Introductions & Welcome
Chapter 1: Purpose of the Guide

The Federal Highway Administration’s Bikeway Selection Guide is a resource to help transportation practitioners consider and make informed trade-off decisions relating to the selection of bikeway types.
It is intended to supplement planning and engineering judgment.
It incorporates and builds upon FHWA’s support for design flexibility to assist transportation agencies in the development of connected, safe, and comfortable bicycle networks that meet the needs of people of all ages and abilities.
Chapter 1: Introduction
Purpose of the Guide

FHWA goals

- Increase the number of short trips made by bicycling and walking to 30% by 2025
- Reduce pedestrian and bicyclist fatalities
  - by 80% in 15 years
  - to zero in 20 – 30 years
Disclaimer

This guide IS NOT a design guide. It’s sole purpose is to help practitioners make informed decisions for selecting a bikeway.
Chapter 1: Introduction
Bikeway Selection Guide Supports

FHWA  
AASHTO  
NACTO & ITE
Chapter 1: Introduction
Bikeway Selection Guide Complements

- FHWA Separated Bike Lane Planning and Design Guide
  - May 2013
- FHWA Achieving Multimodal Networks
  - August 2016
- FHWA Accessible Shared Streets
  - September 2017
- FHWA Measuring Multimodal Network Connectivity
  - February 2018
2017 North Texas Regional Bicycle Opinion Survey
Bicycle Opinion Survey Background

- Statistically Valid Survey Conducted by Telephone During the Month of May 2017
- 95% Confidence Interval
- Conducted in English and Spanish
- Survey Area: 12-County MPA Region (also includes county-level results)
- A Total of 1,909 Interviews Conducted with Respondents Over the Age of 18
- 693 (36%) Reported They Had Bicycled in the Last 12 Months and 1,216 Reported They Had Not
Frequency of Bicycling

I would like to travel by bike more than I do now.

55% Would like to bicycle more

- Strongly Agree 30%
- Somewhat Agree 25%
- Somewhat Disagree 14%
- Strongly Disagree 31%

ALL Respondents
Availability of Bicycle Facilities

Do you think there are too many, about the right amount, or too few in your community?

Percent of ALL Respondents rating as “TOO FEW”

- **BICYCLE PARKING**: 75%
- **DEDICATED ON-STREET BIKE LANES**: 73%
- **BICYCLE-FRIENDLY STREETS**: 63%
- **OFF-STREET BICYCLE PATHS AND TRAILS**: 62%
## Importance of Improving Bicycle Access

How important, if at all, do you feel it is for your community to do each of the following?

<table>
<thead>
<tr>
<th>Action</th>
<th>Percent of ALL respondents rating as “ESSENTIAL” or “VERY IMPORTANT”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Providing traffic signals or crossing beacons at intersections and crossings to warn drivers of bike and trail users crossing the road</td>
<td>72%</td>
</tr>
<tr>
<td>Providing bike lanes separated from vehicles so bikes and cars do not have to share the same lane</td>
<td>70%</td>
</tr>
<tr>
<td>Providing bike trails separated from roadways</td>
<td>56%</td>
</tr>
<tr>
<td>Lowering traffic speeds on community roadways to improve safety of pedestrians and bicyclists sharing the road</td>
<td>50%</td>
</tr>
</tbody>
</table>
Level of Comfort

How comfortable are you riding a bike on the following?

Percent of ALL respondents reporting they would feel "VERY COMFORTABLE" or "SOMewhat COMFORTABLE"

- A PATH OR TRAIL THAT IS SEPARATED FROM A STREET: 85%
- A MAJOR STREET WITH TWO OR THREE TRAFFIC LANES IN EACH DIRECTION, TRAFFIC SPEEDS OF 35 TO 40 MILES PER HOUR, AND NO BIKE LANE: 9%
- THE SAME STREET WITH A STRIPED BIKE LANE ADDED: 60%
- WHAT IF IT ALSO HAD A WIDE BICYCLE LANE SEPARATED FROM TRAFFIC BY A RAISED CURB: 78%
Four Types of Cyclists*
Regional Comparison

- **Strong & Fearless**: Will ride a bicycle regardless of the roadway conditions. Riding is a strong part of their identity.
- **Enthused & Confident**: Somewhat comfortable sharing the road with vehicle traffic. Prefers dedicated bike facilities.
- **Interested But Concerned**: Like riding a bicycle and would ride more if they felt safer on the roadways.
- **No Way No How**: Not comfortable, not interested, or not physically able to ride a bicycle.

* Determined in large part by comfort of cycling on different types of facilities.
2017 NCTCOG
Regional Bicycle Opinion Survey Results

Bicycle Opinion Survey Website:
nctcog.org/bikesurvey

- Key Findings
- Executive Summary
- Final Report
- Presentation Slides and Graphics
Tell Us About You

Mentimeter Survey Tool…
What Type of Bikeway Would You Choose?

- Posted Speed = 25 mph
- Vehicle Volume = 4,000 AADT
What Type of Bikeway Would You Choose?

Posted Speed = 25 mph
Vehicle Volume = 14,000 AADT
What Type of Bikeway Would You Choose?
How We Got Here
We are a car dependent culture
San Francisco bicyclists seeking a dedicated bike lane on Market Street protest in front of City Hall in 1972.
Source: Joe Rosenthal, The Chronicle
Background

Bicycle crash increases 1970 - 1971:

- Miami up 50%
- Colorado up 50%
- California up 35%
- Massachusetts 45%

Source: NYTimes, 9/24/1972
America’s First Bikeway Network – Davis, CA, 1967-1972
Need for Guidance

As bicycling increased, the US DOT recognized a need for design guidance.

In 1974, the AASHTO Bike Guide was born!
1974 AASHTO Bike Guide

Minimum design speed: 10 mph
Desirable design speed: 15 mph
Bicycle lane criteria: specific volumes included
Wide curb lanes: not included
Separated bike lanes: recommended
Sidepath intersection: use protected intersection
Some Bicyclists Grow Concerned

- Mandatory use laws inconvenient, restrictive, potentially unsafe
- Facilities not well maintained
- “Right to road” endangered
“…the California government decided to "make cycling safe" by establishing a system of laws and facilities that would **impose the childish cyclist-inferiority system of operation upon all cyclists.**”
Vehicular cycling...is faster and more enjoyable, so that the plain joy of cycling overrides the annoyance of even heavy traffic.

- John Forester
Early Research

1975 report on Safety and Locational Criteria for Bicycle Facilities findings consistent with modern-day research on bicyclists’ preferences and safety:

- Bicyclists prefer separation
- Bike lanes safer than shared lanes
- Contra-flow bicycling increased crashes
- Sidewalk cycling less safe

California as a Bellwether

“The fear of liability on the part of the organizations whom the members represented was the only argument that swayed them.”

- J. Forester

Efforts to separate bicycles from the normal flow of vehicular traffic are not practical in the 20th century – the priority is to accommodate motorized vehicular traffic.

- CalTrans engineer Harold Munn
The LAW supports bike paths as separate facilities where no public road exists, on bridges, to bypass or parallel limited access highways, or in special recreation and park areas.

- League of American Wheelman, 1973
Minimum design speed: 20 mph
Desirable design speed: 30 mph
Bicycle lane criteria: loose
Wide curb lanes: preferred if no bike lane
Separated bike lanes: prohibited
Sidepath intersection: avoid designing sidepaths
Many of the common problems are related to improper behavior and can only be corrected through effective education and enforcement programs.

- AASHTO Introduction
Wide Lanes Win the Day in 1980s
### 1991 AASHTO Bike Guide

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum design speed</td>
<td>20 mph</td>
</tr>
<tr>
<td>Desirable design speed</td>
<td>30 mph</td>
</tr>
<tr>
<td>Bicycle lane criteria</td>
<td>loose</td>
</tr>
<tr>
<td>Wide curb lanes</td>
<td>preferred if no bike lane</td>
</tr>
<tr>
<td>Separated bike lanes</td>
<td>prohibited</td>
</tr>
<tr>
<td>Sidepath intersection</td>
<td>avoid designing sidepaths</td>
</tr>
</tbody>
</table>
1999 AASHTO Bike Guide

Minimum design speed: 20 mph
Desirable design speed: 30 mph
Bicycle lane criteria: loose
Wide curb lanes: preferred if no bike lane, wider
Separated bike lanes: prohibited
Sidepath intersection: integrate with intersection
2000s
European Evidence Increasingly Important

National mode share: 27%  1%
Minimum design speed: 18 mph
Desirable design speed: 30 mph
Bicycle lane criteria: may serve potential cyclists
Wide curb lanes: last resort if no bike lane
Separated bike lanes: introduced as one-way sidepath
Sidepath intersection: integrate with intersection
Today: Bicycling for Everyone!
Minimum design speed: 15 mph
Desirable design speed: 18-30 mph
Bicycle lane criteria: may serve potential cyclists
Wide curb lanes: last resort if no bike lane
Separated bike lanes: definitively supports
Sidepath intersection: protected intersection option
Big issue with every guide: what facility type to choose...

...and what if you can’t get your first choice?
Policy and Planning

Vision

Goals
Chapter 2: Bikeway Selection Process

- Policy
- Planning
- Selection
- Design
Figure 1: FHWA Bikeway Selection Process and Guide Outline

Section 2: Bikeway Selection Policy
- Establish Policy

Section 3: Bikeway Selection Planning
- Plan
- Identify Project Purpose (Includes Design User)
- Identify Corridor or Project

Sections 4 and 5: Bikeway Selection
- Identify Desired Bikeway Type (Includes Design User)
- Assess and Refine
- Evaluate Feasibility
- Select Preferred Bikeway Type
- Design (AADT/TO Bike Count)

Explore Alternatives (For Preferred Design User)
- Downgrade Bikeway Type AND Parallel Route
- Downgrade Bikeway Type OR Parallel Route

Infeasible
- (Infeasible)
- (Infeasible)
2. Bikeway Selection Policy

A transportation agency’s policies can help to define a vision for the transportation network. They can also support consistency in the implementation of projects that meet the needs of all users. Policies can address a broad range of topics, such as bikeway selection, funding, project development, planning, design, accessibility, and maintenance. Policies are also useful to guide and prioritize acceptable trade-offs. The following section highlights examples of how policies can provide context and serve as a framework for the bikeway planning and selection process.

Policies relating to bikeway selection can:

1. Define specific goals and expectations for the bicycle network. For example, an agency may establish a policy stating that the primary bicycle network should serve the “interested but concerned” user type and/or be designed to support a target bicycle mode share (see page 13).

2. Make the linkage between bikeway selection and broader goals for multimodal access and safety. Vision Zero policies and related “Road to Zero” or “Toward Zero Deaths” initiatives can specifically reference bikeway selection as a strategy for reducing fatalities and serious injuries. Policies can explain how bikeway selection occurs as part of all transportation planning and funding programs. They can also explain the relationship between broader goals for level of service (LOS) and the project’s defined purpose. For example, as part of the long-range planning process, an agency can establish a desired LOS for bicyclists and identify the bikeway types that will achieve the desired LOS.

3. Prioritize, and programming transportation projects, including specific bikeway types. Policies can promote a transparent decision making process for prioritizing and funding transportation projects and planning bikeways.

4. Define different planning contexts and decision-making considerations used to select desired bikeways. Roadways pass through a broad range of land use, development contexts, such as rural areas and urban centers. An agency’s policies for bikeway selection can clearly describe planning context and highlight relevant factors such as topography, curbside uses, geographic distribution of destinations, local plans, and traffic characteristics. Policies can also address accessibility requirements and guidelines. For example, agencies can demonstrate how people with disabilities will cross a separated bike lane.
Chapter 2: Establish Bikeway Selection Policy

Example:

Define specific goals and expectations for the bicycle network.

- Increase bicycling?
- Improve safety?

Reconfigure streets and intersections to improve safety and operations

Continue building the enhanced bikeway network and the amenities that support it (bicycle detection, parking), and phase implementation to ensure connectivity.

20 miles of bikeways/year

Source: U.S. Census Bureau (2011-2015); DPD (2011-2016)
Chapter 2: Establish Bikeway Selection Policy

The Dutch Approach to Safety and Bikeway Selection

Between the 1950s and 1970s, the Netherlands and the United States began an intense period of auto-centric planning. The resulting increases in motor vehicle travel led to a steady increase in transportation related fatalities. In 1972 transportation-related fatalities peaked in both countries. Improvements in roadway design, vehicle design, and medical care since the early 1970s have led to decreases in fatalities between 1972 and 2011, and between 1972 and 2017, as shown in Table 1 below.

<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>United States</td>
<td>54,589</td>
<td>32,367 (- 40.7%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>40,100 (- 26.6%)</td>
</tr>
<tr>
<td>Netherlands</td>
<td>3,506</td>
<td>661 (- 81.1%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>613 (- 82.5%)</td>
</tr>
</tbody>
</table>

Sustainable Safety Principles:
- Functionality
- Homogeneity
- Predictability
- Forgiveness
- State Awareness
Chapter 2: Establish Bikeway Selection Policy

Define goals, expectations, and metrics for success
Tied to multimodal network standards
- e.g. Complete Streets, Sustainable Safety, Vision Zero

Transparent project prioritization
Project-level feasibility assessments
Proactively address maintenance
3. Bikeway Selection Planning

Vision

At the core of the planning process is a vision for a future bicycle network. The vision is developed through a planning process and is typically documented in a local, regional, or state plan. The vision describes desired future characteristics and outcomes for bicycle transportation and typically defines, explicitly or implicitly, the target bicyclist design user type (as described on page 13).

The vision for the bike network can inform planning-related activities, such as decisions regarding where an agency chooses to pave shoulders and transportation recommendations in a small area plan. It should also be integrated into planning discussions about large scale transportation initiatives and plans for other types of networks, such as transit and freight.

To strengthen the vision, an agency may see it into policy. Agencies may consider adoption of the Safe Systems or Sustainable Safety policy, as described in the previous pages, which applies to all transportation decisions. In this case, the agency might prioritize the most vulnerable road users above other transportation objectives. These priorities inform the planned network and specific objectives for each transportation improvement project.

The Bicycle Network

A bicycle network is a seamless interconnected system of bikeways. The purpose and quality of the network depends on the assumptions, goals, and decisions made during the planning process. Networks should be thoughtfully designed and prioritized. The most successful bicycle networks enable opportunities for safe and convenient travel for all users, including non-motorists.

The bicycle network informs bikeway type selection and prioritization, where higher order facilities are needed. The project is planned on a roadway that is critical to the network, including the appropriate bike infrastructure prioritized as part of that project. A lower quality bikeway type (such as a regular bike lane or a bike boulevard) connects to a bus or transit route is a missed opportunity to build a quality bike network that serves a greater population. The opportunity to make a high-quality project may not occur again for decades. While this bike lane improvement over no bikeway facility, it will not meet the needs and priorities given the context.

Similarly, if a project is planned on a road that is part of a bicycle network, a trade-off on the quality of the bikeway may be more acceptable (keeping in mind that bicycle users generally travel on all public roads, unless prohibited, or a bicycle facility is present).

By influencing bikeway selection in this way, the network helps communities be strategic about end implementation, while also helping to balance network needs, such as for transit and freight. Staff and advocates set priorities by recognizing individual street or road does not serve the same network and that some are more important than others. The network also helps to determine the extent to which a route (described on page 13) is a feasible alternative.
Chapter 3: Bikeway Selection Planning

Vision
The Bicycle Network
Target Design User
Bikeway Types
Road Context
Project Type and Purpose

Bicycle Network Vision Statements

Massachusetts Department of Transportation Statewide Bike Plan Vision
Massachusetts’ integrated and multimodal transportation system will provide a safe and well-connected bicycle network that will increase access for both transportation and recreational purposes. The Plan will advance bicycling statewide as a viable travel option - particularly for short trips of three miles or less - to the broadest base of users and free of geographic inequities.
Planning Inputs

- Network
- Users
- Bikeway types
- Context
Network
Chapter 3: The Bicycle Network

Seven Principles of Bicycle Network Design

Safety
The frequency and severity of crashes are minimized and conflicts with motor vehicles are limited.

Comfort
Conditions do not deter bicycling due to stress, anxiety, or concerns over safety.

Connectivity
All destinations can be accessed using the bicycling network and there are no gaps or missing links.

Directness
Bicycling distances and trip times are minimized.

Cohesion
Distances between parallel and intersecting bike routes are minimized.

Attractiveness
Routes direct bicyclists through lively areas and personal safety is prioritized.

Unbroken Flow
 Stops, such as long waits at traffic lights, are limited and street lighting is consistent.
Network Context

The level to which the preferred bikeway type should be compromised, if compromise is necessary, should be informed by the relative importance of the segment within the larger network and the availability of alternative routes. For example, if the form of the bike network is a grid, a compromise on one segment may be acceptable given that a high-quality parallel route may be available.

In contrast, if there is only one roadway that provides access for bicyclists, for example to a downtown center, compromising on the bikeway type is less desirable.
Key Components of Pedestrian and Bicycle Network Connectivity

- Network Completeness
- Network Density
- Route Directness
- Access to Destinations
- Network Quality
Users
Key Principles

**Safety**
The frequency and severity of crashes are minimized and conflicts with motor vehicles are limited.

**Comfort**
Conditions do not deter bicycling due to stress, anxiety, or concerns over safety.

**Connectivity**
All destinations can be accessed using the bicycling network and there are no gaps or missing links.

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**Attractiveness**
Routes direct bicyclists through lively areas and personal safety is prioritized.

**Unbroken Flow**
Stops, such as long waits at traffic lights, are limited and street lighting is consistent.
**BICYCLIST DESIGN USER PROFILES**

**Interested but Concerned**

- Often not comfortable with bike lanes, may bike on sidewalks even if bike lanes are provided; prefer off-street or separated bicycle facilities or quiet or traffic-calmed residential roads. May not bike at all if bicycle facilities do not meet needs for perceived comfort.

**Somewhat Confident**

- Generally prefer more separated facilities, but are comfortable riding in bicycle lanes or on paved shoulders if need be.

**Highly Confident**

- Comfortable riding with traffic; will use roads without bike lanes.

BICYCLIST DESIGN USER PROFILES

Interested but Concerned
51%-56% of the total population

Often not comfortable with bike lanes, may bike on sidewalks even if bike lanes are provided; prefer off-street or separated bicycle facilities or quiet or traffic-calmed residential roads. May not bike at all if bicycle facilities do not meet needs for perceived comfort.

Somewhat Confident
5-9% of the total population

Generally prefer more separated facilities, but are comfortable riding in bicycle lanes or on paved shoulders if need be.

Highly Confident
4-7% of the total population

Comfortable riding with traffic; will use roads without bike lanes.

Chapter 3: Bicycle Network – Design User

High Traffic Stress

Low Traffic Stress
Bikeway Types
Chapter 3: The Bicycle Network - Form

Key Principles

- **Safety**
  The frequency and severity of crashes are minimized and conflicts with motor vehicles are limited.

- **Comfort**
  Conditions do not deter bicycling due to stress, anxiety, or concerns over safety.

- **Connectivity**
  All destinations can be accessed using the bicycling network and there are no gaps or missing links.

- **Directness**
  Bicycling distances and trip times are minimized.

- **Cohesion**
  Distances between parallel and intersecting bike routes are minimized.

- **Attractiveness**
  Routes direct bicyclists through lively areas and personal safety is prioritized.

- **Unbroken Flow**
  Stops, such as long waits at traffic lights, are limited and street lighting is consistent.
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

- Referred to often as an “all ages and abilities” network or a high-comfort network.
- Designed to be safe and comfortable for all users.
- Created with an emphasis on quality.
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, low-stress networks maximize system use. They have resulted in bicycling rates of 5 to 15 percent in the United States.
Context
Bikeway Selection Process

1. Plan
2. Identify Desired Bikeway Type
3. Assess and Refine
4. Evaluate Feasibility
5. Select Preferred Bikeway Type
Facility Selection Tools
City, Small Town, and Suburban Roadways

Identifies the preferred bikeway type.

**Design User Assumption:**
Interested but concerned cyclist

**Analysis:**
Bicycle Level of Traffic Stress
Rural Roadways

Identifies the preferred shoulder width.

Design User Assumption: Confident cyclist

Analysis:
Bicycle Level of Service
Rural Roadways
Rural Roadways
Rural Roadways

- **10'** Shoulder
- **8'** Shoulder
- **5'** Shoulder
- Shared Lanes

VOLUME: VEHICLES PER DAY

SPEED: MILES PER HOUR

Federal Highway Administration

U.S. Department of Transportation
Context
Bikeway Selection Process

1. Plan
2. Identify Desired Bikeway Type
3. Assess and Refine
4. Evaluate Feasibility
5. Select Preferred Bikeway Type
Preferred Bikeway Type
Urban, Urban Core, Suburban, and Rural Town Contexts
Preferred Bikeway Type
Rural Context
Assessing and Refining the Desired Bikeway Type

- Motor Vehicle Peak Hour Volumes
- Traffic Vehicle Mix
- Curbside Activity (e.g. deliveries and parking turnover)
- Driveway and Intersection Frequency
- Direction of Operation
- Vulnerable Populations and Equity Considerations
- Network Connectivity Gaps
- Transit Considerations (first- and last-mile connections)
Assessing and Refining
Assessing and Refining
Feasibility
Bikeway Selection Process

1. Plan
2. Identify Desired Bikeway Type
3. Assess and Refine
4. Evaluate Feasibility
5. Select Preferred Bikeway Type
Let’s discuss feasibility

Mentimeter survey
Evaluating Feasibility
Finding Space for Bikeways

Project Type

- New construction
- Reconstruction (curb changes)
- Resurfacing or striping (no curb changes)

Options for reallocating roadway space
- Narrowing travel lanes
- Removing travel lanes
- One-way streets
- Reorganizing street space
- Changing street parking
Evaluating Feasibility
Evaluating Feasibility
Evaluating Feasibility
Assess Desirable Bikeway Design Values

Example for standard bicycle lanes from NACTO Urban Bikeway Guide:

Against Curb:
Desirable = 6’
Minimum = 4’

Against Parking:
Desirable = 7.5’
Minimum = 5’

Source: NACTO Bikeway Design Guide
Evaluating Feasibility
Constrained Bikeways

“the use of minimum width bikeways should be limited to constrained roadways where desirable or preferred bikeway widths cannot be achieved after all other travel lanes have been narrowed to minimum widths appropriate for the context of the roadway.”
Evaluating Feasibility
Wide Outside Lane or Bike Lane?

Wide lanes:
- Do not improve bicycling comfort
- Encourage faster traffic
- Shared lanes have higher bike crash risk

Narrow lanes with bike lanes:
- Improve bicycling comfort
- Encourage slower traffic
- Have lower bike crash risk
- Generally do not increase motorists crash rates if on 45 mph or less roadways
Evaluating Feasibility
Door Zone Bike Lane or No Bike Lane?

Wide lanes:
- Do not improve bicycling comfort
- Encourage faster traffic
- Shared lanes have higher bike crash risk
- Parking increases bike crash risk

Narrow lanes with bike lanes:
- Improve bicycling comfort
- Encourage slower traffic
- May lower bike crash risks compared to wide lanes
Evaluating Feasibility
Narrow Bike Lane or 2-Way Separated Bike Lane?

Narrow Bike Lanes:
• Improve bicycling comfort for Confident bicyclists
• Do not accommodate Interested but Concerned bicyclists

2-Way Separated Bike Lanes:
• Improve bicycling comfort for all bicyclists increasing use
• Has higher rate of bicycle crashes compared to 1-way separated bike lanes due to contra-flow movement
Door Zone Bike Lane or No Bike Lane?

Case Study: 15th Street, NW. Washington DC

Data Sources: District Department of Transportation

Existing Shared Lanes
2005 - 2009:
- 30 – 60 bicyclists/hour
- averaged 5 crashes/year
- Crash Risk ~
  20 crashes/million cyclists

Option 1
Bike Lane
Not Chosen

Option 2 built in 2010
Separated Bike Lane
2016:
- 350 – 400 bicyclists/hour
- averaged 10 crashes/year
- Crash Risk ~
  7 crashes/million cyclists

65% reduction in crash risk

Case Study: 15th Street, NW. Washington DC

Data Sources: District Department of Transportation
Shared Lanes
Crash Risk ~
20 crashes/million cyclists

2-Way PBL
Crash Risk ~
7 crashes/million cyclists
Evaluating Feasibility
Other Options Discussed

• Shared Use Path or Separated Bike Lane?
• Narrow Shoulder or No Shoulder?
• One-Way Separated Bike Lane on Both Sides or Two-Way Separated Bike Lane?
Chapter 4: Bikeway Selection
preferred bikeway is “infeasible”

Downgrading Bikeway has potential impacts:

- Suppressed bicycling
- Reduced safety from:
  - Sidewalk bicycling
  - Shared lane or constrained bikeway dimensions
Chapter 4: Bikeway Selection

If the preferred bikeway is infeasible on the main route, select “the next best facility” for it as a short term measure.

*Assumption is high volume roadway with speeds > 30mph with sidepath bicyclists comfort contingent upon pedestrian volume.
Chapter 4: Bikeway Selection

Parallel routes can accommodate the Interested but Concerned if:

- It is designed for their comfort
- Detour is less than 30% in length*
- Bike boulevards may require assessments of major street crossings

Lunch
Bikeway Selection Process

Illustrative examples
Bikeway Selection Process

1. Plan
2. Identify Desired Bikeway Type
3. Assess and Refine
4. Evaluate Feasibility
5. Select Preferred Bikeway Type
Chapter 5.
Bikeway Selection in Practice

Example Case Studies to Apply the Guide Include:

- Rural Context, 2-Lane Roadway
- Small Town Context, 2-Lane Roadway
- Suburban, 4-Lane Roadway
- Suburban, 6-Lane Roadway
High-Speed 2-Lane Roadway (Base Condition)

- rural, two-way, 22-foot-wide undivided road
- popular state bicycle route connecting two small towns
- Average Daily Traffic (ADT) is 1,500 (4% trucks)
- operating speed is 45 mph
- public right-of-way extends to 10 feet on either side of the roadway
- motorists can easily change lanes to pass; however, there are locations with limited sight lines
- pedestrian volumes are expected to be low
Who is Our Design User?

- popular state bicycle route connecting two small towns
  - Confident Bicyclists?
  - Interested But Concerned?
  - Both are uncomfortable due to 45+ mph speeds
- pedestrian volumes are expected to be low
Who is Our Design User?

- popular state bicycle route connecting two small towns
  - Confident Bicyclists?
  - Interested But Concerned?
  - Both are uncomfortable due to 45+ mph speeds
- pedestrian volumes are expected to be low

Confident Bicyclists Chosen for this Example
Preferred Bikeway Type

Rural Context

- Average Daily Traffic (ADT) is 1,500 (4% trucks)
- Operating speed is 45 mph.

Design User Assumption = Confident Bicyclists
5’ Shoulder Option

- Confident cyclists are comfortable (BLOS = “B”)
- Relatively inexpensive option
- No room for rumble strips
- Interested but Concerned cyclists are uncomfortable due to 45 mph and no protection (potential suppressed bike volume)
- Pedestrians may walk in shoulder, but will not feel safe
Wide Shoulder Option

- Confident cyclists are very comfortable (BLOS = "A")
- Relatively more expensive option
- Room for rumble strips
- Interested but Concerned cyclists are uncomfortable due to 45 mph and no protection (potential suppressed bike volume)
- Pedestrians may walk in shoulder, but will not feel safe
Shared Use Path Option

- Confident cyclists are very comfortable (BLOS = “A”)
- Most expensive option
- Room for rumble strips
- Interested but Concerned cyclists are comfortable due with protection
- Pedestrians are comfortable and will feel safe, while low volume will not result in conflicts with bikes
4-Lane Suburban Roadway (Base Condition)

- 4-lane, 50-foot-wide street
- Various large business and retail parcels with busy driveways
- Average Daily Traffic (ADT) is 9,000 (2% trucks/buses)
- Operating speed is 35 mph
- Public right-of-way extends to 10 feet on either side of the roadway with continuous sidewalks that have trees and utility poles located within them.
- Expected peak hour volumes:
  - 25-50 pedestrians
  - 200-250 bicyclists

Built environment is a challenge
Who is Our Design User?

- Important retail corridor for the area with lots of destinations for work and shopping
  - Confident Bicyclists?
  - Interested But Concerned?
  - Both are uncomfortable due to 35+ mph speeds and 9,000 ADT
- Pedestrian volumes are moderate due to businesses
Who is Our Design User?

- Important retail corridor for the area with lots of destinations for work and shopping
  - Confident Bicyclists?
  - Interested But Concerned?
  - Both are uncomfortable due to 35+ mph speeds and 9,000 ADT

- Pedestrian volumes are moderate due to businesses

Interested But Concerned Bicyclists Chosen for this Example
Preferred Bikeway Type
Urban, Urban Core, Suburban, and Rural Town Contexts

Design User Assumption = Interested But Concerned Bicyclist

- Average Daily Traffic (ADT) is 9,000
- 2% trucks/buses
- operating speed is 35 mph
Bike Lane Option

- Road Diet gains 12’ of space for 6’ bike lane
- Confident cyclists are comfortable (BLOS = “B”)
- Relatively inexpensive option
- Motorist passing, turning easier
- Pedestrians enjoy buffer
Separated Bike Lane Option

- Road Diet gains 12' of space for 4' bike lane with 2' buffer
- Relatively inexpensive option
- Interested but Concerned cyclists are comfortable (LTS 1) due to separation
- Confident cyclists are comfortable (BLOS = “A”)
- Pedestrians enjoy additional buffer
Shared Use Path Option

- Road Diet gains 12’ of space from road to create 6’ - 12’ buffer
- Most expensive option
- Utilities relocate to buffer and sidewalk widened to 12’ - 14’
- Interested but Concerned cyclists are comfortable (LTS 1) due to separation
- Confident cyclists may prefer the road due to pedestrians on the path
- If bicycle volumes increase beyond 200/hour, or pedestrians exceed 30% of users, the path can begin to conflicts between pedestrians and bicyclists may result
Putting It Into Practice
Now What Type of Bikeway Would You Choose?

Posted Speed = 25 mph
Vehicle Volume = 4,000 AADT
Now What Type of Bikeway Would You Choose?

Posted Speed = 25 mph
Vehicle Volume = 14,000 AADT
Now What Type of Bikeway Would You Choose?

Posted Speed = 30mph
Vehicle Volume = 40,000 AADT
Bikeway Selection Small Group Exercise

Local Case Study A:
Future Town Center
Bikeway Selection for Networks
State Highway 5 Context Zones

Apply Bikeway Selection Guide to the early stages of bikeway selection:

- policies
- plans
- project purpose
- project selection
Corridor Maps (Group A – Urban Context Zone) Limits: Watt St – Standifer St
SH 5 (Urban Context Zone)  
McKinney, TX

Objectives

- Identify appropriate bicycle facilities on SH 5 along the Urban Context Zone suitable for all ages and abilities
- Assume the entire roadway will be reconstructed, allowing you to use the entire ROW

Planning Factors and Constraints

- Town Center Master Plan shows expanding historic downtown square east of SH 5 rather than having the roadway divide the core of McKinney
- Form-based code will encourage mix of land uses in a more pedestrian-oriented context
- Need to create a safe and vibrant pedestrian and bicycle streetscape
- Accommodate on-street parking
Existing Corridor Photos

Viewing north on SH 5 @ Standifer St

Viewing south on SH 5 @ Virginia St

Viewing south on SH 5 @ Watt St
Land Use Vision

- Future “Town Center” land use plan with an urban form that includes a mix of residential housing types as well as neighborhood and regional commercial uses.
For Whom are you Designing?

Build a bikeway system suitable for people of all ages and abilities (8 to 80 years old)
Recommended Design Parameters (Urban Context Zone)

- Target Speed: 30-35 mph
- Number of Through Lanes: 4L
- Width of Travel Lanes: 11’
- Offset to Face of Curb: 0’
- Shoulder Width: N/A
- Raised Median Width: 15’
- On-Street Parking: Yes
- Parking Width: 8’ parallel
- Sidewalk Width: 10-17’
- Bicycle Facility: Yes (TBD)
- ROW: 100’
1. What is the appropriate roadway context sensitive design for the land use vision? (assume entire roadway reconstruction)

2. What is the appropriate bikeway facility type suitable for people of all ages and abilities?

3. Should the bikeway be one-way (on both sides of the street) or two-way (on one side of the street)?

4. What are the potential trade-offs, barriers, or constraints to implementing the desired bikeway type?

5. How will on-street parking be provided?
Bikeway Selection Small Group Exercise

Local Case Study B:
Suburban Mix
Corridor Maps (Group B – Suburban Context Zone)
Limits: Harry McKillop Blvd – Spur 399
Example: SH 5 (Suburban Context Zone)  
McKinney, TX

Objectives

- Identify appropriate bicycle facilities on SH 5 along the Suburban Transition Context Zone suitable for all ages and abilities.

- Assume the entire roadway will be reconstructed, allowing you to use the entire ROW.

Planning Factors and Constraints

- Future development in this zone will generally be auto-oriented, with a mixture of single use developments.
Existing Corridor Photos

Viewing south on SH 5 @ Harry McKillop Blvd

Viewing north on SH 5 @ Wilson Creek

Viewing north on SH 5 @ Spur 399
Land Use Vision

- The preferred land use is “Suburban Mix” which includes single-family residential, office, and commercial uses.

Source: The Sacramento Bee
For Whom are you Designing?

Build a bikeway system suitable for people of all ages and abilities (8 to 80 years old)
Recommended Design Parameters (Suburban Context Zone)

- **Target Speed**: 40-45mph
- **Number of Through Lanes**: 4L
- **Width of Travel Lanes**: 12’
- **Offset to Face of Curb**: 1’
- **Shoulder Width**: N/A
- **Raised Median Width**: 15’
- **On-Street Parking**: No
- **Sidewalk Width**: 10’ on both sides
- **Bicycle Facility**: Yes (TBD)
- **ROW**: 100’
Group B – Team Discussion

1. What is the appropriate roadway context sensitive design for the land use vision? (assume entire roadway reconstruction)

2. What is the appropriate bikeway facility type suitable for people of all ages and abilities?

3. Should the bikeway be one way (on both sides of the street) or two-way sidepath (on one or both sides of the street)?

4. What are the potential trade-offs, barriers, or constraints to implementing the desired bikeway type?
Team Discussion Questions

Case Study A (Town Center)

1. What is the appropriate roadway context sensitive design for the land use vision? (assume entire roadway reconstruction)

2. What is the appropriate bikeway facility type suitable for people of all ages and abilities?

3. Should the bikeway be one-way (on both sides of the street) or two-way (on one side of the street)?

4. What are the potential trade-offs, barriers, or constraints to implementing the desired bikeway type?

5. How will on-street parking be provided?

Case Study B (Suburban Mix)

1. What is the appropriate roadway context sensitive design for the land use vision? (assume entire roadway reconstruction)

2. What is the appropriate bikeway facility type suitable for people of all ages and abilities?

3. Should the bikeway be one-way (on both sides of the street) or two-way sidepath (on one or both sides of the street)?

4. What are the potential trade-offs, barriers, or constraints to implementing the desired bikeway type?
Action Plan for Moving Forward

Please refer to Action Plan Handout
Discussion, Wrap-up and Evaluations

Sean Corcoran
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