Pedestrian and Bicycle Information Center

AASHTO Bike Guide Webinar Series (Part 1)

Evolution of Bicycle Infrastructure and the AASHTO Bike Guide

Patricia Bush American Association of State Highway and Transportation Officials
Charlotte Claybrooke Washington State Department of Transportation
Hannah Pritchard Minnesota Department of Transportation
Jeremy Chrzan Toole Design

AASHTO Bike Guide Webinar Series

Part 1 6/26/25	Part 2 7/31/25	Part 3 9/11/25
Evolution of Bicycle Infrastructure and the AASHTO Bike Guide	**Design Principles of High-Comfort Bikeways**	**Additional Advances in Bicycling Design**

Follow-on deep dive sessions will be scheduled to address specific topics we identify from feedback following these episodes.

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Pedestrian and Bicycle Information Center

The Evolution of Bicycle Infrastructure and the AASHTO Bike Guide

Webinar 1

Jeremy Chrzan, PE, PTOE, LEED AP
Owner | Multimodal Design Practice Lead
TOOLE DESIGN

June 26, 2025

pedbikeinfo.org
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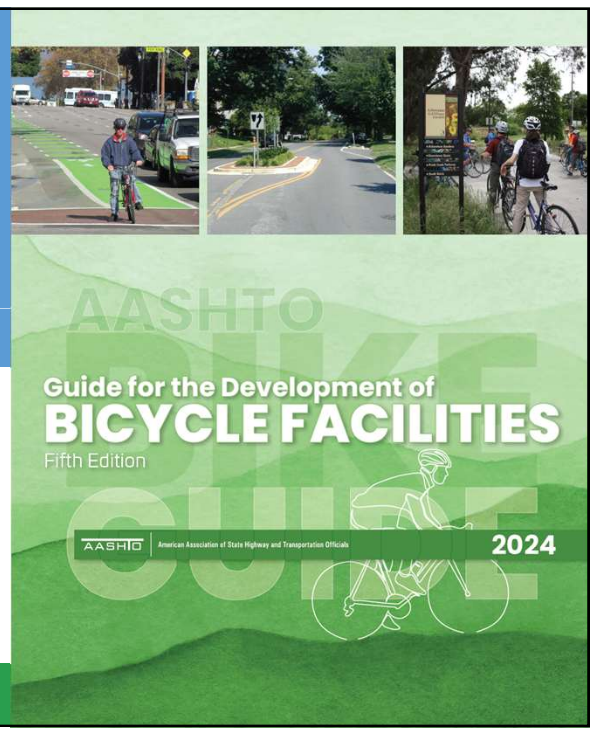
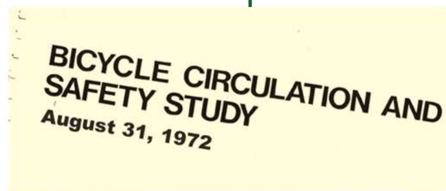
2024 AASHTO Bike Guide 5th Edition



2

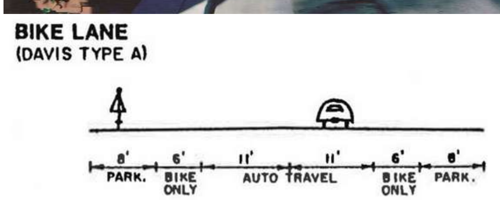
A Historical Perspective on the AASHTO Guide and the Impact of the Vehicular Cycling Movement (2018)

Bill Schultheiss, Rebecca Sanders, and Jennifer Toole

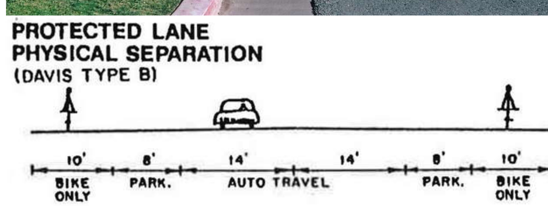

BICYCLE CIRCULATION AND SAFETY STUDY
August 31, 1972

1967 – 1972 Davis California

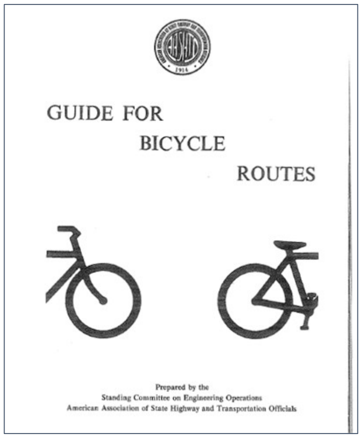
3rd Street Bike Lane
(Rush Hour Parking Restricted)



Sycamore Street
Barrier/Parking Protected Bike Lane



1974 AASHTO Bike Guide



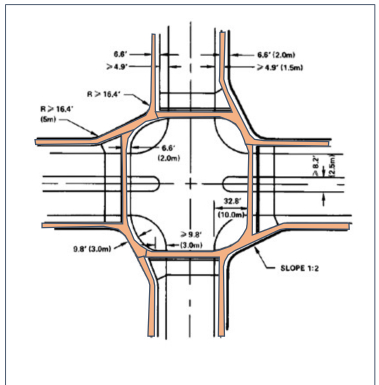
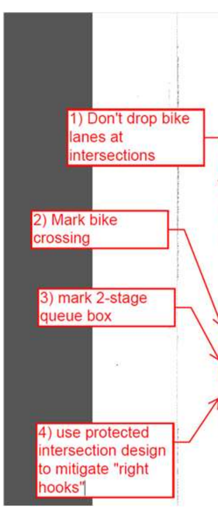


Figure 3.8.14. Recommended Intersection Design for Intersecting Arterial Roads with Bikeways on Each Road. Intersection is Asymmetrically Designed to Provide Bicycle Queue Areas at the Entrance to the Crossings. (Reference 26, p. 23)

Protected Bike Lanes & Intersections

Davis, California 1967

1974 AASHTO Bike Guide



Intersections and Crossings

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

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

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

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

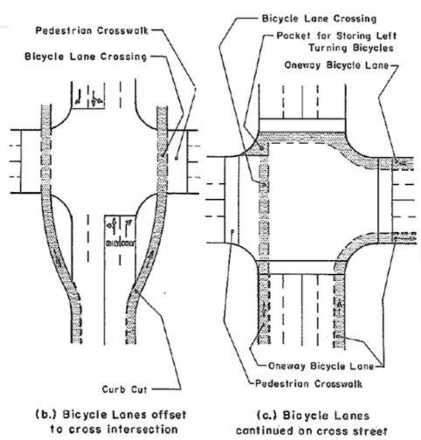
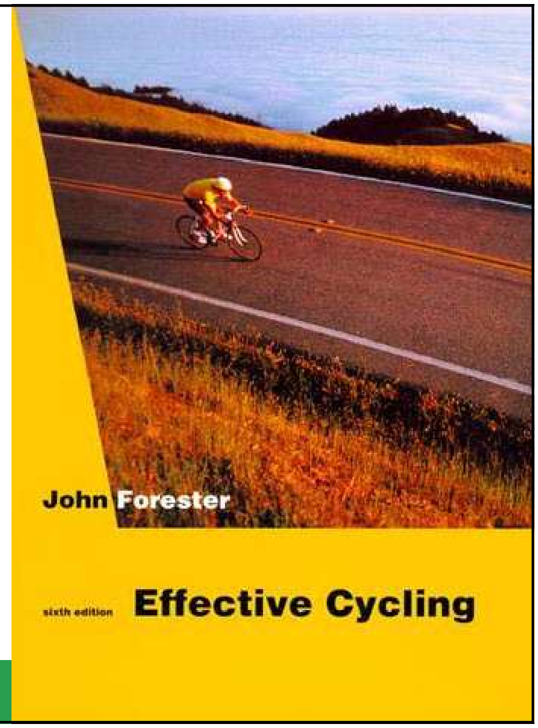


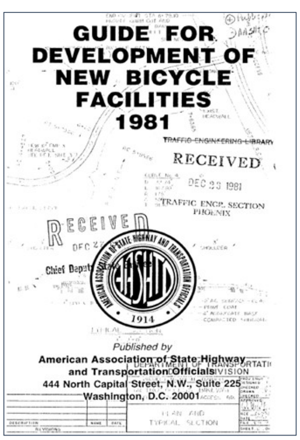
Figure 7
Bicycle Channelization Arrangements
At Street Intersections

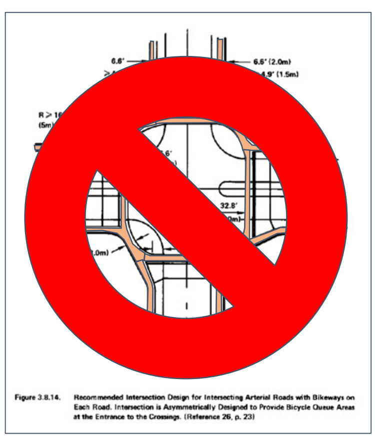
1975 Effective Cycling

"Cyclists fare best when they act and are treated as drivers of vehicles"



1981 AASHTO Bike Guide





Protected Bike Lanes & Intersections

Davis, California 1967

“Communities across the country are all different, but the AASHTO Bike Guide allows each of those communities to learn how to grow, maintain, and operate their bicycle infrastructure – allowing for more transportation options for those who cannot or choose not to drive”

AASHTO Executive Director Jim Tymon

TOOLE DESIGN

Who should the default design user be?

Experienced & Confident Bicyclist

AASHTO 1981 - 2012

Interested but Concerned Bicyclist

AASHTO 2024

10 | 6/26/2025

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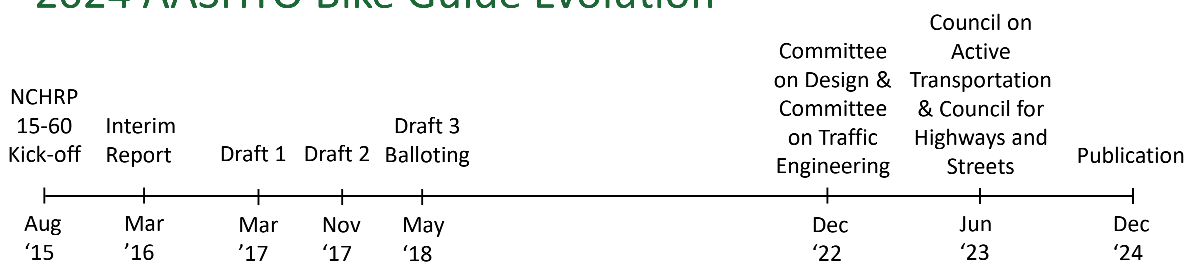
2024 AASHTO Bike Guide Evolution

- Consideration of 2012 balloting comments
- ID and evaluate new and existing bicycle facility types and treatments in the US
- Research review & state of the practice
- Develop framework for selecting appropriate facilities
- Consideration of users of all ages and abilities, including children
- Preparation of common definitions
- Harmonization with applicable standards and guidelines

2024 AASHTO Bike Guide Evolution



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- Develop framework for selecting appropriate facilities
- Consideration of users of all ages and abilities, including children
- Preparation of common definitions
- Harmonization with applicable standards and guidelines

2012 Guide compared to 2024 Guide

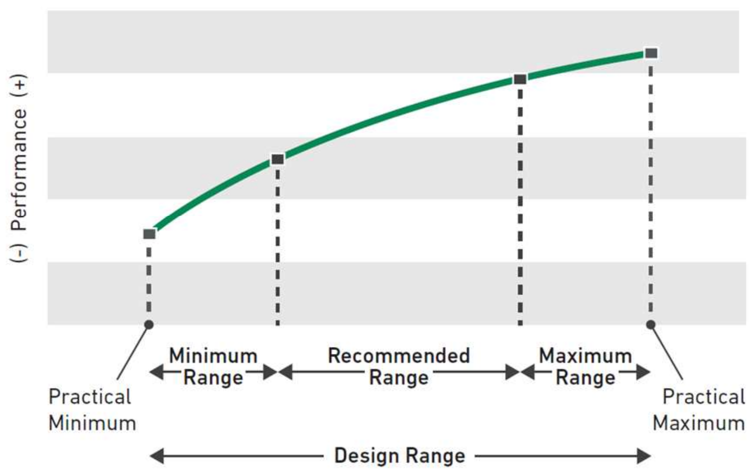
2012 Guide	2024 Guide	Notable Changes of 2024 compared to 2012
Chapter 1. Introduction	1. Introduction	REWRITE with new discussion of design range concept
Chapter 3. Bicycle Operation and Safety	2. Bicycle Operation & Safety	REWRITE of former Chapter 3
Chapter 2. Bicycle Planning	3. Bicycle Planning	REWRITE and NEW CONTENT added to former Chapter 2
	4. Facility Selection	NEW CHAPTER with a few items carried from Chapter 2
	5. Elements of Design	NEW CHAPTER with 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 Alternative Intersections	NEW CHAPTER with new content
	12. Rural Area Bikeways	NEW CHAPTER with some content pulled from Chapter 4
	13. Structures	NEW CHAPTER with some content pulled from Chapter 5
	14. Wayfinding	NEW CHAPTER with 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, Bike Share, & End of Trip Facilities	REVISION of chapter 6

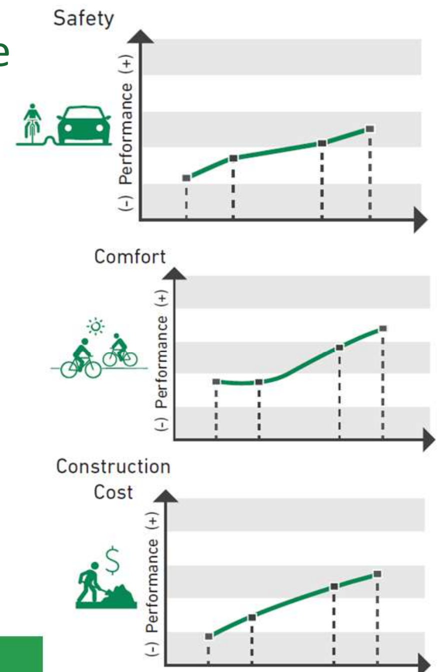
Chapter 1 – Introduction

1.1 Design Imperative for Bicycle Facilities
1.2 Purpose
1.3 Design Flexibility
1.4 Use of Values in the Guide
1.5 Scope
1.6 Relationship to other Design Guides and Manuals
1.7 Structure of this Guide
1.8 Definitions

Section 1.4 – Use of Values in the Guide

Figure 1-1: Design Range

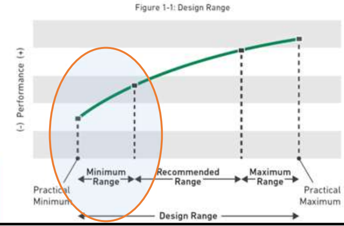




Section 1.4 – Use of Values in the Guide

1.4.1. Minimum Range

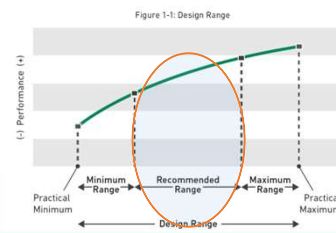
- The use of **values within the minimum range should be minimized** because they are likely to diminish mobility, safety and comfort benefits for bicyclists as well as other users



Section 1.4 – Use of Values in the Guide

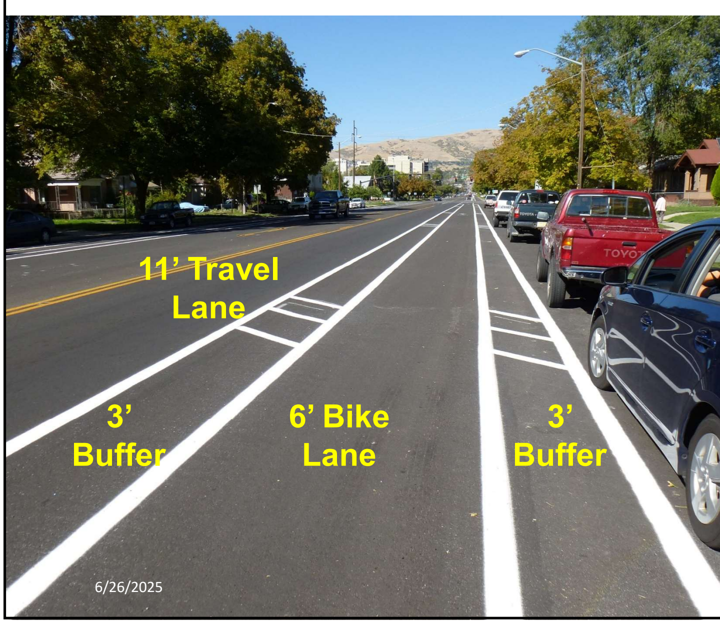
1.4.2. Recommended Values Range

- 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.



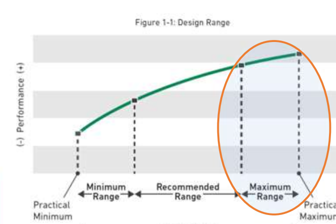
17 6/26/2025

Section 1.4 – Use of Values in the Guide



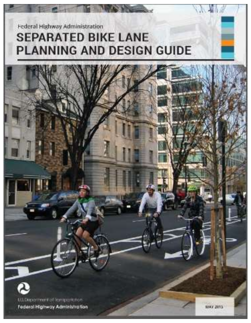
1.4.3. Maximum Range

- 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.



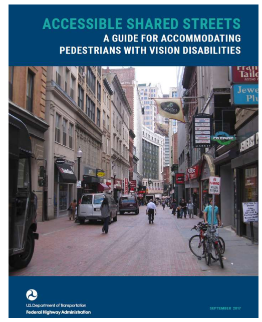
6/26/2025

Section 1.6 - Relationship to Other Manuals

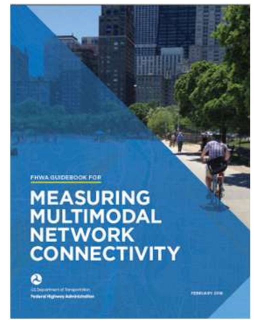


FHWA Separated Bike Lane Planning and Design Guide
May 2015

FHWA Achieving Multimodal Networks
August 2016



FHWA Accessible Shared Streets
September 2017



FHWA Measuring Multimodal Network Connectivity
February 2018

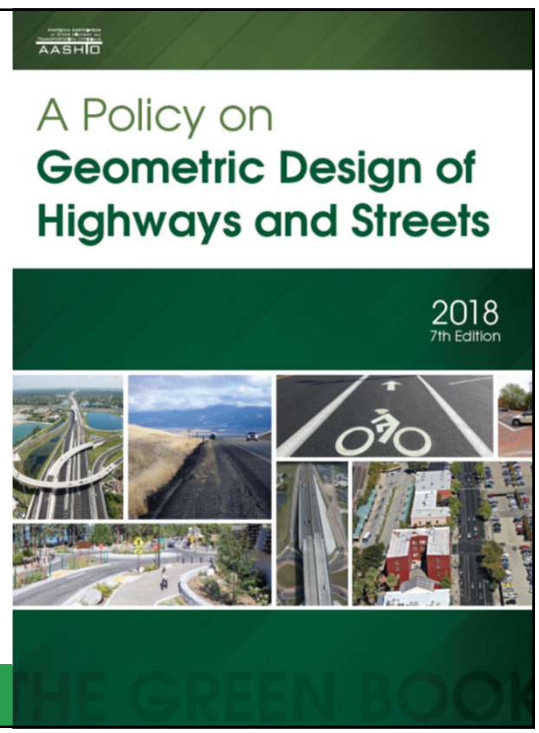
Section 1.6 - Relationship to Other Manuals

AASHTO Green Book

- **All NHS Roads** = design speed, design loading
- **Interstates, freeways, and roadways with design speed** > 50mph: lane width, shoulder width, horizontal curve radius, superelevation rate, maximum grade, stopping sight distance, cross slope, vertical clearance

State and Local Agencies

Adopt their own guidance which may be more stringent than FHWA/AASHTO



> Sufficient flexibility is permitted to encourage independent designs tailored to particular situations.
>
> *-AASHTO Green Book*

TOOLE DESIGN

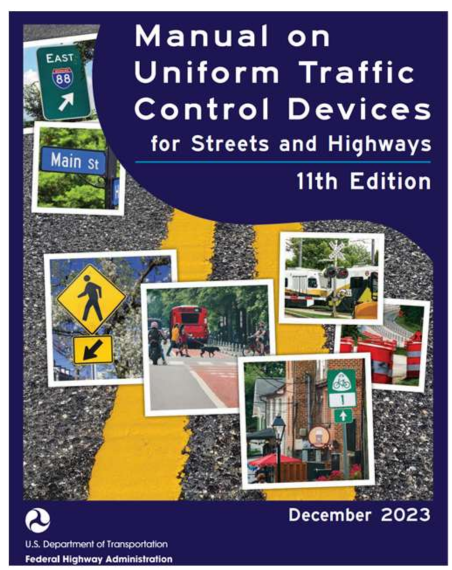
1.6.1. Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD)

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)

<u>AASHTO expands upon the application of TCDs</u>



Experimental Treatments

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

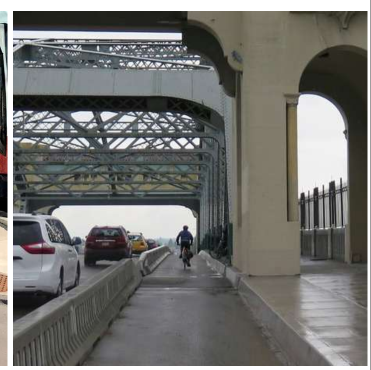
- **Bicyclist Design User Profile** – A **generalized profile of different types of bicyclists based on their comfort when bicycling with motor vehicle traffic**, as well as their bicycling skills and experience. Profiles range from Highly Confident to Somewhat Confident to Interested but Concerned.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

Chapter 2 - Bicycle Operation and Safety

2.2.1. Relationship between Perceived Comfort and Substantive Safety

Research has found a significant relationship between:

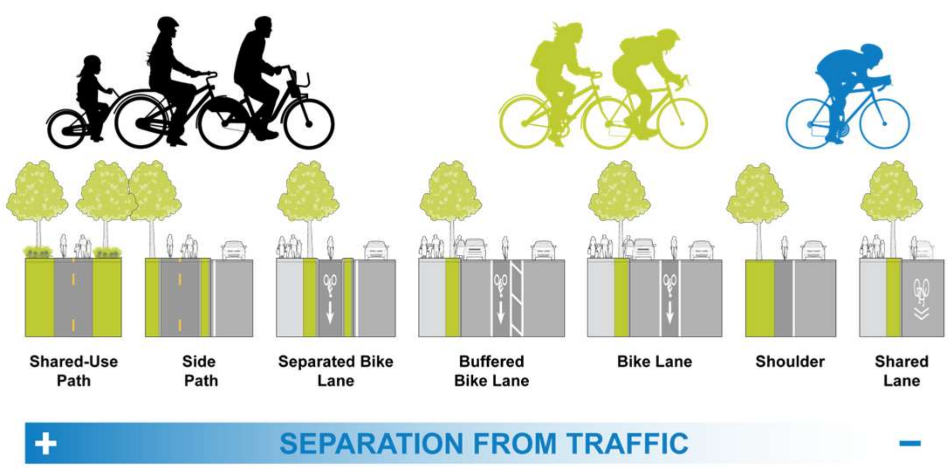
- how safe and comfortable people feel bicycling
- whether and how often they bicycle
- their preferences for facility types
- the provision of those facilities



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)

Comfort Increases with Separation



2.2.2. Safety in Numbers

- **Bicyclist risk** does not increase proportionately to their increased volume, but actually **decreases as the number of bicyclists increases**.

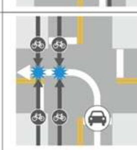
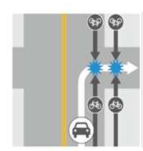
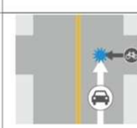
Example
15th Street, NW
Washington DC

Shared Lane
2010: <100 cyclists /day

Separated Bike Lane
2017: 2,500 cyclists /day

2.2.3. Bicyclist Crash Data

- **2% of roadway fatalities**
- **# of crashes steadily increasing**
- **Understand crash data shortcomings**
- **HCM uses CMFs for cost / benefit assessments**
  - **- Lack of CMF for bicyclists**
  - **- Bike volume lower than motorists**
  - **- Suppressed demand not captured**
  - **- Bike crashes undervalued due to minimal property damage costs**

Motorist Pre-Crash Maneuver/ Common Crash Types	Common Contributing Factors to Crash	Visual Examples
Motorist Overtaking Bicyclist • Sideswipe • Rear-End • Bicyclist Left Turn Across Traffic • Motorist Misjudged Space • Bicyclist Swerved • Undetected Bicyclist	These crash types predominantly occur in situations where a motorist and bicyclist are operating in a shared lane. Fatalities are higher where motorists' travel speeds are higher. These crash types represent a high percentage of rural area crashes.	
Motorist Left Turn into Bicyclist ("Left Hook") • Motorist Left Turn into Same Direction Bicyclist • Motorist Left Turn into Opposite Direction Bicyclist (Counterflow Bicyclist)	These crash types commonly occur in situations where a motorist is focused on identifying gaps in on-coming traffic and does not recognize an approaching bicyclist before turning. Counterflow bicyclists on sidewalks are over-represented in this crash type.	
Motorist Right Turn into Bicyclist ("Right Hook") • Motorist Motorist Right Turn into Same Direction Bicyclist • Motorist Right Turn into Opposite Direction Bicyclist (Counterflow Bicyclist)	These crash types commonly occur in situations where a motorist misjudges the speed of the approaching bicyclist or seeks to pass and turn in front of a bicyclist proceeding straight through the intersection. Bicyclists are typically operating in shared lanes when these crashes occur, however, they also occur where bicyclists are traveling on bicycle lanes, separated bicycle lanes, shared use paths or sidewalks. Crashes with freight and other large vehicles on streets without bikeways and crashes with counterflow bicyclists on sidewalks are over-represented in this crash type.	
Motorist Right-Angle into Bicyclist • Bicyclist Failure to Yield • Motorist Failure to Yield • Bicyclist Failure to Clear the Intersection • Bicyclist Ride-Through—Sign or Signal Controlled Intersection • Bicyclist Ride-Through—Signalized Intersection • Motorist Drive-Out—Driveway • Motorist Drive-Through—Controlled Intersection	These crash types commonly occur in situations where a bicyclist misjudges the approaching speed of motorists or is not seen by an approaching motorist as they attempt to cross a road. At signalized intersections bicyclists may not be detected or have sufficient clearance time, or they may have crossed against the light. Bicyclists exiting driveways are also over-represented in this crash type.	 Note: Arrows represent the direction and location of travel for motorists and bicyclists prior to collision.

2.2.5. Contributing Crash Factors Involving Bicyclists

- **Motorists (Speeds, Sizes, Attention)**
- **Freight & Large Vehicles**
- **Wrong-Way Bicycling**
- **Parked Vehicles**
- **Sidewalk Riding**
- **Dusk and Evening Hours**
- **Other Crashes**

Foundational Change in Philosophy Underpinning the Guide

1980 – 2012 AASHTO Bike Guide Design User Profile = Confident Male Recreational Bicyclist

Wide Outside Lanes

Cycling Rates
1-2%

“Vehicular cycling…is faster and more enjoyable…the plain joy of cycling overrides the annoyance of even heavy traffic” - john forester

2.3. Bicyclist Design User Profiles

Comfort Typology of Bicyclists				
Design User Profile	Non-Bicyclist	Interested but Concerned	Somewhat Confident	Highly Confident
Bicycling Preferences	Uncomfortable bicycling in any condition, have no interest in bicycling, or are physically unable to bicycle.	Often not comfortable with bike lanes; may bike on sidewalks even if bike lanes are provided. Prefer off-street or separate bicycle facilities or quiet or traffic-calmed residential roads. May not bike at all if bicycle facilities do not meet needs for perceived comfort.	Generally prefer more separated facilities, but comfortable riding in bicycle lanes or on paved shoulders if need be.	Comfortable riding with traffic; will use roads without bike lanes.
Percent of Population	31–37%	51–56%	5–9%	4–7%

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

2.4 – Safety and Performance Characteristics by Age

Children: 6.5 – 11.5 mph

Adults:

- Median Speed: 9.7 mph
- Design Speed: 15 mph

Reaction Time:

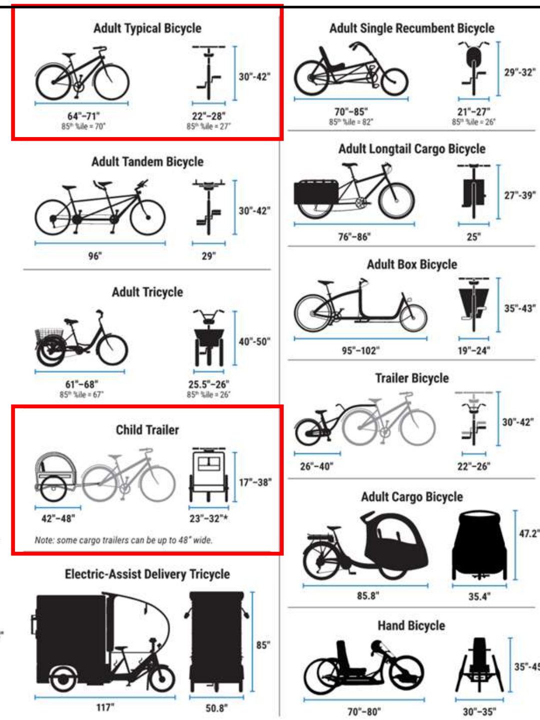
- 1.5 seconds (expected stop)
- 2.5 seconds (unexpected stop)

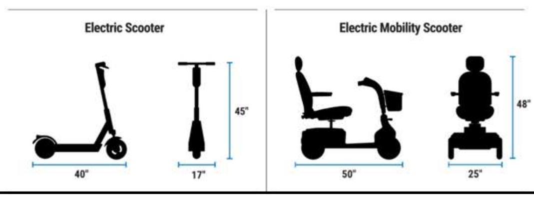
Typical Adult Upright Bicyclist Performance Characteristics

Feature	Value	Recommended Default Design Value
Speed, paved level terrain	8.0–15.0 mph	15 mph design speed 8.0 mph (intersection crossing speed) 11 mph (intersection approach speed)[b]
Speed, downhill[c]	For every 1% increase in downhill grade, speed is increased by 0.53 mph.	—
Speed, uphill[c]	For every 1% increase in uphill grade, speed is reduced by 0.90 mph.	—
Perception reaction time	1.0–2.5 s	1.5 s[a] (expected stop) 2.5 s[a] (unexpected stop)[b]
Acceleration rate[d]	2.0–5.0 ft/s^2	2.5 ft/s^2
Coefficient of friction for braking, dry level pavement	0.1–0.8	0.32[e]
Coefficient of friction for braking, wet level pavement	0.16	0.16
Deceleration rate (dry level pavement)[e]	8.0–10.0 ft/s^2	10.0 ft/s^2
Deceleration rate for wet conditions	2.0–5.0 ft/s^2	5.0 ft/s^2

2.5. Types of Bikes

- Typical Design Vehicle: Adult bike + Trailer
- 10’ Length for refuge medians
- 10’-15’ Turn Radius – 5’ Minimum
- Recommendations will accommodate scooters and most other micromobility





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2.5.3. Bicyclist Operating Space

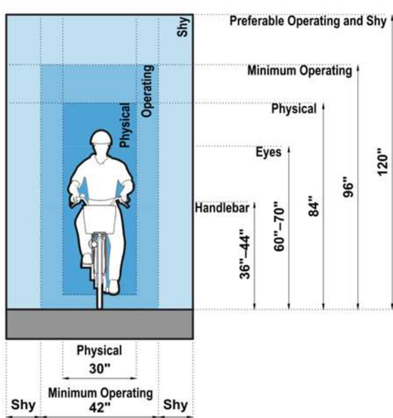

Figure 2-5: Typical Adult Bicyclist Operating Space

Table 2-5: Bicyclist Lateral Shy Distance to Physical Elements

Physical Element	Shy Distance (in.)	
	Practical Minimum	Recommended Range
Intermittent Elements (such as tree, flex post, pole)*	0	24–36
Traffic Signs and Supportive Posts on Curbed Roadways	12	24–36
Traffic Signs and Supportive Posts adjacent to Shared Use Paths	24	36–48
Continuous Elements (such as fence, railing, planter)	12	24–36
Vertical Curbs	6	12–24
Mountable or Sloping Curbs	0	6–12

** To reduce crash risks, eliminating the shy distance is not preferable as any additional shy distance will be beneficial.*

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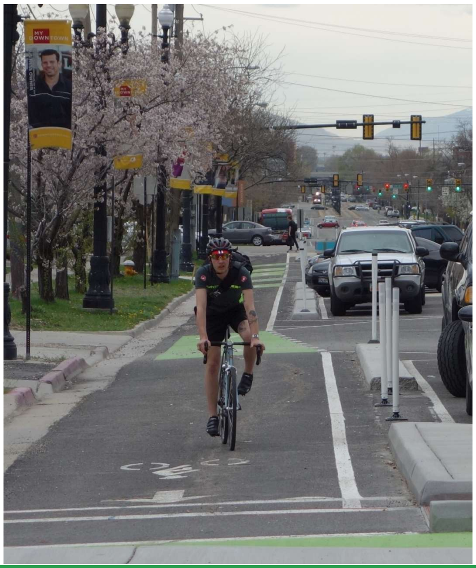
2.7. Guiding Principles for Bicyclist Safety



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

Chapter 3: Bicycle Planning

3.2 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

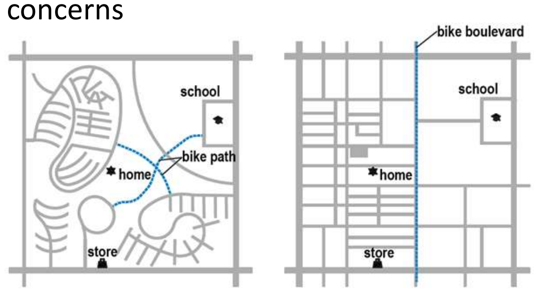


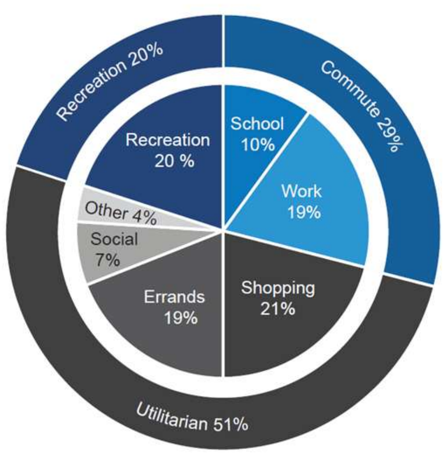
Figure 3-1: Examples of Contrasting Connectivity

Section 3.3 – Primary Considerations for Bicycle Planning

90% of bike trips are under 5 miles

Trip purpose varies

Planning for non-discretionary bicycling



Section 3.4 – Networks Designed for Intended Users

- **Low-Stress Bicycle Network** - is designed to be safe and comfortable for all users. These support All Ages and Abilities (≈ 72% of public)
- **Baseline Bikeway Network** - consist primarily of bicycle lanes and shoulders. These networks support Highly Confident Bicyclists and some Somewhat Confident Bicyclists (≈ 16%)
- **Traffic Tolerant Network** - all roads and paths on which bicycling is legally allowed. These networks support Highly Confident Bicyclists (≈ 4%)

≈ 72% : everyone

≈ 4%

3.9.2. Quality of Service and Bicycle Level of Service Tools

3.9.2.2 Level of Traffic Stress

objective and quantitative method of classifying road segments and bikeway networks based on how comfortable bicyclists

Figure 3-3: Example of Bicycle Master Plan Recommendations Map[34]

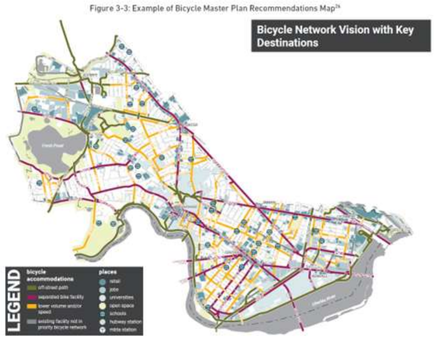


Table 3-4: Levels of Traffic Stress[32]

Levels of Traffic Stress (LTS)	
LTS 1	Presenting little traffic stress and demanding little attention from cyclists, and attractive enough for a relaxing bike ride. Suitable for almost all cyclists, including children trained to safely cross intersections. On links, cyclists are either physically separated from traffic, or are in an exclusive bikeway next to a slow traffic stream with no more than one lane per direction, or are on a shared road where they interact with only occasional motor vehicles (as opposed to a stream of traffic) with a low speed differential. Where cyclists ride alongside a parking lane, they have ample operating space outside the zone into which car doors are opened. Intersections are easy to approach and cross.
LTS 2	Presenting little traffic stress and therefore suitable to most adult cyclists but demanding more attention than might be expected from children. On links, cyclists are either physically separated from traffic, or are in an exclusive bicycling zone next to a well-confined traffic stream with adequate clearance from a parking lane, or are on a shared road where they interact with only occasional motor vehicles (as opposed to a stream of traffic) with a low speed differential. Where a bike lane lies between a through lane and a right-turn lane, it is configured to give cyclists unambiguous priority where motor vehicles cross the bike lane and to keep speeds in the right-turn lane comparable to bicycling speeds. Crossings are not difficult for most adults.
LTS 3	More traffic stress than LTS 2, yet markedly less than the stress of integrating with multilane traffic, and therefore welcome to many people currently riding bikes in American cities. Offering cyclists either an exclusive bikeway next to moderate-speed traffic or shared lanes on streets that are not multilane and have moderately low speed. Crossing may be longer or across higher-speed roads than allowed by LTS 2, but still considered acceptably safe to most adult bicyclists.
LTS 4	A level of stress beyond LTS 3. Bicyclist mix with motor vehicle traffic. Generally uncomfortable for most adults.

3.9.4. Bicycle Travel Demand Analysis and Volume Estimation

Demand Analysis

Assumptions regarding how many people would bike if conditions were conducive to biking based on land use information and other relevant variables

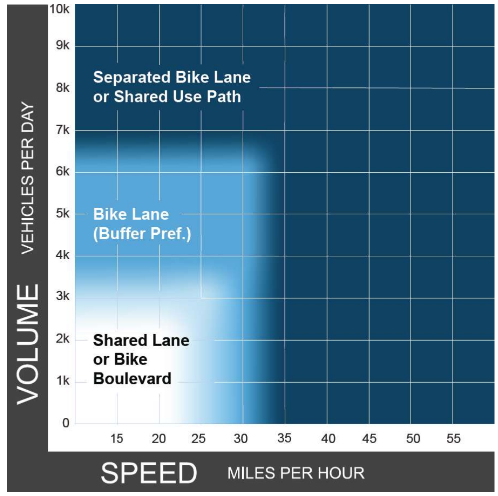
- **Population Density**
- **Destinations**
- **Bicycle Network (existing & planned)**

Chapter 4 - Guidance for Choosing a Bikeway Type

4.1 Introduction
4.2 Project Performance Goals and Objectives
4.3 Selecting the Preferred Bikeway Type
4.4 Strategies to Achieve the Preferred (or Next Best) Design
4.5 Evaluating Design Alternatives and Trade-offs to Select a Bikeway

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



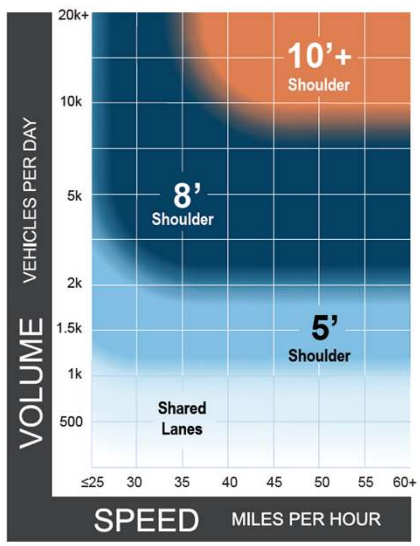
Section 4.3.2 – Rural Roadways

Identifies the **preferred** shoulder width assuming:

Design User = highly confident cyclist

Analysis = Bicycle LOS

Figure 4-2: Preferred Paved Shoulder Widths for Rural Roadways to Accommodate Highly Confident or Somewhat Confident Bicyclists



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Section 4.3.2 – Rural Roadways

Other Considerations:

It may be preferable to provide a shared use path separated from the road:

- In locations with larger volumes of bicycling
- Between key bicycle destinations,
- For routes serving families and children

Section 4.3.3 – Conditions Where Increasing Separation from Motor Vehicles is Appropriate

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

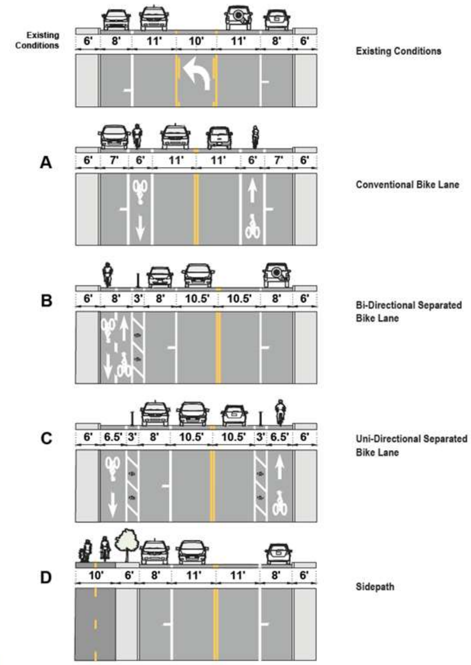


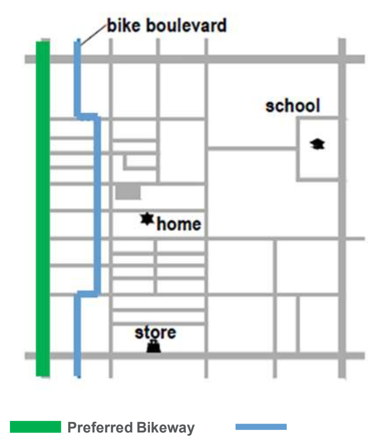
Figure 4-3: Common Bikeway Options within a 48-ft Cross Section

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



Thank you!
Questions?

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TOOLE DESIGN

Discussion

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