Bikeway Design User Guide

Introduction + Purpose

This User Guide equips TxDOT planners and designers to select the appropriate bicycle facility and to design it according to established guidance in the Roadway Design Manual (RDM).

This User Guide also allows partner agencies and the public to clearly understand the TxDOT decision-making process and considerations related to bikeways.

The RDM

The User Guide summarizes what is available within **Chapter 18 – Bicycle Facilities** of the Roadway Design Manual (RDM) and gives guidance on how to use it. The User Guide focuses on summarizing key ideas from 18.2 Planning and Context and 18.4 Bikeway Types.

18.1
General
Provides the purpose of the bicycle facilities section, key definitions, relationships to other policies and regulations, and details about when bicycle accommodations are not required.

18.2
Planning and Context
Outlines key planning principles and context considerations to understand unique needs of people bicycling. Summarizes design users and the process for selecting and assessing the feasibility of bikeway types.

18.3
Elements of Design
Summarizes design characteristics of people using bikes and the bikes themselves. Provides design details like how to ensure people driving see people biking, especially at intersections.

18.4
Bikeway Types
Provides an overview of bicycle facility types and goes into basic design details around width, signs, road markings, and other considerations specific to each type.

18.5
Intersections and Crossings
Summarizes the principles of intersection design and goes into detail on elements that specifically improve the safety and comfort for people riding bikes and walking. Examples includes options for right-turn conflicts and driveways.

18.6
Maintenance, Operations, and Work Zone
Details out additional needs and considerations for maintaining bikeways and how to accommodate people on bikes during construction.

Appendix C
References
Provides links and citations to additional research and resources available to people planning and designing bikeways.

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Pedestrian Facilities
Provides an overview of pedestrian facility planning and design, including additional detailed guidance on Shared Use Paths.

Bikeway Need

TxDOT must take bicycle accommodation into consideration during the planning and implementation of all construction and rehabilitation projects. Projects on the Bicycle Tourism Trails Network must provide bikeways. Consideration of the needs of people bicycling should begin early in the roadway project development process.

Bikeway Need

Selecting and designing the appropriate bikeway requires answering many questions. Some of the most important questions are included below.

A bikeway need is a location where there is a gap in the bicycle network, which could be missing links in the network or gaps in safe crossings. A bikeway need can also be an existing bikeway that does not meet the needs of the people on bicycles or an existing crossing that is stressful for people on bicycles. To determine the degree of bikeway need, consider the following:

- Are people currently cycling along the route?
- Are people not cycling along this route because there is no bicycle accommodation or the accommodation is stressful?
- Are people likely to be cycling along the route in the future?
- Is the route in a bike plan (district plan, regional plan, local plan, on a Bicycle Tourism Trail route, etc)?
- Does the route connect existing bikeways?
- Are conditions unsafe for cycling or is there a history of crashes involving people on bicycles?
- Is the existing bikeway designed to meet existing and projected cycling demand?

Land Use Context

Land uses can influence who is cycling and the number of people on bicycles. Routes in areas with high concentrations of people and destinations often have greater numbers of people on bicycles. Routes near schools or parks often have more children cycling. Routes in urban areas often carry more vehicular traffic, increasing stress for inexperienced people on bicycles (See Sec. 18.2.2).

Roadway Context

The conditions of the roadway influence the type of bikeway needed to accommodate the target design user and bikeway function. Factors to consider are traffic speed, traffic volumes, presence of large vehicles, intersection frequency, and bikeway function, as identified in the RDM Table 18-2 (See Sec. 18.2.2).

Bikeway Need

MORE SEPARATION/ PROTECTION NEEDED → LESS SEPARATION/ PROTECTION NEEDED

Target Design User

People on bicycles have varying degrees of experience and confidence, which influence their tolerance to stress (See Sec. 18.2.3). Stress is usually caused by adjacent traffic speeds and volumes. Separation and/or protection from adjacent motor vehicles can reduce stress for people on bicycles. Less experienced people on bicycles often need greater separation and/or protection from adjacent vehicle traffic. The most vulnerable people on bicycles are children, youth, older adults, people with disabilities, and less experienced cyclists. Our most vulnerable people on bicycles often need greater separation and/or protection from adjacent vehicle traffic. TxDOT endeavors to provide bicycle facilities to serve bicyclists of "All Ages and Abilities" to maximize the number of people who may use the facility. To the extent practical, designers should meet the needs of target design users with little experience or tolerance to stress.

Bikeway Function

Different routes can serve different functions, depending on nearby destinations and the kinds of users who may bicycle there.

- **All ages bikeways:** routes near community destinations like schools, parks, libraries, and senior centers, which need to serve people of all ages and abilities including children and other people inexperienced riding a bicycle.
- **Daily travel bikeways:** routes in developed areas with a range of different destinations, where people may make short trips on a regular basis.
- **Long-distance bikeways:** routes that connect outdoor recreation sites, tourist attractions, or are popular with local bicycling groups, which may attract motivated and curious riders of a range of abilities.
- **Basic bikeways:** routes that don't serve one of the other three functions and where only occasional bicycling use is expected.

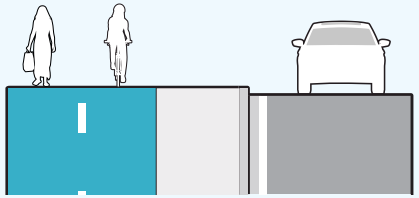
Bikeway Types

There are several bikeway facility types to choose from. The land use and roadway context, bikeway function, and target design user should guide planners and designers to the ideal bikeway type.

Bikeway Types

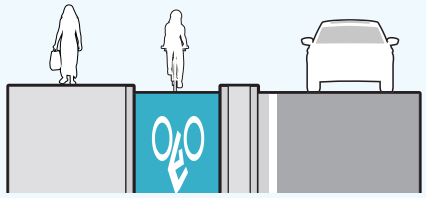
Different bikeway types serve different target design users. Section 18.4 of the RDM describes each bikeway type, applicability, and design considerations.

Shared Use Path



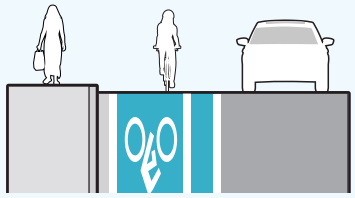
Shared use paths are shared by pedestrians, bicyclists, and micromobility users. They can be located between the roadway and the right-of-way line or on an independent alignment with their own right-of-way. When located along a roadway, they are separated from vehicular traffic by a buffer space (curb optional). Shared use paths may be applicable in urban and rural areas.

Separated Bike Lane



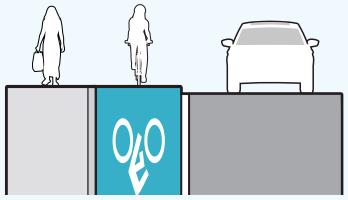
Separated bike lanes are located between vehicles and pedestrians. They are buffered from adjacent vehicular traffic by a horizontal buffer space that includes a vertical element such as a raised median or flexible posts. If on-street parking is present, the people on bicycles are buffered from opening doors. People on bicycles are also separated from people walking by a horizontal buffer space that can include vertical elements. Separated bike lanes are suitable in urban areas.

Buffered Bike Lane



Buffered bike lanes are separated from adjacent vehicle traffic or parking lane by a striped buffer. The buffer is generally only space designated by pavement striping. Buffered bike lanes are suitable in urban environments.

Raised Bike Lane



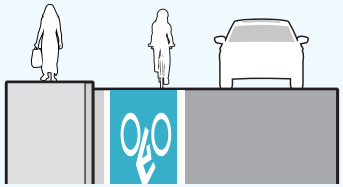
Raised bike lanes are at sidewalk level or between street level and sidewalk level to provide vertical separation from vehicular traffic. However, they do not provide horizontal separation. They are an option to consider on roadways where separation is needed and width is constrained. Raised bike lanes are suitable in urban environments.

MORE SEPARATION / PROTECTION

SUITABLE FOR ALL RIDERS

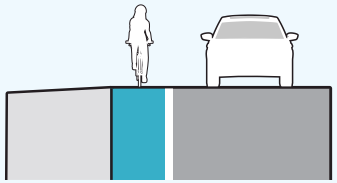
Bikeway Types

Bike Lane



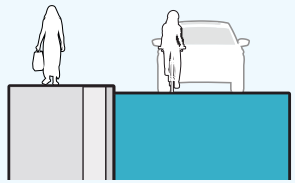
Bike lanes are similar to buffered bike lanes except there is only one painted line separating the bike lane and the adjacent vehicle traffic or parking lane. Signage and other pavement markings are used to further identify the space for use by people on bicycles. Bike lanes are most suitable in rural town, urban, and urban core environments where they will not be confused for a shoulder.

Bike-Accessible Shoulder



Roadway shoulders are separated from travel lanes by a painted line. They may meet the needs of bicyclists if they are paved, are an appropriate width, and do not allow other uses such as on-street parking. They are most suitable in rural environments, but can be used in urban settings as well (RDM 18.4.6 and 18.4.8.2).

Shared Lane



Shared lanes are most suitable on local roadways, especially if Bicycle Boulevard treatments are present and enhanced crossings are provided at major intersections. They are most appropriate on slower speed roads with little vehicle traffic, such as local streets in residential neighborhoods. The bikeway selection charts on the following page show when shared lanes are appropriate based upon traffic volumes and speeds.

Only suitable for all ages and abilities if/when Bike Boulevard treatments are present, primarily at crossings of major roadways. Reference RDM 18.5 for Intersections and Crossings guidance.

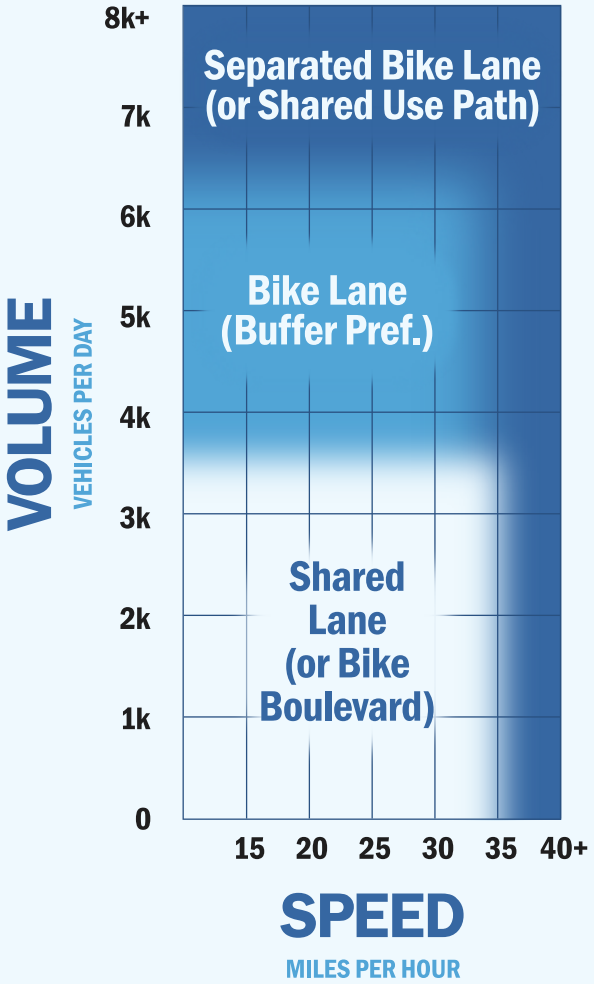
LESS SEPARATION / PROTECTION

SUITABLE FOR EXPERIENCED RIDERS

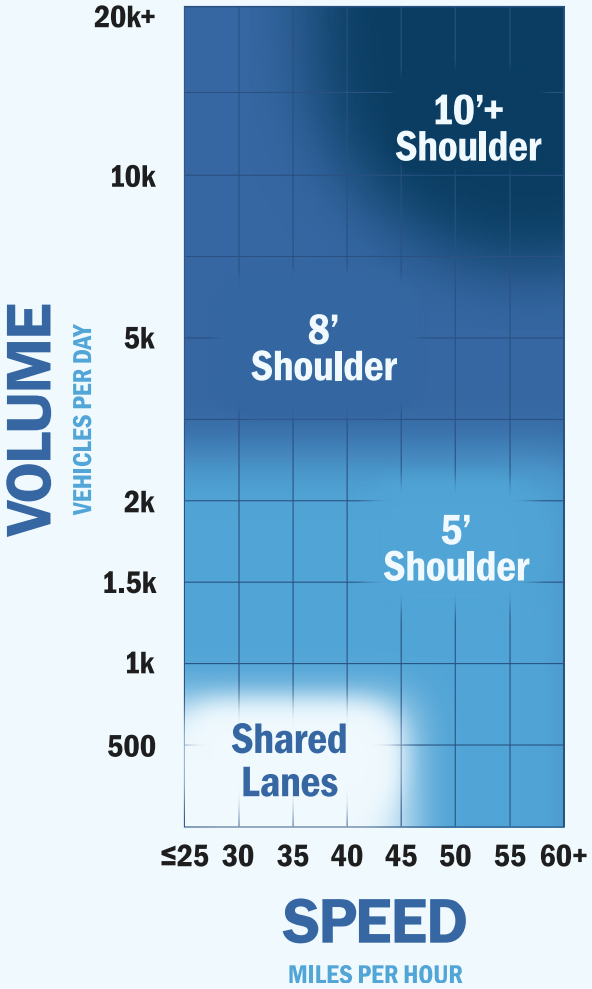
Bikeway Selection

Bikeway Selection

Recommended bicycle facility selection for Urban Core, Urban, Suburban, and Rural Town context



Recommended bicycle facility selection for Rural context



The charts to the left provide general guidance on bikeway selection based upon the context and should be the starting point for selecting the appropriate bicycle facility type. The amount of separation and protection will be heavily influenced by the traffic volumes and speed along the roadway. More details on bikeway selection are provided in Section 18.2.4. Geometric values for each facility type, such as the width of the facility and buffer, should follow specific guidance for each facility type in Section 18.4.

Bikeway Scoping and Design

Scoping

Developing a scope, schedule, and budget for the project allows the project to be programmed for funding.

It is best if you understand the bikeway needs and ideal facility type prior to developing the scope, schedule, or budget. This allows the bikeway needs to be included from the start.

If the project is already programmed and has a scope, schedule, and/or budget that has not accommodated bicycles, time should be taken to reassess the project to ensure bicycling needs are met. The project should be modified to address bikeway needs in the phases prior to construction, even if it requires additional design or redesign.

Bikeway Design

The design phase starts by assessing the feasibility of implementing the ideal bikeway type while achieving other modal needs and design requirements. This process requires a careful balance of priorities while prioritizing safety (See Sec. 18.2.5).

Desirable, Minimum, and Constrained Widths

Section 18.1.6 defines these terms and Section 18.4 provides these widths for each bikeway type.

Basic Design Guidelines

For each bikeway type presented in Section 18.4, the following information is provided:

- Application
- Width
- Buffer Width, as applicable
- Signing and Marking
- Bicyclist Design Speed
- Cross Slope and Grade
- Other Considerations, as applicable

Upgrading and Downgrading Bikeways

The comfort and safety of people on bicycles should be considered when evaluating alternative bikeway designs. Safety, comfort, and network connectivity should be evaluated when considering alternative or parallel routes to ensure the project will meet the intended purpose. People bicycling may not use the bikeway or may use it improperly if it does not meet the needs of the target user, is too narrow, is too close to fast moving traffic, is too close to parking, or if the parallel route is too long (see Sec. 18.2.5.2).

Each bikeway should safely and effectively meet the needs of people on bicycles. Consider bikeway types or bikeway design elements with more separation and/or protection from vehicular traffic when the target design user is less experienced (as the default target design user should be). Consider wider bikeways when more people on bicycles are likely to use the facility or will be sharing it with people walking. Downgrading bikeway types or using minimum or constrained widths should only be considered when those designs are adequate for the conditions described in Section 18.2.5.1 of the RDM.

Principles of Intersection Design

Section 18.5.1 states the fundamental considerations for getting people on bicycles safely through an intersection:

- Minimize exposure to conflicts
- Reduce speeds at conflict points
- Communicate right-of-way priority
- Provide adequate sight distance (See Sec. 18.3.5)
- Provide clear transition between bikeway types (See Sec. 18.5.2)
- Accommodate people with disabilities (See Sec. 19.2.2)

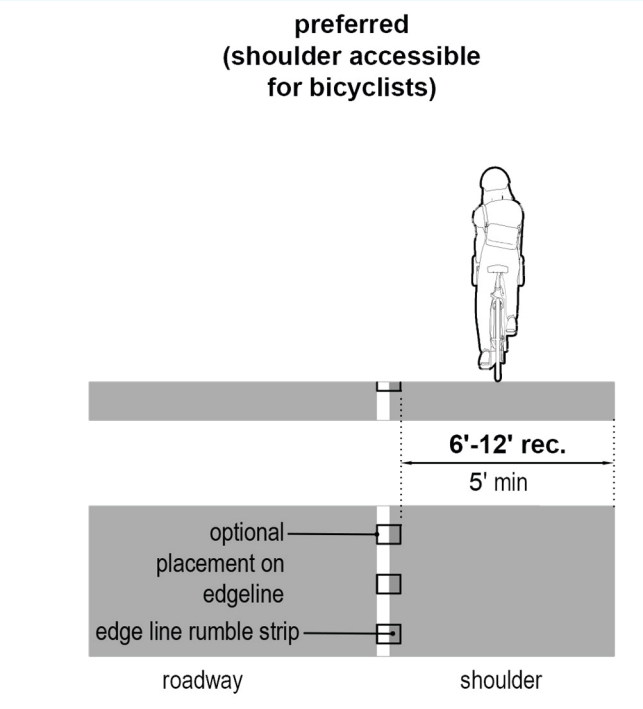
Solutions for Constrained Right-of-Way

Solutions for Constrained Right-of-Way

Repurposing excess shoulder space for bikeways

- Shoulder widths
- Bike accessible shoulders

A bike accessible shoulder is one that is at least as wide or wider than a bike lane to accommodate bicyclists and paved to provide a smooth, solid surface across its width. More details are found in Section 18.4.6 and 18.4.8.2. The placement of rumble strips plays a key role in making a shoulder usable for people on bikes, and the below figure summarizes where they should go in ideal and constrained width scenarios.



Narrowing travel or median lanes to RDM minimums required to gain additional space

- Cross-Sectional Elements

For high-speed facilities such as all freeways and most rural arterials, lane widths should be 12-ft minimum. For lower-speed urban streets, lane widths of 11-ft are generally applicable. Median widths are much more contextual and should consider elements such as pedestrian access, U-turn permissions, heavy truck traffic, and other land use context.

Selecting a two-way bike facility (i.e. shared-use path) instead of two one-way facilities to reduce bikeway width

- Tables 8-11 and 8-12 provide an overview of considerations

While it is often the case that a two-way facility is narrower than two one-way bicycle lanes, factors like driveways, crossing opportunities, intersection operations, and driver expectations are important to consider.

Reconfiguring the roadway

Reduce the number of vehicle lanes, if appropriate given traffic volumes and turning movements, stakeholder coordination, and Department approval.

Selecting a narrower or less protective bicycle facility due to space constraint

See earlier discussion on downgrading bikeways. Optimizing safety should always be the priority, so consider safety of all people when reducing the bikeway width or providing less protection and/or separation from vehicular traffic.

Other Considerations and Resources

Bicycle Tourism Trails (BTT)

Bicycle facilities located on the BTT network should be designed for a 10' shoulder (minimum 8'), shared use path, or other locally preferred facility type. Bicycle facility type selection is to be coordinated with the local community. See Sections 18.1, 18.2, and 18.4.

Other Considerations

Here are some other considerations that can enhance safety and comfort for people on bicycles.

Consolidating **property access** where driveway aprons cover the full property line, to reduce conflict areas

- **FHWA National Best Practices**
- **NACTO Minor Crossings Guidance**

Improving **intersections and crossings** to reduce conflicts in space and time

- **RDM 18.3**
- **RDM 18.5**

Locating **drainage grates** outside of the bikeway, to maximize the rideable space in the bikeway

- **RDM 18.3**

Resources

RDM

- Ch. 4 - Basic Design Criteria
  General descriptions of traffic considerations
- Ch. 4, Section 10 - Cross-Sectional Elements
  Guidance on lane widths, cross slope, median design, and more
- Appendix C - List of References
  Citations for various bicycle related guidance used in Section 6.4
- Ch. 18 - Bicycle Facilities
  Guidance on the design of bikeways

Additional Resources

- Texas Manual on Uniform Traffic Control Devices (2014)
  Statewide standards for signals, signing, and striping of roads
- NACTO Urban Bike Design Guide (2013) / NACTO Designing for All Ages and Abilities (2017) / NACTO Don't Give Up at the Intersection (2019)
  Guidance focused on more urban settings provided by the National Association of City Transportation Officials
- ITE Designing Walkable Urban Thoroughfares: A Context Sensitive Approach (2010)
  Expanded discussion of context-sensitive design by Institute of Transportation Engineers
- FHWA Small Town and Rural Multimodal Networks (2016)
  Active transportation guidance for rural areas by Federal Highway Administration
- Pedestrian and Bicycle Information Center
  FHWA supported; resources include the Bicycle Safety Guide and Countermeasure Selection System
- FHWA Bicycle and Pedestrian Program
  Provides funding, policy guidance, program management, and resource development
- AASHTO Guide for the Development of Bicycle Facilities (2024)
  Engineering design guidance on the physical infrastructure needed to support bicycling