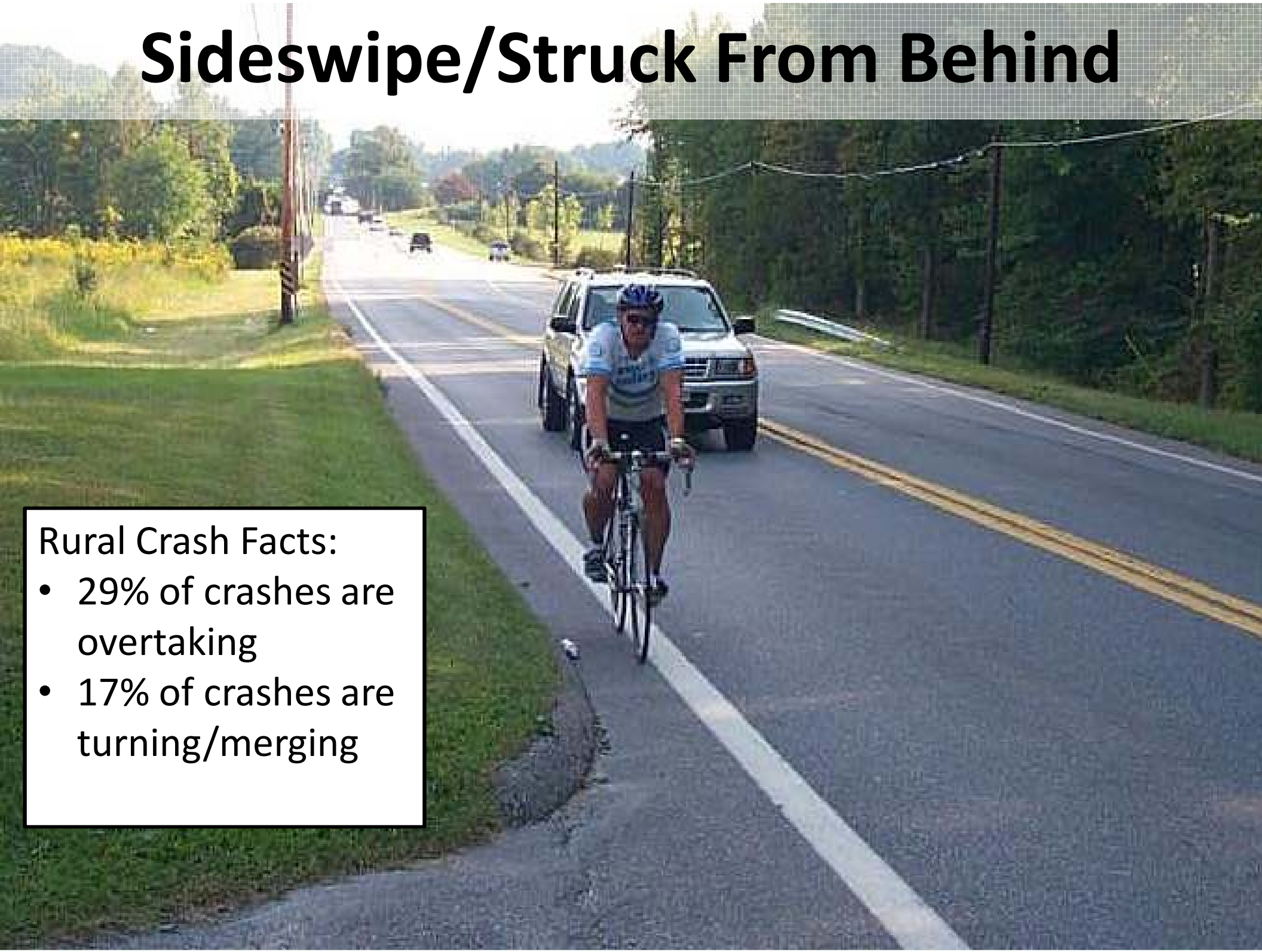
Lane diets

- Narrow arterial lanes up to 10 feet acceptable - AASHTO.
- 10’ and 11’ travel lanes don’t increase crash rates in urban and suburban areas – NCHRP Project 17-26

Buffered Bike Lanes

Increased comfort can promote correct use…

Sideswipe/Struck From Behind



Rural Crash Facts:

- 29% of crashes are overtaking
- 17% of crashes are turning/merging

Struck from Behind Countermeasures

- Shoulders
- Separated bicycle lanes (cycle tracks)
- Bicycle lanes
- Shared use paths

Sideswipe/Struck From Behind

Struck From Behind Countermeasure
Curb-Separated Bike Lanes

Struck From Behind Countermeasure
Barrier-Separated Bike Lanes

Separated Bicycle Lane Intersection Safety Countermeasures

Dooring

Dooring Countermeasure
Climbing lanes

Marked shared lane downhill

Bike lane uphill

Dooring Countermeasures

Wider Bike Lanes

Wider Parking Lanes

Failure to Yield

Countermeasure – Minicircle

Mini-Traffic Circles

- Typically 12-16 feet in diameter
- Add deflection to travel lane
- Preferable to stop signs
- Positive effect on bicycling

Bike Boulevards

Source: NACTO

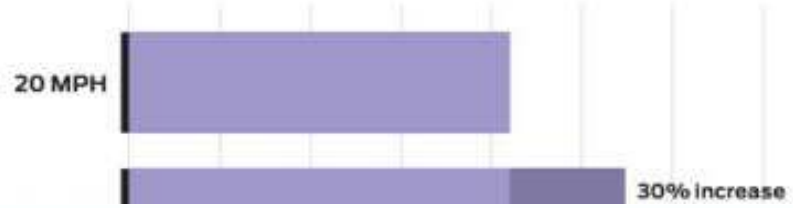
(10) Guidance for vertical traffic calming features:

- Slopes should not exceed 1:10 or be less steep than 1:25.
- Side slopes on tapers should be no greater than 1:6 to reduce the risk of bicyclists losing their balance.

Optional Features

(12) Speed management may be implemented on a trial basis to gauge residents' support prior to finalizing the design. Temporary speed humps, tables, and lumps are available. Temporary traffic calming should be used with caution as they can diminish residents' opinions due

Depending on motor vehicle speeds, a bicyclist will be passed by a car going the same direction this many times during a 10 minute trip:



Right Hook Crashes

Photo Credit:
Jonathon Maus

Right Hook Countermeasure

- Add Right Turn Lane
- Minimize length of right turn lane
- Add R4-4 sign

Right Hook Countermeasure

Highlight Conflict Zone

- Green increases conspicuity and awareness of conflict area
- Green can be dotted to match dotted lines within merging area

Right & Left Hook Countermeasure

- Bike lanes extended through intersection
- Option to color green

Right & Left Hook Countermeasure

- Bicycle boxes
  - Provide head start for bicyclists
  - Improve bicyclists visibility at on-set of green signal

Darkness Countermeasures

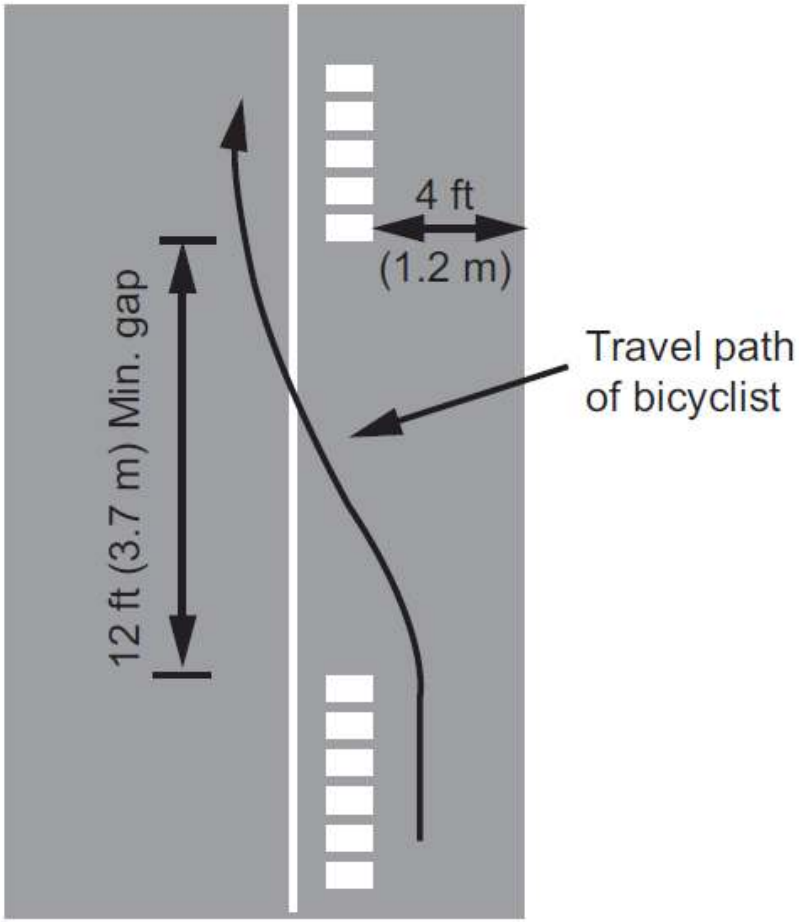
- **Street lighting**
- **On-bike lighting**

Crash facts for hours 6pm to 6am:

- 31% of all injuries
- 50% of all fatalities (alcohol frequent contributor)

Rumble strips – NOT recommended unless:

- Maintain a 4-ft min. clear path width with no curb present; 5-ft with curb
- Use gaps to allow cyclists to move across rumble strips as needed
- Centerline rumble strips may lead motorists to shy away from the centerline and move closer to bicyclists
- Utilize the narrowest and shallowest rumble strip design



Bridges, viaducts, and tunnels

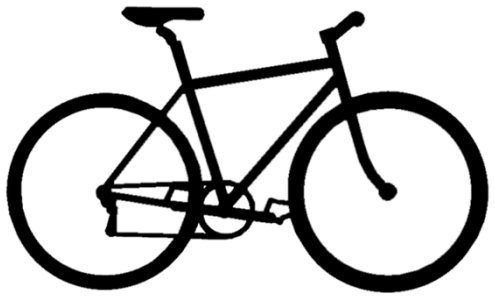
- All should accommodate bicycles unless prohibited

Bridges, viaducts, and tunnels

- On long (1/2 mile+) bridges consider providing a shared-use path on each side separated by concrete barriers

Signal Timing Practices

- AASHTO Bicycle guide describes 2 conditions:
  - Standing bicycle minimum green (start from stop)
  - Rolling bicycle minimum green (arrive moving)
- Children aged 10 to 19 over-represented in "trap" type crashes



Speed: 10 mph
Acceleration: 1.5 ft/s²
Deceleration: 5 ft/s²
Perception-Reaction Time: 1 s

Countermeasure Takeaways

- Connected networks improve safety
- Comfort and safety have a relationship
- Land use, terrain, and traffic character influence use and safety
- Education & Enforcement strategies are also very important
- Our industry needs more count data for CMF's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Questions?

Q&A

- **Archive at www.pedbikeinfo.org/webinars**
  - Downloadable and streaming recording, transcript, presentation slides
- **More questions?**
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