

# Separated Bike Lanes on Higher Speed Roadways

## FHWA Toolkit Guide



Source: Wikimedia Commons/Bart Everson - , CC BY 2.0



U.S. Department  
of Transportation

**Federal Highway  
Administration**

CADMUS

**KITTELSON  
& ASSOCIATES**

THE UNIVERSITY OF NORTH CAROLINA  
**HIGHWAY SAFETY  
RESEARCH CENTER**

# Agenda



Introductions



Project  
Background



Project  
Objective



Literature  
Review



Toolkit Guide  
Key Takeaways



Case Studies



Other Resources



Questions  
and Discussion

# Stakeholder Committee

- Dongho Chang, Washington State DOT
- Nathan Wilkes, City of Austin
- Eric Virag, City of Austin
- Matthew Roe, National Association of City Transportation Officials (NACTO)
- Cary Bearn, NACTO
- Paul Benton, City of Charlotte
- Violet Wilkins, Massachusetts DOT
- Mike Murphy, Massachusetts DOT
- Josh Saak, Ada County Highway District
- Gary Obery, Oregon DOT
- Jenn Rhodes, City of Orlando
- Peter Ohlms, Virginia DOT
- Nicole Hahn, City of Fort Collins
- Jacob Rueter, Minnesota DOT

# Background

- In 2021, the U.S. Department of Transportation (USDOT) released the National Roadway Safety Strategy
- The National Transportation Safety Board (NTSB) concluded in 2019 that separated bike lanes could reduce bicyclist fatalities and injuries
- FHWA has included separated bike lanes in Proven Safety Countermeasures to make bicycling safer
- FHWA's Bikeway Selection Guide generally recommends separated bike lanes or shared-use paths on roads with speeds greater than 30 mph to provide a low-stress bicycling experience
- FHWA's 2023 crash modification factor (CMF) study showed a clear trend that, with the implementation of separated bike lanes, a transportation agency can expect to see a reduction in bicycle crashes

# Project Objective



- **Develop a toolkit guide for implementing separated bike lanes on higher speed roadways (40 mph +)**
  - Synthesize existing research and guidance for separated bike lanes
  - Identify best practices for policies, planning, and design
  - Identify potential obstacles, key considerations, and experiences from practitioners
  - Document example case studies
  - Not intended to be a detailed design guide

# How did we define separated bike lanes?

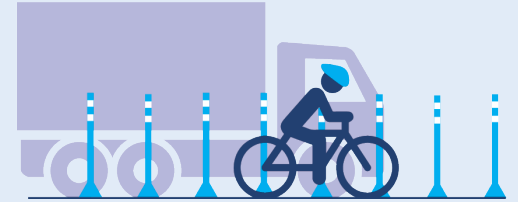
**1** INTENDED EXCLUSIVELY FOR BICYCLISTS AND SCOOTERS



**2** HORIZONTAL BUFFER SEPARATES BICYCLISTS FROM MOTOR TRAFFIC



**3** HAS SOME TYPE OF VERTICAL ELEMENT WITHIN THE BUFFER SPACE



# Research Summary

- Higher speeds are a risk factor for crashes and injuries
- Separated bicycle lanes improve safety for all modes
- Separated bicycle lanes influence driver behavior
- Everyone is more comfortable with separated bicycle lanes, drivers too.



# SBL Crash Modification Factor





# Existing design guidance

- AASHTO Guide for the Development of Bicycle Facilities
- Separated Bike Lane Planning and Design Guide (FHWA)
- Bikeway Selection Guide (FHWA)
- Traffic Analysis and Intersection Considerations to Inform Bikeway Selection (FHWA)
- On-Street Motor Vehicle Parking and the Bikeway Selection Process (FHWA)
- Urban Bikeway Design Guide (NACTO)
- Designing for All Ages and Abilities (NACTO)
- Recommended Design Guidelines to Accommodate Pedestrians and Bicycles at Interchanges (ITE)
- Small Town and Rural Multimodal Networks (FHWA)
- State and local planning and design guides



# Current Challenges

1

Lack of  
guidance

2

Maintenance  
concerns

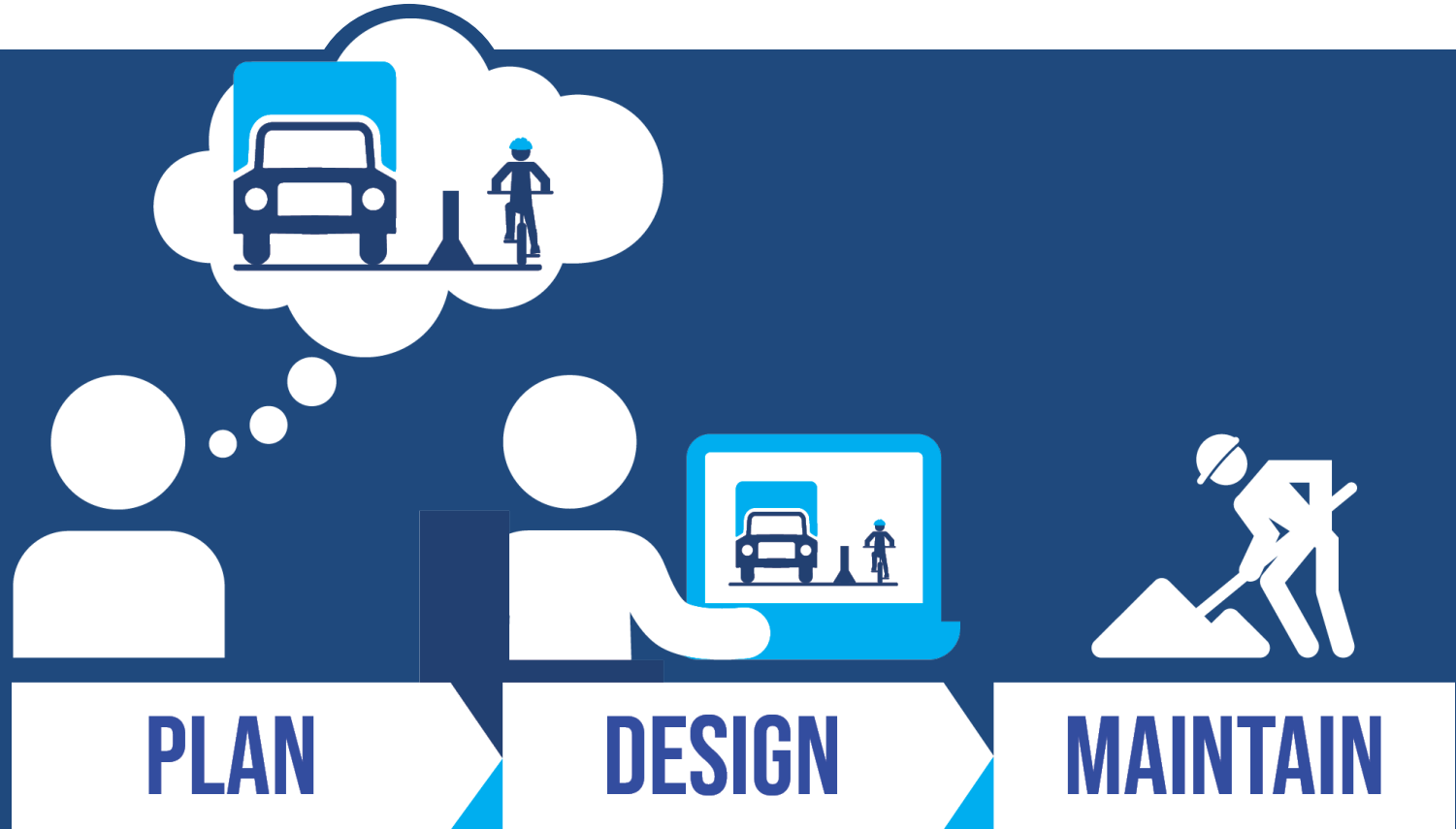
3

Driveways &  
intersections

4

Separated  
bike lanes on  
higher speed  
roads  
relatively  
rare

# Structure of the Toolkit Guide



# Planning



Justify the project

- Identify safety or network need
- Leverage planned projects
- Identify support and engage the community



Analyze funding options

- Federal
- Local
- Private sector

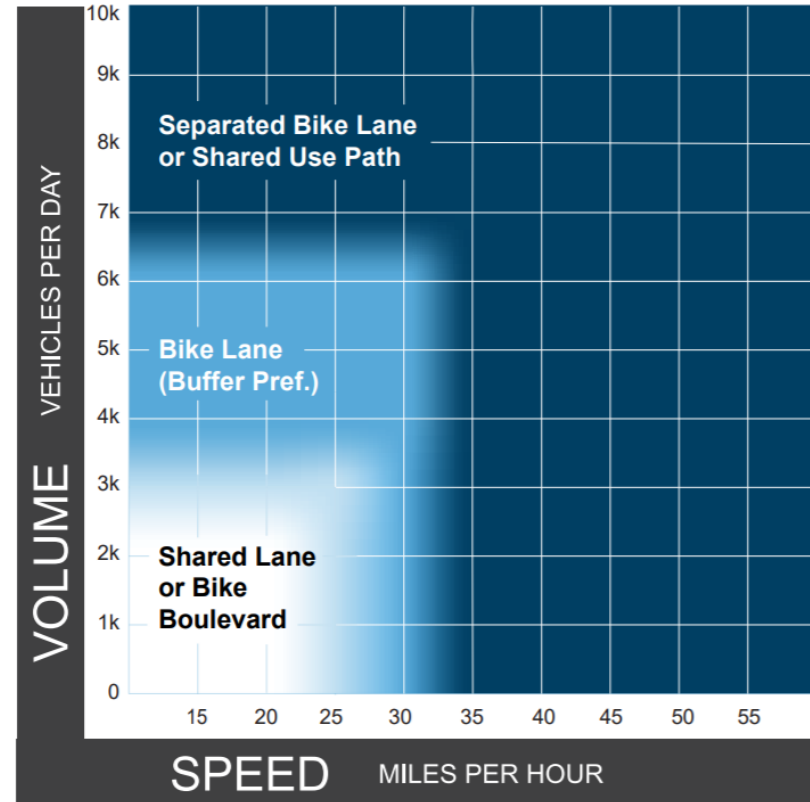


Enact supportive policies

- Vision Zero
- Safe System approach
- Design guidelines

# FHWA Bikeway Selection Guide

- Help practitioners make informed decisions about tradeoffs relating to the selection of bikeway types.
- Highlight linkages between the bikeway selection process and the transportation planning process.
- Emphasizes engineering judgment, design flexibility, documentation, and experimentation.
- Available at:  
[https://safety.fhwa.dot.gov/ped\\_bike/tools\\_solve/docs/fhwasa18077.pdf](https://safety.fhwa.dot.gov/ped_bike/tools_solve/docs/fhwasa18077.pdf)



# Designing – Vertical Separation



## DELINEATOR POSTS

- Common separators due to low cost, visibility, ease of installation
- Modify driver behavior
- Do not provide crash protection
- Less durable than other separators
- Consider converting these types of buffers to a more permanent style when design and budgets allow
- May need to change barrier type as speed increases for bicyclist comfort



## PARKING STOPS

- Inexpensive, low linear barrier
- High level of durability
- Provides near-continuous separation
- Provides better barrier for safety and comfort than delineator posts



## PARKED CARS

- Can provide an additional level of protection and comfort for bicyclists
- Less common on higher speed roads
- Additional vertical elements, such as delineator posts, should be paired with this design
- Must provide an access aisle for accessible parking

# Designing – Vertical Separation



## BARRIERS

- Provides highest level of crash protection among these separation types
- Requires little maintenance
- May require additional drainage and service vehicle solutions
- Crash cushion should be installed where the barrier end is exposed



## RAISED MEDIAN CURB

- More expensive to construct
- Provides a continuous raised buffer that is attractive and requires little long-term maintenance



## RAISED BIKE LANE

- Provides high level of comfort for bicyclists
- More expensive to construct than on-street separated bike lanes
- Different pavement types, markings, or buffers may be necessary to keep bicyclists and pedestrians separated at sidewalk level
- 3" mountable curb may be used to permit access of sweeping equipment if placed at an intermediate level

# Designing – Vertical Separation

## Key Considerations

Cost

Perceived  
safety

Durability

Maintenance

Stormwater  
management

Run-off-road  
crashes

Aesthetics

Construction  
needs and  
impacts

Width  
required

Strategies to  
lower design  
speed



# Designing – Intersections & Driveways

## Key Considerations

Access  
Management

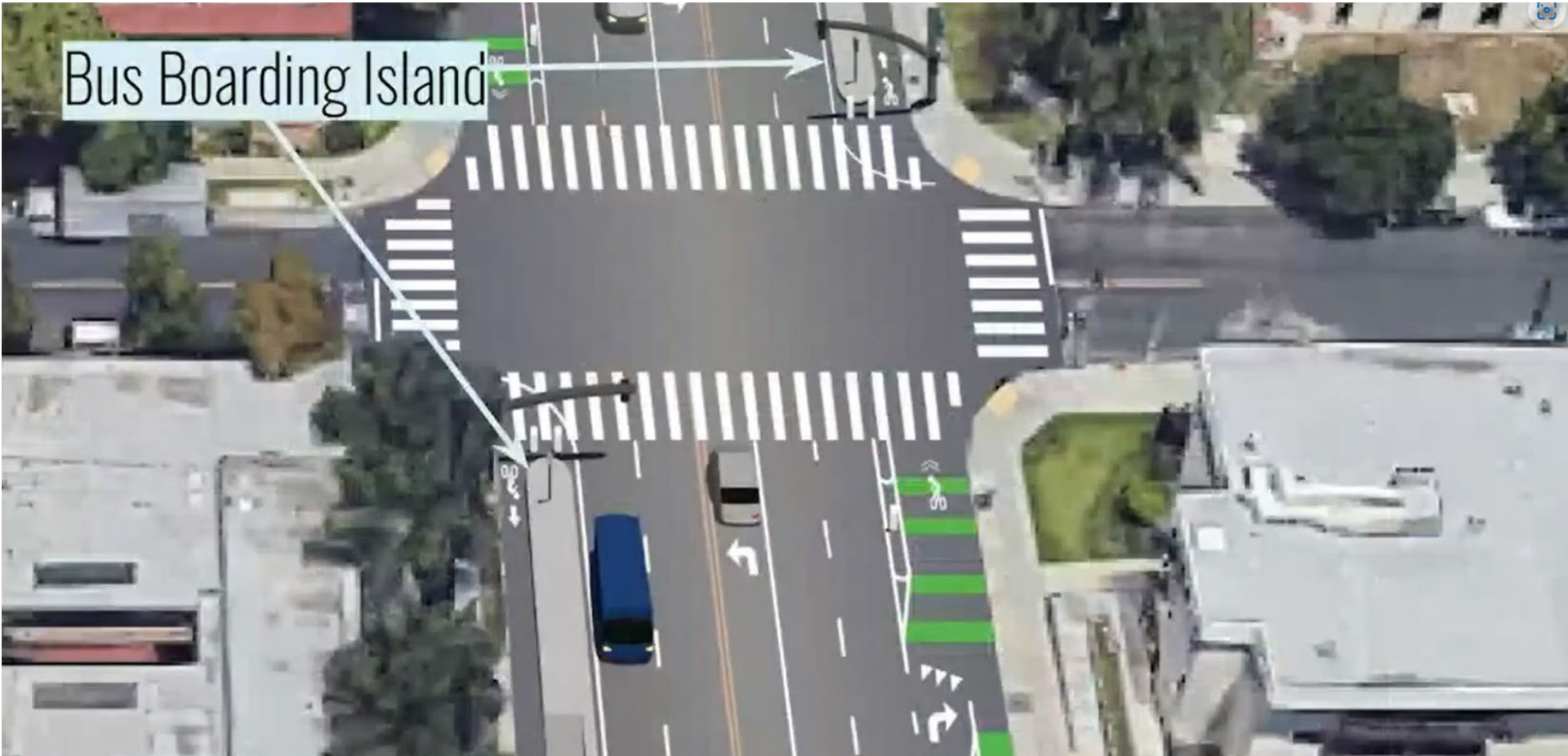
One-way vs.  
two-way bike  
lanes

Visibility at  
crossings

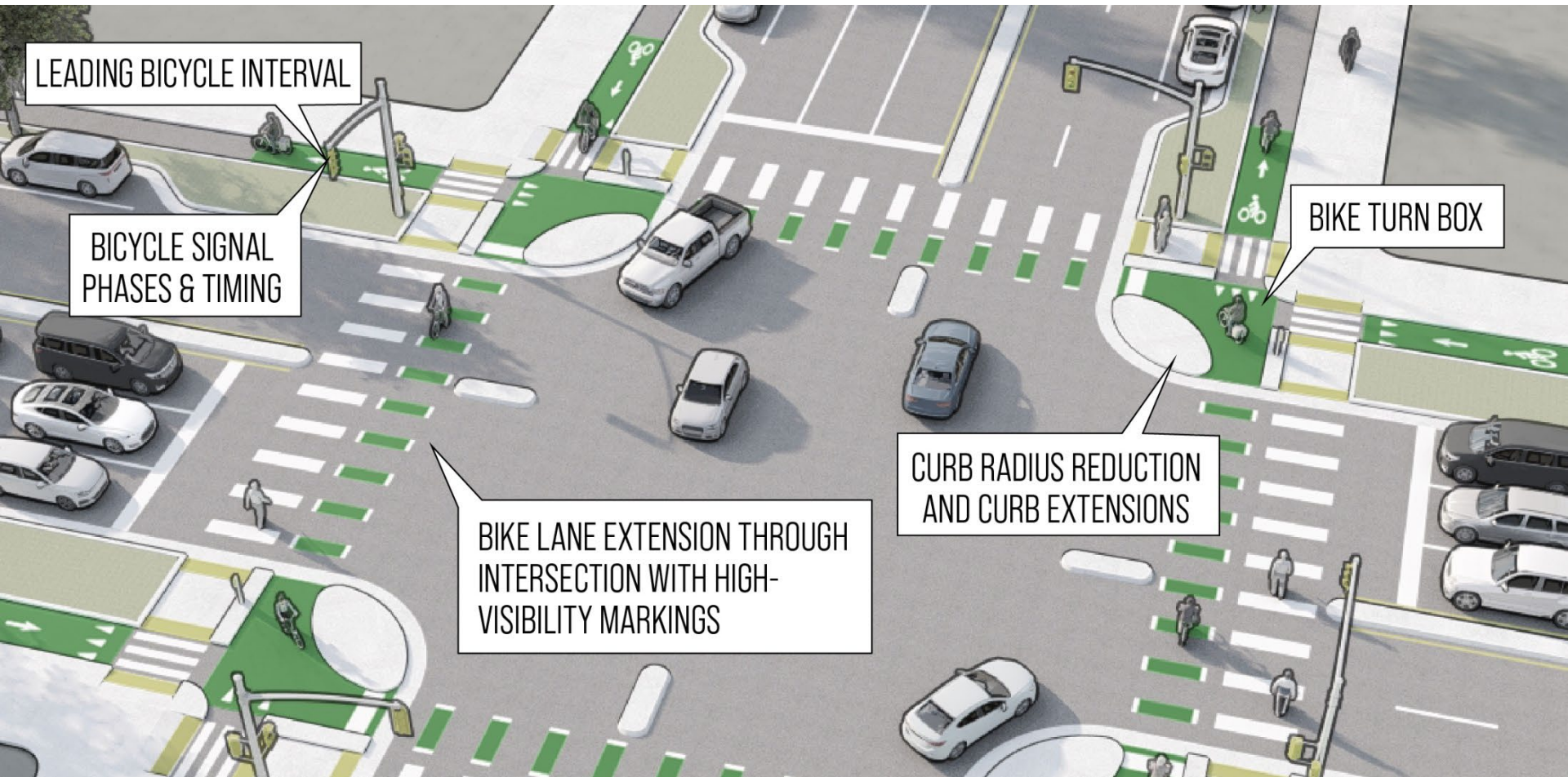
Mixing zones  
and  
deceleration  
lanes

Signalized  
intersections

# Mixing Zones & Deceleration Lanes



# Signalized Intersections



LEADING BICYCLE INTERVAL

BICYCLE SIGNAL PHASES & TIMING

BIKE TURN BOX

CURB RADIUS REDUCTION AND CURB EXTENSIONS

BIKE LANE EXTENSION THROUGH INTERSECTION WITH HIGH-VISIBILITY MARKINGS

# Maintaining

**1**

Stormwater  
Management

**2**

Asset  
Management

**3**

Street  
Sweeping

**4**

Seasonal  
Maintenance

# Key Questions



What form of separation is needed on a higher speed road?



How can separated bike lanes on higher-speed roads be maintained through driveways and intersections?



How can agencies sustain safe separated bicycle lane operations on high-speed roads?

# Case Study – Austin, TX



Source: Austin Corridor Program Office

- 4 miles of separated bicycle lanes
- Curb separated
- 45 mph speed limit
- 38,000 AADT (2021)
- One-way, street level

# Case Study – Pomona, CA



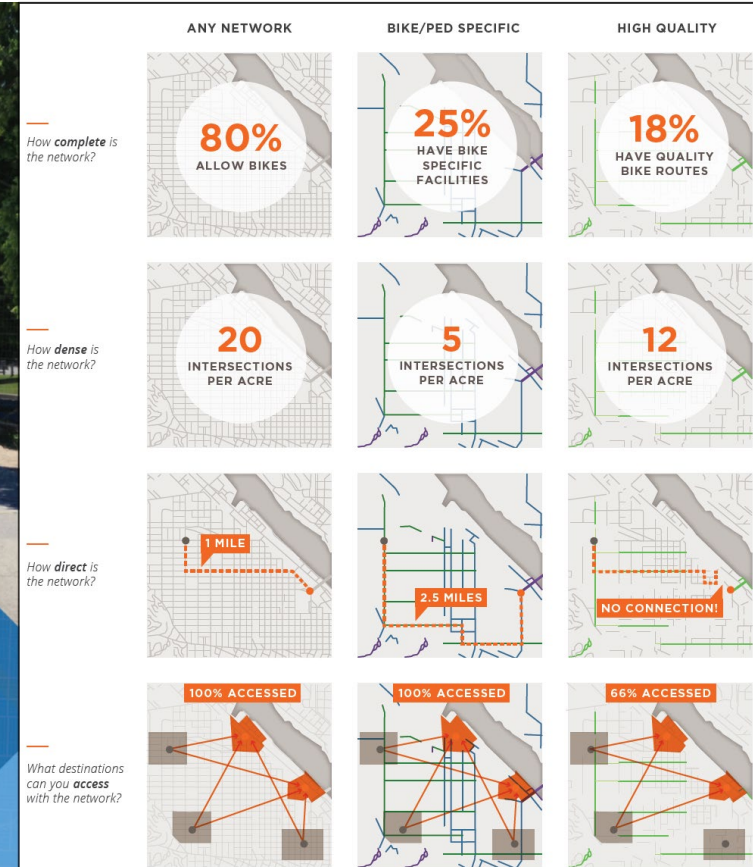
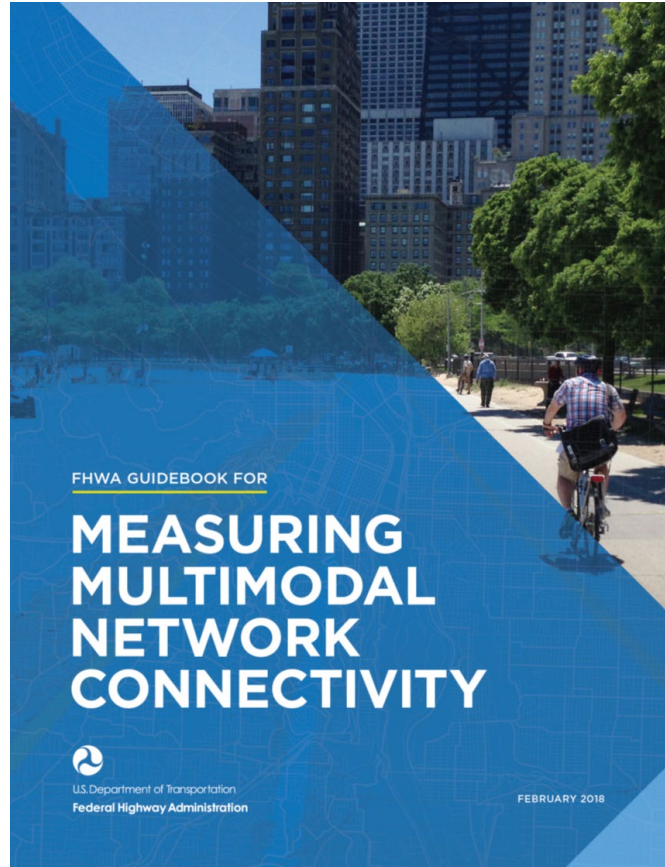
Source: Joe Linton/Streetsblog

- 1.5 miles of protected bicycle lanes
- Raised curb with flexible delineator posts
- 45 mph
- Two-way, street level

# FHWA Guidebook for Measuring Multimodal Network Connectivity

Source:

[https://www.fhwa.dot.gov/environment/bicycle\\_pedestrian/publications/multimodal\\_connectivity/](https://www.fhwa.dot.gov/environment/bicycle_pedestrian/publications/multimodal_connectivity/)

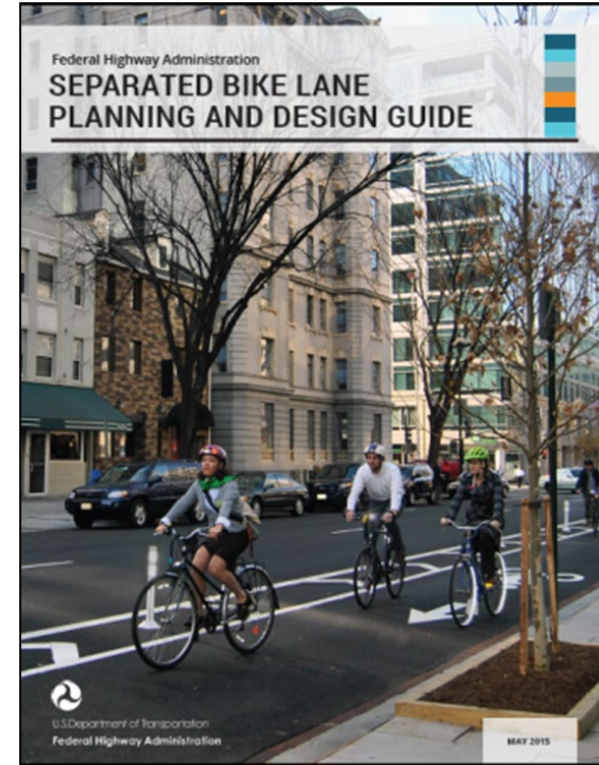




# Separated Bike Lane Planning and Design Guide

## Four Step Design Process

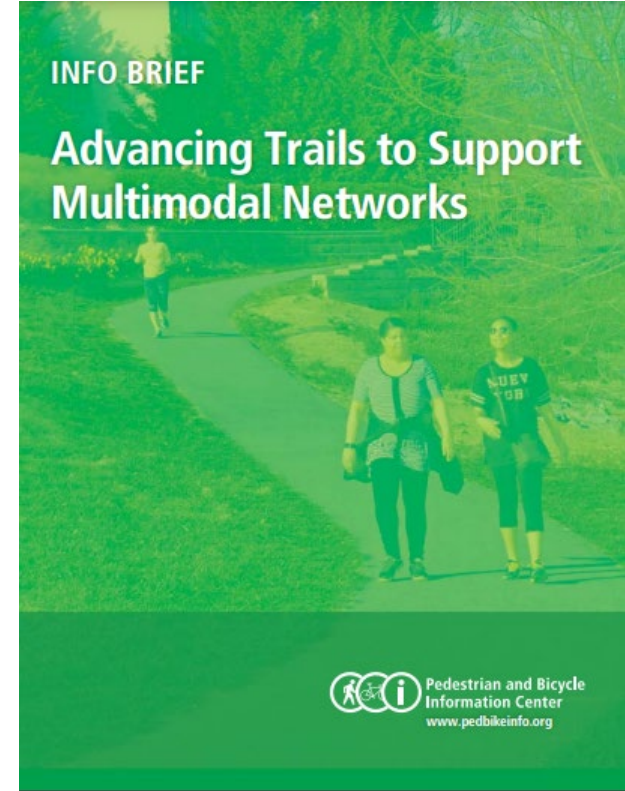
1. Establish Directional and Width Criteria
2. Select Forms of Separation
3. Identify Midblock Design Challenges and Solutions
4. Develop Intersection Design



Source: [https://www.fhwa.dot.gov/environment/bicycle\\_pedestrian/publications/separated\\_bikelane\\_pdg/](https://www.fhwa.dot.gov/environment/bicycle_pedestrian/publications/separated_bikelane_pdg/)

# Trails

- Trails are a low-stress and safe bikeway type
- Trails enhance access to transit, and complement it



Sources:

<https://railroads.dot.gov/sites/fra.dot.gov/files/2021-06/Rails%20with%20Trails%20Best%20Practices%20and%20Lessons%20Learned.pdf>

[https://www.pedbikeinfo.org/pdf/AdvancingTrailsToSupportMultimodalNetworks\\_PBICInfoBrief.pdf](https://www.pedbikeinfo.org/pdf/AdvancingTrailsToSupportMultimodalNetworks_PBICInfoBrief.pdf)

# NHI Bicycle Facility Design Web Training (course #142080)

## Bicycle Planning Principles



**Safety**



**Comfort**



**Connectivity**

Get started: [https://www.nhi.fhwa.dot.gov/course-search?sf=0&course\\_no=142080](https://www.nhi.fhwa.dot.gov/course-search?sf=0&course_no=142080)

**ZERO** IS OUR  
GOAL  
A SAFE SYSTEM IS HOW WE GET THERE



U.S. Department  
of Transportation  
**Federal Highway  
Administration**

# Complete Streets Design Model



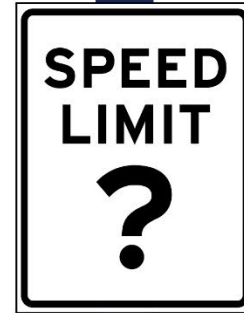
# The Complete Streets Design Model

In implementing a Complete Streets Policy, planners and designers can use a Complete Streets Design Model that **prioritizes safety, comfort and connectivity for all users** of the roadway.

In general, the Complete Streets Design Model:

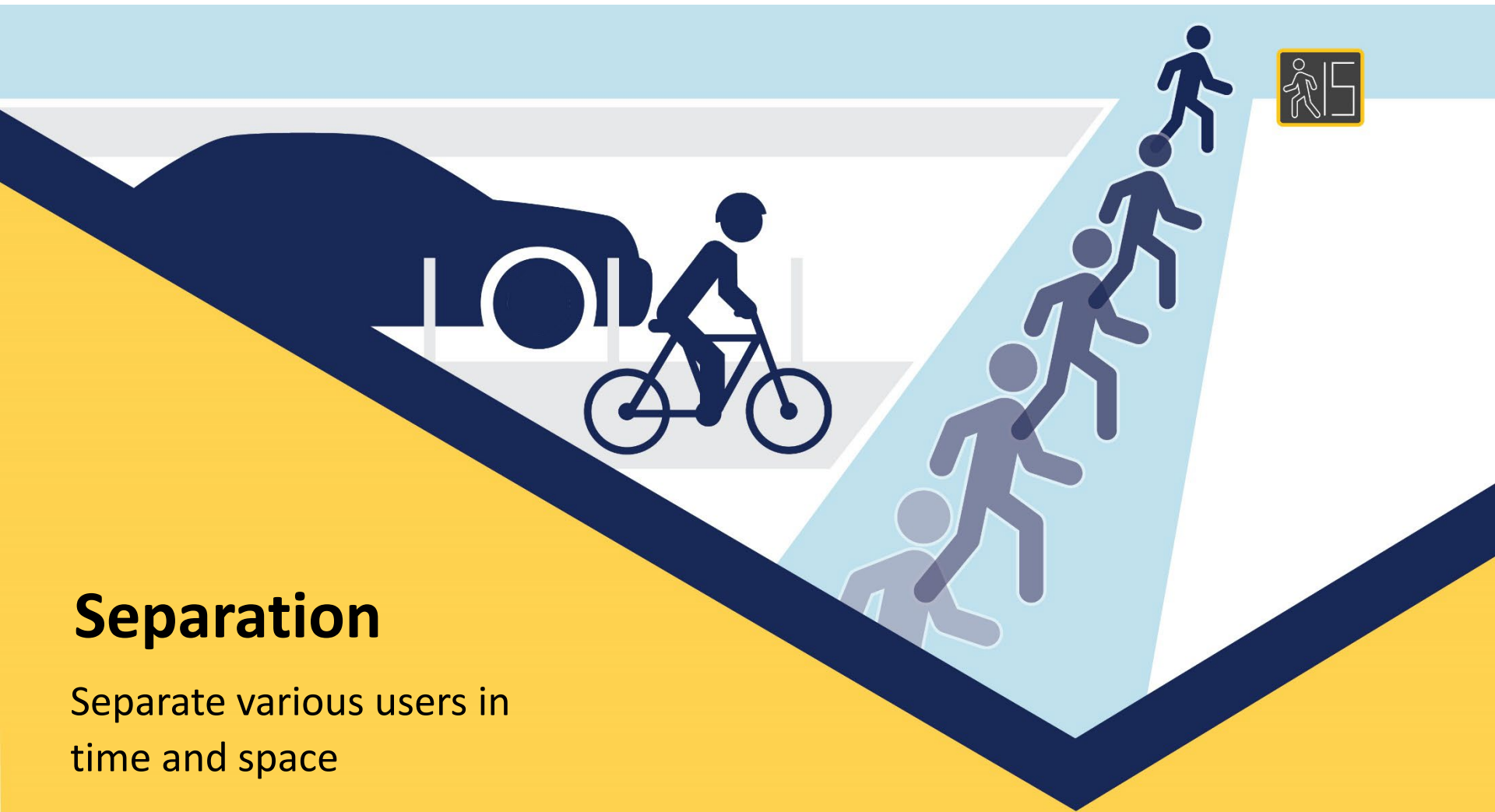
1. Carefully considers measures to set and design for appropriate speeds
2. Separates various users in time and space
3. Improves connectivity and access for pedestrians, bicyclists, and transit riders, including for people with disabilities
4. Implements safety countermeasures

Review of State Geometric Design Procedures for Resurfacing, Restoration, and Rehabilitation Projects on the NHS <https://www.fhwa.dot.gov/design/rrrguidance230301.pdf>



# Speed

Carefully consider measures to set and design for appropriate speeds



# Separation

Separate various users in  
time and space

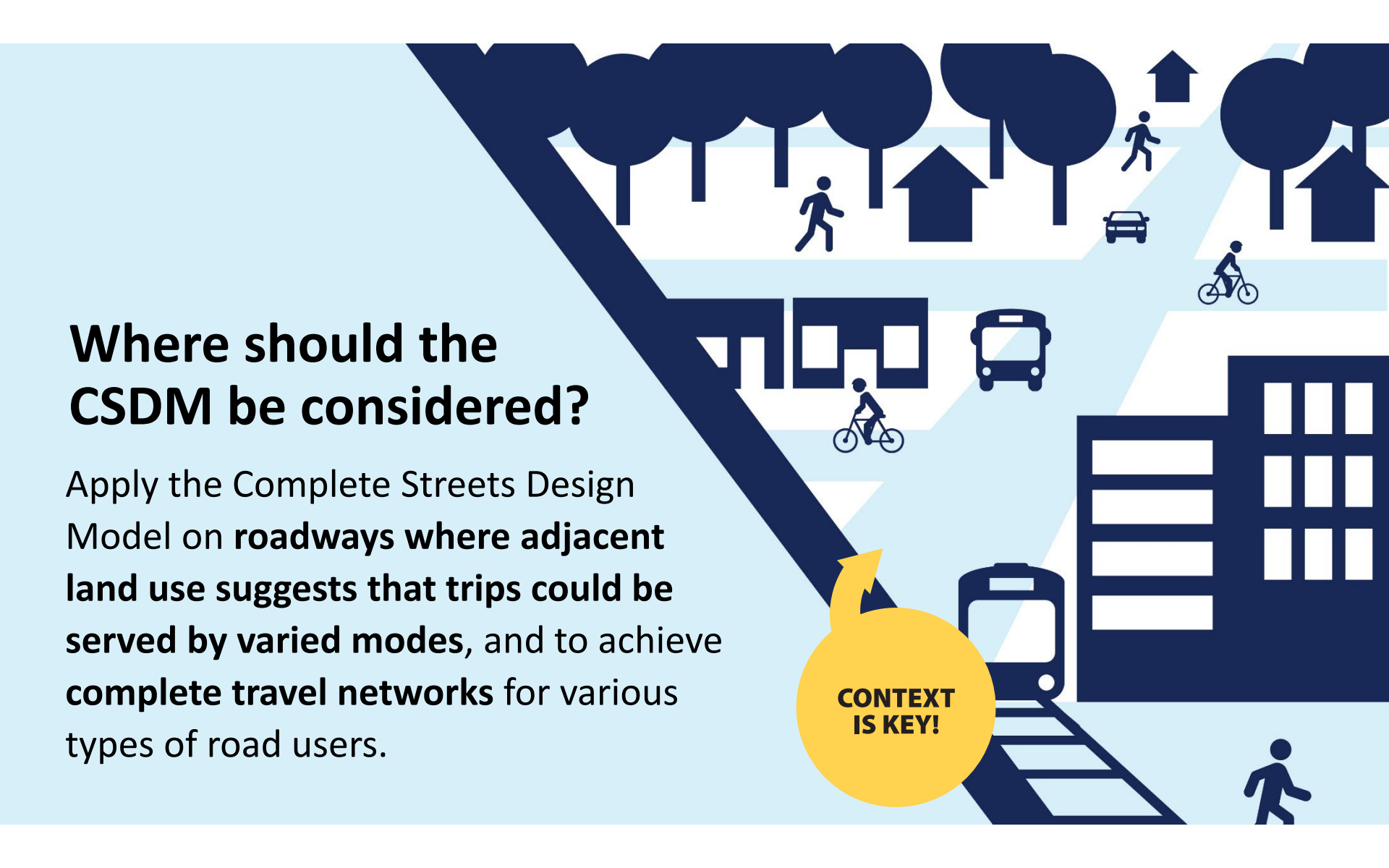






# Safety Countermeasures

Implement safety countermeasures

The background features a stylized illustration of a city street scene. A large, dark blue diagonal arrow points from the top right towards the bottom left. Along this arrow, various icons represent different transportation modes and land uses: a pedestrian, a car, a cyclist, a bus, and a train. The scene is set against a light blue background with dark blue silhouettes of trees, houses, and buildings. A yellow circle with an arrow pointing to the diagonal arrow contains the text 'CONTEXT IS KEY!' in bold, black, uppercase letters.

## Where should the CSDM be considered?

Apply the Complete Streets Design Model on **roadways where adjacent land use suggests that trips could be served by varied modes**, and to achieve **complete travel networks** for various types of road users.

**CONTEXT  
IS KEY!**



## Where does the CSDM appear in FHWA guidance?

- Vulnerable road user (VRU) safety assessment guidance
- Pedestrian and bicycle guidance
- Resurfacing, restoration, and rehabilitation (3R) guidance



# Questions and Discussion