SANTA FE METROPOLITAN BICYCLE MASTER PLAN 2019

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SANTA FE METROPOLITAN PLANNING ORGANIZATION

APPENDICES

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APPENDIX A

SANTA FE METROPOLITAN BICYCLE DESIGN TOOLKIT

TOOLE DESIGN

SANTA FE METROPOLITAN BICYCLE DESIGN TOOLKIT

April 2019

Santa Fe Metropolitan Planning Organization Members:

City of Santa Fe
Pueblo of Tesuque
Santa Fe County
New Mexico Department of Transportation

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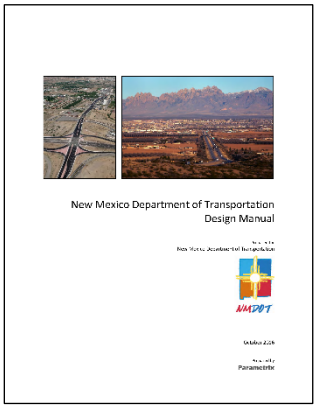
AVAILABLE STANDARDS AND RESOURCES

The publications listed here are excellent resources for planning and design guidance in implementing safe and comfortable facilities for pedestrians and bicyclists. Many of these resources are available online at no cost.

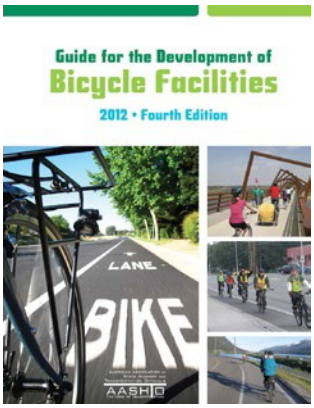
New Mexico Department of Transportation (NMDOT)

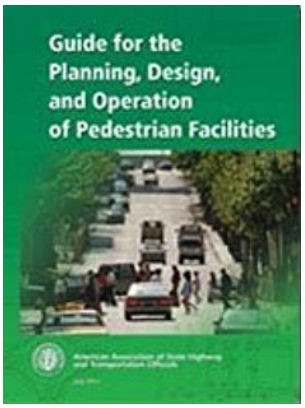
- NMDOT Design Manual, Chapter 1200 Pedestrian Facilities (2016)
- NMDOT Design Manual, Chapter 1210 Bicycle Facilities (2016)



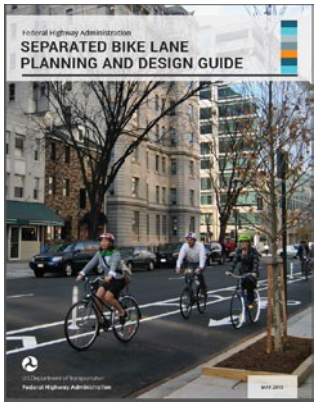
American Association of State Highway and Transportation Officials (AASHTO)

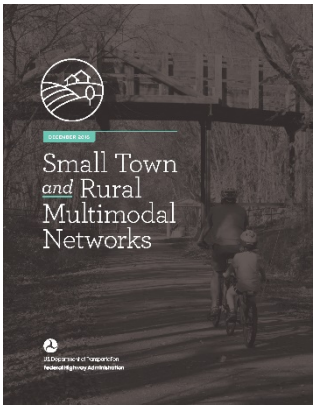
- Guide for the Development of Bicycle Facilities (2012) (update anticipated in 2019)
- Guide for the Planning, Design, and Operation of Pedestrian Facilities (2004)
- A Policy on Geometric Design of Highways and Streets, 7th Edition (2018)

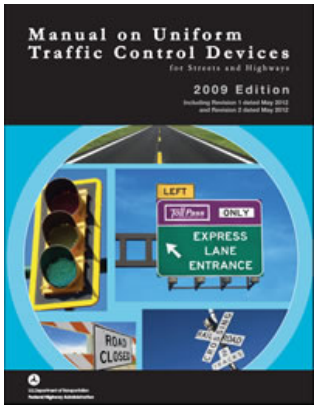


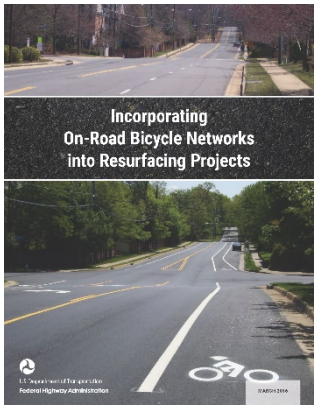


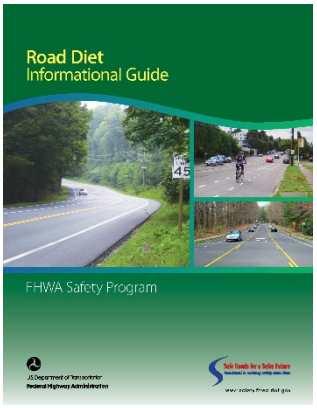
Federal Highway Administration (FHWA)











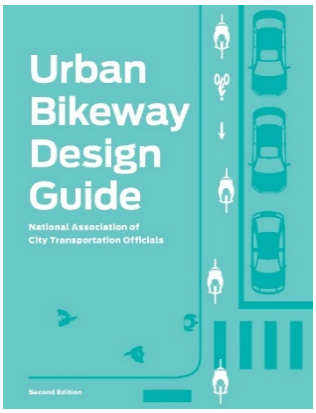
- Guide for Achieving Multimodal Networks: Applying Design Flexibility and Reducing Conflicts (2016)
- Separated Bike Lane Planning and Design Guide (2015)
- Small Town and Rural Multimodal Networks (2016)
- Manual on Uniform Traffic Control Devices (2009)
- Incorporating On-Road Bicycle Networks into Resurfacing Projects (2016)
- Road Diet Informational Guide (2014)

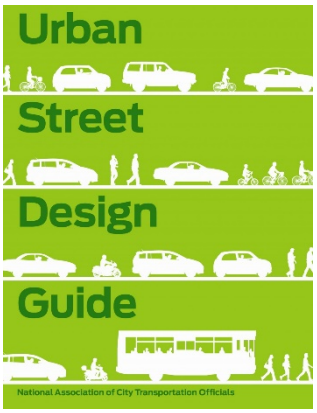
Massachusetts Department of Transportation (MassDOT)

- Separated Bike Lane Planning and Design Guide (2015)

National Association of City Transportation Officials (NACTO)

- Urban Bikeway Design Guide (2012)
- Urban Street Design Guide (2013)





INTRODUCTION

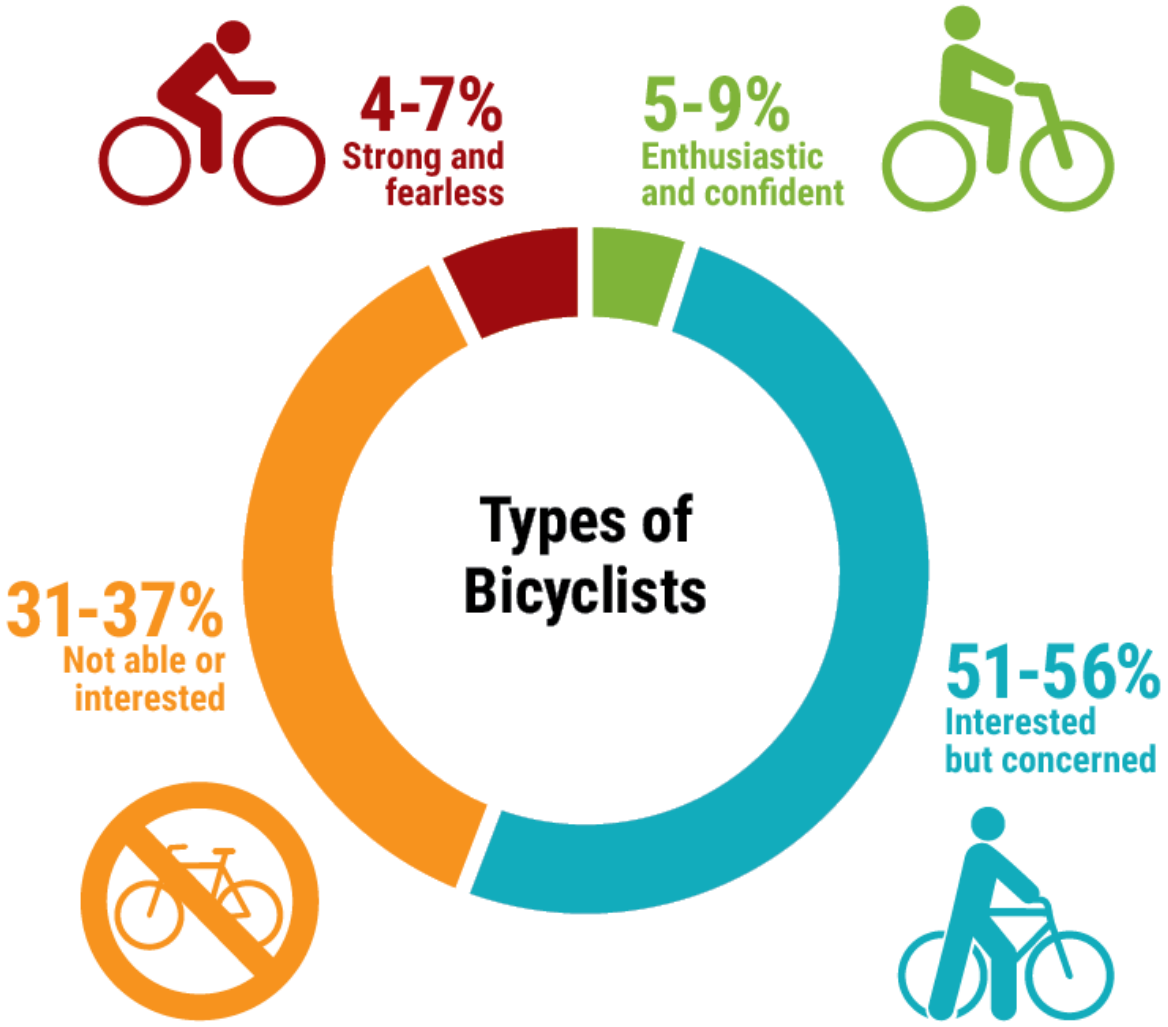
PURPOSE AND FUNCTION

The purpose of this toolkit is to provide guidance for planning, designing, and operating bicycle facilities in the Santa Fe region of New Mexico. This toolkit provides information on infrastructure for bicycle travel in most urban, suburban, and rural contexts. This toolkit is not intended to be a detailed design manual for every situation, and sufficient flexibility is permitted to encourage designs that are context-sensitive and incorporate the needs of all users.

This design toolkit may be endorsed by member agencies of the Santa Fe Metropolitan Planning Organization and can inform the future development of decision-making policies and design standards for bicycle facilities across the region. While this design toolkit is not regulatory, its recommendations reflect national best practices for the planning and design of bicycle facilities that accommodate the Interested but Concerned bicyclist, described in the following section. Successful bicycle facility implementation will require interjurisdictional coordination, dedicated funding sources, and adequate staffing.

THE DESIGN USER

The figure below illustrates the spectrum of interest in bicycling as a mode of transportation among the general population in most U.S. communities. Estimates show the greatest percentage of the population—over half—fall into the Interested but Concerned category. Interested but Concerned bicyclists are most comfortable biking when separated from motorized vehicles and include children, seniors, and less experienced bicyclists. On the other end of the spectrum, Highly Confident bicyclists are comfortable sharing the road with motorized vehicles. In the middle, Somewhat Confident people are comfortable biking for short distances with motorized vehicles but prefer dedicated bicycle facilities. To increase ridership, facilities should be designed to accommodate bicyclists of all ages, abilities, and backgrounds. Bicycle facilities should meet the desired level of comfort for most users. Research indicates that providing less separation on roads with higher speeds and volumes will result in fewer people choosing to use a bicycle on those roads.



These percentage values are typical ranges for most US communities.

Photo credit: Tim Rogers

Interested but Concerned

bicyclists require physical bicycle infrastructure improvements before they will choose to ride.

Photo credit: Tim Rogers

Somewhat Confident

bicyclists will ride comfortably on most types of streets, but prefer dedicated bicycle facilities.

Highly Confident

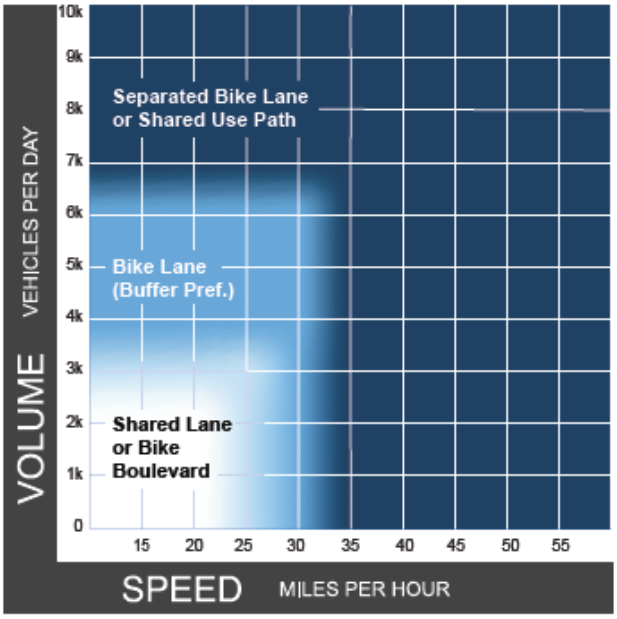
bicyclists are comfortable mixing with motor vehicle traffic and will ride on almost any road.

LINEAR BICYCLE FACILITIES

FACILITY SELECTION

This section provides guidance on selecting the appropriate bicycle facility based on traffic characteristics and land use context.

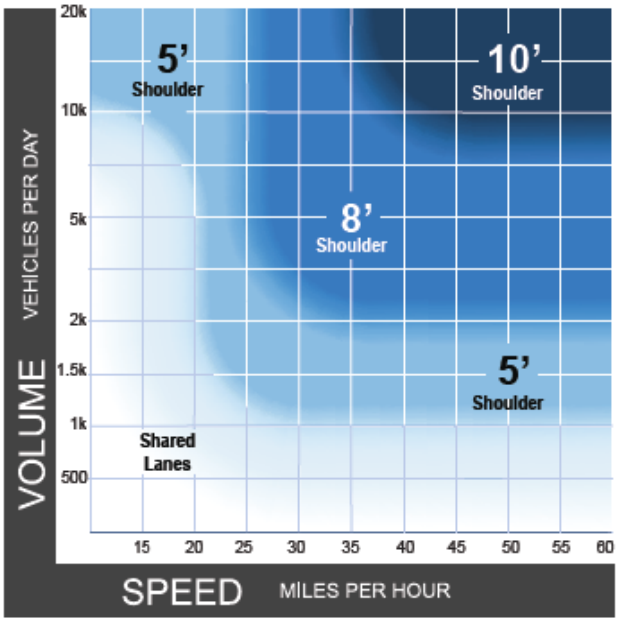
TRAFFIC VOLUMES AND SPEEDS



Notes

1. *Chart assumes operating speeds are similar to posted speeds. If they differ, use operating speed rather than posted speed.*
2. *Advisory bike lanes may be an option where traffic volume is <3K ADT.*
3. *See Section 4.4 for a discussion of alternatives if the preferred bikeway type is not feasible.*

Preferred Bikeway Types for Urban and Suburban Contexts



Notes

1. *This chart assumes the project involves reconstruction or retrofit in constrained conditions. For new construction, follow recommended shoulder widths in the AASHTO Green Book.*
2. *A separated shared use pathway is a suitable alternative to providing paved shoulders.*
3. *Chart assumes operating speeds are similar to posted speeds. If they differ, use operating speed rather than posted speed.*
4. *If the percentage of heavy vehicles is greater than 10%, consider providing a wider shoulder or a separated pathway.*

Preferred Shoulder Widths for Rural Contexts

Bicyclists' comfort levels decrease with increases in motor vehicle volumes and speeds. Both traffic volume and traffic speed are important considerations when choosing an appropriate bikeway type. In general, as traffic volume and speed increase, so does the need for greater separation of the bikeway from traffic in order to appeal to a wider cross-section of users. Wider bikeways also help to mitigate the effects of volume and speed, albeit to a lesser extent than providing painted buffers or physical barriers.

The bicycle facility selection charts below combine both speed and volume into a single chart to help identify an appropriate treatment for given roadway. The threshold shown in the charts are intentionally blurred to allow the planners and designers some degree of flexibility in selecting the facility type.

On urban and suburban streets, the Interested but Concerned individual is assumed as the design user. As this is the largest population group, designing bicycle facilities for them will yield the greatest increases in bicycle ridership. The chart shows the degree to physical separation increasing as the volume and speed of motor vehicle traffic increases. This allows for higher level of comfort and protection for the design user in potentially unsafe environment.

On rural roadways, the design user is assumed to be the Highly Confident or Somewhat Confident group. For these population groups, paved shoulders and shared lanes are often appropriate facility types. However, it may be determined that the Interested but Concerned population group should be the primary design user in rural roadways as well. In this case, implementation of shared-use paths with physical separation from motor vehicle traffic would be

the preferred facility type. This type of facility would potentially increase ridership as it accommodates a broader group of bicyclists and offers better access to scenic views along rural corridors.

LAND USE CONTEXT

Land use can often impact the distances between destinations, as well as the expected number and types of bicyclists. Traditionally, streets are often assigned one functional classification despite passing through multiple land use contexts. Therefore, considering land use allows for a more thorough assessment of needs to develop an appropriate balance of transportation modes within a corridor.

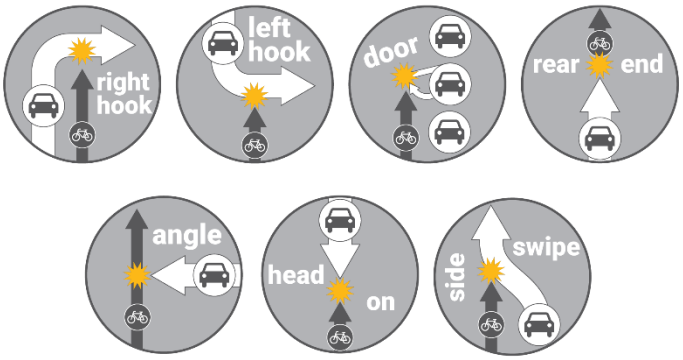
High density and urban areas generally have higher volumes of walking and bicycling due to shorter distances between destinations, more diverse land uses, and a higher concentration of human activity. These areas are more likely to require separation between motorists, bicyclists, and pedestrians. Depending on traffic speeds and volumes, separation between bicyclists and motorists may also be needed. Lower density areas with less diverse land uses often have lower bicyclist and pedestrian volumes. In these locations, shared-use paths may be a sufficient alternative to separated bike lanes or bike lanes. Rural areas often have lower rates of utilitarian bicycle trips and serve more recreational bicycle trips made by more confident bicyclists. Paved shoulders or bike lanes are often sufficient in these areas, but separation should be considered for locations near schools, parks, or popular bicycle routes.

CRASH HISTORY

Crash data and history are a valuable tool when selecting the appropriate facility type or spot treatment. Whenever a facility type or treatment is selected, safety issues and crash patterns should be assessed to address existing issues when data is available. Where crash data is unavailable or inadequate, near misses or public concerns can help designers better understand the safety of an existing facility. This is important because available data does not include unreported bicycle crashes.

Data that includes bicycle counts can also be useful when assessing crash history. Some facilities may appear unsafe due to a high number of crashes. However, they may be safer than expected, if the facility is used by high number of bicyclists. As such, the number of crashes per bicycle volume may be used to prioritize crash locations.

Crash data and maps are compiled by the University of New Mexico Traffic Research Unit and are available online at https://gps.unm.edu/tru.



Common types of Crashes Involving Bicyclists and Motorists

ALTERNATIVE ROUTE SELECTION

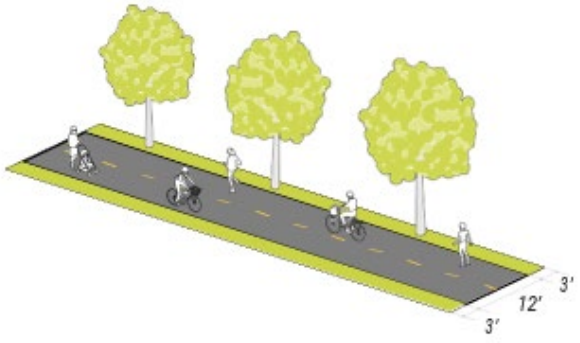
If implementation of a bicycle facility on a corridor is determined to be infeasible, alternative parallel routes may be considered to provide bicycle network connectivity. Alternative routes should not increase trip length by more than 30 percent, and adequate wayfinding signage should clearly guide bicyclists to and along the alternative route.

Development of an alternative route should consider regular connections to the primary corridor if the primary corridor contains major destinations.

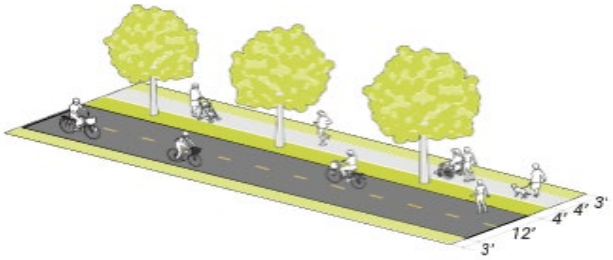
FACILITY TYPES

SHARED-USE PATHS

Shared-use paths are physically separated from motor vehicle traffic and used by bicyclists, pedestrians, and other non-motorized users. Shared-use paths, also referred to as trails, are often located in an independent alignment, such as a greenbelt or converted railroad right-of-way. Shared-use paths that are located parallel to an adjacent roadway are also known as sidepaths, which are addressed in the following section.



Two-way Shared-Use Path Width



Two-way Shared-Use Path with Parallel Soft Surface Path

Considerations

- According to AASHTO, "Shared-use paths should not be used to preclude on-road bicycle facilities, but rather to supplement a network of on-road bike lanes, shared roadways, bicycle boulevards, and paved shoulders."
- Shared-use paths make up a network or system of routes designed specifically for off-street travel.
- Shared-use paths are used for recreation, leisure activity, general mobility trips, and commuting.
- These paths are often located along waterways, within parks and open spaces, along roadways, and through easements and rights-of-way for utilities.
- Shared-use paths are appropriate when an on-street route may be too dangerous for Interested but Concerned bicyclists due to the speed of the road, the majority of users are recreational or leisure users, or to provide a more direct route between points of interest.

Guidance

- Where shared-use paths terminate or cross roads, transitions should be seamless, intuitive, and designed to ensure visibility and predictability for all users. Each roadway is also an access point and should be designed to facilitate movements of path users to either enter or exit the shared-use path. It is important to provide clear guidance to ensure users are going the appropriate direction when exiting the shared-use path. Latest Manual of Uniform Traffic Control (MUCTD) guidance, FHWA Interim Approvals, as well as AASHTO guidance should be used to determine appropriate traffic control at the crossings.
- A separate soft surface path such as crusher fines or decomposed granite may be constructed adjacent to a hard surface shared-use path to allow for users on foot to select the path material that suits their needs.
- The soft surface path should be separated from the adjacent paved path if possible. Where the site allows, additional separation between the soft surface path and the paved path should be provided to allow greater opportunity for vegetative growth between the two paths.
- The paved and soft surface path may follow separate alignments. They do not need to be parallel; in fact, the path experience is enhanced when they are not parallel.
- The FHWA Shared-Use Path Level-of-Service Calculator may be used to determine the width of the shared-use path and when to provide separation between bicyclists and pedestrians.

- All shared-use paths must conform to the current editions of both AASHTO and Americans with Disabilities Act (ADA) guidelines, including the Public Right-of-way Accessibility Guidelines (PROWAG) and corresponding Supplemental Notice for Pedestrian Facilities in the Public Right-of-Way.

Maintaining surfaces along shared-use paths is critical to the longevity facilities and is crucial to bicyclists' safety and comfort. The following measures can mitigate maintenance problems and improve comfort:

- Place manholes, drainage grates, and other utilities outside of high use areas of bikeways if possible.
- Design cross-slopes to ensure the riding surface is kept clear of water and debris.
- Use Fiber Reinforced Polymer (FRP) decking for trail bridges and crossings. FRP decking resists salt, water, and chemical corrosion that can damage or warp traditional wood decking.
- Consider using slurry seals or microsurfacing in lieu of chip sealing to ensure a smooth riding surface for bicycles.
- Use tightly woven geotextile fabric under asphalt pavement to reduce the intrusion of weeds and encroaching vegetation.
- Install root barriers where trail surfaces are adjacent to trees and large shrubs to prevent root intrusion under paved surfaces.
- Control vegetation and noxious weeds during construction.

References

- AASHTO Guide for the Development of Bicycle Facilities (2012)
- FHWA Shared-Use Path Level of Service Calculator (2006)
- Manual on Uniform Traffic Control Devices (2009)

SIDEPATHS

A shared-use path constructed parallel to and within the right-of-way of a roadway is referred to as a sidepath. Bicyclists and pedestrians will have increased interactions with motor vehicles at driveways and intersections on these sidepaths compared to a shared-use path on an independent alignment.

Considerations

- AASHTO states that "Shared-use paths should not be used to preclude on-road bicycle facilities, but rather to supplement a network of on-road bike lanes, shared roadways, bicycle boulevards, and paved shoulders." In other words, in some situations it may be appropriate to provide an on-road bikeway in addition to a sidepath along the same roadway.
- Sidepaths may be desirable along high-volume or high-speed roadways, where accommodating the targeted type of bicyclist within the roadway in a safe and comfortable way is impractical. However, sidepaths may present increased conflicts between path users and motor vehicles at intersections and driveway crossings. Conflicts can be reduced by minimizing the number of driveway and street crossings present along a path and otherwise providing high-visibility crossing treatments.
- Sidepaths typically have a lower design speed for bicyclists than on-street facilities and may not provide appropriate accommodation for more confident bicyclists who desire to travel at greater speeds. In addition, greater numbers of driveways or intersections along a sidepath corridor can decrease bicycle travel speeds, and traffic signals can increase delay for bicyclists on off-street paths compared to bicyclists using in-street bicycle facilities such as bike lanes. Therefore, sidepaths should not be considered a substitute to accommodating more confident bicyclists within the roadway.

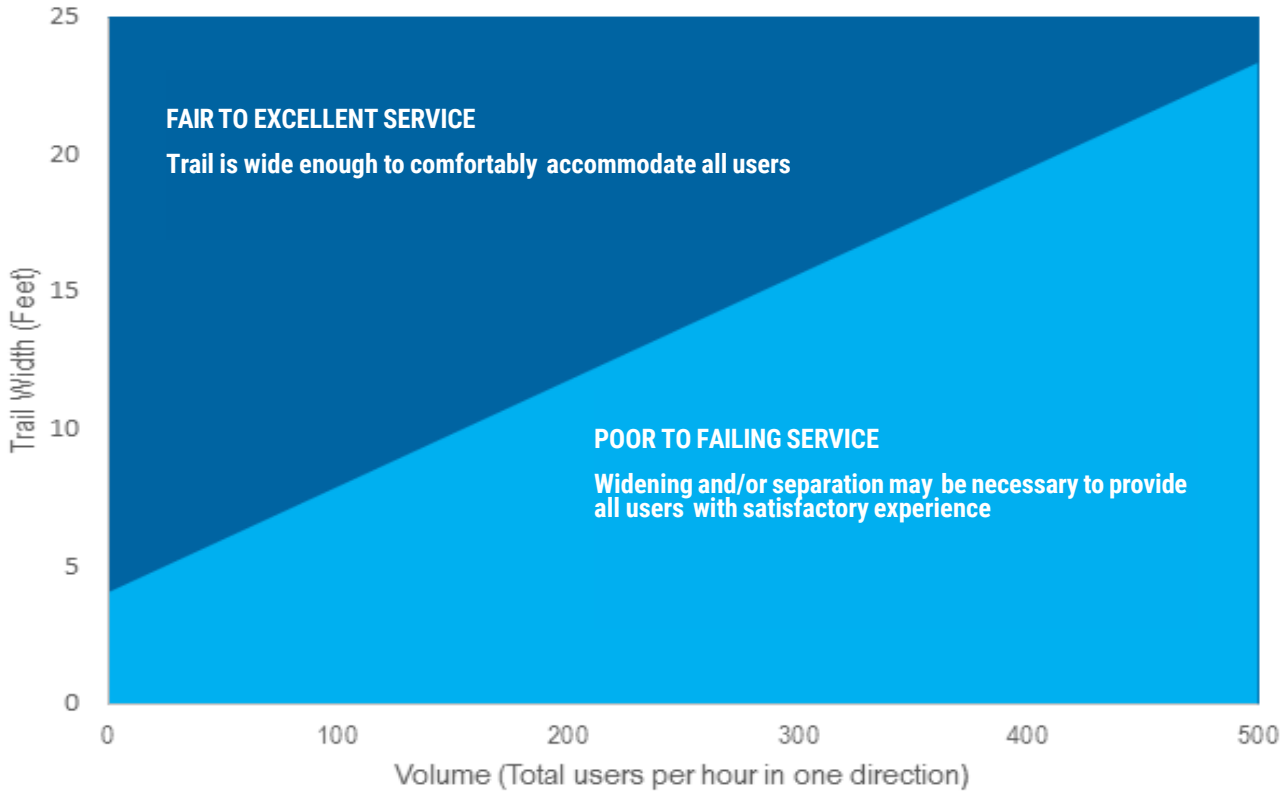
Guidance

- Sidepaths are most appropriate where driveways and intersections are limited. In areas with high concentrations of driveways and intersections, on-street accommodations (including bike lanes, buffered bike lanes, and separated bike lanes) are preferred because they are more visible to approaching motorists.

References

- AASHTO Guide for the Development of Bicycle Facilities (2012)
- FHWA Shared-Use Path Level of Service Calculator (2006)
- Manual on Uniform Traffic Control Devices (2009)

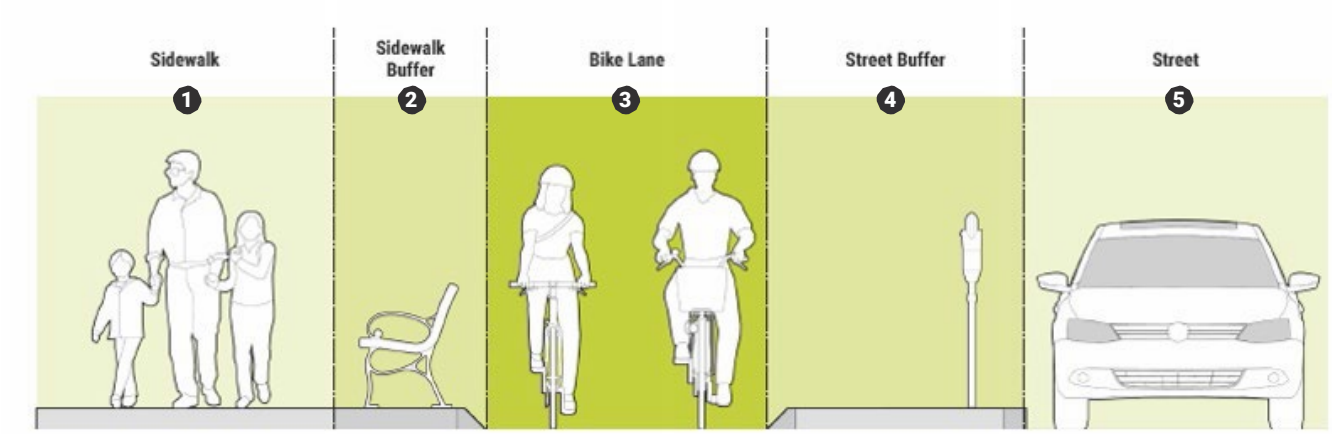
PATH WIDTH CONSIDERATIONS FOR SHARED-USE PATHS AND SIDEPATHS



- Path width should be determined based on three main characteristics: the number of users, the types of users, and the differences in their speeds. For example, on a path that is used by higher-speed bicyclists and children walking to school, users may experience conflicts due to their speed differences. By widening the path to provide space to accommodate passing movements, conflicts can be reduced. A typical path width is 12 feet with 3 foot shoulders on each side. This width allows users to pass one another with minimal conflict.
- Widths as narrow as 8 or 10 feet are acceptable for short distances under physical constraints or where volume is expected to be low.
- If there is frequent conflict between bicyclists and other users, separate paths for each mode may be constructed. The separate facilities may include two hard surface paths, or one hard surface path and one soft surface path.
- See above chart for path width recommendations based on volume. Use FHWA Shared-Use Path LOS Calculator for additional guidance.
- Soft surface paths are also preferred by some users, such as runners or equestrians.
- MUTCD warning signs showing the path narrowing should be considered at locations where the path narrows.
- Shared-use paths should be designed according to state and national guidelines. This process includes establishing a design speed (typically 18 mph) and designing path geometry accordingly. See *AASHTO Guide for the Development of Bicycle Facilities (2019)* for more detailed information about design speed.

SEPARATED BIKE LANES

Separated bike lanes (also known as protected bike lanes or cycletracks) are an exclusive bikeway facility type that combines the user experience of a sidepath with the on-street infrastructure of a conventional bike lane. They are physically separated from motor vehicle traffic and are distinct from the sidewalk. Separated bike lanes are more attractive to a wider range of bicyclists than striped bikeways on higher volume and higher speed roads. They reduce the risk of a bicyclist being hit by an opening car door and can prevent motor vehicles from driving, stopping, or waiting in the bikeway. They also provide greater comfort to pedestrians by separating them from bicyclists operating at higher speeds.



Considerations

- Separated bike lanes can provide different levels of separation:
- Separated bike lanes with flexible delineator posts ("flex posts") alone offer the least separation from traffic and are appropriate as an interim solution.
- Separated bike lanes that are raised with a wider buffer from traffic provide the greatest level of separation from traffic but will often require road reconstruction.
- Separated bike lanes that are protected from traffic by a row of on-street parking offer a high degree of separation from moving traffic, but also require designated separation between the parked cars and the bikeway.
- Separated bike lanes should be maintained in a similar manner to the adjacent roadway. This includes routine street sweeping and removal of snow to provide a minimum four-foot clearance per direction (i.e. 8 feet minimum for two-way facilities).
- In constrained environments where providing adequate buffer width is infeasible, reductions should first be considered to the vehicle space before narrowing sidewalks and other spaces allocated to pedestrians. This reduction can include decreasing the number of travel lanes, narrowing the widths of existing lanes or adjusting on-street parking. This consideration provides higher importance to the vulnerable users of the public right-of-way.
- Transitions between separated bike lanes and other facility types will typically be required for most, if not all, projects. The design will vary greatly between different locations and facility types but should always clearly communicate how bicyclists should enter and exit the facility to minimize conflicts with other users.

Guidance

- The street buffer is required and should provide separation from the street with vertical objects or a median. The street buffer can consist of parked cars, vertical delineators, raised medians, landscaped medians, and a variety of other elements. The buffer should be at least 2 feet wide at mid-block locations and should be between 6 feet and 20 feet wide at intersections to provide maximum safety benefits. When the street buffer consists of parked cars, a 3 feet wide buffer between the bike lane and parked cars is preferred. Intersections must be designed with consideration of potential conflicts with motor vehicle traffic. Where the buffer width is reduced below 6 feet, a raised bicycle crossing or signal phase separation should be considered. A minimum shy distance of one foot should be provided between any vertical objects in the sidewalk or street buffer and the bike lane.
- Separated bike lanes generally attract a wider spectrum of bicyclists, some of whom operate at slower speeds, such as children or seniors. Because the elements used to separate the bike lane from the adjacent motor vehicle lane include some vertical component, bicyclists usually do not have the option to pass each other by moving out of the separated bike lane. If the peak hour

bicycle volume is anticipated to be high, the bike lane should be sufficiently wide to enable passing maneuvers between bicyclists. The width should be at least 6.5 feet for one-way bike lanes and 8 feet for two-way bikeways.

- The sidewalk buffer is desirable, but not required. The sidewalk buffer zone separates the bike lane from the sidewalk, communicating each as distinct spaces. By separating people walking and bicycling, encroachment into these spaces is minimized and the safety and comfort is enhanced for both users. The sidewalk buffer may be eliminated at locations with low pedestrian volume.
- Travel lanes and parking should be narrowed to the minimum widths in constrained corridors.

Types of Separation

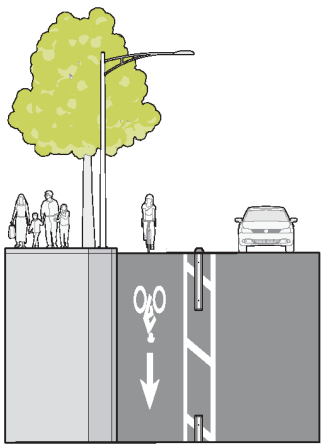
Vertical objects are needed in the street buffer to provide separation between motor vehicle traffic and the bikeway operating zone. Objects can be continuous or intermittent and material options include raised medians, flexible delineators, precast curbs or parking stops, and planter boxes. In most cases, vertical objects should be supplemented with pavement markings clearly delineating the buffer zone. Placement of vertical objects within the buffer should consider the required shy distance to both the bikeway and adjacent travel lane. Occupied parking lanes can also provide an additional level of protection and comfort for bicyclists.

Vertical separation should be clearly visible to approaching bicyclists and motorists. For low height objects such as curbs and median islands, vertical elements such as flexible delineators or signage should be included at intersections to further define the bikeway. This also ensures visibility of vertical buffers during snow events and minimized potential damage from snow removal operations.

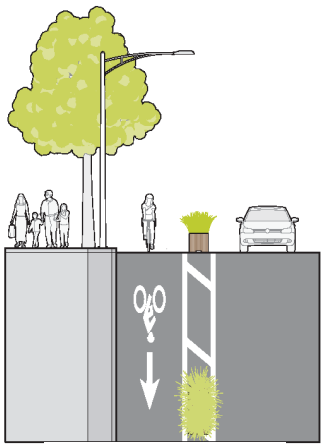
Separation treatments should accommodate drainage. Retrofit projects can achieve this with non-continuous vertical objects to maintain positive drainage from the roadway crown to existing catch basins.

References

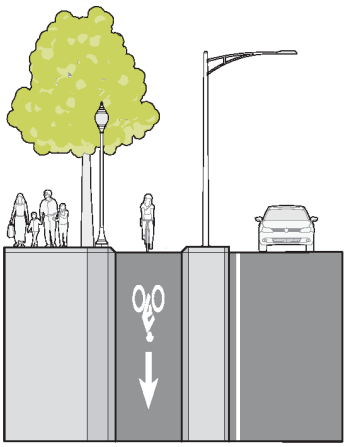
- AASHTO Guide for the Development of Bicycle Facilities (2012)
- NACTO Urban Bikeway Design Guide (2014)
- MassDOT Separated Bike Lane Planning and Design Guide (2015)



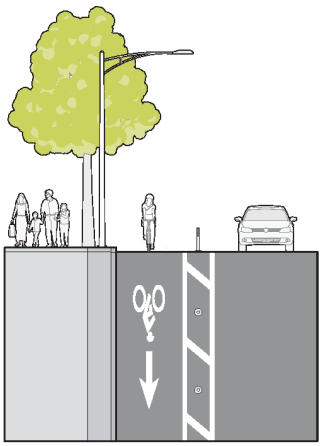
Curb Stops



Planters



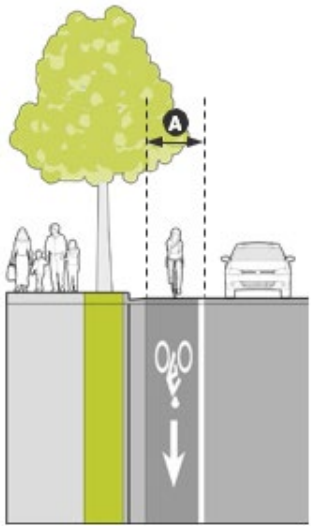
Raised Median



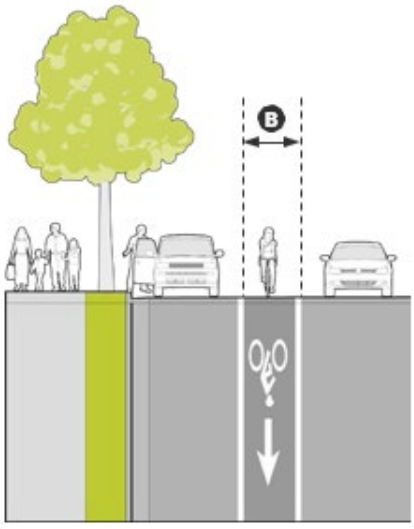
Flexible Delineator

BIKE LANES

Bike lanes provide an exclusive space for bicyclists in the roadway. Bike lanes are established with striping and symbols on the roadway surface. They are generally for one-way travel and are normally provided in both directions on two-way streets or on one side of a one-way street. Bicyclists are not required to remain in a bike lane when traveling on a street and may leave the bike lane as necessary to make turns, pass other bicyclists, avoid hazards, or to properly position themselves for other necessary movements. Bike lanes may only be used temporarily by motor vehicles accessing parking spaces and entering and exiting driveways and alleys. Stopping, standing, and parking in bike lanes is prohibited.



Bike Lane Adjacent to a Curb



Bike Lane Adjacent to Parking

Considerations

- Bike lanes can typically be installed by reallocating existing street space.
- Stopping, standing and parking in bike lanes may be problematic in areas of high parking demand and deliveries, especially in commercial areas.
- Wider bike lanes or buffered bike lanes are preferable at locations with high parking turnover.
- Contra-flow bike lanes may be used to allow two-way bicycle travel on streets designated for one-way motor vehicle travel to improve bicycle network connectivity.
- Bike lanes can be placed on the left side of one-way streets and median-divided streets, resulting in fewer conflicts between bicyclists and motor vehicles, particularly on streets with heavy right-turn volumes, on-street parking, and/or frequent bus service.

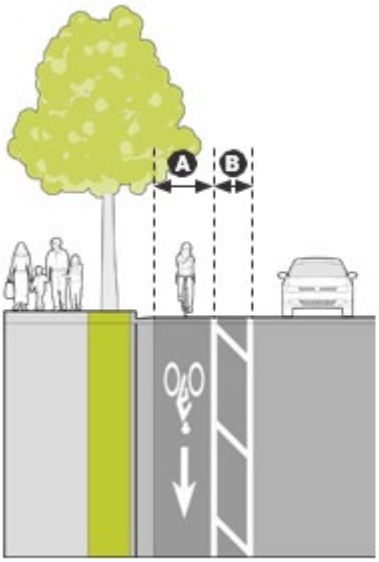
Guidance

- (A) The preferred width for bike lanes adjacent to a curb exclusive of a gutter is 6 feet. The minimum width is 5 feet exclusive of a gutter (4 feet in highly constrained locations).
- (B) The preferred width for bike lanes adjacent to parking is 6 feet; the minimum width is 5 feet.

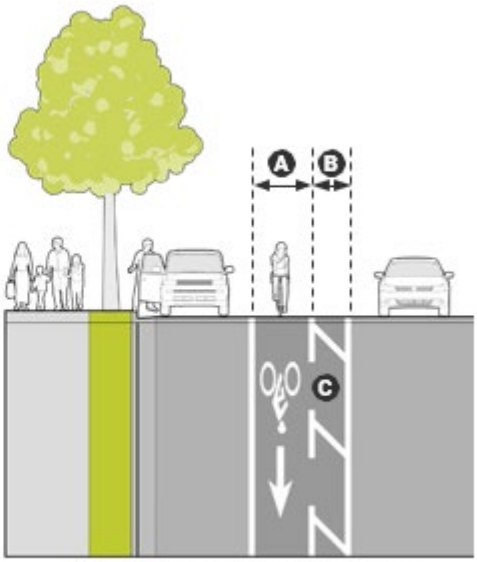
References

- AASHTO Guide for the Development of Bicycle Facilities (2012)
- NACTO Urban Bikeway Design Guide (2014)
- NMDOT Design Manual, Chapter 1210 Bicycle Facilities (2016)

BUFFERED BIKE LANES



Buffered Bike Lane Adjacent to a Curb



Buffered Bike Lane Adjacent to Parking

Considerations

- Buffered bike lanes are typically installed by reallocating existing street space.
- They can be used on one-way or two-way streets.
- They are preferable to conventional bike lanes when used as a contra-flow bike lane on one-way streets.
- Buffers can be placed next to parking lane where there is commercial or metered parking.
- Buffers should be placed between the bike lane and travel lane where speeds are 30 mph or greater or when traffic volume exceeds 6,000 vehicles per day.
- Where there is 7 feet of roadway width available for a bike lane, a buffered bike lane should be installed instead of a conventional bike lane. The preferred configuration is a 5-foot or wider bike lane and an 18-inch or wider buffer. Typical buffer widths are 3 to 5 feet.
- Buffered bike lanes allow bicyclists to ride side by side or to pass slower moving bicyclists.
- Research has documented buffered bike lanes increase the perception of safety.

Guidance

- (A) The preferred width of a buffered bike lane adjacent to parking or a curb is 6 feet exclusive of gutter. The minimum width 4 feet.
- (B) The minimum buffer width is 18 inches. There is no maximum width. Diagonal cross hatching should be used for buffers less than 3 feet in width. Chevron cross hatching should be used for buffers greater than 3 feet in width.
- (C) Buffers are to be broken where curbside parking is present to allow cars to legally cross the bike lane.

References

- AASHTO Guide for the Development of Bicycle Facilities (2012)
- NACTO Urban Bikeway Design Guide (2014)
- NMDOT Design Manual, Chapter 1210 Bicycle Facilities (2016)

PAVED SHOULDERS

Paved shoulders provide a range of benefits: they reduce motor vehicle crashes, reduce long-term roadway maintenance, ease short-term maintenance such as snow plowing, and provide space for bicyclists and pedestrians (although paved shoulders typically do not meet accessibility requirements for pedestrians). Paved shoulders are typically reserved for rural road cross-sections.

Photo credit: Bike Santa Fe

Considerations

- Where 4-foot or wider paved shoulders exist already, it is acceptable or even desirable to mark them as bike lanes in various circumstances, such as to provide continuity between other bikeways. If paved shoulders are marked as bike lanes, they need to also be designed as bike lanes at intersections. Where a roadway does not have paved shoulders already, paved shoulders can be retrofitted to the existing shoulder when the road is resurfaced or reconstructed. In some instances, adequate shoulder width can be provided by narrowing travel lanes to 11 feet.
- Reducing travel lane width on existing roads—also known as a "lane diet"—is one way to increase paved shoulder width.
- There are several situations in which additional shoulder width should be provided, including motor vehicle speeds exceeding 50 mph, moderate to heavy volumes of traffic, and above average bicycle or pedestrian use.

Guidance

- Paved shoulders provide separated space for bicyclists and can be used by pedestrians.
- They reduce run-off-road motor vehicle crashes.
- They reduce pavement edge deterioration and accommodate maintenance vehicles.
- Paved shoulders provide emergency refuge for public safety vehicles and disabled vehicles.
- They provide space for large agricultural equipment.
- They may not provide a comfortable experience for all bicyclists when used on high-speed roads.
- They may not facilitate through-intersection bicycle movement unless designed as bike lanes through intersections.
- For pedestrians, paved shoulders do not meet accessibility requirements.
- Bicycle-friendly rumble strips should be placed as close to the lane edge line as practicable and a minimum of four feet of usable space should be provided for bicyclists and a minimum of five feet for shoulders adjacent to curbs, guardrails, or other obstacles. Where rumble strips are present, gaps of at least 12 feet should be provided every 40 to 60 feet.

References

- AASHTO Guide for the Development of Bicycle Facilities (2012)
- AASHTO Policy on Geometric Design of Highways and Streets (2018)
- Manual on Uniform Traffic Control Devices (2009)
- NMDOT Design Manual, Chapter 1210 Bicycle Facilities (2016)

BICYCLE BOULEVARDS

Bicycle boulevards incorporate traffic calming treatments with the primary goal of prioritizing bicycle through-travel, while discouraging motor vehicle traffic and maintaining relatively low motor vehicle speeds. These treatments are typically applied on quiet streets, often through residential neighborhoods. Treatments vary depending on context, but often include traffic diverters, speed attenuators such as speed humps or chicanes, pavement markings, and signs. Bicycle boulevards are also known as neighborhood greenways and neighborhood bikeways, among other locally-preferred terms.

Considerations

- Many cities already have signed bike routes along neighborhood streets that provide an alternative to traveling on high-volume, high-speed arterials. Applying bicycle boulevard treatments to these routes makes them more suitable for bicyclists of all abilities and can reduce crashes as well.
- Stop signs or traffic signals should be placed along the bicycle boulevard in a way that prioritizes the bicycle movement, minimizing stops for bicyclists whenever possible. Shared lane markings should be placed where bicyclists are anticipated to operate to denote shared bicycle and vehicular travel lanes.
- Bicycle boulevard treatments include traffic calming measures such as street trees, traffic circles, chicanes, and speed humps. Traffic management devices such as diverters or semi-diverters can redirect cut-through vehicle traffic and reduce traffic volume while still enabling local access to the street.
- Communities should begin by implementing bicycle boulevard treatments on one pilot corridor to measure the impacts and gain community support. The pilot program should include before-and-after crash studies, motor vehicle counts, and bicyclist counts on both the bicycle boulevard and parallel streets. Findings from the pilot program can be used to justify bicycle boulevard treatments on other neighborhood streets.
- Additional treatments for major street crossings may be needed, such as median refuge islands, rapid flash beacons, bicycle signals, and HAWK or half signals.

Guidance

- Maximum Average Daily Traffic (ADT): 3,000 vehicles per day
- Preferred ADT: Up to 1,000 vehicles per day
- Target speeds for motor vehicle traffic are typically around 20 mph; there should be a maximum 15 mph speed differential between bicyclists and vehicles.

References

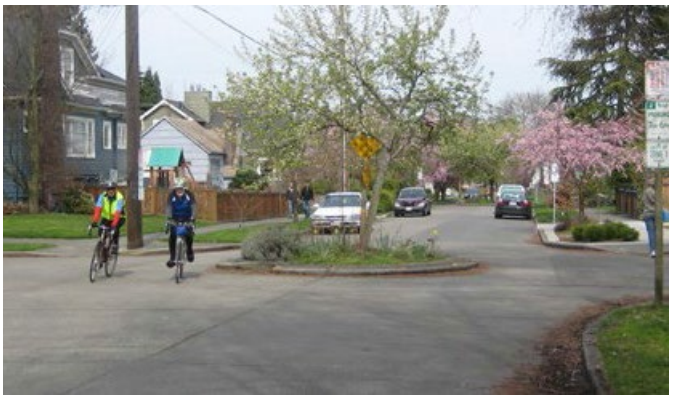
- AASHTO Guide for the Development of Bicycle Facilities (2012)
- NACTO Urban Bikeway Design Guide (2012)
- FHWA Manual on Uniform Traffic Control Devices (2009)
- IBPI Fundamentals of Bicycle Boulevard Planning & Design (2009)

TRAFFIC CALMING

Traffic calming elements are not exclusive to bicycle boulevards and can be implemented as spot treatments to provide comfort at particular intersections or areas with higher vehicular traffic speeds. Traffic calming aims to slow the speeds of motorists to a "desired speed" (usually 20 mph or less for residential streets and 25 to 35 mph for collectors and minor arterials). The greatest benefit of traffic calming is increased safety and comfort for all users on and crossing the street. Compared with conventionally designed streets, traffic calmed streets typically have fewer collisions and far fewer injuries and fatalities. These safety benefits are the result of slower speeds for motorists that result in greater driver awareness, shorter stopping distances, and less kinetic energy during a collision.

NEIGHBORHOOD TRAFFIC CIRCLES

Traffic circles, or mini roundabouts, can reduce speeds and crashes in low-volume areas and are an ideal treatment for uncontrolled intersections. They can be installed using simple markings or raised islands, but they also provide great opportunities to include stormwater management infrastructure public art. Traffic circles on neighborhood residential streets and bicycle boulevards provide advantages for bicyclists and vehicles as they reduce the need for a full stop and enable continuous progression when conflicting traffic is not present. Traffic cicles are a good alternative to stop-controlled intersections, and are usually preferred by bicyclists over four-way stops.



TRAFFIC DIVERSION

Traffic diversion strategies are used to reroute traffic from a bicycle boulevard or other intentionally low-traffic streets onto other adjacent streets by installing design treatments that allow access by bicyclists and pedestrians but restrict motorized traffic from passing through. considering and addressing potential changes in traffic volume on other local streets during the planning, design and evaluation process. Traffic diversion may not be appropriate in some suburban areas, where street networks are not the traditional grid. Impacts of diversion in these areas may be greater due to the inability to easily redirect traffic along alternate routes.

SPEED HUMPS & RAISED CROSSWALKS

Speed humps compel motorists to slow speeds. By lowering the speed differential between bicycles and motorists, safety and bicyclist comfort is increased. These treatments are typically located where other types of traffic controls are less frequent, for instance along a segment where stop signs have been removed to ease bicycle travel. Speed humps should extend the full length of the roadway and should be designed with a sinusoidal approach profile for minimal impact on bicyclist comfort.

Raised crosswalks can be used similarly to speed humps to calm traffic at mid-block locations where a shared-use path crosses the roadway. In addition to slowing motor vehicle speeds, raised crosswalks increase the visibility of crossing pedestrians and bicyclists and improves the line of sight for users crossing the roadway. Raised crosswalks are typically used at locations where other types of traffic controls are less frequent

CHICANES & CURB EXTENSIONS

Chicanes and curb extensions reduce motorist speeds by narrowing lanes and creating a sense of enclosure and additional friction between passing vehicles. Chicanes should be designed to deflect motor vehicle traffic without forcing the path of bicyclists into a merging motorist. Construction materials can range from low-cost options such as paint and flex posts to more permanent features with curbs and landscape features or green infrastructure.

TRAIL CROSSING TREATMENTS

SIGNS AND SIGNALS

Traffic control using signs and signals can improve comfort and safety for all users on trails and shared-use paths. The following guidance supplements MUTCD guidance for these treatments. All signs at trail crossings must be legible and color distinguishable during dark and daylight conditions via external illumination or retroreflective materials. All crossing treatments should abide by ADA standards.

PEDESTRIAN HYBRID BEACONS

Activated beacons, including the High-intensity Activated Crosswalk Beacon (HAWK), are a type of hybrid signal intended to allow pedestrians and bicyclists to stop traffic to cross high-volume arterial streets. This type of signal may be used in lieu of a full signal that meets any of the traffic signal control warrants in the MUTCD. It may also be used at locations which do not meet traffic signal warrants but where assistance is needed for pedestrians or bicyclists to cross a high-volume arterial street.

Pushbutton actuators should respond immediately when pressed, be placed in convenient locations for all users, and abide by other ADA standards. Passive signal activation, such as video or infrared detection, may also be considered.

Selection

- The MUTCD recommends minimum volumes of 20 pedestrians or bicyclists an hour for major arterial crossings (volumes exceeding 2,000 vehicles/hour).
- This type of device should be considered for all arterial crossings in a bicycle network and for path crossings if other engineering measures are found inadequate to create safe crossings.
- See FHWA's Safety Effects of Marked Versus Unmarked Crosswalks at Uncontrolled Locations publication and the Manual of Uniform Traffic Control Devices to determine warrants for traffic control at midblock crossings.

RECTANGULAR RAPID FLASHING BEACONS (RRFBS)

RRFBs are user-actuated high-intensity yellow LEDs, that flash in a rapidly flashing sequence, that supplement crossing warning signs at uncontrolled crossings. Like pedestrian hybrid beacons, RRFBs supplement crossing warning signs; however, RRFBs can achieve much higher motorist yield rates.

While RRFBs may be installed for the purposes of also providing a bicycle crossing, the flashing operations should be timed for a pedestrian to cross. The duration of flashing operation of the RRFBs following each actuation should be based on the MUTCD procedures for timing of pedestrian clearance times for pedestrian signals. This will provide sufficient time for bicyclists to clear the roadway. On 4- or 6-lane streets, RRFBs produce higher rates of motorists yielding when they can be mounted in the median (or overhead) as well as on the right edge of the roadway in combination with advanced stop or yield lines.

Selection

- RRFBs can be used when a signal is not warranted at an unsignalized crossing. They are not appropriate at intersections with signals or STOP signs.
- RRFBs are not recommended for installation on undivided roadways of more than four lanes. RRFBs might also be beneficial for use at multilane exits of roundabouts where motorist yielding is poor and gaps are infrequent during peak hours.
- While RRFBs have been used on roadways with posted speeds over 45 mph and on roads with more than four travel lanes, caution should be used as motorist yielding percentages might be lower in these conditions.

REGULATORY SIGNS

A combined Bicycle-Pedestrian Warning sign (W11-15) may warn roadway users of a crossing where bicyclists and pedestrians cross together in a shared crossing or in close proximity. At locations where only bicyclists are crossing, a Bicycle Warning Sign (W11-1) should be used.

At crossings that experience frequent conflicts between motorists and path users or crossing bicyclists, or on multilane roadways where a sign on the right-hand side of the roadway may not be visible to all travel lanes, an additional crossing warning sign should be installed on the opposite side of the road, or on the median or crossing island if one is present.

Where there is inadequate stopping sight distance for motorists to see a pedestrian or bicyclist at a crossing, the warning sign at the crossing can be supplemented with an additional advanced warning sign. The W11-15 or W11-1 sign should be at the distance recommended for the approach speed in Table 2C-4 of the MUTCD.

PAVEMENT MARKINGS

Traffic control pavement markings at shared-use path crossings can improve safety and operations for all users. Per the MUTCD, all markings used on bicycle facilities shall be retroreflective.

STOP LINES

Stop lines may be used to indicate the point at which motorist should stop in compliance with a traffic signal or stop sign at locations where bicycles are crossing. Stop lines must be white and 12 to 24 inches wide.

YIELD LINES

Yield lines may be used to indicate the point at which a motorist should yield in compliance with a yield sign, a Yield Here for Pedestrians or Bicyclists sign, or a turning traffic Yield to Pedestrians or Bicyclists sign. See Bike Lane Regulatory Signs on page 31 for more information regarding the use of these signs.

CROSSWALKS

Crosswalk markings should be located at all locations where a shared-use path crosses a roadway. Crosswalks should conform to NMDOT standards and have minimum width equal to the shared-use path.

RAIL-WITH-TRAIL CROSSINGS

Trails that cross roadways adjacent to railroad corridors can be complex and often require coordination with railroad companies and the Rio Metro Regional Transit District. The U.S. Department of Transportation's *Rails-with-Trails: Lessons Learned* provides design solutions for rail-with-trail crossings. The report identifies three primary methods:

- Directing path users to a nearby intersection: This method can be used if there is an existing crossing at an intersection within 350' of the rail-with-trail crossing.
- Provide uncontrolled crossing: This is a standard shared-use path crossing treatment and should only be used at locations with low traffic volumes and speed limits less than 35 mph.
- Provide signalized crossing: Signals are appropriate at crossing locations with four or more lanes and high traffic volumes.

References

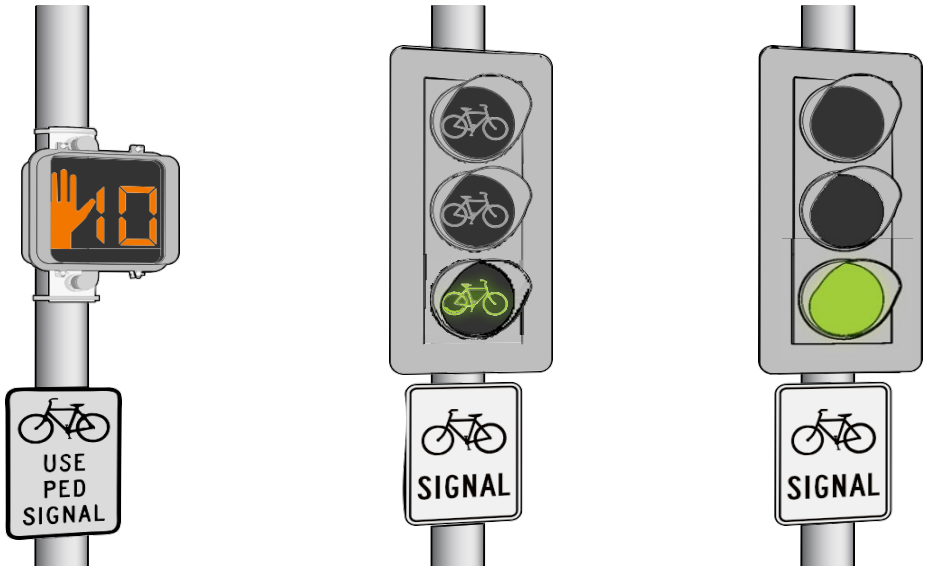
- Rails-with-Trails: Lessons Learned, United States Department of Transportation (2002)
- Pedestrian/Bicyclist Warning Devices and Sign at Highway-Rail and Pathway-Rail Grade Crossings, Illinois Center for Transportation (2013)

BIKEWAY INTERSECTION TREATMENTS

While street segments that include bicycle facilities may generally be comfortable for bicyclists, major street crossings must be addressed to provide safe, convenient and comfortable travel along the entire route. Treatments provide waiting space for bicyclists, control cross traffic, and reduce conflicts for all users.

SIGNALS

Bicyclists have unique needs at signalized intersections. Bicycle movements may be controlled by the same indications that control motor vehicle movements, by pedestrian signals, or by bicycle-specific traffic signals. The introduction of separated bike lanes creates situations that may require leading or protected phases for bicycle traffic, or place bicyclists outside the cone of vision of existing signal equipment. In these situations, provision of signals for bicycle traffic will be required.



Considerations

- Bicycle-specific signals may be appropriate to provide additional guidance or separate phasing for bicyclists per the 2012 AASHTO *Guide for the Development of Bicycle Facilities*.
- It may be desirable to install advanced bicycle detection on the intersection approach to extend the phase, or to prompt the phase and allow for continuous bicycle through movements.
- Video detection, microwave and infrared detection can be an alternative to loop detectors.
- Another strategy in signal timing is coordinating signals to provide a "green wave", such that bicycles will receive a green indication and not be required to stop. Several cities including Denver, CO, Portland, OR, and San Francisco, CA have implemented "green waves" for bicycles.

Guidance

- A stationary, or "standing", bicyclist entering the intersection at the beginning of the green indication can typically be accommodated by increasing the minimum green time on an approach per the 2012 AASHTO *Guide for the Development of Bicycle Facilities*.
- A moving, or "rolling", bicyclist approaching the intersection towards the end of the phase can typically be accommodated by increases to the red times (change and clearance intervals) per the 2012 AASHTO *Guide for the Development of Bicycle Facilities*.
- Loop detectors should be set to the highest sensitivity level possible without detecting vehicles in adjacent lanes and field check. Type D and type Q loops are preferred for detecting bicyclists.
- Install bicycle detector pavement markings and signs per the MUTCD, 2012 *AASHTO Guide for the Development of Bicycle Facilities*, and the NACTO *Urban Bikeway Design Guide*.

References

- AASHTO Guide for the Development of Bicycle Facilities (2012)
- NACTO Urban Bikeway Design Guide (2014)

REGULATORY SIGNS

Traffic control signs can improve bicyclists' safety and operations for all types of bicycle facilities. The following guidance supplements the MUTCD guidance provided for bicycle facilities.

BIKE LANE REGULATORY SIGNS

The standard BIKE LANE (R3-17) sign may be placed along bike lanes, separated bike lanes, or bicycle-only paths to indicate the restricted nature of the bicycle facility to motorists, bicyclists, and pedestrians. These signs may be placed in advance of the start of the bicycle facility and at periodic intervals along a bicycle facility, as appropriate.

MUTCD
R3-17

TURNING VEHICLES

Where turning vehicles interface with bicycle facilities at intersections, the TURNING VEHICLES YIELD TO (or STOP FOR) BICYCLISTS (OR PEDESTRIANS) sign (R10-15 series) may be installed to alert motorists of their requirement to yield or stop for bicyclists within a crossing. In cases where motorists need to be alert to a potential conflict with pedestrians and bicyclists, the sign should include both a pedestrian and bicycle symbol. Engineering judgement should be used to determine the location of the sign. Signs should be placed in a location that is conspicuous to drivers and can be placed at the near or far side of a controlled or uncontrolled intersection. Request for approval is required for the use of R10-15 signs with bicycles.

MUTCD
R10-15b

MUTCD
R10-15b

YIELD HERE TO BIKES

At uncontrolled crossings where stop or yield lines are provided to denote the location where motorists should stop or yield to bicyclists in a crossing, a YIELD HERE TO (or STOP HERE FOR) BICYCLES (R1-5 alt. A) sign may be used. If the stop or yield condition includes pedestrians, the YIELD HERE TO (or STOP HERE FOR) BICYCLES AND PEDESTRIANS (R1-5 alt. B) sign may be used. Request for approval is required for the use of R1-5 signs with bicycles.

MUTCD
R1-5

MUTCD
R1-5b

BLANK-OUT SIGNS

Blank-out signs are illuminated versions of regulatory signs that can be used for a portion of time. It may be used in place of a static sign where it is desirable to only be active for a portion of time or peak hours. Signs can also be activated by detection to remind motorists to yield while turning if a bicyclist is approaching.

An example of a blank-out sign during peak (left) and non-peak (right) hours

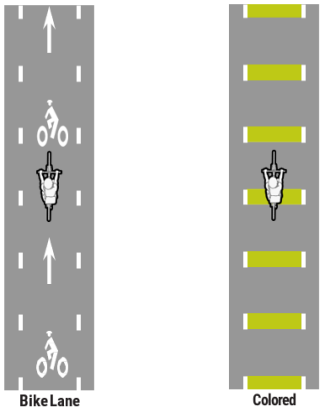
PAVEMENT MARKINGS

All pavement markings should be supplemented with appropriate signage according to the latest version of the MUTCD.

CONFLICT MARKINGS

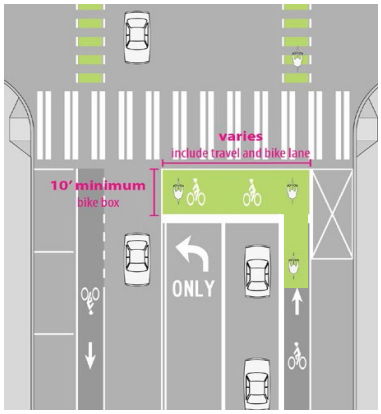
Conflict area markings are intersection pavement markings designed to improve visibility, alert all roadway users of expected behaviors, and to reduce conflicts with turning vehicles.

For bike lanes and separated bike lanes, dotted white edge lines should be used to delineate the bicycle path through the intersection and should match the width of the bike lane. Enhanced markings with green pavement and/or symbols should be used for crossing as complex intersections and intersections with safety concerns. A corridor-wide treatment can maintain consistency; however, spot treatments can be used to highlight conflict locations.



BIKE BOXES

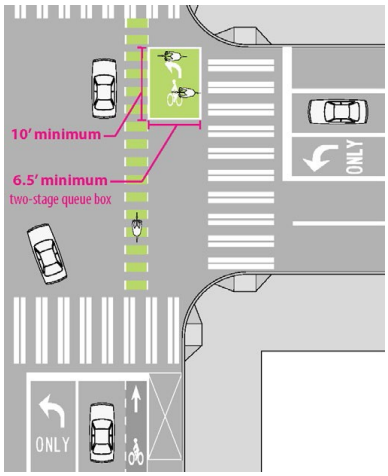
A bicycle box provides dedicated space between the crosswalk and vehicle stop line where bicyclists can wait during the red light at signalized intersections. The bicycle box allows a bicyclist to take a position in front of motor vehicles at the intersection, which improves visibility and motorist awareness, and allows bicyclists to "claim the lane" if desired. Bike boxes aid bicyclists in making turning maneuvers at the intersection and provide more queuing space for multiple bicyclists than that provided by a typical bike lane. A Request for Approval application with FHWA is required for the citywide use of bike boxes.



TWO-STAGE TURN BOXES

A two-stage turn box should be considered where bike lanes are continued up to an intersection and a protected intersection is not provided. The two-stage turn box designates a space for bicyclists to wait while performing a two-stage turn across a street at a location outside the path of traffic.

Two-stage turn boxes can be located in a variety of locations including in the front of the pedestrian crossing (crosswalk locations may need to be adjusted) in a "jug-handle" configuration within a sidewalk, or at the tail end of a parking lane or median island. The box should consist of a green box bordered by solid white edge lines and a turn arrow to emphasize the crossing direction. A Request for Approval application with FHWA is required for the citywide use of two-stage turn box.



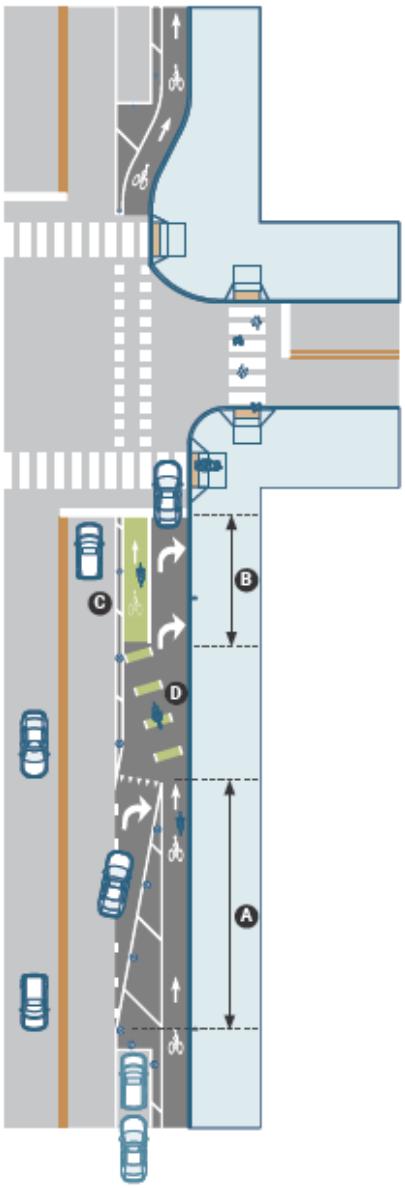
MIXING ZONES

A mixing zone requires turning motorists to merge across a separated bike lane at a defined location in advance of an intersection. Unlike a standard bike lane, where a motorist can merge across at any point, a mixing zone design limits bicyclists' exposure to motor vehicles by defining a limited merge area for the turning motorist.

Mixing zones are only appropriate on street segments with one-way bike lanes, either separated or conventional. They are not appropriate for two-way separated bike lanes due to the contra-flow bicycle movement.

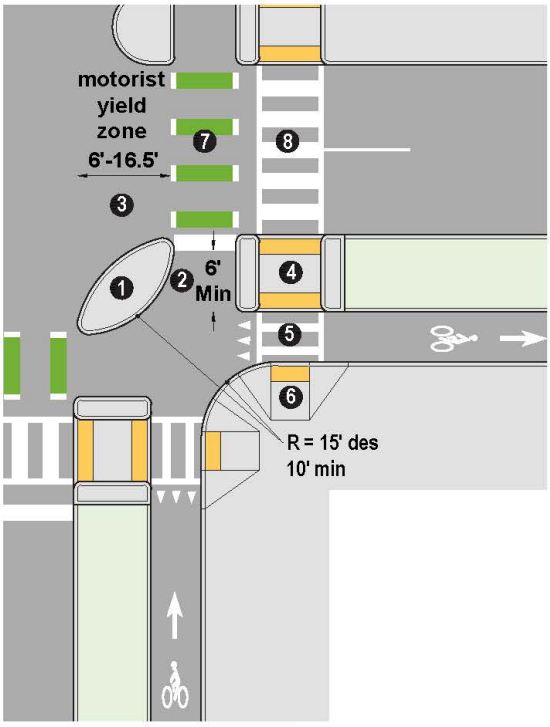
Guidance:

- A) Locate merge area where the entering speeds of motor vehicles will be 20 mph or less by (a) minimizing the length of the merge approach and (b) locating the merge area as close as practical to the intersection.
- B) Minimize the length of the storage portion of the turn lane.
- C) Provide a buffer and physical separation (e.g. flexible delineator posts) from the adjacent through lane after the merge area, if feasible.
- D) Highlight the conflict area with green surface coloring and dashed bike lane markings, as necessary, or shared lane markings placed on a green box.
- Provide a BEGIN RIGHT (or LEFT) TURN LANE YIELD TO BIKES sign (R4-4) at the beginning of the merge area.
- Restrict parking within the merge area
- At locations where raised separated bike lanes approach the intersection, the bike lane should transition to street elevation at the point where parking terminates.
- Where posted speeds are 35 mph or higher, or at locations where it is necessary to provide storage for queued vehicles, it may be necessary to provide a deceleration/storage lane in advance of the merge point.



PROTECTED INTERSECTIONS

Protected intersections spatially and temporally separate motorist, bicyclists, and pedestrian movements at intersections using geometric design and signal timing. While the application of protected intersections may vary, the most important design element is the corner island, which:



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

- Reduces adjacent lane motorist-turning speeds;
- Provides space, completely or partially outside of through travel lanes, for a single turning motor vehicle to yield to crossing bicyclists or pedestrians;
- At signalized or stop controlled intersections, positions queuing bicyclists closer to the intersection, which increases conspicuity, and reduces the likelihood of right-hook crashes; and
- Can shorten the crossing distance for pedestrians and bicyclists during which they are exposed to turning motorized traffic.

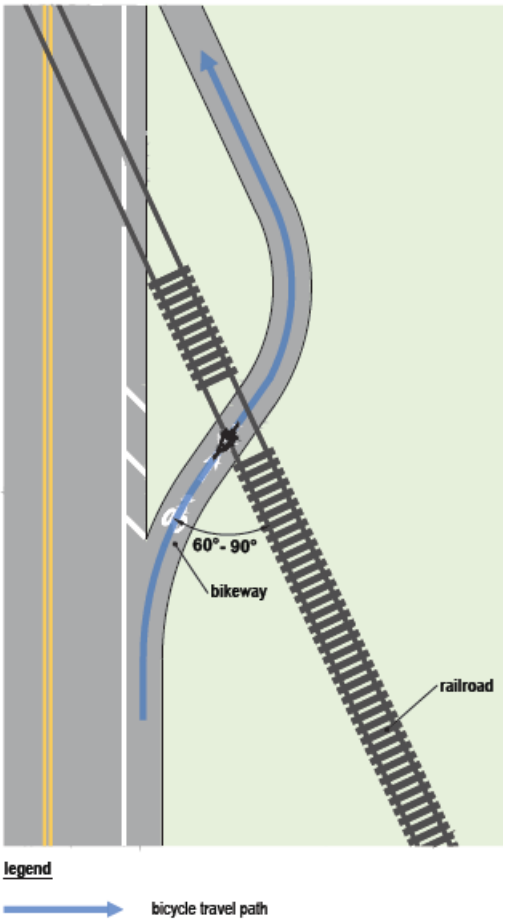
Protected intersection corner islands should be considered for intersection approaches with separated bike lanes to reduce the likelihood of right-hook crashes between motorists and bicyclists. Protected intersections can be supplemented with bicycle signals, which are required if a separated bike lane is placed to the outside of a dedicated turn lane.

RAIL CROSSINGS

Railroad tracks that interface with bicycle facilities can be hazardous to bicyclists. Tracks running along bike facilities create hazards for bicyclists traveling parallel to the tracks as well as when turning across the tracks. Tracks crossing bicycle facilities may have uneven pavement surfaces and gaps, known as flangeways, that can cause bicyclists to lose control. The metal rails are also slippery when wet, requiring bicyclists to cross nearly perpendicular to the rails to maintain control.

Guidance:

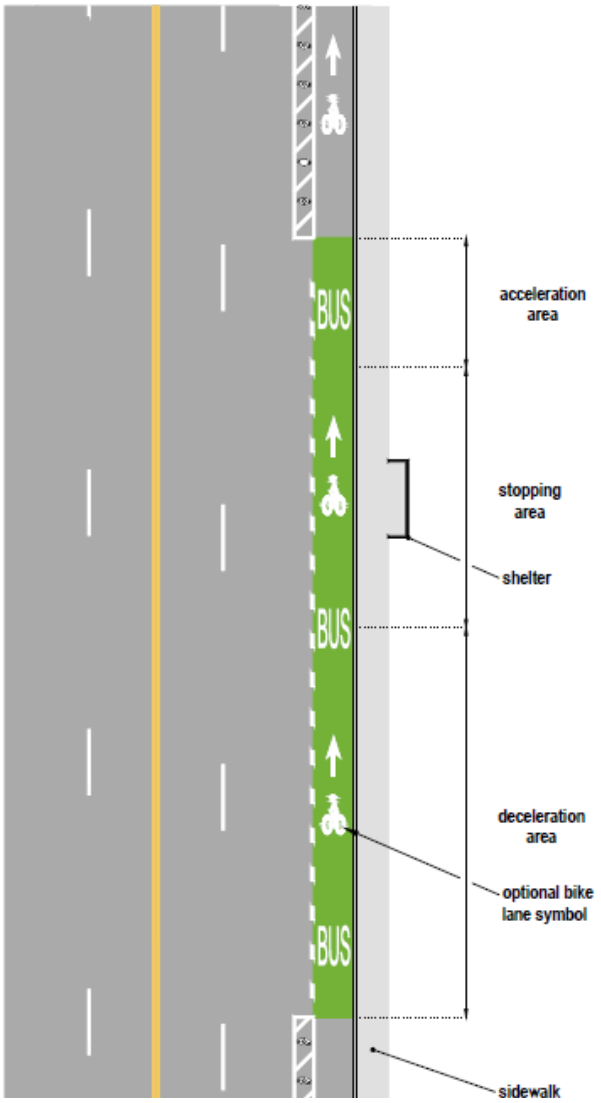
- Design rail crossings such that bicyclists cross the rail at an angle between 60 and 90 degrees.
- Avoid curves in the pathway as it crosses the rail; the pathway should be straight at the point of crossing.
- Provide, as practical, the best track surface treatment for bicyclists to reduce the area of slick surfaces where bikes are required to cross.
- Reduce the flangeway width.
- Provide clear delineation with pavement markings indicating to bicyclists where they should travel to cross railroad tracks at an optimum location.
- Provide firm, stable, and slip resistant pavement.
- Provide adequate sight lines for approaching bicyclists to see approaching trains at rail crossings.
- Provide warning signs to alert bicyclists of the crossing ahead.



CONTEXT-SPECIFIC CONSIDERATIONS

TRANSIT STATIONS/STOPS

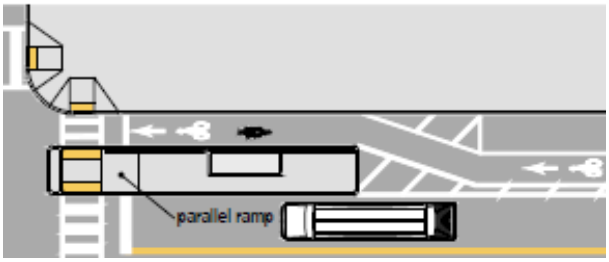
Transit vehicles have different operating characteristics than standard motor vehicles and frequently access curbside transit stops. Locations where buses are required to merge across bike lanes can result in interactions that can be hazardous to bicyclists.



Example of bus stop conflict pavement markings

Guidance

- Where buses frequently enter or stop in the bike lane, the bike lane should be, at a minimum, dashed along the length of the bus stop.
- Additional pavement markings such as bike lanes symbols and bus lane markings should be included at locations with high volumes of bus activity. Green paint can further distinguish conflict areas between bicycles and transit vehicles.
- In addition to the stopping area, the extent of conflict markings should cover the entire length of the transit vehicles deceleration and acceleration areas.
- Appropriate site lines to adjacent traffic should be provided for both bicyclists and drivers in advance of conflict zones.
- Where space is available, bicycle lane and bus stop should be separated to reduce conflict and provide safer operation. This may be achieved by designing a floating bus stop with the platform located between the bike lane and the bus stop.
- Bicycle parking should always be considered near transit stops. Long-term parking such as bike lockers or secure sheltered bike parking should be provided at regional stops. High quality secure bicycle parking can further encourage the use of transit and bicycle facilities.



Example of Floating Bus Stop Configuration

References

- NACTO Urban Street Design Guide (2013)
- AASHTO Guide for Geometric Design of Transit Facilities on Highways and Streets (2014)
- AASHTO Guide for the Development of Bicycle Facilities (2012)
- APBP Essentials of Bike Parking: Selecting and Installing Bike Parking that Works (2015)

SCHOOLS

Appropriate design measures should be considering when designing bicycle facilities near schools. Since school-aged children are able to use bicycles for many of their transportation needs, but are not yet old enough to possess the skills necessary to safely ride near vehicular traffic, bicycle facilities that are separate from vehicular traffic are often the most appropriate facility type. Areas near schools tend to have high traffic volumes during drop-off and pick-up times regardless of street classification. Facilities near schools should consider operational challenges related to pick-up and drop-offs, surges of increased vehicular traffic volumes, short-term parking, and high pedestrian volumes. These challenges often warrant special accommodations such as controlled crossings, high-visibility pavement markings, and physical separation to provide increased comfort and safety for young bicyclists.

TRAILHEADS

Trailheads, parking areas, and rest stops provide access to the bikeway network, encourage more use of the paths and bikeways, and provide meeting and parking locations for groups. The number and type of amenities provided at a trailhead, parking area, or rest stop should be based on the number of users of the path or bikeway and the relative ease of finding services nearby.

Trailheads should be located along a major trail to provide convenient connections to and from surrounding communities, as well as to connect users to other facilities and amenities through the trail system. Based on the type of user and the volume of us, amenities may include: restrooms, potable water (for people and dogs), bike racks, a bike service station, picnic tables, map and information kiosks, benches, small playground, and a parking area. All trailheads and rest stops should be designed for accessibility in accordance with pertinent ADA codes.

IMPLEMENTATION

IMPLEMENTATION STRATEGIES

The implementation of bicycle facilities outlined in this toolkit will occur over time, commensurate with available resources and related opportunities. Regardless of the method, projects that propose changes to street configurations, traffic flow, and connectivity should include a community engagement process to encourage transparency between residents and the City of Santa Fe. This section outlines strategies for building out the bicycle network and improving existing facilities. The following implementation strategies are listed in order of general cost.

DEMONSTRATION/PILOT PROJECTS

An example of a two-way protected bike lane pilot installed in Denver, Colorado

An emerging strategy for implementation uses low-cost installation methods and materials to demonstrate the benefits and tradeoffs of a project on a temporary basis. The temporary nature of these types of projects allows for rapid changes to be made, if needed, based on observation of operations and feedback from the community. These projects can take place over a day as a basic demonstration, or longer as a pilot project. Demonstration projects provide cities the opportunity to test a concept and solicit public feedback before committing significant resources to permanent installation. This implementation strategy should include a specific evaluation plan to gauge each project's success and inform next steps, along with careful selection of project locations.

References

- NACTO Urban Street Design Guide (2013)
- FHWA Separated Bike Lane Planning and Design Guide (2015)

RESURFACING

When evaluating the pavement condition of streets to determine which ones will be selected for resurfacing, local agencies should look for opportunities to implement bicycle facilities on those streets, including bike lanes, buffered bike lanes, bike boulevards, crosswalks, and curb ramps. The Federal Highway Administration provides valuable guidance in their *Incorporating On-Road Bicycle Networks into Resurfacing Projects* document. Because these projects are already planned, this can be one of the most efficient and inexpensive ways for to build its active transportation network.

References

- FHWA Incorporating On-Road Bicycle Networks into Resurfacing Projects (2016)

NEW CONSTRUCTION

When new roadways are constructed, whether privately or publicly funded, they should include sidewalks and bicycle facilities where appropriate. Streets without adequate active transportation infrastructure can be major barriers for people bicycling or walking, and new roadway construction should improve connectivity and accessibility for all users.