

2024 AASHTO Bike Guide 5th Edition



AASHTO Guide for the Development of **BICYCLE FACILITIES** Fifth Edition

AASHTO

American Association of State Highway and Transportation Officials

2024



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2024–2025

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Active NCHRP Panels

- 07-31 State DOT & Tribal Use of Active Transportation Data: Practices, Sources, Needs and Gaps
- 17-112 Enhance Highway Safety Manual on Pedestrian & Bicyclist Safety Countermeasures
- 20-44(52) Implement a Guide on Urban and Suburban Roadway Cross Section Reallocation
- 20-123(22) Update the Council on Active Transportation's Research Roadmap, Chair
- 07-37 Update the AASHTO Pedestrian Guide

Who should the default design user be?



Experienced & Confident Cyclist
AASHTO 1981 - 2012



Interested but Concerned Cyclist
AASHTO 2024

AASHTO 2024 Chapter Outline

- 
1. Introduction
 2. Bicyclist Operation & Safety
 3. Bicycle Planning
 - 4. Guidance for Choosing a Bikeway Type**
 - 5. Elements of Design**
 6. Design of Shared Use Paths
 - 7. Design of Separated Bike Lanes and Side Paths**
 - 8. Bicycle Boulevard Planning and Design**
 9. Design of Shared Lanes & Bicycle Lanes
 - 10. Traffic Signals and Active Warning Devices**
 - 11. Bicycle Facility Design at Interchanges, Alternative Intersections, and Roundabouts**
 - 14. Rural Area Bikeways and Roadways**
 - 14. Structures**
 - 14. Wayfinding Systems for Bicyclists**
 15. Maintenance & Operations
 16. Bicycle Parking, Bike Share Siting, and End of Trip Facilities

2014 Guide compared to 2024 Guide



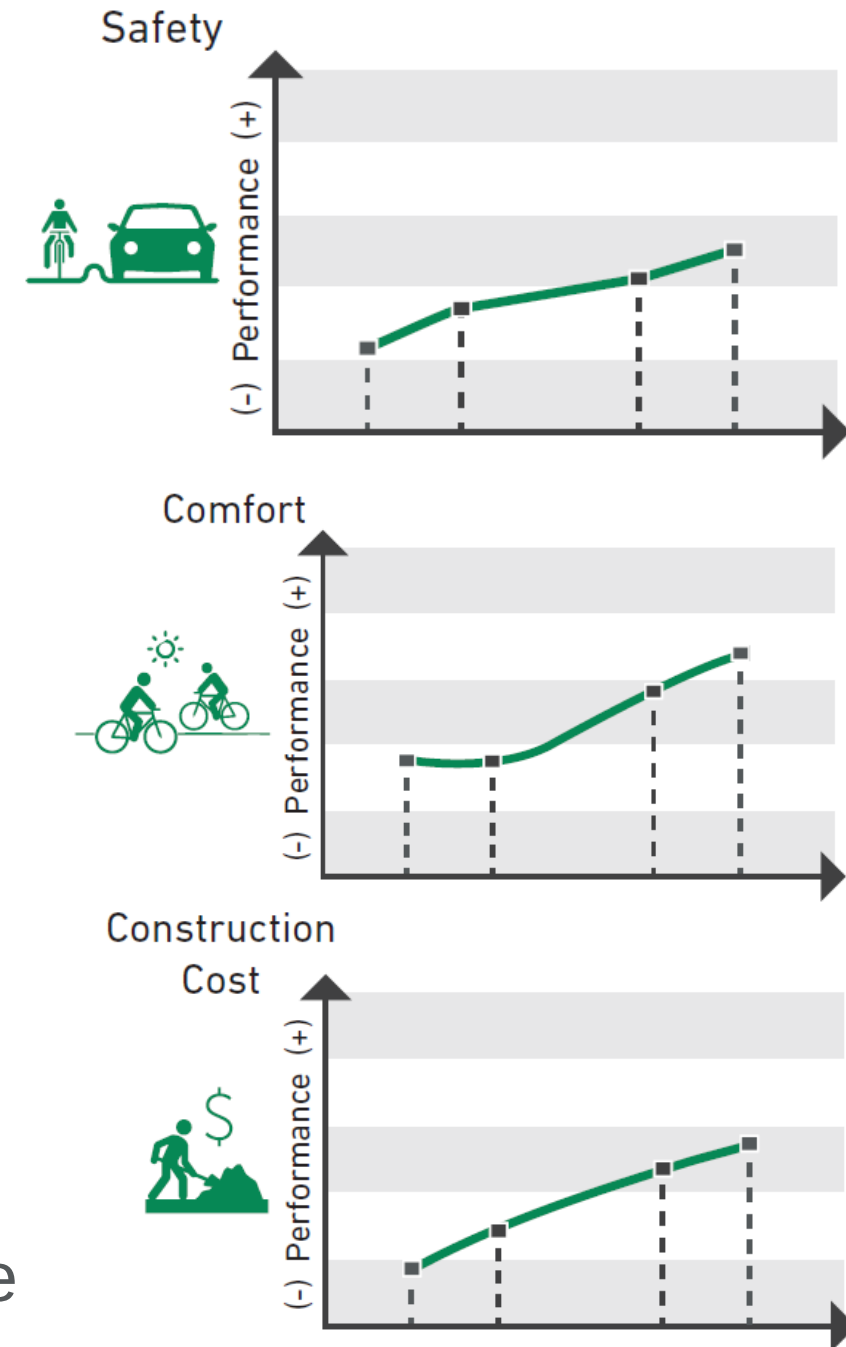
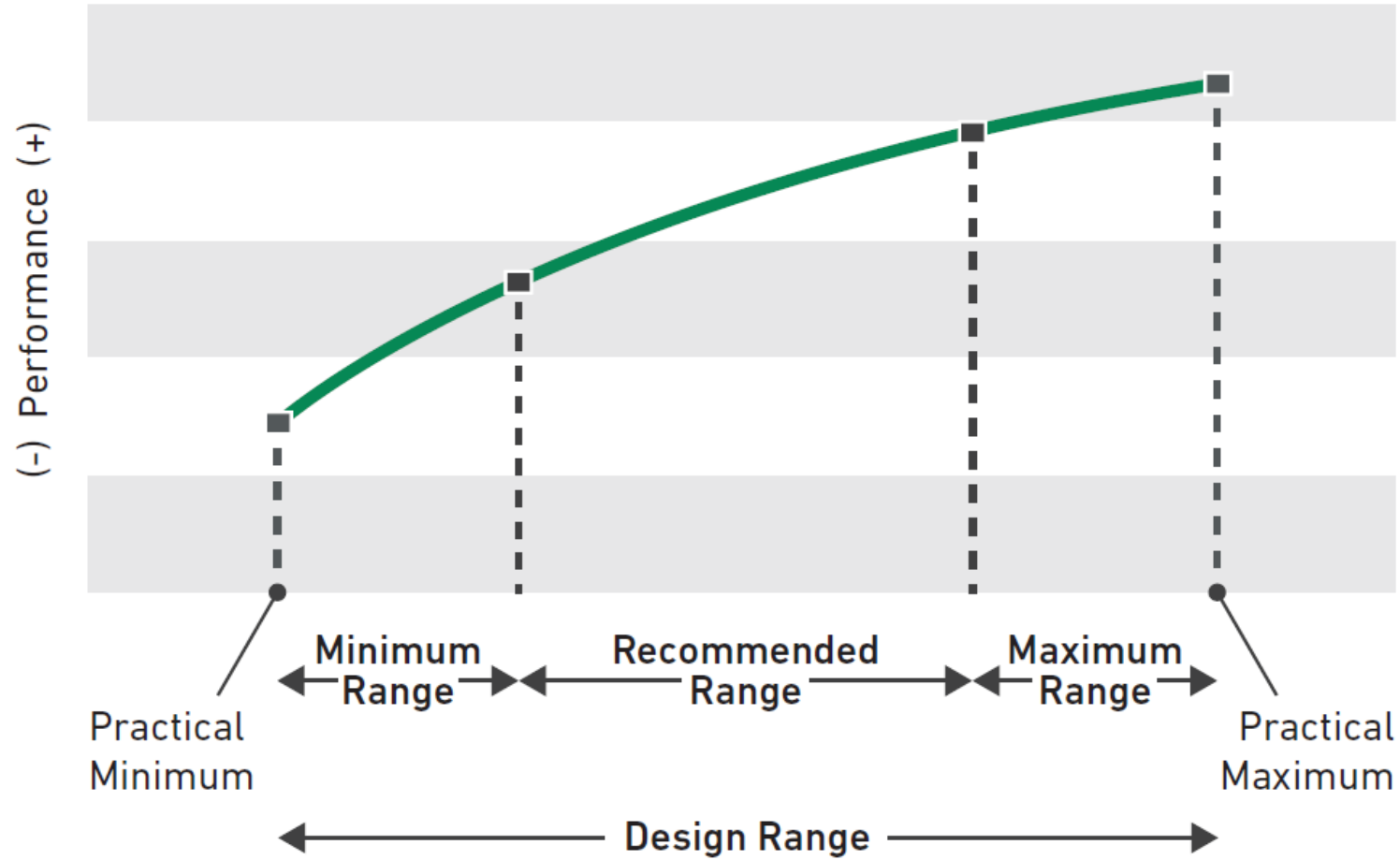
2012 Guide	2024 Guide	Notable Changes of 2024 compared to 2012
Chapter 1 - Introduction	1. Introduction	REWRITE with new discussion of design range concept
Chapter 3: Bicycle Operation and Safety	2. Bicycle Operation & Safety	REWRITE of former Chapter 3
Chapter 2 - Bicycle Planning	3. Bicycle Planning	REWRITE and NEW CONTENT added to former Chapter 2
Chapter 2 - Bicycle Planning	4. Facility Selection	NEW CHAPTER; new content with a few items carried from Chapter 2
	5. Elements of Design	NEW CHAPTER with new content; some content pulled from Chapters 4 and 5
Chapter 5: Design of Shared Use Paths	6. Shared Use Paths	REVISION of chapter 5
	7. Separated Bike Lanes	NEW CHAPTER with new content
	8. Bicycle Boulevards	NEW CHAPTER with new content
Chapter 4: Design of On-Road Facilities	9. Bike Lanes & Shared Lanes	REVISION of chapter 4
	10. Traffic Signals and Active Warning Devices	NEW CHAPTER with new content
	11. Roundabouts, Interchanges, and Other Intersections	NEW CHAPTER with new content
	12. Rural Area Bikeways	NEW CHAPTER with new content; some content pulled from Chapter 4
	13. Structures	NEW CHAPTER with new content; some content pulled from Chapter 5
	14. Wayfinding	NEW CHAPTER with new content; some content pulled from Chapter 4
Chapter 7: Maintenance and Operations	15. Maintenance & Operations	REVISION of chapter 7
Chapter 6: Bicycle Parking Facilities	16. Parking & End of Trip Facilities	REVISION of chapter 6

Guide Facts: 2012 Guide vs 2024 Guide



	2012 Guide	2024 Guide
chapters	7	16
pages	201	627
figures	75	256
tables	19	50
references	60	293

Figure 1-1: Design Range



Section 1.4 – Use of Values in the Guide

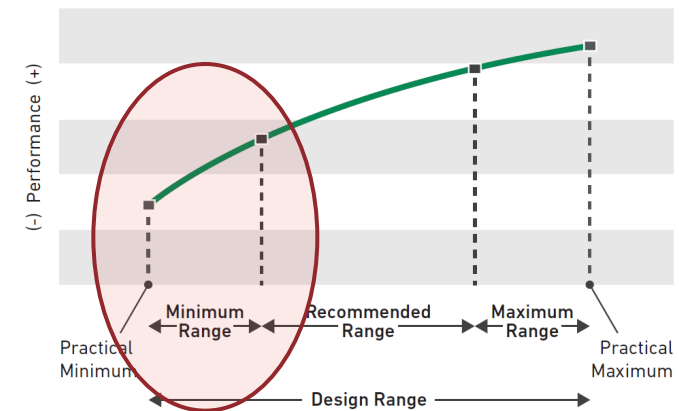
Section 1.4 – Use of Values in the Guide



1.4.1. Minimum Range

The use of **values within the minimum range should be minimized** because they are likely to diminish mobility, safety and comfort benefits for bicyclists as well as other users

Figure 1-1: Design Range



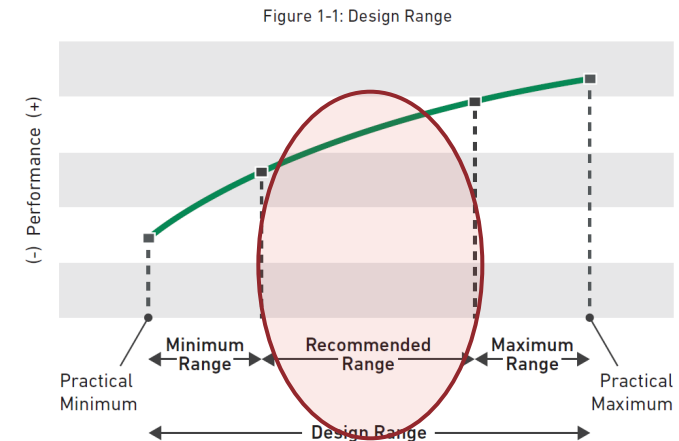
Section 1.4 – Use of Values in the Guide



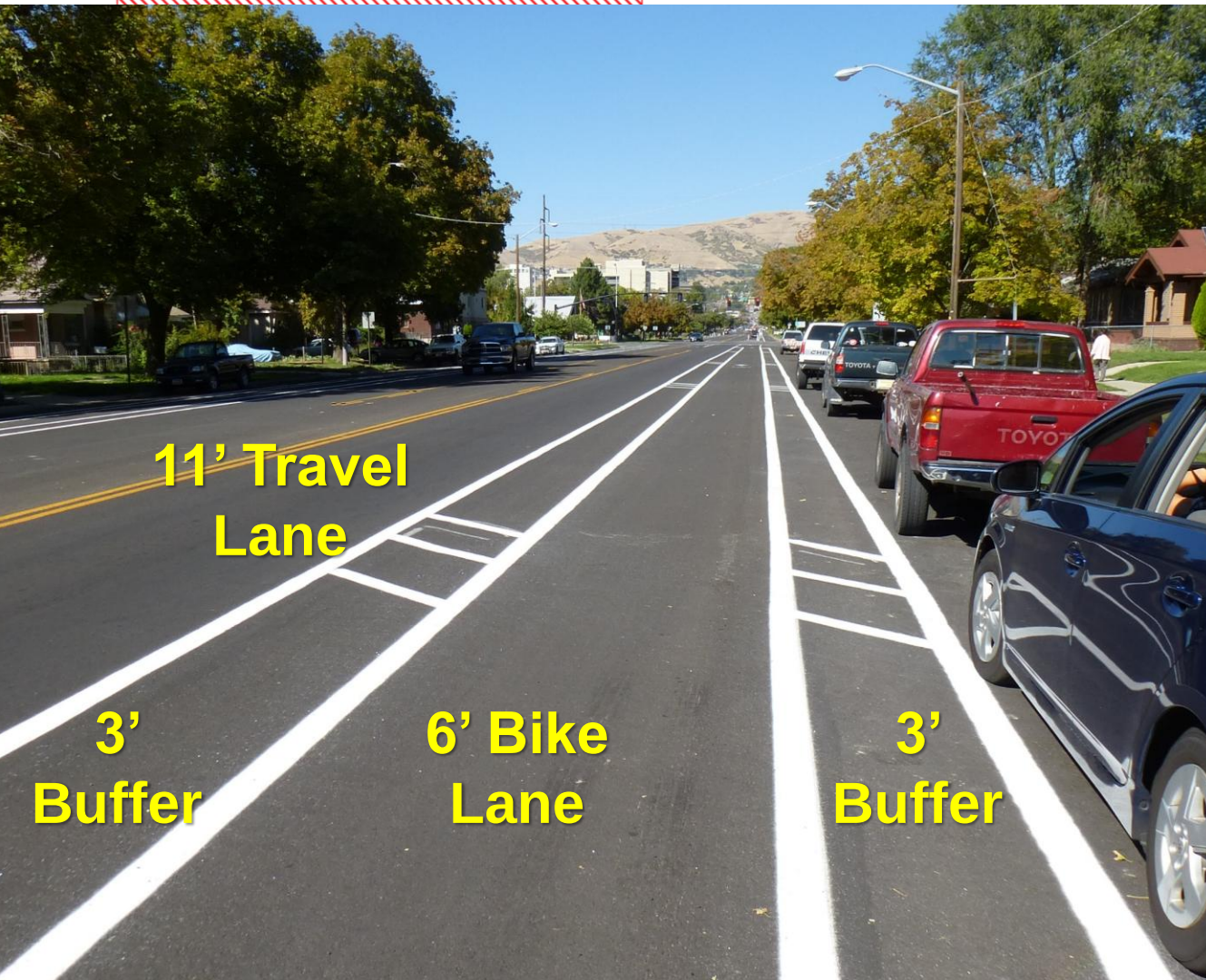
1.4.2. Recommended Values Range

The use of **values within the recommended range should be chosen** to maximize mobility, safety and comfort benefits for bicyclists as well as other users.

These values were determined by research or established best practice.



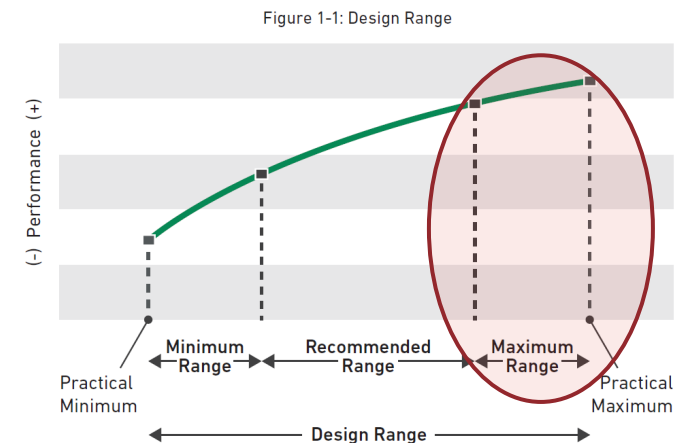
Section 1.4 – Use of Values in the Guide



1.4.3. Maximum Range

the **use of values within the practical maximum range** should only be considered when

- there are clear benefits to all users and
- bicyclist volumes are high.



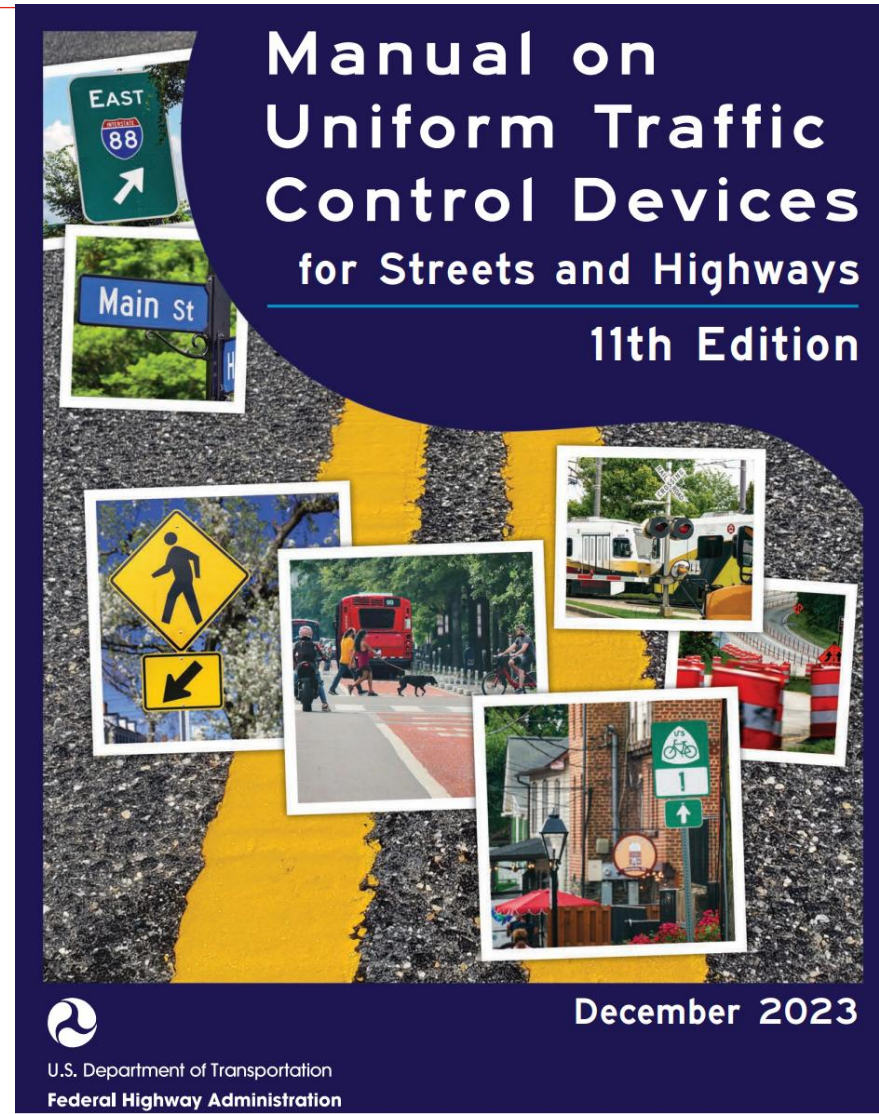
1.6.1. Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD)

MUTCD defines design and application of traffic control devices (TCDs).

2024 Bike Guide conforms to 2023 MUTCD

Includes some TCDs that require experimental approval by FHWA (located at the end of their respective section)

AASHTO expands upon the application of TCDs



Example

9.8. Advisory Bicycle Lanes (Experimental)

Advisory bicycle lanes are continuously-dotted bicycle lanes which permit motorists to temporarily enter the bicycle lane, allowing opposing motor vehicle traffic sufficient space to pass (see [Figures 9-15](#) and [9-16](#)). They are an experimental design treatment for streets with lower traffic speeds and volumes where it is not feasible to provide standard-width travel lanes and bicycle lanes. They are designed to improve bicyclist comfort while also providing a traffic calming benefit. This is the same procedure for motorists operating on yield streets where motorists must move to the right side of the road, into unoccupied parking spaces or driveways, to permit oncoming traffic to pass (see [Section 8.4.1](#)).



Figure 9-15: Example of an Advisory Bicycle Lane in Alexandria, VA

Where advisory bicycle lanes are installed, they should include bicycle lane signs (R3-17) and bicycle lane symbol pavement markings. The placement of the signs and bicycle lane symbols should follow guidance for bicycle lanes. Experimental approval from FHWA is required to use this traffic control treatment. See [Section 1.6.1](#) for guidance on requests to experiment.

Advisory shoulders are a similar treatment used in locations where sidewalks are not provided. Bicycle symbols are omitted to allow pedestrians to share the shoulder space with bicyclists. [Chapter 12](#) provides design guidance for advisory shoulders.

Section 1.8 - Definitions

Bicyclist Design User Profile – A generalized profile of different types of bicyclists based on their comfort when bicycling with motor vehicle traffic, as well as their bicycling skills and experience. Profiles range from Highly Confident to Somewhat Confident to Interested but Concerned.

Bicycle Facilities – A general term denoting provisions to accommodate or encourage bicycling, including bikeways, bicycle boulevards, bicycle detection, in addition to parking and storage facilities.

Bikeway – Any road, path, or facility intended for bicycle travel which designates separate space for bicyclists distinct from motor vehicle traffic or a bicycle boulevard designed for bicyclist travel priority. A bikeway does not include shared lanes, sidewalks, signed routes, or shared lanes with shared lane markings.

2.2.1. Relationship between Perceived Comfort and Substantive Safety

Research has found 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.

This section has 80 unique references; most peer reviewed research from the last 15 years

2.2.1. Relationship between Perceived Comfort and Substantive Safety

crashes and near-crash experiences influence perceived bicycling safety and comfort

(Lee et al., 2015; Sanders, 2015; Aldred & Crossweller, 2015)



2.3. Bicyclist Design User Profiles

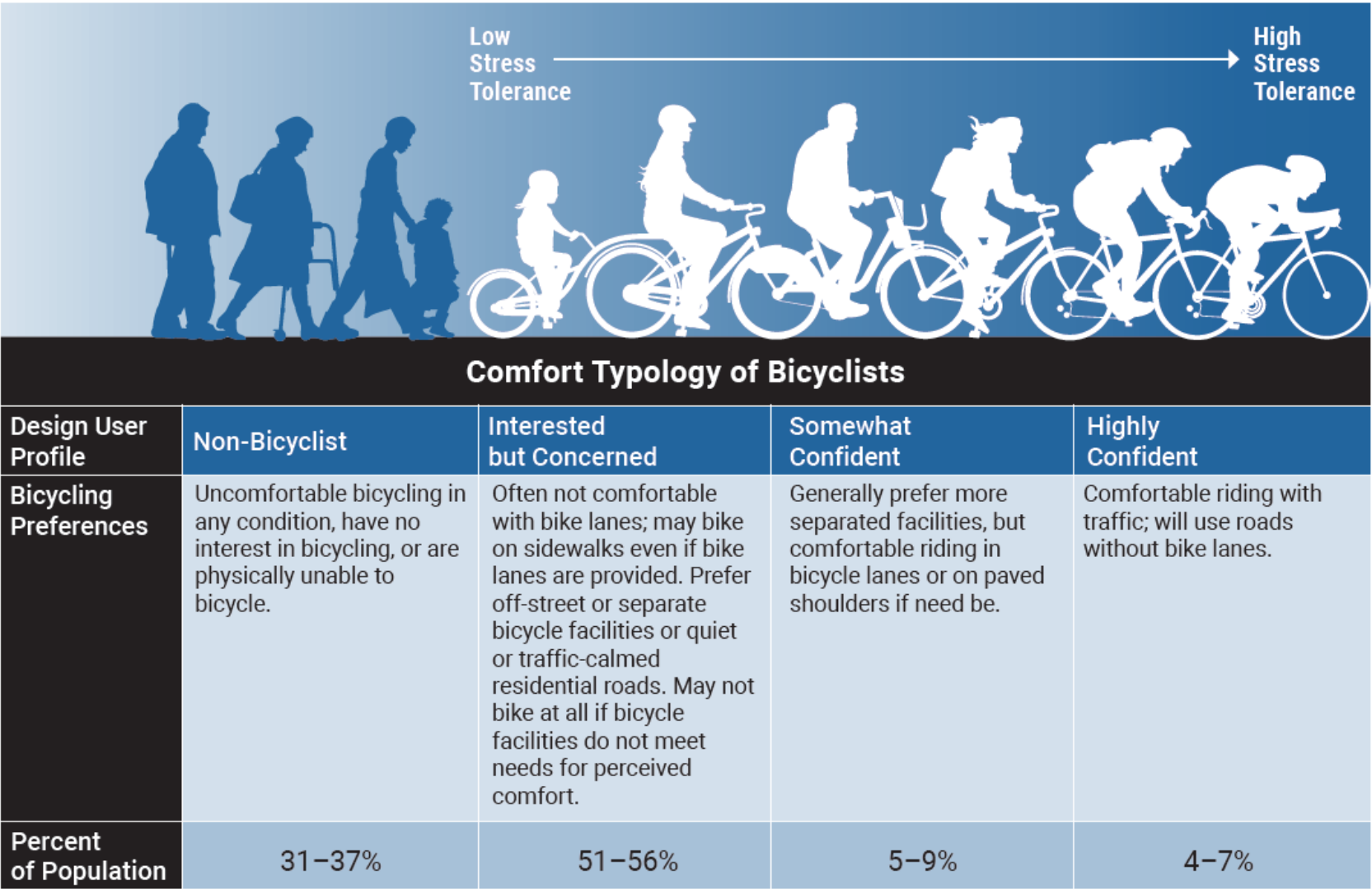


Figure 2-2: Comfort Typology of Bicyclists (See Chapter 2 References: Dill and McNeill, 2016)

2.7. Guiding Principles for Bicyclist Safety

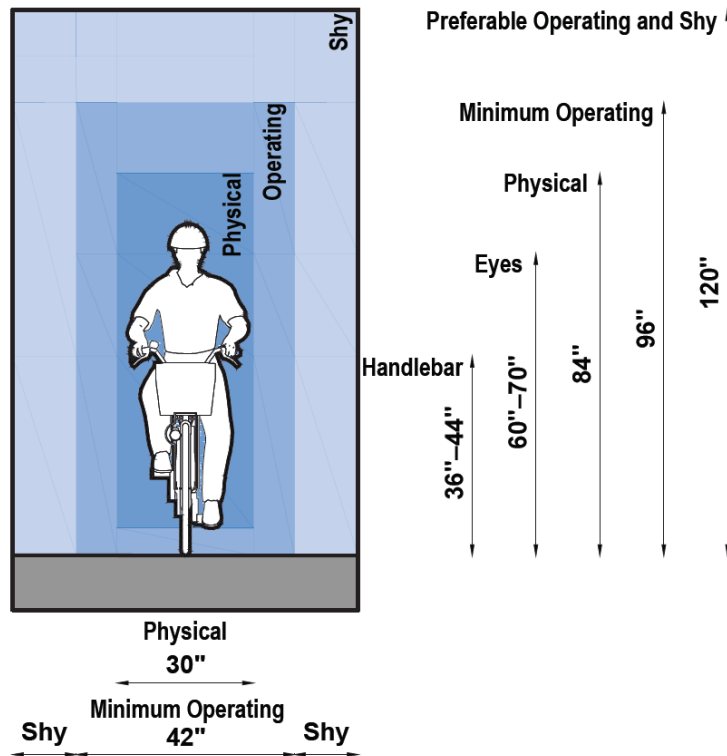


Figure 2-5: Typical Adult Bicyclist Operating Space

- SBLs 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)
- SBLs preferred over striped or shared lanes by both cyclists and motorists
(Monsere et al., 2014; Monsere et al., 2012; Sanders, 2014)
- One-way SBLs generally safer than two-way SBLs
(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)

Bicycle Planning Principles

3.2.1. Safety - reduce frequency and severity of crashes by separating bicyclists from higher speed and volumes of motorists

3.2.2. Comfort – do not deter use due to safety concerns

3.2.3. Connectivity – direct, complete and continuous

3.2.4. Legibility – easy to recognize and intuitive to use

3.4.1 Designing for the Intended Users – low stress networks,

Table 3-2: Relationship between Network Type and Mode Share

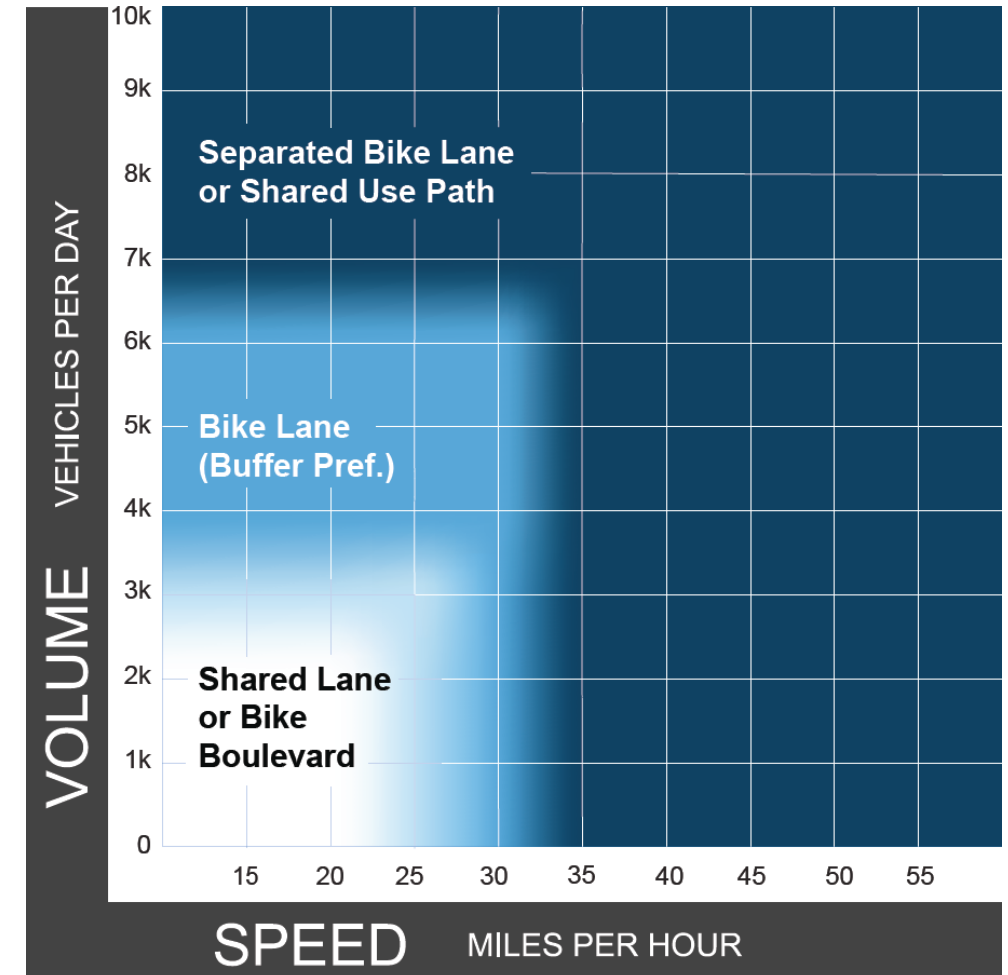
Network Types	Expected Users	Percent of the General Public Accommodated	Potential Bicycle Mode Share	U.S. Examples*
Low Stress Network	Interested but Concerned, Somewhat Confident, Highly Confident	60–72%	5–50%	Davis, CA: 16.6% Boulder, CO: 9% Portland, OR: 6.3%
Basic Network	Somewhat Confident, Highly Confident	9–16%	2–3%	Tucson, AZ: 2.6% Philadelphia, PA: 2.2%
Traffic-Tolerant Network	Highly Confident	4–7%	1%	Numerous examples
See Chapter 3 References: * U.S. Census Bureau (2017), 2016 1-year estimates. <i>Note that neighborhoods within cities often see larger bicycle mode share than city-wide numbers indicate.</i>				

Section 4.3.1 – Streets in Urban, Suburban and Rural Town Contexts

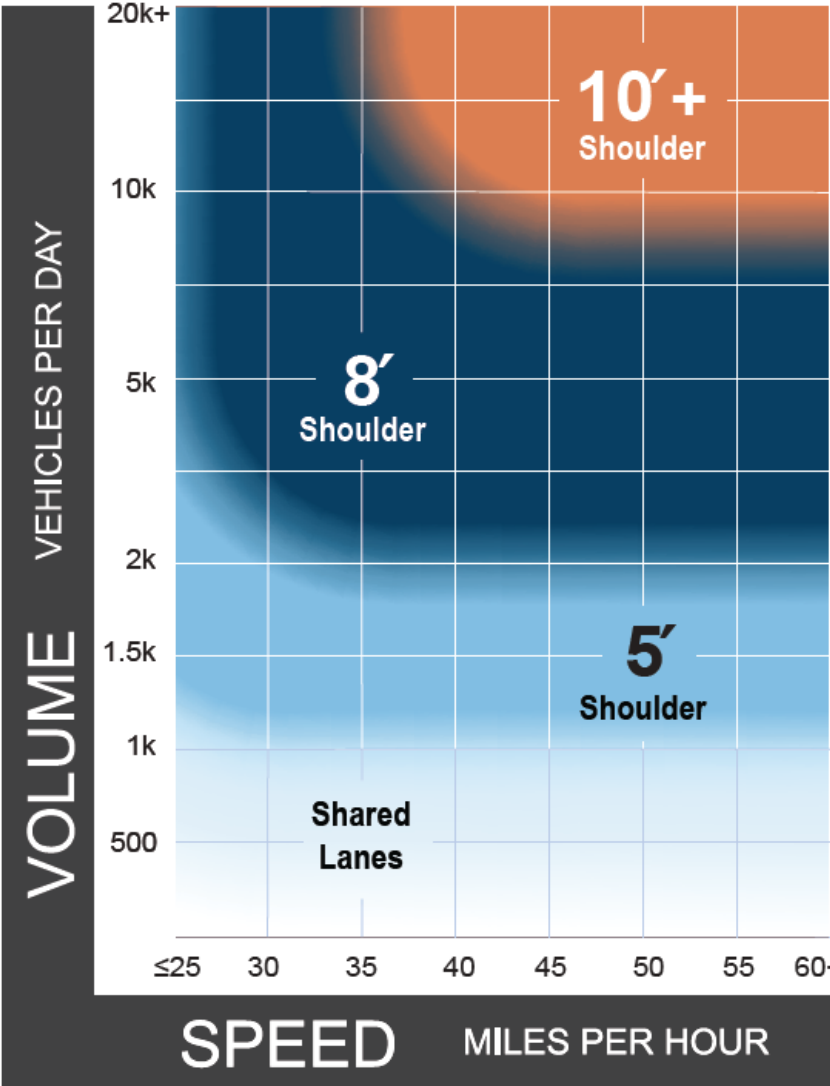
Identifies the **preferred** bikeway type assuming:

Design User = Interested but concerned cyclist

Analysis = Level of Traffic Stress



Section 4.3.2 – Rural Roadways



4.4.2. Example Strategies for Constrained Rights-of-Way

4.4.2.1 Traffic Analysis Approach

4.4.2.2 Narrowing Travel Lanes

4.4.2.3 Removing Travel Lanes

4.4.2.4 Reorganizing Street Space

4.4.2.5 Making Changes to On-Street Parking

4.4.2.6 Reducing Bikeway Widths

4.4.2.7 Reducing Motor Vehicle Traffic Volumes and Speeds

4.5.2. Example of Trade-off Considerations Between Common Bikeway Types

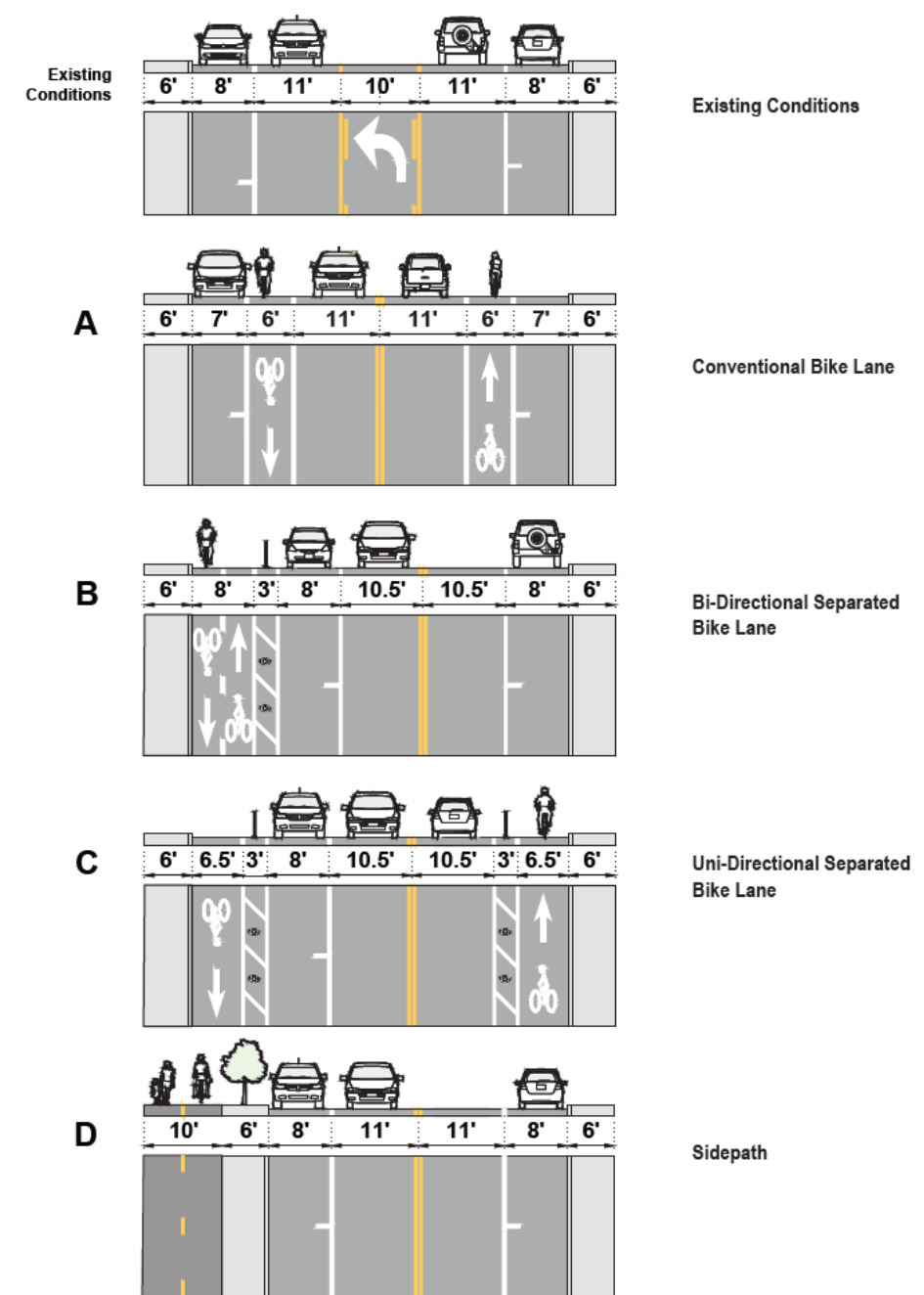


Figure 4-3: Common Bikeway Options within a 48-ft Cross Section

4.5.3. Selecting the Next Best Facility When the Preferred Bikeway Is Not Feasible

Alternative Route

If no other design improvements are feasible, it is necessary to consider alternative parallel routes.

Research indicates that for an alternative low-stress route to be viable, **the increase in trip length should be less than 30 percent.**

Broach, J., Dill, J., and J., Gliebe. Where Do Cyclists Ride? A Route Choice Model Developed with Revealed Preference GPS Data

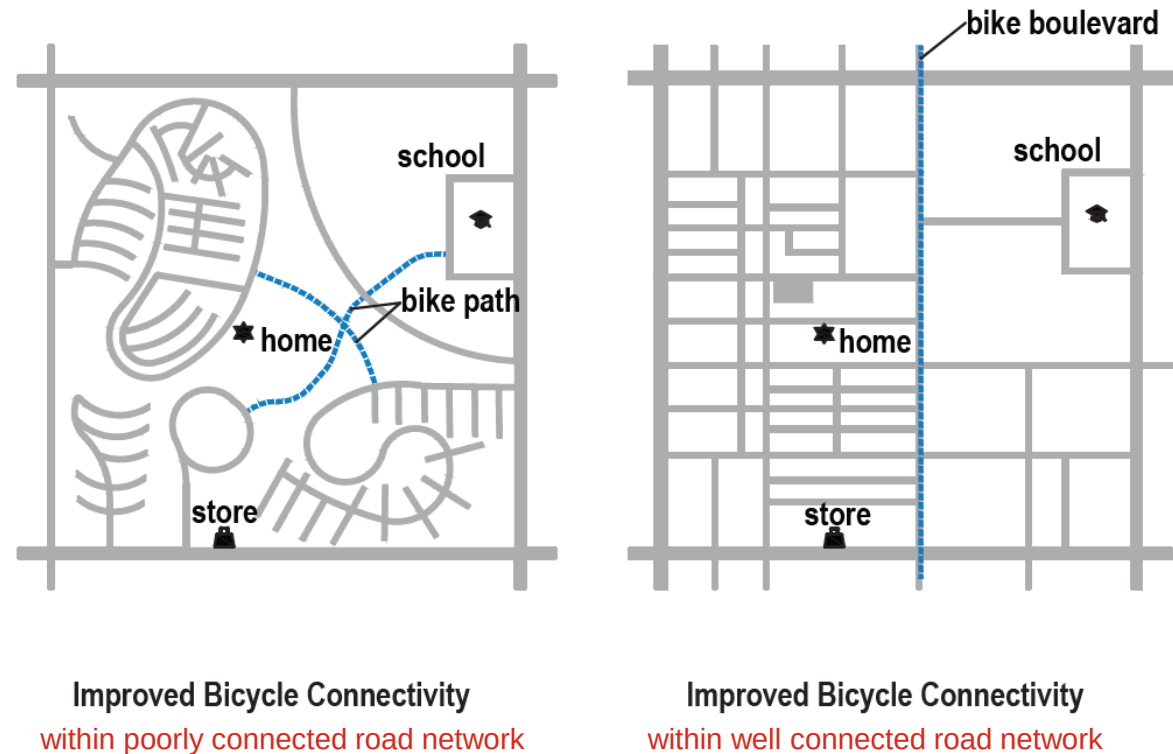


Figure 3-1: Examples of Contrasting Connectivity

Section 5.4 – Understanding Assignment of Right of Way

All street users need opportunity for Mutual Identification because:

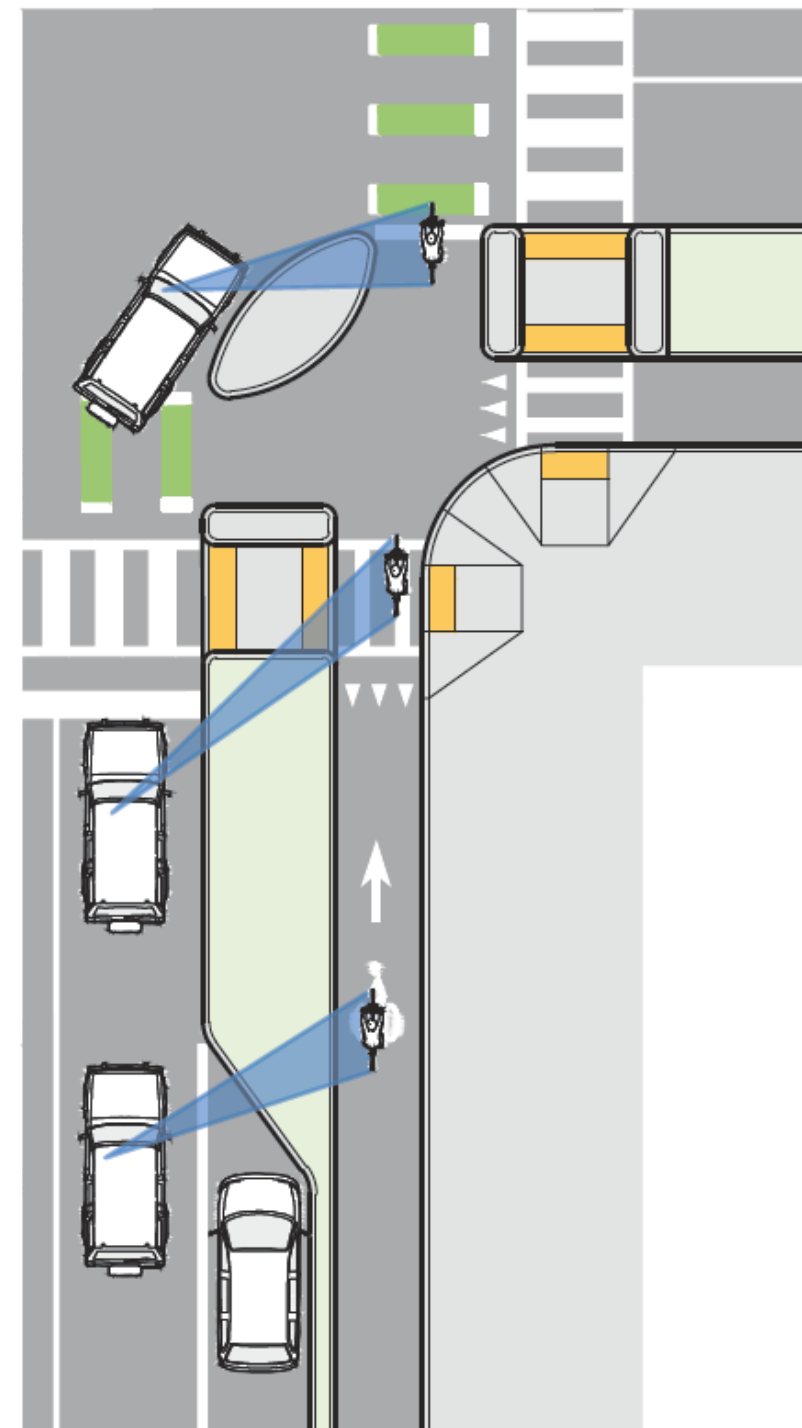
- Motorists & bicyclists must yield to pedestrians in crosswalks
- Pedestrians cannot suddenly leave the curb if vehicles too close to stop
- Motorists must exercise due care to avoid colliding with bicyclists/peds

The approach to a conflict point is composed of three zones.

yield/
stop
zone

decision
zone

recognition
zone



5.5.4.1.1 Case S – Right-Turning Motorist Across Separated Bike Lane or Side Path



Table 5-4: Recommended Intersection Approach Clear Space by Vehicular Turning Design Speed

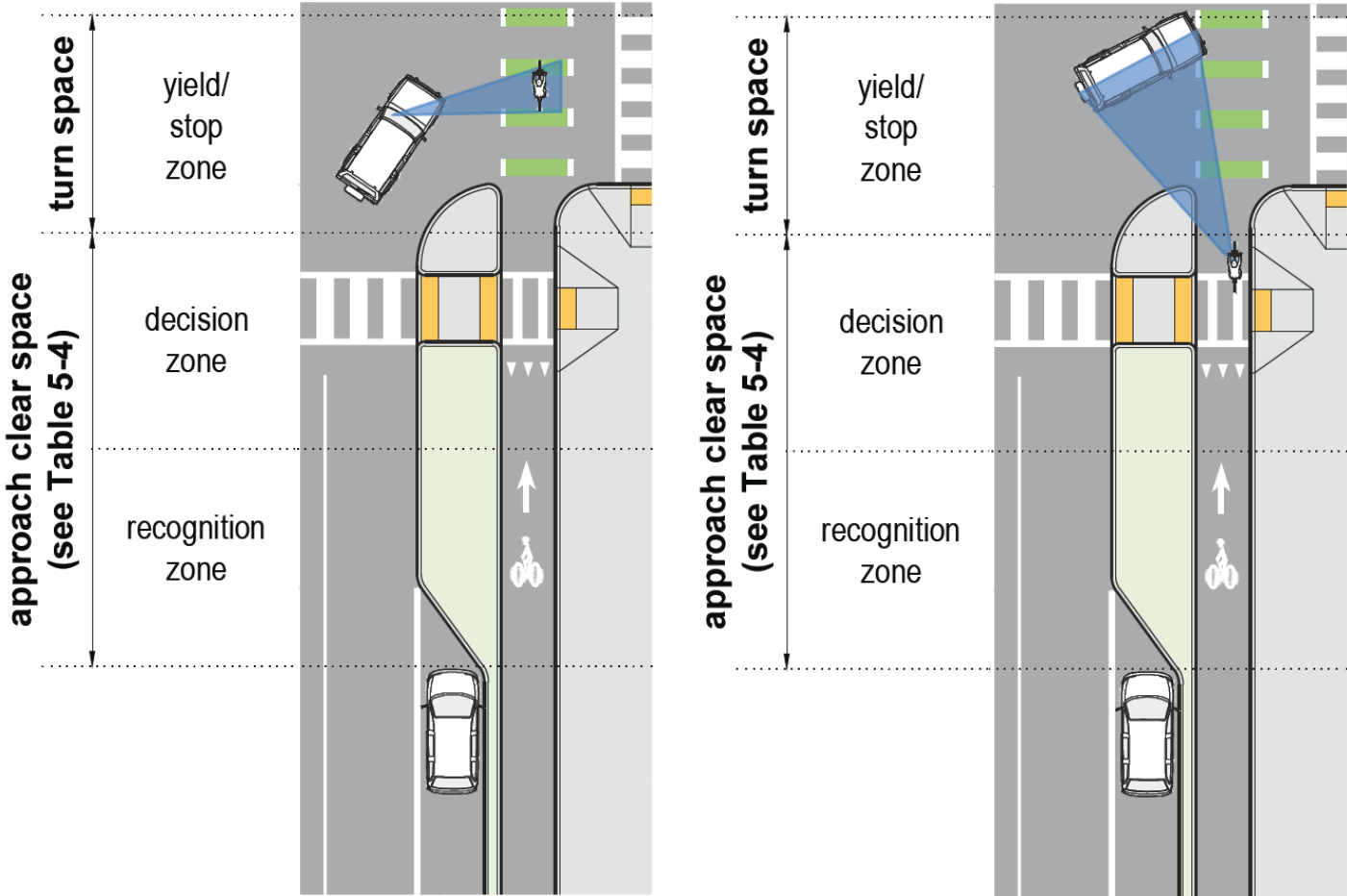
Effective Vehicle Turning Radius	Vehicular Turning Speed	Recommended Approach Clear Space
<18 ft	<10 mph ^a	20 ft
18 ft	10 mph	40 ft
25 ft	15 mph	50 ft
30 ft	20 mph	60 ft
>30 ft	25 mph	70 ft

^a Most low-volume driveways and alleys

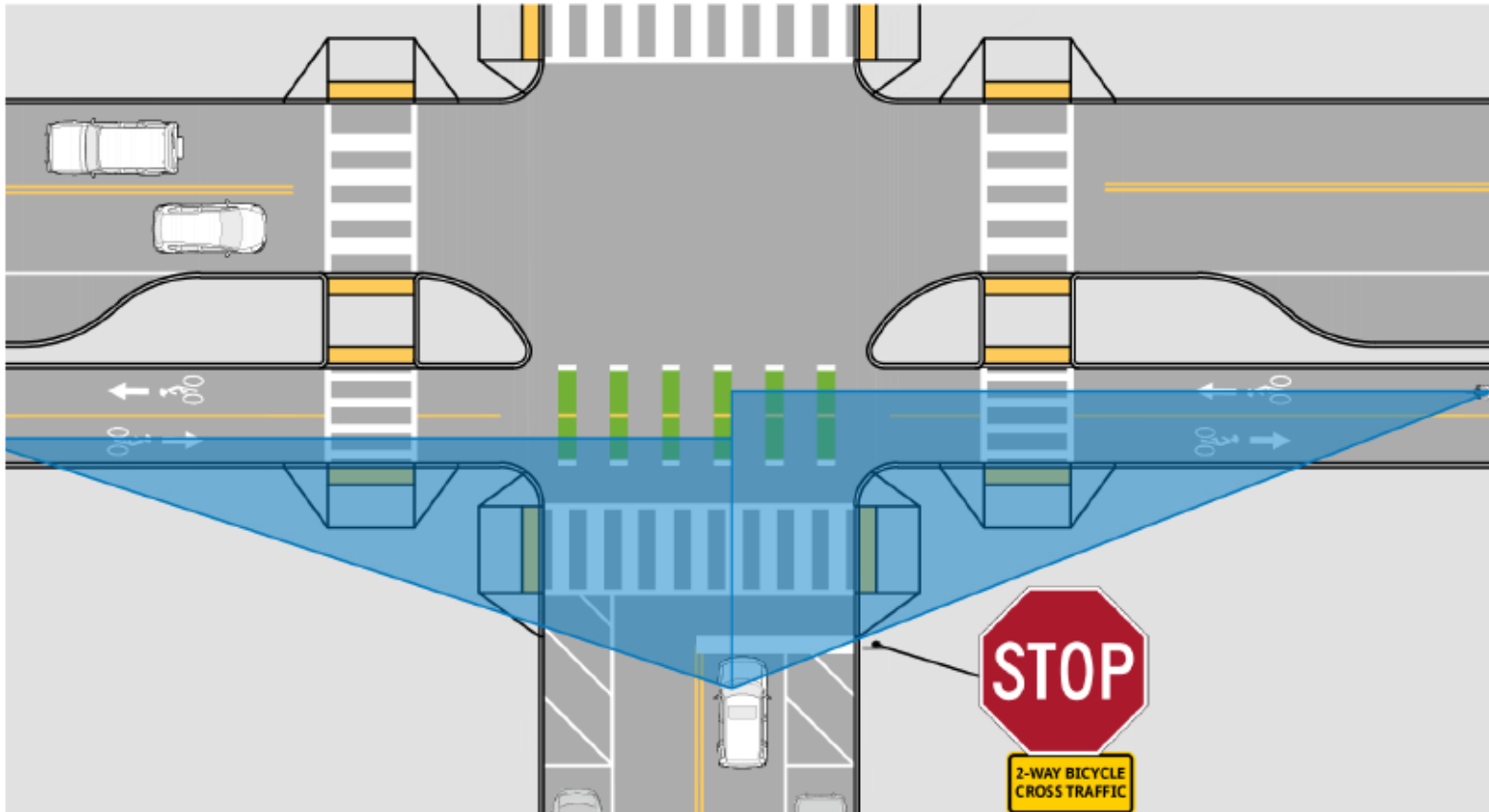
legend



line of sight



5.5.4.1.3 Case U – Through Motorist Crossing of a Separated Bike Lane or Shared Use Path



at a minimum the **provision of stopping sight distance for bicyclists** (See Section 5.5.2) **should be provided** to allow a bicyclist to slow or stop if a vehicle encroaches into the separated bike lane or side path

legend

▼ Case U1
sight triangles

Figure 5-3: Intersection Sight Distance: Case U1

5.8. Intersection Design Objectives

- 5.8.1. Minimize Exposure to Conflicts
- 5.8.2. Reduce Speeds at Conflict Points
- 5.8.3. Communicate Right-of-Way Priority
- 5.8.4. Providing Adequate Sight Distance
- 5.8.5. Transitions to Other Facilities
- 5.8.6. Accommodating Persons with Disabilities

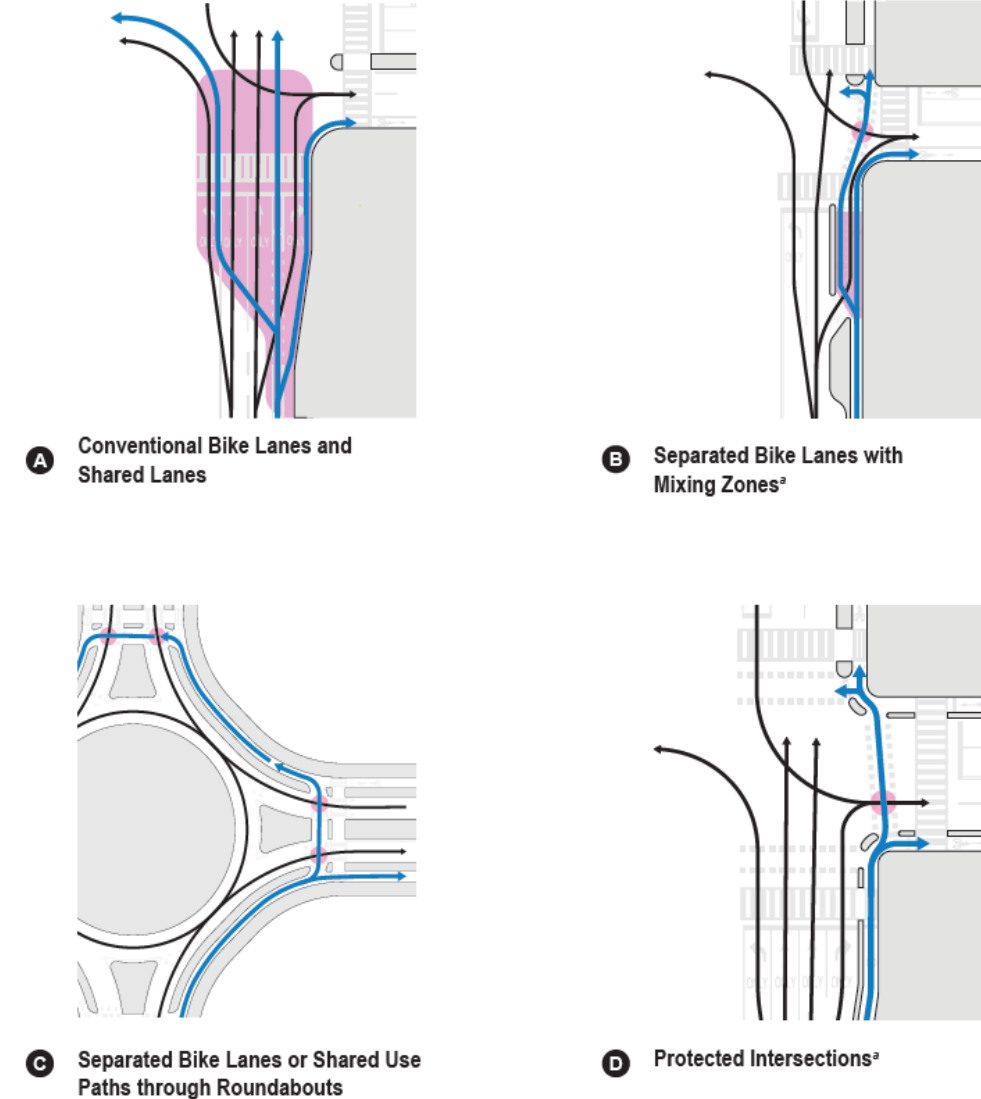


Figure 5-13: Comparison of Bicyclist Exposure to Motor Vehicles at Intersections

Section 5.9 – Evaluating Bicycle & Pedestrian Roadway Crossings



5.9.2.3 Apply Countermeasures to Improve Yielding

Table 5-15: Uncontrolled Crossing Evaluation

Uncontrolled Crossing Countermeasure Evaluation Table												
Roadway Type	Vehicle ADT < 9,000			Vehicle ADT 9,000 - 12,000			Vehicle ADT 12,000 - 15,000			Vehicle ADT > 15,000		
Number of Travel Lanes and Median Type	Speed Limit (mph)											
	≤30	35	40≥ ^a	≤30	35	40≥ ^a	≤30	35	40≥	≤30	35	40≥
2 Lanes ^b	1	1	2	1	1	2	1	1	3	1	2	3
3 Lanes with Raised Median ^b	1	1	2	1	1	2	1	2	3	2	2	3
3 Lanes without Raised Median ^{b,c}	1	1	2	1	2	2	2	3	3	2	3	3
4 Lanes with Raised Median ^{c,d}	1	1	2	1	2	2	2	3	3	3	3	3
4+ Lanes without Raised Median	1	2	3	2	2	2	3	3	3	3	3	3

Notes:

^a Where the speed limit exceeds 40 mph, Tier 3 should be considered.

^b 1 lane in each direction.

^c Raised medians must be at least 6 ft wide to serve pedestrians. See [Figure 2-4](#) for different bicycle lengths to serve bicyclists. Where median width is less than these values, review category of 4+ lanes without raised median.

^d 2 lanes in each direction.

Legend

Tier 1: 1

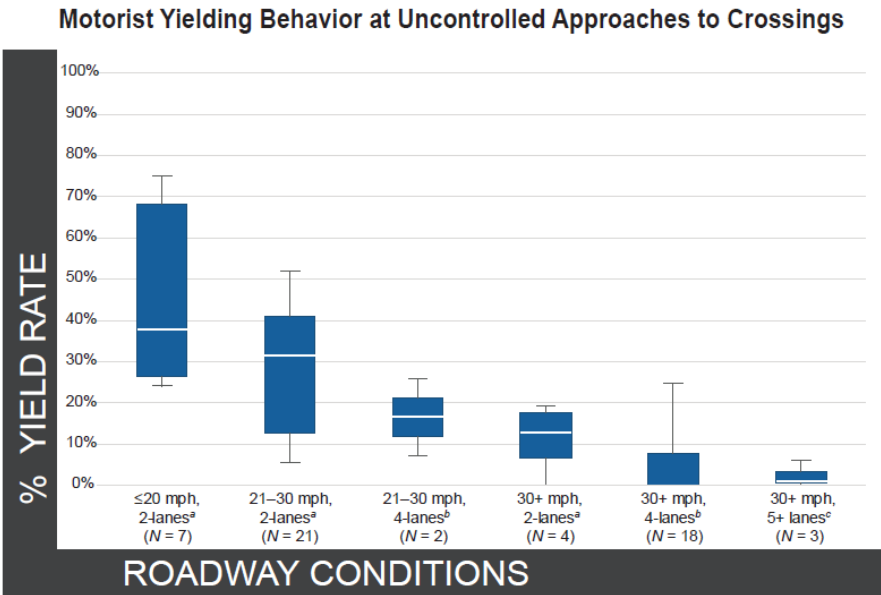
Tier 2: 2

Tier 3: 3

Tier 1: Signing & Markings

Tier 2: RRFB & Geometric Improvements

Tier 3: HAWK, Signal, or Grade Separation



N = number of sites where observations were taken

Note: Traffic control at all study locations were limited to marked crosswalks and standard crossings signs (W11-1, W11-2, W11-15)

Legend

- Maximum value
- Third quartile
- Median value
- First quartile
- Minimum value

^a One lane in each direction
^b Two lanes in each direction
^c At least two lanes in each direction

Figure 5-14: Motorist Yielding at Uncontrolled Crossings Based on Roadway Characteristics

Evaluating Bicycle & Pedestrian Roadway Crossings, IDOT Policy TRA-23



Tier 1: Signing & Markings

Tier 2: Activated Warning Beacons + Tier 1

Tier 3: RRFB + Tier 1

Tier 4: Traffic Signals, Hybrid Beacons, and higher designs

Departmental Policy TRA-23: Guidelines for Establishing Pedestrian Crossings

October 15, 2021

Figure 1 – Base Recommendations for Legs of Intersections Without Stop, Yield, or Signal Control¹, Two-Way Streets²

Configuration including turn and parking lanes ³	ADT ≤ 9000				9000 < ADT < 15,000				15,000 < ADT < 25,000				25,000 < ADT < 35,000				ADT ≥ 35,000
	Posted Speed or 85 th Percentile Speed, mph																
	≤30	35	40	≥ 45	≤30	35	40	≥ 45	≤30	35	40	≥ 45	≤30	35	40	≥ 45	
2 lanes or 3 with refuge	1	2	3	Site-Specific Design	1	2	3	Site-Specific Design	2	2	3	Site-Specific Design	2	3	3	Site-Specific Design	
3 lanes no refuge	1	2	3		1	3	3		2	3	3		3	4			
4 lanes with refuge	2	2	3		2	3	3		3	3	3		3	4	4		
6 lanes with refuge	2	3	3		2	3	4		3	3	4		4	4	4		
> 4 lanes no refuge	Site-Specific Design				Site-Specific Design				Site-Specific Design				Site-Specific Design				
4 lanes, refuge not feasible	2	2	4		2	3	4		3	4	4		4	4	4		

Treatment Number	Treatment Detail
1	Two W11-2 Ped Signs, each with W16-7P Slanted Down Arrow plaques. ⁴
2	Treatment 1 + Pedestrian-actuated warning beacons in suburban and less dense urban areas. In dense urban areas Treatment 1 alone may be considered. Continuously operated beacons are not recommended.
3	Treatment 1 + Rectangular Rapid Flashing Beacon
4	Request Traffic Signal Warrant Study

Crosswalk Pavement Marking	Application – Refer to Part 4, Guidelines for Implementation, Crosswalk Pavement Markings
Continental	Standard application
Ladder	Enhanced conspicuity application

Footnotes:	1. Base recommendations are a starting point for design. Engineering judgment must be applied to all locations.
	2. One-way streets are evaluated as one side of a multi-lane road with refuge. See Part 4 discussion of Site Specific Design for more information.
	3. Refuge is defined as a raised median or other pedestrian safety island.
	4. W16-9P (Ahead) plaques should also be considered in accordance with the MUTCD. Ahead plaques may be omitted in dense urban areas to avoid proliferation of signs.

Departmental Policy TRA-23: Guidelines for Establishing Pedestrian Crossings

October 15, 2021

Figure 2 – Base Recommendations for Midblock Locations¹, Two Way Streets²

Configuration including turn and parking lanes 3	ADT ≤ 9000				9000 < ADT < 15,000				15,000 < ADT < 25,000				25,000 < ADT < 35,000				ADT > 35,000 0			
	Posted Speed or 85 th Percentile Speed, mph																	All		
	≤30	35	40	≥ 45	≤30	35	40	≥ 45	≤30	35	40	≥ 45	≤30	35	40	≥ 45				
2 lanes or 3 with refuge	1	2a	3	Site-Specific Design	1	2b	3	Site-Specific Design	2a	2b	3	Site-Specific Design	2a	3	3	Site-Specific Design				
3 lanes no refuge	1	2a	3		1	3	3		2b	3	3		3	3	4					
4 lanes with refuge	2a	2b	3		2b	3	3		3	3	3		3	4	4					
6 lanes with refuge	2b	3	3		2b	3	4		3	3	4		4	4	4					
> 4 lanes no refuge	Site-Specific Design				Site-Specific Design				Site-Specific Design				Site-Specific Design							
4 lanes, refuge not feasible	2b	2b	4		2b	3	4		3	4	4		4	4	4		4			

Treatment Number	Treatment Detail
1	Two W11-2 Ped Signs, each with W16-7P Slanted Down Arrow plaques. ⁴
2a	Treatment 1 + Pedestrian-actuated warning beacons. Continuously operated beacons are not recommended.
2b	Treatment 2a + R1-5b Stop Here for Pedestrians signs at stop bar pavement marking (omit R1-5b for single lane approach)
3	Treatment 1 + Rectangular Rapid Flashing Beacon
4	Evaluate Standard Traffic Signal or Pedestrian Hybrid Beacon; review IL MUTCD for placement restrictions

Crosswalk Pavement Marking	Application – Refer to Part 4, Guidelines for Implementation, Crosswalk Pavement Markings
Continental	Standard Application.
Ladder	Enhanced conspicuity application.

Footnotes:	1. Base recommendations are a starting point for design. Engineering judgment must be applied to all locations.
	2. One-way streets are evaluated as one side of a multi-lane road with refuge. See Part 4 discussion of Site Specific Design for more information.
	3. Refuge is defined as a raised median or other pedestrian safety island.
	4. W16-9P (Ahead) plaques should also be considered in accordance with the MUTCD. Ahead plaques may be omitted in dense urban areas to avoid proliferation of signs.

Section 5.10 – Geometric Design Treatments to Improve Intersection Safety

5.10.1 Medians and Pedestrian Refuge Islands; Hardened Centerlines

5.10.2 Curb Extensions

5.10.3 Curb Radius

5.10.4 Mountable Truck Aprons

5.10.5 Raised Crossings

5.10.6 Multiple Threat Crossing Treatments

5.10.7 Bike Ramps

5.10.8 Directional Indicators

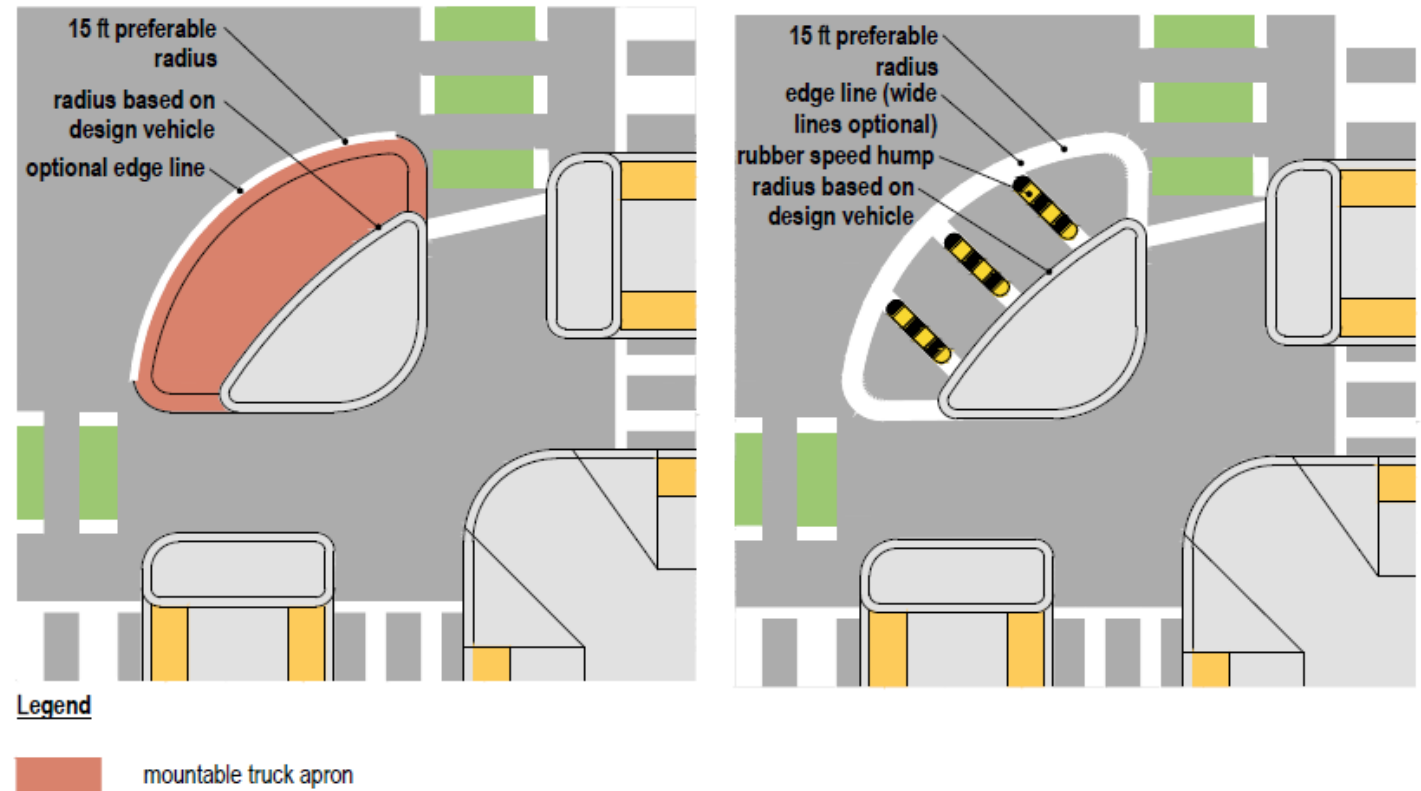


Figure 5-18: Mountable Truck Apron

Section 5.10 – Geometric Design Treatments to Improve Intersection Safety

5.10.1 Medians and Pedestrian Refuge Islands; Hardened Centerlines

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5.10.3 Curb Radius

5.10.4 Mountable Truck Aprons

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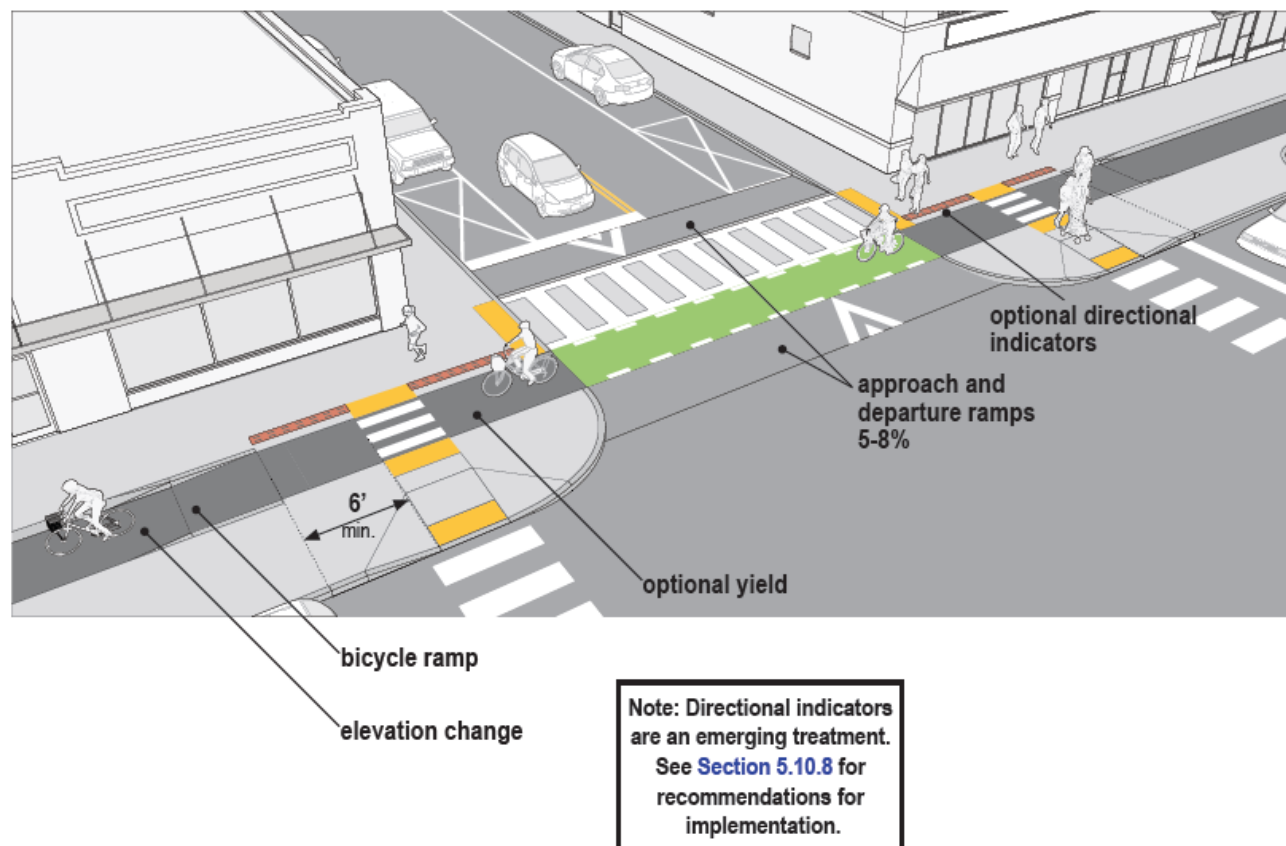


Figure 5-20: Raised Side Street Crossing

Section 5.10 – Geometric Design Treatments to Improve Intersection Safety

5.10.1 Medians and Pedestrian Refuge Islands;
Hardened Centerlines

5.10.2 Curb Extensions

5.10.3 Curb Radius

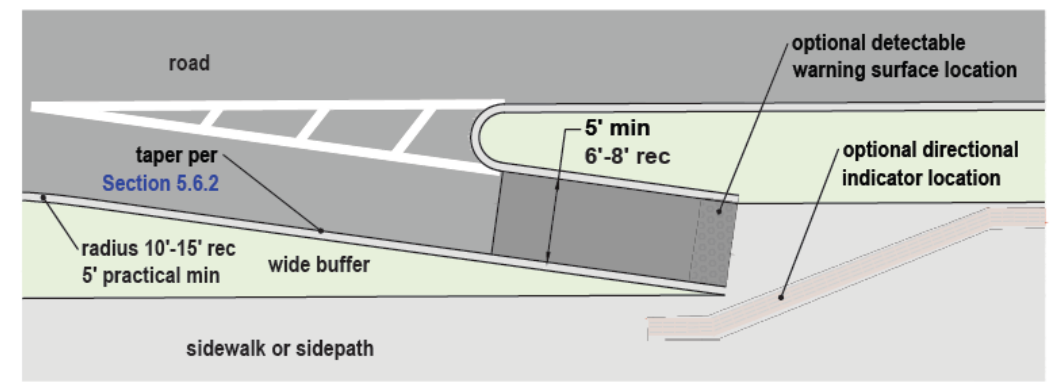
5.10.4 Mountable Truck Aprons

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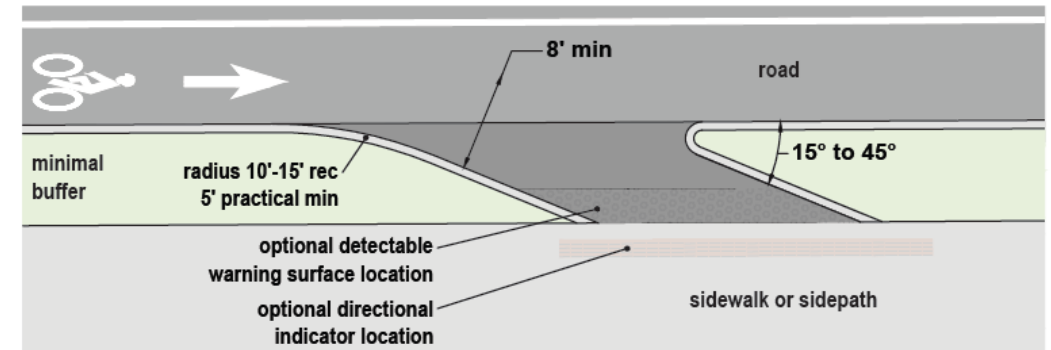
5.10.6 Multiple Threat Crossing Treatments

5.10.7 Bike Ramps

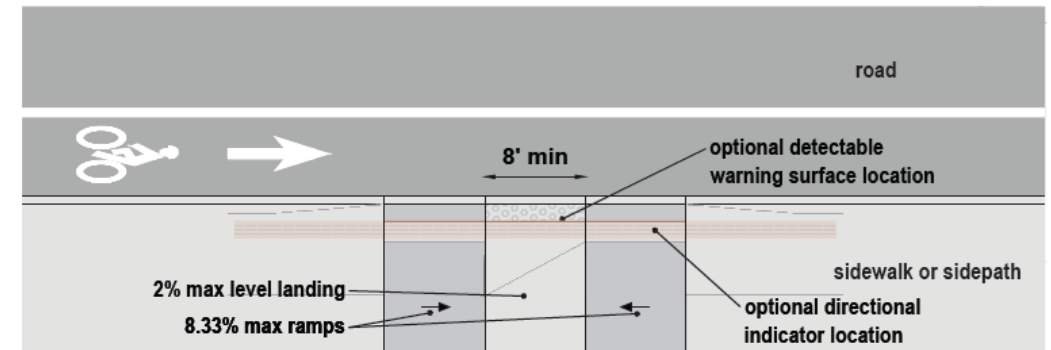
5.10.8 Directional Indicators



Detail 1—Preferred bicycle ramp alignment with wide sidewalk buffer



Detail 2—Lateral shift bicycle ramp alignment with minimal width sidewalk buffer



Detail 3—Parallel bicycle ramp with no sidewalk buffer

Note: All shown locations for detectable warning surfaces and directional indicators are for reference only. See [Section 5.10.7](#) for additional guidance.

Note: Directional indicators are an emerging treatment. See [Section 5.10.8](#) for recommendations for implementation.

Figure 5-23: Bicycle Ramp Alignments

5.10.8 Directional Indicators

Per ISO 23599 the width of the directional indicator (DI) can vary based on use:

- If the DI is laid out perpendicular to the pedestrian path of travel (for example to direct a pedestrian towards a mid-block crossing or transit stop), it must be a minimum width of 2 ft to be detectable.
- If the DI is laid out parallel to the pedestrian path of travel, it can be as narrow as 1 ft.
- At some locations (such as near intersections) pedestrian paths may interact with directional indicators both parallel and perpendicular, and in these situations the wider width should be used.

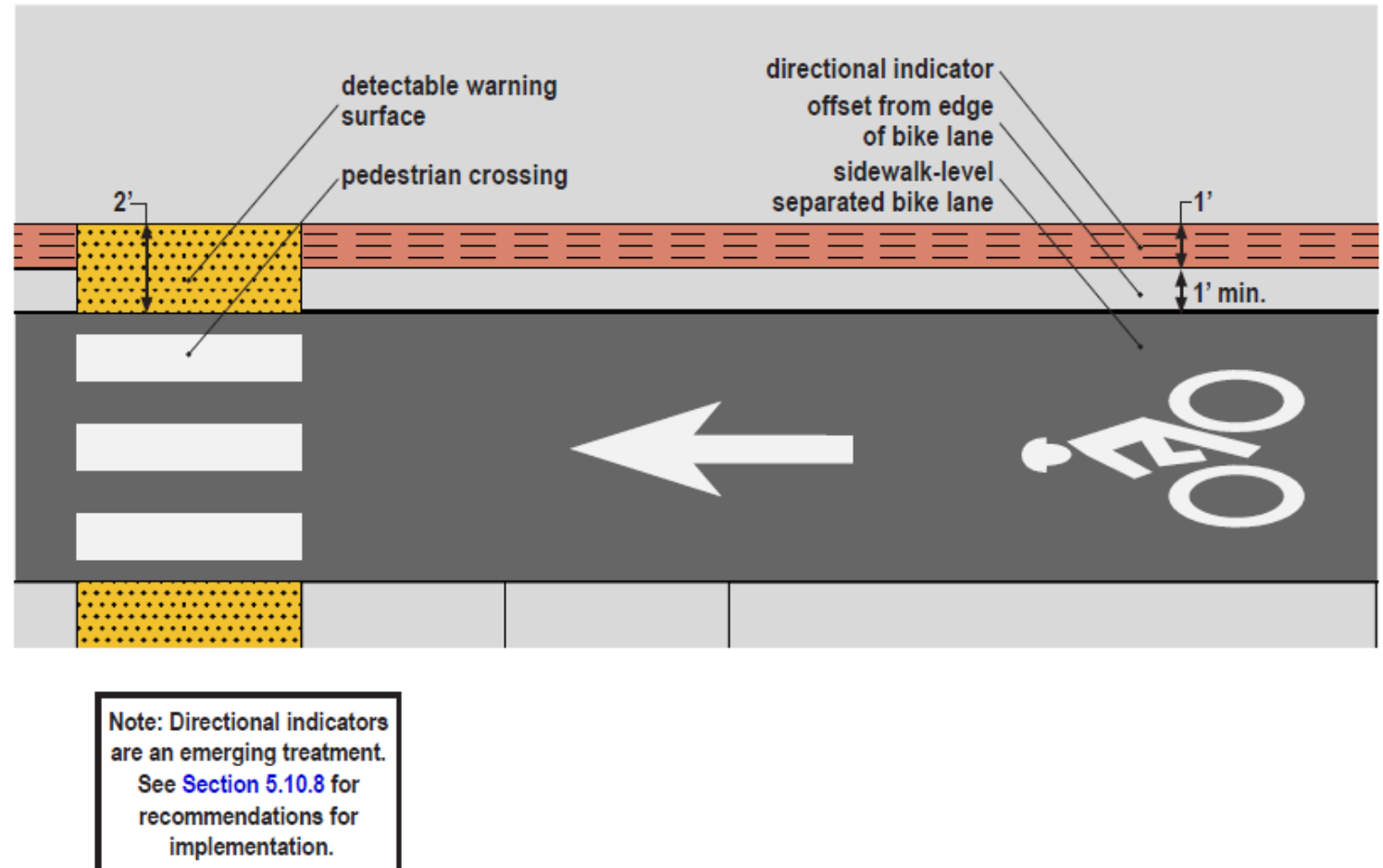


Figure 5-24: Sidewalk-Level Separated Bike Lane with Directional Indicator

Chapter 6

SUP Width (Two-way)



6.4.3. Recommended Shared Use Path Widths

Table 6-3: Recommended Shared Use Path Widths* to Achieve SUP LOS “C”

Shared Use Path Operating Widths and Operational Lanes*					
SUPLOS “C” Peak Hour Volumes	Recommended Operational Lanes	Practical Minimum	Recommended Lower Limit	Recommended Upper Limit	Practical Maximum
150 to 300	2	8 ft	10 ft	12 ft	13 ft
300 to 500	3	11 ft	12 ft	15 ft	16 ft
500 to >600	4	15 ft	16 ft	20 ft	None

*Typical Mode Split is 55% adult bicyclists, 20% pedestrians, 10% runners, 10% in-line skaters, and 5% child bicyclists



6.4.2. Shared Use Path Level of Service

Table 6-1: Shared Use Path Operating Conditions Based on Level of Service Criteria

Shared Use Path Level of Service (SUPLOS) and Operating Conditions	
SUPLOS	Peak Operating Conditions
A. Excellent	A significant ability to absorb more users across all modes is available.
B. Good	A moderate ability to absorb more users across all modes is available.
C. Fair	Path is close to functional capacity with minimal ability to absorb more users.
D. Poor	Path is at its functional capacity. Additional users will create operational and safety problems.
E. Very Poor	Path operating beyond its functional capacity resulting in conflicts and people avoiding the path.
F. Failing	Path operating beyond functional capacity resulting in significant conflicts and people avoiding the path.

Table 6-2: Shared Use Path Level of Service Look-Up Table, Typical Mode Split

Shared Use Path Level of Service Look-Up Table, Typical Mode Split*										
Shared Use Path Peak Hour Volume	Shared Use Path Width (ft)									
	8	10	11	12	14	15	16	18	20	≤ 25
50	B	B	B	B	B	A	A	A	A	A
100	D	C	B	B	B	A	A	A	A	A
150	D	C	B	B	B	A	B	A	A	A
200	D	D	C	B	B	A	B	A	A	A
300	E	D	C	C	C	B	B	B	B	A
400	F	E	D	D	C	C	C	B	B	A
500	F	F	D	D	D	C	C	C	C	A
600	F	F	E	E	E	D	D	C	C	A
800	F	F	F	F	F	E	E	E	E	A
1,000	F	F	F	F	F	E	F	F	F	A
≥ 1,200	F	F	F	F	F	F	F	F	F	A

*Assumptions:

1. Mode split is 55 percent adult bicyclists, 20 percent pedestrians, 10 percent runners, 10 percent in-line skaters, and 5 percent child bicyclists.
2. An equal number of trail users travel in each direction (the model uses a 50 percent–50 percent directional split).
3. Trail volume represents the actual number of users counted in the field (the model adjusts this volume based on a peak hour factor of 0.85).
4. Trail has a centerline.

6.4.4. Separation of Pedestrians and Bicyclists



6.4.4.1 Land Use Considerations Where Separation is Desirable

6.4.4.2 Volume Thresholds Where Separation is Desirable

should be considered when:

- Level of Service is projected to be at or below level “C.”
- Pedestrians can reasonably be anticipated to be 30 percent or more of the volume

6.4.4.3 Separation Strategies

6.4.4.4 Accessibility Considerations



Figure 6-3: Burke-Gilman Shared Use Path (2008) and Separated Paths (2021), Seattle, WA

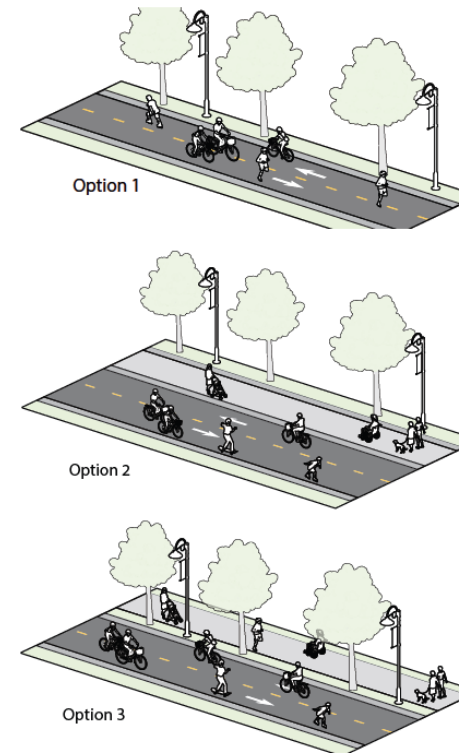


Figure 6-4: Options for Separating Bicyclists and Other Wheeled Users from Pedestrians

7.2. General Design Considerations

The cross section of a separated bike lane comprises three distinct zones (see [Figure 7-1](#)):

- 1 **Bike lane**—The bike lane is the space in which the bicyclist operates. It is located between the street buffer and the sidewalk buffer.
- 2 **Street buffer**—The street buffer separates the bike lane or side path from motor vehicle traffic.
- 3 **Sidewalk buffer**—The sidewalk buffer separates the bike lane from the sidewalk.

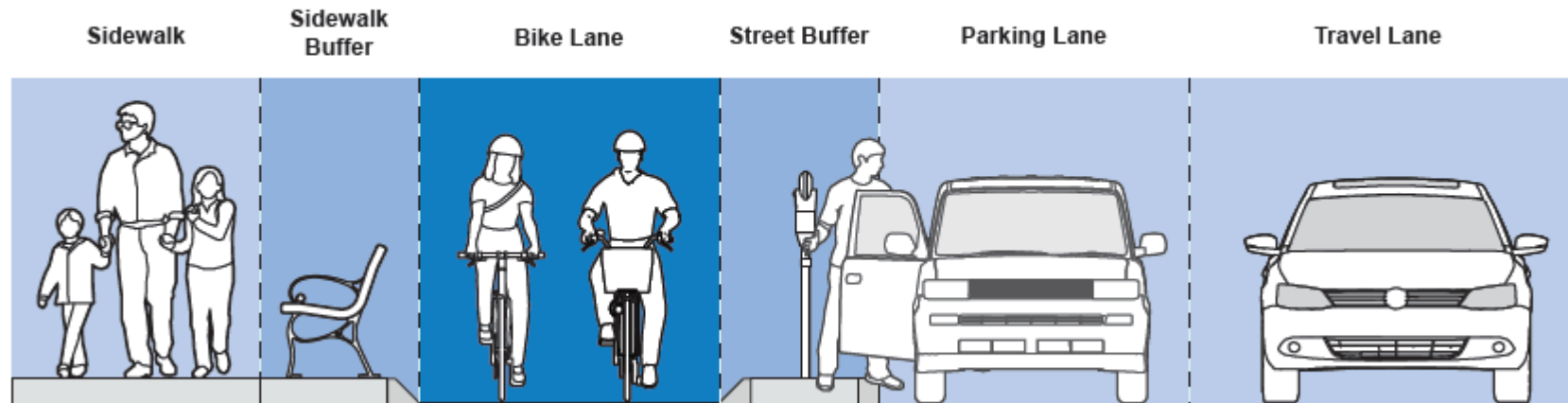


Figure 7-1: Separated Bike Lane Zones

7.2.2.3 Intermediate-Level Separated Bike Lanes

curb reveal of 2-3 in. below sidewalk elevation is recommended to”

- provide vertical separation to the adjacent sidewalk, and
- provide a detectable edge for pedestrians with vision disabilities

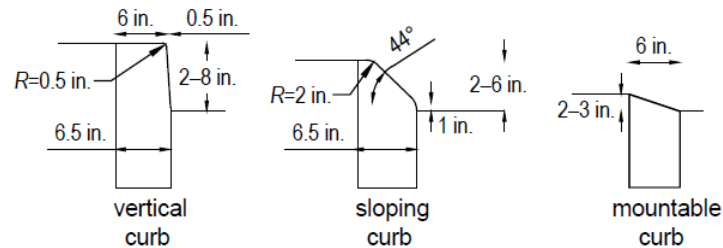


Figure 7-5: Curb Types for Separated Bike Lanes

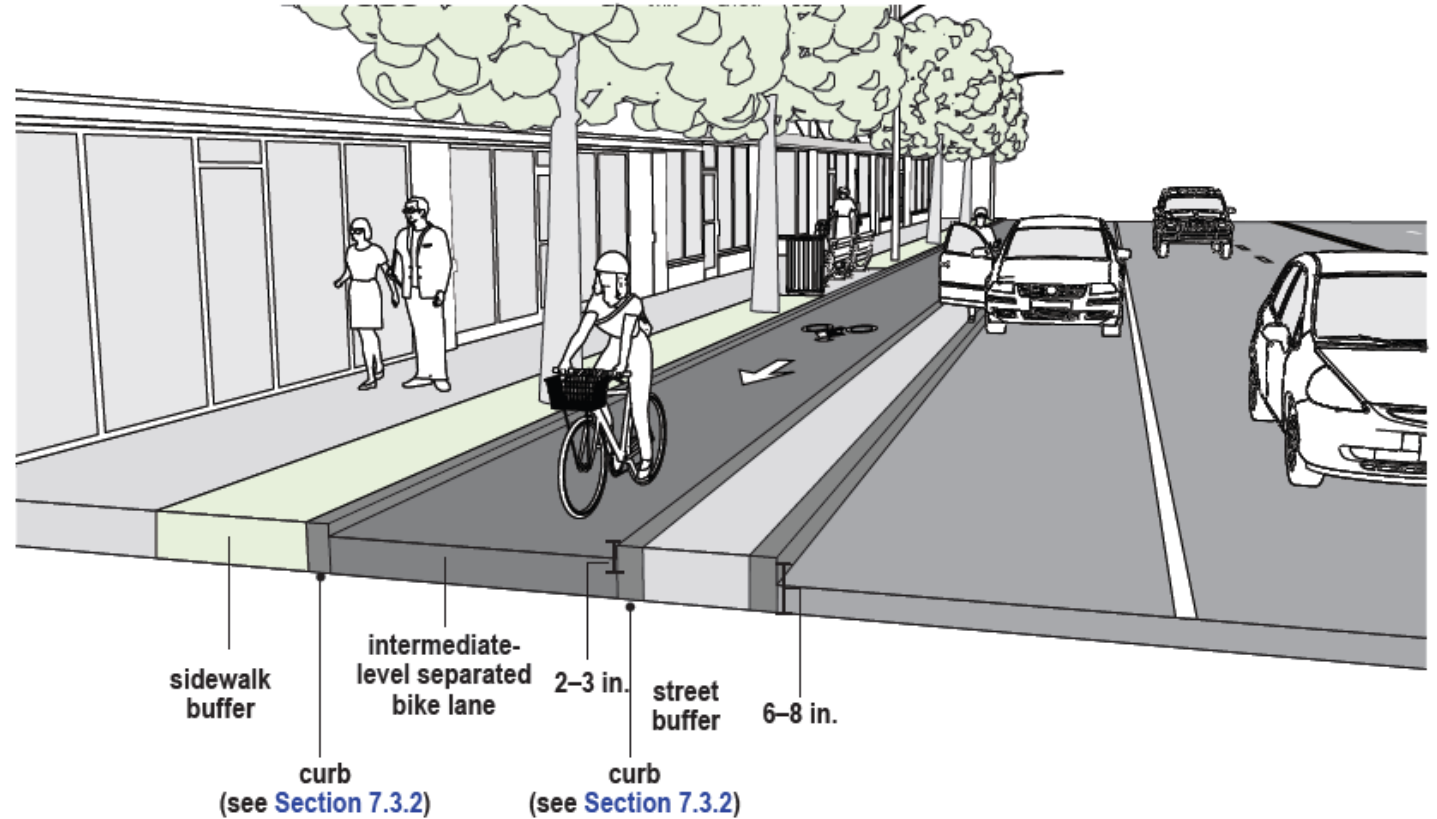


Figure 7-4: Intermediate-Level Separated Bike Lane

Section 7.3.4 – SBL Width (One-way)

Table 7-3: One-Way Separated Bike Lane Widths Based on Existing or Anticipated Volumes

Peak Hour Directional Bicyclist Volume	One-Way Separated Bike Lane Width (ft) Recommended Values		
	Between Vertical Curbs without Gutter	Adjacent to One Vertical Curb	Between Sloped Curb, at Sidewalk Level, or Adjacent to Curb with Gutter
<150	6.5–8.5	6–8	5.5–7.5
150–750	8.5–10	8–9.5	7.5–9
>750	≥10	≥9.5	≥9
Practical Minimum*	4.5	4	4

*Peak Hour Directional Bicyclist Volume not applicable

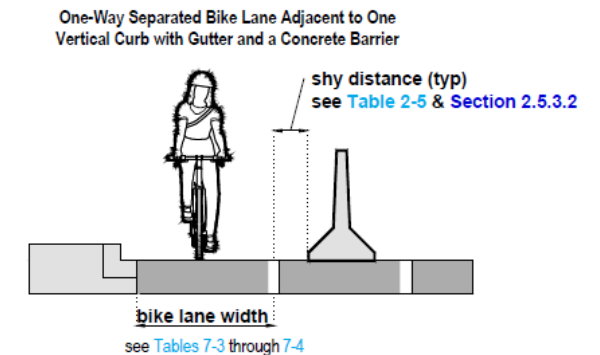
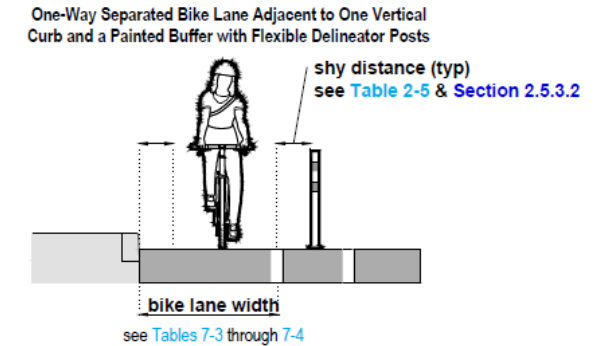
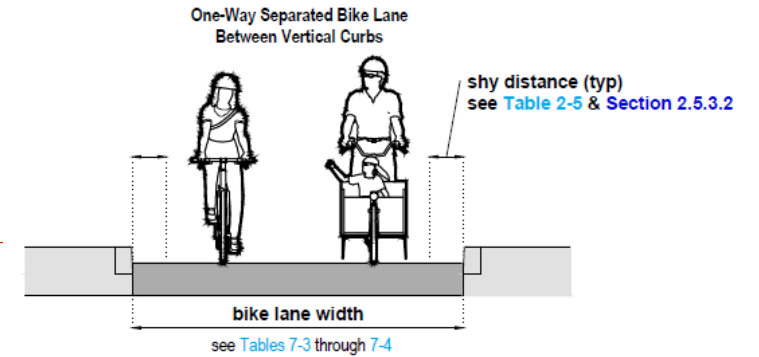


Figure 7-7: Separated Bike Lane Width

7.9. Separated Bike Lane and Side Path Intersection Design

7.9.1. Minimizing Exposure to Conflicts

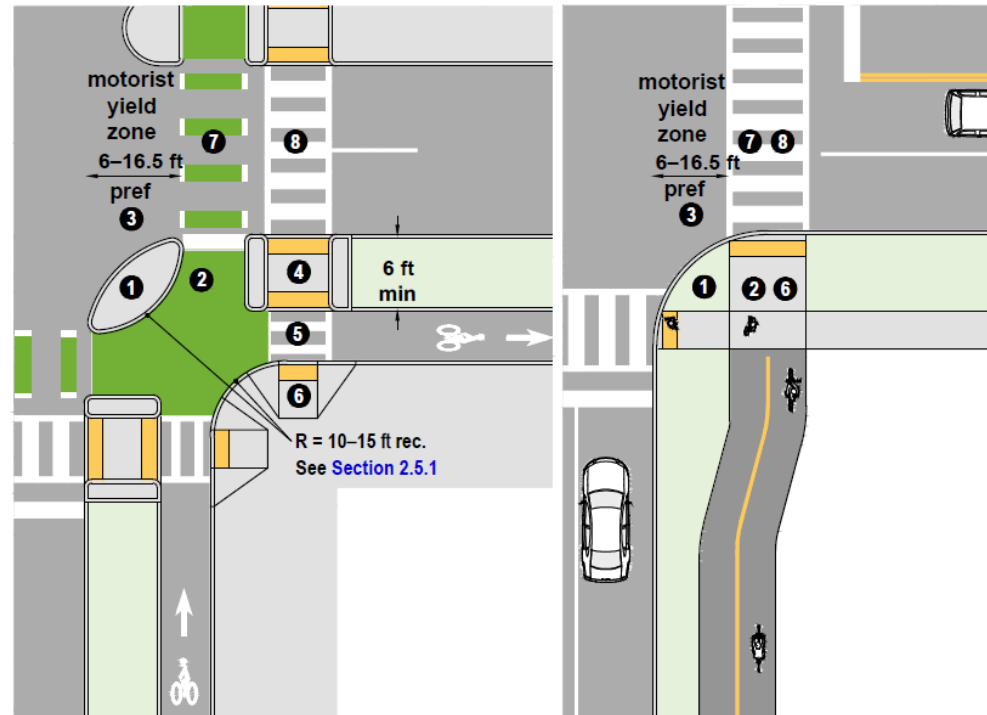
7.9.2. Reducing Speeds at Conflict Points

7.9.3. Transitions between Elevations

7.9.4. Right-of-Way Priority

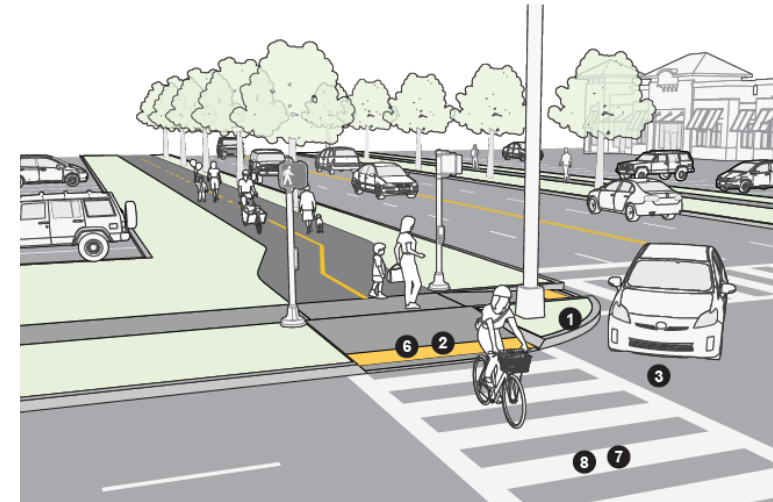
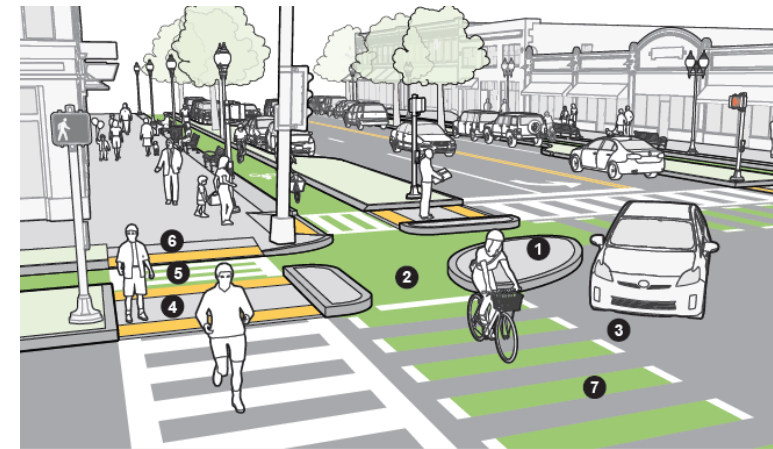
7.9.5. Sight Distance

7.9.6. Restricting Motor Vehicles



- | | |
|--------------------------------|--|
| 1 corner island | 5 pedestrian crossing of the separated bike lane |
| 2 forward bicycle queuing area | 6 pedestrian curb ramp |
| 3 motorist yield zone | 7 bicycle crossing of travel lanes |
| 4 pedestrian refuge island | 8 pedestrian crossing of travel lanes |

Figure 7-13: Protected Intersection Design for Separated Bike Lanes and Side Paths



7.9.9. Intersection Design with Mixing Zones

reduce speeds of motor vehicles entering the merge point to 20 mph or less:

- Minimize the length of the merge area
- Locate the merge point as close as practical to the intersection.
- Minimize the length of the storage portion of the turn lane.
- Provide a buffer and physical separation (e.g., flexible delineator posts) from the adjacent through lane after the merge area, if feasible.
- Highlight the conflict area with a green-colored pavement and dotted bike lane markings (see Figure 7-20), as necessary, or shared lane markings (see Figure 7-21).
- Raise the elevation of the turn lane at the start of the mixing zone.

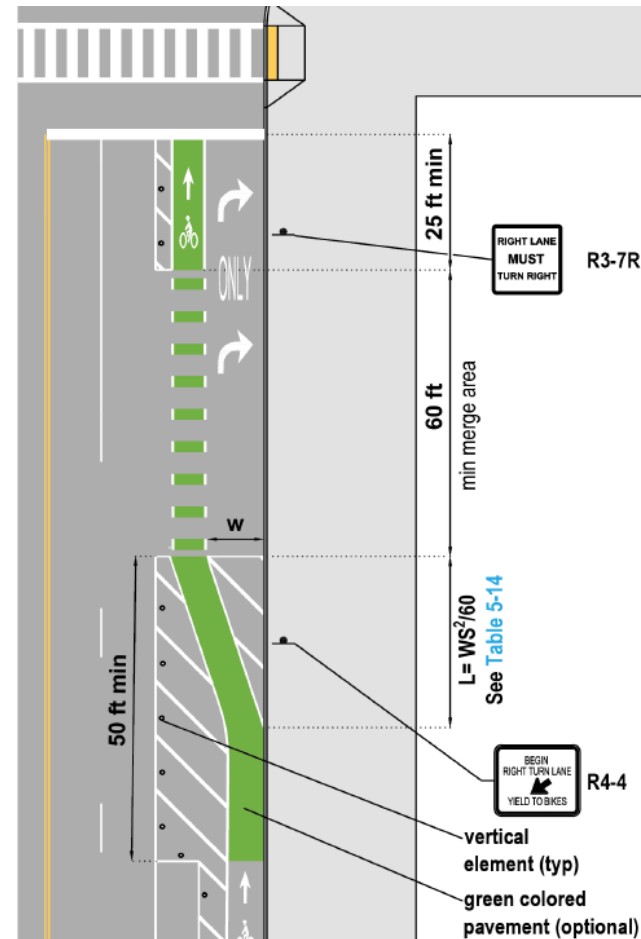


Figure 7-20: Angled Crossing Mixing Zone with Bike Lane

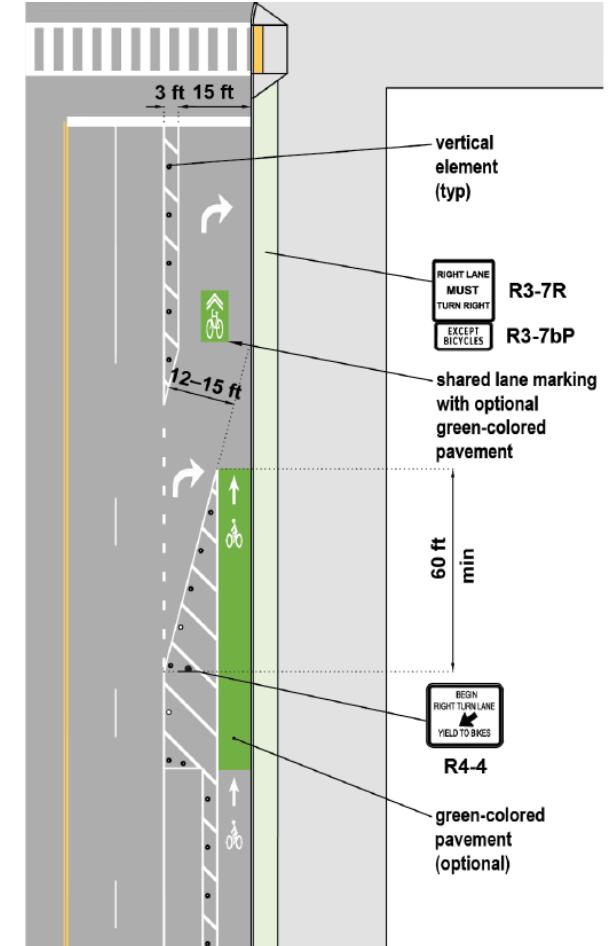


Figure 7-21: Angled Crossing Mixing Zone with Shared Lane

7.9.12.1 Accessible Motor Vehicle Parking

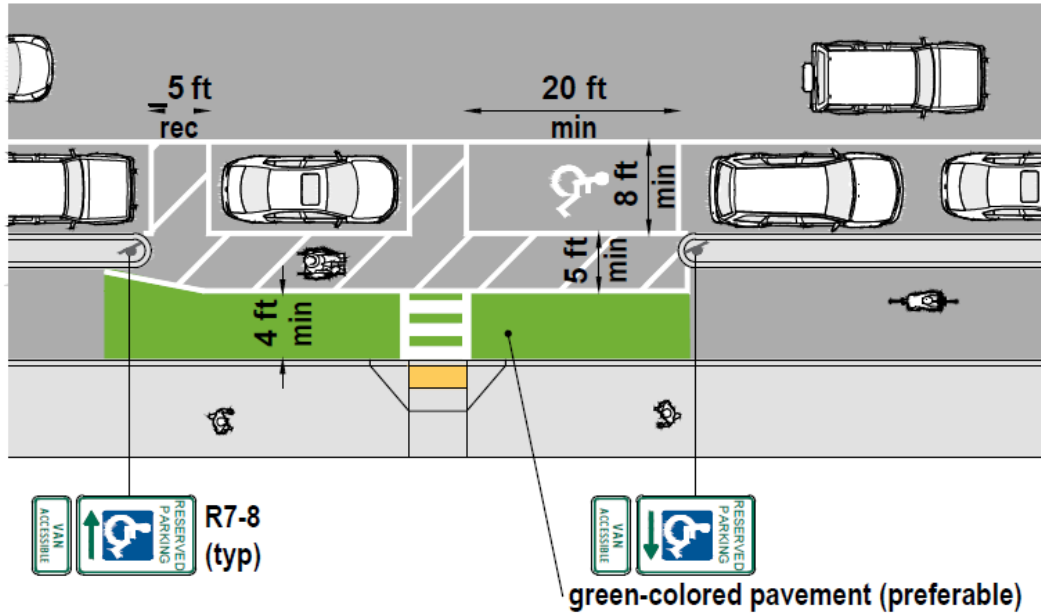


Figure 7-23: Accessible On-Street Motor Vehicle Parking Mid-Block

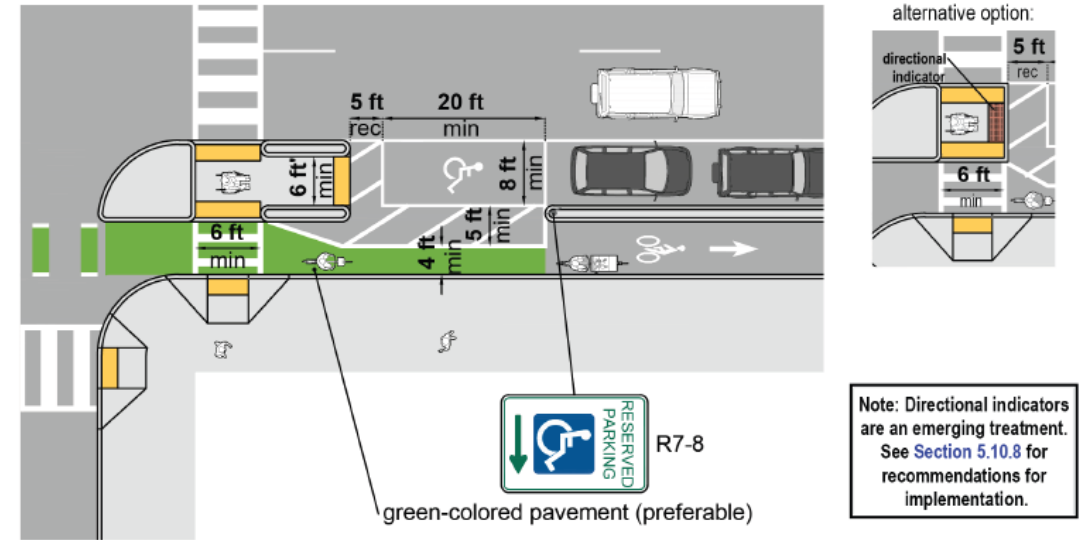


Figure 7-22: Accessible On-Street Motor Vehicle Parking at Intersections

7.9.14. Transit Stops

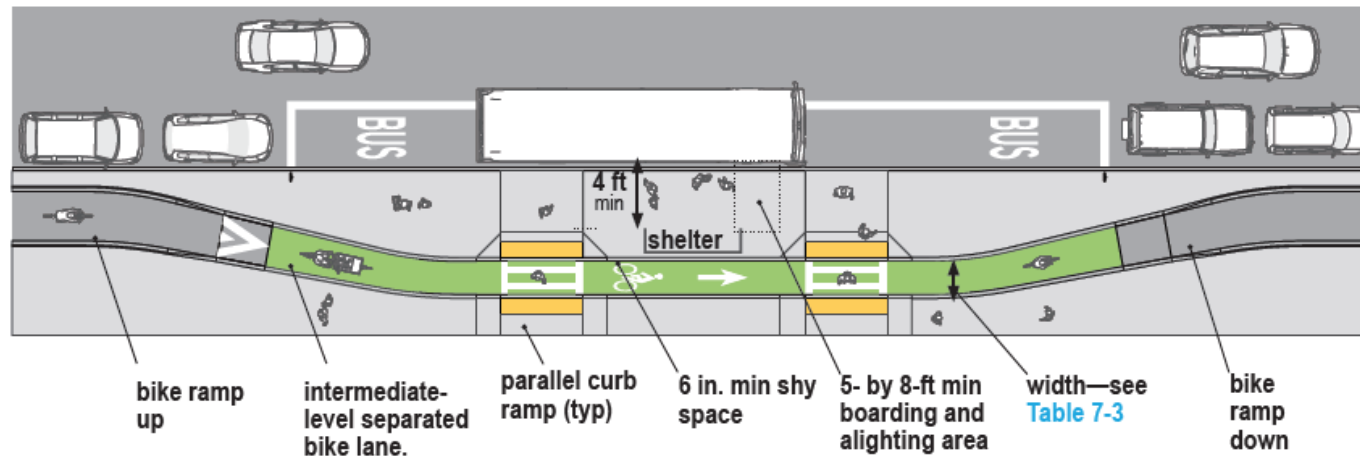
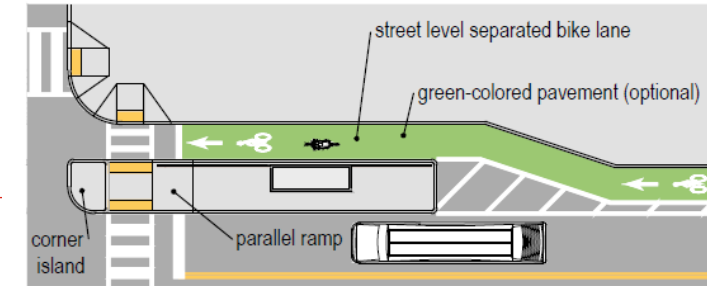
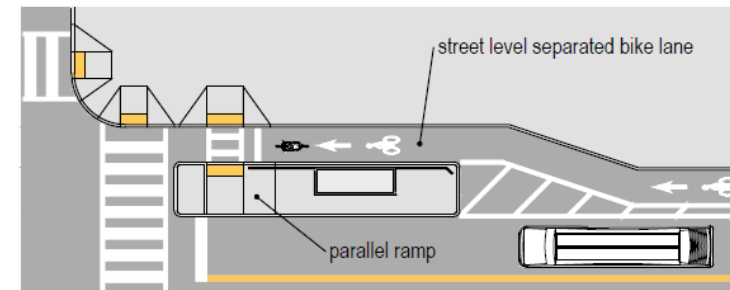


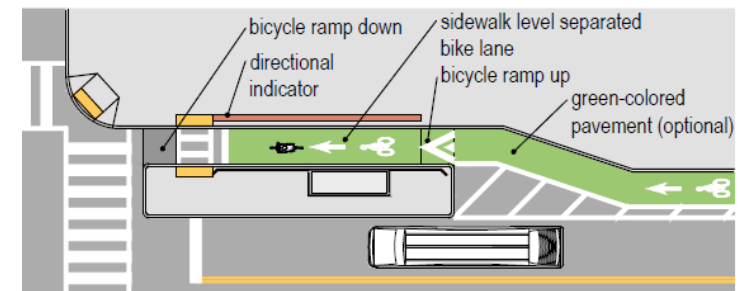
Figure 7-26: Example Configuration: Floating Transit Stop (Mid-Block)



ALTERNATIVE 1



ALTERNATIVE 2



ALTERNATIVE 3

Figure 7-31: Example Configurations: Floating Transit Stop (Near-Side)

Note: Directional indicators are an emerging treatment. See [Section 5.10.8](#) for recommendations for implementation.

7.10. Transitions between Facilities

In general, it is preferable for a transition from a separated bike lane to a standard bicycle lane or shared lane to occur on the far side of the intersection.

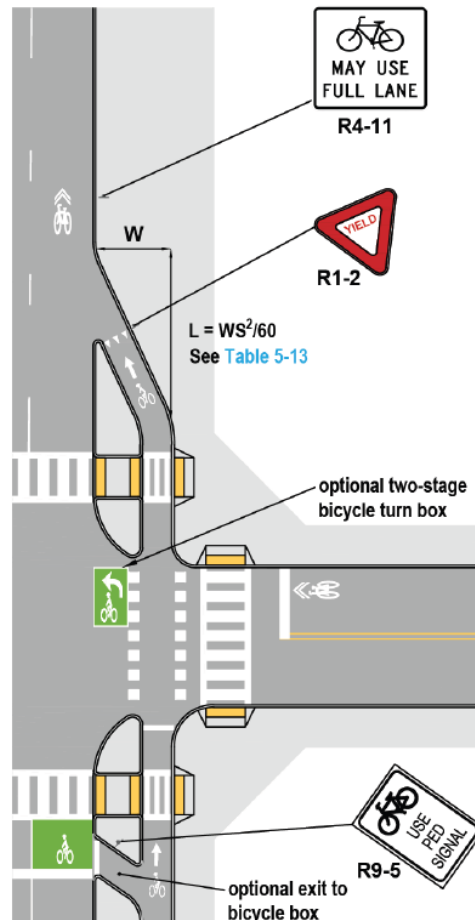


Figure 7-32: Transition to Shared Lane

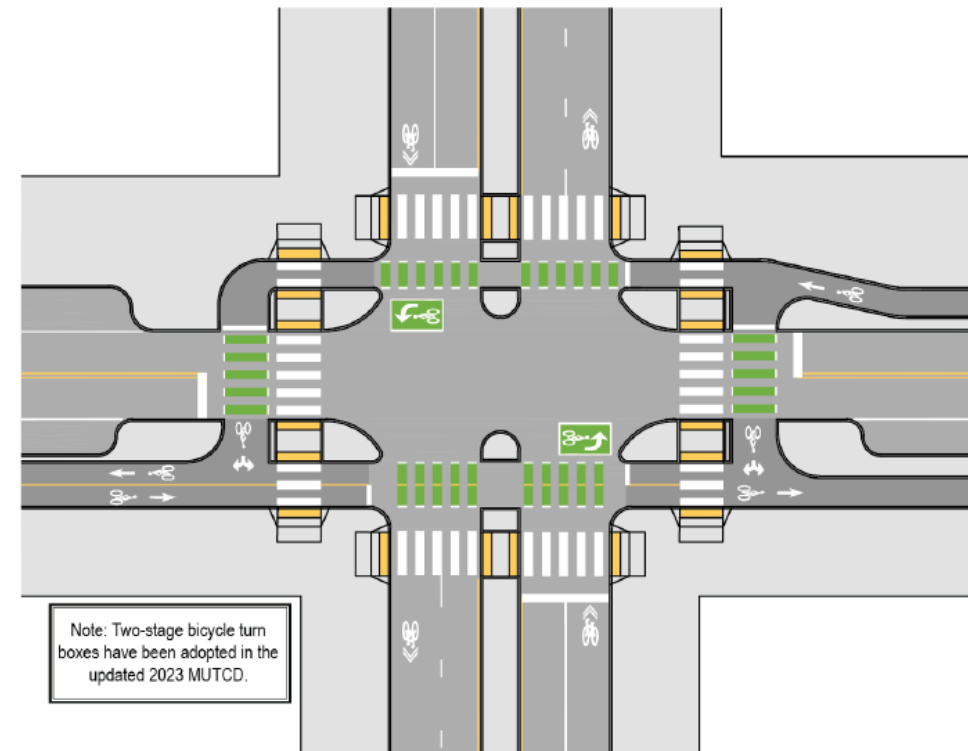


Figure 7-35: Transition from One-Way to Two-Way Separated Bike Lanes at Protected Intersection

7.11. Raised Bike Lanes

Table 7-5: Raised Bike Lane Widths

Raised Bike Lane Widths				
Bike Lane Context	Practical Minimum (ft)	Recommended Lower Limit (ft)	Recommended Upper Limit (ft) ²	Practical Maximum (ft) ²
Intermediate level or sidewalk level raised bike lane ¹	5	6.5	8	10

¹Raised bike lane widths are exclusive of the gutter unless the gutter is integrated into the full widths of the bike lane.

²Separated bike lane with a street buffer may be preferable to a curb-attached, wide raised bike lane.

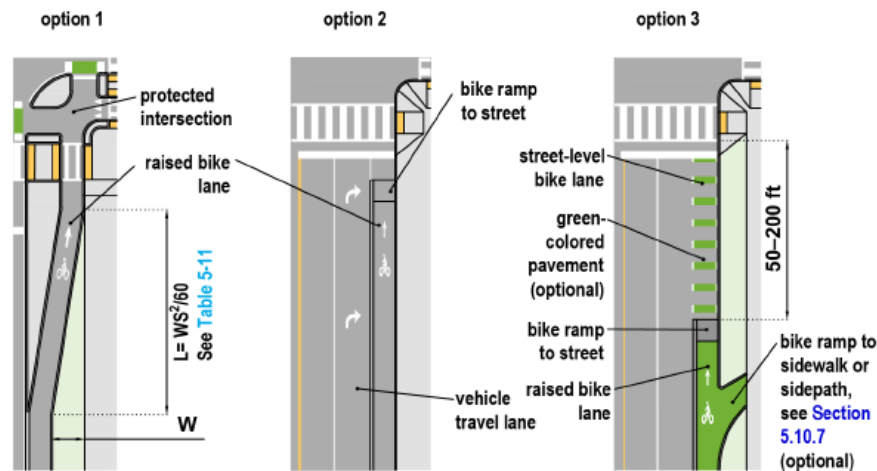


Figure 7-40: Raised Bike Lane Transitions at Intersections

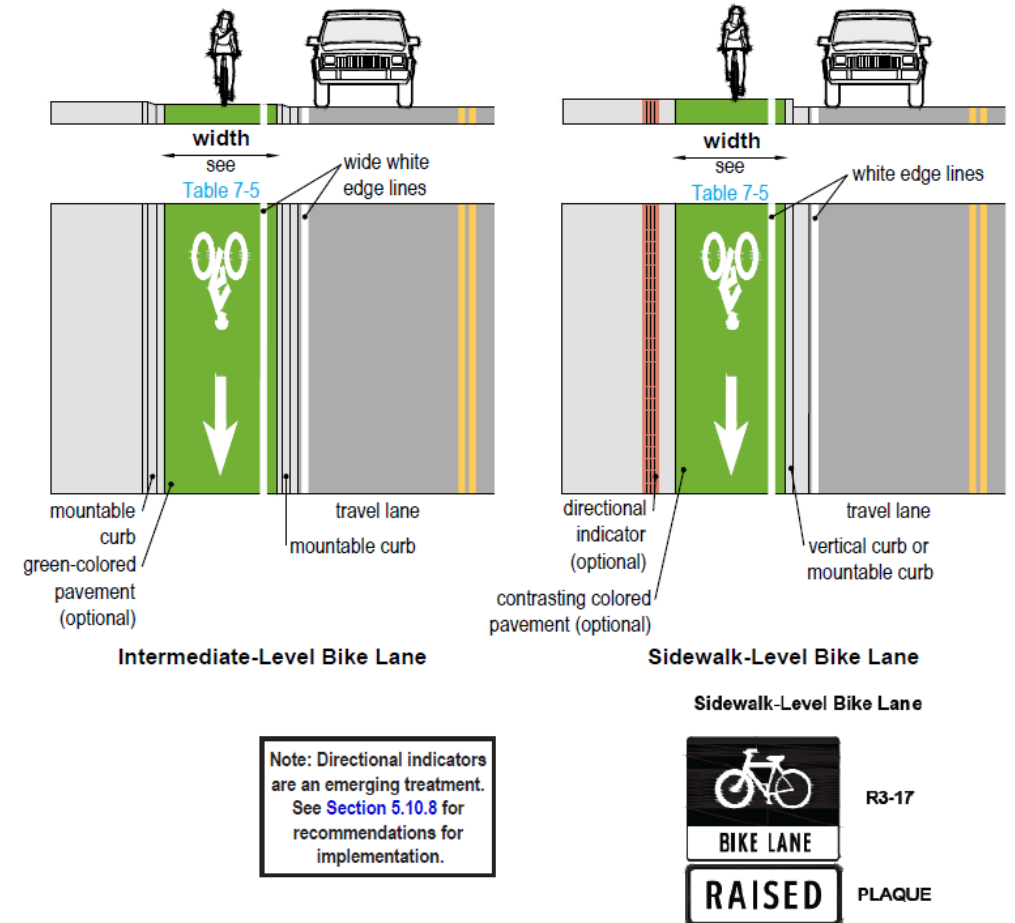


Figure 7-39: Intermediate-Level and Sidewalk-Level Raised Bike Lanes

Section 8.2 – Bicycle Boulevard Principles

Bicycle Boulevards are not just signed bike routes.

Principles that set them apart from local streets include:

- 8.2.1. Manage motorized through traffic volumes and speeds
- 8.2.2. Prioritize right-of-way at local street crossings
- 8.2.3. Provide safe and convenient crossings at major streets

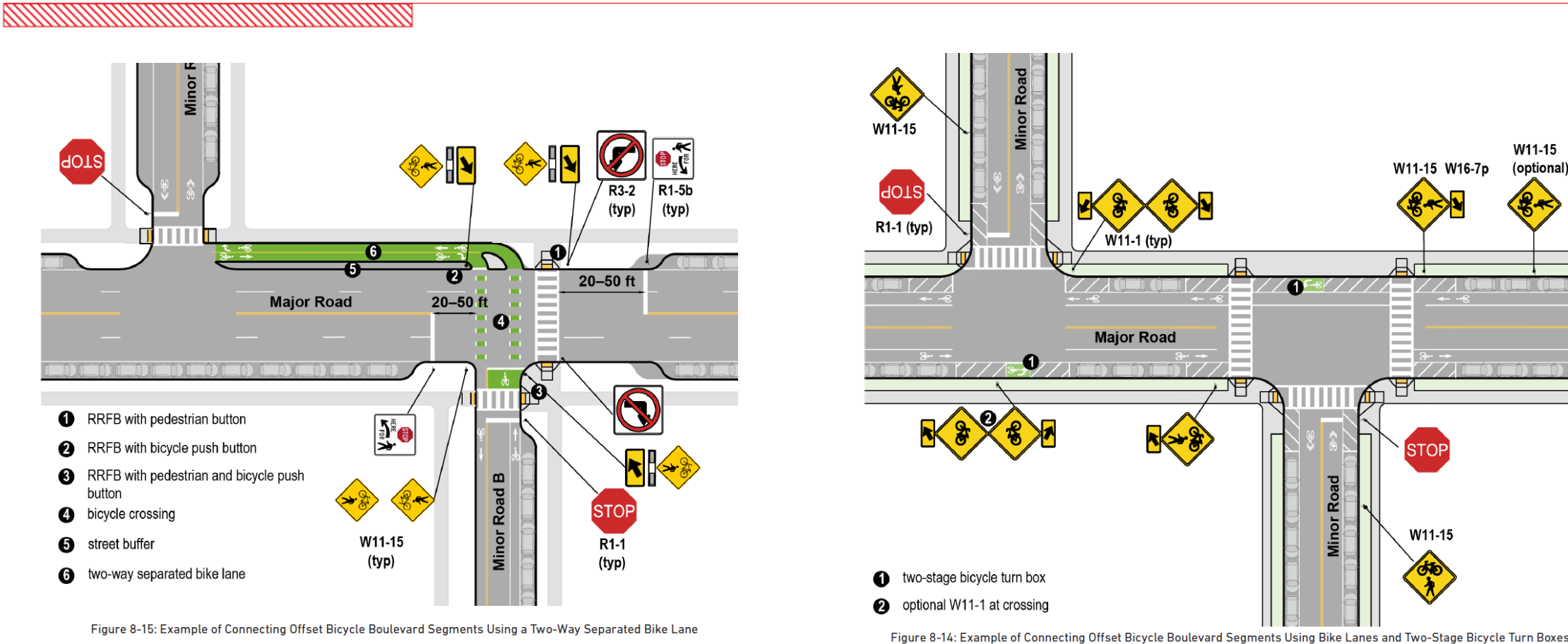
Minimize Motorized Through Traffic Volumes and Speed Differential

	Hourly Traffic Volume	Daily Traffic Volume	Speed
Preferred	50 vehicles/hr	1,000 ADT	15 mph
Acceptable	75 vehicles/hr	2,000 ADT	20 mph
Maximum	100 vehicles/hr	3,000 ADT	25 mph

Major Street Crossings (opportunities per hour)

Preferred	120
Minimum	60

8.7. Traffic Controls for Major Street Crossings



9.3.2. Limited Effectiveness of Wide Outside Lanes

Figure 9-1: Shared Lane Conditions (Rural Context, Suburban Context, Urban Context)

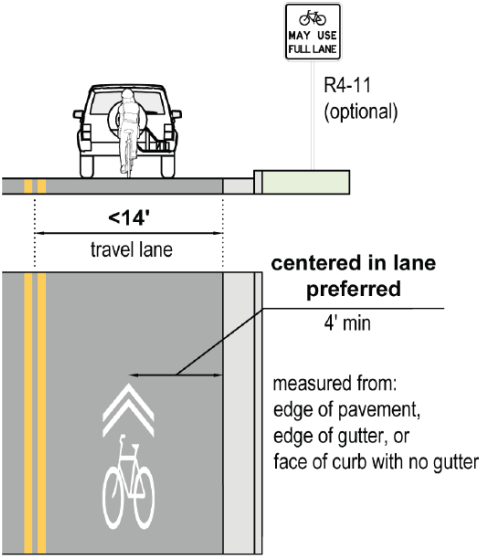


Rural Roadway



Suburban Arterial

Figure 9-3: Shared Lane Marking Lateral Placement in Travel Lanes < 14 Feet Without Parking



IL Passing Law

- 625 ILCS 5/11-703 (d) (2): Motor vehicles shall provide no less than 3 feet separation to pass a bicyclist operating in same direction of travel.



9.4.1. Bicycle Lane Widths

Table 9-1: One-Way Standard Bicycle Lane Widths

One-Way Standard Bike Lane Widths				
Bike Lane Context	Practical Minimum (ft)	Recommended Lower Limit (ft)	Recommended Upper Limit (ft)	Practical Maximum (ft)
Adjacent to edge of Pavement	4 ¹	5	7	8 ³
Adjacent to curb (exclusive of gutter)	5 ¹	6	7	8 ³
Between through lanes and turn lanes ²	5 ¹	6	7	8 ³
Between buffers	4	5	7	8 ³
Adjacent to parking	5	6	7	8 ³
To allow occasional passing or side-by-side bicycling ⁴	6.5	8 ³	10 ³	11 ³

Notes

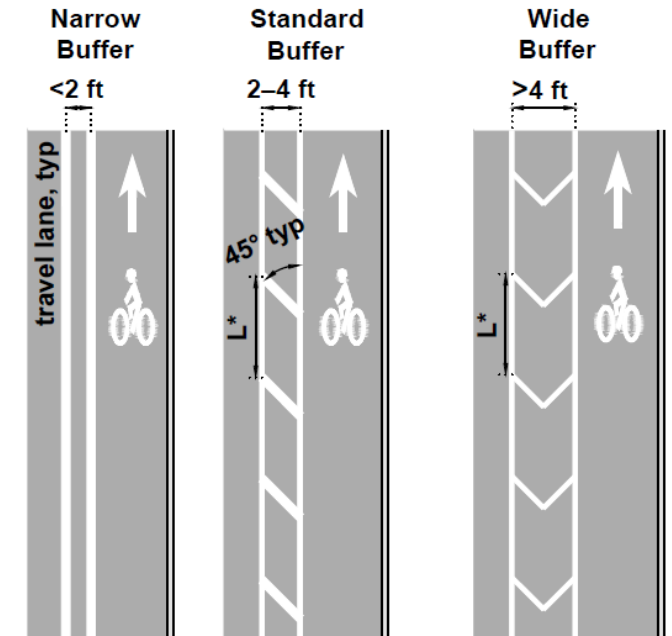
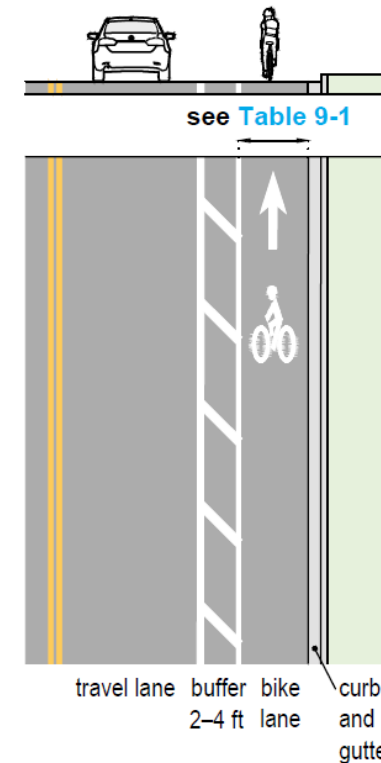
¹Shoulders should be provided in lieu of narrow bicycle lanes to avoid confusion below the practical minimum width.

²Buffers are desirable where bicycle lanes are located between through lanes and turn lanes, especially as motorist speeds exceed 30 mph.

³Buffered bike lanes or separated bike lanes should be considered in lieu of wider bicycle lanes to avoid confusion with a parking or travel lane.

⁴A minimum of 6.5 ft is necessary for occasional passing and 8 ft or more for comfortable side-by-side bicycling.

9.5. Buffered Bicycle Lanes



L = 20 ft (typical); L = posted speed limit (max)

*spacing may be reduced where engineering judgement determines more frequent spacing

*Wider buffers recommended for higher speed and/or higher volume roadways

Figure 9-9: Buffer Design Options

9.6.4. Bicycle Lanes Adjacent to Parallel Parking and Loading

9.6.4.1 Minimum Width Bike Lane Considerations

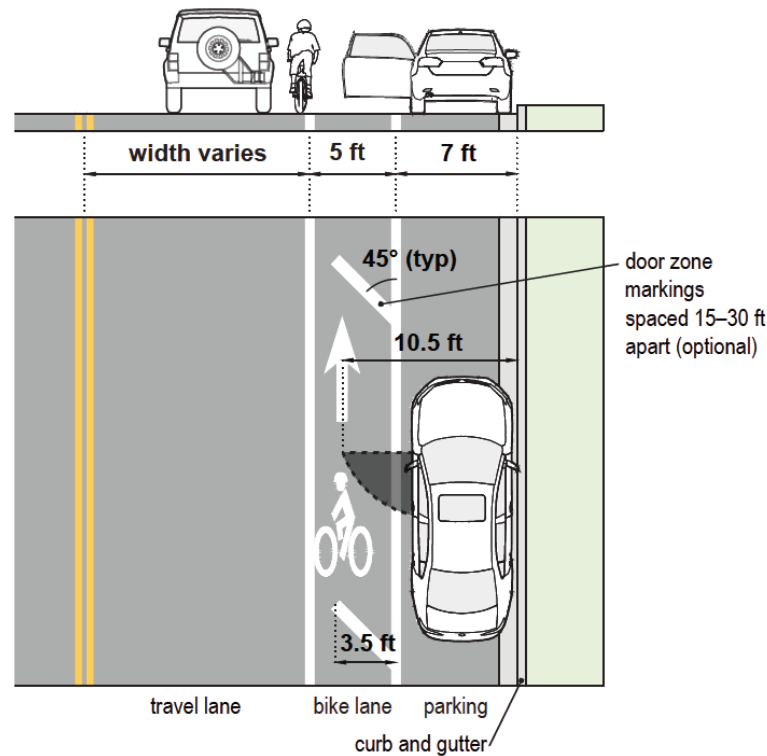
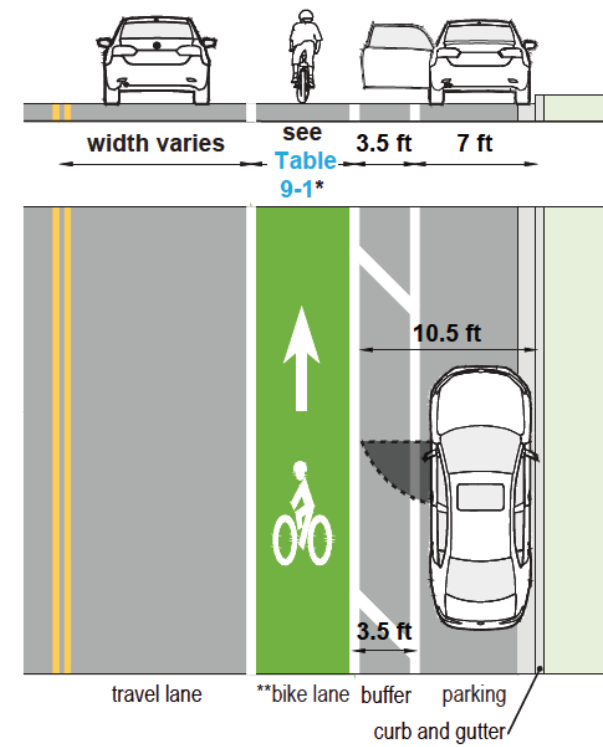


Figure 9-10: Constrained Bike Lane Adjacent to Parking Example



*bike lane may be a minimum of 4 ft if located adjacent to a buffer
**optional green-colored pavement

Figure 9-11: Bike Lane with a Door Zone Buffer adjacent to Parking

10.2.4. Traffic Signal Indication Options for Bicyclists

Bike signal head warrant:

- 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

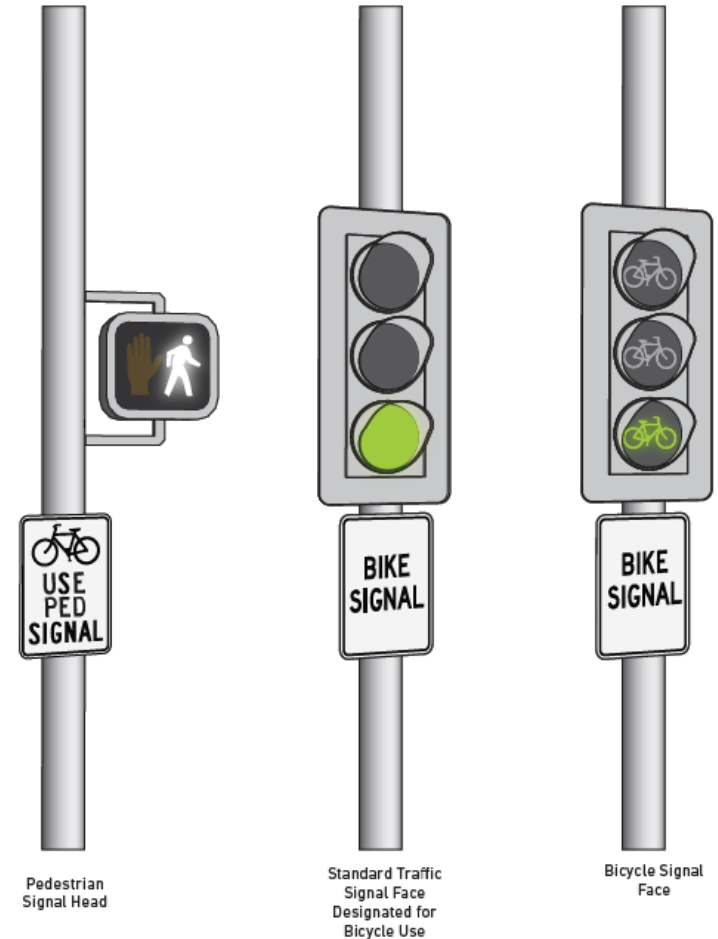


Figure 10-2: Examples of Signal Indication Options for Bicyclists

10.4.1. Green Time, Change Interval and Clearance Intervals for Bicyclists



Vehicle
Minimum Green

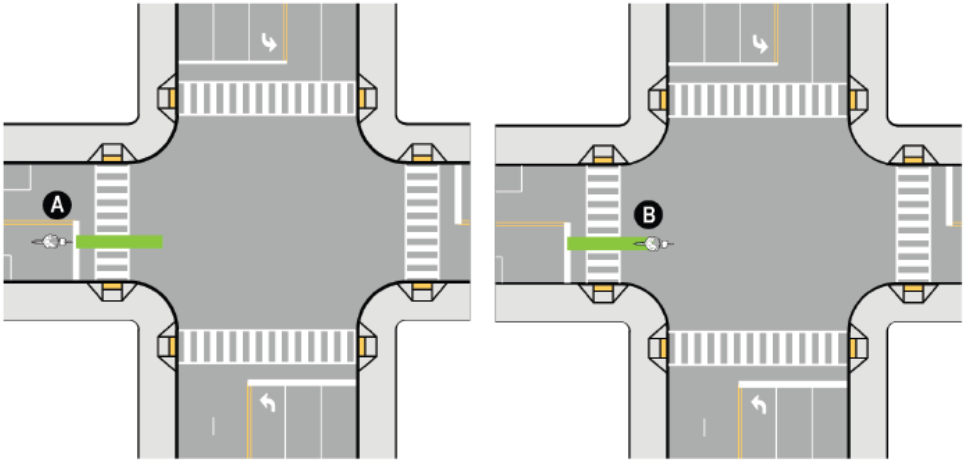
- VS -

Bicycle
Minimum Green

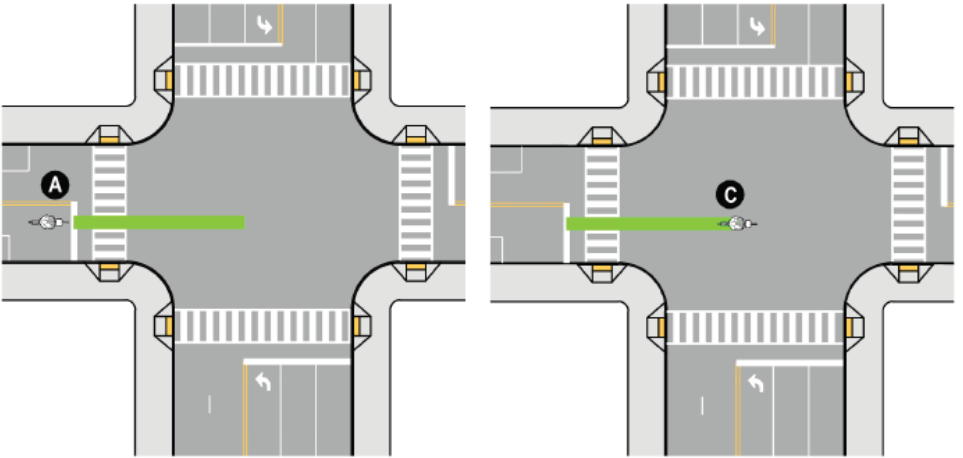
Table 10-2: Bicycle Minimum Green Time Equation

Bicycle Minimum Green Time Equation		
$G_{min} = t + \frac{1.47v}{2a} + \frac{d+L}{1.47v}$		
Where:		
G_{min}	=	bicycle minimum green time (s)
v	=	attained bicycle crossing speed (assumed 8 mph)
t	=	perception reaction time (generally 1.5 s)
a	=	bicycle acceleration (assumed 2.5 ft/s ²)
d	=	distance from stop bar to middle of the intersection (ft)
L	=	typical length of a bicycle (6 ft)

Bicycle Position with Vehicle Minimum Green Time



Bicycle Position with Bicycle Minimum Green Time



legend

- bicycle travel path during minimum green time
- A bicycle position waiting for green
- B bicycle position at end of vehicle minimum green
- C bicycle position at end of bicycle minimum green

11.3. Exit and Entrance Ramps

- On-road and off-road options
- Bike ramp to access to sidewalk
- Sidewalk becomes shared use path
- Perpendicular crossings

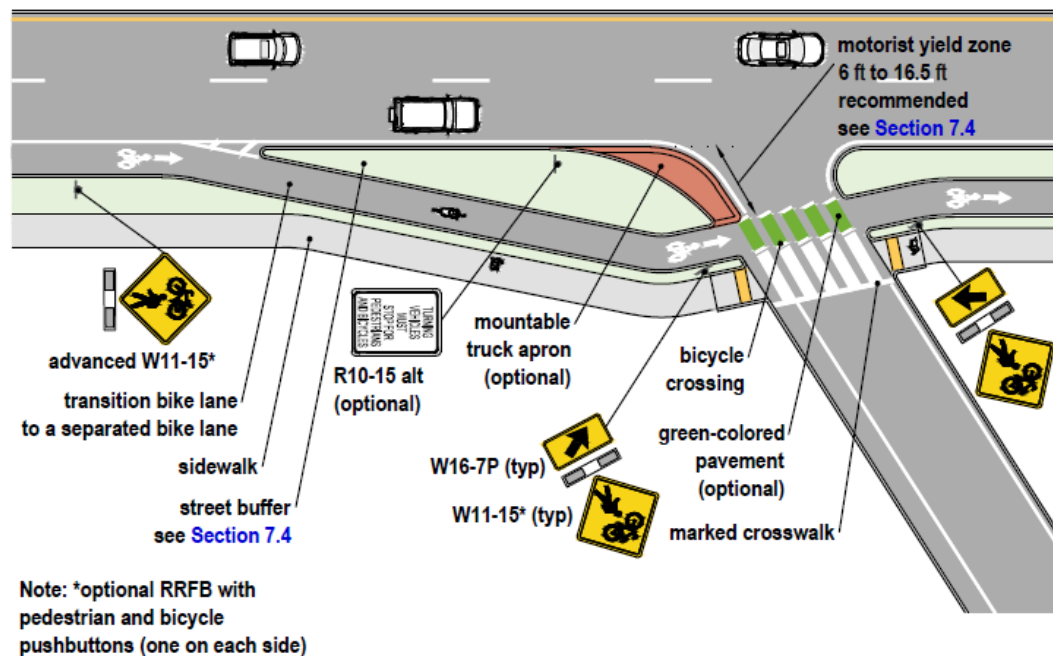


Figure 11-4: Entrance Ramp with Truck Apron and Separated Bike Lane

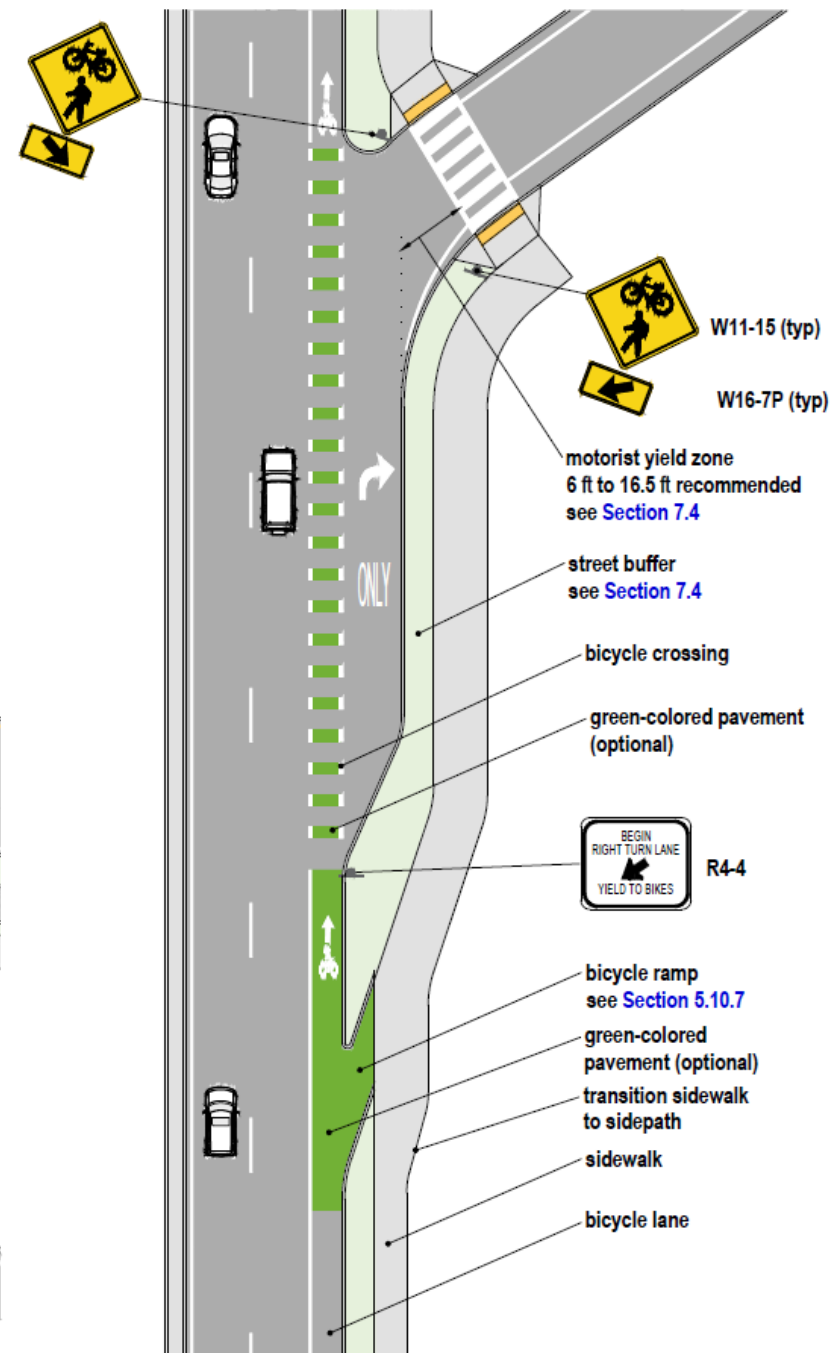


Figure 11-5: Entrance Ramp with Right-Turn Lane, Bike Lane, and Side Path

11.3.3. Merging and Weaving Areas

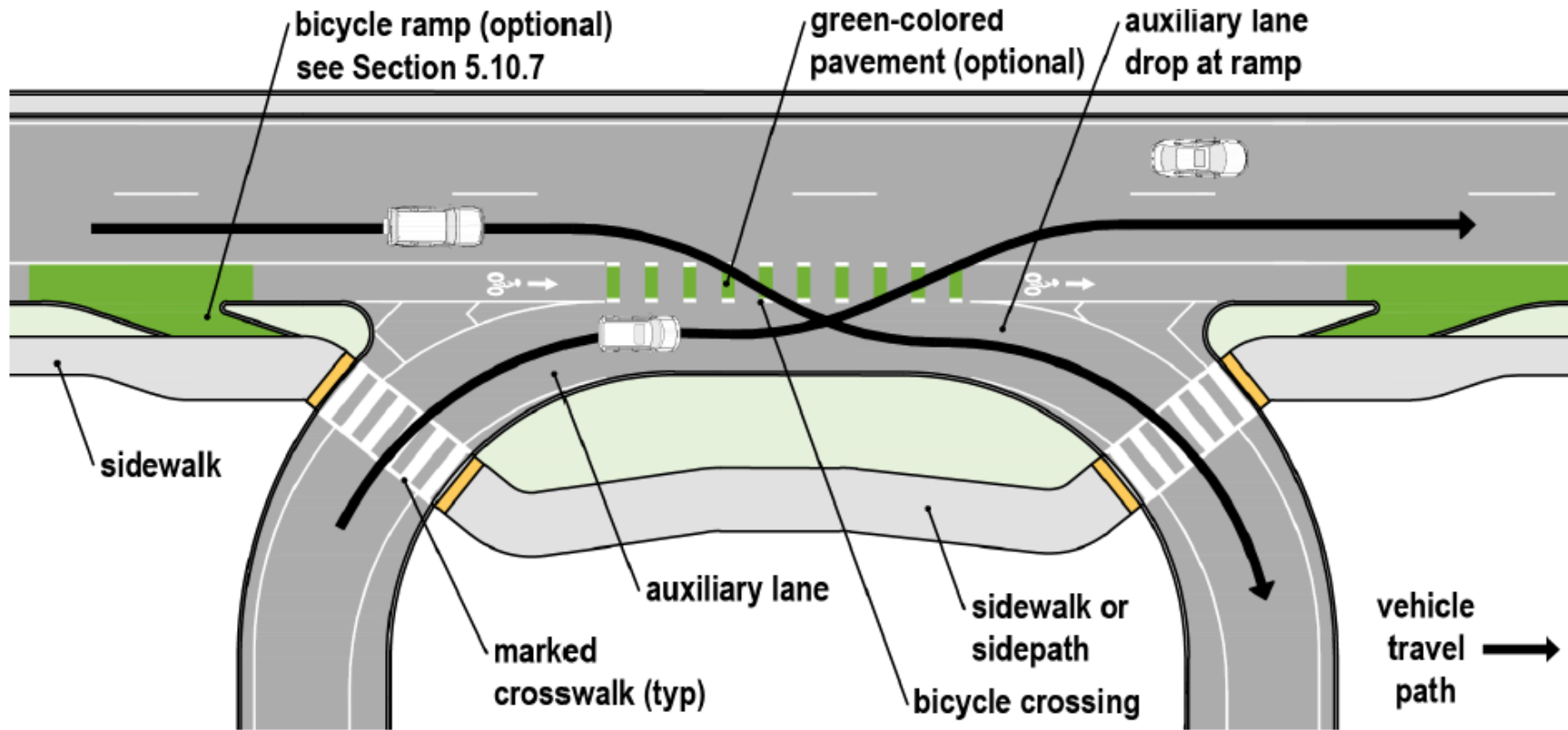


Figure 11-9: Bike Lane Positioned in High-Exposure Weaving Area

11.10. Roundabouts

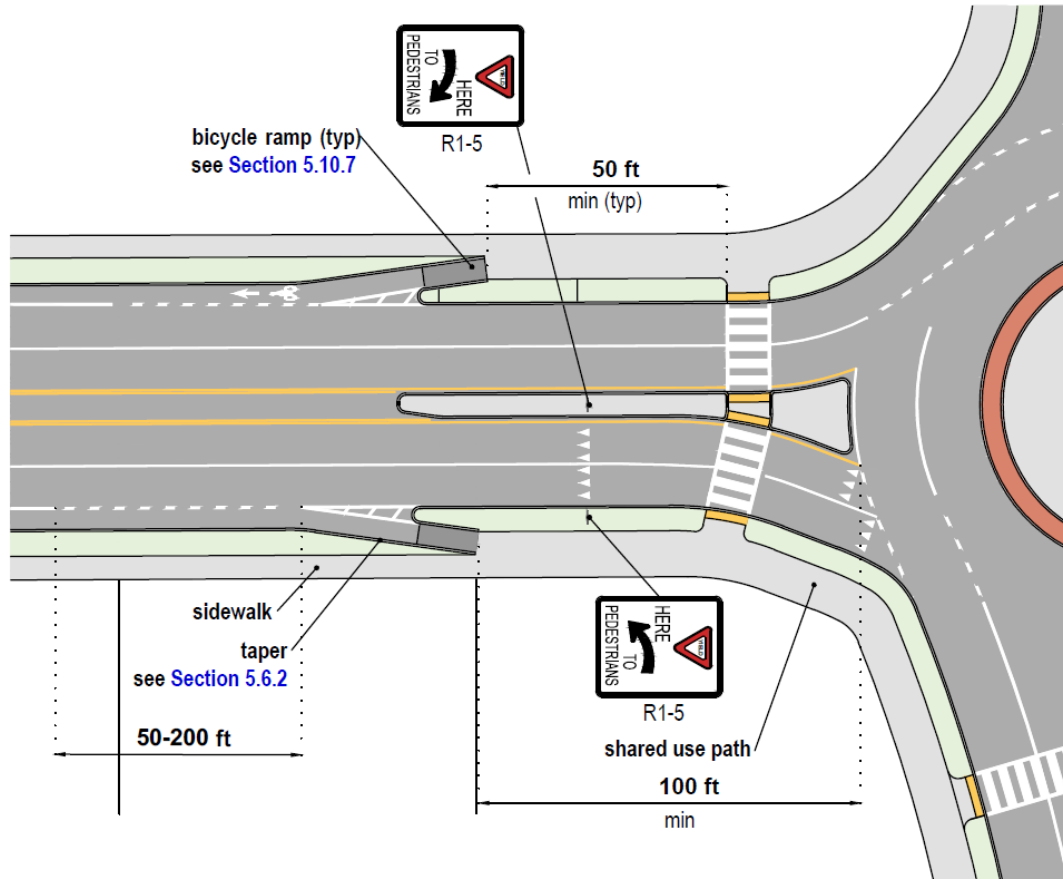


Figure 11-16: Typical Layout of Bike Lane Transitions to Shared Use Path at Multilane Roundabout with Bike Ramps

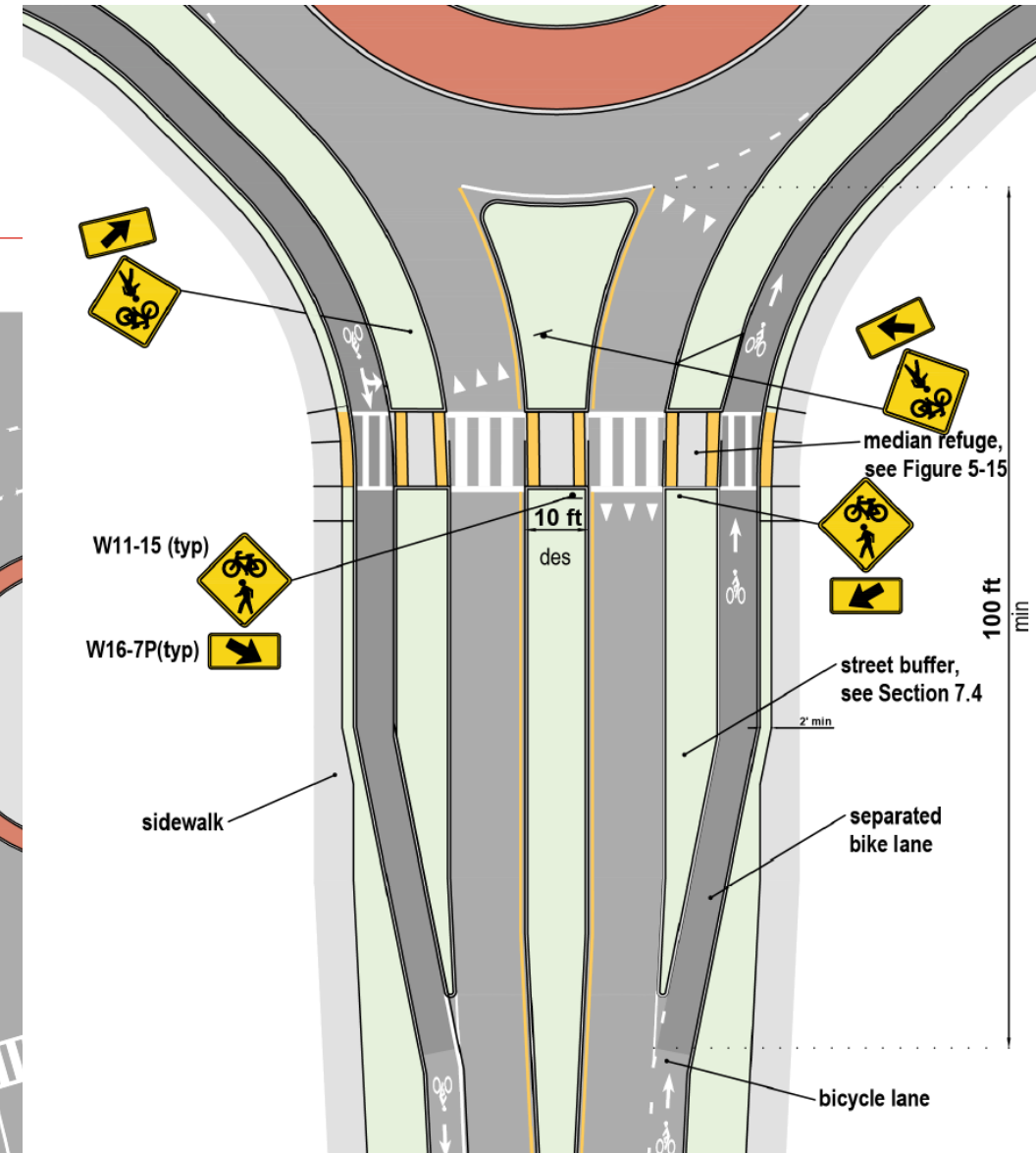


Figure 11-17: Typical Layout of Separated Bike Lanes at Roundabout

12.4.3.2 Widths of Paved Shoulders

Table 12-1: Paved Shoulder Widths for Bicycling (see Chapter 12 References: FHWA, 2016b)

Paved Shoulder Widths Exclusive of Rumble Strips ⁱ for Bicycling				
Design Year Average Daily Traffic (ADT) and Posted Speed (MPH) Thresholds	Practical Minimum ⁱⁱ	Recommended Range		Practical Maximum
		Lower Limit ⁱⁱⁱ	Upper Limit	
< 2,000; all speeds	2 ft	3 ft	5 ft ⁱⁱ	10 ft
2,000 - 6,000; all speeds	2 ft	4 ft	6 ft ⁱⁱ	10 ft
6,000 - 10,000; all speeds	4 ft	6 ft	8 ft ⁱⁱ	10 ft
> 10,000; ≤ 35 mph	5 ft	6 ft	8 ft ⁱⁱⁱ	12 ft ⁱⁱⁱ
> 10,000; > 40 mph ^{iv}	5 ft	6 ft	10 ft ⁱⁱⁱ	12 ft ⁱⁱⁱ

Notes

ⁱSee Section 12.5.1 for rumble strip design considerations.

ⁱⁱWhere roadside barriers, walls, or other vertical elements are present, they should be offset a minimum of 2 ft from the outer edge of the rideable shoulder to provide minimum shy distance to bicyclists (see Section 2.5.3.2.)

ⁱⁱⁱWhere >10 percent of traffic consists of trucks.

^{iv}Shared use paths are preferred.



Figure 12-3: Shoulder Widening on Uphill Section of Roadway to Accommodate Bicycling

12.4.4. Advisory Shoulders (Experimental)

12.4.4. Advisory Shoulders (Experimental)

Similar to advisory bike lanes (see [Section 9.8](#)), advisory shoulders are an experimental design treatment for roads with lower traffic speeds and volumes where it is not feasible to provide standard bike lanes or shoulders for bicycle travel. When motor vehicles traveling in opposite directions meet, motorists may need to enter the advisory shoulder to create sufficient space to pass (see [Figure 12-7](#)). Experimental approval from FHWA is required to use this traffic control treatment. Where sidewalks are not present and it is desired for pedestrians to walk within the advisory shoulders, the advisory shoulder should be accessible to and usable by individuals with disabilities (see [Section 1.6.3](#)). See [Section 1.6.1](#) for guidance on requests to experiment. See [Section 9.8](#) and the FHWA Small Town and Rural Multimodal Networks Guide (see [Chapter 12 References: FHWA, 2016b](#)) for additional design guidance.



Note: The use of this treatment requires a Request to Experiment from FHWA. (See [Section 1.6.1](#))

Figure 12-7: Example of Advisory Shoulders in Hanover, NH

Advisory shoulders may be considered in rural contexts on roads with the following characteristics:

Advisory shoulders may be considered in rural contexts on roads with the following characteristics:

- Low operating speeds
 - < 25 mph preferable
 - < 35 mph maximum
- Low to moderate motor vehicle volumes
 - < 3,000 vehicles/day preferable
 - < 6,000 vehicles/day maximum
- Infrequent heavy vehicles
- Adequate passing sight distance for motorists
- Regular bicycle traffic

If an advisory shoulder is being considered on a low-volume roadway with operating speeds above 35 mph, traffic calming treatments should be implemented to promote operating speeds at or below 35 mph.

13.2. General Design Principles for Structures



Figure 13-1: Bikeway along the Interstate 90 Bridge over Lake Washington, WA

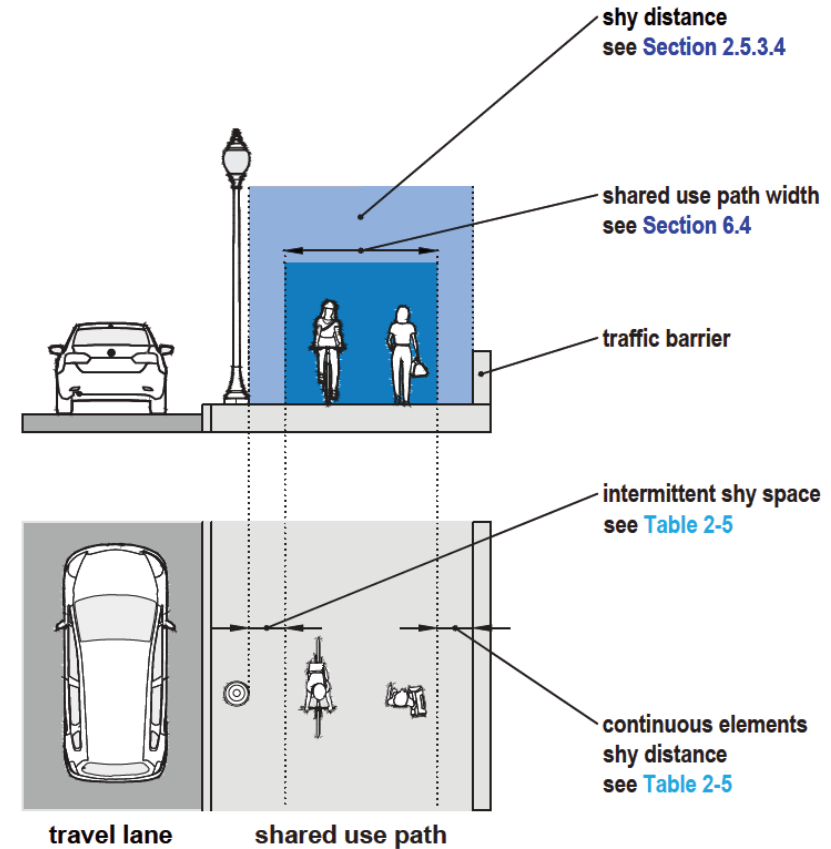


Figure 13-5: Horizontal Clearances for Shared Use Paths on Bridges Along Roads

14.6. Bicycle Wayfinding Sign Assemblies

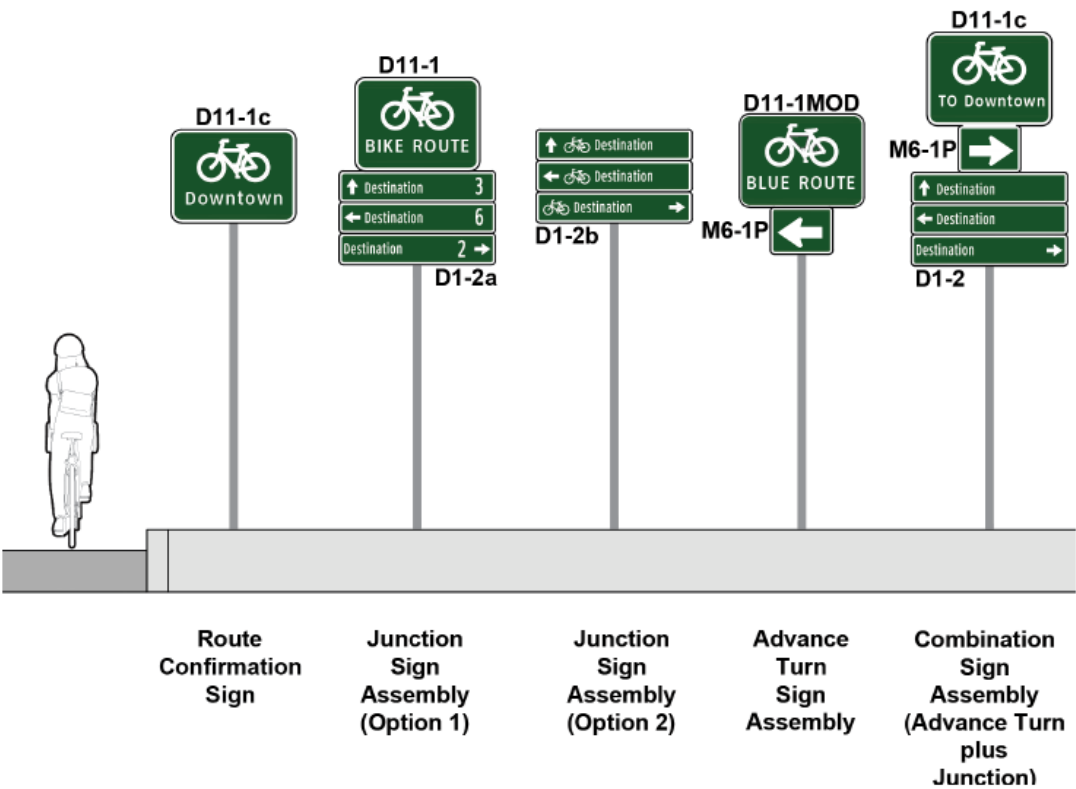


Figure 14-4: Examples of Confirmation, Decision, and Turn Sign Assemblies

Table 14-1: Mileage Rounding Guidelines

Mileage Rounding Guidelines	
Distance (mi)	Guideline
< 0.2	Do not include mileage; blocks are appropriate, if necessary
0.2 - 5.0	Round mileage to the nearest tenth of a mile
> 5.0	Round mileage to the nearest whole mile



Figure 14-7: Example of Community Wayfinding

15.2. Maintenance Policy and Programs



Figure 15-1: Examples of Debris, Faded Markings, and Snow Clearing



Figure 15-4: Fog Sealing a Shared Use Path

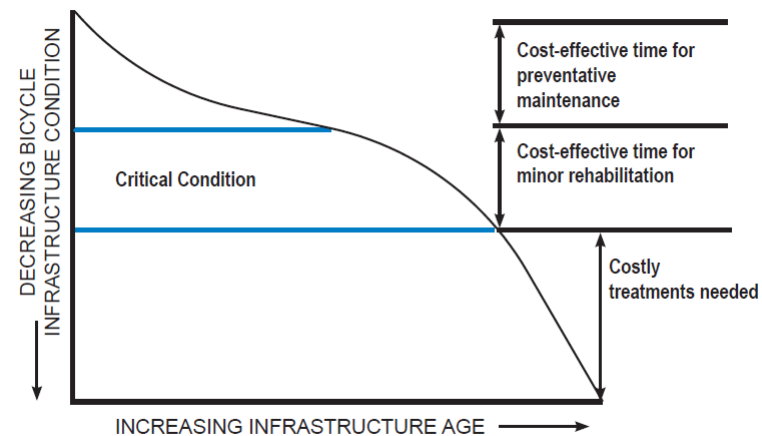


Figure 15-2: Bicycle Infrastructure Life Cycle

Table 15-1: Maintenance Equipment Types

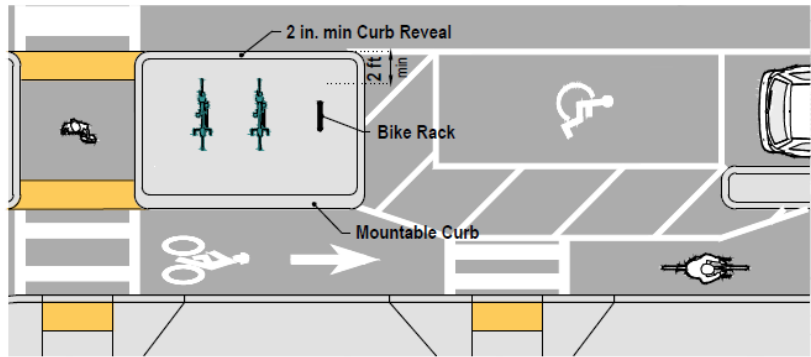
Maintenance Equipment Types				
Type of Equipment	Corresponding Design Vehicle ^a	Width (ft) ^b	Height (ft)	Uses
3-Axle Single Unit Truck	SU-40	8	11-13	highway snow plowing, heavy construction, emergency vehicles
2-Axle Single Unit Truck	SU-30	8	11-13	ambulance, snow plowing, construction, routine maintenance
Pickup Truck	N/A	6-8	6-7	snow plowing, routine maintenance, law enforcement
Typical Skid-Steer Loader	N/A	5.5	6.5	snow plowing, routine maintenance, sweeping
Specialty Equipment	N/A	Varies by manufacturer		Varies

^a For detailed information on vehicle geometry and turning radius, refer to Chapter 2 of AASHTO's *A Policy on Geometric Design of Highways and Streets* (See [Chapter 15 References](#); AASHTO, 2018).

^b Width of attachments such as sweeper brooms or snowplow blades may exceed the width of the vehicle.

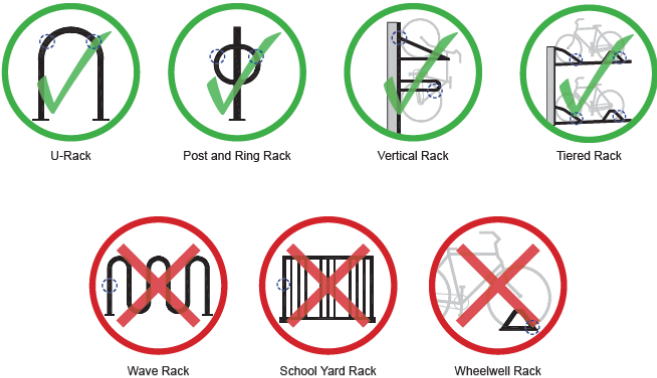
16.3. Short-Term Parking

16.3.4. Example Designs with Unique Considerations



Bike Parking on Raised Median Adjacent to Accessible Car Parking Space

Figure 16-2: On-Street Bicycle Corrals



Note:
 Locking point of a single bicycle on the rack

Figure 16-6: Examples of Recommended and Not Recommended Racks

Table 16-1: Sample Short-Term Bicycle Parking Quantity Requirements

Short-Term Parking Quantities		
Types of Activity	Sample Bicycle Parking Quantities ^a	
	Most Contexts	Urbanized or High Bicycle Mode Share Areas
Multi-unit residential dwellings	0.05 spaces per bedroom	0.10 spaces per bedroom
Libraries and government buildings	One space per 10,000 square ft of floor area	One space per 8,000 square ft of floor area
Church, theatres, stadiums, parks, beaches	Spaces for 2 percent of maximum expected attendance	Spaces for 5 percent of maximum expected attendance
Schools (K-12)	One space per 20 students	1.5 spaces per 20 students
Colleges and universities	One space per 10 students of planned capacity	One space per 10 students of planned capacity
Rail or bus terminals and stations and airports	Spaces for 1.5 percent of a.m. peak passengers	Spaces for 2 percent of a.m. peak passengers
Retail- groceries	One space per 2,000 ft ² of floor area	One space per 2,000 ft ² of floor area
Retail- general	One space per 5,000 ft ² of floor area	One space per 5,000 ft ² of floor area
Office	One space per 20,000 ft ² of floor area	One space per 20,000 ft ² of floor area

^a A minimum of two bike parking spots is recommended in all cases

Adapted from Anderson et al. (2010); see [Chapter 16 References](#).

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