ZERO IS OUR GOAL

A SAFE SYSTEM IS HOW WE GET THERE

Source: left, right - @Getty Images, middle - FHWA

Complete Streets for Cities

Road Safety Mini Series

National League of Cities

Barbara McCann

Brooke Struve, PE

U.S. Department of Transportation

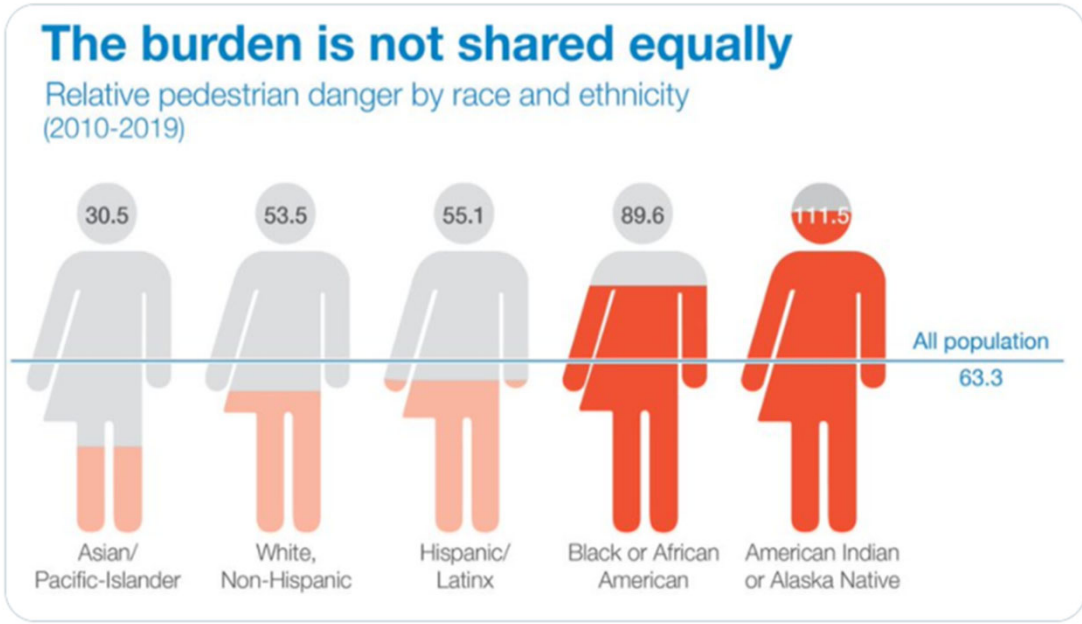
Federal Highway Administration

Why are we doing this?

Safety Focus

Secretary Pete Buttigieg
@SecretaryPete

These disparities are awful, but we know how to fix them. It's time to reverse these patterns of exclusion and invest in safer, equitable streets.
smartgrowthamerica.org/dangerous-by-d...



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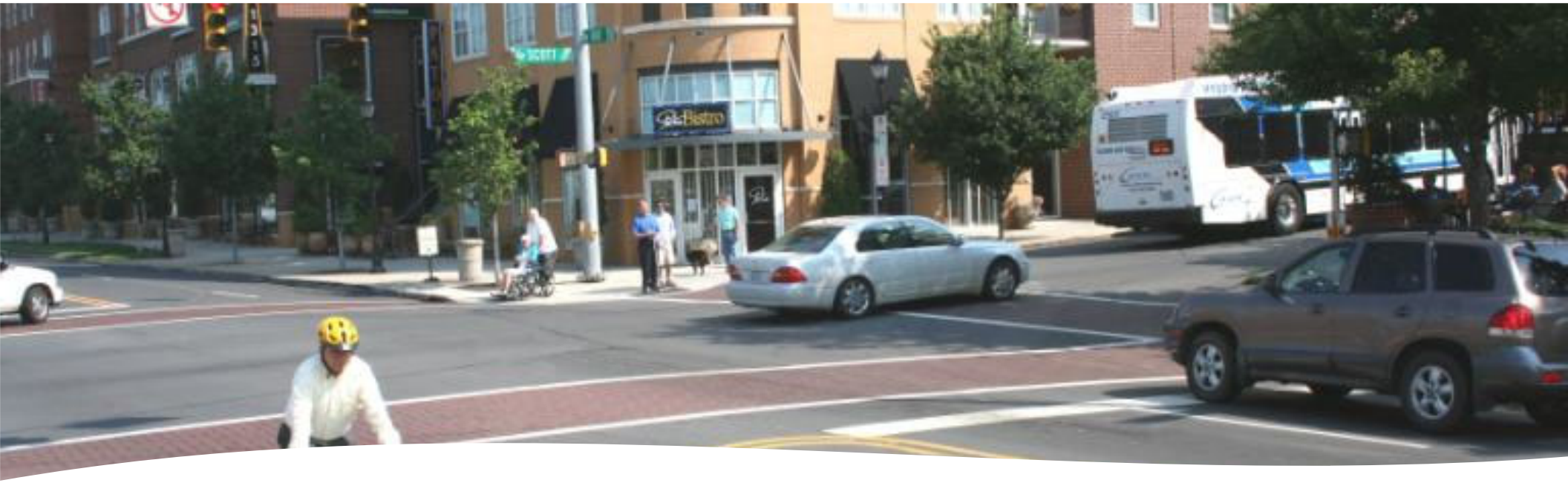

What are Complete Streets?

- “A complete street is safe and feels safe for everyone using the street.” -- Stephanie Pollack
- A complete streets approach means routinely improving safety and access for all road users.

The Safe System Approach: 6 Core Principles

- Death/Serious Injury is Unacceptable
- Humans Make Mistakes
- Humans are Vulnerable
- Responsibility is Shared
- Safety is Proactive
- Redundancy is Crucial

Source: FHWA

5 Inter-Related Elements

U.S. Department of Transportation
Federal Highway Administration

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The Safe System Approach: Complete Streets

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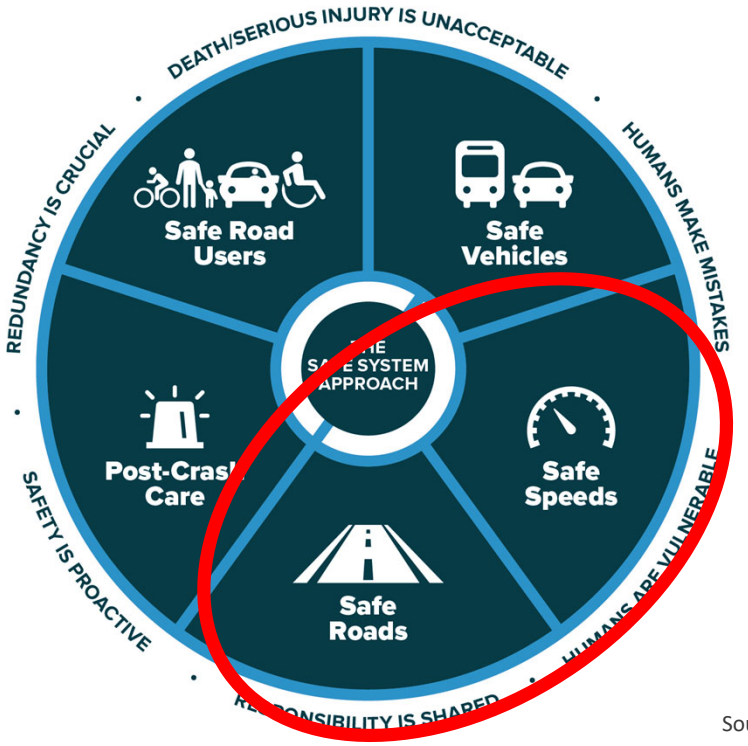

Source: FHWA

5 Inter-Related Elements

U.S. Department of Transportation
Federal Highway Administration

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Massachusetts Approach

- **Training & Grant program for locals:**
  - Training and technical assistance
  - Grant programs for communities with policies
- **Changing the way Massachusetts DOT builds its projects**
  - Updated project development guide
  - Clearing barriers

MADOT: Work with Local communities

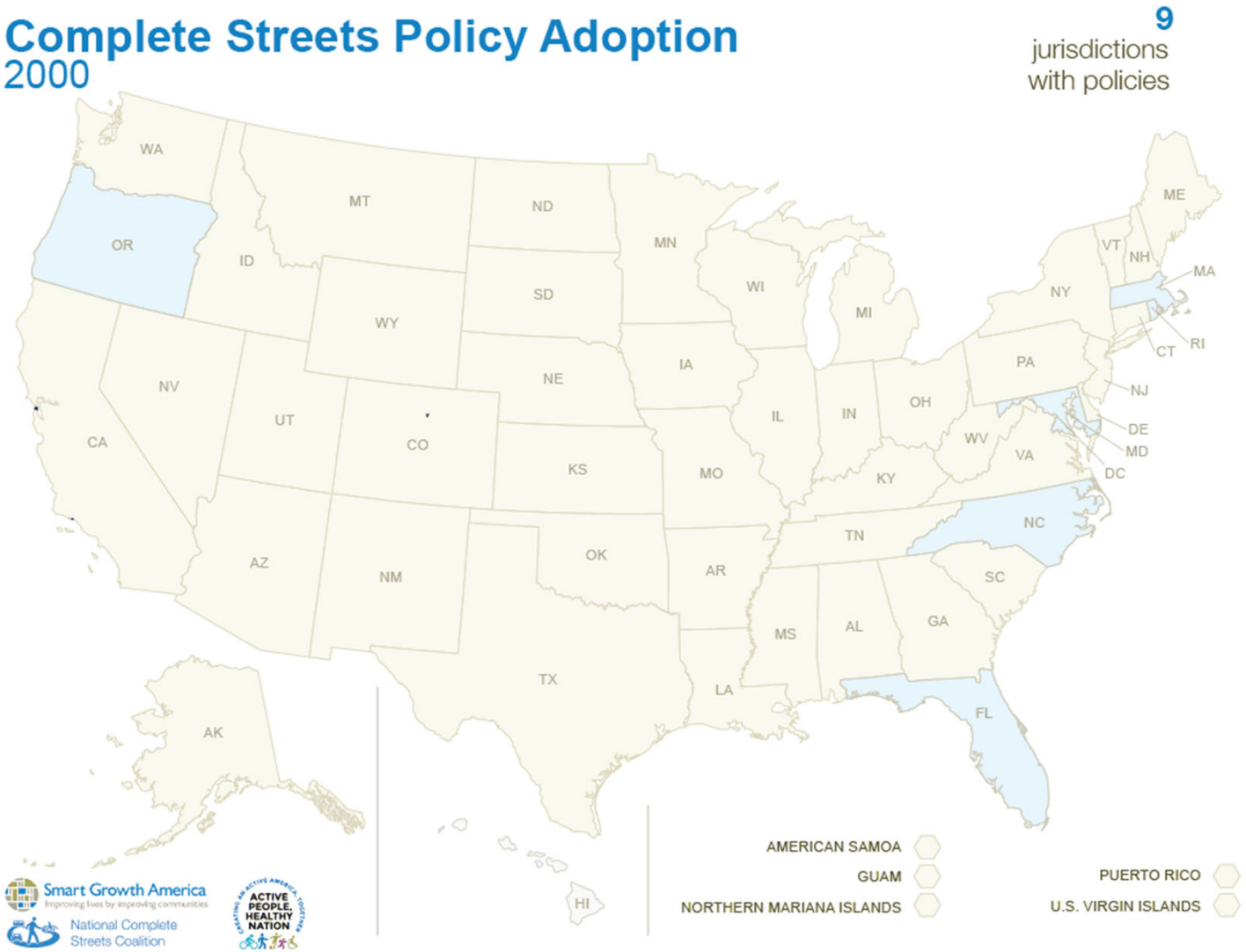
- Technical Assistance
- Provide consulting grants to identify barriers to CS in project development process
- Require a prioritization plan based on local needs and travel patterns
  - Plans were approved by state DOT
- Provided capital funds to communities with polices and prioritization plans
- Result: Dramatic increase in CS policies (250 jurisdictions) and 160 construction grants ($70 million grants total)

MADOT: Changing the way it builds projects

- **Basic principle: Make the things you want easier, and the things you don't want, harder.**
- Systematically eliminate barriers
- Massachusetts eliminated all existing design exceptions, created 3 new scenarios requiring exceptions:
  - Failure to provide safe travel for pedestrians, bicyclist, and (when present), transit vehicles.

Complete Streets Policy

Complete Streets Policy Adoption
2000



Smart Growth America
Improving lives by improving communities
National Complete Streets Coalition

ACTIVE PEOPLE, HEALTHY NATION

Policy adoption has spread for 20 years across the United States

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

A Complete Streets Policy

"… ensures that the entire right of way is planned, designed, and operated to provide safe access for all users."

An ideal complete streets policy

1) Sets a vision
2) Includes all users and modes
3) All projects and phases
4) Clear, accountable exceptions
5) Other jurisdictions, involved in the process
6) Inclusive design guidelines - flexible
7) Is context-sensitive
8) Sets performance measures
9) Provides project selection criteria
10) Includes implementation steps

Smart Growth America
Making Neighborhoods Great Together

National Complete Streets Coalition

Resources:

The Best Complete Streets Policies of 2018

https://smartgrowthamerica.org/resources/the-best-complete-streets-policies-of-2018/

Types of Complete Streets Policies

- Council-driven
  - Ordinance
  - Resolution
- Council-approved
  - Plans
  - City policies
  - Design guidelines
- Directives
  - Departmental policy
  - Executive order
- Citizen vote
  - Tax levy
  - Ballot measure

Poll Question

Do you have a complete streets policy?

- Yes
- No
- Under development
- I don’t know

Implementation – From Policy to Practice

- Planning for Implementation
- Changing procedure and process
- Offering training and education
- Reviewing and updating design guidance
- Measuring Performance

Source: National Complete Streets Coalition
CS Implementation Guidebook

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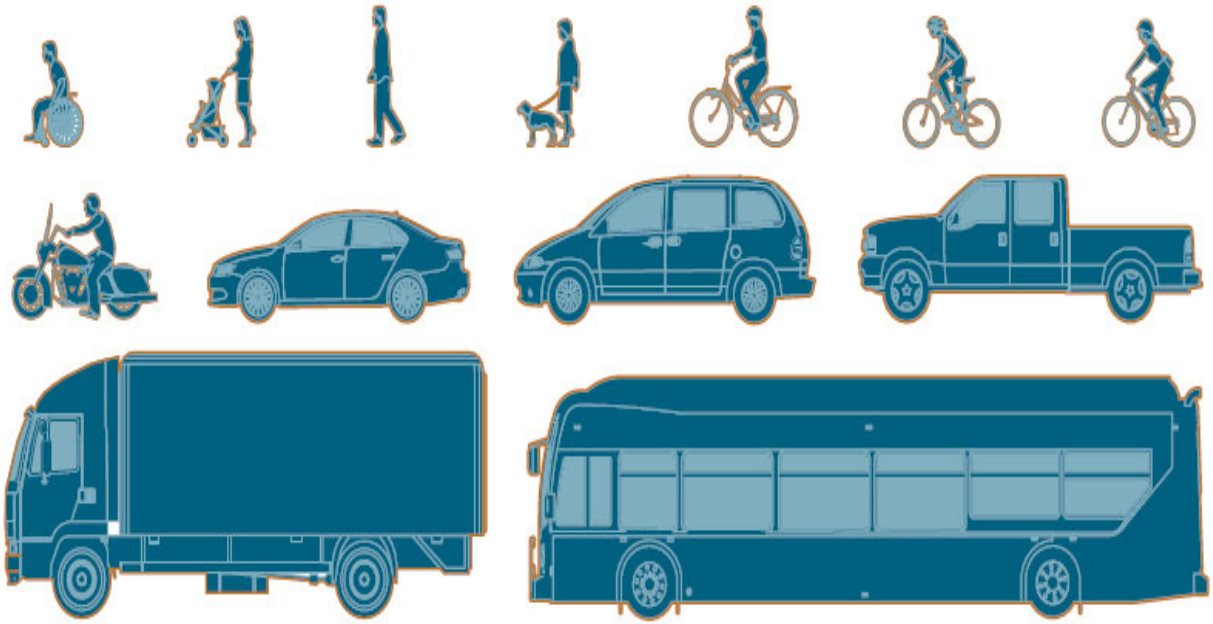
Pedestrian Fatality Hot Spots

- **Multilane roadways** (97%)
- **Pedestrians crossing 5+ lanes** (70%)
- **Speed limits 30 mph or higher** (3/4)
- **Volumes exceeding 25,000 vehicles per day** (62%)
- **Bordered by low-income neighborhoods** (3/4)
- **Adjacent commercial land uses** (nearly all)

Source: Schneider, Sanders, and Proulx. 2020. *United States Fatal Pedestrian Crash Hot Spot Locations and Characteristics*. Journal of Transportation & Land Use, Vol 14, No 1

Multimodal Networks



Who are you accommodating?
How will you accommodate them safely?

Graphic Credit: FHWA Achieving Multimodal Networks, 2016

What about Scooters and E-Bikes?

Complete Network

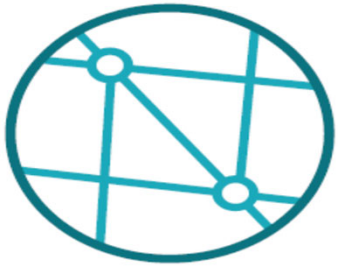
- Network for each mode
- Equity for all populations
- Not all users are prioritized on all corridors
- Always provide access:
  - Across low-comfort corridors
  - Along key links

Source: METRANS Transportation Center

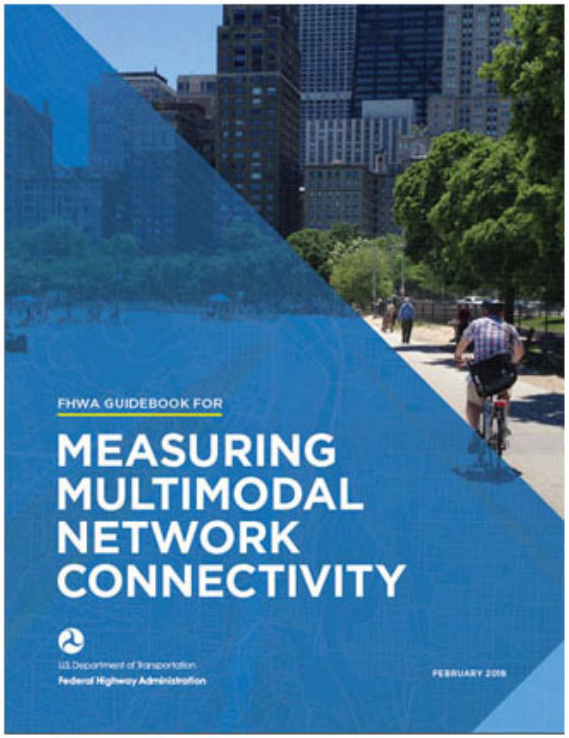
Complete Streets Create a Safe Network

Safety

Comfort



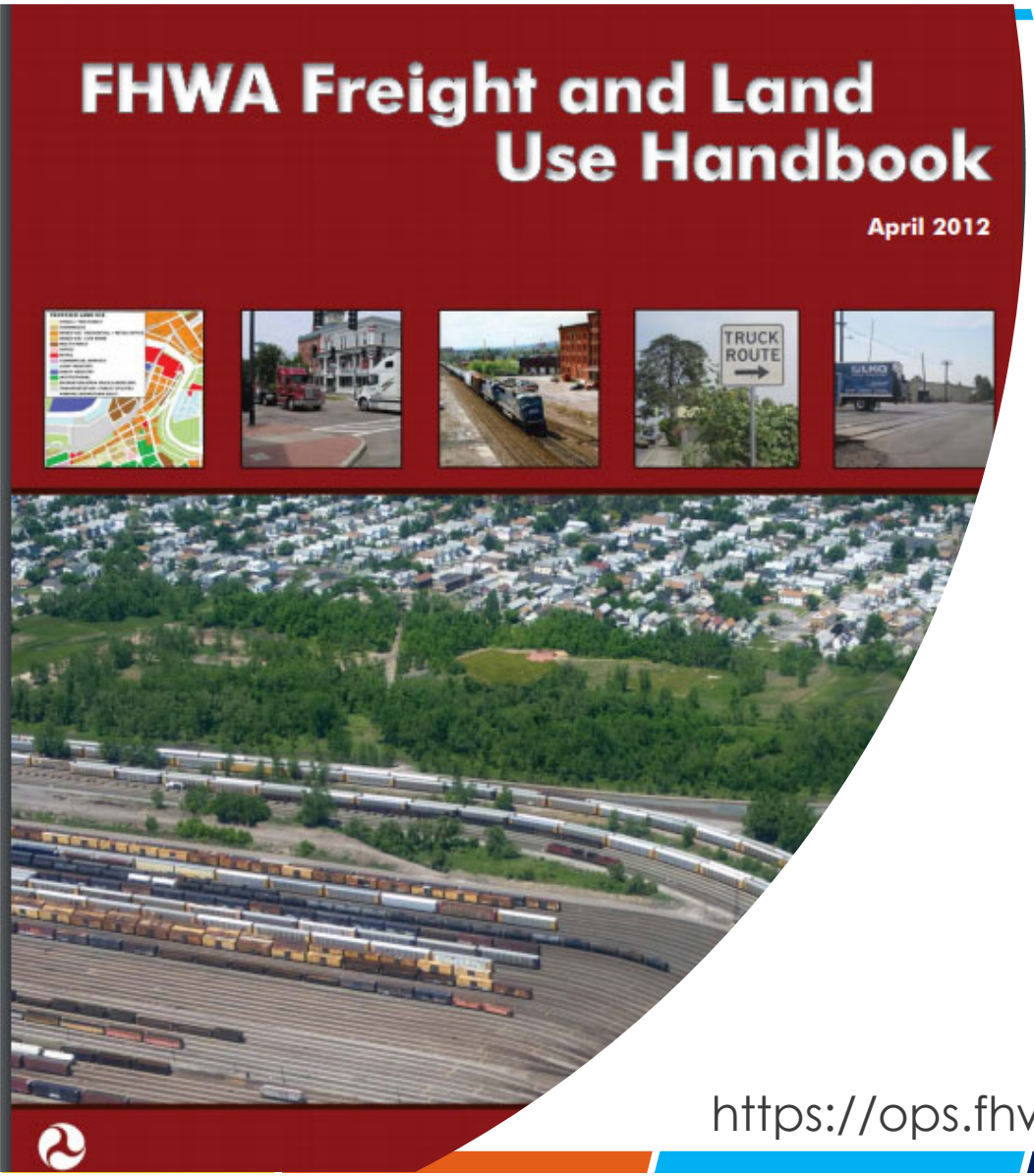
Connectivity



Resources:
Multimodal Connectivity Newsletter
https://www.fhwa.dot.gov/livability/newsletter/
Guidebook for Measuring Multimodal Connectivity
https://www.fhwa.dot.gov/environment/bicycle_pedestrian/publications/

Complete Streets for Freight

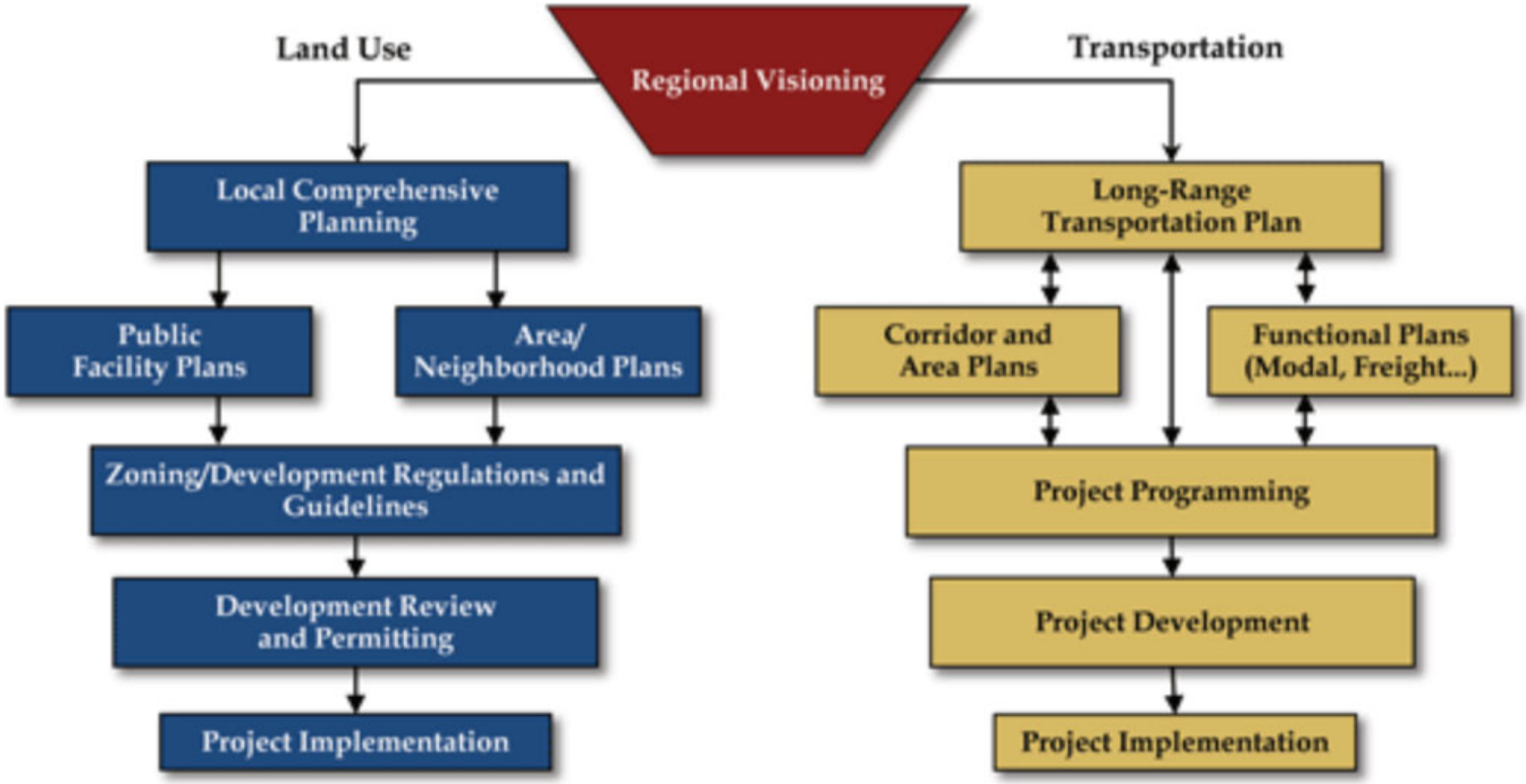
U.S. Department of Transportation
Federal Highway Administration



- Employment
- Tax benefits
- Economic output

https://ops.fhwa.dot.gov/publications/fhwahop12006/

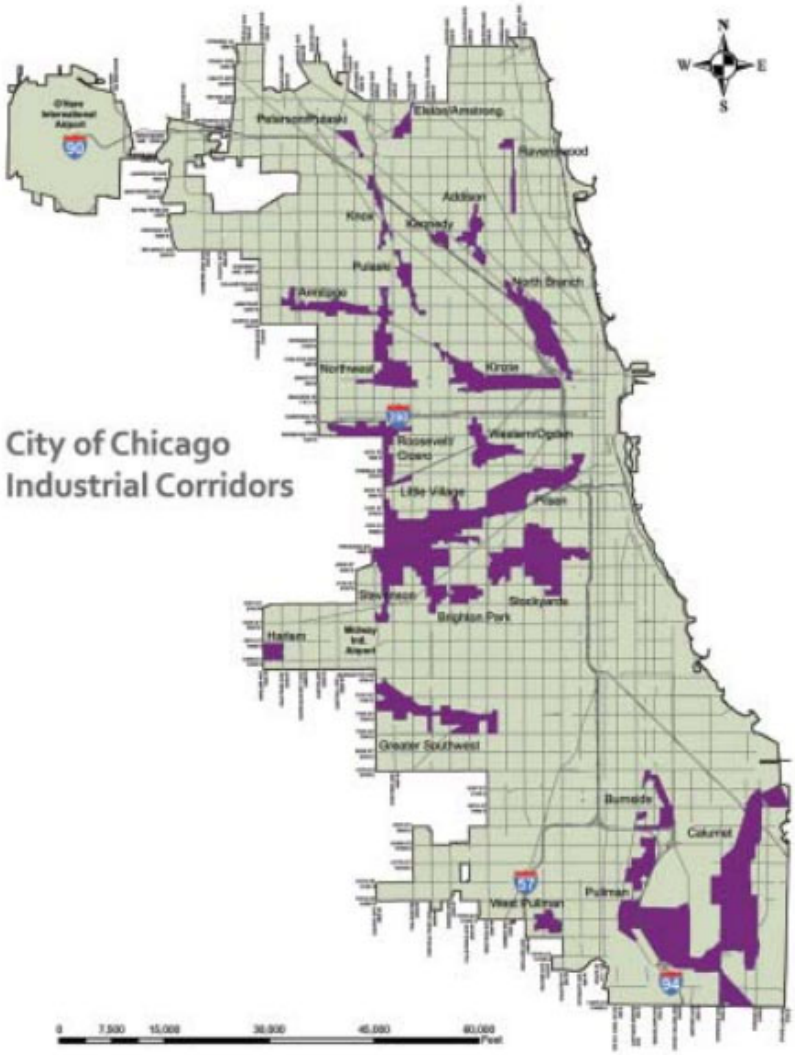
Land Use and Transportation Planning



Source: Cambridge Systematics, Inc., 2010

Manufacturing District

- Prevent encroachment of incompatible land uses
- Buffer sub-zones
- Performance criteria for each zone



Source: City of Chicago.

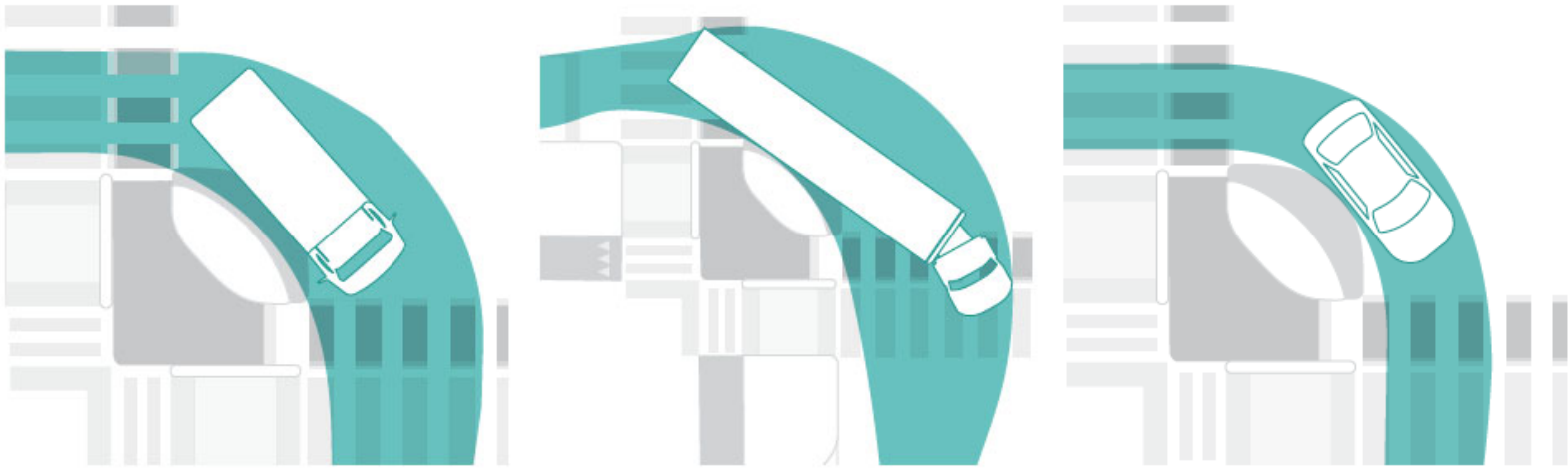
Defining Truck and Emergency Routes

- Benefits
  - Informs street design to accommodate larger vehicles and greater turning radii
  - Encourages Complete Streets networks with modal priorities varying by street

Defining Truck and Emergency Routes

- Process
  - Coordinate with freight carriers and emergency service providers
  - Conduct network analysis to determine travel sheds
  - Establish and communicate truck routes and emergency service routes
  - Update street design as opportunities arise

Turning Radii



DESIGN VEHICLE

CONTROL VEHICLE

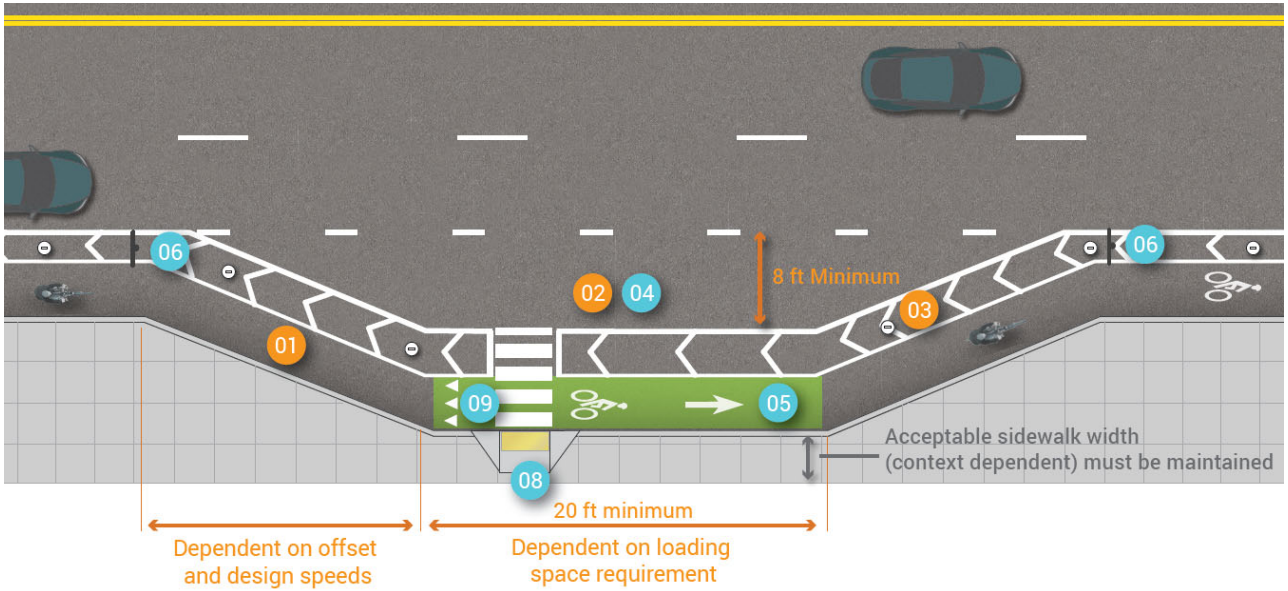
MANAGED VEHICLE

Source: NACTO, Don’t Give Up at the Intersection

Truck Apron

- Provide space for design and control vehicles
- Minimize turning radius for managed vehicle

Loading Zones



A dedicated loading zone along Polk Street in San Francisco, CA. (Source: Alek Pochowski)

Resources:
Separated Bike Lane Planning and Design Guide
https://www.fhwa.dot.gov/environment/bicycle_pedestrian/publications/

Loading Zones

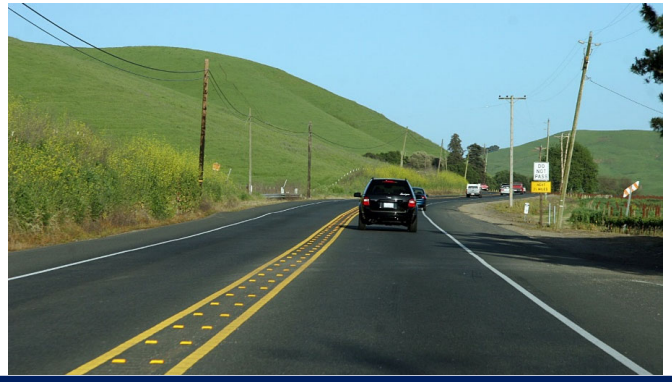
Complete Streets for Pedestrians

U.S. Department of Transportation
Federal Highway Administration

Shoulders

- Enhance safety for all users
- Reduce walking along the roadway pedestrian crashes by 70%

  (Gan et al study)

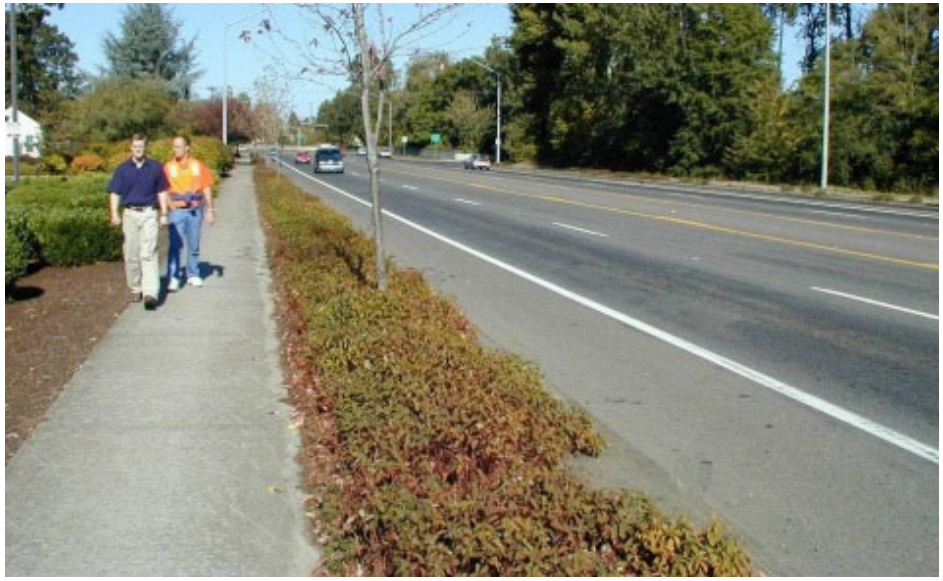


Sidewalks

- Reduce walking along the roadway pedestrian crashes by 88%

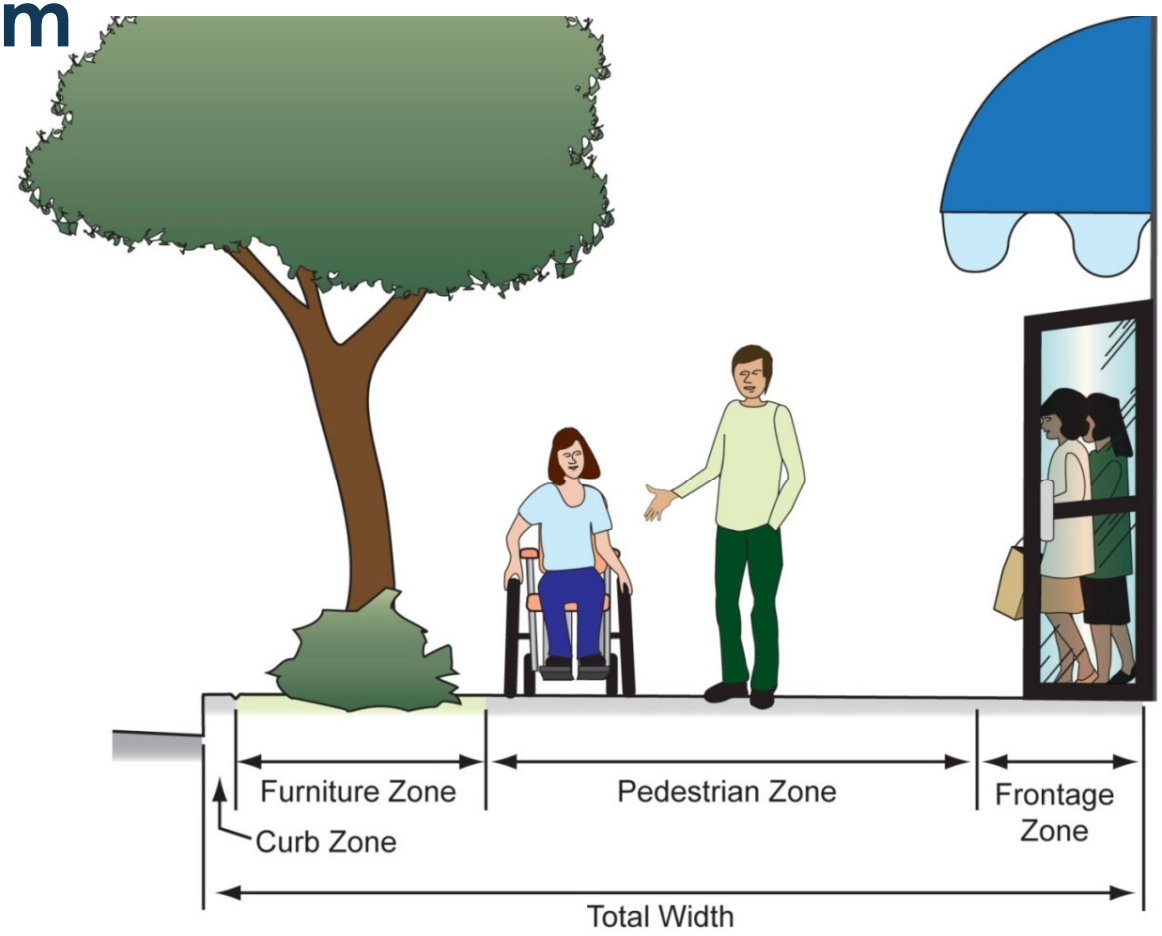
  (McMahon Study)
- “Sidewalks are an integral part of city streets.”

  (2011 AASHTO Green Book 4.17.1)



Sidewalk Zone System

- Curb zone
- Furniture zone
- Pedestrian zone
- Frontage zone

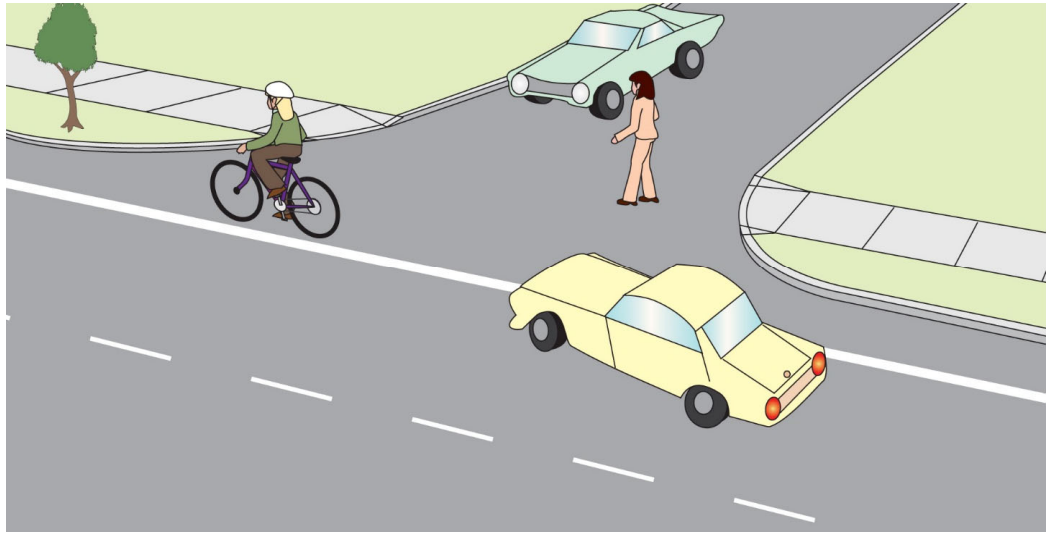


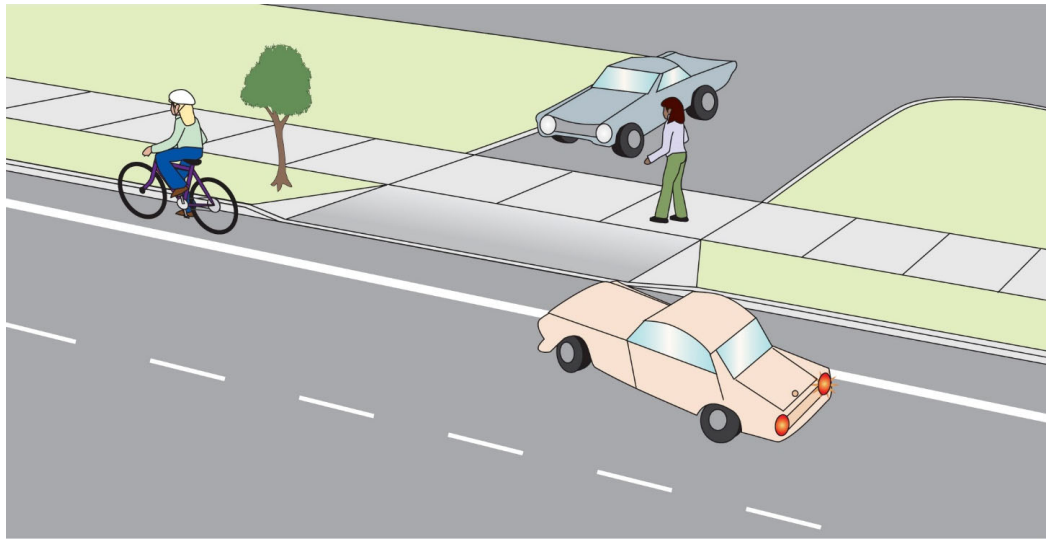
Driveways

Source of most conflicts between pedestrians and motor vehicles

Driveways

- Those built like intersections encourage high-speed turns
- Those built like driveways encourage slow-speed turns





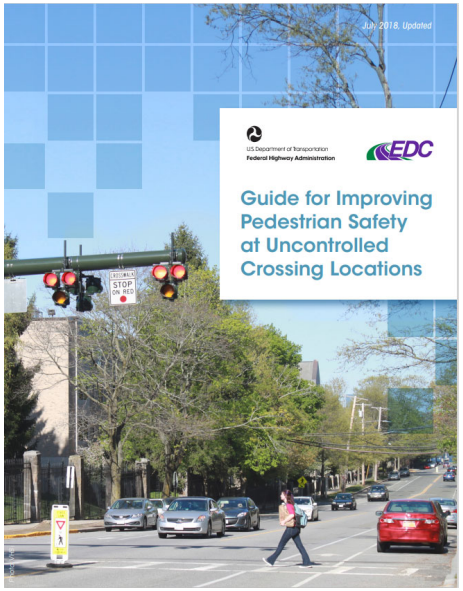
Crosswalk Markings

- Indicate to pedestrians where to cross
- Indicate to motorists where to expect pedestrians
- At mid-block, legally establish a crosswalk

Where to Mark Crosswalks

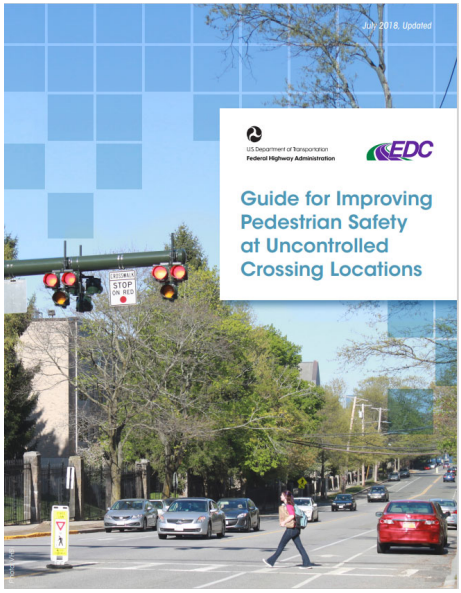
Consider origins and destinations

Uncontrolled Pedestrian Crossings



- High Visibility Markings
- Illumination
- Signing
- Advance Stop Bars
- Median Islands
- Raised Crosswalks
- Curb Extensions
- RRFB
- PHB
- Pedestrian Signals
- Road Diets

Uncontrolled Pedestrian Crossings



Resources:

Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations
https://www.pedbikeinfo.org/resources/resources_details.cfm?id=5119

Evaluation of Pedestrian-related Roadway Measures:
A Summary of Available Research
https://www.pedbikeinfo.org/cms/downloads/PedestrianLitReview_April2014.pdf

Safe Transportation for Every Pedestrian (STEP)
https://safety.fhwa.dot.gov/ped_bike/step/resources/

Selecting Design Treatments

Table 1. Application of pedestrian crash countermeasures by roadway feature.

Roadway Configuration	Posted Speed Limit and AADT								
	Vehicle AADT <9,000			Vehicle AADT 9,000–15,000			Vehicle AADT >15,000		
	≤30 mph	35 mph	≥40 mph	≤30 mph	35 mph	≥40 mph	≤30 mph	35 mph	≥40 mph
2 lanes (1 lane in each direction)	❶ 2 4 5 6	❶ 5 6 7 9	① 5 6 ❼ ❾	❶ 4 5 6	❶ 5 6 7 9	① 5 6 ❼ ❾	❶ 4 5 6 7 9	① 5 6 7 9	① 5 6 ❾
3 lanes with raised median (1 lane in each direction)	❶ 2 3 4 5	❶ ❸ 5 7 9	① ❸ 5 ❼ ❾	① 3 4 5	① ❸ 5 ❼ ❾	① ❸ 5 ❼ ❾	① ❸ 4 5 7 9	① ❸ 5 ❼ ❾	① ❸ 5 ❾
3 lanes w/o raised median (1 lane in each direction with a two-way left-turn lane)	❶ 2 3 4 5 6 7 9	❶ ❸ 5 6 7 9	① ❸ 5 6 ❾	① 3 4 5 6 7 9	① ❸ 5 6 ❼ ❾	① ❸ 5 6 ❾	① ❸ 4 5 6 7 9	① ❸ 5 6 ❾	① ❸ 5 6 ❾
4+ lanes with raised median (2 or more lanes in each direction)	❶ ❸ 5 7 8 9	❶ ❸ 5 7 8 9	① ❸ 5 8 ❾	① ❸ 5 7 8 9	① ❸ 5 ❼ 8 ❾	① ❸ 5 8 ❾	① ❸ 5 ❼ 8 ❾	① ❸ 5 8 ❾	① ❸ 5 8 ❾
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Given the set of conditions in a cell,

- # Signifies that the countermeasure is a candidate treatment at a marked uncontrolled crossing location.
- ● Signifies that the countermeasure should always be considered, but not mandated or required, based upon engineering judgment at a marked uncontrolled crossing location.
- ○ Signifies that crosswalk visibility enhancements should always occur in conjunction with other identified countermeasures.*

The absence of a number signifies that the countermeasure is generally not an appropriate treatment, but exceptions may be considered following engineering judgment.

1. High-visibility crosswalk markings, parking restrictions on crosswalk approach, adequate nighttime lighting levels, and crossing warning signs
2. Raised crosswalk
3. Advance Yield Here To (Stop Here For) Pedestrians sign and yield (stop) line
4. In-Street Pedestrian Crossing sign
5. Curb extension
6. Pedestrian refuge island
7. Rectangular Rapid-Flashing Beacon (RRFB)**
8. Road Diet
9. Pedestrian Hybrid Beacon (PHB)**

*Refer to Chapter 4, 'Using Table 1 and Table 2 to Select Countermeasures,' for more information about using multiple countermeasures.

**It should be noted that the PHB and RRFB are not both installed at the same crossing location.

This table was developed using information from: Zegeer, C.V., J.R. Stewart, H.H. Huang, P.A. Lagerwey, J. Feaganes, and B.J. Campbell. (2005). Safety effects of marked versus unmarked crosswalks at uncontrolled locations: Final report and recommended guidelines. FHWA, No. FHWA-HRT-04-100, Washington, D.C.; FHWA. Manual on Uniform Traffic Control Devices, 2009 Edition. (revised 2012). Chapter 4F, Pedestrian Hybrid Beacons. FHWA, Washington, D.C.; FHWA. Crash Modification Factors (CMF) Clearinghouse. http://www.cmfclearinghouse.org/; FHWA. Pedestrian Safety Guide and Countermeasure Selection System (PEDSAFE). http://www.pedbikesafe.org/PEDSAFE/; Zegeer, C., R. Srinivasan, B. Lan, D. Carter, S. Smith, C. Sundstrom, N.J. Thirsk, J. Zegeer, C. Lyon, E. Ferguson, and R. Van Houten. (2017). NCHRP Report 841: Development of Crash Modification Factors for Uncontrolled Pedestrian Crossing Treatments. Transportation Research Board, Washington, D.C.; Thomas, Thirsk, and Zegeer. (2016). NCHRP Synthesis 498: Application of Pedestrian Crossing Treatments for Streets and Highways. Transportation Research Board, Washington, D.C.; and personal interviews with selected pedestrian safety practitioners.

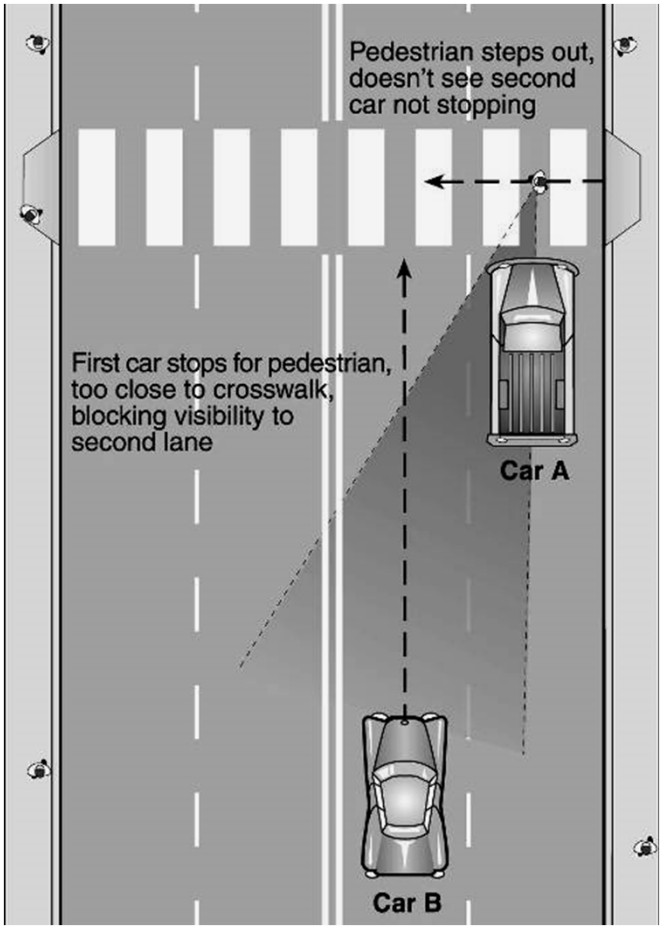
Selecting Design Treatments

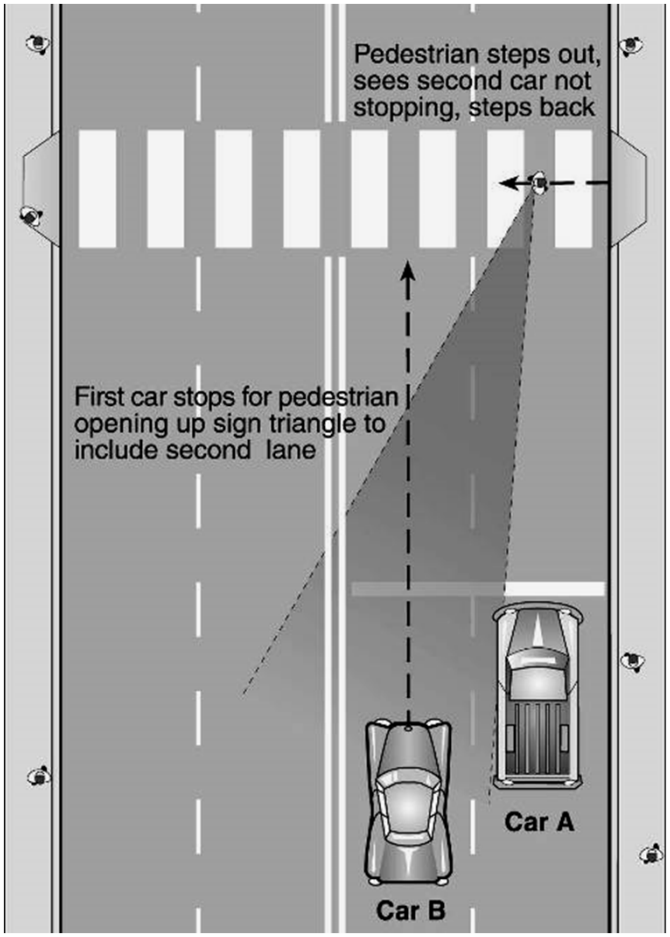
Table 2. Safety issues addressed per countermeasure.

Pedestrian Crash Countermeasure for Uncontrolled Crossings	Safety Issue Addressed				
	Conflicts at crossing locations	Excessive vehicle speed	Inadequate conspicuity/ visibility	Drivers not yielding to pedestrians in crosswalks	Insufficient separation from traffic
Crosswalk visibility enhancement	✓	✓	✓	✓	✓
High-visibility crosswalk markings*	✓		✓	✓	
Parking restriction on crosswalk approach*	✓		✓	✓	
Improved nighttime lighting*	✓		✓		
Advance Yield Here To (Stop Here For) Pedestrians sign and yield (stop) line*	✓		✓	✓	✓
In-Street Pedestrian Crossing sign*	✓	✓	✓	✓	
Curb extension*	✓	✓	✓		✓
Raised crosswalk	✓	✓	✓	✓	
Pedestrian refuge island	✓	✓	✓		✓
Pedestrian Hybrid Beacon	✓	✓	✓	✓	
Road Diet	✓	✓	✓		✓
Rectangular Rapid-Flashing Beacon	✓		✓	✓	✓

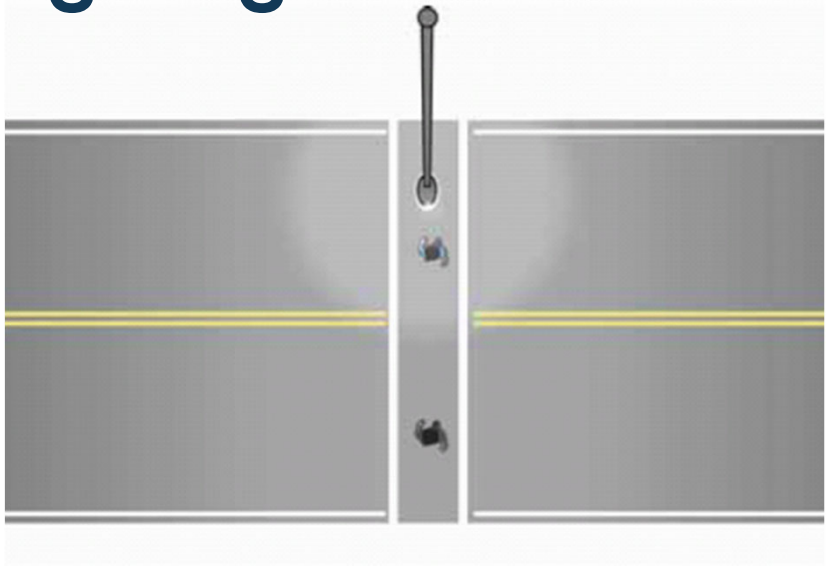
*These countermeasures make up the STEP countermeasure "crosswalk visibility enhancements." Multiple countermeasures may be implemented at a location as part of crosswalk visibility enhancements.

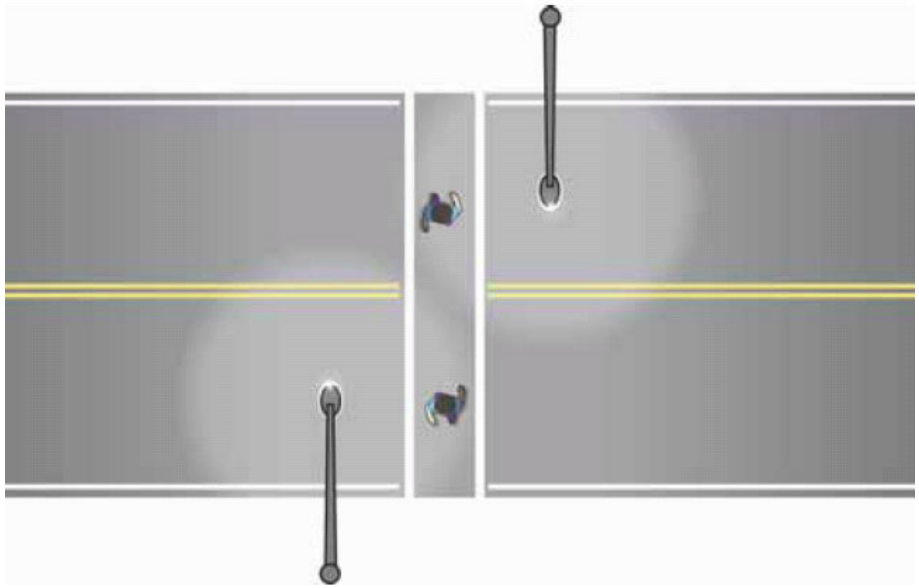
Advance Stop/Yield





Lighting Crosswalks





Lighting Crosswalks

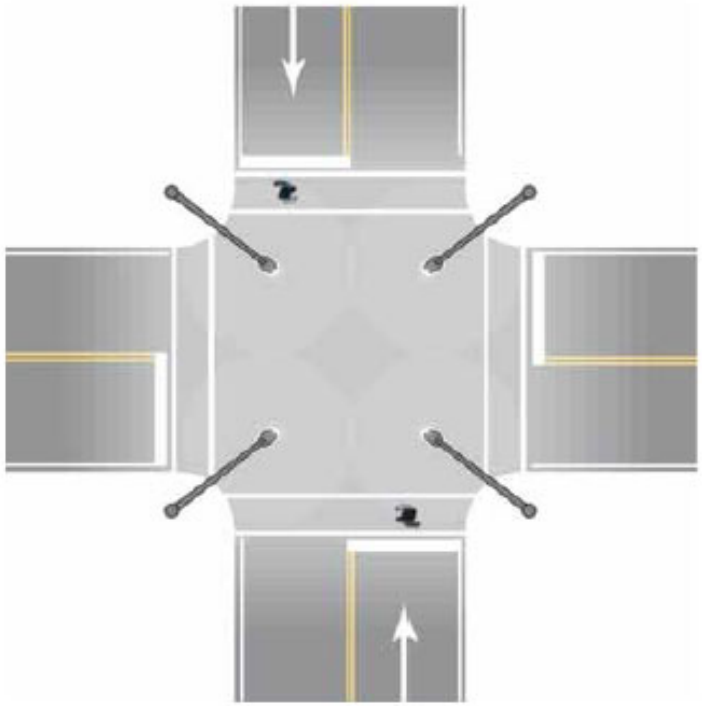


Figure 13. Drawing. Traditional intersection lighting layout.

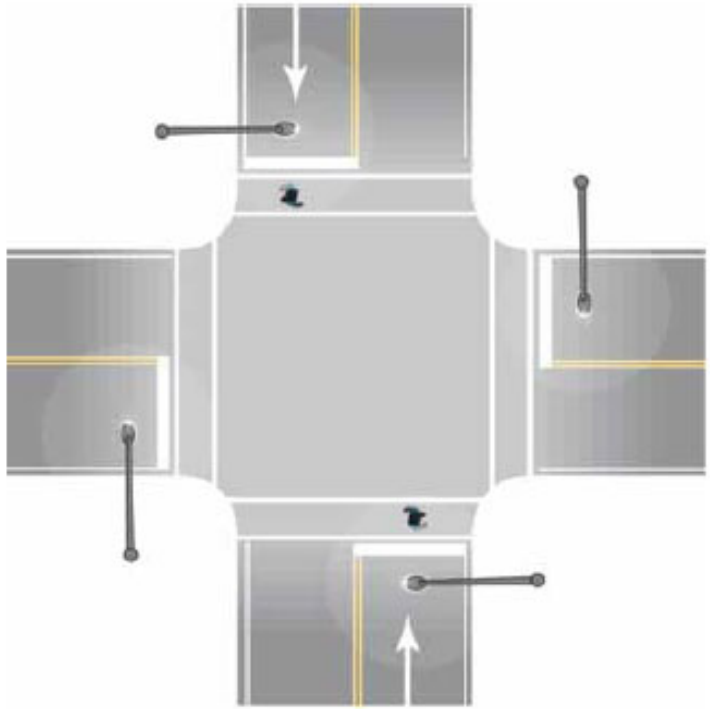


Figure 14. Drawing. New design for intersection lighting layout for crosswalks.

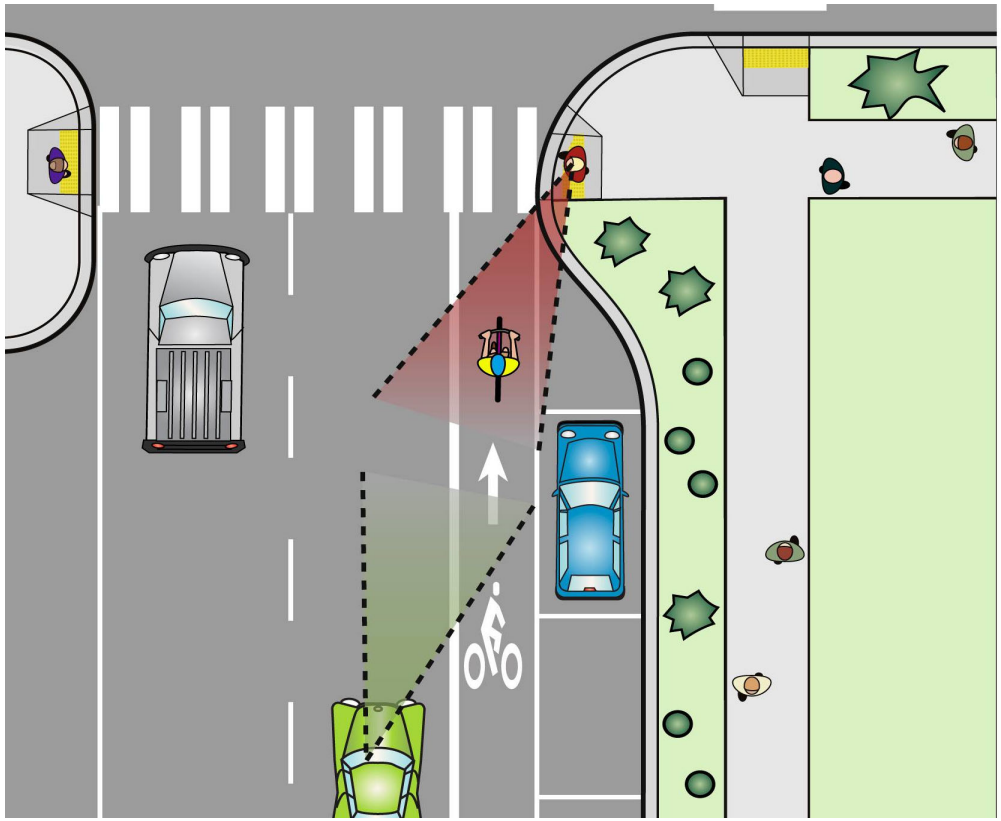
Intersection Geometry

- Small, tight intersections are best for pedestrians
  - Simple
  - Fewer conflicts
  - Slower speeds

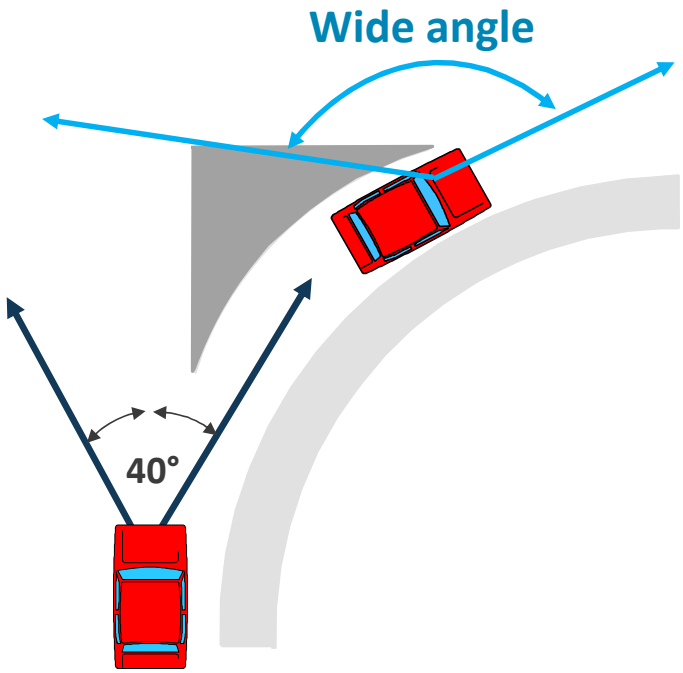
Mitigation for Large Intersections

Curb Extensions

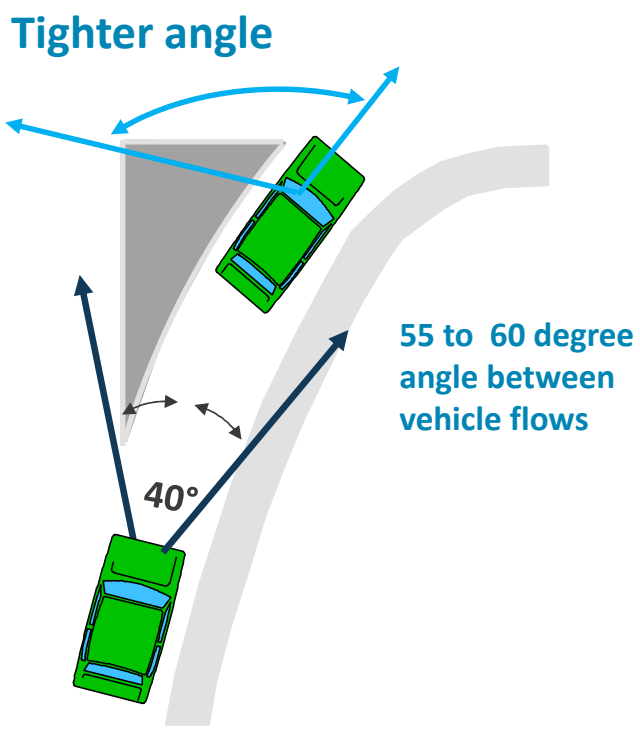
- Improve sight distance
  - Pedestrians and motorists
  - Motorists and signs
- Curb ramps
- Slow-speed turns
- Pedestrian storage



Channelizing & Crossing Islands



High speed, head turner =
low visibility of pedestrians



Slow speed, good angle =
good visibility of pedestrians

Transforming an Intersection (Makati, The Philippines)

Image source: Arvin Estrada, PGAA Creative Design
https://m.facebook.com/story.php?story_fbid=10161162517024488&id=772454487

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Complete Streets for Bicyclists

U.S. Department of Transportation
Federal Highway Administration

Key Factors for Bicyclist Safety

- Speed
- Number of lanes
- Traffic volume & composition
- Conflict points
- Visibility/Conspicuity
- Proximity
- Bike control
- Connectivity

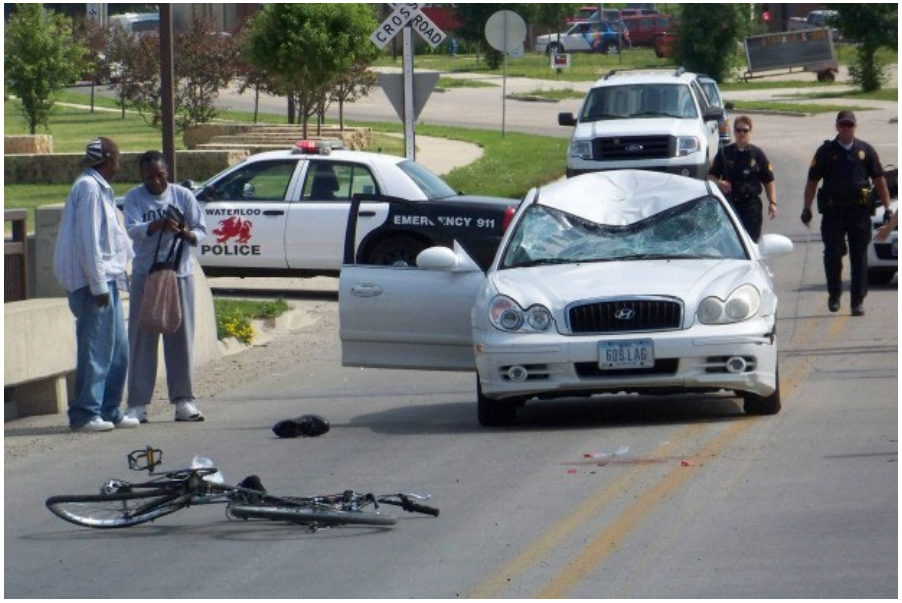
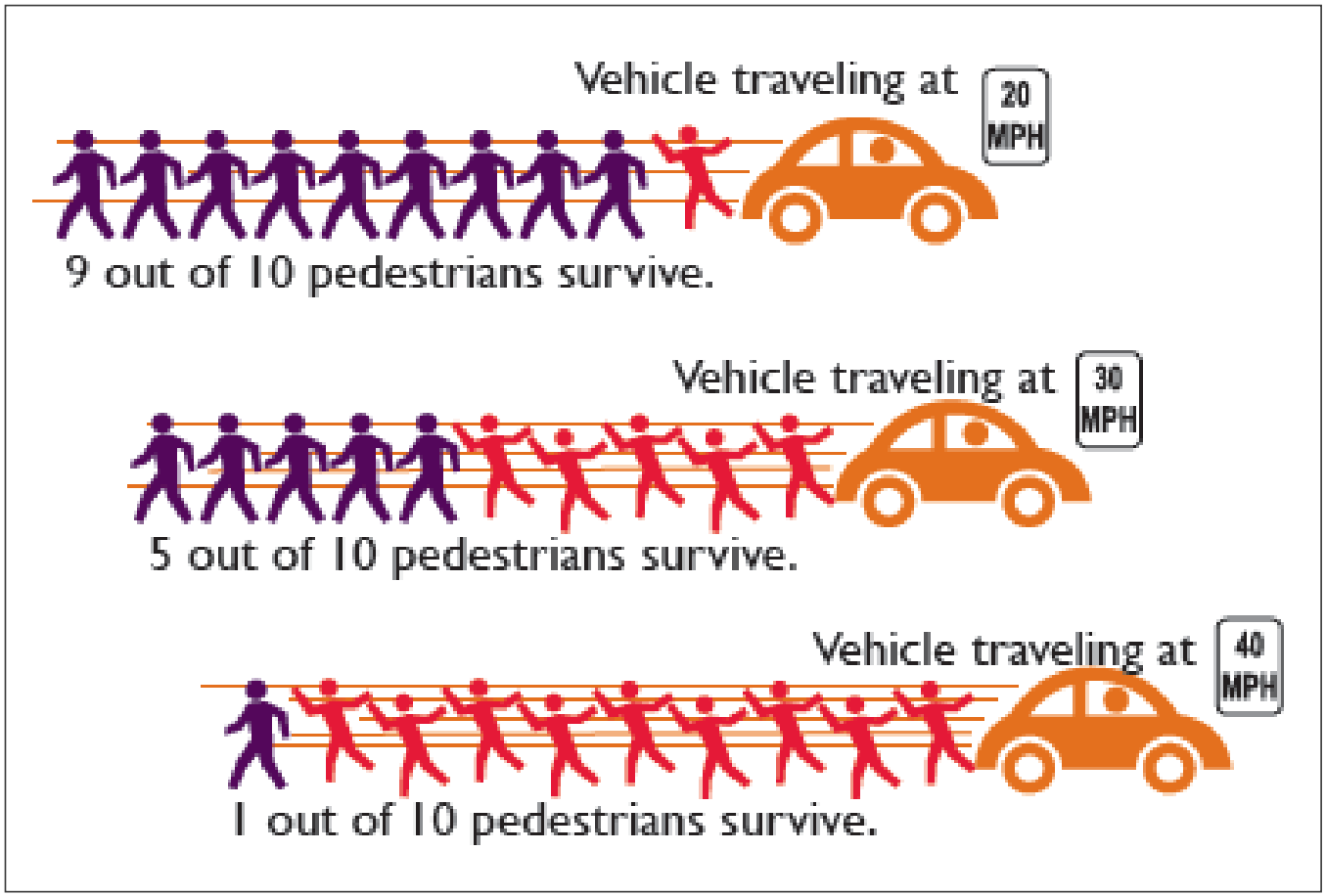


Image source: https://wcfcourier.com/news/local/update-car-driver-charged-in-bike-car-crash/article_b6d55ec4-af22-11e1-9e2c-0019bb2963f4.html

Speed


Vehicle traveling at
20 MPH
9 out of 10 pedestrians survive.
Vehicle traveling at
30 MPH
5 out of 10 pedestrians survive.
Vehicle traveling at
40 MPH
1 out of 10 pedestrians survive.

Number of Lanes

Traffic Volume & Composition

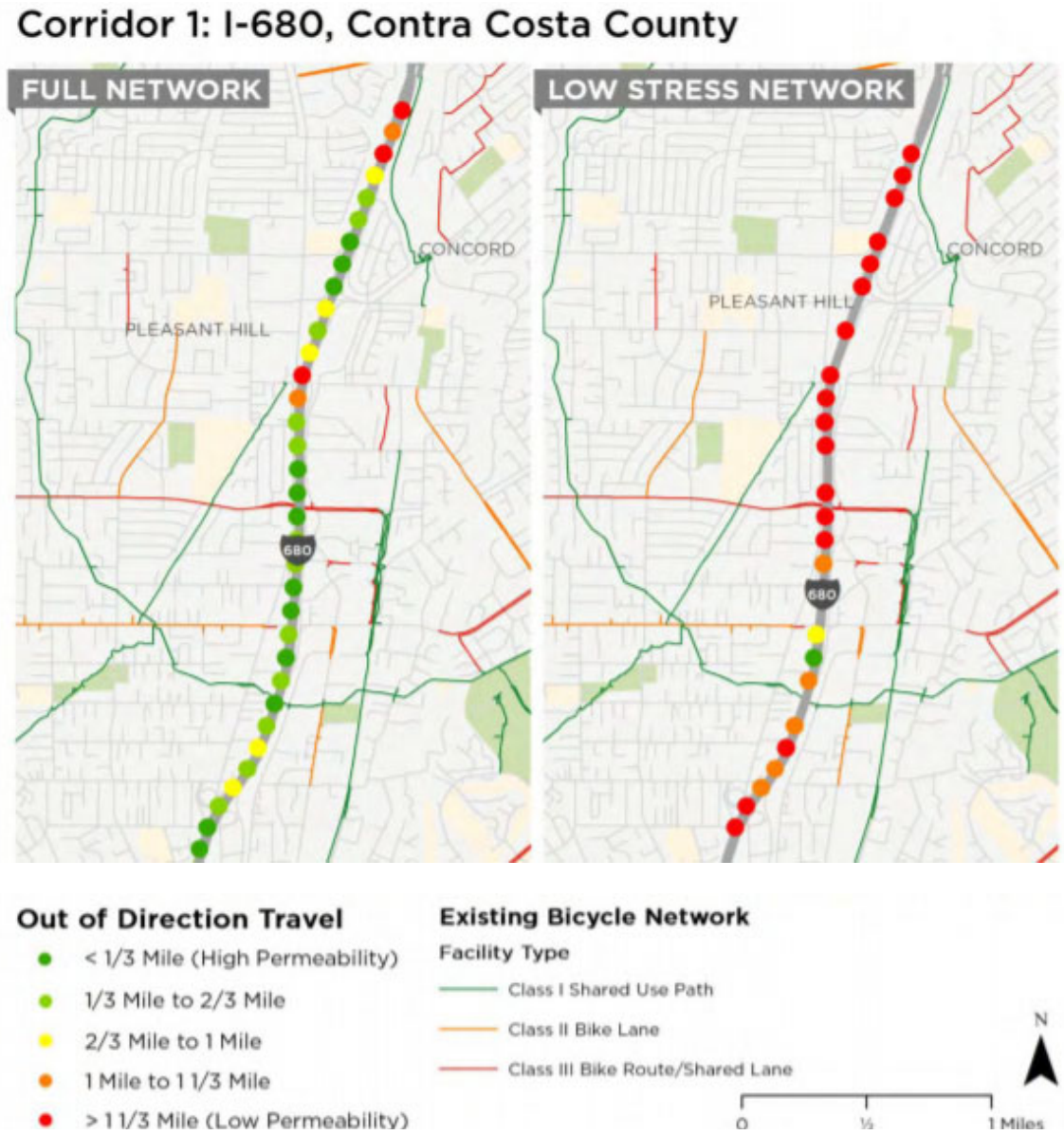
Conflict Points

Visibility and Conspicuity

Proximity

Bike Control

Connectivity



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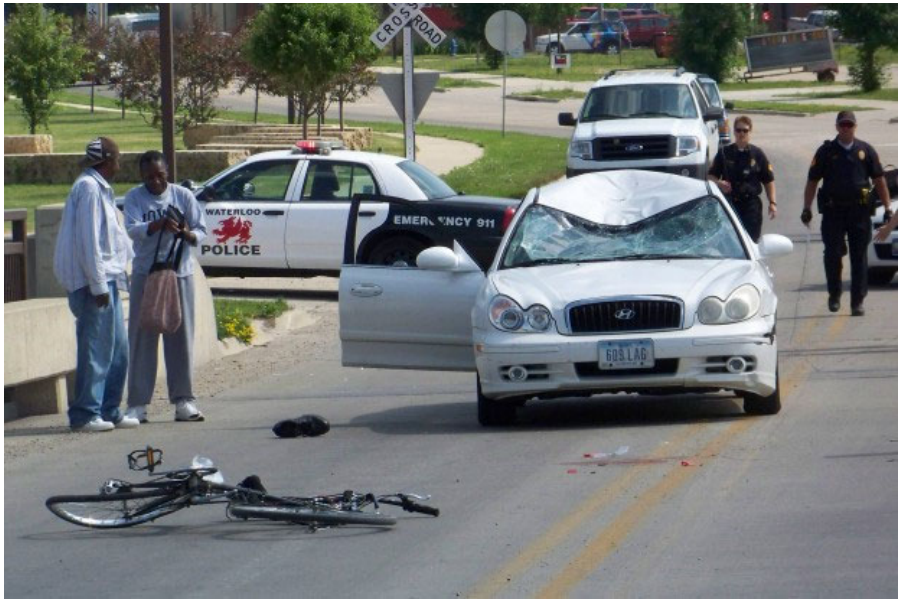

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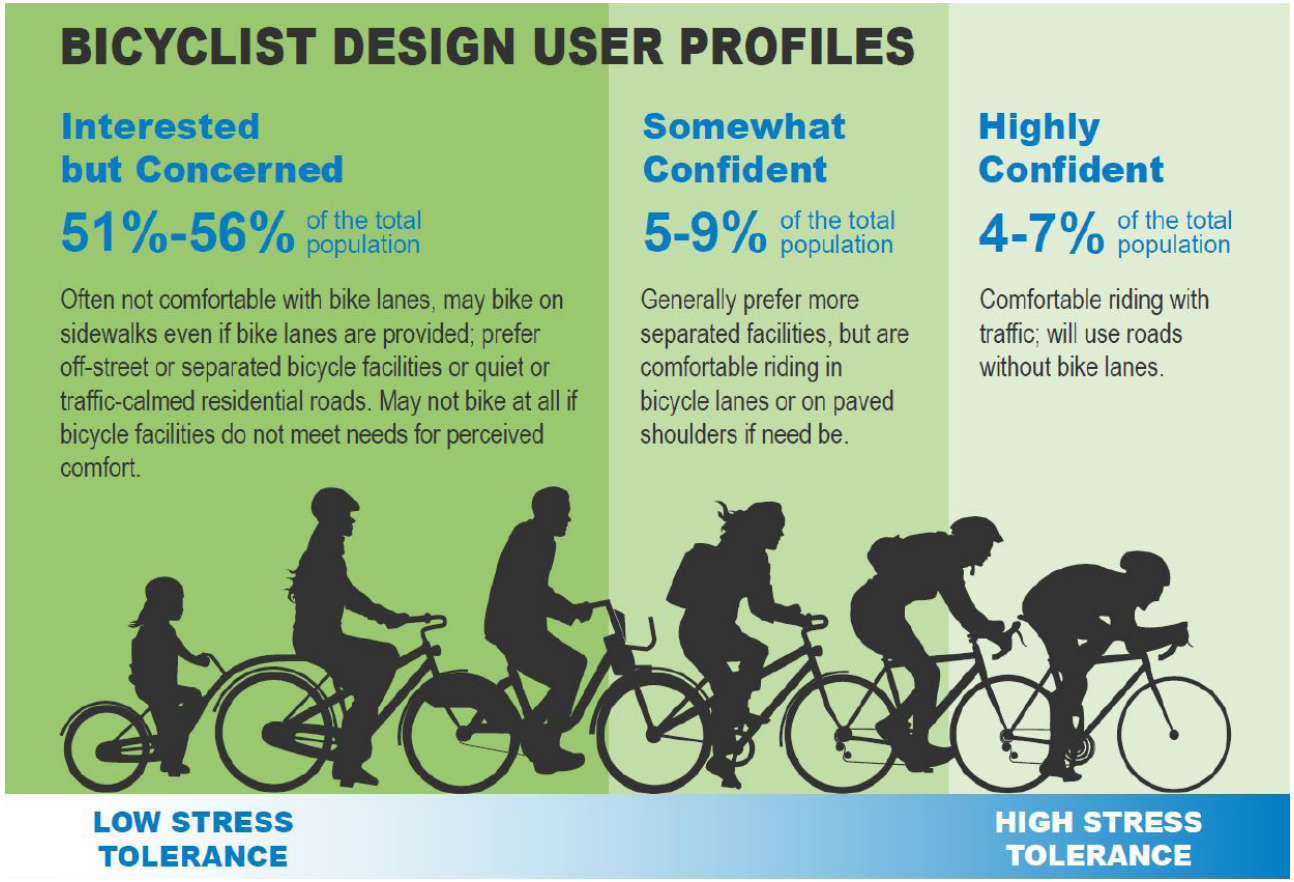
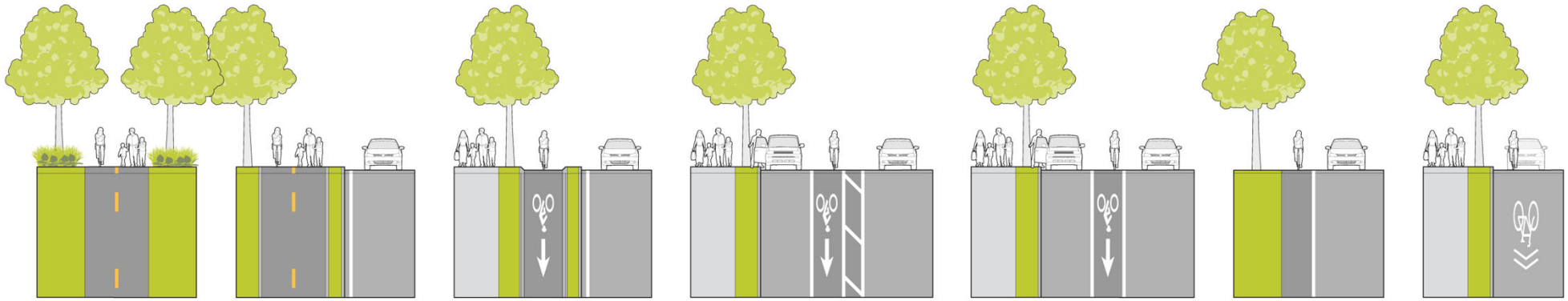
Bicyclist Design User Profiles



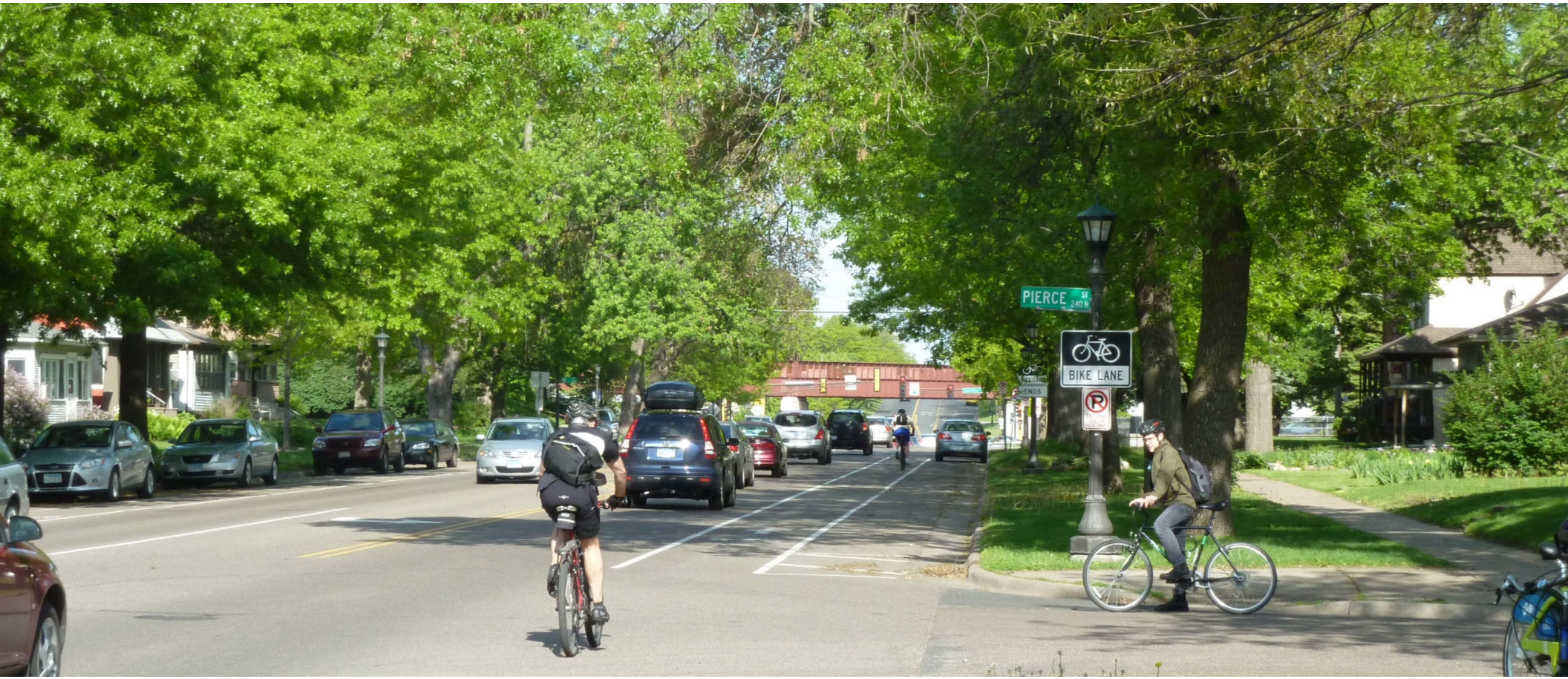
Resources:
Bikeway Selection Guide
https://safety.fhwa.dot.gov/ped_bike/tools_solve/



Shared-Use Path | Side Path | Separated Bike Lane | Buffered Bike Lane | Bike Lane | Shoulder | Shared Lane

+ SEPARATION FROM TRAFFIC −

Conventional Bike Lanes (High Speed and Volume Environments)



Conventional Bike Lanes (Low Speed Environments)

Buffered Bike Lanes (High Speed and Volume Environments)

Separated Bike Lane - Retrofit

Separated Bike Lane - Reconstruction

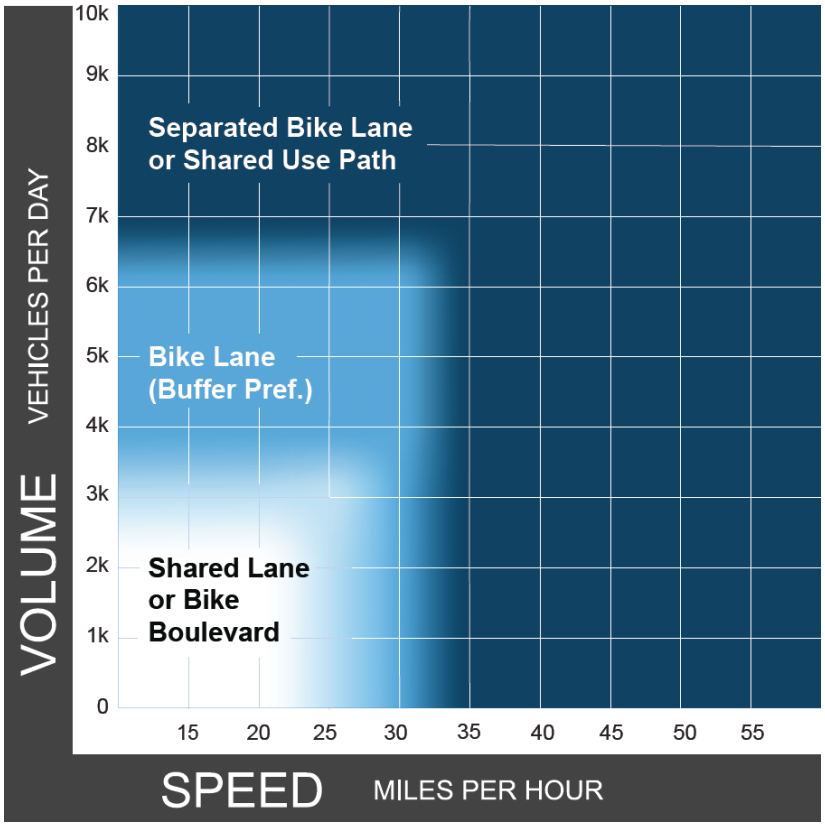
Shared Use Paths

Neighborhood Greenways (aka Bike Boulevards)

Low-stress Bicycle Network

- Separated bike lanes and shared use paths
- Low-speed and low-volume streets with characteristics of bicycle boulevards
- By serving a broad audience, maximize system use
- Bicycling rates of 5 to 15% in the United States.

Bikeway Selection
City, Small Town, and Suburban Roadways



Identifies the **preferred** bikeway type.

Design User Assumption:
Interested but concerned cyclist

Analysis:
Bicycle Level of Traffic Stress

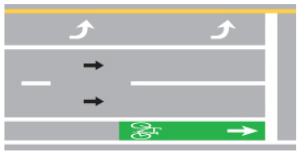
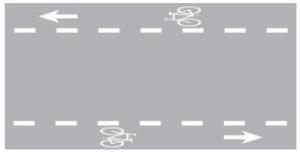
Bikeway Traffic Control Devices

Bicycle Facilities and the Manual on Uniform Traffic Control Devices

Background

The Federal Highway Administration receives occasional inquiries about what bicycle facilities, signals, and markings are permitted in the Manual on Uniform Traffic Control Devices (MUTCD). The table below lists various bicycle-related signs, markings, signals, and other treatments and identifies their status (e.g., can be implemented, currently experimental) in the 2009 version of the MUTCD.

If you have MUTCD related questions, please contact: David Kirschner, MUTCD Team.

Subject to Experimentation	Available through Interim Approval	Interpretations
 Two-Stage Turn Box	 Green-Colored Pavement	 Use of R4-11 Sign on Roads with Speed Limits Above 35mph
 Dashed Bicycle Lanes	 Alternate Design for the U.S. Bicycle Route (M1-9) Sign	 Modified Bicycle Destination Sign
		

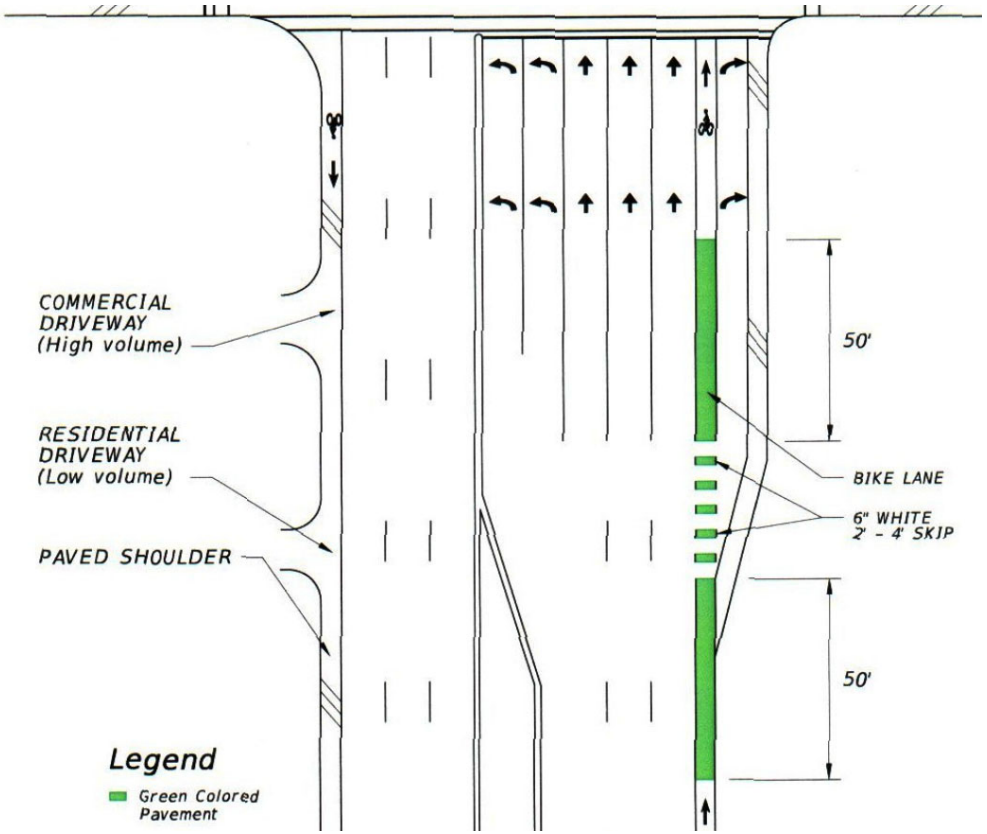
Resources:
Bicycle Facilities and the Manual on Uniform Traffic Control Devices
https://www.fhwa.dot.gov/environment/bicycle_pedestrian/guidance/mutcd/

Bike Lane Extension Lines

7th Ave, Seattle, WA

14th Ave, Denver, CO

Bike Lane Extension Lines



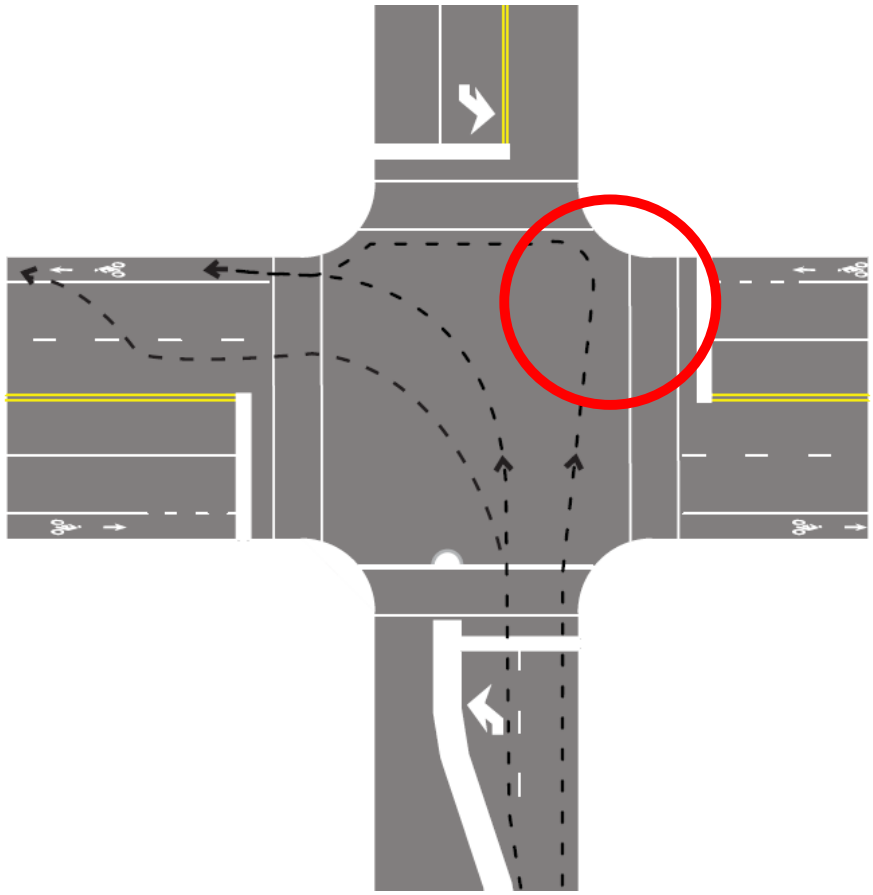
Bike Box

- Reduced conflicts between bicyclists and turning vehicles
- Reduced avoidance maneuvers
- Reduced encroachment into crosswalks
- Use clearly understood by motorists and bicyclists

Two-stage Turn Boxes

Typical left turn movements by cyclists through an intersection

2- Stage Turn Box formalizes left turn movement currently allowed by traffic laws

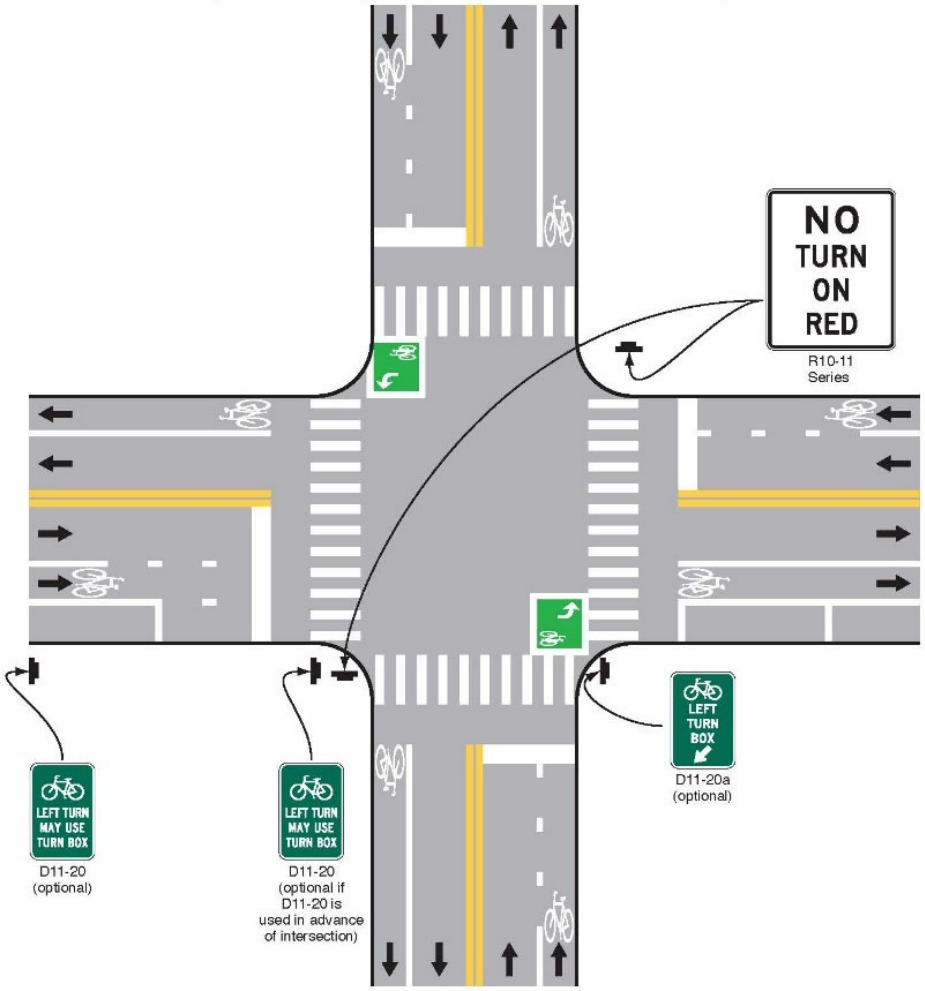


Two-stage Turn Boxes

D11-20L

LEFT (RIGHT) TURN MAY USE TURN BOX

Attachment IA-20-1
Example of Two-Stage Bicycle Turn Box when Use is Optional



Transforming an Intersection (Scheveningen, The Netherlands)

Image source: Dutch Cycling Embassy https://www.
https://www.facebook.com/dutchcyclingembassy/posts/4490328967725464

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Complete Streets for Transit

U.S. Department of Transportation
Federal Highway Administration

Goal of Transit

- Carry passengers between residences, employment, and other destinations in a safe, efficient, and reliable manner
- Physical safety of ALL passengers is vital to the success of any transit system- not only to retain riders, but to encourage new riders

Agency Considerations

- Focus Resources on Needs
  - High usage
    - Busy corridors
    - Stops for key generators and transfers
  - Infrastructure gaps
    - Sidewalks
    - Crossings
    - ADA
  - Safety
    - High crash or high risk

Passenger Demand

Key Generators

- Understand activities and locations that generate demand
- Understand pedestrian paths

Catchment Area

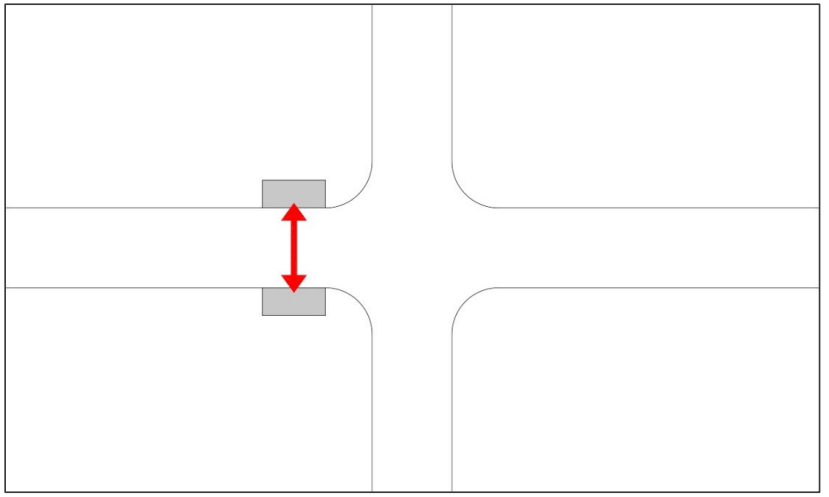
★ - Bus Stop

- Bus Stop Catchment Area

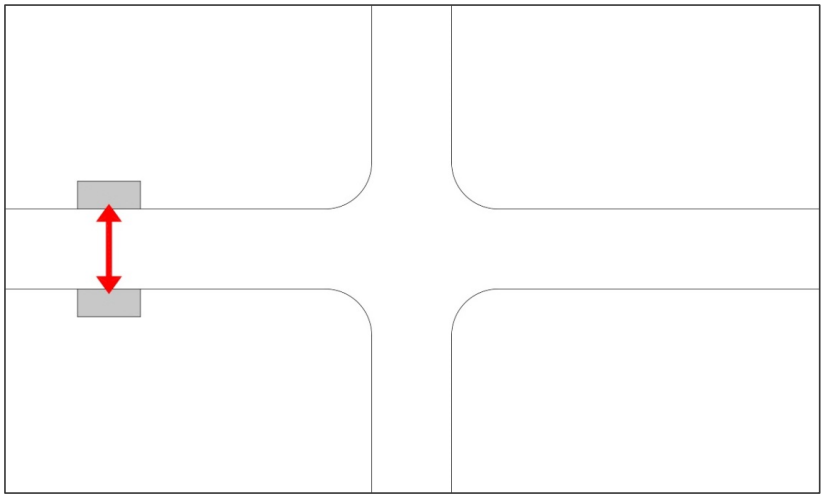
- Corridor Catchment Area

Bus Stop Locations

- Bus stops near intersections encourage crossings at the intersection

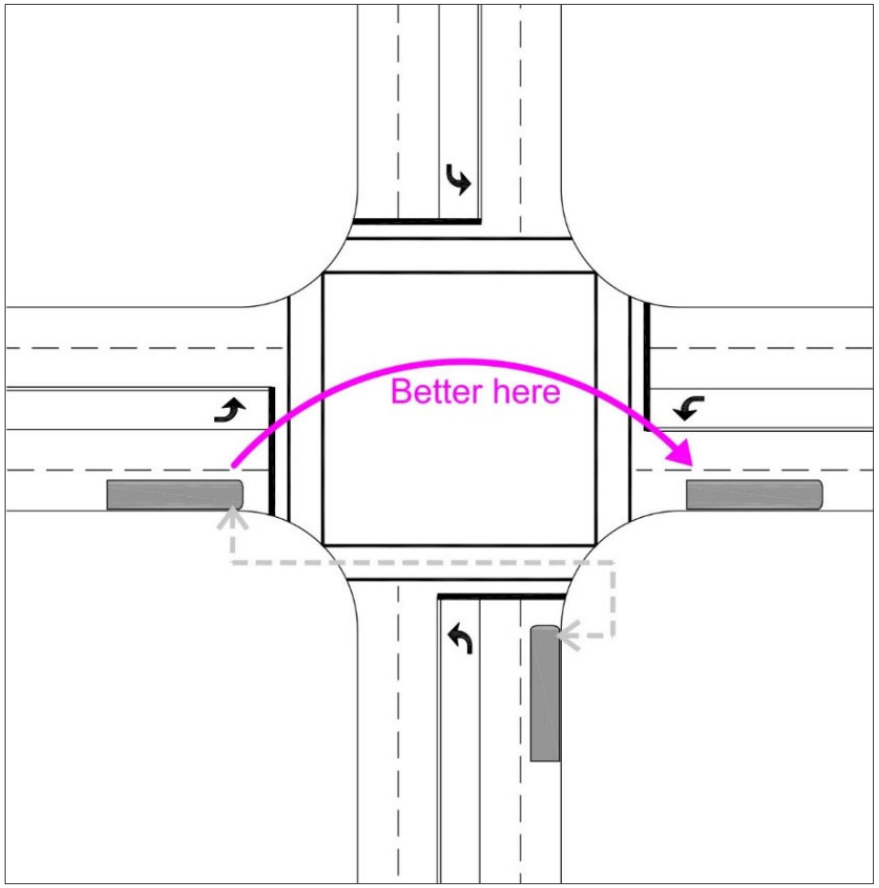


- Mid-block bus stops create demand for mid-block crossings



Bus Stop Locations

Bus stops at transfer locations—avoid street crossings

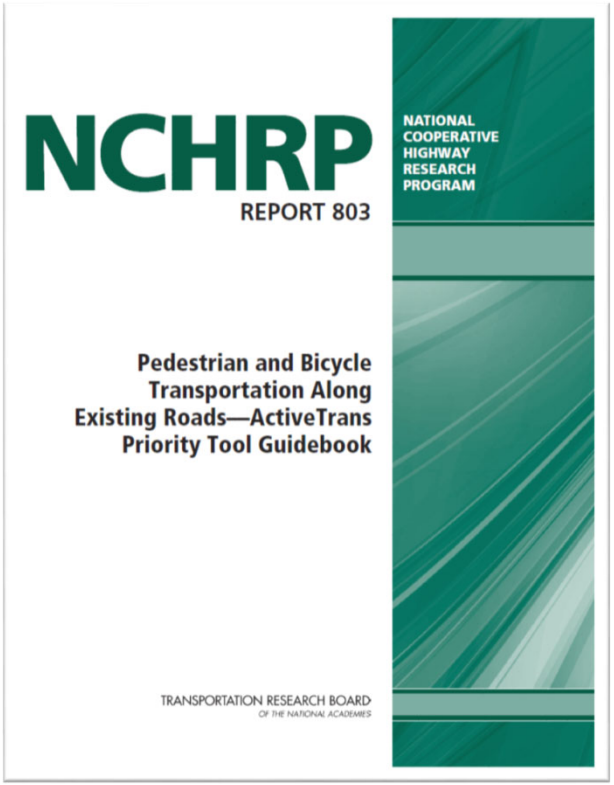


Putting it all together with Implementation Strategies

Implementation – from policy to practice

Prioritization

- Complete Streets projects should receive higher scores



Poll Question

Do you have an implementation plan?

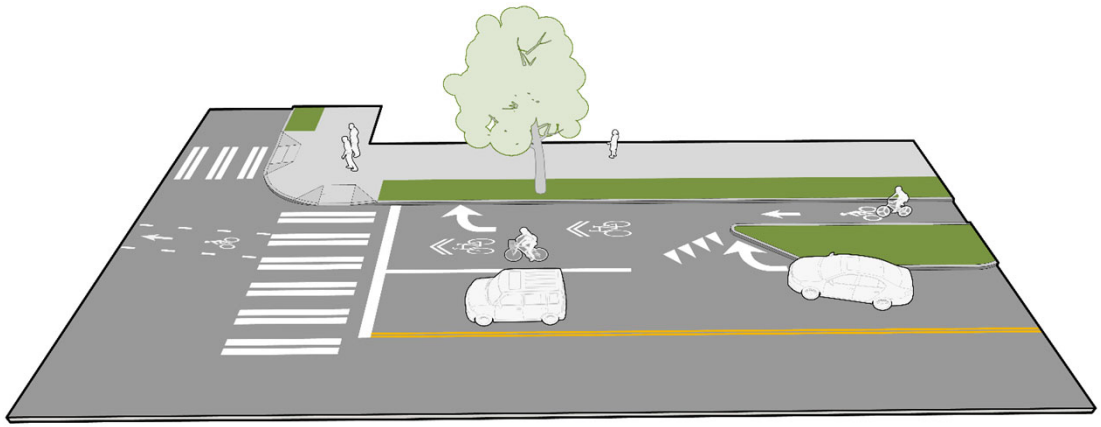
- Yes
- No
- Under development
- I don’t know

In the chat: what kind of implementation plan do you have?

Implementation – From Policy to Practice

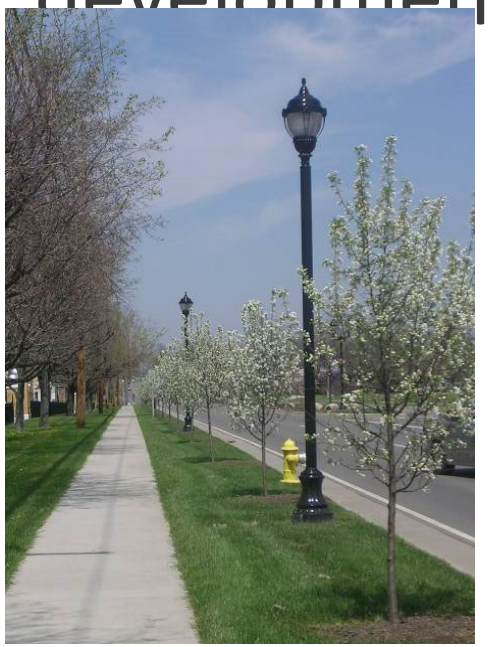
Design standard updates

- Optimum for all modes
- Considerations



Implementation – From Policy to Practice

Checklist for project development

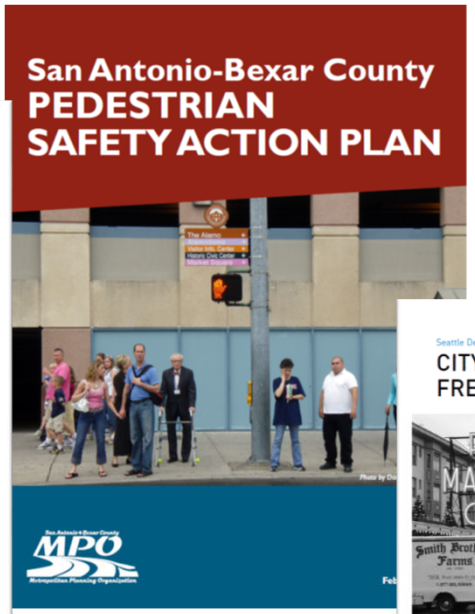


- Modal Plans
- Historic Zone
- Urban Tree Plan
- Lighting Requirements
- Utility Plans
- Overlay Zones
- Greenway & Open Space Plans

Implementation – from policy to practice

Modal Plans

- Transit Plan
- Freight Plan
- Bike Plan
- Pedestrian Plan



Implementation – from policy to practice

New performance measures

Example:

Measure the success of this complete streets policy using the following performance measures:

a. Total miles of on-street bicycle routes defined by streets with clearly marked or signed bicycle accommodation
b. Linear feet of new pedestrian accommodation
c. Number of new curb ramps installed along city streets
d. Number of new street trees planted along city streets

Considerations for Successful Implementation

- Cross-jurisdictional and regional coordination
- Internal project development processes and protocols
- External partners including utility companies, private developers, emergency services, transit providers, etc.
- Dedicated staff and funding sources
- Street typology vs. functional classification
- Synergy with Vision Zero, SRTS, etc.
- Quick-build and pilot projects

Implementation – from policy to practice

Consultants

- Ensure that RFPs require expertise in planning and designing for all modes

Implementation – From Policy to Practice

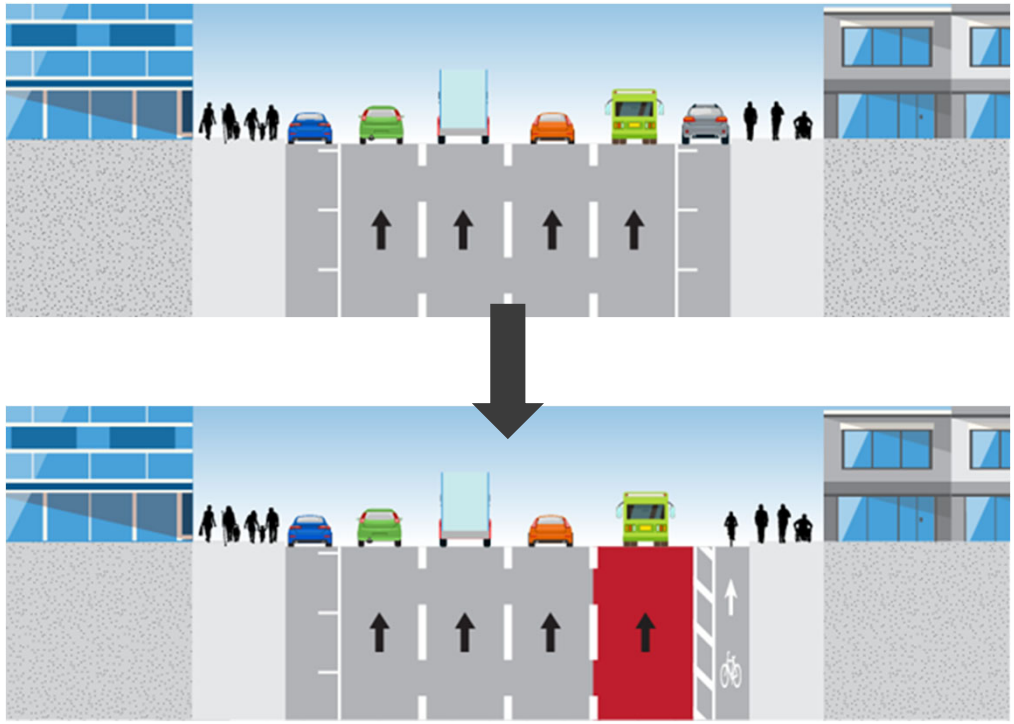
Training for Planners,
Designers and Engineers

Coming Soon

- **Complete Streets Web portal** under development for
  - New CS introductory products
  - Links to existing resources

Coming Soon

- CS Transformations fact sheet with simple arterial conversion scenarios
- Complete Streets At-A-Glance for planners
- Resources on performance measures, operational considerations, and more



Poll Question

In the chat:
What can FHWA do to support you in your efforts to implement complete streets?