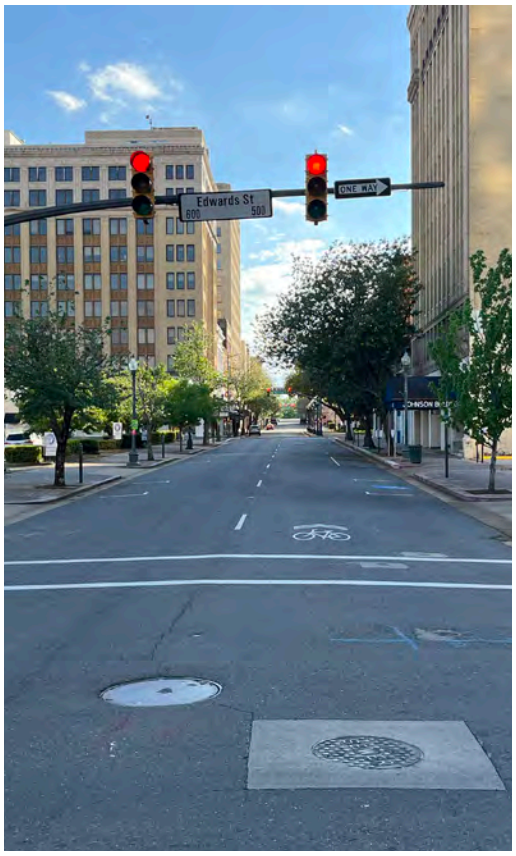
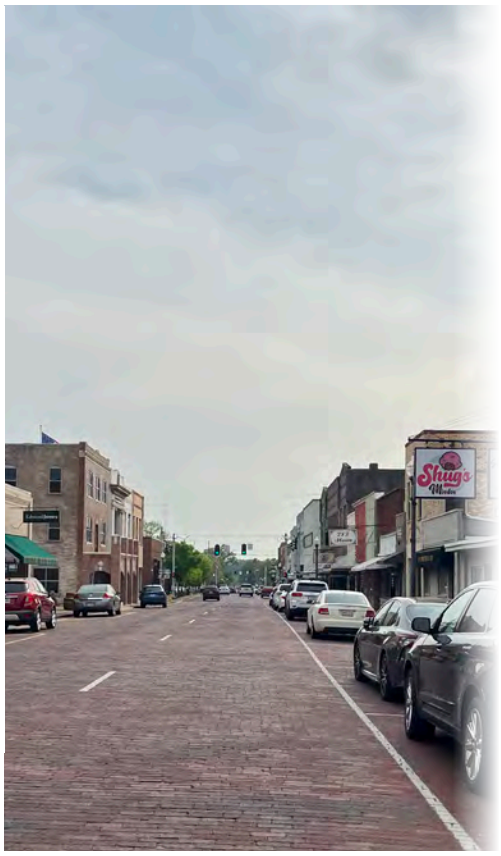
2024

NLCOG

Regional Active Transportation Plan

Design Guide





NLCOG
REGIONAL ACTIVE
TRANSPORTATION PLAN

NORTHWEST LOUISIANA
NLCOG
COUNCIL OF GOVERNMENTS

1 Introduction

The Northwest Louisiana Council of Governments (NLCOG) is responsible for regional transportation planning and coordination in Bossier, Caddo, DeSoto, and Webster Parishes. The Regional Active Transportation Plan is an opportunity to set forth an innovative and unified regional vision for biking and walking.

This guide provides practical resources towards the design of active transportation facilities that are safe, accessible and comfortable for residents and visitors throughout the region. The design guidelines complement the network, policy, and programmatic recommendations available in the Regional Active Transportation Plan.

This guide applies national design resources and best practices to the real-world conditions, desires, and practical limitations present in the NLCOG region. This guide is intended to be used by a variety of users, including:

Practitioners: This guide serves as a resource for engineers, planners, and policymakers on the parish and city staff to apply a consistent design approach across the region.

Advocates and Elected Officials: This guide presents a common language and list of possible design treatments for a variety of contexts, empowering advocates to champion new active transportation projects.

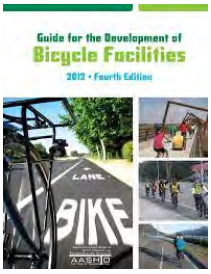
Members of the Public: The resources, principles, written descriptions, photographs, and graphics found in this document are intended to be used as educational materials for public engagement for practitioners to more effectively describe, inform, and meaningfully engage with the public about active transportation design treatments.

These recommendations are rooted in national design standards and tailored to the NLCOG context and available for planners and designers to refer to in scoping potential projects. However, the recommendations should not be used as the sole reference for any detailed engineering design.

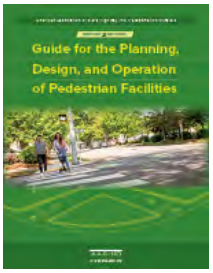
State, Local, And National Design Guide Review

The NLCOG design guidelines are drawn from national, state, and local standards and industry best practices. Where appropriate, design standards were modified and adapted to fit the context of the NLCOG region. This guide reflects the latest updates to federal, statewide, and local design standards and guidelines, several of which were updated in 2023. This includes the National Association of City Transportation Officials (NACTO) Urban Bikeway Design Guide, the American Association of State Highway and Transportation Officials (AASHTO) Guide for the Development of Bicycle Facilities, and the Federal Highway Administration (FHWA) Manual of Uniform Traffic Control Devices (MUTCD). In addition to the recommendations listed in this document, practitioners are encouraged to consult with the latest available federal design guidelines. The following pages summarize and reference design guideline standards and additional resources.

National Guidelines

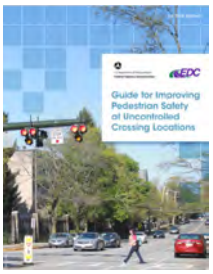


AASHTO's Guide for the Development of Bicycle Facilities: The American Association of State Highway and Transportation Officials (AASHTO) Guide for the Development of Bicycle Facilities (2012) provides specific guidance on dimensions, use, and layout of each type of bicycle facility.

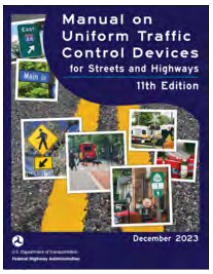


AASHTO's Guide for the Planning, Design, and Operation of Pedestrian Facilities: The AASHTO Guide for the Planning, Design, and Operation of Pedestrian Facilities (2021) provides guidance on methods, dimensions, use, layout, and operation for facilities that accommodate pedestrians in the public right-of-way.

FHWA Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations: The FHWA Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations (2018) provides guidance to support the installation of countermeasures at uncontrolled pedestrian crossing locations and local policy development associated with these countermeasures.



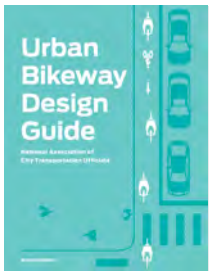
FHWA's Manual on Uniform Traffic Control Devices: The FHWA Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD) (2023) specifies the legal standard for traffic signs and road surface markings. The MUTCD is the primary source for guidance on lane striping requirements, signal warrants, recommended signage, and pavement markings.



FHWA's Separated Bike Lane Planning and Design Guide: The FHWA Separated Bike Lane Planning and Design Guide (2015) outlines design options and considerations for separated bike lanes and resources for practitioners and stakeholders to design and plan bike networks.

FHWA Bikeway Selection Guide: The FHWA Bikeway Selection Guide (2019) serves as a guide for trade-offs and factors that influence selecting different types of biking facilities.

FHWA's Small Town and Rural Multimodal Design Guide: The FHWA Small Town and Rural Multimodal Design Guide (2016) translates existing street design guidance and facility types for bicycle and pedestrian safety and comfort for the smaller scale places.



NACTO's Urban Bikeway Design Guide: The NACTO Urban Bikeway Design Guide (2023): Provides practitioners and stakeholders with resources to design and plan complete streets that are safe for bicyclists of all ages and abilities.

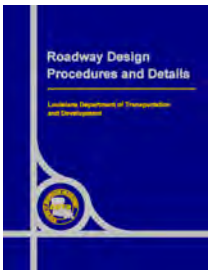
NACTO Urban Street Design Guide: The NACTO Urban Street Design Guide (2013) provides a toolbox of treatments transportation officials can utilize to make streets more inviting and safer for people using all modes of transportation.

NACTO Designing for Small Things With Wheels: The NACTO Designing for Small things with Wheels (2023) working paper outlines strategies planners and engineers can implement to adapt to users traveling by bike, e-bike, e-scooter, skateboards, and other forms of small mobility devices.

NACTO Don't Give Up at the Intersection: The NACTO Don't Give up at the Intersection guide (2019) expands on intersection guidance provided in the NACTO urban bikeway and urban street design guides, to provide details on design strategies to reduce conflicts between motor vehicles and vulnerable road users at intersections.

Public Right-of-Way Accessibility Guidelines (PROWAG): The PROWAG guidelines were written in 2011 and adopted by the US Access Board in 2023. These guidelines are a minimum accessibility standard set by the federal government.

State Guidelines



DOTD Road Design Manual: The DOTD Design Manual was created by the Louisiana Department of Transportation and Development and provides general guidance on the policies and procedures of roadway design and the plan development process.

Additional Resources

- Statewide Bicycle and Pedestrian Master Plan
- Statewide Complete Streets Manual — Center for Planning Excellence
- Complete Streets Toolkit — Center for Planning Excellence
- Complete Streets Work Group Final Report
- Louisiana Recreational Trails Program Plan
- Louisiana Statewide Comprehensive Outdoor Recreation Plan

Local Guidelines

In the NLCOG region, previous transportation plans, such as the Metropolitan Transportation Plan, have introduced some design guidelines determined by zoning, corridor features, and adjacent land uses. However, this guidance has been limited in scope and this guide marks the first unified and comprehensive design guide in the region.

Additional Resources

- I-49 Corridor Land Use Regulation
- Caddo Parish Bicycle Plan
- Shreveport Unified Development Code Article 12
- Bossier City/Parish Unified Development Code

2 Selecting Bicycle and Pedestrian Facilities

To provide a network of active transportation facilities that meets the needs of most residents in the NLCOG region, they must be low-stress, easy to navigate, accessible, and connected to regional activity centers. Generally, most people will only bike on facilities that are low-traffic or separated from vehicle traffic. Pedestrian pathways must be sufficiently wide, connect destinations, provide safe crossings, and be free of obstacles, to be accessible to all. Building facilities that all bicyclists and pedestrians can confidently use improves traffic safety, reduces congestion, enhances air quality and public health, provides better and more equitable access to jobs, and boosts the local economy.

Design Needs for Pedestrians

Everyone who goes outside is considered a pedestrian at some point in their journey. Safe and comfortable pedestrian facilities should therefore be a priority throughout the NLCOG region. Pedestrians range widely in their ability and comfort navigating roadways. Each ability level and mode requires unique design considerations. The table below outlines various pedestrian user types and factors that may influence how to design accommodating facilities. In designing pedestrian facilities, the Public Right-of-Way Accessibility Guidelines (PROWAG) should be referenced to meet minimum accessibility standards. The AASHTO Pedestrian Facilities Guide, and the NACTO Urban Street Design Guide provide additional details for pedestrian standards.

This guidance ensures that sidewalks, pedestrian street crossings, pedestrian signals, and other facilities for pedestrian circulation and use that fall in the public right-of-way are easily accessible by all pedestrian types.

Additionally, the number of pedestrians on a street will depend on the surrounding land use/density, key destinations, the time of day, day of the week, and other characteristics (such as if the facility is also a destination for recreation, like jogging). In places expected to be used heavily by pedestrians, the facilities should be wide enough to comfortably accommodate the pedestrian volume. FHWA's shared use path level of service calculator (SUPLOS) is a tool available to practioners to assist in determining the pathway width based on anticipated use.

Table 1: Design Needs for Pedestrians

USER TYPE		SPEED OF TRAVEL	CONSIDERATIONS
	Children	1 to 3 mph	◆ Need wider areas for movement ◆ Comfortable on sidewalks and facilities that are grade separated from vehicles and fast active users
	Typical Walkers	1 to 3 mph	◆ Need wider areas for traveling in groups or walking dogs ◆ Comfortable on sidewalks and facilities that are grade separated from vehicles and fast active users
	Wheelchair Users	1 to 3 mph (non-motorized) 3-5 mph (motorized)	◆ Comfortable on sidewalks and paths that are separated from vehicles and fast cyclists

Design Needs for Bicyclists

The current AASHTO Guide for the Development of Bicycle Facilities encourages designers to identify their rider type according to the purpose of their trip (Recreational vs. Transportation) and their comfort and skill level (Casual vs. Experienced).

New and casual bicyclists tend to be more cautious and have some inclination towards bicycling but are held back by concern over sharing the road with cars. These users prefer separated pathways or low traffic neighborhood streets. On the other hand, experienced and confident bicyclists are willing to ride a bicycle on roadways with mixed vehicle and bicycle traffic and may even prefer this to sharing facilities with pedestrians or less confident bicyclists. Additionally, younger and older riders, and riders with disabilities require greater separation from vehicles, pedestrians, and faster-moving cyclists.

In recent years, micromobility devices have grown in popularity. Traditional bicycle facilities have evolved from only considering the design needs of a standard bicycle to accommodating additional micromobility users. Increasingly, bikeway users have varying device sizes and speeds. For example, cargo bikes are longer in length than a standard bicycle with space to carry cargo or passengers. Electric micromobility users and electric bike users typically travel faster than standard bike riders. This creates a greater need to provide separated spaces for pedestrians and micromobility vehicle users, and wide enough bikeways for faster riders to pass slower ones. Additionally, micromobility users, by nature of their smaller wheels and overall device stability, are more impacted by poor facility design or maintenance.

By understanding the unique characteristics and needs of bicyclists and other micromobility users, a facility designer can provide quality facilities and minimize user risk. The table below highlights unique speeds and considerations needed for four key bikeway facility users. Additional details are provided in the NACTO working paper Designing for Small Things With Wheels.

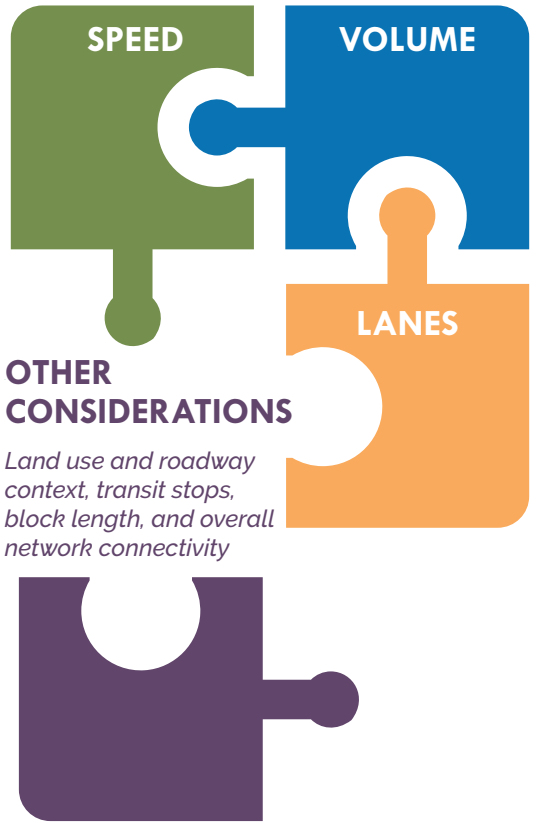
Table 2: Design Needs for Bicylists

USER TYPE	SPEED OF TRAVEL	CONSIDERATIONS
Casual and New Cyclists	6 to 12 mph	◆ Prefer riding on off-street facilities ◆ Less critical to have a facility that is separated from pedestrians
E-Bike Users	16 to 20 mph	◆ Most prefer fewer crossings, separated facilities, and room to pass slower riders ◆ Opportunities for shared mobility docking stations with charging stations
E-Scooter Users	Up to 20 mph	◆ Stand-up and seated versions, e-skateboards, hoverboards, balance boards ◆ Access to on-street corrals, racks in landscaping zones, shared mobility parking zones
Experienced Cyclists	12 to 25 mph	◆ Very experienced cyclists may choose to use roadways over dedicated bikeways ◆ Most prefer fewer crossings, separated facilities, and room to pass slower cyclists

Factors in Facility Selection

Selecting an appropriate facility type for the roadway and land use context is as important as designing the active transportation facility to the appropriate specifications. The type of active transportation facility will directly affect how comfortable it is to use, and ultimately, how many people in the community are likely to use it.

Key inputs for determining an appropriate biking facilities include speed limit, traffic volume, number of travel lanes, surrounding land use, number of driveways and intersections, and overall network connectivity. When selecting pedestrian facilities, in addition to traffic volume and speeds, block lengths, lighting, landscaping, and crossing locations will impact the suitability for paths, trails, and sidewalks. The guidelines recommended in this chapter are general guidelines and not a replacement for professional best judgment.



Steps to selecting the appropriate bicycle facility type include:

Determine motor vehicle speed and volume to refer to Table 3.

Select a type of bicycle facility.

Review bicycle facility information presented in this guide to understand facility requirements, opportunities, and limitations.

Refine facility selection, if necessary, based on professional planning and engineering judgement to ensure the facility fits within the specific land use and roadway characteristics and takes into account any special considerations such as transit.

Consider feedback on the selected facility from the public and agency staff.

Factors such as cost and available right of way can limit the ability to implement the recommended facility type. **Generally, a less protected facility is not a suitable substitute for a more protected one, when a protected facility is warranted**. Planners and engineers should consider if an alternate route can accommodate an appropriate facility or if lower cost materials can be used (see page 73 for Quick Build options).

Roadway Resurfacing Process

This chart, from FHWA's resource on **Incorporating On-Road Bicycle Networks into Resurfacing Projects**, highlights points in the roadway resurfacing planning and design process where bikeway selection occurs.

Inventory road conditions *(ongoing)*

→

Process data from conditions inventory

↓

Process preliminary resurfacing list
(two years or longer)

←

- Overlay list with existing & proposed bicycle and complete streets projects
- Compare to bike plan
- Identify opportunities to add bikeways

Coordination with Transportation, Planning and other divisions

↓

Produce final resurfacing list

→

Implementation preparation

Conduct fieldwork and public engagement.

Prepare roadway & pavement marking plans

↓

Actual resurfacing completed

Review final list for additions/edits

Suggest schedule adjustments

Review bike plan again for any additions

Building Out a Network to Connect Destinations

An active transportation network is successful when it serves the community's needs. This includes the following guiding principles:

- Building a network accessible for people from all backgrounds, ages, and abilities.
- Providing connections for a variety of trip purposes, connecting people to jobs, education, recreation, and everyday destinations.
- Providing a connected network that avoids large gaps between comfortable facilities, which can discourage use.
- Developing a network where there is unfulfilled demand. Land-use, transit, density, and vehicle access can provide insight into where there may be built up potential demand for biking and walking if safe and accessible facilities were provided. Only focusing on areas with the highest current biking and walking volumes leaves out areas where there is latent demand.

While active transportation networks are not developed all at once, and are limited by feasibility factors such as funding, right-of-way, the current built environment, and political will, a well-conceived plan provides the foundation for a network that provides connections to the greatest number of users. A regional network that connects people to destinations includes:

Principal routes connect neighborhoods to regional destinations. These typically serve longer trips such as commutes or recreational trips. These routes are typically wider and more separated from vehicle traffic to accommodate the higher trip volume.

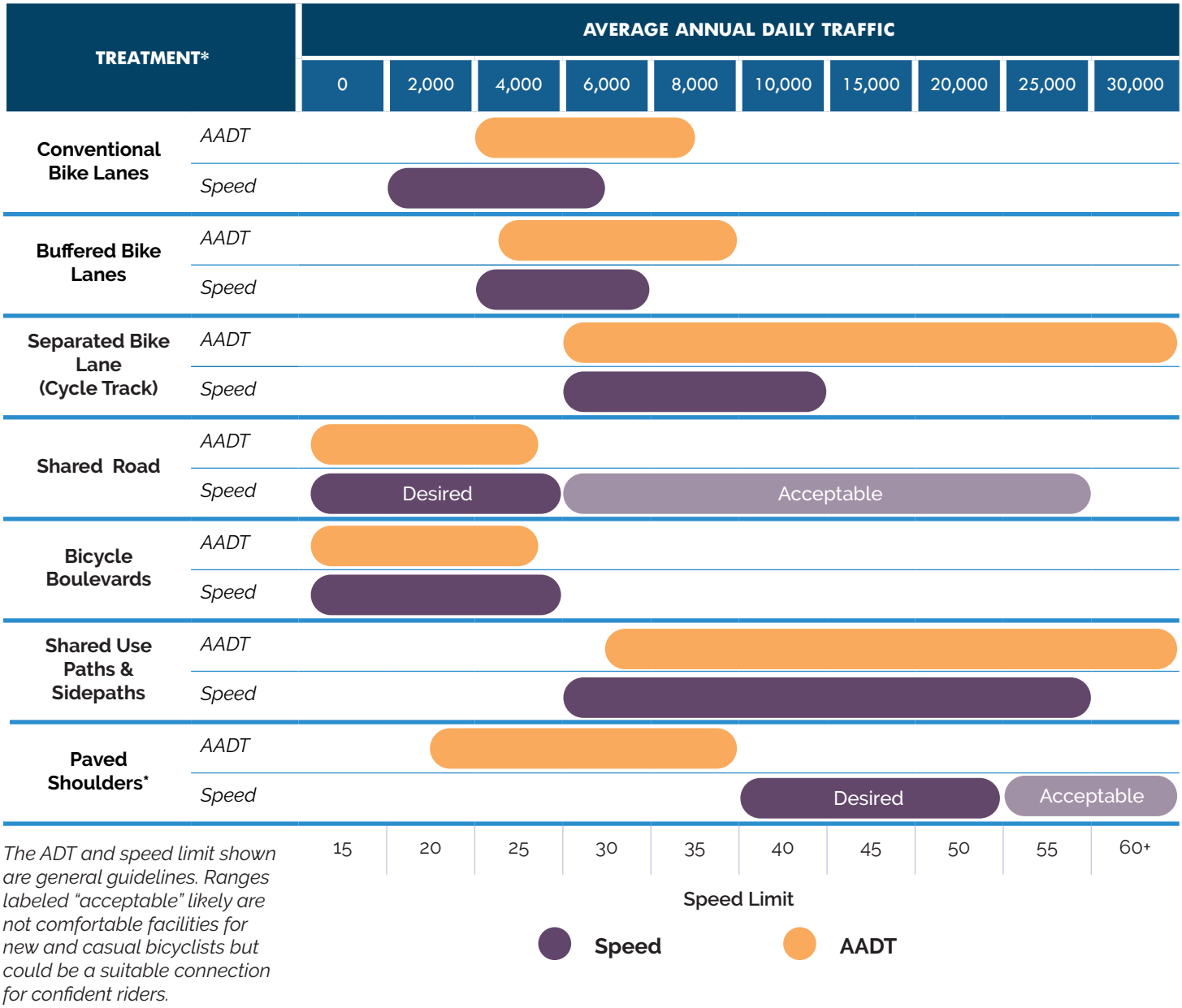
Neighborhood Routes: connect trips within a neighborhood or small community and feed into the regional principal active transportation routes or connect to a neighborhood destination such as a school, park, grocery store, or transit stop.

Intersections and Spot Improvements: these often address a gap in an otherwise connected network. These include dangerous intersections or notable barriers such as a railroad or waterbody crossing.

Figure 1: Typical Network Hierarchy

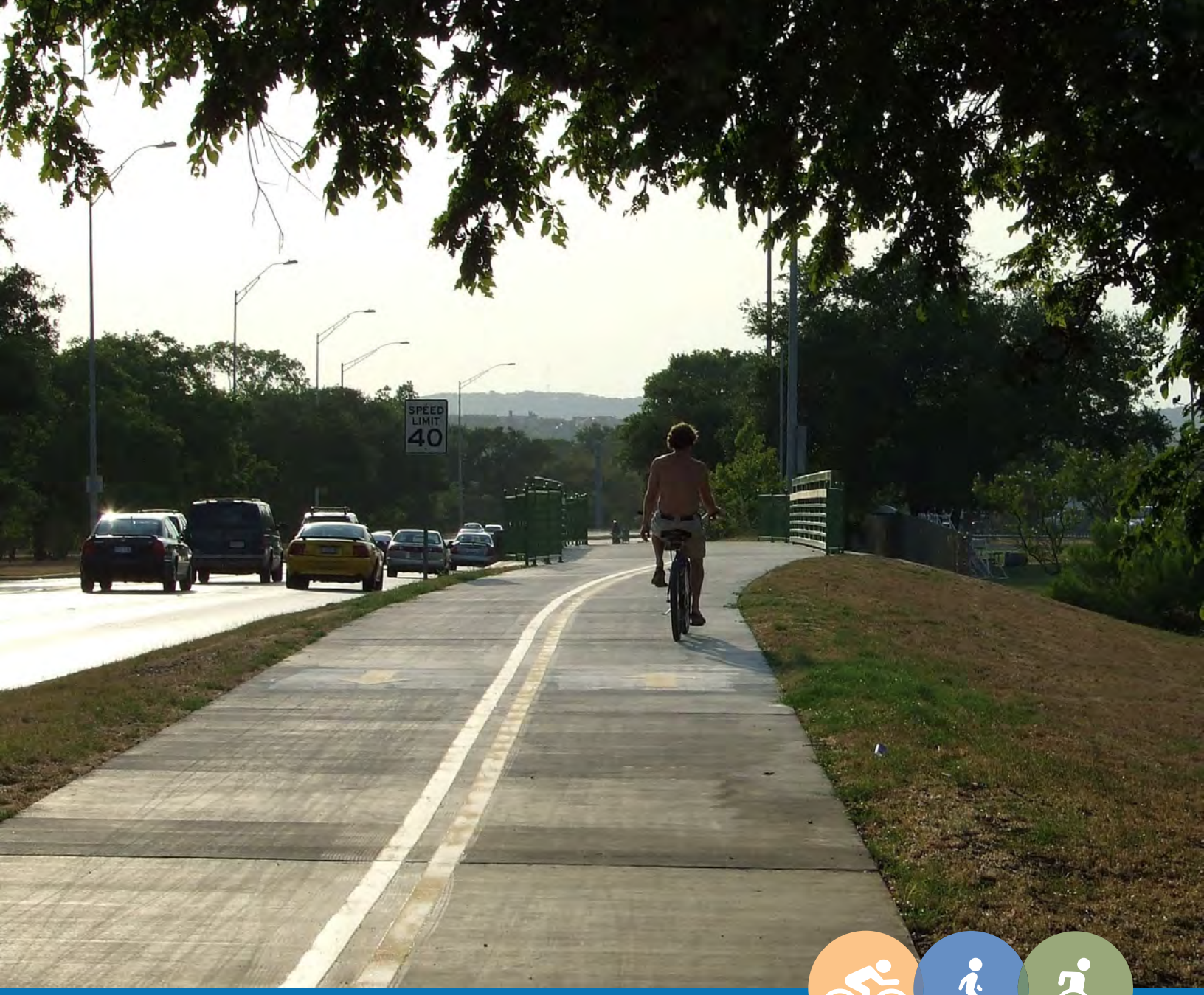
Table 3 shows the preferred speed and volume for each facility type presented in Chapter 3, based on the guidance provided in the FHWA Bikeway Selection Guide. As motor vehicle speeds and volumes increase, more separation between non-motorized and motorized users is necessary. Refer to Chapter 3 for additional design details and considerations for each facility type.

Table 3: Preferred Facility Type for Speed and Volume



The ADT and speed limit shown are general guidelines. Ranges labeled "acceptable" likely are not comfortable facilities for new and casual bicyclists but could be a suitable connection for confident riders.

*Paved shoulders are only used in rural contexts. All other treatment types are used in urban and rural contexts



3 Design Guidelines

The design guidelines presented in this section represent facility types relevant to roadway contexts and user demand found in Northwest Louisiana. The guidelines for each facility type were developed using federal and local design standards such as FHWA, MUTCD, and DOTD.

Professionals and advocates alike can pair the details in this chapter with the facility selection guide from the previous chapter to develop recommendations for the proposed active transportation network.

Facility Types

The facility types present in this chapter are as follows:

Corridor Treatments

- Sidewalks
- Bike Lanes
- Conventional Bike Lanes
- Buffered Bike Lanes
- Paved Shoulders
- Separated Bike Lanes (cycle track)
- Bicycle Boulevards
- Shared Lanes

Shared Use Facilities

- Shared Use Paths Along Roadways (sidepaths)
- Shared Use Paths Diverging From Roadways (greenways)

Intersection Treatments

- Uncontrolled Intersections
- Signalized Intersections
- Rail Crossings

Pedestrian Treatments

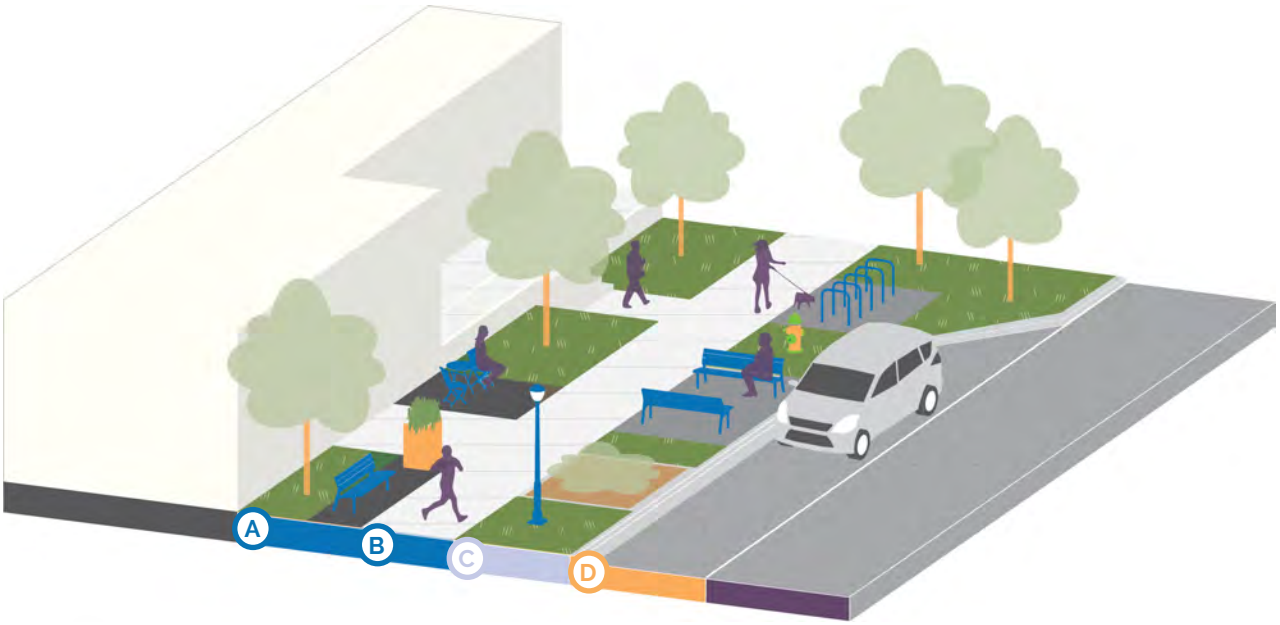
Sidewalks

Sidewalks are the most fundamental element of the walking network, as they provide an area for pedestrian travel separated from vehicle traffic. Providing adequate and accessible facilities can increase the number of people walking, improve accessibility, and create social space.

Benefits

Promote Accessibility

Opportunity for Placemaking



A ***Building Frontage Zone:***
The building frontage zone allows pedestrians a comfortable distance from the building fronts, fencing, walls and vertical landscaping. It offers opportunities to place signs, planters, or chairs.

B ***Primary Pedestrian Zone:***
The primary pedestrian zone is the area intended for pedestrian travel. This zone should be entirely free of objects while fully meeting the requirements for pedestrian accessibility. Wider zones are needed in areas where pedestrian flows are high.

C ***Amenity Zone:***
The amenity zone, also called the furnishing or landscaping zone, buffers pedestrians from the adjacent roadway. It is also the area where elements such as street trees, signal poles, signs, and other street furniture are located.

D ***Enhancement Zone:***
The curbside lane can act as a flexible space to further buffer the sidewalk from moving traffic and may be used for a bike facility. Curb extensions and bike corrals may be utilized in this area.

Typical Use

- Wider sidewalks should be constructed near schools, transit stops, or where high pedestrian concentrations exist.
- Sidewalks should be continuous on both sides of urban commercial streets and should be required in areas of moderate residential density.
- When retrofitting sidewalk network gaps, consider locations near transit stops, schools, parks, public buildings, and other areas with high pedestrian volumes.
- At transit stops, an eight ft by five ft clear space is required for ADA-compliant accessible passenger boarding/alighting at the front door location.

Materials & Maintenance

- Sidewalks typically consist of concrete and are separated from the roadway by a curb or gutter and sometimes a landscaped boulevard.
- Ensure accessibility and properly maintain all surfaces regularly.
- Colored, patterned, or stamped concrete can add distinctive visual appeal.

Further Considerations

- The recommended width for the primary pedestrian zone is 5 to 7 ft in residential areas, and 8 to 12 ft in commercial areas.
- PROWAG guidelines require a 4 ft clear width in the pedestrian zone, though 4 ft is typically only recommended as an absolute minimum in very constrained situations. 5 ft is the recommended minimum sidewalk width.
- Detectable warning surfaces should be used where there are hazards or street crossings within the walking path.
- Select trees that are less likely to produce roots close to the surface, which can damage sidewalks. Trim any low-hanging branches, and consider pedestrian visibility when selecting trees.
- Provide good sight distance for pedestrians and vehicles when sidewalks cross driveways.

Implementation Factors

costs vary based on context

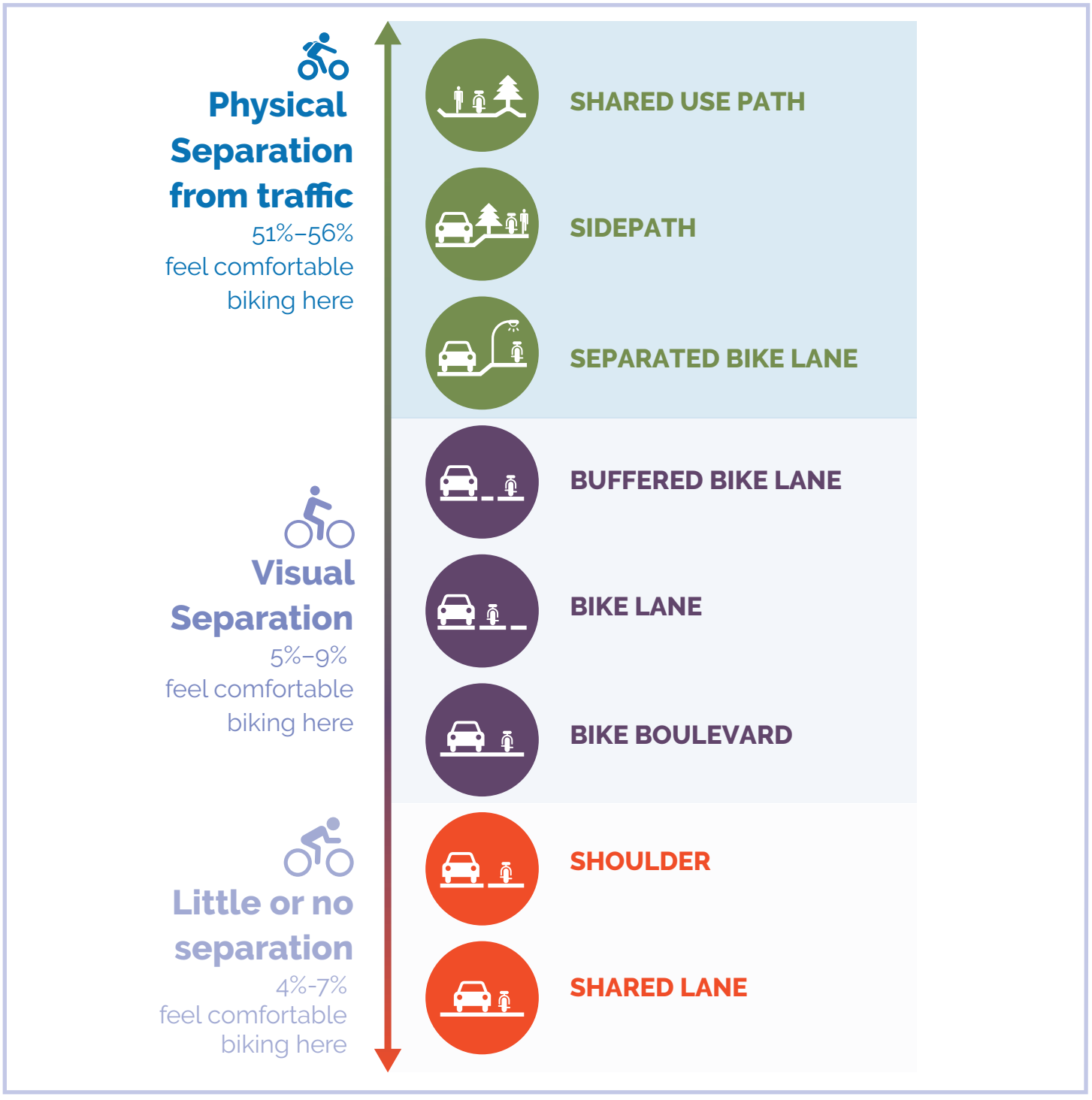
short-term

urban & rural contexts

Bikeways

Which facilities make riders feel safe?

Figure 2: Facilities by separation and comfort



Note: Percentages represent the level of comfort that people feel biking, according to peer-reviewed surverys collected as recently as 2016. Source: FHWA Bikeway Selection Guide.

Conventional Bike Lane

Conventional on-street bike lanes designate a dedicated space for on-road biking using pavement markings and signs. Bike lanes abut motor vehicle travel lanes and follow the same direction as motor vehicle traffic. Bike lanes improve safety by reducing conflict points between bicyclists and motorists and allow riders to ride at a comfortable speed.

Benefits

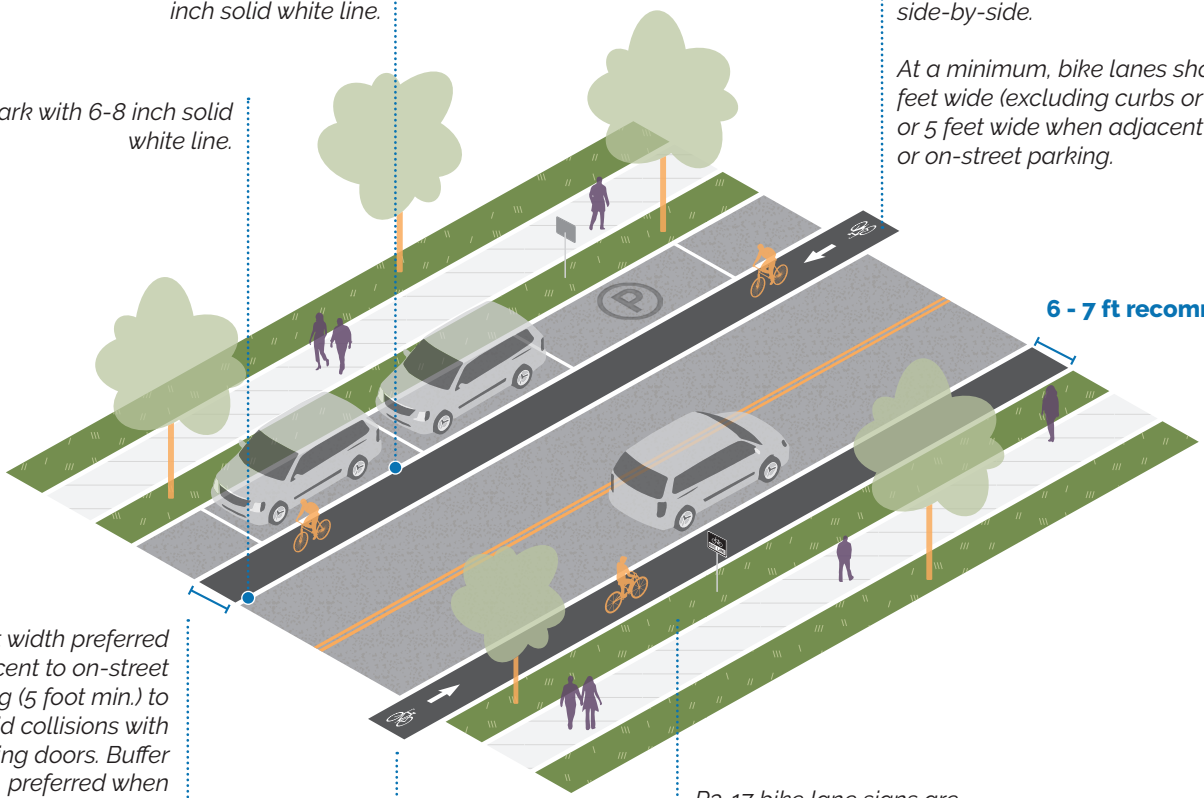
- **VISUALLY SEPARATED**
- **DEDICATED SPACE**
- **BUFFERS SIDEWALK FROM VEHICLE TRAFFIC**

Mark parking divider with a 4 inch solid white line.

Mark with 6-8 inch solid white line.

The preferred minimum for a bike lane is 6.5 feet to allow for passing or riding side-by-side.

At a minimum, bike lanes should be 4 feet wide (excluding curbs or gutters) or 5 feet wide when adjacent to a curb or on-street parking.



6 - 7 ft recommended

6 foot width preferred adjacent to on-street parking (5 foot min.) to avoid collisions with opening doors. Buffer preferred when parking has high turnover.

Include a bicycle lane marking (MUTCD 9C-3) at the beginning of the bike lane, after major intersections, and in periodic intervals (80ft-1,000 ft based on engineering judgment).

R3-17 bike lane signs are recommended in most contexts to identify the bike lane. If vehicles frequently park in the bike lane, a no parking sign may be used.

R3-17

Typical Use

- Bike lanes may be used on any street with adequate space but are most effective on streets with moderate traffic volumes: ≤ 7,000 ADT.
- Most appropriate on streets with low to moderate speeds ≤ 25 mph.
- Appropriate for skilled adult riders on most streets.
- May be appropriate for children when configured as 6+ ft wide lanes on lower speed, lower-volume streets with one lane in each direction.

Materials & Maintenance

- Bike lane striping and markings will require higher maintenance where vehicles frequently traverse over them at intersections, driveways, parking lanes, and along curved or constrained segments of roadway.
- Green conflict markings (if used) will also generally require higher maintenance due to vehicle wear.
- Bike lanes should also be maintained so that there are no potholes, cracks, uneven surfaces or debris.

Further Considerations

- On multi-lane streets, the most appropriate bicycle facility to provide for user comfort may be buffered bicycle lanes or physically separated bicycle lanes.
- Roadway surface inconsistencies pose a threat to safe riding conditions for bicyclists. Manholes, drainage grates, or other obstacles should be set flush with the paved roadway.
- Gutters, drainage outlets, and utility covers located within 50 ft of intersections or 20 ft of driveways should be designed/configured as to not impact bicycle travel.

Parking Considerations

- Parking should be prohibited within 30 ft of intersections and driveways to improve visibility; indicate parking prohibition through the use of a red curb, signs, or other tools.
- Consider additional buffers denoting door area or wider bike lanes when placed next to parallel parking.
- If space allows, consider reverse angle-in parking. This eliminates risk of "dooring" bicyclists and provides clear sight lines between drivers and bicyclists.

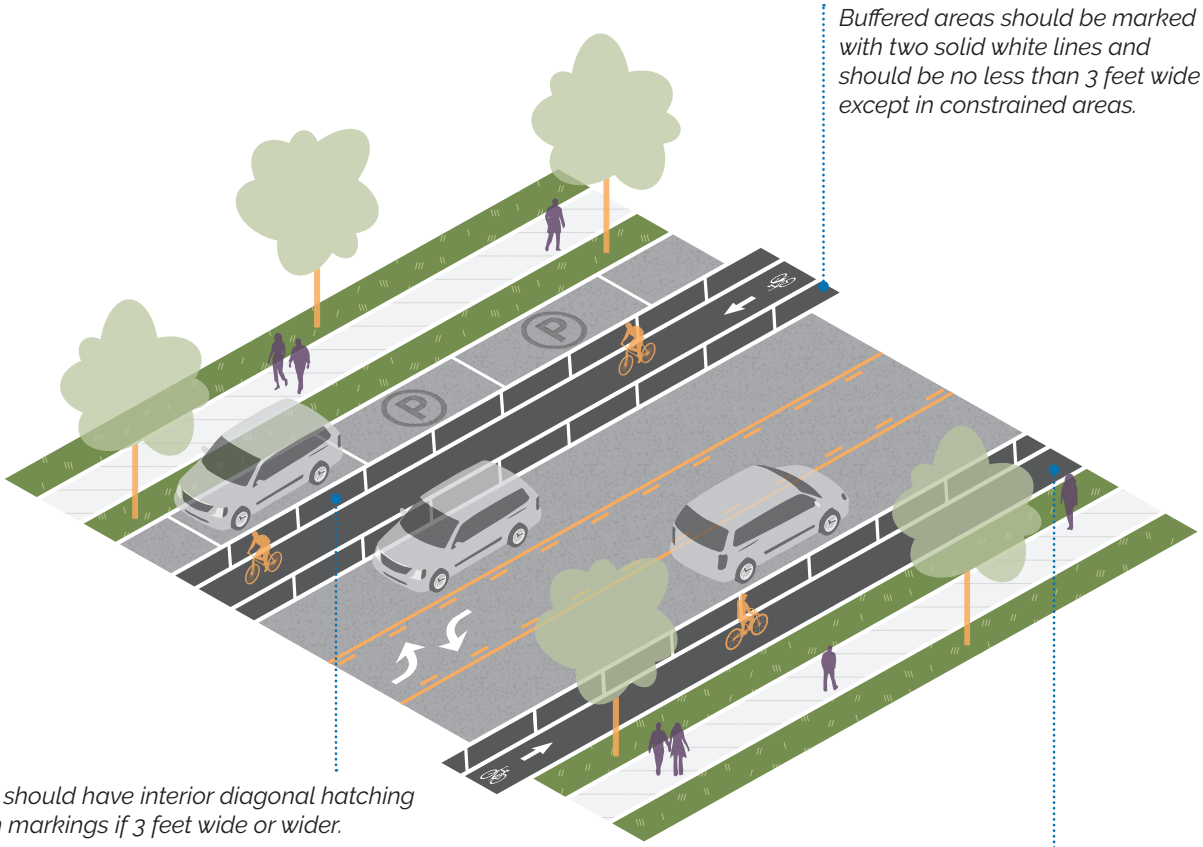
Implementation Factors

Buffered Bike Lane

Buffered bike lanes provide a striped buffer between the bike lane and vehicle travel lanes. The buffer provides separation and allows bikes to ride further away from car doors when curb parking is present.

Benefits

- VISUALLY SEPARATED
- DEDICATED SPACE
- WIDE ENOUGH FOR PASSING



Buffered areas should be marked with two solid white lines and should be no less than 3 feet wide except in constrained areas.

The buffer should have interior diagonal hatching or chevron markings if 3 feet wide or wider.

- *For clarity at driveways or minor street crossings, consider utilizing intersection tracking or conflict markings.*
- *The R3-17 "Bike Lane" sign is optional but recommended in most contexts.*

R3-17

The minimum width of the bike lane is 5 feet. This width does not include the buffer.

Typical Use

- While conventional bike lanes are most appropriate on streets with lower to moderate speeds (≤25 mph), buffered bike lanes provide additional safety on streets with higher speeds (≥30 mph) and high volumes or high truck volumes (up to 10,000 ADT).
- May be used anywhere a conventional bike lane is being considered.
- Can be implemented as a component of a road diet treatment on streets with extra lanes or lane width.
- Appropriate for skilled adult riders on most streets.

Materials & Maintenance

- Painted buffers can be implemented as an interim treatment for physically separated bike lanes.
- If there is high parking lane usage, consider allocating some or all the buffer space to the parking lane side.

Further Considerations

- Bike lane striping and markings will require greater maintenance when vehicles frequently traverse over them at intersections, driveways, parking lanes, and along curved or constrained sections of roadway.
- Bike lanes should be maintained so that there are no potholes, cracks, uneven surfaces or debris.
- Manhole covers within bike lanes should be adjusted to be flush with the pavement when repaving occurs.
- Ensure the bike lane entrance is not so wide that it appears to be a regular travel lane.

Parking Considerations

- Parking should be prohibited within 30 ft of intersections and driveways to improve visibility.
- Provide a striped crosswalk spanning the bike lane at accessible parking spaces.
- Consider adding a stick delineator or bollard in the buffer zone.

Implementation Factors

One-Way Separated Bike Lane

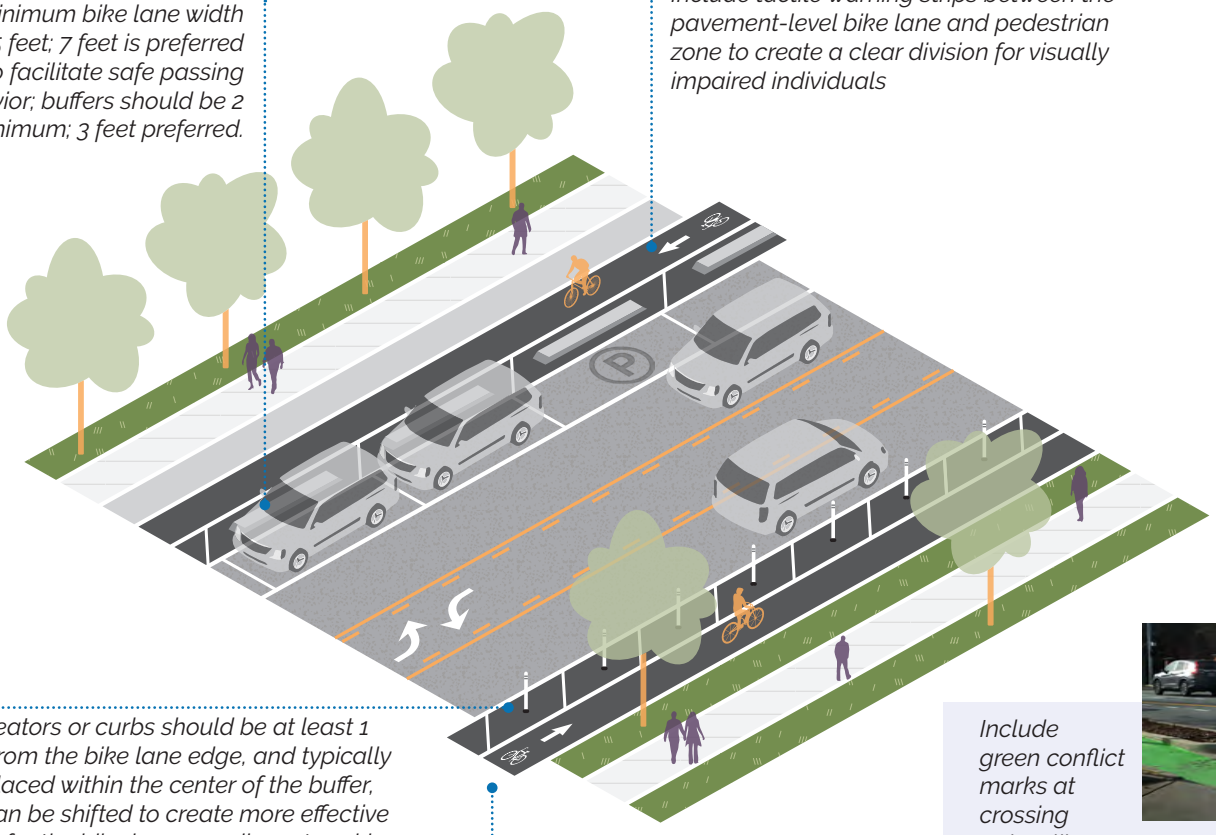
Separated bike lanes (cycle tracks) can take multiple forms but always provide exclusive space for bicyclists and other micromobility users that is fully separated from motor vehicle traffic, parking, and sidewalks. Physical separation is provided by a barrier between the bikeway and the vehicular travel lane. These barriers can include flexible posts, bollards, planter strips, extruded curbs, or on-street parking. Separated bikeways using these barrier elements typically share the same elevation as adjacent travel lanes, but the bikeway could also be raised above street level, either below or at the sidewalk level.

Benefits

- **VISUALLY SEPARATED**
- **DEDICATED SPACE**
- **REDUCES CONFLICTS WITH PARKED CARS**

Minimum bike lane width is 5 feet; 7 feet is preferred to facilitate safe passing behavior; buffers should be 2 feet minimum; 3 feet preferred.

Include tactile warning strips between the pavement-level bike lane and pedestrian zone to create a clear division for visually impaired individuals



Delineators or curbs should be at least 1 foot from the bike lane edge, and typically are placed within the center of the buffer, but can be shifted to create more effective width for the bike lane, or adjacent parking or travel lane if desired.

Pavement markings, symbols, and/ or arrow markings must be placed at the beginning of the bikeway and at designated intervals along the facility.

Include green conflict marks at crossing points like intersections or driveways.

Green pavement for bike lanes was approved for use in the 11th edition of the MUTCD. Refer to section 3H.06 for additional information.

Typical Use

- Along streets on which conventional bicycle lanes would cause many bicyclists to feel stress because of factors such as multiple lanes, high bicycle volumes, high motor vehicle volumes (greater than 10,000 ADT), higher traffic speeds (≥35 mph), high incidence of double parking, higher truck traffic (10% of total ADT) and high parking turnover.
- Along streets where conflicts at intersections can be effectively mitigated using parking lane setbacks, bicycle markings through the intersection, and other signalized intersection treatments.

Materials & Maintenance

- Bikeway striping and markings will require higher maintenance where vehicles frequently traverse over them at intersections, driveways, parking lanes, and along curved or constrained segments of roadway. If used, green conflict markings will also generally require higher maintenance due to vehicle wear.
- Placing the bike lane at the same elevation as the sidewalk allows typical sidewalk cleaning techniques to be used to clean the bike lane.

Further Considerations

- A retrofit in-street separated bikeway has a relatively low implementation cost compared to road reconstruction by using existing pavement and drainage systems.
- Gutters, drainage outlets, and utility covers should be designed/configured as to not impact bicycle travel.
- Parking should be prohibited within 30 ft of intersections and driveways to improve visibility.
- Special consideration should be given at transit stops to manage bicycle and pedestrian interactions.

Parking Considerations

- For a parking protected separated bike lane, the combined buffer and parking lane width should be less then 11 feet to discourage vehicle encroachment in the bike lane.
- Provide a striped crosswalk spanning the bike lane at accessible parking spaces.
- Consider using a thicker stick delineator, such as a K71 style bollard.

Implementation Factors

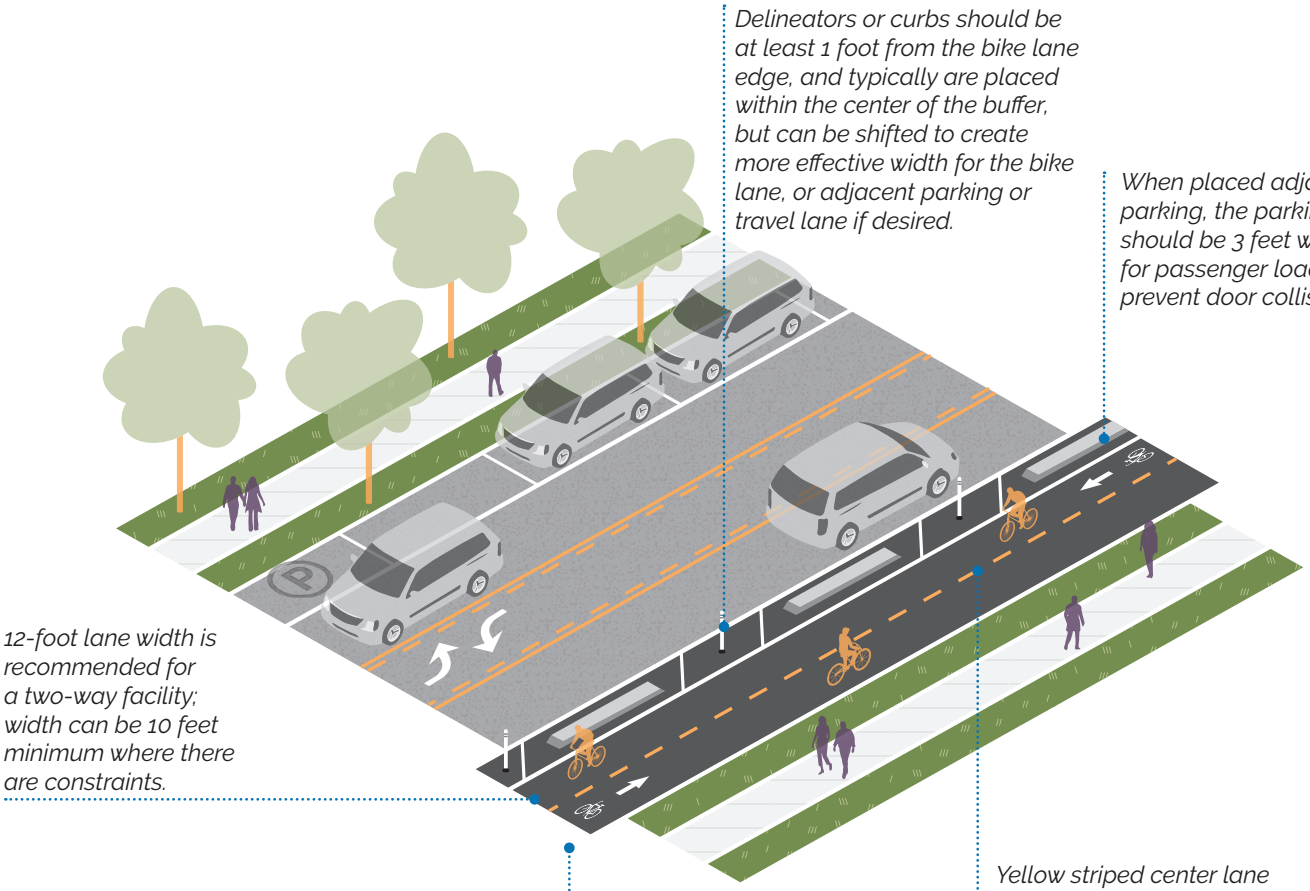
mid-cost | long-term | urban context

Two-Way Separated Bike Lane

Two-way separated bike lanes (cycle tracks) are bicycle facilities that allow bicycle movement in both directions on one side of the road. Two-way separated bikeways share some of the same design characteristics as one-way separated bikeways but require additional considerations at driveway and side-street crossings and intersections with other bikeways. These facilities often function well on one-way streets.

Benefits

- **VISUALLY SEPARATED**
- **DEDICATED SPACE**
- **REDUCES CONFLICTS WITH PARKED CARS**



Typical Use

- Considered in similar roadway contexts as one-way separated bike lanes, where greater physical separation from traffic is desired.
- Work best on one-way streets; single direction motor vehicle travel minimizes potential conflict with bicyclists.
- Recommended along streets where conflicts at intersections can be effectively mitigated using parking lane setbacks, bicycle markings through the intersection, and other signalized intersection treatments, or for streets with few access points for motor vehicles.
- Could be considered for streets that connect to other two-way biking facilities, such as a sidepath or shared use path.

Materials & Maintenance

- Bikeway striping and markings will require higher maintenance where vehicles frequently traverse over them at intersections, driveways, parking lanes, and along curved or constrained segments of roadway. If used, green conflict markings will also generally require higher maintenance due to vehicle wear.
- Having the bike lane at the same elevation as the sidewalk allows typical sidewalk cleaning techniques to be used to clean the bike lane.

Further Considerations

- A two-way separated bikeway on one-way street should be located on the left side.
- A two-way separated bikeway may be configured at street level or as a raised separated bikeway with vertical separation from the adjacent travel lane.

Parking Considerations

- Requires the greatest distance for pedestrians to cross the bike lane. Consider pedestrian volumes during facility selection.
- Provide a striped crosswalk spanning the bike lane at accessible parking spaces.
- Prohibit parking at intersections and driveways. Two-way separated bike lanes on roads with two way traffic may create additional complexities at intersections and driveways.
- Vehicle loading or trash collection may block bicycle travel if not accommodated.

Implementation Factors

mid-cost

long-term

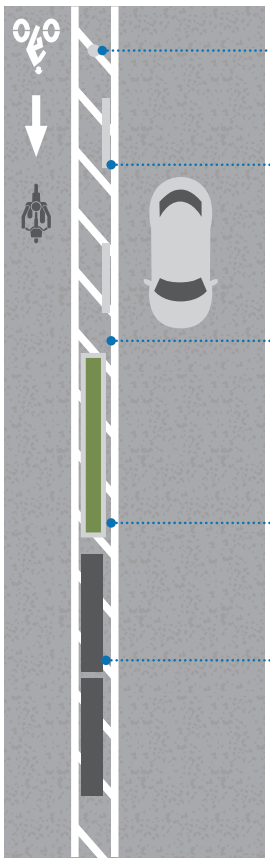
urban context

Cost and timeline largely are influenced by if the facility can be implemented in the existing right of way, and if lower cost materials are used. Raising the separated bike lane to sidewalk level is typically higher cost.

Separated Bike Lane Barriers

Figure 3: Barriers used for separated bike lanes (cycle tracks)

Barrier Separation



Flexible delineators (10-40 ft spacing)

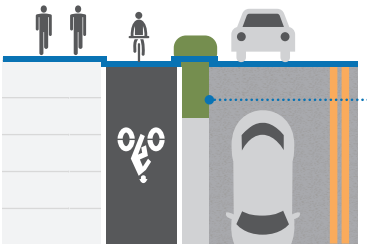
Modular curbing (6 ft spacing, 1 ft from travel lane)

3 ft buffer and spatial envelope for barriers

Planter boxes (consistent spacing)

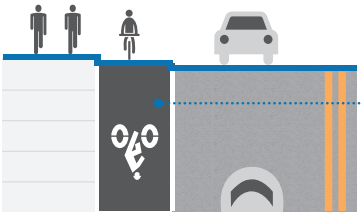
Jersey barriers (consistent spacing)

Median Separation



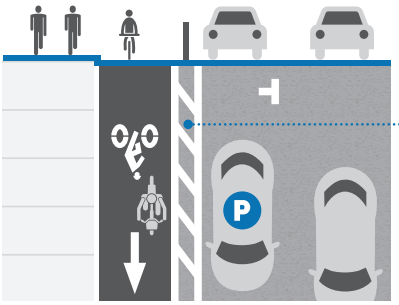
Raised curb (2 ft min. width, 4 ft if plantings present optional planting

Elevation Separation



Raised bike facility

Parking Separation



Buffered door zone (3 ft min. 4 ft preferred), with no vertical elements next to parking spaces

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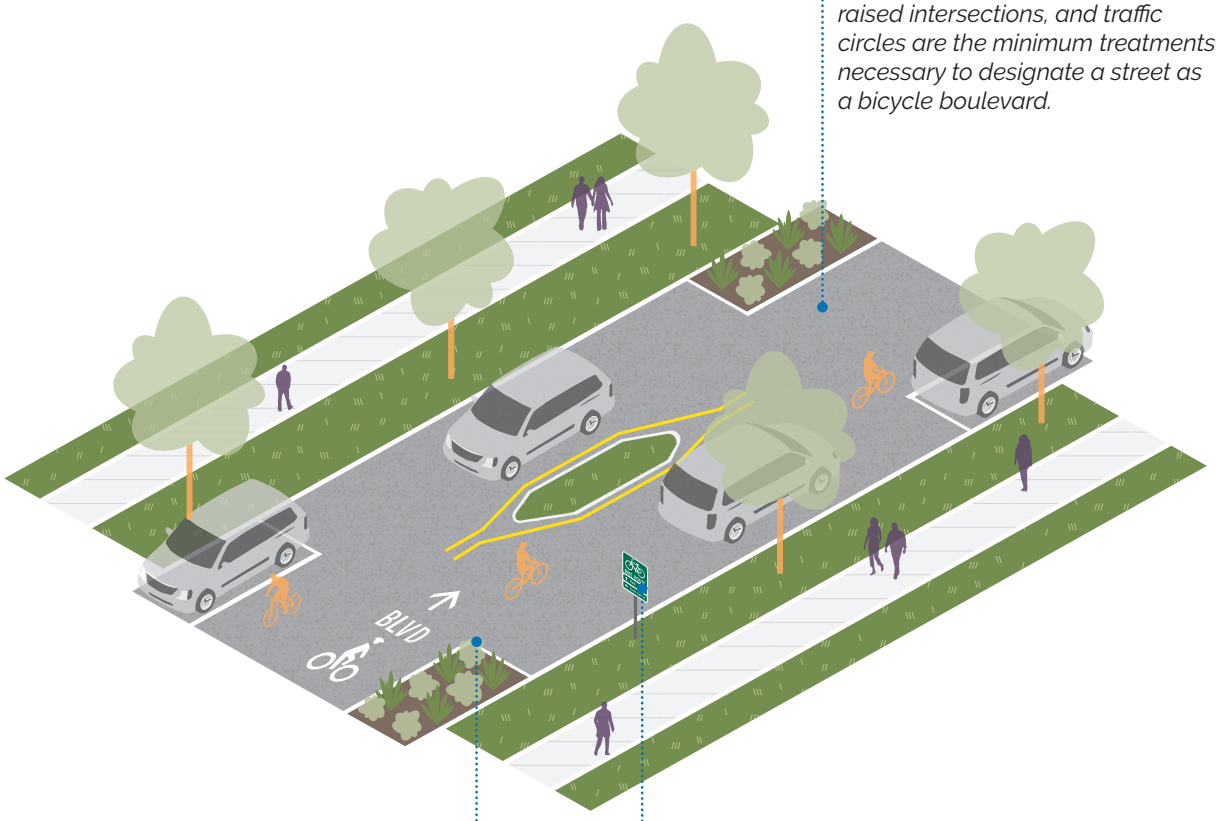
Bicycle Boulevards

Bicycle boulevards (or neighborhood greenways/byways) are residential streets with very low motor vehicle volumes and speeds designed to give bicycles travel priority. These streets use a series of vertical traffic calming devices at intersections and along corridors to slow motor vehicle traffic.

Benefits

- **LOW STRESS**
- **CALMS VEHICLE TRAFFIC**
- **LOW MAINTENANCE COSTS**

Elements such as speed humps, raised intersections, and traffic circles are the minimum treatments necessary to designate a street as a bicycle boulevard.



Implement volume control treatments based on the context of the bicycle boulevard and using engineering judgment.

- *Intersection crossings should be designed to enhance comfort and minimize delay for bicyclists of diverse skills and abilities.*

Wayfinding and identity signs, pavement markings, and traffic calming.

Typical Use

- On low-volume, low-speed streets. Utilize traffic calming to maintain or establish low volumes and discourage vehicle cut through/speeding.
- Follow a desire line for bicycle travel that is ideally long and relatively continuous (1-5 miles).

Materials & Maintenance

- Bicycle boulevards require few additional maintenance requirements to local roadways.
- Signage, signals, and other vertical traffic calming elements should be inspected and maintained according to local standards.

Further Considerations

- Intersection crossings should be designed to enhance comfort and minimize delay for bicyclists of diverse skills and abilities.
- Bicycle boulevard retrofits to local streets are typically located on streets without existing signalized accommodation at crossings of collector and arterial roadways. Without treatments for bicyclists, these intersections can become major barriers.

Implementation Factors

Bicycle Boulevard – Additional Considerations

Network Planning

The success of a bicycle boulevard is dependent on appropriately placed bicycle routes. The routes must facilitate low-stress biking and smooth connections to other bike routes, while avoiding frequent stopping and high traffic speed/volume roadways to work effectively. By doing this, a wide spectrum of cyclists will feel comfortable using the bike network.

There are several factors to consider when implementing bicycle boulevards:

Motor Vehicle Speeds and Volumes: Select routes with low vehicle volumes and travel speeds. The routes must have less than 3,000 motor vehicles per day and speeds of no more than 25 mph.

Vertical Traffic Calming (or Speed Management): vertical traffic calming treatments should be implemented, or already exist, to manage vehicle speeds along the route. See Table 5 for potential vertical traffic calming treatments.

Connectivity: Ideally, the route is long and relatively continuous (2-5 miles) with generally low motor vehicle speeds and volumes to provide access to commercial destinations for people who do not feel safe riding along main street roadways. When major roadways are inhospitable to bike facilities, bike boulevards can provide a low-stress, parallel alternative.

Intersection Crossings: All intersections along bicycle boulevards should improve safety and minimize delay for bicyclists.

Identification: Clearly make bicycle boulevard routes visible to cyclists and motorists through different-colored lanes, art, signage, landscaping, etc.

Emergency Vehicle Routes: Consider existing emergency response routes when considering speed and volume calming techniques to encourage bicycle boulevard use. It is possible to integrate traffic calming techniques while minimizing constraints to emergency vehicles.

Maintenance: Maintain the bicycle boulevards so that they are kept in good condition by repaving routes, sidewalk maintenance, curb ramps, painted crossings, landscaping maintenance, and other features incorporated into the bike boulevard.

Below is a description of different types of speed and volume management techniques to provide safe bicycle passage, adapted from guidance provided in the NACTO Urban Bikeway Design Guidelines. See the following page for a glossary matching these strategies to photo examples.

Table 4: Bicycle Boulevard Strategies

TREATMENT TYPE	TREATMENT NAME	DESCRIPTION	TREATMENT SUBTYPE	TREATMENT SUBTYPE DESCRIPTION
Speed Management	Reduced Speed Limits	Bicycle boulevards should have a posted speed of 25 mph maximum, but in certain instances lower than that is appropriate. Targeted enforcement is recommended when speeds are reduced. An engineering study is required to reduce the speed below the statutory speed for the type of roadway.	A	N/A
	Vertical Traffic Calming	Vertical traffic calming measures are composed of wide, slight pavement elevations that self-enforce a slower speed for motorists.	B Speed humps/ bumps	3 to 4 inches high and 12 to 14 feet long, such that speeds are reduced to 15 to 20 mph. Typically used on local streets with speed limits of 25 mph or less.
			C Speed cushions	A speed hump/table that includes wheel cutouts to allow large vehicles to pass unaffected, while reducing passenger car speeds, typically used on key emergency response routes.
			D Speed tables	Longer than speed humps and flat-topped, with a height of 3 to 3.5 inches and a length of 22 feet. Intended for 25 to 35 mph routes.
			E Raised crosswalk	A speed table that is marked and signed for pedestrian crossing. It extends fully across the street, can be longer than a typical speed table, and is typically 3 inches high.
	Horizontal Speed Control	Horizontal speed control measures cause motorists to slow down in response to either a visually narrower roadway or a need to navigate a curving travel lane.	F Curb extensions/ bulb outs	Extend the sidewalk or curb face into the parking lane at an intersection to visually narrow the roadway and slow motorists.
			G Neighborhood traffic circles	Raised or delineated islands placed at intersections that reduce vehicle speeds by narrowing turning radii, narrowing the travel lane, and, if planted, obscure the visual corridor along the roadway. These can be dangerous for bicyclists and less effective than frequent speed humps, however.

TREATMENT TYPE	TREATMENT NAME	DESCRIPTION	TREATMENT SUBTYPE	TREATMENT SUBTYPE DESCRIPTION
Speed Management	Horizontal Speed Control (cont.)		(H) Pinchpoints/ choker narrowing	These include curb extensions or edge islands placed on either side of the street to narrow the center of the lane such that two drivers have difficulty passing through simultaneously. Use only in slow areas and with cut throughs for cyclists.
			(I) A short center island narrowing	A median parallel to the bicycle boulevard that causes a small amount of deflection without blocking driveway access
			(J) Skinny streets or queuing streets	Narrow residential streets that require low motor vehicle speeds and accommodate travel in a bi-directional lane, forcing vehicles to yield to each other to pass.

A


B

C


D


E


F

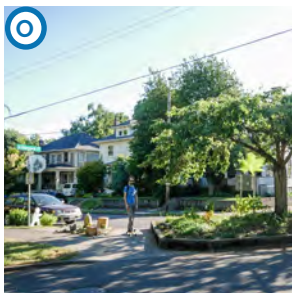

G


H


I


J

TREATMENT TYPE	TREATMENT NAME	DESCRIPTION
Volume Management	(K) Forced turn at an Intersection	This restricts through-movements for motor vehicles, except buses and emergency vehicles, using signs or other methods. However, the sign-only approach may not gain full compliance from motorists.
	(L) Channelized right-in/right-out island	This forces vehicles to turn right while bicyclists can continue straight through the intersection.
	(M) Partial closures/choker entrances	These occur across one direction of traffic at an intersection, which allows full bicycle passage while restricting vehicle access to one side only.
	(N) Median islands/diverters	These restrict through-vehicle movements while providing refuge for bicyclists to cross one direction of traffic at a time by having a bike-only throughway crossing the median.
	(O) Diagonal diverters	These are placed at four-way minor intersections that require all motor vehicle traffic to turn, while allowing bicyclists and pedestrians through movements.
	(P) Full diverters	These create a "T" that blocks motor vehicles from continuing on a bicycle boulevard, while bicycle travel can continue unrestricted. Full closures can be constructed to be permeable to emergency vehicles.



Paved Shoulders

Paved shoulders can be used to accommodate bicycle traffic in constrained conditions, where other facility types that provide greater separation from vehicle traffic are not feasible. Paved shoulders utilize the existing roadway or shoulder and widen the shoulder area to accommodate biking. Paved shoulders are typically applied in more rural contexts where limited alternate routes are available.

Benefits

- **VISUALLY SEPARATED**
- **DEDICATED SPACE**
- **LOW MAINTENANCE COST**

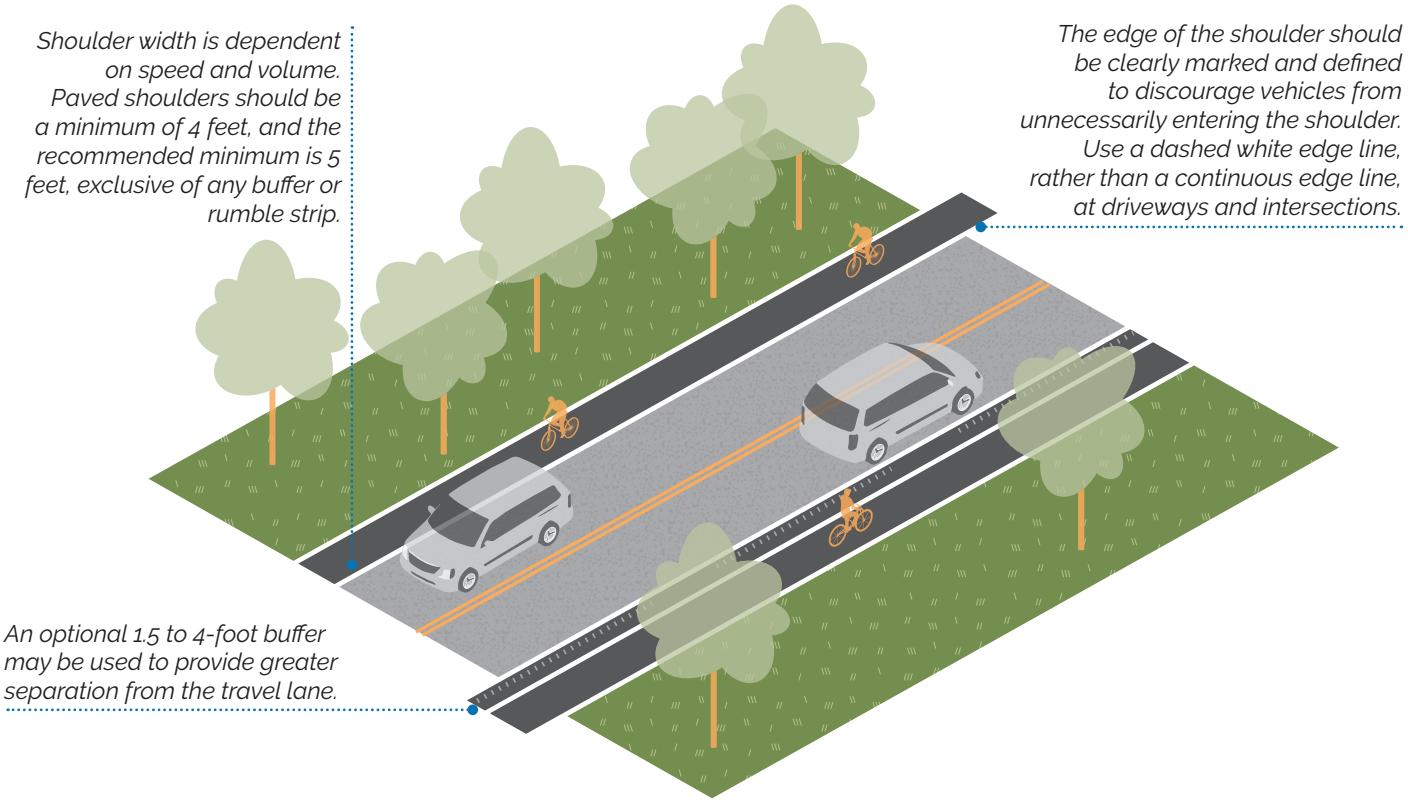


Table 5: Recommended Minimum Paved Shoulder Widths by Roadway Conditions

FUNCTIONAL CLASSIFICATION	VOLUME (ADT)	SPEED (MPH)	RECOMMENDED MINUMUM PAVED SHOULDER WIDTH
Minor Collector	up to 1,100	35 (55 km/h)	5 ft (1.5 m)
Major Collector	up to 2,600	45 (70 km/h)	6.5 ft (2.0 m)
Minor Arterial	up to 6,000	55 (90 km/h)	7 ft (2.1 m)
Principal Collector	up to 8,500	65 (100 km/h)	8 ft (2.4 m)
Major Arterial	greater than 8,500	65 (100 km/h)	10 ft (3.0 m)

Typical Use

- Paved shoulders are typically used on two-lane roadways.
- Requires a wider roadway or existing shoulder.
- Speeds above 35 mph and vehicle traffic over 3,000 ADT are typically not comfortable for all users. However, speeds and volumes may be up to 50 mph and 8,000 ADT, especially in rural settings when there are not alternate facility options available.
- For roadways with less than 2,000 ADT and speeds 25 miles or less, a shared roadway could be considered in lieu of a paved shoulder.

Materials & Maintenance

- Contrasting or colored pavement materials may be used to differentiate the shoulder from the adjacent travel lanes.
- Rumble strips may be used to enhance vehicle safety but must be placed and use dimensions that do not negatively impact bicycle travel. Additional information on rumble strip design can be found in FHWA Technical Advisory 5040.39 and on the FHWA Rumble Strips and Rumble Stripes Website.

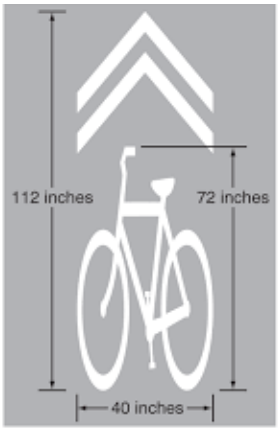
Further Considerations

- Where possible, provide greater width for added comfort, user passing, and side-by-side riding.
- Consider using a gap pattern within shoulder or edge line rumble strips so bicyclists can safely move between the shoulder and travel lane as necessary to avoid debris, make turns, pass, etc. Typical patterns use 10-12-foot gaps every 40-60 feet of rumble strips.
- In sparsely populated rural areas, paved shoulders may also serve as a pedestrian walkway, however in most contexts the appropriate pedestrian facility is a sidewalk. Paved shoulders intended for pedestrian use should be compliant with PROWAG accessibility standards.
- Provide a continuous connection through intersections, where shoulders may be narrowed or replaced by a turn lane. A center turn lane is an option for left-hand turns, and an on-street bike lane or side path are options for right-hand turn lanes.

Implementation Factors

Shared Lanes

Shared lanes feature motor vehicle and bicycle traffic traveling in a shared travel lane. Shared lanes use signage or shared lane markings ("sharrows") but typically do not feature other design elements to separate bicycle traffic or promote slower speeds. Shared lanes are lower cost to implement and can be implemented on roadways that are too narrow for separated facilities. However, they typically do not provide an adequate connection for new and casual bicyclists.



Typical shared lane marking (MUTCD Chapter 9)

Typical Applications

Shared lanes reinforce the legitimacy of bicycle traffic on the street and can provide directional and wayfinding guidance. Shared lanes are not a substitute for bike lanes or other separation treatments but are a versatile part of a complete bikeway network. They alert motorists to the presence of bicyclists, encourage safe passing, and reduce incidences of sidewalk riding and wrong-way bicycling. Shared lanes are particularly useful on streets with a designed speed of less than 25 mph, downhill segments, and in the street alongside separated bike lanes for bicyclists who prefer to ride in the street. However, because there is minimal infrastructure involved in this intervention, the sharrows do not improve comfort for the average rider, especially on higher speed roads.

Scenic roadways with shared lanes can serve as recreational bike routes for experienced riders.

Image Source: Visit Shreveport Bossier

Recreational Applications

Another application for shared lanes is to create a scenic or recreational bike route. These routes offer experienced cyclists a desirable recreational travel experience, often connecting parks, open spaces, and communities while promoting local economic activity. Recreational shared lanes can be designated on low-speed, low-volume routes with scenic, historic, recreational, cultural, archaeological, or natural qualities.

These routes are typically found in rural areas, providing a tranquil and visually pleasing experience. However, it is important to note that these bikeways are best suited for highly confident cyclists, especially on roads where speeds can exceed 30 mph.

The selection of a scenic bikeway includes evaluating the route's potential to connect destinations and provide scenic or recreational value. When considering the creation of a scenic bikeway, there are a variety of important factors to keep in mind:

Assessing Road Context and Project Type: Understanding the setting (rural, suburban, urban) and the nature of the project (new construction, reconstruction, retrofit) is crucial for determining suitable bikeway options.

Safety Evaluations: Conducting thorough safety assessments to ensure the proposed bikeway will be safe for cyclists is a key step in the process.

Community Engagement: Involving local communities and stakeholders in the planning process to ensure the bikeway meets the needs and expectations of potential users.

Environmental Impact: Considering the potential environmental impact of the bikeway and ensuring it preserves the scenic and natural qualities of the rural area.

Maintenance and Funding: Establishing a plan for the maintenance of the bikeway and securing funding for both initial construction and long-term upkeep.

Informing Users: Developing strategies to inform users about the bikeway, including safety campaigns and route-specific information.

These considerations help ensure that scenic bikeways are not only enjoyable and safe for cyclists but also sustainable and beneficial for the rural communities they traverse.

Shared Use Facilities

Shared Use Paths Along a Roadway (Sidepath)

A sidepath is a is a type of shared use path that is located adjacent and parallel to a roadway. Sidepaths offer bidirectional travel and a high-quality experience for users of all ages and abilities as compared to on-roadway facilities.

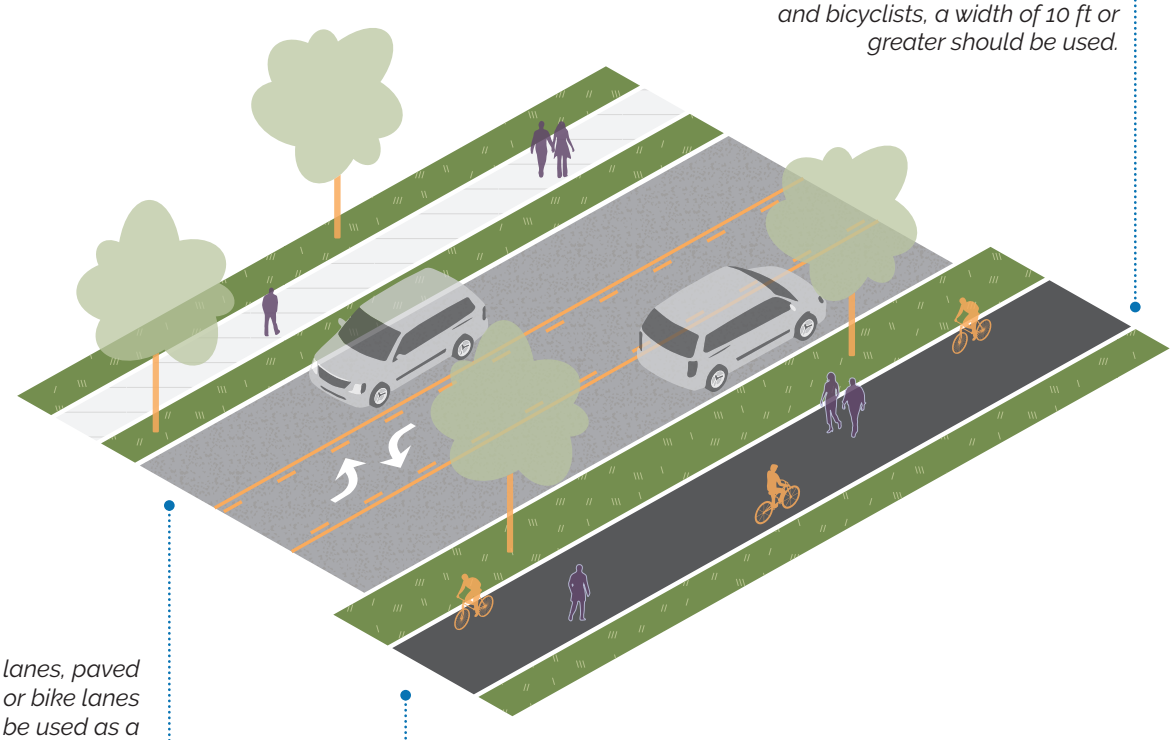
Benefits

PHYSICALLY SEPARATED

PEDESTRIAN AND BICYCLE ACCESS

LOW STRESS

In locations with potential for high level of travel demand, or for regular use by both pedestrians and bicyclists, a width of 10 ft or greater should be used.



Shared lanes, paved shoulders, or bike lanes may be used as a complimentary facility

The minimum sidepath width is 8 ft, exclusive of any shoulders, roadway separation or horizontal offset.

Typical Use

- Ideal candidates for sidepath facilities operate at 35 mph or above. May be applicable at 25 mph.
- Sidepaths should be considered on streets with 7,000 ADT or higher.
- Sidepaths are particularly appropriate for longer distance travel in between activity centers. This is most likely between and approaching urban or suburban areas where there are fewer intersections or driveway conflicts.

Materials & Maintenance

- Centerlines are not necessary, but may be used where there is a high volume of bidirectional traffic
- Relocate utility poles, signs, vegetation and trees to not obstruct the sidepath. If relocation of these elements is not possible, the sidepath may deviate around these obstructions.

Further Considerations

- Crossings should be designed to promote awareness of conflict points, and facilitate proper yielding of motorists to bicyclists and pedestrians.
- Roadways most suited for sidepaths have fewer than 8 residential driveways or 2 major intersections per mile. Refer to LADOTD selection chart for additional details.
- Sidepaths are well-suited for rural roads with high speeds, frequent traffic, and insufficient shoulders.
- Sidepaths should be given the same priority as the parallel roadway at all crossings.
- Where sufficient roadway width or right of way is available, designers should consider the simultaneous provision of both sidepaths and bicycle accessible shoulders to serve a diverse range of user types. Sidepaths on both sides of the roadway may be considered. LADOTD design guidance typically requires sidepaths on both sides of the street to support one way bicycle travel.

Implementation Factors

higher cost

longer-term

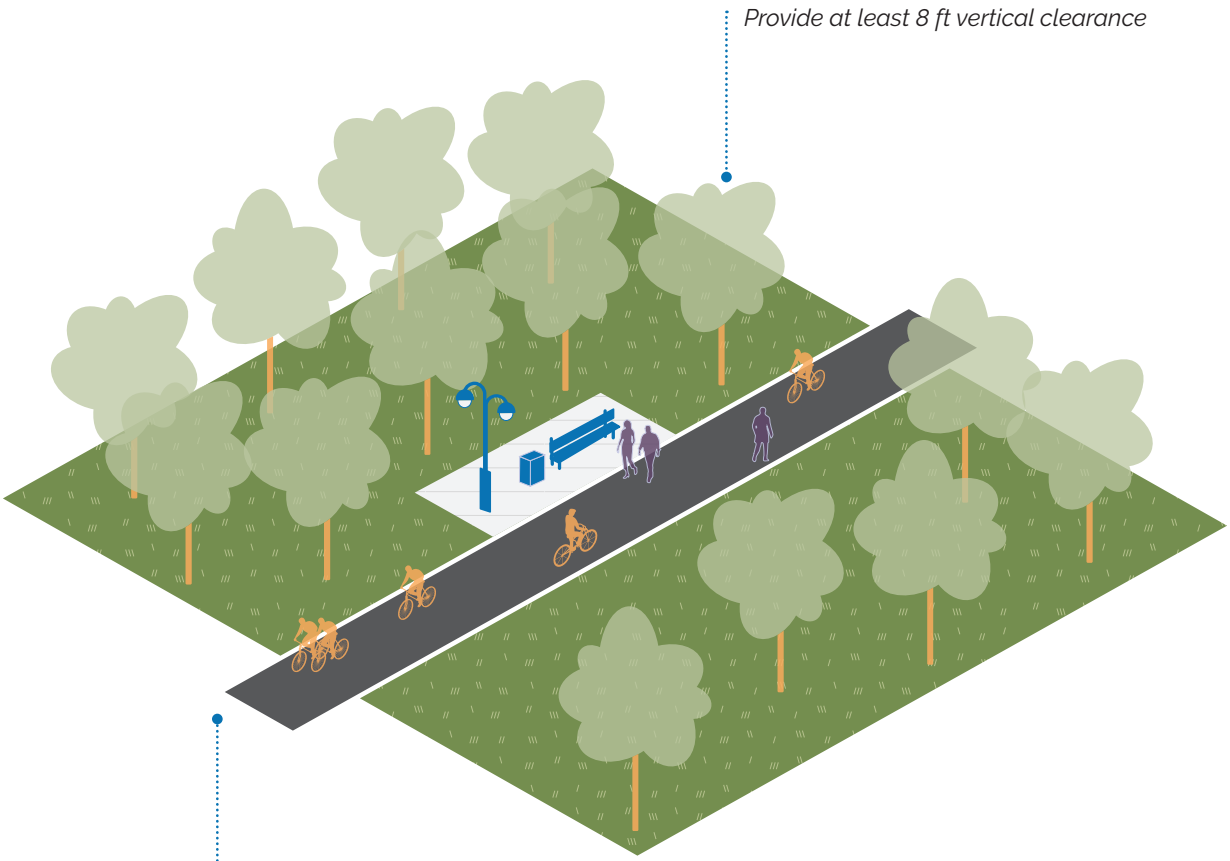
rural & suburban contexts

Shared Use Paths Diverging From Roadways (Greenways)

A shared use path allows for two-way, off-street bicycle use; it may also be used by pedestrians, skaters, wheelchair users, joggers and other non-motorized users. These facilities are frequently found in parks, along rivers, and in railway or utility corridors where there are opportunities for travel not provided through the existing roadway network.

Benefits

- **OFF-STREET**
- **PEDESTRIAN AND BICYCLE ACCESS**
- **MORE NATURAL EXPERIENCE / RECREATIONAL OPPORTUNITIES**



Minimum Width
The minimum width of a shared use path is 10 ft, but this width is only recommended in low-traffic situations.

Typical Width
12 ft is recommended in most situations and is adequate for moderate to heavy use.

High-Use Width
14 ft is recommended in areas with high foot and bike traffic. Where there is heavy pedestrian traffic, a separate walking track (5 ft minimum) should be considered to separate the travel modes.

Typical Use

- In waterway corridors such as along canals, drainage ditches, rivers, and creeks.
- In abandoned or inactive rail corridors (commonly referred to as Rails-to-Trails or Rail-Trails).
- In active rail corridors, trails can be built adjacent to active railroads (referred to as Rails-with-Trails) with the consent of the operating railroad.
- In utility corridors such as power line and sewer corridors.

Materials & Maintenance

- Under most conditions, centerline markings are not necessary. Paths with a high volume of bidirectional traffic should include a yellow dashed centerline, however. This can help communicate that users should anticipate traffic in both directions and encourage users to travel on the right and pass on the left.
- Where there is a sharp blind curve, painting a solid yellow line with directional arrows reduces the risk of head-on collisions.
- Use of bollards should be avoided when possible. If bollards are used at intersections and access points, they should be colored brightly and/or supplemented with reflective materials to be visible at night.

Further Considerations

- Utilize resources such as the Shared Use Path Level of Service Calculator to estimate greenway use and determine recommended width to accomodate users.
- Terminate the path where it is easily accessible to and from the street system, preferably at a trailhead, controlled intersection, or at the beginning of a dead-end street.
- A 2 ft minimum clear zone should be maintained on either side of the trail.

Implementation Factors

Greenways Along a Levee / Canal

Trail systems or linear parks can be integrated into existing levee and canal systems. This existing infrastructure can provide a straight and connected route separated from vehicle traffic, utilize unused space, and connect residents to waterways. However, canal and levee trails must manage stormwater and flooding risks and coordinate with canal and levee operators and additional agencies such as the US Army Corps of Engineers (US ACE) and local Levee Districts. To protect users from steep slopes (greater than 1V:3H), security fencing or other physical barriers is recommended. Fencing is not recommended on both sides of the greenway, unless required for a short distance.

Mississippi River Trail

Railways & Trails

Active and abandoned railway corridors present an opportunity for shared use paths or natural surface trails on or near the railroad property. There are two forms of railway trails: trails that are located adjacent to railroad tracks ("rails with trails") and the conversion of abandoned or discontinued rail infrastructure into a shared use path or trail ("rails to trails"). Both forms of trails require significant collaboration with the property owner.

Trails adjacent to active rail are more commonly implemented along transit, tourism, or passenger rail lines. In recent years, private freight rail companies are hesitant to permit parallel trails within the railroad's right of way. Rail operators in the NLCOG region have policies which prohibit rail-with-trails developments. However, there are examples of local coordination with rail operators to allow for the development of trails in specific circumstances. Strong local advocacy and dedicated local staff are important for successfully negotiating with railroad companies. Trails along an active rail corridor should be setback from the railway as much as possible and include physical separation (such as a fence) from the railway to prevent trespassing. Recommended minimum setbacks vary based on speed, train frequency, sight-distance and operator standards.

Path alongside active rail in Memphis, TN

Shared Use Path Transitions

Shared use paths are only useful if they can be easily accessed from the roadway network. Safe and comfortable transitions should be provided between off-street trails and on-street bikeways when the two facilities intersect.

It is important to ensure that these transitions comply with ADA standards to safeguard low-vision pedestrians from unknowingly entering an uncontrolled roadway.

The diagram on the following pages outlines a process for selecting shared use path transitions in various scenarios.

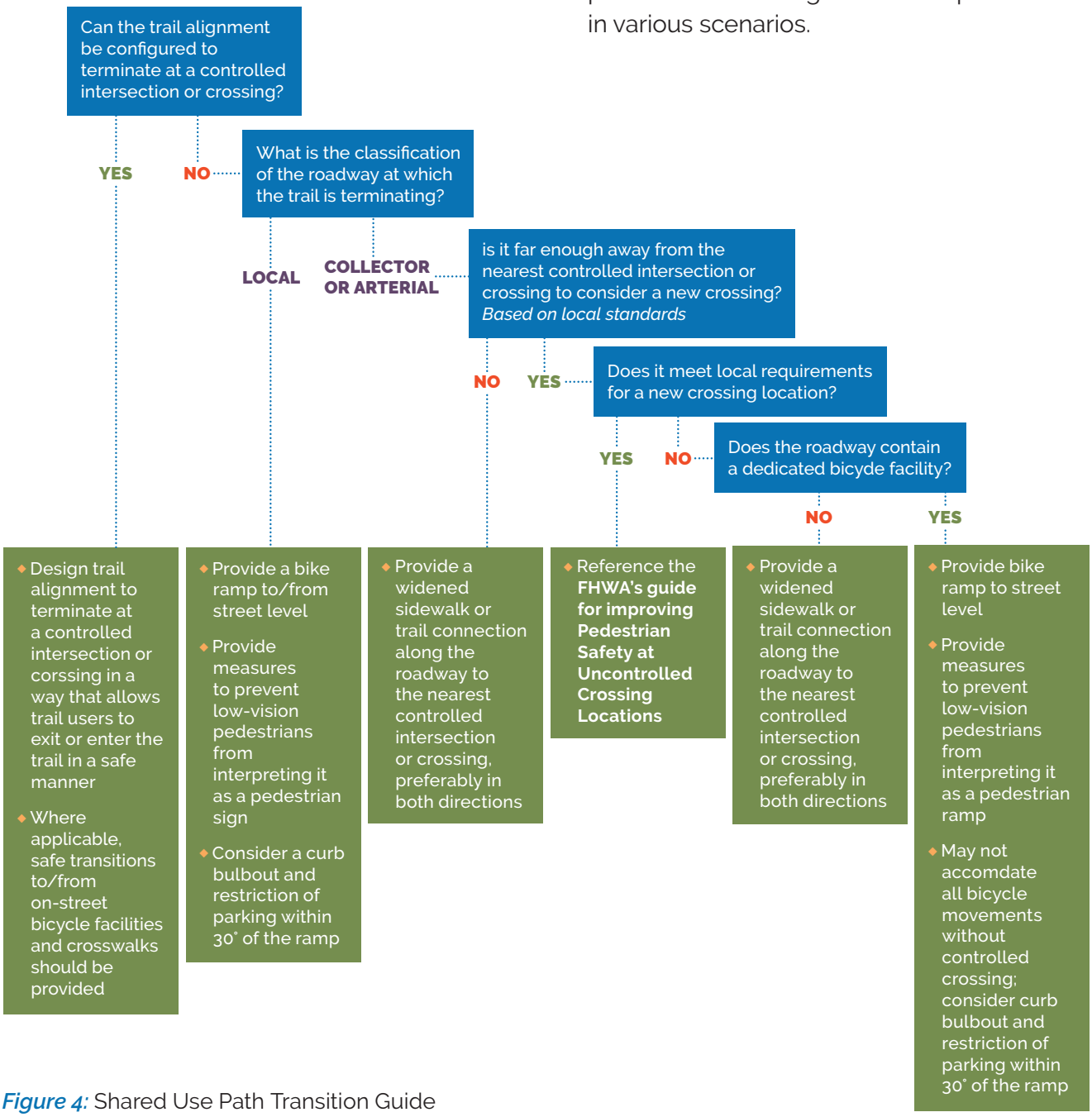


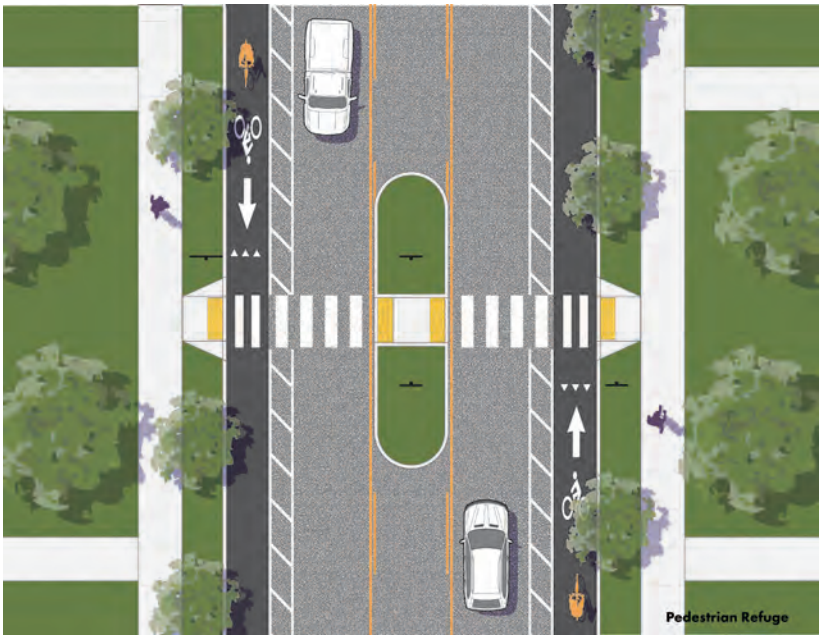
Figure 4: Shared Use Path Transition Guide

Intersection Treatments

Uncontrolled Intersections

Curb Extensions

Curb extensions minimize pedestrian exposure during crossings by shortening crossing distances and giving pedestrians a better chance to see and be seen before committing to crossing. They are appropriate for any crosswalk where it is desirable to shorten the crossing distance and there is a parking lane adjacent to the curb.



Median Refuges Island

Median refuges or "islands" are protected areas across a roadway or in an intersection that allow pedestrians and/or bicyclists to cross a street in stages, reducing exposure, increasing visibility, and improving overall safety.

Rectangular Rapid Flashing Beacons (RRFBs)

An active warning beacon is suitable for roads with 2-3 lanes and moderate vehicle speeds (25-40 mph). This treatment includes high-visibility crosswalks and pedestrian warning signage with Rectangular Rapid Flashing Beacons (RRFBs) mounted on the signpost. While RRFBs are typically push-activated, they can also feature passive detectors that recognize pathway users and activate the RRFB immediately. When possible, pedestrian refuge islands should be included.

Pedestrian Hybrid Beacons (PHBs)

Pedestrian hybrid beacons should be installed at crossings of streets that are more arterial in nature, either due to high vehicle speeds or a high number of lanes. These beacons are centered over each travel lane, typically push-activated, and come with signage to indicate where drivers should stop and how to interpret the light patterns. Hybrid beacons should not be used with railroad crossing signals due to the similarity of flashing signals; instead, a full traffic signal should be used. It is important that the beacon is immediately activated after the button is pushed, unless there are nearby signals requiring coordinated timing.

Signalized Intersections

ADA Accessibility Features at Signalized Intersections

Curb Ramps

Accessible curb ramps allow all sidewalk users safe access to intersection or midblock crossings by providing a sloped ramp to the grade level of the crossing. The slope of this ramp should be compliant with current ADA standards (maximum 1:10 or 10%, and ideally 1:12 or 8%). The level landing at the top of a ramp should be at least 4 ft long and at least the same width as the ramp itself.

Tactile Warning Surfaces

Tactile Warning Surfaces (also known as truncated domes) are used along curb ramp edges to alert people with visual impairments of an upcoming crossing. Tactile warning surfaces are also a contrasting color and material to provide additional distinction between pedestrian and vehicle zones.

Signal Enhancements

Bike and Pedestrian Detection

Fixed-time signals, which provide a pedestrian signal without detection, are generally recommended in urban areas. They provide predictability and regularity to the network and minimize delay for pedestrians. In less-trafficked areas, pedestrian and bike detection devices may be used to trigger a signal change, allowing the activating bicyclist or pedestrian to cross the intersection. Detection can be either active or passive (through in-pavement loops, videos, microwaves, etc.) Passive detection is preferred in urban context if fixed-time signals are not used.

Detection types:

- Loop: Induction loop embedded in pavement
- Video: Aimed at bicyclist approaches; calibrated to detect bicyclists
- Microwave: Microwave radar that picks up non-background targets
- Push-button: User-activated button mounted on a pole facing the street

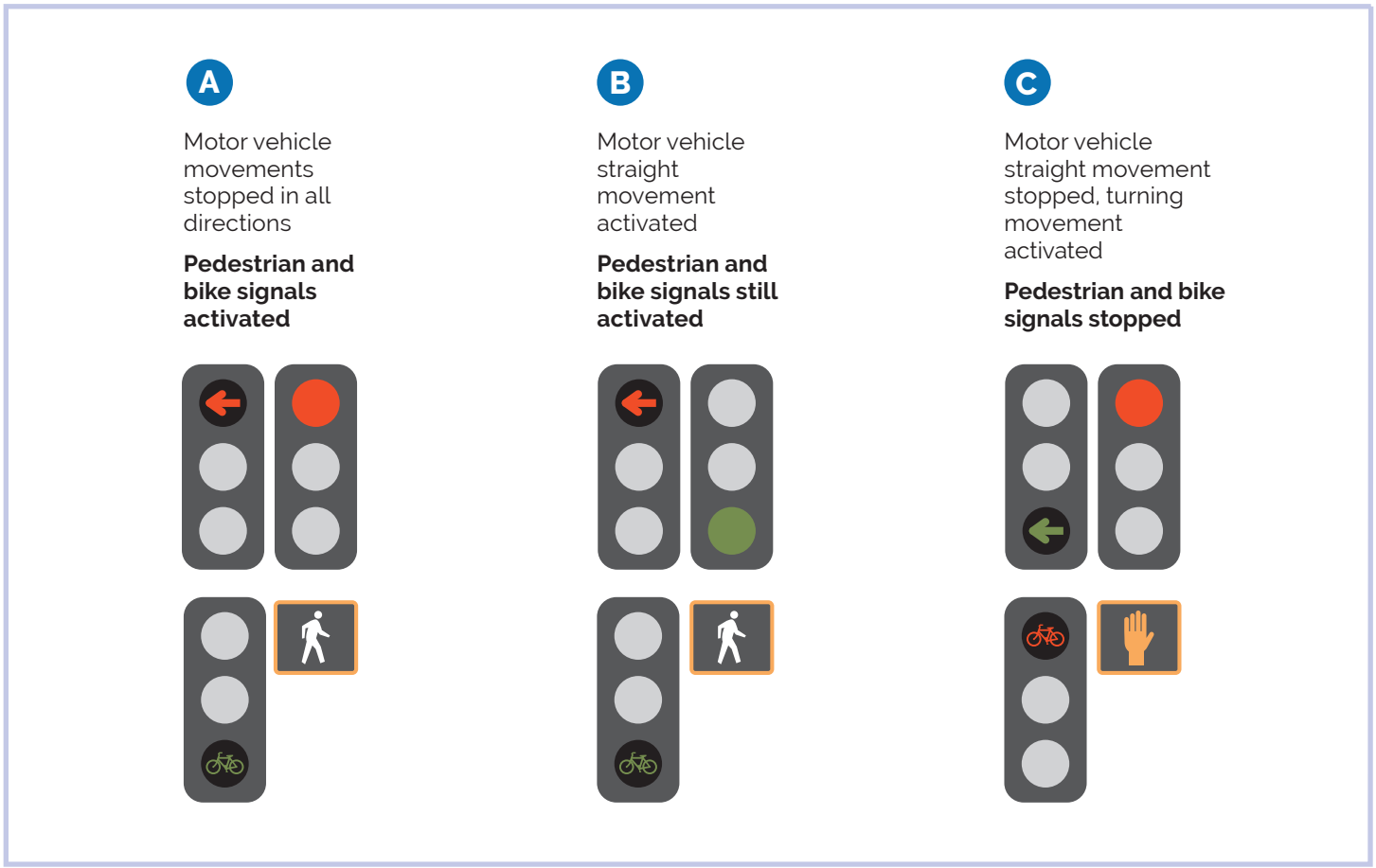
Accessible Pedestrian Signals (APS)

Accessible pedestrian signals (APS) are devices that communicate information about the WALK and DON'T WALK intervals at signalized intersections in non-visual formats (audible and vibrotactile) to pedestrians who are blind or who have low vision. APS often use a push button to activate them, but some versions can be activated by a hand wave through an infrared sensor to minimize touch. Though the crossing may not require pedestrian detection to trigger the signal change, the pushbutton vibrotactile feedback provides an alternate cue for low vision pedestrians.

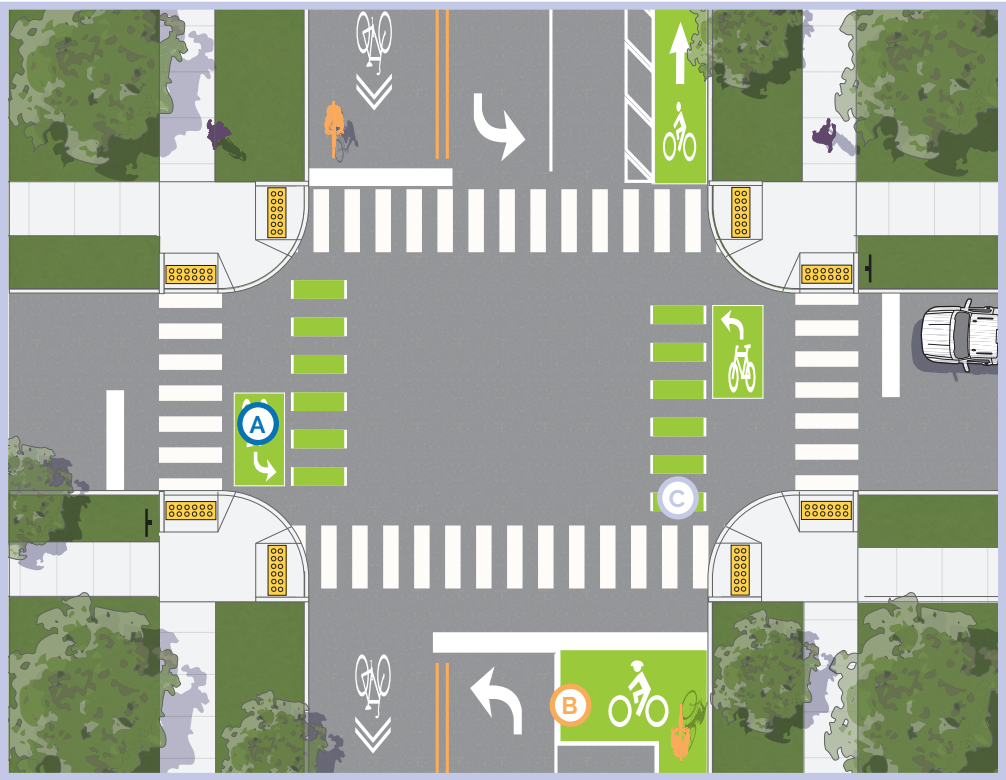
Leading Pedestrian / Bike Intervals

A Leading Pedestrian Interval (LPI) or Leading Bike Interval (LBI) activates the pedestrian/bike crossing signal in advance of the light turning green to allow pedestrians and bicyclists to begin crossing the intersection before motor vehicles, enhancing their visibility.

Figure 5: Features of LPI/LBIs



Bikeway Treatments at Intersections



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Two-Stage Queuing Box

Two-stage turn queue boxes provide bicyclists with a safe way to make left turns at multi-lane signalized intersections from a right-side bike lane. On right-side separated bike lanes, bicyclists are often unable to merge into traffic to turn left due to physical separation, making two-stage left turn boxes critical. Design guidelines for two-stage turns apply to both separated and unseparated bike lanes.

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Bike Box

A bike box is a designated space at the front of a traffic lane at a signalized intersection that provides bicyclists with a space to wait in front of vehicle traffic during a red signal phase. This allows cyclists to enter the intersection first on a green light.

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Conflict Striping

Green-colored conflict striping should be included within a bicycle lane where conflicts may occur, such as driveway entrances and at intersections where motorists will be turning right over the bike lane. Striping increases the facility's visibility and reinforces priority of bicyclists in conflict areas.

Rail Crossings

Rail crossings must be carefully considered to adequately alert active transportation users of the active rail line, and presence of railroad tracks. Class I rail operators in the NLCOG region include Kansas City Southern, BNSF, and Union Pacific. Union Pacific and BNSF published a joint document detailing design requirements for railway crossings, Guidelines For Railroad Grade Separation Projects (2016). Kansas City Southern maintains a similar document, last updated in 2020. These guidelines provide guidance on design features and processes needed to install new rail crossings.

Figure 6: Railroads in NLCOG

Greenway and Trail Rail Crossings

Greenways and trails outside of the right of way may need to navigate across active rail tracks. Trail and railroad crossings may be at-grade or grade-separated through a bridge, underpass, or tunnel.

BNSF and Union Pacific prohibit new at-grade trail-rail crossings but may allow new trails to cross railroad tracks adjacent to existing at-grade roadway/rail crossings. Rail-with-trail overpasses and underpasses are both allowed, but these types of crossings can add significant costs and time needed to construct the trail. The Guidelines for Railroad Grade Separation Projects published by these operators provides extensive guidance for bridge and underpass design. Grade-separated crossings should be designed with accessible approach grades, along with fencing and lighting as appropriate.

A pedestrian bridge over rail tracks in Salt Lake City

Image Source: Union Pacific

Sidepath/Bikeway Rail Crossings

Installing sidepaths, paved shoulders, or bikeways on roads with existing at-grade rail and roadway crossings can present challenges to non-motorized users who may be unsure how to safely cross. Installing a bikeway at an existing at-grade crossing is typically permitted by operators, but the operator typically maintains the crossing and should be involved in the design process.

Care must be taken to evaluate the site-specific conditions to determine the traffic control devices needed to maintain users' safety and to provide necessary guidance for users. As mentioned in the FHWA report Rails with Trails: Best Practices and Lessons Learned, safe crossings should provide:

- Advanced notice of the crossing
- Properly located traffic control devices
- Ability to see an approaching train

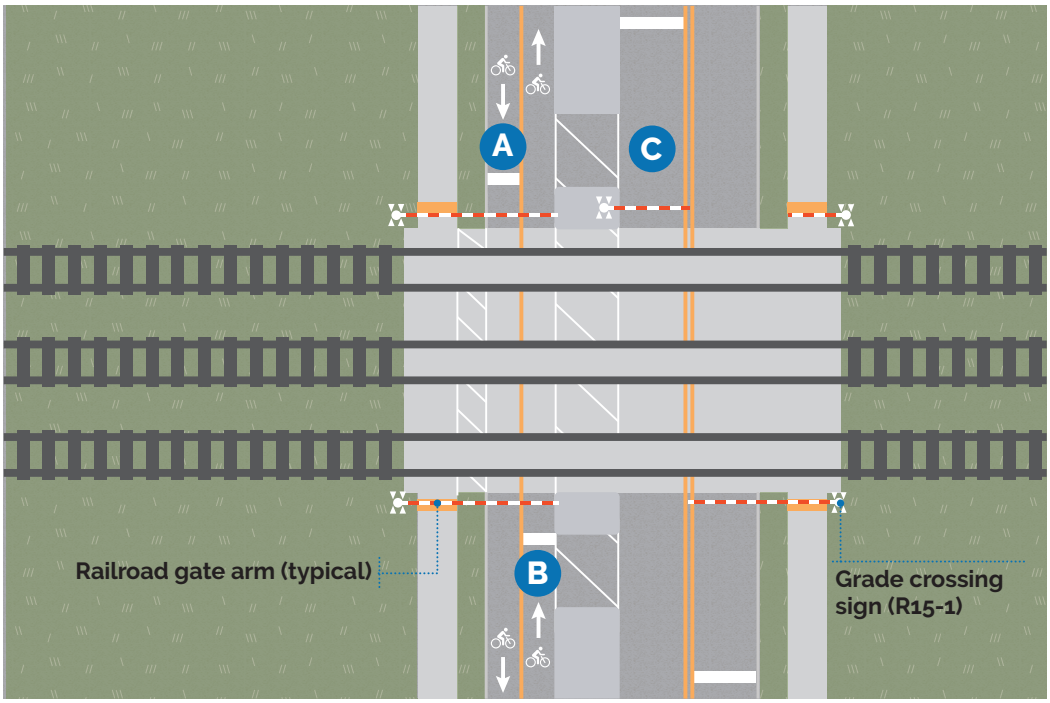
Selecting a traffic control device is influenced by a variety of factors such as train frequency, sight lines, traffic volumes, and user behavior. Each individual crossing should be studied to determine the features to implement. Traffic control devices may alert users through **Active** or **Passive** warning systems. Passive crossings consist of signing and pavement markings. Active warning systems provide visual and audible warning of the approach of a train and require power.

CROSSBUCK sign
(R15-1)

STOP sign
(R1-1)

For bicyclists to maintain control while crossing, the approach should be gradual on both sides of the tracks, and grades over five percent are not recommended. Additionally, bicyclists' wheels may catch on the rails when crossing. To minimize this risk, AASHTO recommends that the skew angle between the centerline of the tracks and the bikeway is between 60 and 90 degrees, with closer to 90 degrees preferred.

Figure 7: Two-way separated bike lane and rail crossing



A Southbound bikeway approach

B Northbound bikeway approach

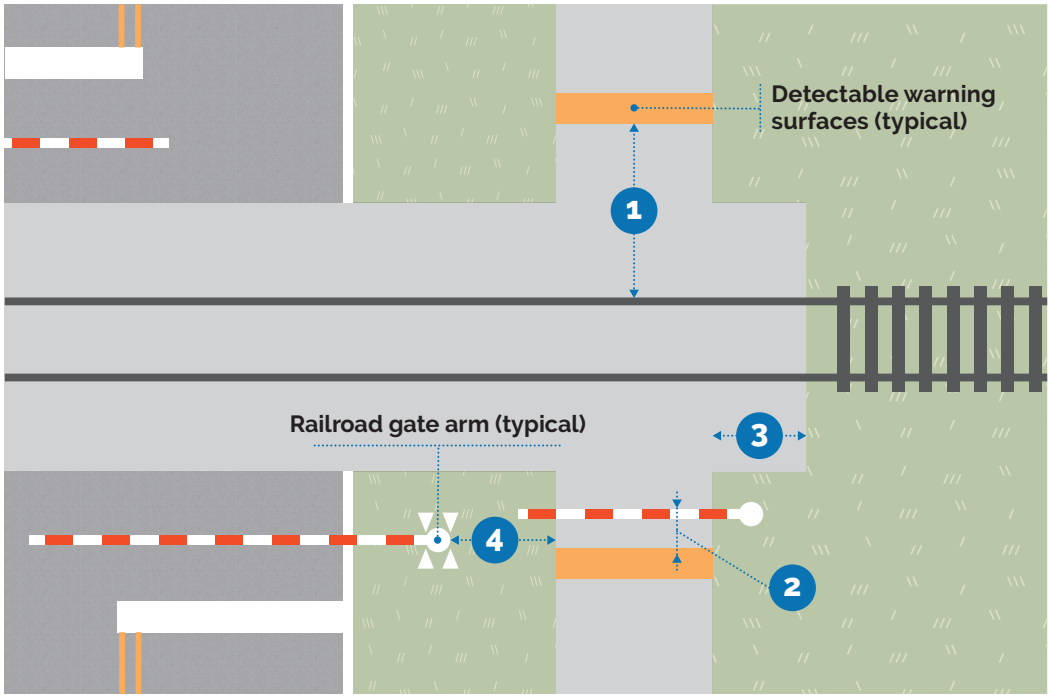
C Southbound vehicle travel lane approach

Adapted from Ohio Department of Transportation Multimodal Design Guide

Sidewalks and Rail Crossings

- Pedestrian routes should conform with accessibility guidelines for standard sidewalks and crossings. Rails and gaps in tracks may present a tripping hazard or catch wheelchair wheels.
- If automatic gates for pedestrian paths are used, they should provide enough space and an emergency escape route away from the track area so that a slower moving pedestrian does not get trapped in between gates.
- Channelized barriers may be used to direct pedestrians towards an optimal crossing location.

Figure 8: Placement of Detectable Warnings for Pedestrian Crossings



1. Nearest edge of detectable warning surfaces shall be placed 6 ft. minimum to 15 ft. maximum from the nearest rail. For skewed railways, in no instance shall the detectable warning be closer than 6 ft. measured perpendicular to the nearest rail.
2. When pedestrian gates are provided, detectable warning surfaces shall be placed on the side of the gates opposite the rail, 2 ft. from the approaching side of the gate arm. This criteria governs over Note 1
3. Crossing surface should extend 2' minimum past the outside edge of walk or shared use path.
4. Ensure that gate arm counterweight does not overlap with sidewalk when gate arm is extended.

Adapted from Ohio Department of Transportation Multimodal Design Guide

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Additional Streetscaping Elements

This chapter outlines additional design treatments that can enhance pedestrian and bicyclist comfort and safety. Items discussed in this chapter include:

Enhancing Biking and Pedestrian Safety

- Access management strategies
- Variable speed limits
- Road diets
- Crosswalk visibility enhancements
- Lighting

Additional Streetscape Elements

- Walking and biking amenities
- Bike parking
- Transit & active transportation elements

Managing Biking And Pedestrian Safety

The following strategies can be incorporated as additional design features integrated into other projects or as standalone projects which improve pedestrian and bicyclist safety.

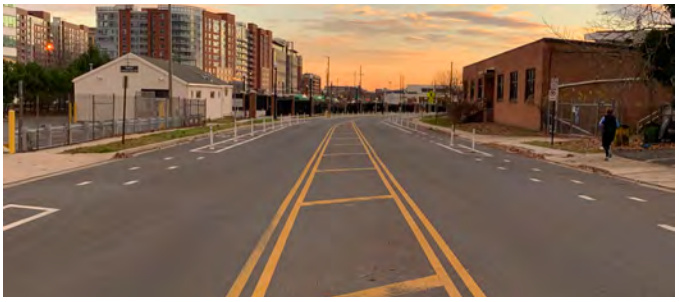
Integrating safety countermeasures into roadway projects where possible can help establish a culture of safety and reduce fatal and serious injuries.

Access Management Strategies

Access management controls the entry and exit points along the roadway through design treatments. This includes commercial and residential driveways along collector and arterial streets. Access management can be an effective strategy in rural and suburban areas, where intersections and driveways are present on high-speed roadways. The following access management strategies recommended in FHWA's Proven Safety Countermeasures initiative can be used individually or in combination with one another:

- Reduce density by closing, consolidating, or relocating driveways.
- Manage intersection and access points spacing.
- Limit allowable driveway movements (such as right-in/right-out only).
- Place driveways on an intersection approach corner rather than a receiving corner.
- Implement raised medians that prevent cross-roadway movements.
- Utilize designs such as roundabouts or reduced left-turn conflicts (such as restricted crossing U-turns, median U-turns, etc.).
- Provide turn lanes (i.e., left-only, right-only, or interior two-way left).

source: FHWA



Variable speed limits

Variable Speed Limits (VSLs) determine and dynamically adjust the speed limit based on traffic volumes, weather, and road surface conditions. VSLs are most effective on urban and rural roads with high speeds (greater than 40 mph).

Road Diets

A Road Diet typically involves eliminating one or more travel lanes on a road with excess capacity. This can be done by converting multiple turn lanes into a center turn lane or transforming a travel lane to a separated biking lane, bus only lane, or shared use facility. Road diets can prevent serious crashes by reducing vehicle speeds.

Crosswalk Visibility Enhancements

Crosswalk treatments such as high-visibility materials, lighting, signage, and pavement markings make pedestrians, bicyclists, and micromobility users more visible to drivers.

Lighting

Lighting can reduce crashes up to 42% for people walking at night (Source: FHWA). Lighting can be particularly helpful at crossing locations and helps enhance feelings of personal security. Lighting creates a vertical delineation between the roadway and the pedestrian space and/or bikeway.

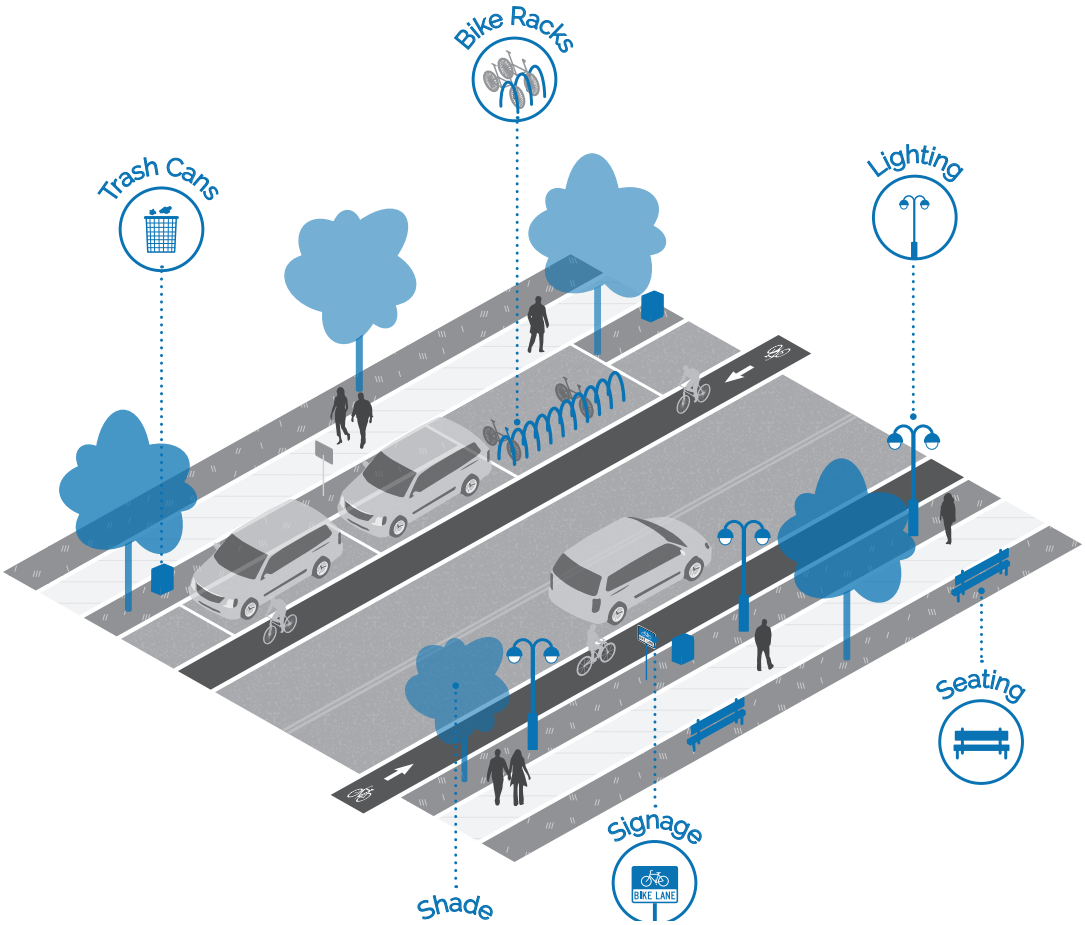
Walking and Biking Amenities

Matching the infrastructure with community needs through amenities such as wide sidewalks, dedicated bike facilities, bikeshare, transit stops, and placemaking features can enhance a sense of place, in addition to providing useful amenities for active transportation users.

The amenities pictured below create more welcoming spaces for walking and biking, which in turn encourages more active transportation. Branding elements and unified palette of street furnishings can integrate into the area's identity.

Figure 9: Additional amenities to support biking and walking

BICYCLE AND PEDESTRIAN AMENITIES



Additional Amenities to Consider

- Access to nearby amenities (ie. shops, restaurants, parks)
- Public art
- Public lockers / showers / bathrooms
- Green infrastructure elements
- Pathway entry control

Streetscaping elements in Bossier City.

Potential Features

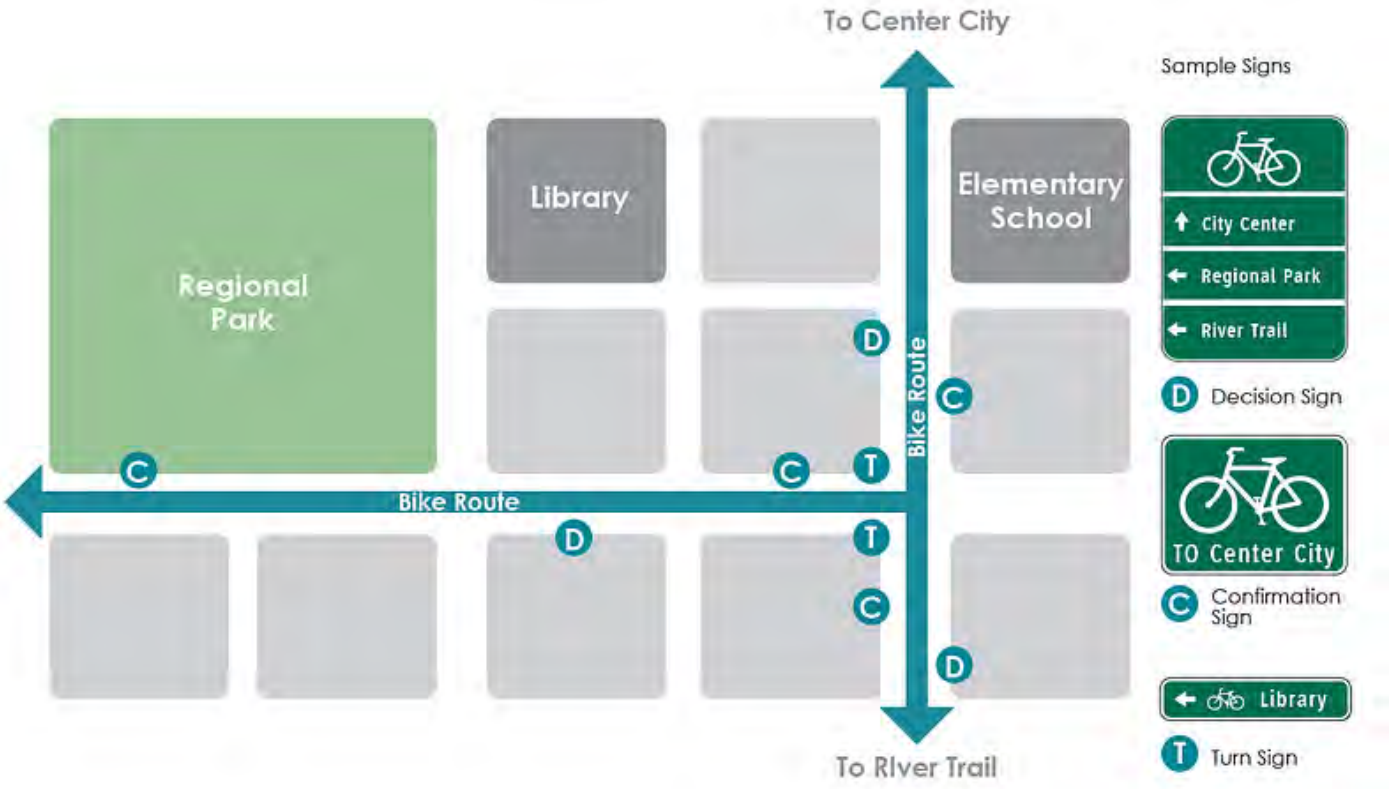
- Street furniture – trash cans, benches, water fountains
- Lighting, benches, newspaper kiosks, utility poles, shade, bus loading islands, and bus stops
- Green infrastructure elements, such as rain gardens or flow-through planters
- Bike fix-it stations, footrests, bike racks, rest stops/benches, bike stations and public lockers/showers
- Signage, pathway entry control, interpretive points of interest, seating, public art
- Bike traffic signals, crossing button poles, bike sharing stations/programs, wayfinding, plantings
- Entrances to destinations easily accessible from sidewalks and bike facilities

Wayfinding

Well-designed wayfinding systems create a sense of place, encourage walking and bicycling, and help foster tourism and economic growth. Effective wayfinding provides clear, intuitive, and accurate information to users.

Design Features

- Connect Places: Wayfinding links the biking and walking network to key destinations. The type of place dictates how far away it can be shown on a sign: recognizable districts may be shown up to 3-4 miles away, landmarks up to 2 miles, and local spots up to 1 mile.
- Promote Active Travel: Signs should highlight the feasibility of walking and bicycling, reducing barriers to these modes of travel. Visibility and clarity of signage can boost the usage of both on-street and off-street facilities.
- Maintain Motion: Signs should be easy to read and understand, clear, and consistent.
- Predictable: A reliable and predictable system builds user trust and encourages future trips. Consistency in design elements is key.
- Simplify Information: Presenting information clearly in decision-making. Placement of signs is important for effectiveness.
- Accessible: Signage should be comprehensible for all users, including those with disabilities or limited English proficiency, ensuring universal accessibility and safety.



Bike Parking

Secure bike parking creates a space for individuals to safely and comfortably park their bike while stopping in an area. Bike parking reduces instances of bikes blocking sidewalks or other navigable areas.

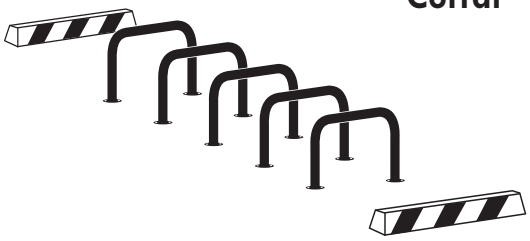
Design Features

- **Short term parking:**
  - Short term bike parking includes bike racks for those visiting a place for up to a few hours. It mostly consists of bike racks. Users of short-term bike parking tend to be infrequent visitors, so the bike parking needs to be self-explanatory and convenient.
  - Short term bike parking should be within 50 ft of the entry of the building it is serving, placed in a high-visibility area, and as weather protected as possible.
  - For short term bike parking, a typical Inverted-U Rack is recommended, as it is easy to use, prevents bikes from falling over, and comfortably fits two bikes. Inverted-U racks should be centered in a 36" (24" minimum) x 96" (72" minimum) area.
- **Long term bicycle parking:**
  - Long term bicycle parking is for extended periods at a location (a full work day or overnight at an apartment building).
  - Long term bicycle parking is designed to be more secure than short term parking and provides enclosed space for one or more bikes.
  - Types of long-term bicycle parking include lockers (around 40" x 78" x 6') for two bikes, cages, and bike rooms.

Short-Term Parking

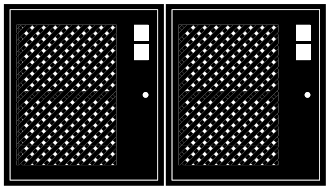
Inverted U

Post & Ring

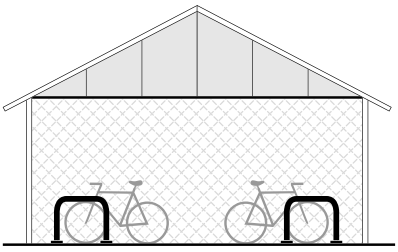


Corral

Long-Term Parking



Bike Lockers



Sheltered Secure Enclosure

Transit & Active Transportation Elements

Transit / Bike Links, Pedestrian Transit Amenities, Transit Hub Design

A well-designed active transportation network can complement a well-designed transit system, strengthening the effectiveness of both networks. Biking facilities can provide a first or last-mile connection to a high-frequency transit stop. Where possible, biking connections to transit hubs should be implemented. Wayfinding signage may be helpful to direct active transportation users towards transit stops.

Features at transit stops themselves that support walking and biking are demonstrated in Table 6.

Bikes can be accommodated on transit inside or outside the vehicles. Inside bike racks can be used on articulated low-floor transit and have the benefit of being quicker to load, though some forms require passengers to lift their bike into the rack. Front-end exterior racks are a common bus feature. Loading bikes on to exterior racks can take up to 30 seconds, adding to stop dwell time.

Table 6: Recommended Transit Stop Amenities

FUNCTIONAL CLASSIFICATION	ALL TRANSIT STOPS	OPTIONAL ENHANCEMENTS
Sidewalk to Transit Stop	✓	
Crosswalk to Transit Stop	✓	
ADA Features (i.e. Curb Ramps)	✓	
Route and Service Information	✓	
Seating	✓	
Lighting	✓	
Bike Parking		✓
Trash and Recycling		✓
Bike and Micromobility Share Stations		✓
Drinking Fountains		✓
Transit Shelter		✓
Real-Time Route Information		✓
Wayfinding Signage		✓

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5 Implementation Considerations

When designing active transportation facilities, consider the appropriate materials to fit the users, context, funding, and maintenance. This chapter covers two elements of streetscaping design:

- Quick-build and lower cost materials
- Landscaping and stormwater management

Quick Build and Low-Cost Materials

Introduction

Quick Build is a strategic approach to urban development that focuses on implementing transportation infrastructure improvements rapidly and affordably. Quick Build is a method to help local governments improve communities for walking, bicycling, and micromobility on a minimal budget and on a compressed timeline, as both planning and building are much less expensive. Quick Build puts bicycle, pedestrian or traffic safety improvements in place using low-cost materials that can be installed quickly (typically less than 1 year). They are flexible and designed to be easily changed or even removed if necessary, but it is important to note that they are not pop-up or demonstration projects. Quick Build can be characterized by its use of inexpensive materials, streamlined planning, and expedited construction processes, allowing for significant changes to be made within months rather than years.

Quick Build also allows designers/implementers to receive public feedback while also building enthusiasm and support for more permanent infrastructure. Once a project is accepted by a community, Quick Builds can last for years if maintained, or they can be rebuilt using more durable materials.

However, some challenges include the potential for projects to be less durable than those constructed through traditional methods and the need for ongoing maintenance to ensure longevity. Some quick build solutions are also less attractive than using more durable materials. Overall, Quick Build offers a pragmatic solution for cities looking to improve transportation infrastructure efficiently.

Table 7: Facilities that can be built using low-cost materials

FACILITY	ELIGIBLE FOR QUICK BUILD?	QUICK BUILD OPTIONS
Standard Bike Lane	✓	Quick-build implementation with paint, traffic tape, planters, and signs.
Buffered Bike Lane	✓	Quick-build implementation with paint, traffic tape, planters, and signs.
Paved Shoulders	✗	
Separated Bike Lane (Cycle Track)	✓	Quick-build implementation with paint, traffic tape, planters, and signs.
Bike Boulevard	✓	Quick-build implementation with stencils and signage; option to add other traffic-calming quick-build elements (such as curb extensions, mini traffic circles, etc.)
Sidepath	✗	
Greenway	✗	

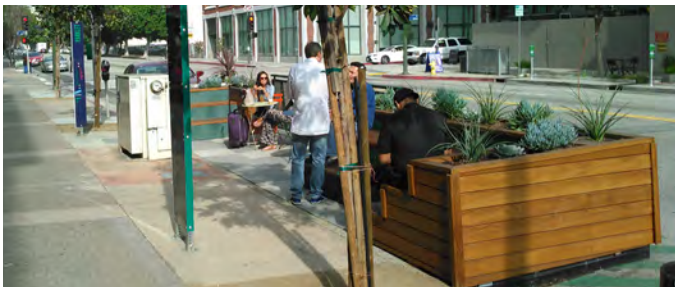
Quick Build Separated Bikeway
Provides separated biking facilities. May use free standing delineator posts, planters, jersey barriers, or curb barriers.

Quick-Build Tightened Corner
Tightened corners slow vehicles down and reduces the opportunity and severity of conflicts at turns. Paint and free standing delineator posts, planters, or flexposts may be used.

Bikeway markings
Applying standard MUTCD bikeway markings to provide visual separation or indication of biking traffic is a low-cost method to implement standard bike lanes or shared roads, in appropriate contexts.

Left Turn Hardening
Left-turn hardening involves applying striping, surface materials, and vertical markers at intersections to reduce left-turn speeds and prevent drivers from "cutting the corner."

Bike corrals
Bike corrals convert curbside parking spaces into parking for bicycles or scooters. By organizing bike parking, corrals help keep sidewalks clear for pedestrians.



Parklets
Parklets transform curbside parking spaces into public areas. These spaces include public seating, greenery, bike parking, and shade, benefiting nearby businesses along busy commercial streets.

Landscaping and Stormwater Management

Landscaping and stormwater management along a street can retain and manage stormwater, create a cooling effect, and enhance a corridor's identity. Bioretention facilities provide space for stormwater to drain and be reused.

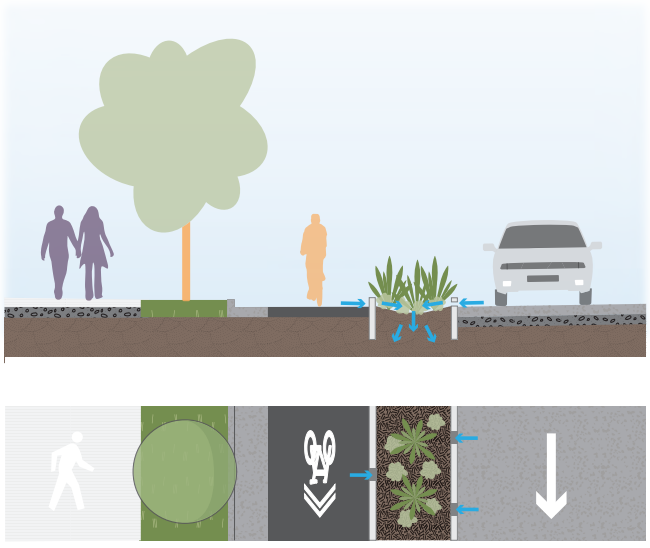
Design Features

- Co-locate bioretention facilities with other street design strategies such as curb extensions or bike lane buffers.
- Street reconstruction offers opportunities for bioretention.
- Landscaping needs to be designed and maintained to be compatible with sidewalks and bikeways.

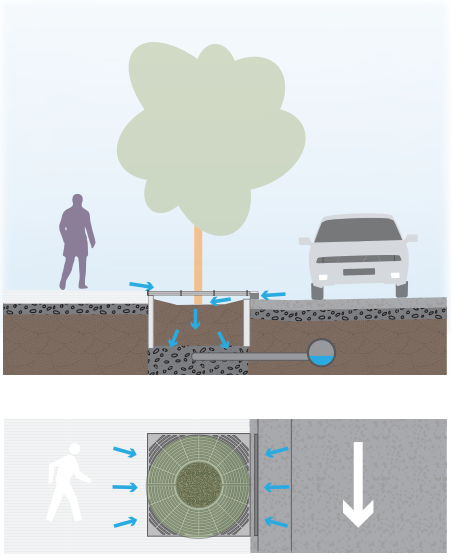
Typical Use

- Green infrastructure can be used in a variety of contexts. Consider using stormwater infrastructure while designing streetscapes, bikeways, and trails.

Permeable Pavement
Permeable pavement materials allow water to infiltrate through them and manage runoff.



Bioretention Swale
Bioretention swales manage stormwater runoff from the street and feature sloped sides.



Stormwater Tree
Stomwater trees can manage street stormwater runoff and provide shade for active transportation users.