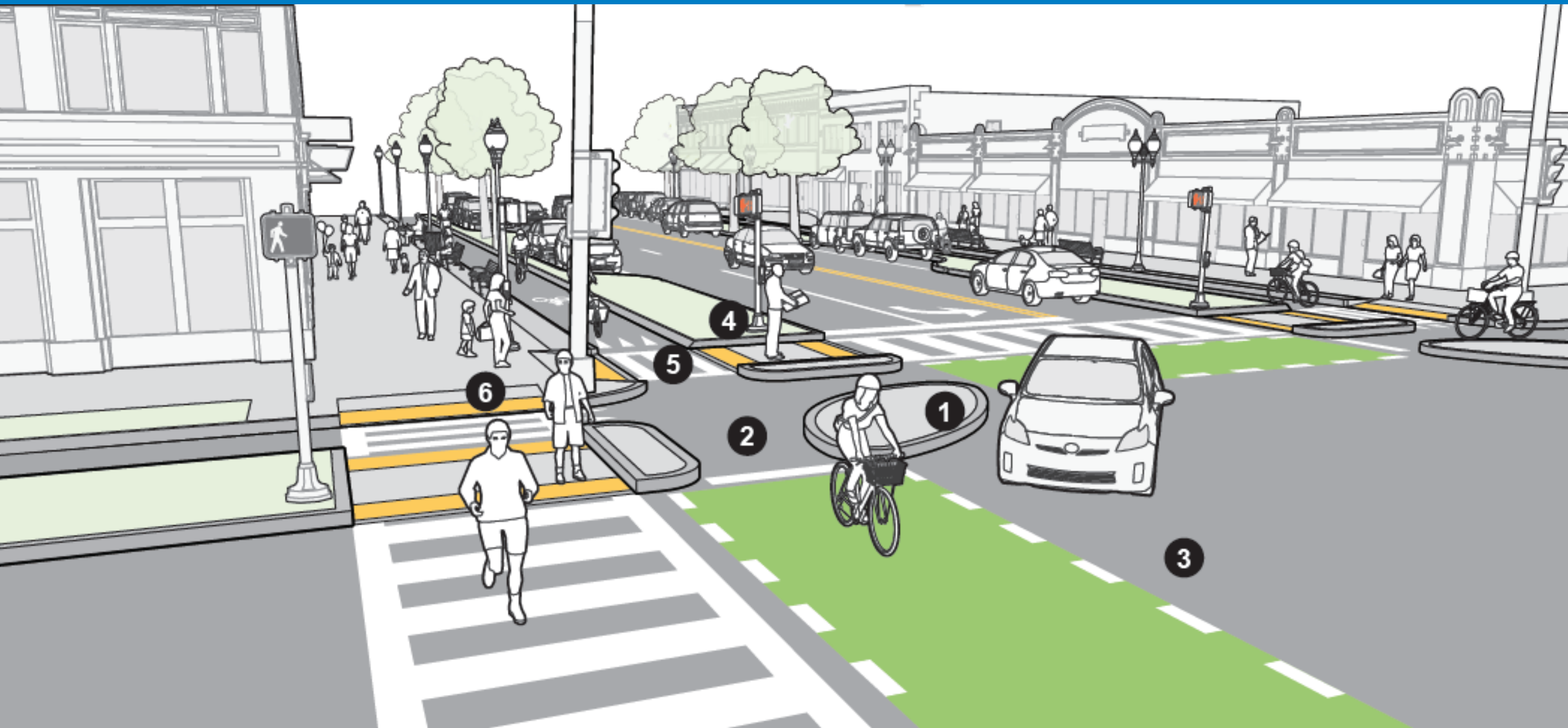
# 2018 AASHTO BIKE GUIDE



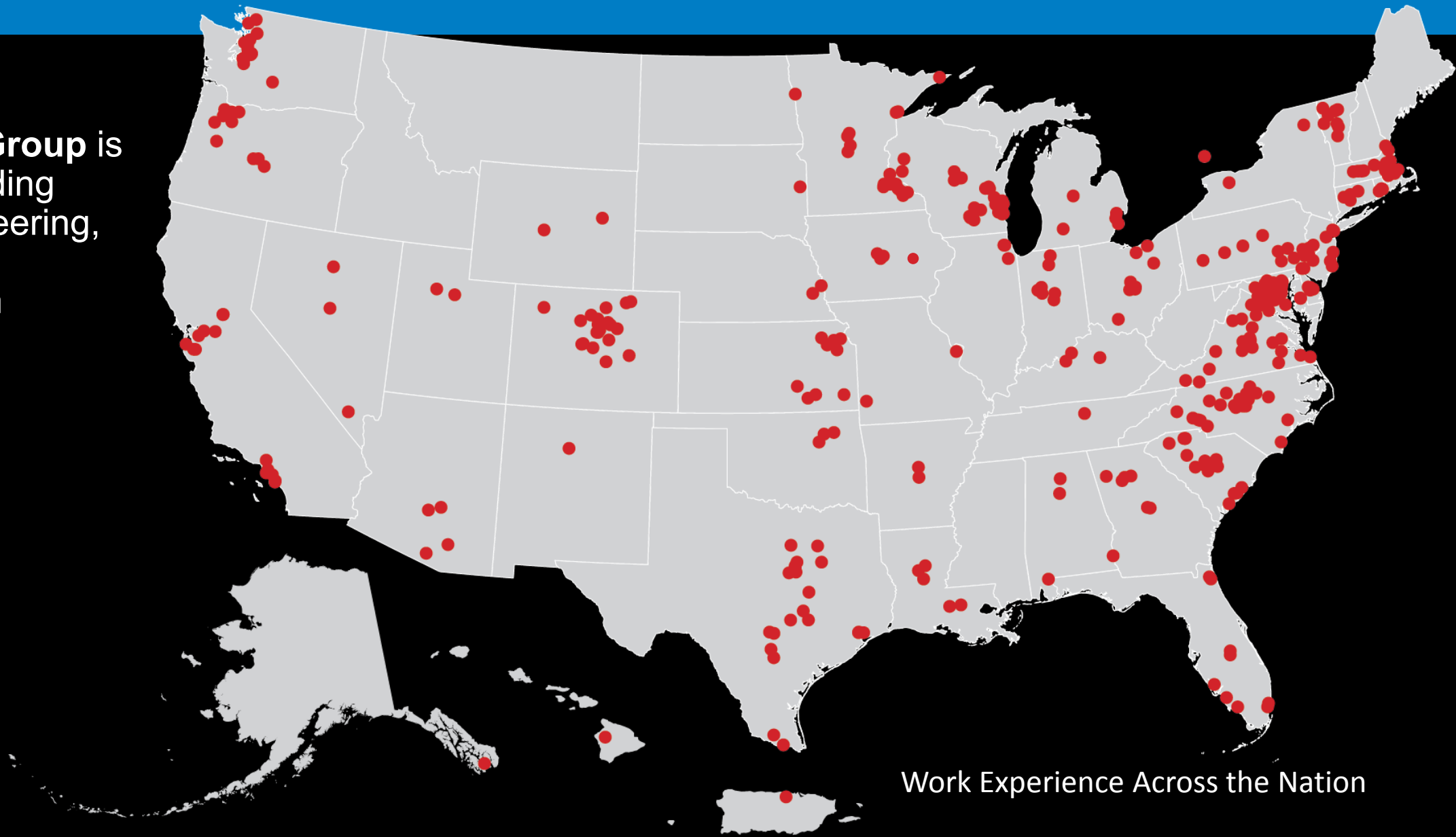
# Your presenter

**Sagar Onta, PE, PTOE**
Denver Engineering Director

15 years of experience street design, transportation planning, traffic engineering, and bicycle facility design

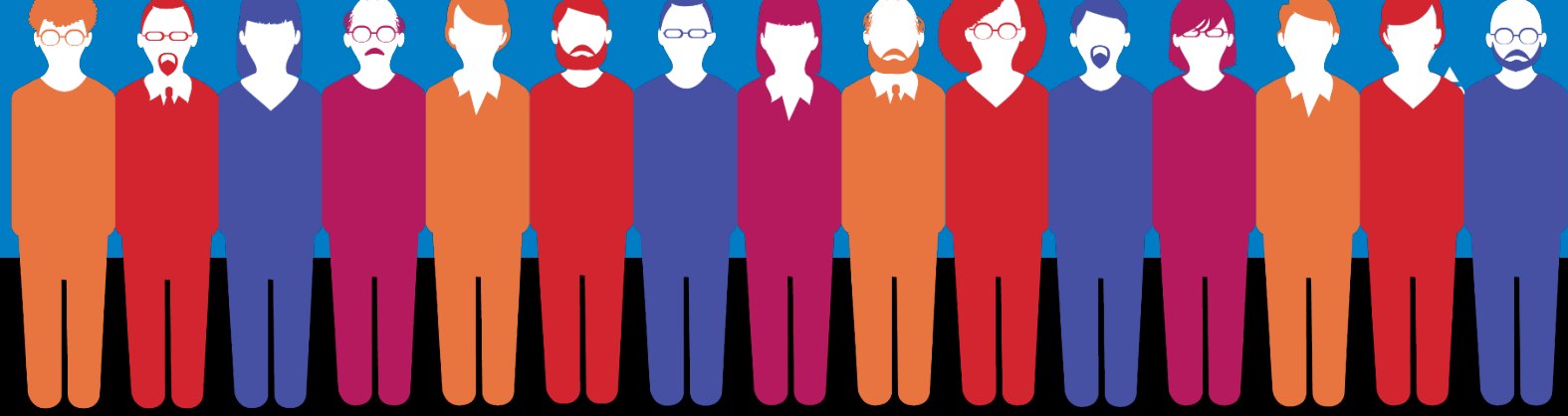
# Toole Design Group

**Toole Design Group** is the nation's leading planning, engineering, and landscape architecture firm specializing in multimodal transportation.

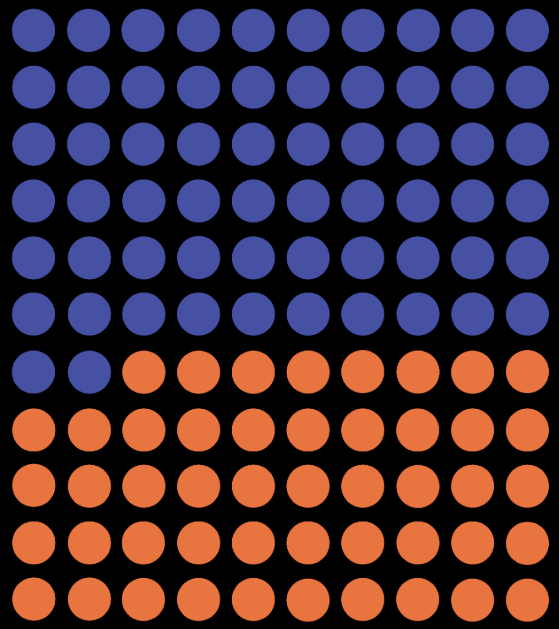


Work Experience Across the Nation

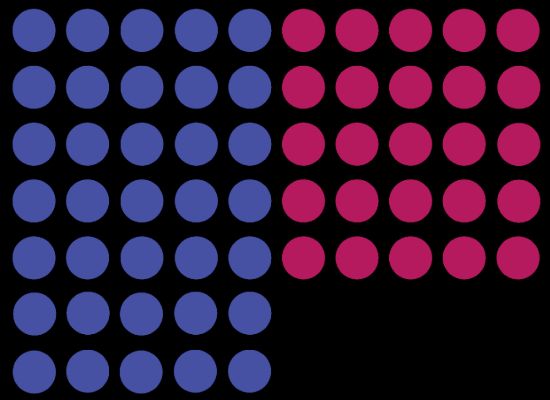
# Toole Design Group



150+ EMPLOYEES 13 OFFICES



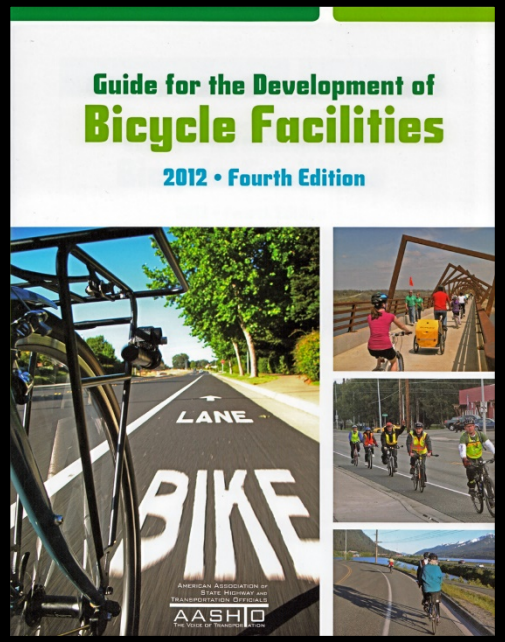
EQUAL DESIGN AND PLANNING



41%

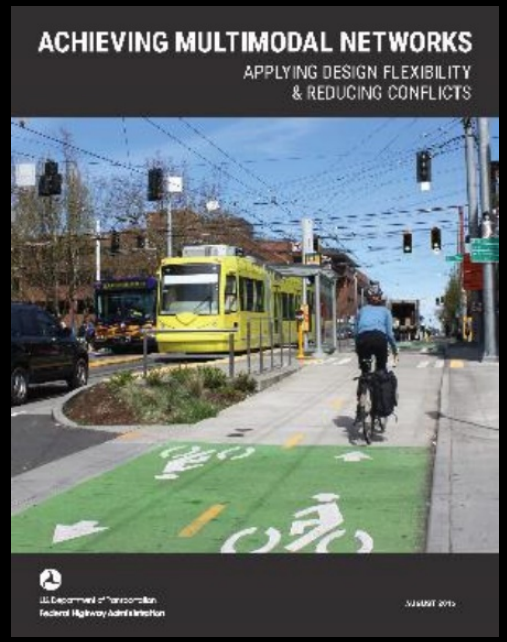
WOMEN DESIGNERS

# Our guidance work

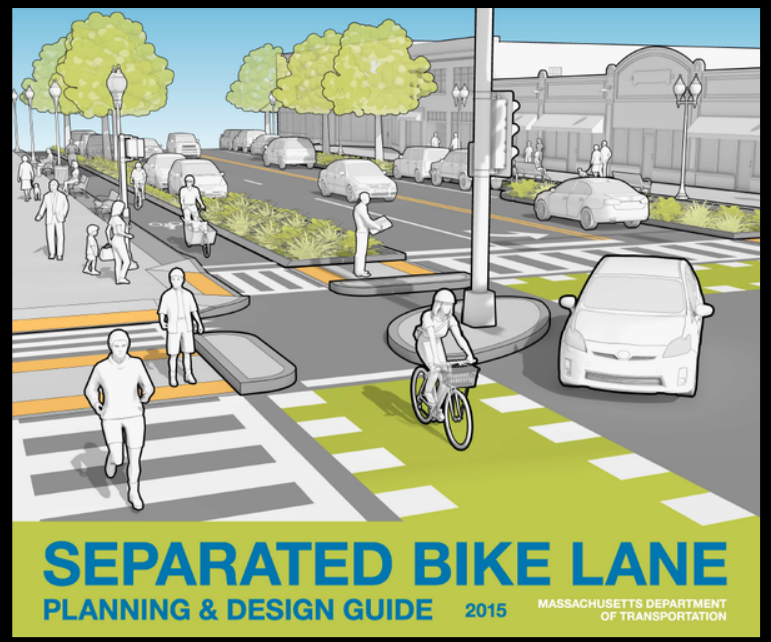



AASHTO *Guide for the Development of Bicycle Facilities*


NCHRP 803 *Pedestrian and Bicycle Transportation Along Existing Roads*

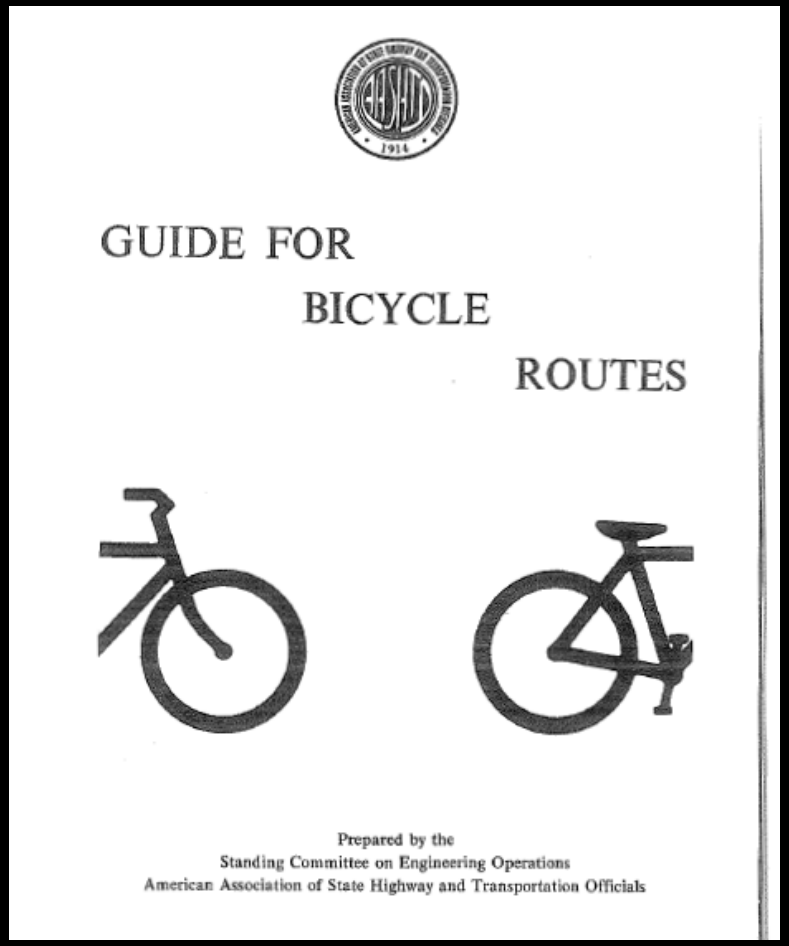



FHWA *Achieving Multimodal Networks: Applying Design Flexibility & Reducing Conflicts*




Massachusetts DOT *Separated Bike Lane Planning & Design Guide*

# 1974 “Guide for Bicycle Routes”



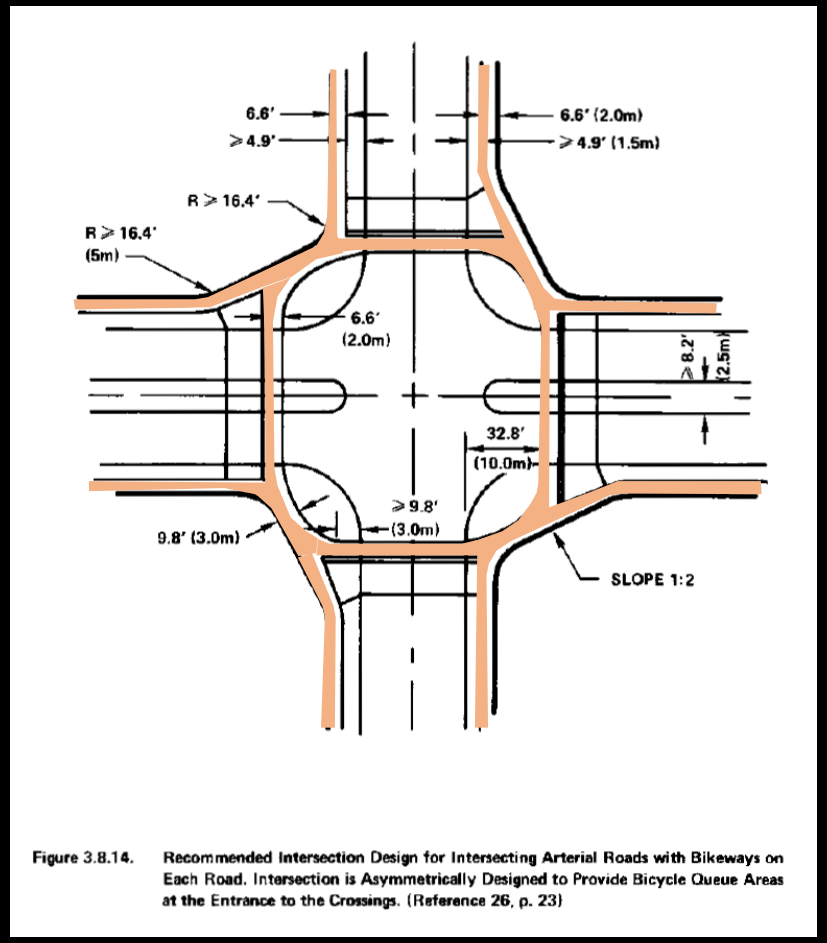




Figure 3.8.14. Recommended Intersection Design for Intersecting Arterial Roads with Bikeways on Each Road. Intersection is Asymmetrically Designed to Provide Bicycle Queue Areas at the Entrance to the Crossings. (Reference 26, p. 23)

Protected Bike Lanes & Intersections


Davis, California 1967

# 1974 “Guide for Bicycle Routes”

1) Don't drop bike lanes at intersections

2) Mark bike crossing

3) mark 2-stage queue box

4) use protected intersection design to mitigate "right hooks"

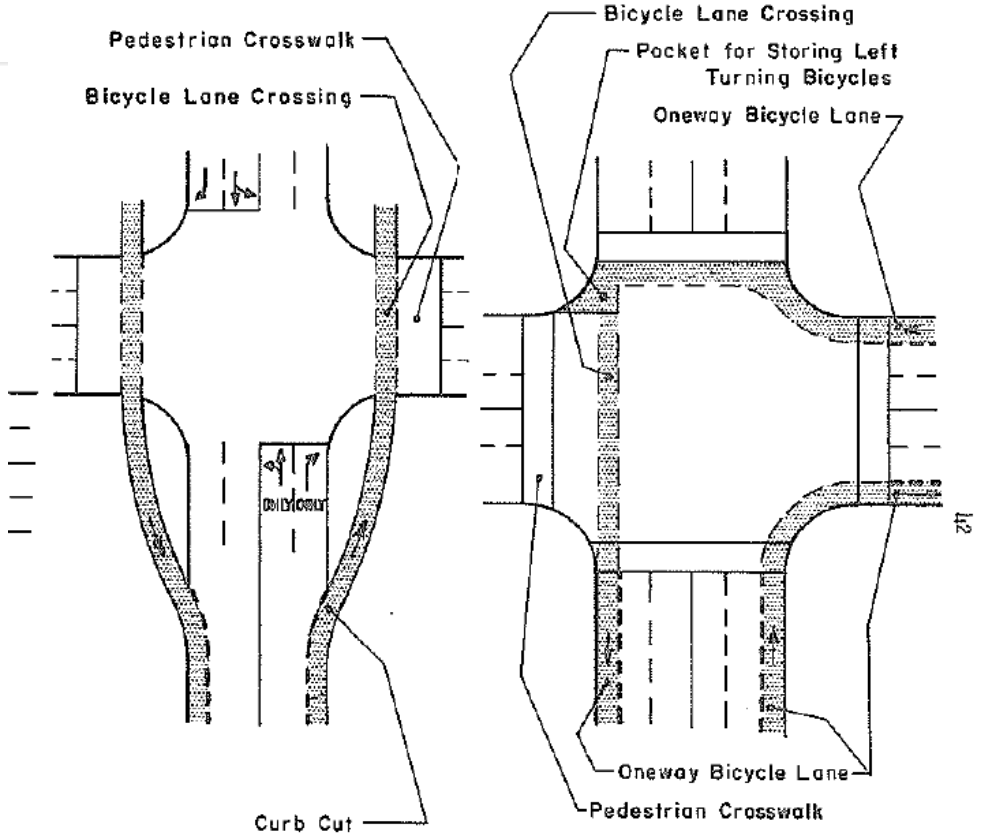
## Intersections and Crossings

Because the number and severity of conflicts between motorists, bicyclists, and pedestrians are greatest at intersections and crossings, utmost care must be taken in designing intersection which are to accommodate bicycle traffic. The safest and most effective way of eliminating conflicts where a bicycle route crosses another roadway is to provide a grade separation. This may be feasible in some cases, as discussed under grade separation structures. However, a grade separation usually cannot be provided because of lack of available space, especially where bicycle lanes or shared roadways cross at or near existing at-grade street intersections. Even where space is available, there seldom is warrant for the high cost of the structure. Therefore, a design which utilizes existing at-grade street intersections usually must be provided.

Wherever a bicycle lane is carried across an at-grade street intersection, some form of channelization with specific routings for bicycles should be provided to minimize the number of possible conflict points between bicycles, motor vehicles, and pedestrians within the intersection. Such channelization would not normally be necessary when shared roadways intersect a cross street, except where bicycle and motor vehicle traffic is heavy, motor vehicle speeds are in excess of 30 mph, or where there is a heavy percentage of motor vehicles making right turns out of the shared roadway.

Channelization usually consists of some form of striping or marking which clearly delineates the path which bicycles must take in crossing the intersection. In most cases the crossing should be adjacent to—but striped separately from—the pedestrian crosswalk. Bicyclists who wish to turn left should be encouraged to cross the cross street first and then proceed to the left within a marked path provided for the second street. The undesirable effect of the conflict between right-turning motorists and straight-through bicyclists can be reduced to some extent by offsetting the bicycle crossing of the cross street away from the intersection.

Examples of channelization arrangements to accommodate bicyclists at intersections are illustrated in Figure 7. Figure 7(a) depicts a pair of bicycle lanes which are carried straight through the intersection.with this arrangement, the bicycle route is a part of the street, directly aligned with the bicycle lane both upstream and downstream. The arrangement in Figure 7(b) likewise carries the bicycle lane through the intersection, but the bicycle crossing is offset from the




(b.) Bicycle Lanes offset to cross intersection

(c.) Bicycle Lanes continued on cross street

Figure 7

al Bicycle Channelization Arrangements At Street Intersections

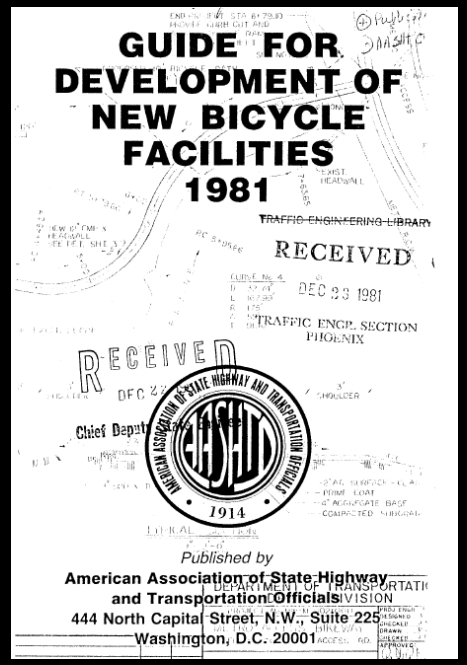
But then…

“Vehicular cycling…Is faster and more enjoyable, so that the plain joy of cycling overrides the annoyance of even heavy traffic.”

John Forester

# AASHTO Bike Guide History

Protected bike lanes removed in first edition of the Bike Guide


GUIDE FOR DEVELOPMENT OF NEW BICYCLE FACILITIES
1981

TRAFFIC ENGINEERING LIBRARY
RECEIVED
DEC 23 1981
TRAFFIC ENGR. SECTION
PHOENIX

RECEIVED

Published by
American Association of State Highway and Transportation Officials
444 North Capital Street, N.W., Suite 225
Washington, D.C. 20001

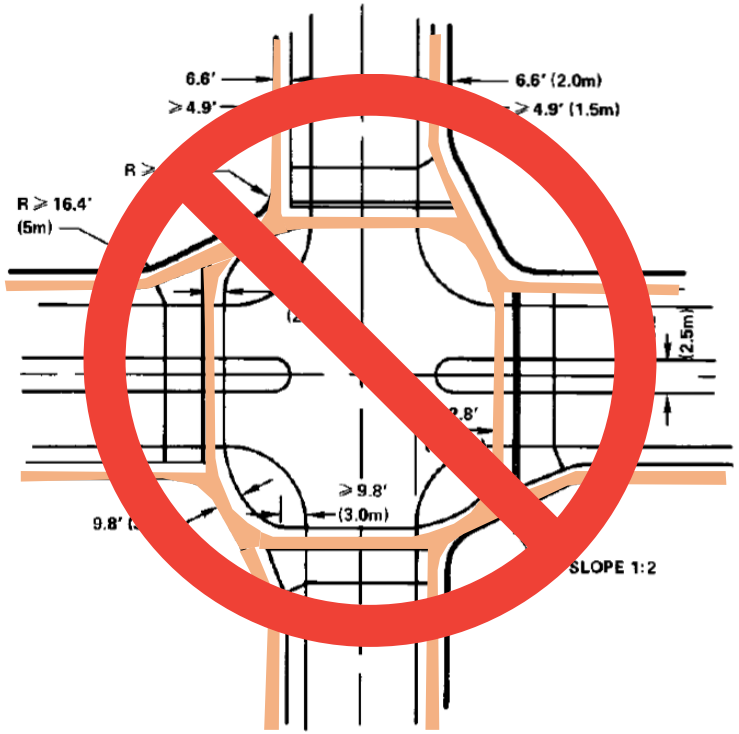



Figure 3.8.14. Recommended Intersection Design for Intersecting Arterial Roads with Bikeways on Each Road. Intersection is Asymmetrically Designed to Provide Bicycle Queue Areas at the Entrance to the Crossings. (Reference 26, p. 23)

(1.5m). Bicycle lanes should always be placed between the parking lane and the motor vehicle lanes. Bicycle lanes between the curb and the parking lane create hazards for bicyclists from opening car doors and poor visibility at intersections and driveways, and they prohibit bicyclists from making left turns; therefore this placement should never be considered.

# 1980s – 1990s The Wide Outside Lane

1- 2%

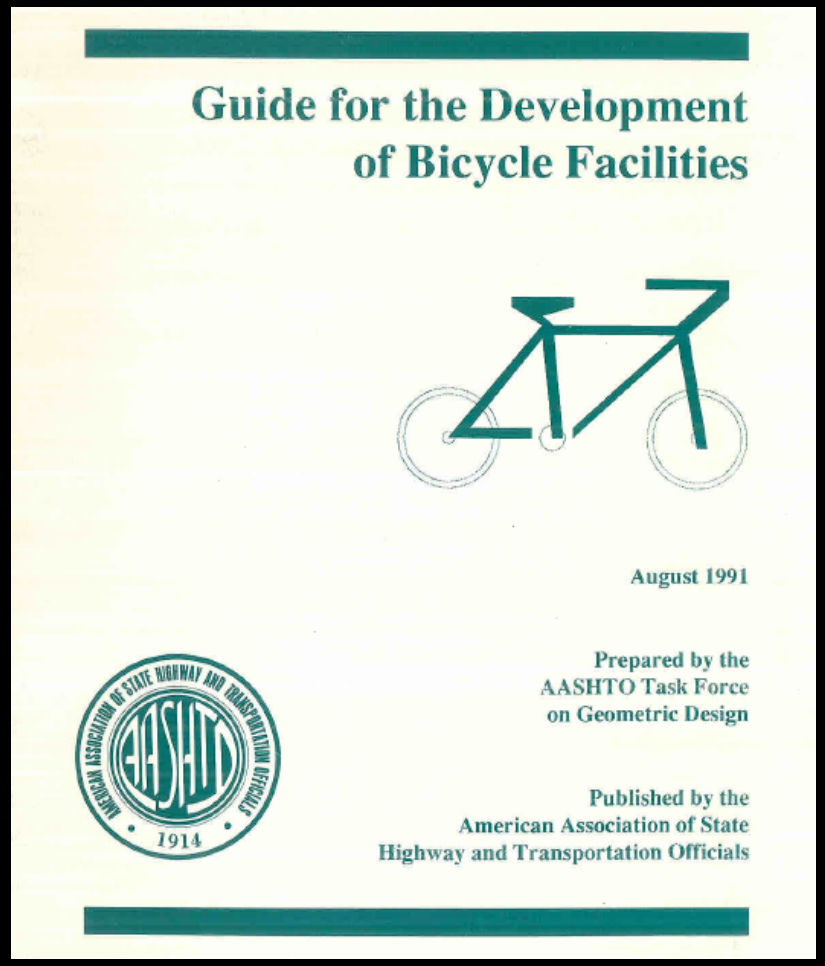

Inside the world of local cycling's **WEEKEND WARRIORS**

BY STEVE GOLDSTEIN

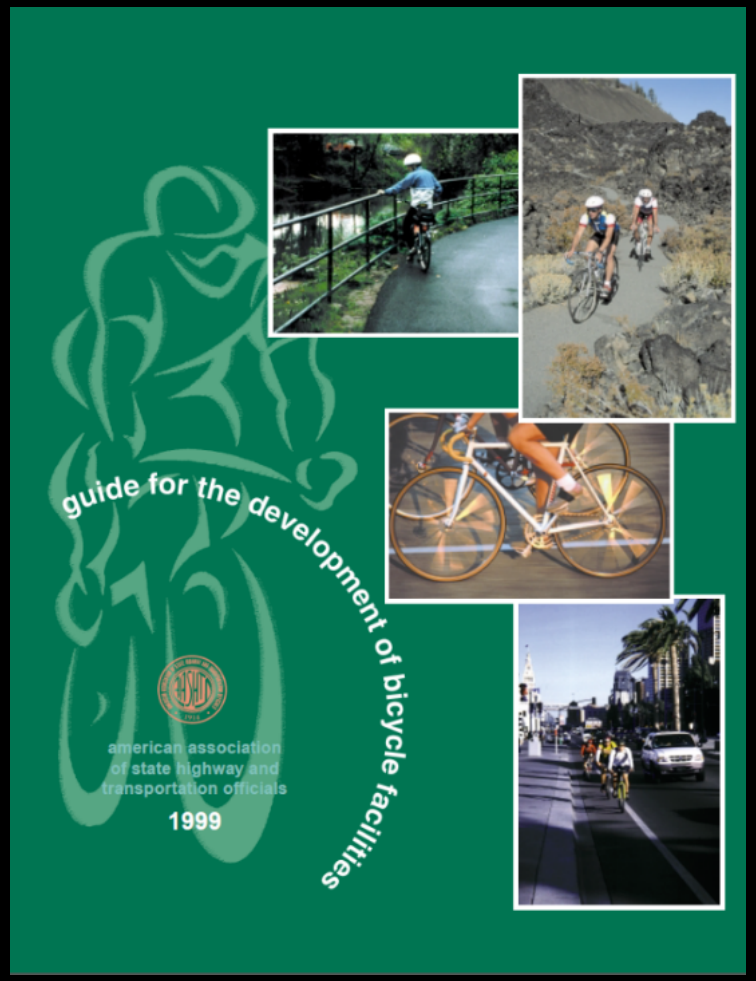
PHOTOS BY SKIP BROWN

# fast and furious

# AASHTO Bike Guide History




1991 AASHTO Bike Guide

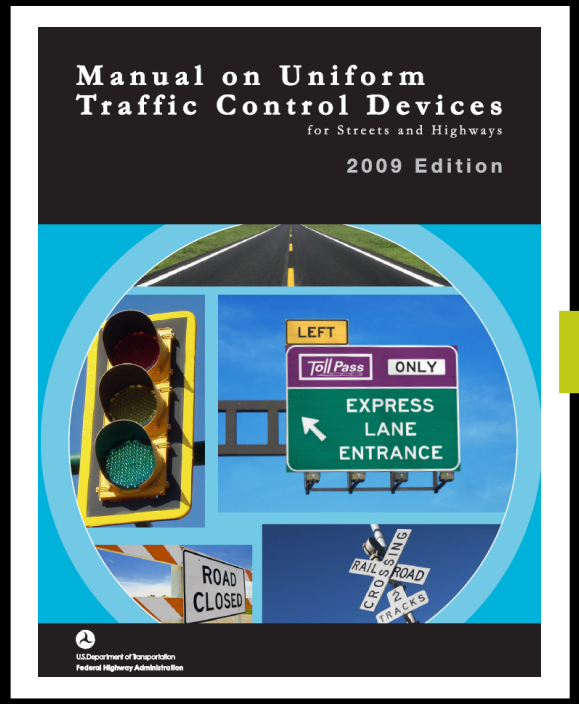


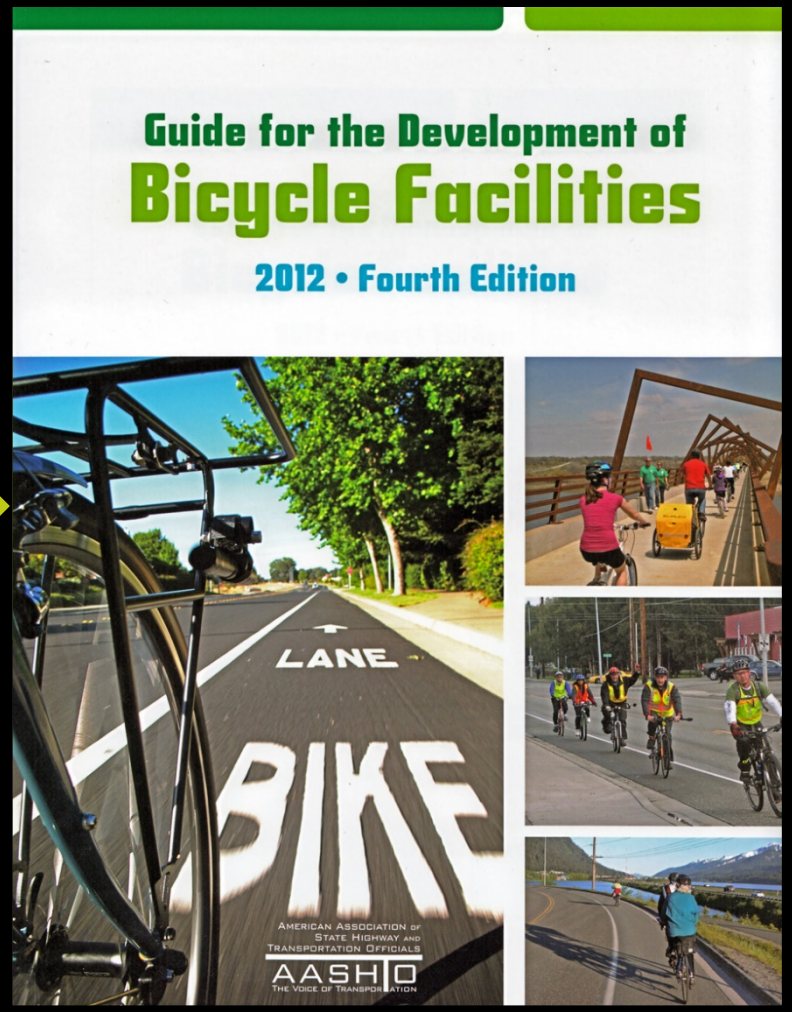

1999 AASHTO Bike Guide

"Bicycle lanes tend to complicate both bicycle and motor vehicle turning movements at intersections."

# AASHTO Bike Guide History

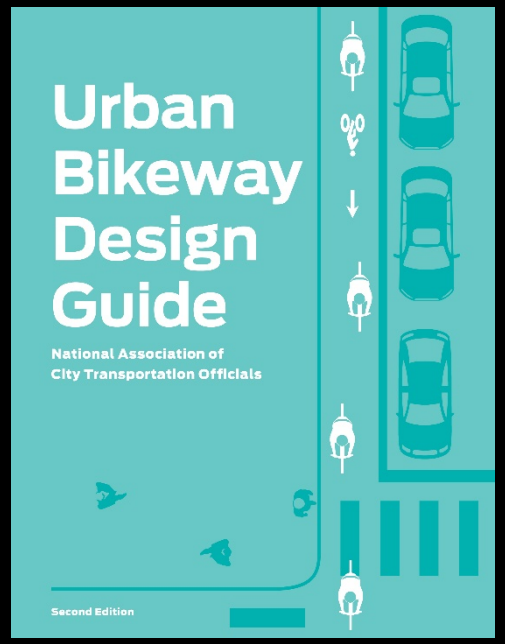
- Latest edition published in 2012
- Written in 2010
- Conforms to 2009 MUTCD which was written in 2007



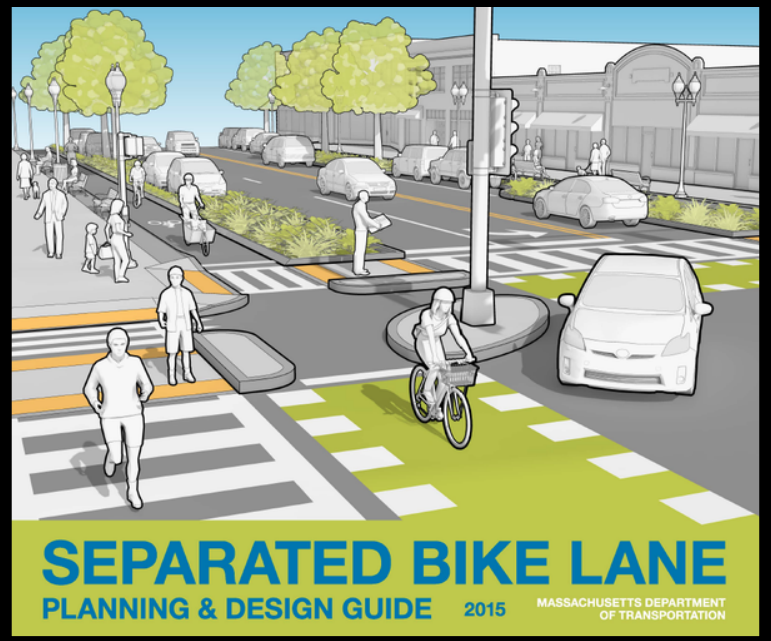
# Other guidance in recent years

2014




NACTO *Urban Bikeway Design Guide*

2015

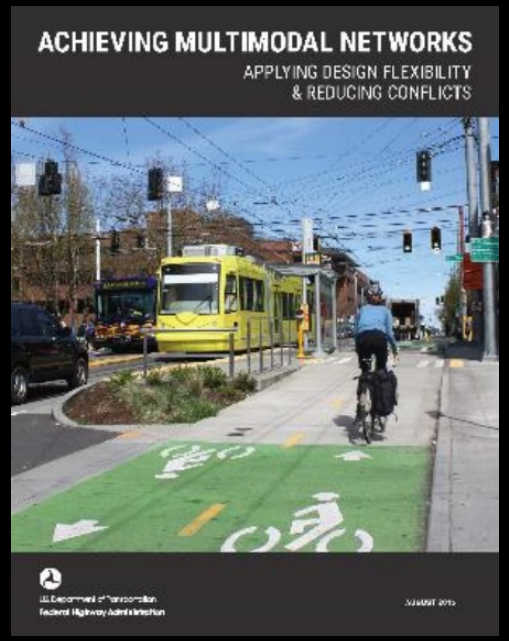



Massachusetts DOT *Separated Bike Lane Planning & Design Guide*

2016


CROW *Design Manual for Bicycle Traffic*

2016



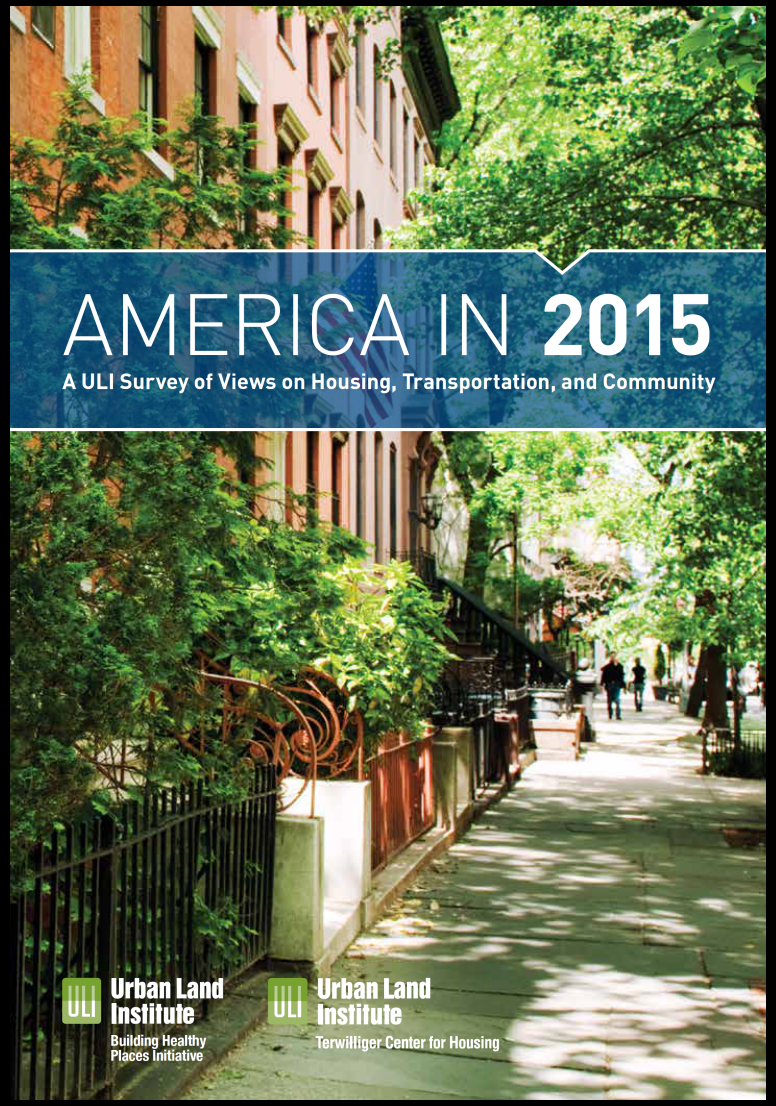

FHWA *Achieving Multimodal Networks: Applying Design Flexibility & Reducing Conflicts*

# NCHRP 15-60: Updating the guide

# Ranking of issues in for the next edition:

| Topic | Score | Rank |
|---|---|---|
| Design of transitions between treatments | 200 | 1 |
| Intersection treatments (e.g. bike boxes, 2-stage turn boxes) | 171 | 2 |
| Separated bike lanes | 167 | 3 |
| Buffered bike lanes | 164 | 4 |
| Application of PROWAG | 155 | 5 |
| Bicycle signals and detection | 151 | 6 |
| Other (please describe in next question) | 146 | 7 |
| Use of green color in bike lanes | 137 | 8 |
| Bicycle boulevards | 128 | 9 |
| Electric assist bicycle (e-bikes) | 121 | 10 |

# Public Demand

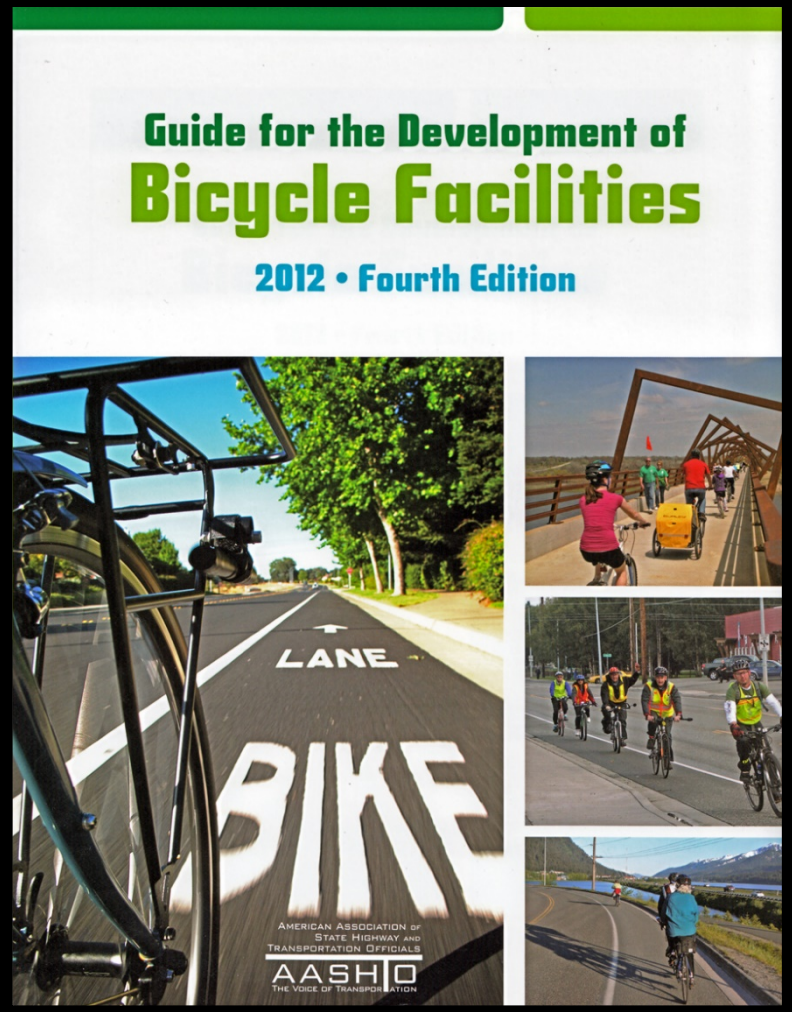



**52%**

of Americans would like to live in a place where they do not need to use a car very often.

# 2012 Chapter List

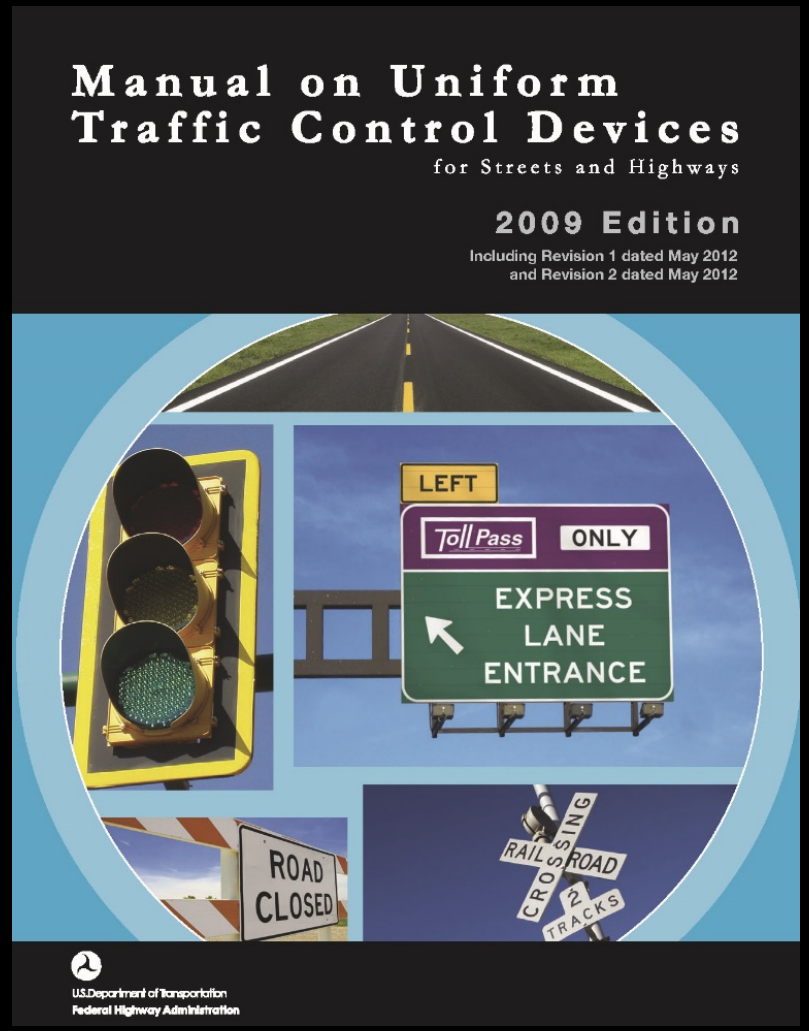
1. Introduction
2. Bicycle Planning
   - Includes wayfinding
3. Bicycle Operation & Safety
4. Design of On-Road Facilities
   - Includes elements of design, shared lanes, shoulders, bike lanes, traffic signals, roundabouts, an structures
5. Design of Shared Use Paths
6. Bicycle Parking Facilities
7. Maintenance and Operations



# 2018 Preliminary Chapter List

1. Introduction
2. Bicycle Operation & Safety
3. Planning
4. **Facility Selection**
5. **Elements of Design**
6. Shared Use Paths
7. **Separated Bike Lanes**
8. **Bicycle Boulevards**
9. Bike Lanes & Shared Lanes
10. **Traffic Signals and Active Warning Devices**
11. **Roundabouts, Interchanges, and Other Intersections**
12. **Rural Area Bikeways**
13. **Structures**
14. **Wayfinding**
15. Maintenance & Operations
16. Parking & End of Trip Facilities

# 1 : Introduction : MUTCD Delays

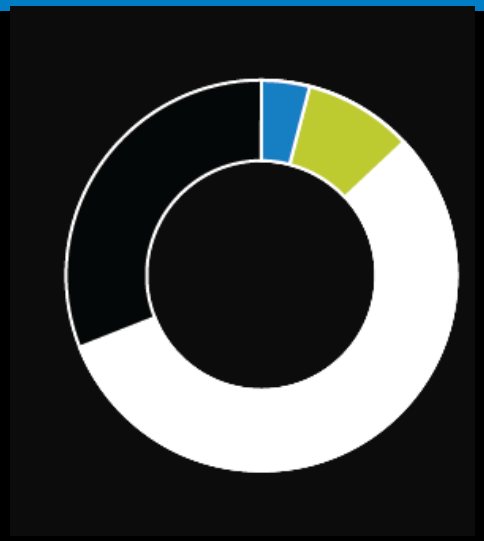



- Current MUTCD content is pre-2007
- Update in 2020 at the earliest
- FHWA issuing interim approvals for new treatments

## 2018 Guide includes treatments not in MUTCD

- Upfront caveat for compliance and experimentation
- Caveat each time discussed

# 2 : Bicycle Operation & Safety



4 - 7% Experienced and 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.*

# 2 : Bicycle Operation & Safety
# Default Design User for Guide

4 - 7%

Experienced & Confident Cyclist
AASHTO 2012

51 - 56%

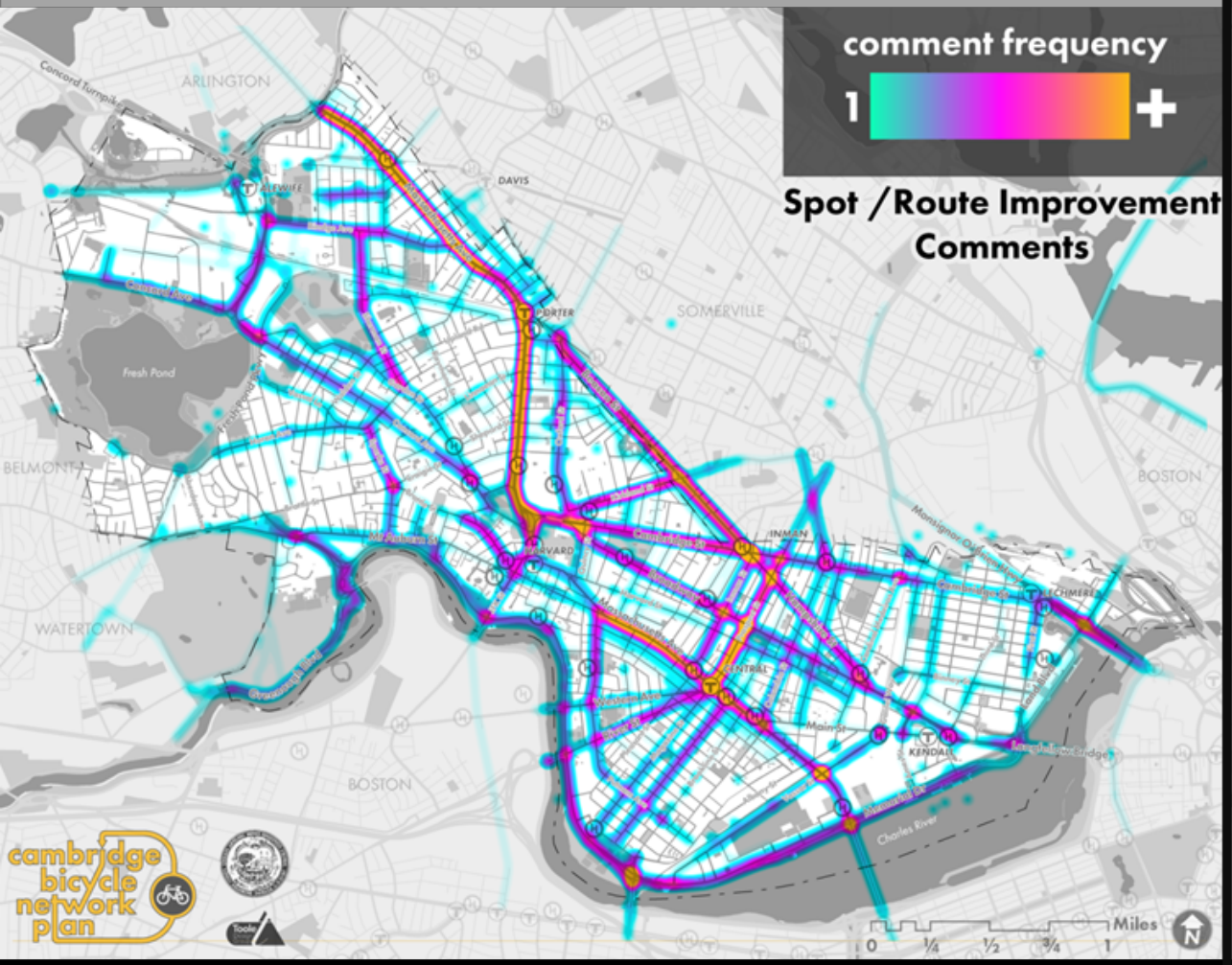
Interested but Concerned Cyclist
AASHTO 2018

# 3 : Planning Principals

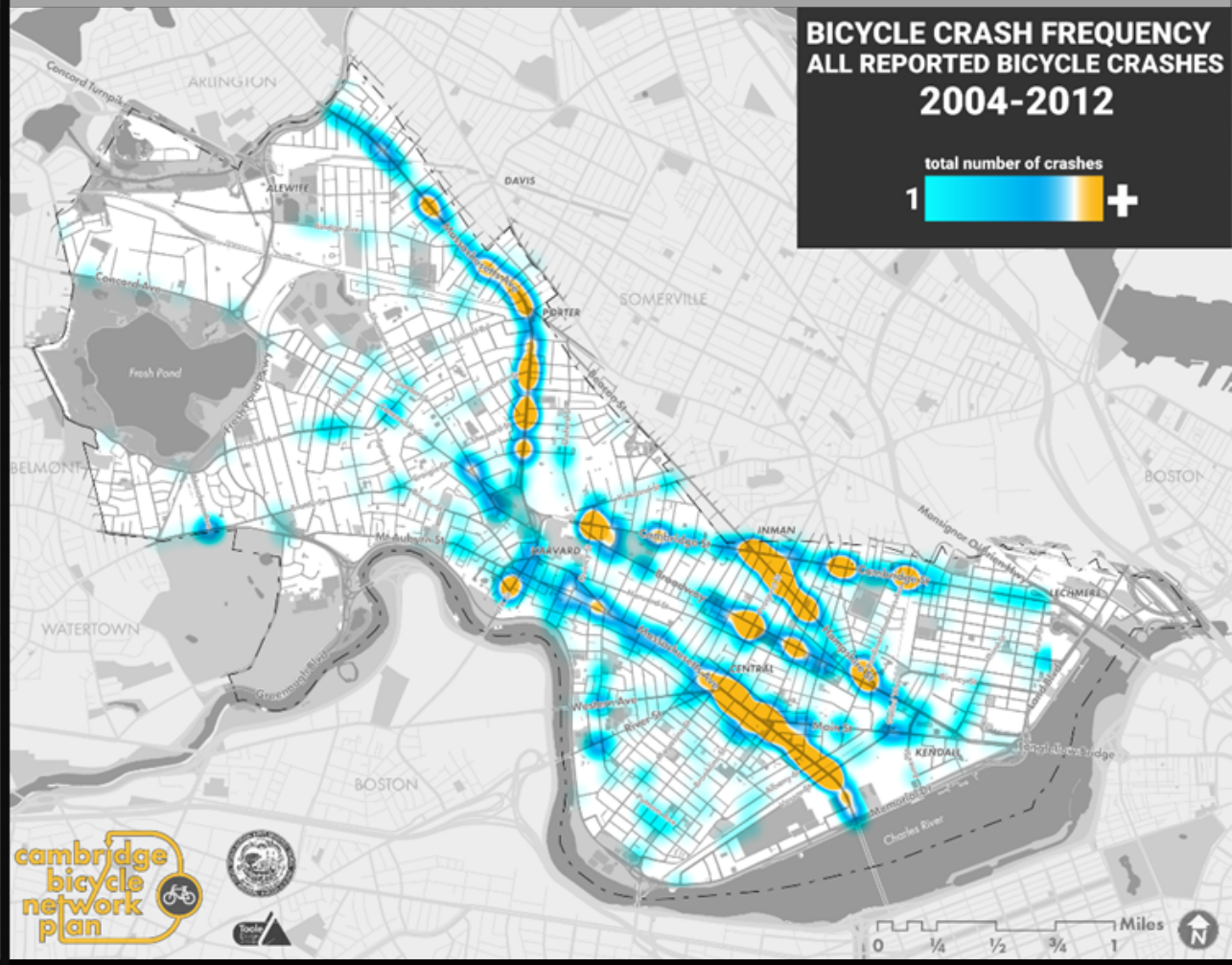
| | |
|---|---|
| Safety | Reduce crashes and conflicts |
| Comfort | Conditions should not deter use |
| Connectivity | Direct and convenient |

# 3 : Perceived Comfort & Objective Safety

## perceptions




## reported crashes



# 3 : Reporting and Exposure

$$Crash\ Rate = \frac{Crash\ Frequency}{Number\ of\ Vehicles}$$

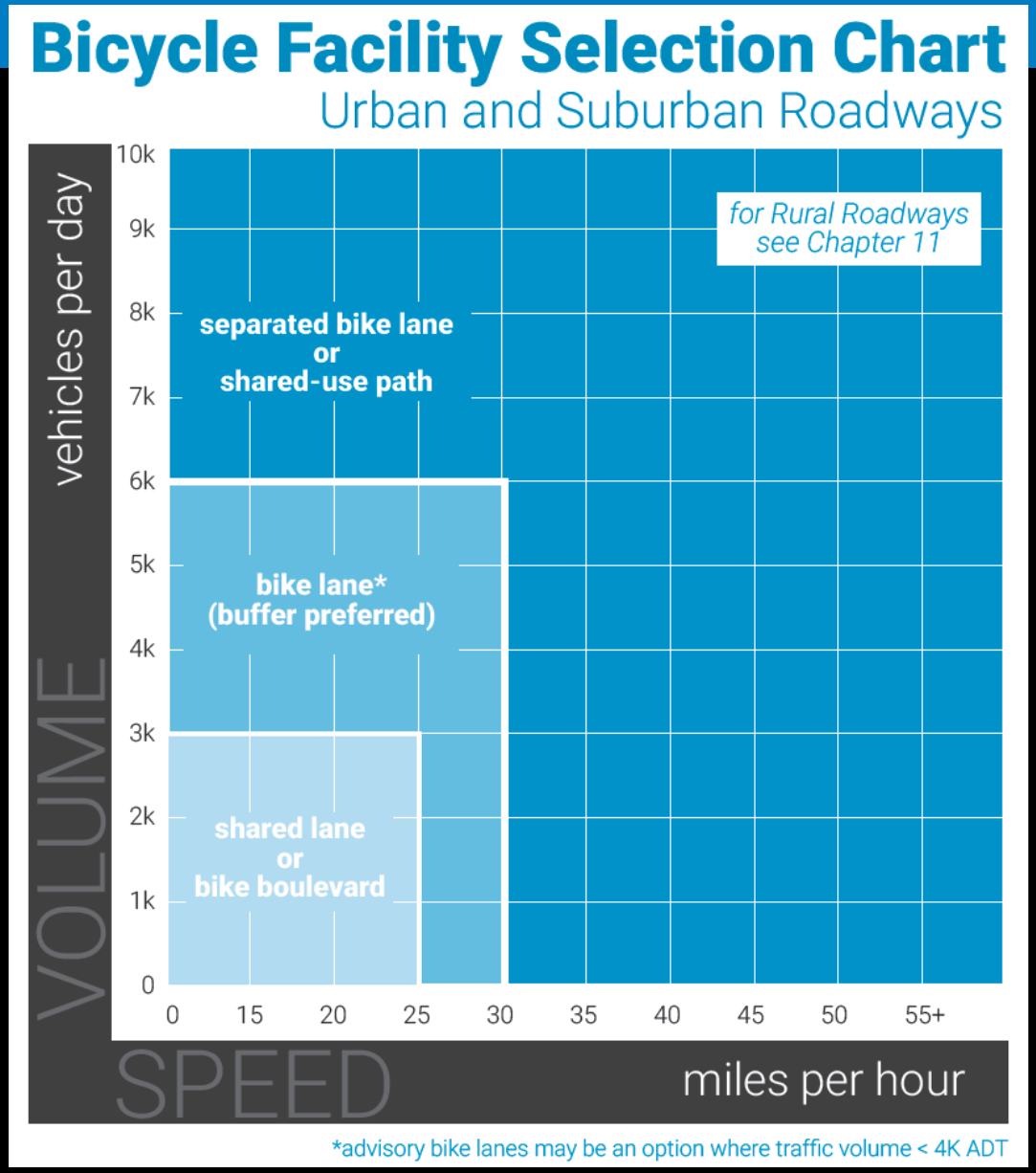
- Bike crashes go unreported
- Bike volumes not always available
- Perception of safety **can** tell us what's going on

# 4 : Facility Selection : Dutch CROW Manual


Table 14. Option diagram for road sections inside the built-up area

| Road Type | Vehicle Speed | Vehicle Volume | Cycle network category: basic network ($I_{bicycle}$ > work 750/day) | Cycle network category: cycle route ($I_{bicycle}$ 500-2500/day) | Cycle network category: main cycle route ($I_{bicycle}$ > 2000/day) |
|---|---|---|---|---|---|
| Local | 18 mph | < 2,500 | Shared lane or Bike boulevards | | Bike Lane |
| Local | 18 mph | > 5,000 | Protected Bike Lane or | | |
| Arterial | 30 MPH | 2x1 lane | Bike Lane | | |
| Arterial | 30 MPH | 2x2 lane | Protected Bike Lane | | |
| Arterial | 45 MPH | | | | |

# 4 : Facility Selection : AASHTO 2018



# 4 : CROW Manual vs AASHTO Manual

## CROW Manual

**Shared Lanes**
- Max volume 2,500 ADT
- Max speed = 18 mph

**Bike Lanes**
- Max volume 5,000 ADT
- Max lanes = 1 / direction
- Max speed = 30 mph

**Separated Bike Lanes**
- More than 2 lanes
- Speed over 30 mph

## AASHTO Manual

**Shared Lanes**
- Max volume = 3,000 ADT
- Max speed = 25 mph

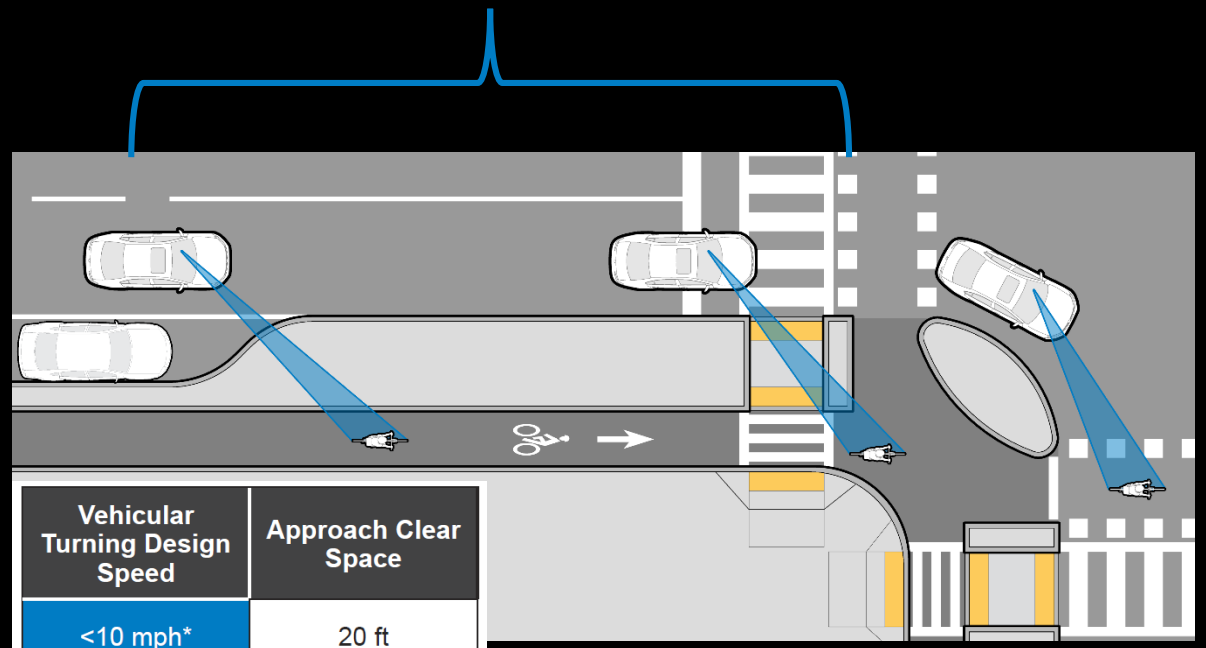
**Bike Lanes**
- Max volume = 6,000 ADT
- No max lanes
- Max speed = 30 mph

**Separated Bike Lanes**
- More than 6,000 ADT
- Speed over 30 mph

# 5 : Elements of Design

"How to" chapter for critical design elements

approach clear space



| Vehicular Turning Design Speed | Approach Clear Space |
|---|---|
| <10 mph* | 20 ft |
| 10 mph | 40 ft |
| 15 mph | 50 ft |
| 20 mph | 60 ft |

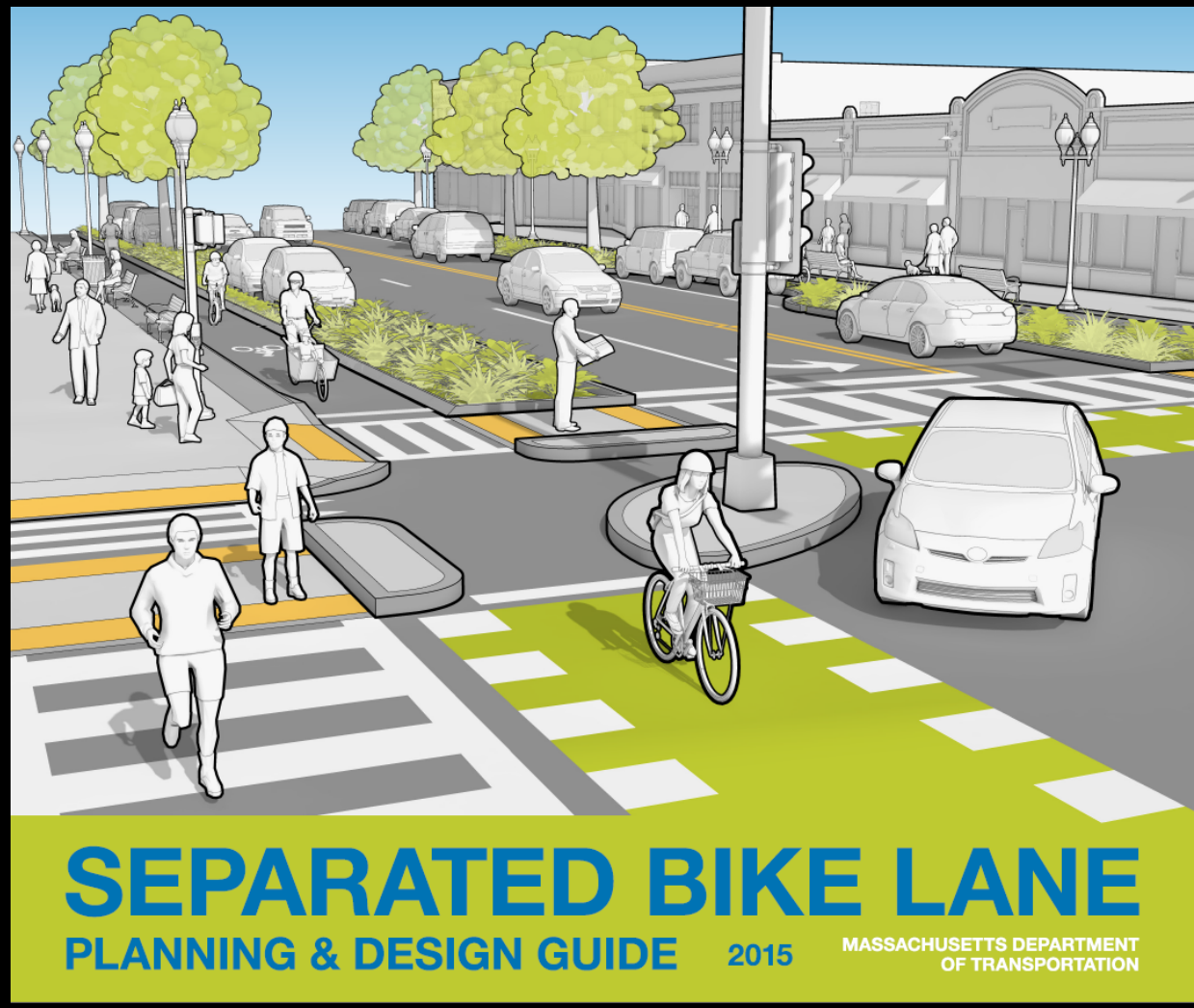
*most low volume driveways and alleys

# 7 : Separated Bike Lanes

## MassDOT 2.0

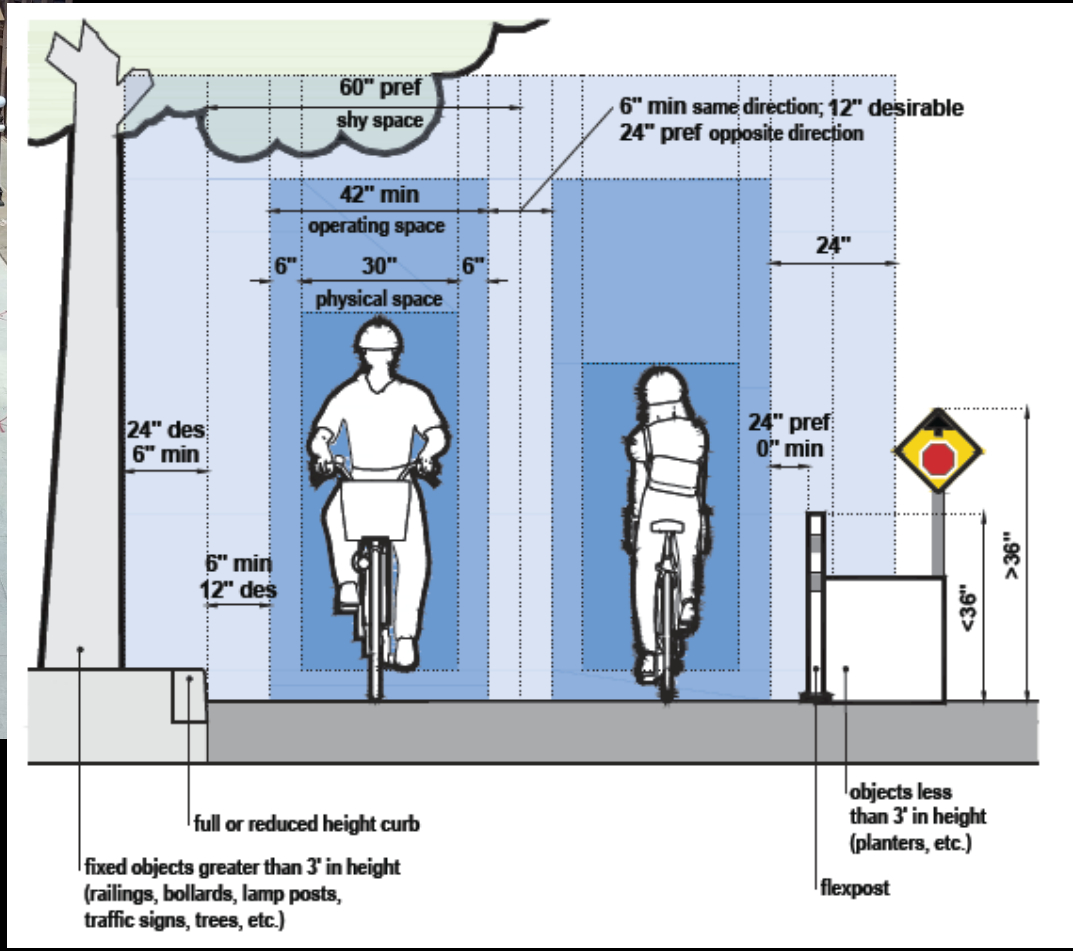
Improvements over MassDOT:

- ADA Guidance
- Transit Stop Design
- Sight Distance Assessment
- Constrained Tradeoff Assessment
- Transition Guidance

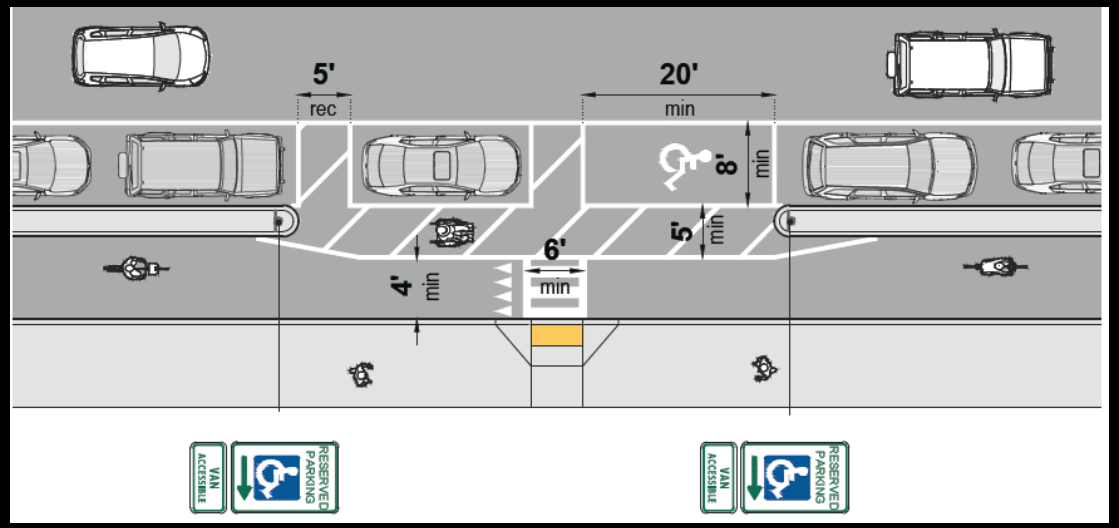


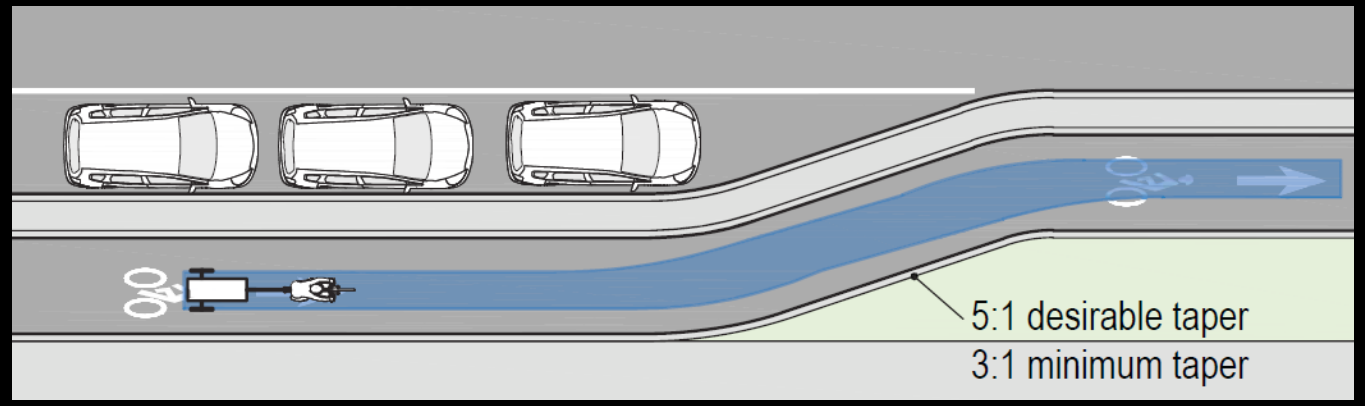
# 7 : Separated Bike Lanes

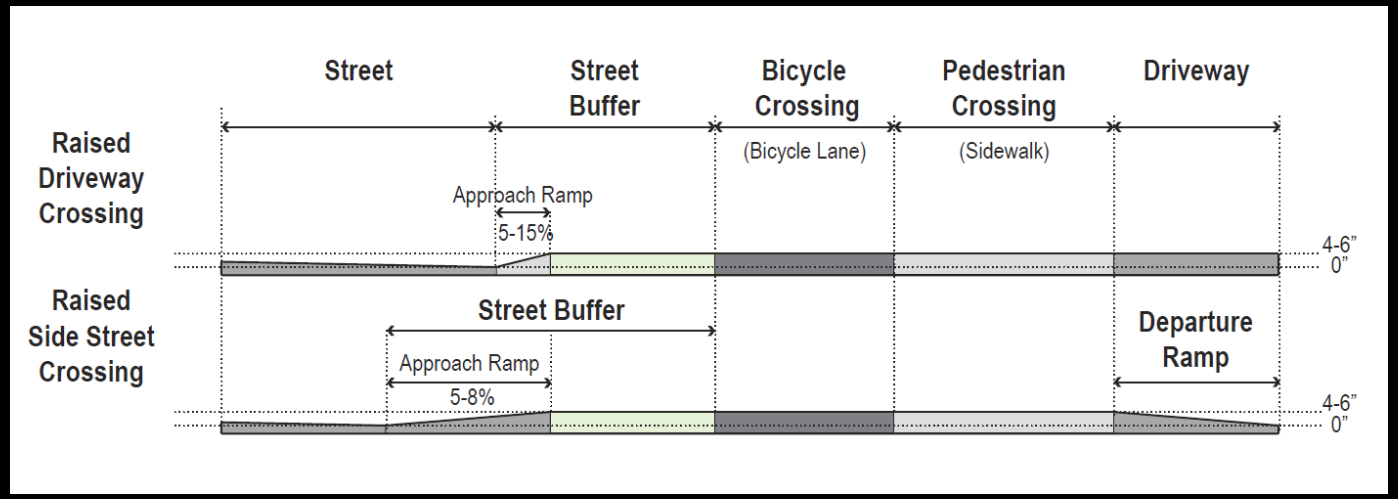
- Designs for transit access
- Two-way vs. one-way guidance
- Can have “win-win-win” scenarios

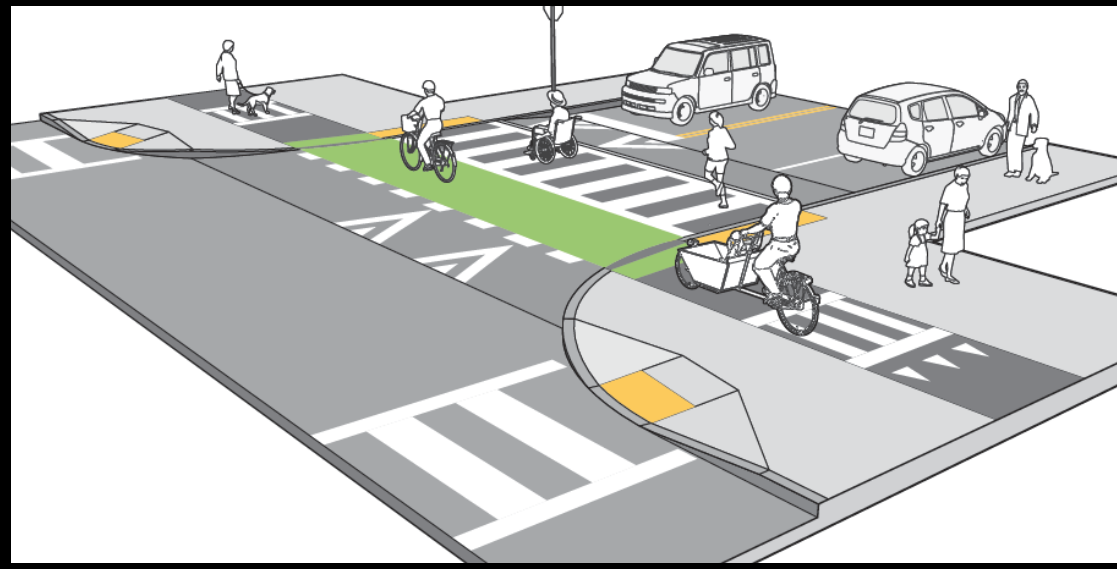


# 7 : Separated Bike Lanes – Some Design Elements



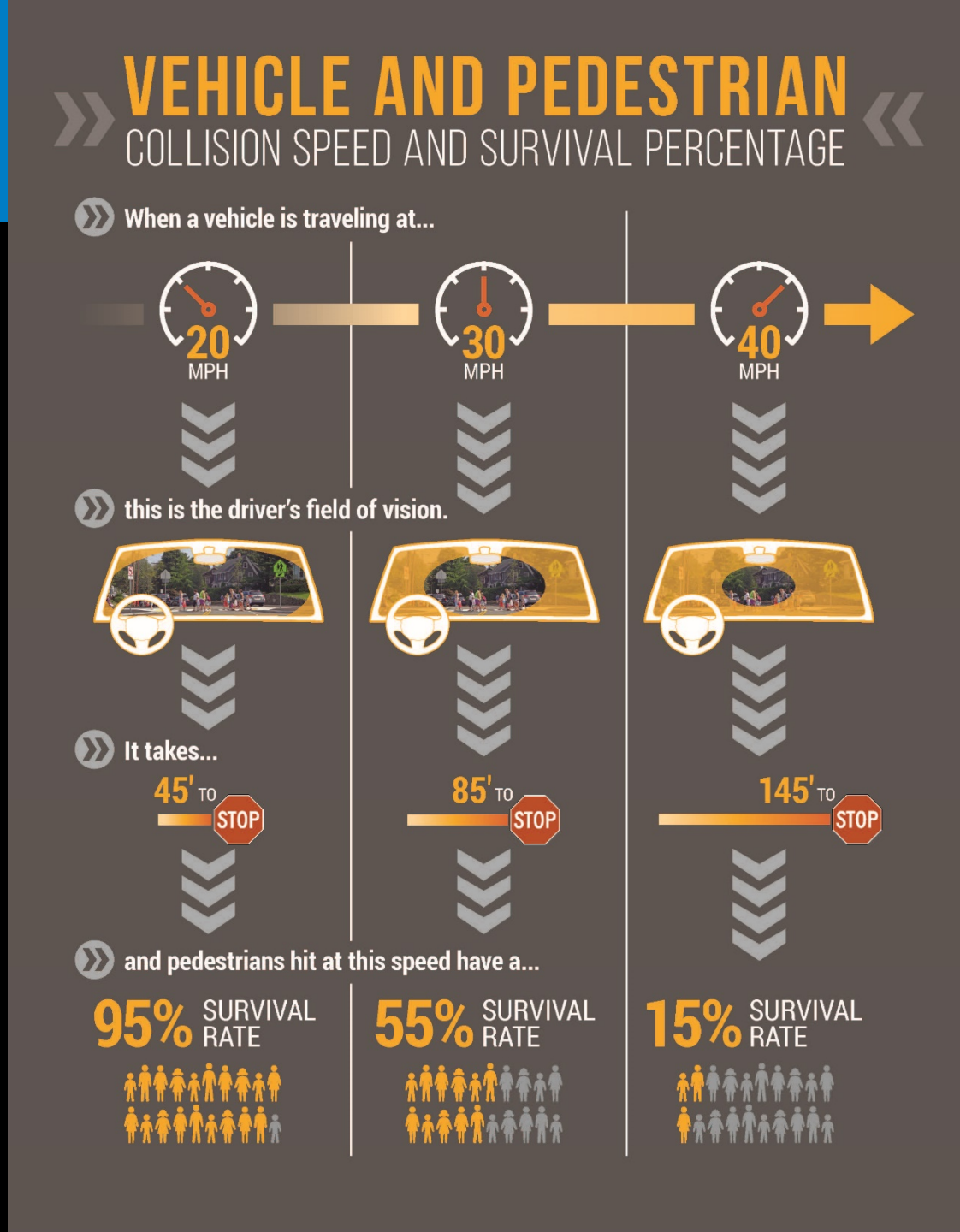



# 8 : Bicycle Boulevards

- Incorporating NACTO bicycle boulevard design treatments
- Speed management
  - Creating enclosure
  - Horizontal and vertical deflection
  - Crossing islands
- Traffic diversion
- Traffic control at intersections



# 8 : Bicycle Boulevards

A bicycle boulevard does not exist unless major street crossings are safe

| Major Street Crossing Opportunities |
|---|
| - 120 crossings/hour preferred |
| - 60 crossings/hour minimum |

| Motor Vehicle Operating Speeds |
|---|
| - 15 mph preferred |
| - 20 mph acceptable |
| - 25 mph maximum |

| Daily Volumes: | Hourly Volumes |
|---|---|
| - 1,000 ADT preferred | - 50 vehicles/hour preferred |
| - 2,000 ADT acceptable | - 75 vehicles/hour acceptable |
| - 3,000 ADT maximum | - 100 vehicles/hour maximum |

# 9 : Bicycle Lanes and Shared Lanes

- “Wide curb lanes are therefore not recommended as a strategy to accommodate bicycling”
- Recommends SHARE THE ROAD signs not be used, instead:



# 9 : Bicycle Lanes and Shared Lanes

"Shared lane markings are most advantageous on roadways with traffic volumes below 3,000 vehicles per day, and speeds that are 25 mph or less. "


# 9 : Bicycle Lanes and Shared Lanes

Establishes a standard for marking buffered bike lanes

# 10 : Active Beacons and Traffic Signals

## Creates a clear process to evaluate major street crossings

# 10: Bicycle signal heads

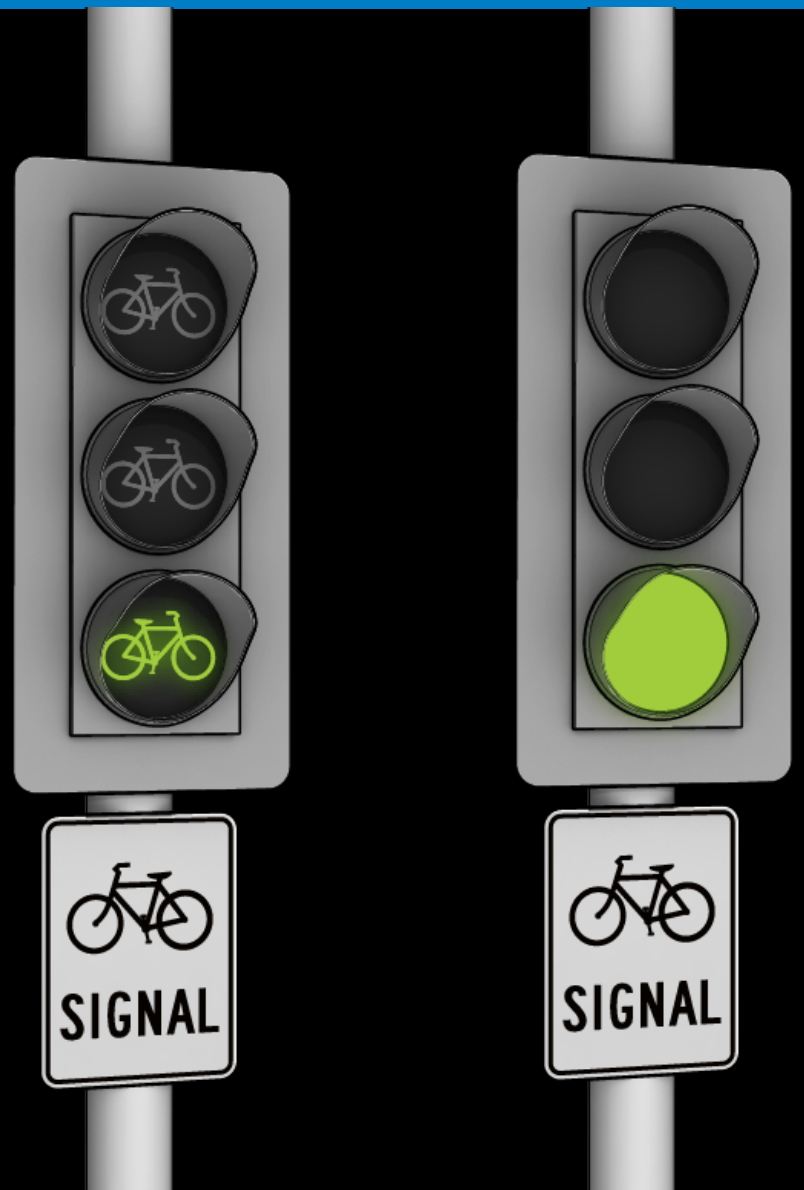
## FHWA Interim Approval

## Bike signal head warrant/requirement:

- Leading or protected phasing
- Contra-flow movements
- Signal heads beyond cone of vision

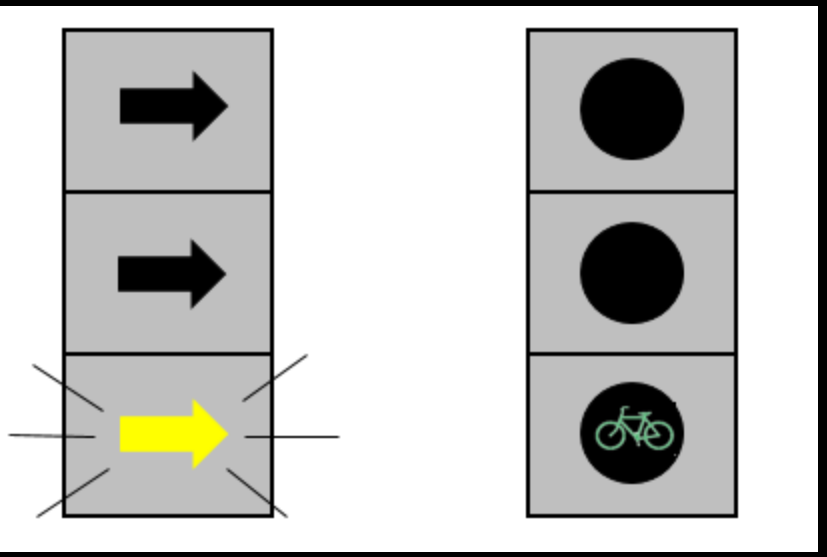
## Bike signal head application:

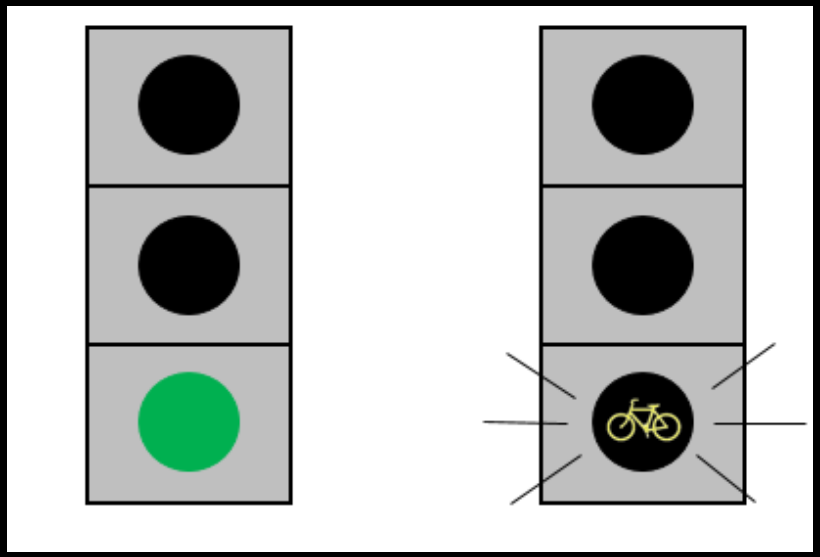
- Can only be used **without** conflicting vehicle turns

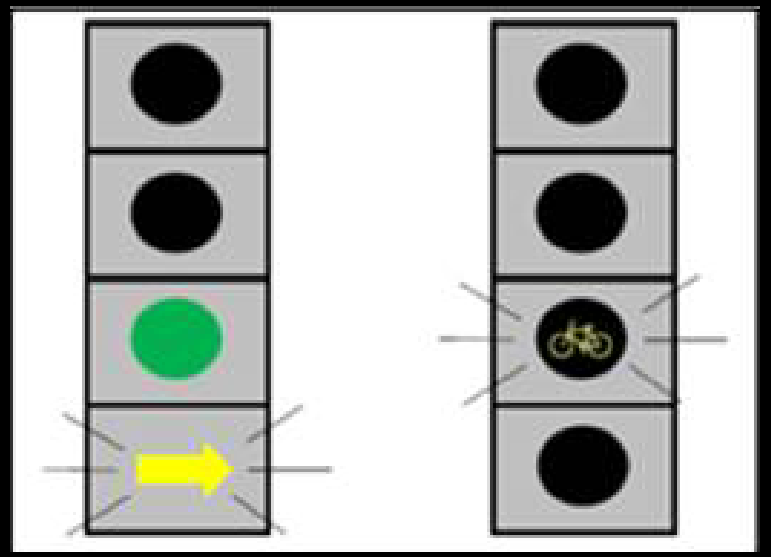


# 10 : Bicycle signal heads

- Options for concurrent movements?
- Requests to experiment







# 11 : Roundabouts, Interchanges & Alternative Intersections

- Provide separated facilities
- Separate pedestrians and bikes
- Uncontrolled motorist crossings should be < 25mph…
  - Unless lots of gaps
  - Add active warning
  - Add control

# 12 : Rural Roadways

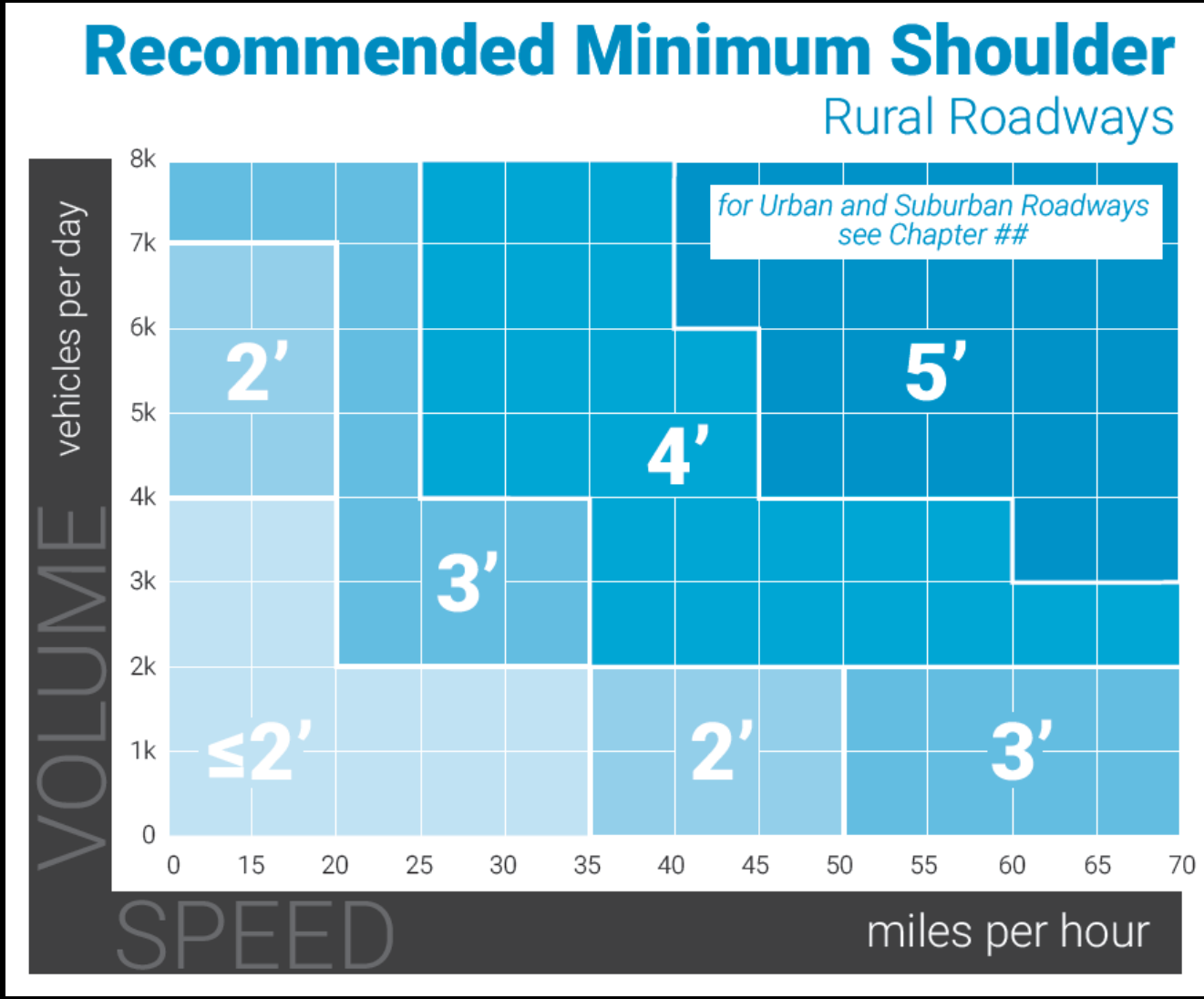
**Design User:**

Between Towns & Villages

Experienced & Confident

In Towns & Villages

Interested but Concerned



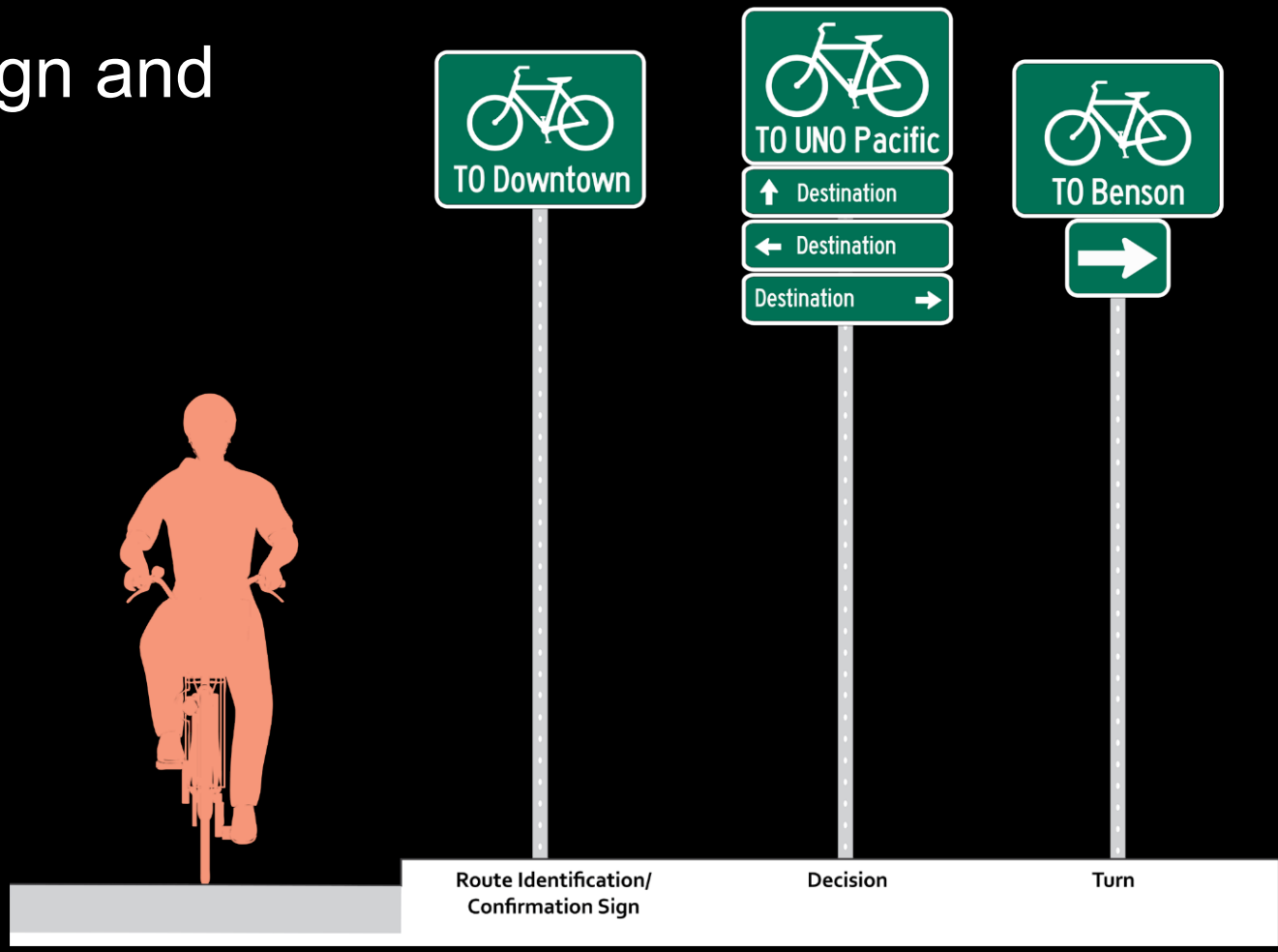
# 12 : Rural Roadways

- Shoulder width recommendations
- Transition recommendations
- Rumble Strip spacing, location, and gap guidance

# 14 : Wayfinding

Expanded guidance for sign design and placement

Added flexibility for sign design



# 15 : Maintenance & Operations


Photo Credit: DDOT


Photo Credit: DDOT

# AASHTO Bike Guide Schedule

- 2nd Draft submitted late 2017
- 3rd Draft: early 2018
- Final Draft and Balloting: mid 2018

  AASHTO Subcommittee Approvals needed from: design, traffic, bicycle

**Final Comments and Publication: Mid 2019 ?**

# Questions?

Sagar Onta, PE, PTOE
sonta@tooledesign.com

www.tooledesign.com
Twitter @tooledesign

Toole Design Group