APPENDIX G
TECHNICAL GUIDANCE

Off-Street versus On-street Bicycle Facilities: Choosing an Appropriate Facility Type

The bikeway design options in the Wichita Bicycle Master Plan (Plan) include bicycle lanes, shared lane markings, paved shoulders, bicycle boulevards, side paths (shared use paths that parallel a roadway) and shared use paths. The design guidelines for side paths and shared use paths are the same.

The draft 2012 AASHTO Guide for the Development of Bicycle Facilities (draft AASHTO Guide) provides guidance for the best application of these facilities. While they are not strict rules, they provide a good starting point and have been used in the development of Plan recommendations.

Multiple Facility Types on a Single Corridor

Corridors that effectively accommodate bicycles often combine multiple facility types, each type being used where appropriate. For example, a shared-use path can connect to a bicycle boulevard to create a continuous corridor. A corridor may start with bike lanes, travel along a bike boulevard, and then transition back to bike lanes.[1] Transitions between facilities should be functional, intuitive and as infrequent as possible. A good rule of thumb for designing transitions is that good engineering should invite good use. For example, a path that transitions to an on-street facility should transition a bicyclist to the correct side of the street thereby reducing the possibility of wrong-way riding.

Guidelines for Choosing an Appropriate Facility

The following guidelines, taken from the draft AASHTO Guide, were used to provide direction for selecting facilities as shown on the Wichita Bicycle Network Map.

[1]Draft AASHTO Guide for the Development of Bicycle Facilities. 2012 (24).

Type of bikeway	Best use	Motor vehicle design speed	Traffic volume	Classification or intended use	Other considerations
Paved shoulders	Rural highways that connect town centers and other major attractors	Variable. Typical posted rural highway speeds (generally 40-55 mph)	Variable.	Rural roadways; inter-city highways	Provides more shoulder width for roadway stability. Shoulder width should be dependent on characteristics of the adjacent motor vehicle traffic, i.e. wider shoulders on higher-speed roads
Bike lanes	Major roads that provide direct, convenient, quick access to major land uses. Also can be used on collector roads and busy urban streets with slower speeds	Generally, any road where the design speed is more than 25 mph	Variable. Speed differential is Generally a more important factor in the decision to provide bike lanes than traffic volumes	Arterials and collectors intended for major motor vehicle traffic movements	Where motor vehicles are allowed to park adjacent to bike lane, ensure width of bike lane sufficient to reduce probability of conflicts due to opening vehicle doors and other hazards. Analyze intersections to reduce bicyclist/motor vehicle conflicts. Sometimes bike lanes are left “undesignated” (i.e. bicycle symbol and signs are not used) in urban areas as an interim measure
Bike boulevard	Local roads with low volumes and speeds, offering an alternative to, but running parallel to, major roads. Still should offer convenient access to land use destinations	Use where the speed differential between motorists and bicyclists is typically 15 mph or less. Generally, posted limits of 25 mph or less	Generally less than 3,000 vehicles per day	Residential roadways	Typically only an option for gridded street networks. Avoid requiring bicyclists to make frequent stops. Use signs, diverters, and other treatments so that motor vehicle traffic is not attracted from arterials to bike boulevards
Shared lanes (shared lane markings)	Space constrained roads with narrow travel lanes, or road segments upon which bike lanes are not selected due to space constraints or other limitations	Variable. Use where the speed limit is 35 mph or less	Variable. Useful where there is high turnover in on-street parking to prevent crashes with	Collectors or minor arterials	May be used in conjunction with wide outside lanes. Explore opportunities to provide parallel facilities for less confident bicyclists. Where motor vehicles allowed to park along shared lanes, ensure marking

			open car doors		placement reduces potential conflicts with opening car doors
Shared roadways (no special provisions)	Minor roads with low speeds and volumes, where bicycles can share the road with no special provisions	Speed differential between motorists and bicyclists is typically 15 mph or less. Generally, speed limits of 30 mph or less	Generally less than 1,000 vehicles per day.	Neighborhood or local streets	Can provide an alternative to busier streets in a gridded street network. On a non-grid network, may be circuitous or discontinuous
Shared use path: independent corridor	Linear corridors in greenways, or along waterways, highways, active or abandoned rail lines, utility rights-of-way, unused rights-of-way. May be a short connection, such as a pathway connector between two cul-de-sacs, or a longer connection.	n/a	n/a	Provides a separated path for non-motorized users	Analyze intersections to anticipate and mitigate conflicts between path and roadway users. Design path with all users in mind, wide enough to accommodate expected usage. On-road alternatives may be desired for advanced riders who desire a more direct facility that accommodates higher speeds

Additional Considerations - Side Path versus On-Street Facility

The Wichita Bicycle Master Plan includes recommendations for on-street bike lanes, shared lane markings, and off-street side paths (shared use paths). In addition to using the general guidance from the draft 2012 AASHTO Guide, the recommendations were developed with the following considerations in mind:

- Arterial continuity: Continuous facility types are recommended along arterials wherever possible to minimize the number of transitions. For example, if an arterial street already has a sidepath with a missing section, the recommendation will be to complete the missing section with a path, not an on-road facility.
- Frequency of driveways: Driveways can function as mini intersections. Arterials with a high frequency of commercial driveways are sometimes not the best location to install a sidepath, especially if there is room for an on-street facility. That said, there are some locations where an off-street facility with multiple driveways is still better than a high volume, high speed, and narrow lane roadway.
- Available Space: Sidepaths are only recommended where there is available right-of-way; and on-street facilities are only recommended where there is available pavement within the

improved portion of the right-of-way. The Plan does not recommend moving existing curbs to accommodate on-street bicycle facilities.

- Structures: The configuration of most structures such as bridges, and over and under passes cannot be significantly changed without extensive rehabilitation and expense. Consequently, the decision to install an on- or off-street facility will usually be determined by the existing cross section – i.e. a sidepath must connect to a sidepath on the bridge; bike lanes on the street should connect to bike lanes on the bridge. Bicyclists should not be encouraged or expected to cross busy arterials at non-signalized locations to access bridge facilities as would be the case if bicyclists were riding on-street with the flow of traffic and a bicycle facility was provided on only one side of the bridge.
- Directness of Route: Bicyclists will often ignore routes that require multiple turns or add significant distance. In some cases, adding a sidepath as opposed to an on-street facility allows for more direct connections, especially short path connections that help avoid busy intersections or other barriers.

On-Street Bicycle Facility Design Approach

The following guidelines are a supplement to the MUTCD Part 9: Traffic Control for Bicycle Facilities and the AASHTO *Guide for the Development of Bicycle Facilities.* They are not design standards, and should not be used as such. Application of guidance provided in this document requires the use of professional engineering judgment when installing bicycle lanes, shared lane markings and other bicycle facilities.

Bicycle Lanes

The minimum width for a bicycle lane between a parking lane and a travel lane is 5 feet. The inside bicycle lane line (parking lane line) should be located 7 to 8 feet from the face of the curb or roadway edge. Generally, a narrower parking lane is desirable to encourage motorists to keep the vehicle as close to the edge of the roadway as possible to maximize the available travel lane width, which will improve the bicyclist's level of comfort on the roadway.

The minimum width of a bicycle lane next to a curb (no parking) is 5 feet from the face of curb, but the bike lane must also be at least 3 feet from the joint between the gutter pan and the road pavement (4 feet preferred). In general, bicycle lanes should be no wider than 6 feet to discourage motor vehicles from using them as a travel lane. Bicycle lane lines should not be extended through a marked crosswalk.

Bicycle lanes should be one-way facilities and carry bicycle traffic in the same direction as adjacent motor vehicle traffic. Two-way bicycle lanes on one side of the roadway are not recommended when they result in bicycles riding against the flow of motor vehicle traffic.

Considerations for Use of Dotted versus Solid Bicycle Lane Lines

Solid lines should be used at all locations where through moving motorists are to be discouraged from entering the bicycle lane. Parking motorists may cross the solid line as necessary to park their vehicle.

Dotted lines (2-foot lines with 4-foot gaps) should be used to demarcate areas where motorists are likely or are to be encouraged to merge into or across the bicycle lane for turning movements. Dotted lines should be used 50-200 feet in advance of intersections where motorists are permitted to turn right. Green bike lanes (not in AASHTO), when used, are often placed within the dotted merge area. Where there is a parking restriction in advance of an intersection, including bus stops, the dotted line should be continued through the parking restriction. The dotted line should generally discontinue at the crosswalk or back edge of the perpendicular street sidewalk if a crosswalk is not present on the near side of an intersection. On the far side, the dotted line should become a solid line at the back edge of the sidewalk or the tangent point of the curb radius (whichever is larger). A dotted line through an intersection may be desirable to provide additional guidance through intersections where bicyclists must cross more than 4 lanes of traffic or cross uncontrolled intersections of any width. Finally, dotted lines may be used through minor intersections where the side streets are stop controlled.

Considerations for Bicycle Lane Symbol Placement

The bicycle lane bicycle with rider symbol with an arrow should be used to identify bicycle lanes. Typically, the bike lane arrow and rider symbol should be located within the center of the bike lane. To reduce wearing, bicycle lane symbols are typically not located within dotted bike lanes; however, it may be desirable to place bicycle lane symbols within dotted lines at locations of frequent conflicts between merging motorists and through-moving bicyclists.

Considerations for Bicycle Lane Symbol Placement Frequency

Bicycle lane symbols should be placed at the far side of an uncontrolled intersection, at both sides of an arterial intersection with traffic control, and at mid-block locations where block faces are more than 250 feet. Where there are marked crosswalks, the tip of the bicycle lane symbol should be placed 25 feet beyond the far side of the marked crosswalk. The frequency of placement of a bicycle lane symbol will depend on a number of factors, including the following:

- Visibility to motorists and bicyclists (markings should be placed to take into account changes in topography or not be blocked by overhanging vegetation or signs when looked at from a distance).
- Generally, the markings should be located in accordance with the proposed guidelines (far side of intersections; then mid-block if block faces are more than 250 feet long).
- Generally the markings should not be located adjacent to each other when located mid-block. It is recommended that they be separated by a minimum of 20 feet.
- Markings may be adjusted from the above dimensions to stay out of the wheel track of turning vehicles to lengthen lifespan.

Bicycle Lanes and Right Turn Lanes

The following figures illustrate several scenarios in which bicycle lanes are integrated into a roadway with dedicated right turn lanes. It is recommended that the transition for tapering centerlines and travel lanes (moving the lines gradually to the right or the left) to create space for bicycle lanes follow standard MUTCD and AASHTO practices.

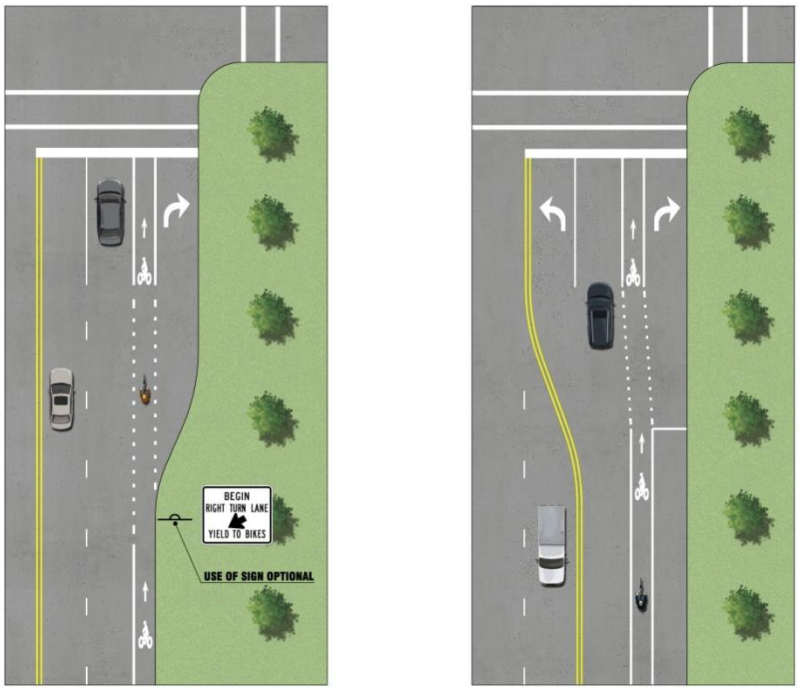


Figure: Examples of bike lanes approaching right-turn only lane (with and without parking)

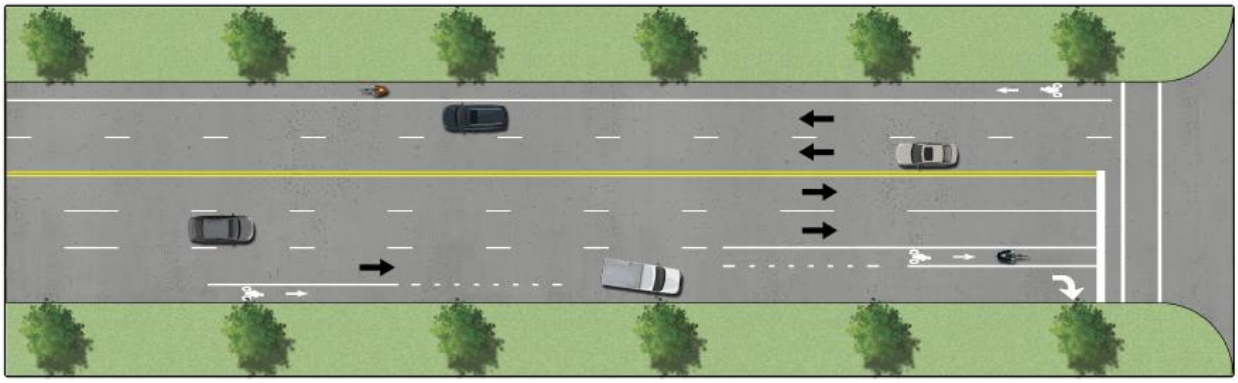
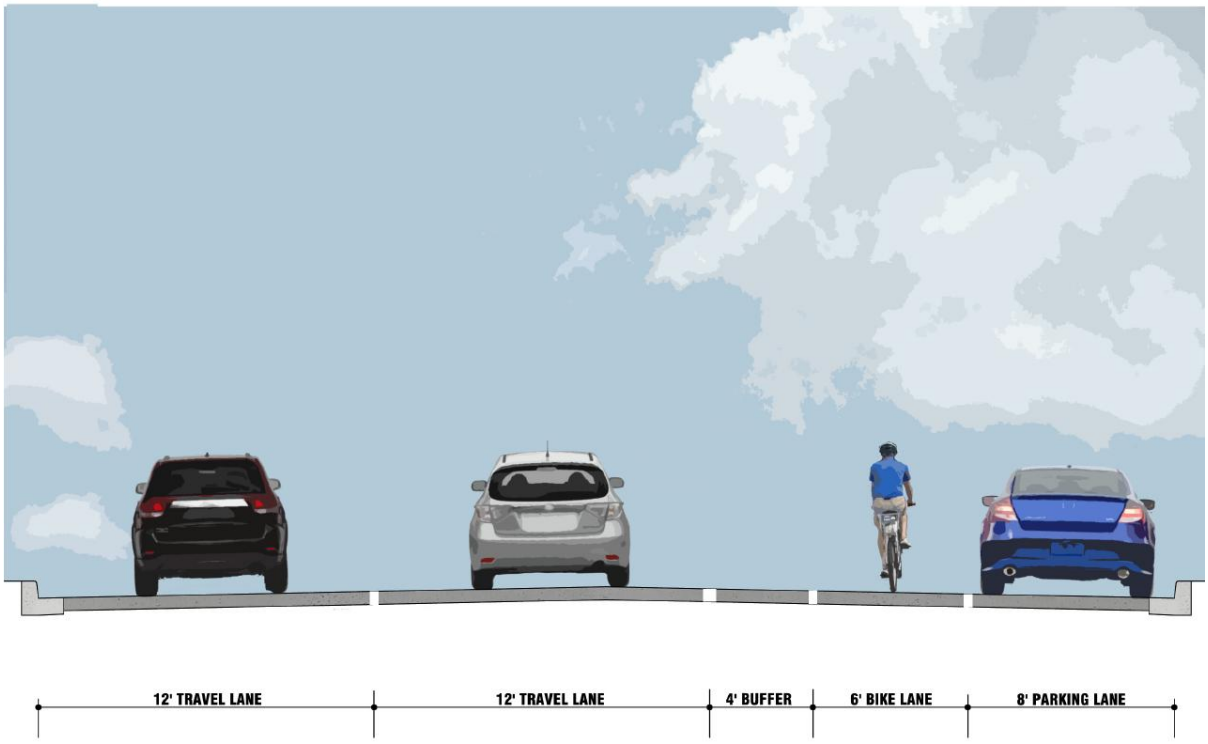


Figure: Example of Bike lane with through lane transitioning to the right-turn only lane

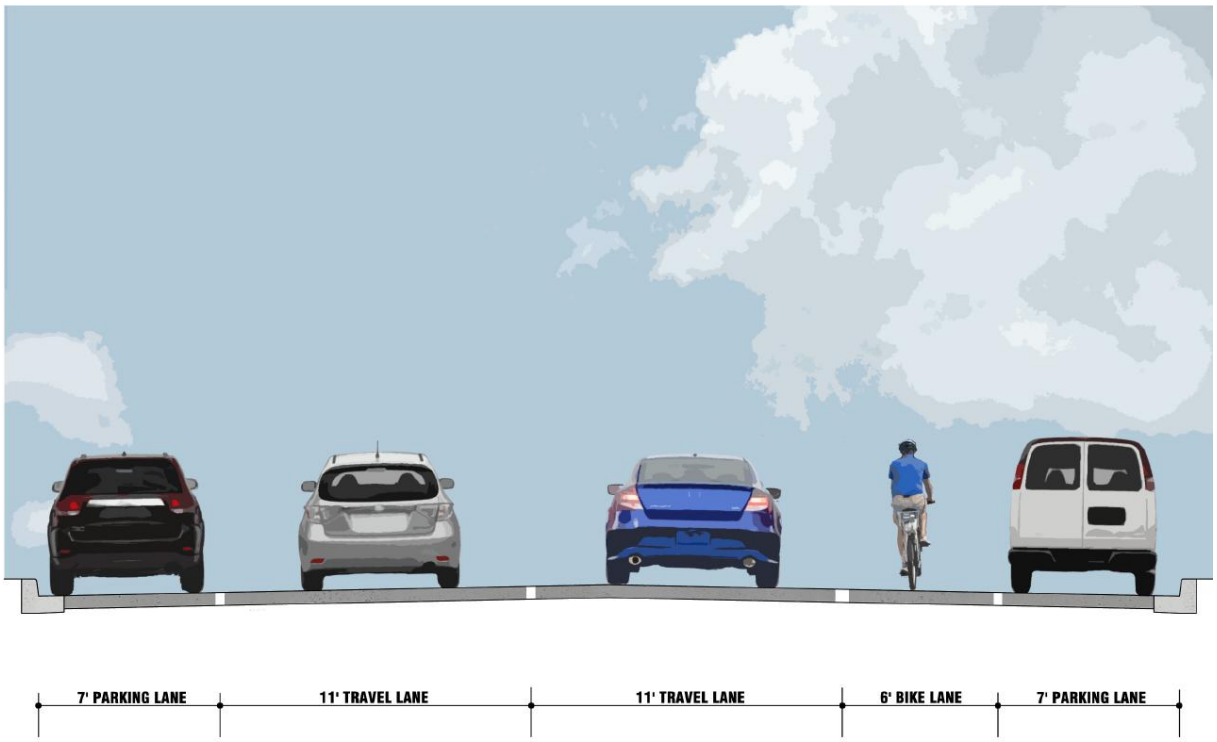
Bicycle Lanes on One-Way Streets

On one-way streets, bicycle lanes generally should be placed on the right side of the street. Bicycle lanes on the left side are unfamiliar and unexpected for most motorists. This should only be considered when

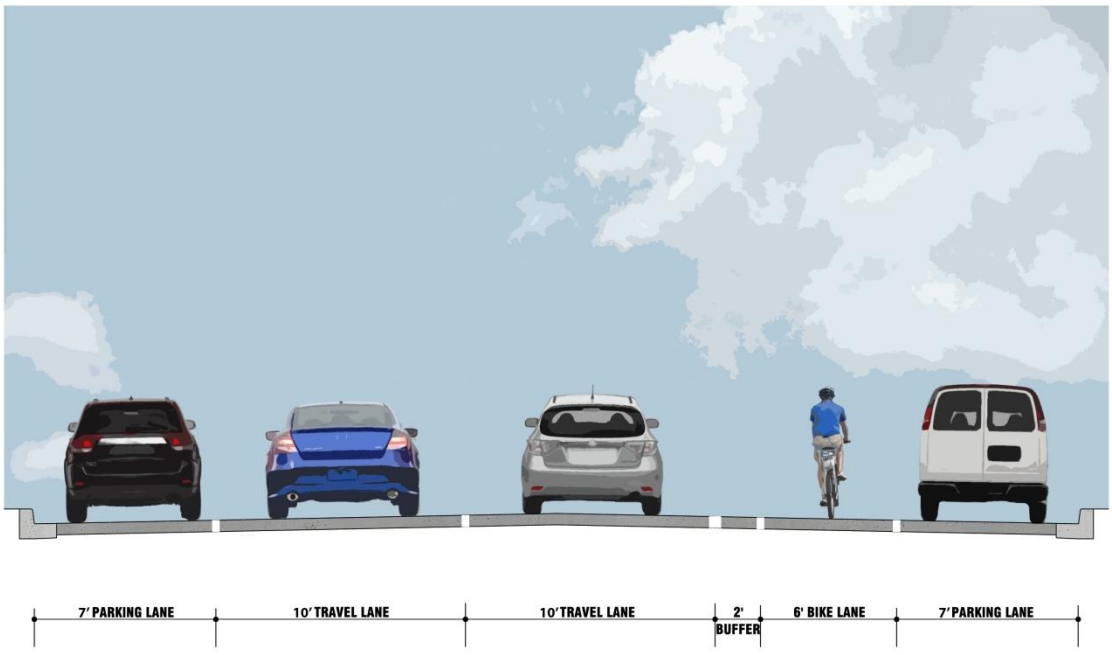
a bicycle lane will substantially decrease the number of conflicts, there are a significant number of left-turning bicyclists or the right lane is unavailable because of a special purpose lane, such as a transit lane. The following figures illustrate several different options to integrating bicycle lanes on one-way roadways in Wichita.



Option 1: Two general purpose lanes, one parking lane and buffered bike lane



Option 2: Two general purpose lanes, two parking lanes and bike lane



Option 4: Two general purpose lanes, two parking lanes and buffered bike lanes

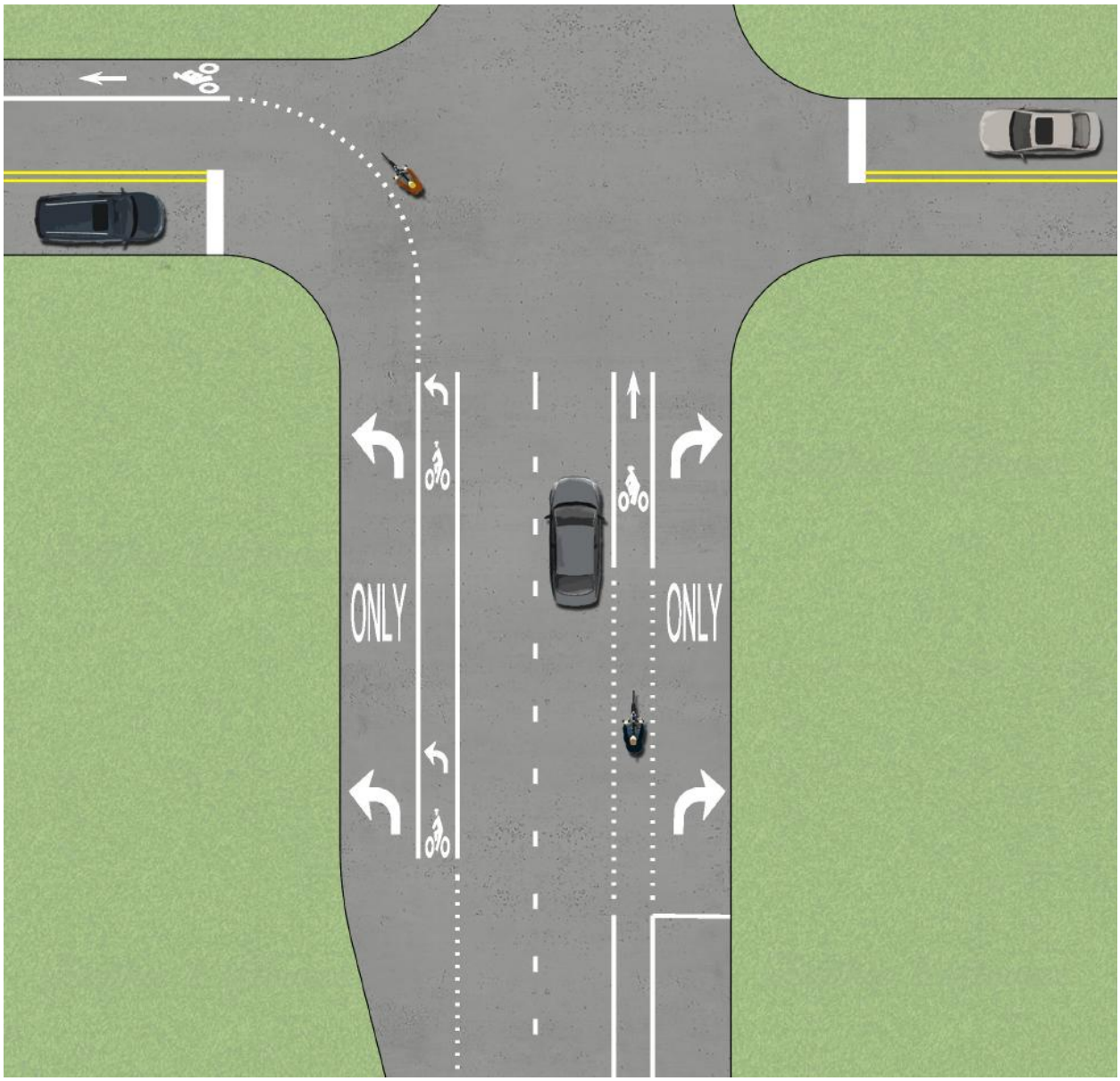


Figure X: Bike left-turn only lanes can be used on one-way streets to provide a dedicated space for left-turning bicyclists and to help direct them through the intersection to a receiving bicycle facility. Bicyclists are expected to transition from the bicycle lane on right side of street to the left-turn bicycle lane several hundred feet before the intersection.

Buffered Bicycle Lanes

A buffered bike lane is a bike lane that is separated from a travel lane or parking lane by a space of 3 to 6 feet. The lane is always one-way and is buffered by cross-hatched pavement marking, and if used, a sign for the exclusive use of bicyclists. The space between cross-hatching is flexible, but typically varies between 5 and 25 feet. Consider discontinuing cross-hatching through areas where motor vehicles may cross such as at driveway entrances and bus stops. All other guidelines and considerations that apply to bike lanes described above, also apply to buffered bike lanes. The MUTCD guidelines allow buffered bike lanes per the buffered preferential lanes found in section 3D-01.

Shared Lane Markings

A Shared Lane Marking is a pavement symbol consisting of a bicycle with two chevron markings above it that is placed in the roadway lane indicating that motorists should expect to see and share the lane with bicycles, and indicating the legal and appropriate line of travel for a bicyclist. Unlike bicycle lanes, they do not designate a particular part of the roadway for the exclusive use of bicyclists.

The following guidelines supplement the 2009 MUTCD and the forthcoming revised *AASHTO Guide for the Development of Bicycle Facilities*. They are not design standards, and should not be used as such. Application of guidance provided in this document requires the use of engineering judgment when installing shared lane markings.

The revised 2009 Edition of the MUTCD includes new provisions for installing Shared Lane Markings. The following is taken directly from the 2009 Edition of the MUTCD.

The Shared Lane Marking shown in Figure 2 may be used to:

- Assist bicyclists with lateral positioning in a shared lane with on-street parallel parking in order to reduce the chance of a bicyclist's impacting the open door of a parked vehicle,
- Assist bicyclists with lateral positioning in lanes that are too narrow for a motor vehicle and a bicycle to travel side by side within the same traffic lane,
- Alert road users of the lateral location bicyclists are likely to occupy within the traveled way,
- Encourage safe passing of bicyclists by motorists, and
- Reduce the incidence of wrong-way bicycling

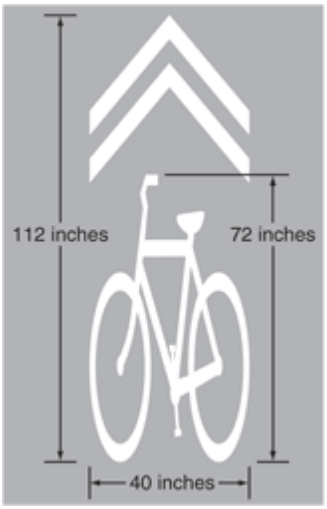


Figure 2: Shared Lane Marking Source: MUTCD, 2009 edition.

Shared Lane Marking Placement

In general, Shared Lane Markings are installed on streets where there is not enough space for bicycle lanes, or there is no desire for a bicycle lane. When bike lanes are desired but space limitations exist, a bike lane can be installed on one side of the street (the up-hill side of the street to provided dedicated space for slower, hill climbing bicyclists) and Shared Lane Markings on the downhill side. Flat streets should either have Shared Lane Markings installed on both sides (no bicycle lane) or have the bicycle lane installed on the side with the highest anticipated bicycle use (engineering judgment required). Shared Lane Markings may be the first choice (even if there is room for a bicycle lane) on some downhill sections.

Consideration for Shared Lane Marking Placement within a Travel Lane

The placement of shared lane markings will require engineering judgment as lane widths, quantity of lanes, operating speeds, and presence of parking will vary from street to street. In particular, the width of the shared travel lane and the number of available travel lanes impact typical operating behavior of motorists and bicyclists. Travel lanes with widths less than 13 feet will require motorists to partially or

fully change lanes to pass bicyclists. Travel lanes of 13 feet or greater generally allow motorists to pass bicyclists with minimal or no encroachment into adjacent travel lanes (allowing 3 feet of horizontal separation between the motorist and bicyclist).

Generally, the center of shared lane markings should be located a minimum of 11 feet from the curb or edge of roadway at locations where parking is permitted adjacent to the travel lane. Generally, the center of shared lane markings should be located a minimum of 4 feet from the curb or edge of roadway at locations where parking is prohibited.

It may be appropriate to move the shared lane marking towards the center of the travel lane (exceeding the MUTCD minimums) if engineering judgment determines that this placement will enhance the safety of the bicyclist operating within the travel lane. The shared lane marking may be moved towards the center of the lane regardless of whether it is adjacent to parking or not. In most cases, it will be a combination of two or more of the following factors which will indicate that consideration should be given to moving the Shared Lane Marking towards the center of the travel lane:

- Travel lane is less than 12 feet in width
- Speed of traffic
- Number of travel lanes (it may be desirable to place the shared lane marking towards the center of a narrower outside travel lane when a center turn lane is present or when there are multiple travel lanes in the same direction)
- Grade of roadway and expected bicyclist speed (center lane placement often works well when going downhill on streets with grade and higher bicycle speeds)
- Volume of traffic (may or may not be an issue – speed, grade, and number of lanes are more important)

Situations Where Travel Lanes Are Less than or Equal to 12 Feet in Width

Shared lane markings should be placed in the center of the travel lane where travel lanes are less than 12 feet to encourage bicyclists to occupy the full lane and not ride too close to parked vehicles or the edge of the roadway. A BIKES MAY USE FULL LANE (R4-11) sign may be used to supplement the marking. Travel lanes of this dimension are too narrow for sharing side by side with vehicles.

Situations Where Travel Lanes Are Between 12 Feet and 13 Feet in Width

Where travel lanes are 12-13 feet in width, the travel lane can appear shareable to roadway users if bicyclists operate on the right side of the lane resulting in unsafe passing maneuvers. It may be desirable to place the marking in the center, or close to the center of the lane to discourage these behaviors. A BIKES MAY USE FULL LANE (R4-11) sign may be used to supplement the marking.

Situations Where Travel Lanes Are Greater than or Equal to 13 Feet in Width

Where travel lanes are 13 feet or wider, motorists will generally be able to pass bicyclists within the same lane or will only need to slightly encroach on adjacent lanes to pass bicyclists. The Shared Lane Marking should generally be located in the right portion of the lane (per the MUTCD minimum requirements) with exceptions for locations adjacent to parking where it is desirable to encourage riding

further from parked vehicles. A Share the Road sign (W11-1 AND W16-1P) may be used to supplement the marking.

Shared lane markings should generally be used on arterial and non-arterial roadways with motor vehicle speeds 35 mph or less. Research has shown placing the marking in the center of travel lanes wider than 13 feet will likely result in poor compliance by bicyclists who will travel in the right portion of the lane which may undermine the effectiveness of shared lane markings in narrower lanes.

Considerations for Parking Lane Line Placement

Where there are no parking restrictions, the Shared Lane Marking should be placed in conjunction with a 4 inch solid or dotted white parking lane stripe (2 foot line with 4 foot gaps). The dotted line should be used through uncontrolled intersections where there is no arterial traffic control and where there are parking restrictions, including bus stops. The intent is to reinforce parking restrictions and to provide a continuous visual cue for the bicyclist to track along. The parking lane line will be located 7 to 8 feet from the face of the curb or roadway edge. Generally, a narrower parking lane is desirable to encourage motorists to keep the vehicle as close to the edge of the roadway as possible to maximize the available travel lane width, which will improve the bicyclist's level of comfort on the roadway.

Considerations for Symbol Placement Frequency

Shared Lane Markings should be placed at the far side of an uncontrolled intersection, at both sides of an arterial intersection with traffic control, and at mid-block locations where block faces are more than 250 feet long.

When placing mid-block Shared Lane markings, they should be placed in such a manner that the first Shared Lane marking a bicyclist or motorist would come upon would be the Shared Lane marking in their direction of travel. The Shared Lane markings should be offset from each other 20 feet from the tip of the leading (top) chevron to tip of leading (top) chevron.

Where there are mid-block marked crosswalks, the tip of the chevron should be placed 25 feet beyond the far side of the marked crosswalk.

Considerations for Shared Lane Marking Placement –Streets without Centerline

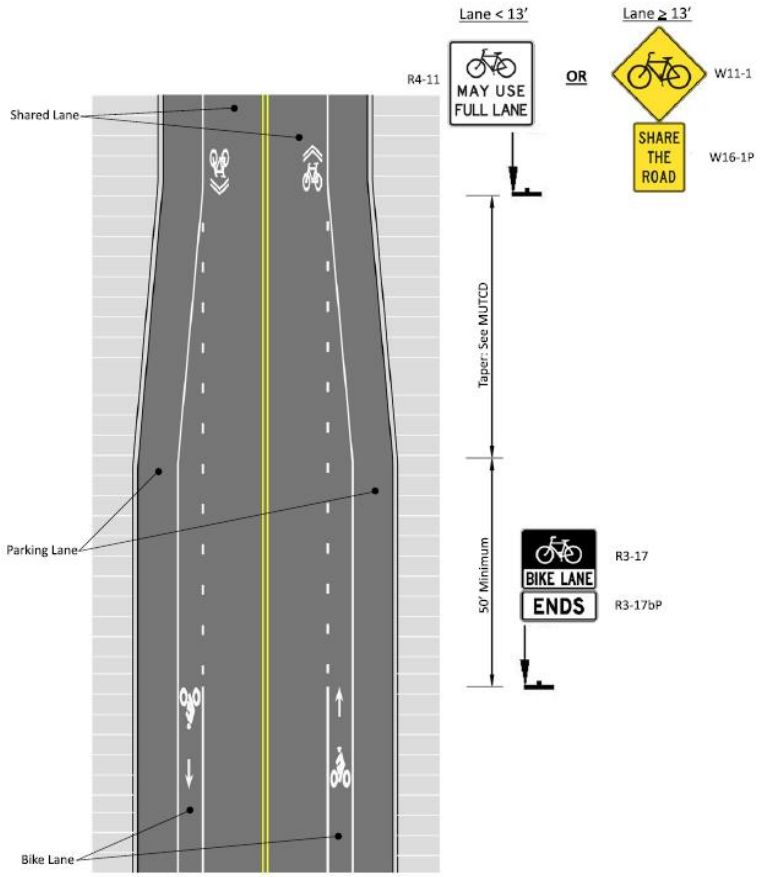
Shared Lane Marking installation on local streets or streets without a centerline should generally follow the guidelines mentioned above. However, no parking lane stripes should be installed. Utilizing the marking on non-arterial streets may require that the Shared Lane Markings be offset at intersections to prevent the symbols from overlapping. The tips of the leading (top) chevrons should be separated by at least 10 feet.

Transitions between Different Bicycle Facility Types

It is often necessary to use different bicycle facilities to provide bicycle access within the same roadway corridor due to existing roadway conditions, surrounding land uses, available right-of-way, and other characteristics. Where this condition occurs, it is important to provide transitions between different facilities. These transitions can be made safer and more understandable for bicyclists and motorists with appropriate and consistent treatments such as spot directional signs, warning signs, pavement markings, curb cuts, etc. Transitions should be provided as a part of the bicycle facility design process.

Bike Lanes to Shared Lanes

At locations where bike lanes terminate to become shared lanes it may be desirable to provide a transition to a marked shared lane for a brief distance, even if it is not desirable to mark a continuous shared lane for the remainder of the roadway. The placement of the shared lane marking should conform to guidance provided above. It is recommended that a SHARE THE ROAD sign (W11-1 and W16-1P) be used for shared lane situations where the lane is wider than 13 feet and BIKES MAY USE FULL LANE (R4-11) signs be used for narrower lane widths. The taper terminating the bike lane should also conform to the MUTCD (Figure 3B-14, 2009 MUTCD) shown here in Figure x.



Path System and the On-Street Bicycle Network Transition

Where a shared use path crosses or terminates at an existing road, it is important to transition the path into the system of on-street bicycle facilities and sidewalks. Care should be taken to properly design the terminus to transition the bicycle traffic into a safe merging of intersecting facilities. For example, a path that transitions to an on-street facility should transition a bicyclist to the correct side of the street

thereby reducing the possibility of wrong-way riding. Where possible, provide additional space where paths intersect roadways, particularly at signalized locations where multiple path users are likely to be waiting to cross the street. Curb ramps at path crossings and other on-street access points should be assessed and widened where they are narrower than the path width and/or where the volume of path users is high.

Appropriate signing is necessary to warn and direct both bicyclists and motorists regarding these transition areas. Each roadway crossing is also an access point, and should, therefore be designed to facilitate movements of path users who either enter the path from the road, or plan to exit the path and use the roadway.

Bicycle Boulevard Guidance

Introduction

Bicycle boulevards are low-volume and low-speed streets that have been optimized for bicycle travel through treatments such as traffic calming and traffic reduction, signage and pavement markings, and intersection crossing treatments. Bicycle boulevards have been implemented in cities across the country, including Columbia (MD), Minneapolis, Berkeley, Seattle and Portland. Bicycle boulevards are garnering more attention as cities look to strategies for attracting more people that are "curious, but cautious" about riding their bicycles in an urban context. Bicycle boulevards allow bicyclists to avoid higher volume, higher speed roadways, offering a more comfortable and leisurely riding experience. For this reason, bicycle boulevards are more likely to attract families, and other more cautious or less confident bicyclists that are less likely to use bicycle facilities on roadways where interaction with higher vehicle volumes and speeds are likely. The primary characteristics of a bicycle boulevard are:

- low motor vehicle volumes
- low motor vehicle speeds
- logical and continuous routes that are well marked and/or signed
- convenient access routes to desired destinations (typically parallel routes to higher speed, higher volume arterial or collector streets)
- minimal bicyclist delay
- comfortable and safe crossings for cyclists at intersections

There are several resources available that provide a thorough introduction to the fundamentals of bicycle boulevards, addressing the planning, design, and maintenance of these facilities. These resources include:

> *Fundamentals of Bicycle Boulevard Planning and Design*, Portland State University and Alta Planning+Design, 2009.
>
> *Bicycle Boulevard Design Tools and Guidelines*, City of Berkeley, 2000.
>
> *Traffic Calming State of the Practice*, ITE, 1999, http://www.ite.org/traffic/tcdevices.asp
>
> *Traffic Calming: Roadway Design to Reduce Traffic Speeds and Volumes*, Victoria Transport Policy Institute, updated 12/26/11, http://www.vtpi.org/tdm/tdm4.htm

Because these resources provide a good background on bicycle boulevards, this section will not focus on the fundamentals of bicycle boulevards, but rather, on key steps in the planning process, how bicycle boulevards might work in the Wichita context, and the specific design considerations that are most applicable to Wichita.

Bicycle Boulevards in Wichita

Bicycle boulevards have the potential to play an important role in Wichita's bicycle network. Wichita has an extensive path network that is the backbone of Wichita's bicycle network. A primary objective of this Master Plan is to extend that network by supplementing paths via an on-street bicycling network.

Bicycle boulevards are an important type of on-street bicycle facility for extending the network, because the types of riders that are attracted to paths will feel comfortable using bicycle boulevards that are properly designed.

There are several areas in the city where it is possible to connect paths by way of a bicycle boulevard, which could significantly expand the reach of the bicycle network. Additionally, there are high volume, high speed arterial roadways in Wichita where on-street bicycle facilities are not feasible due to right-of-way and/or funding constraints. Developing bicycle boulevard facilities parallel to these streets is an ideal solution for expanding the bicycle network into these areas of the city.

Bicycle boulevards have the potential to provide a high return on investment because they tend to attract a wide range of bicyclists and can address additional neighborhood goals such as traffic calming, green streets, storm-water management, etc. that other bicycle facility improvements do not provide. The cost of construction will vary depending on the specific traffic calming and intersection treatments implemented. For example, new pedestrian signals will be needed as some major arterial crossings.

Recommended Bicycle Boulevards

The City of Wichita Bicycle Master Plan recommends approximately 122 miles of bicycle boulevards. The bicycle boulevard network is comprised of three typologies listed below.

- On-street connections between paths
- Residential on-street bicycle boulevards
- Mixed-facility bicycle boulevards (route a combination of bicycle boulevards, bike lanes and shared lane markings; most common)

The following are selected examples of the three typologies. They are represented on the Priority Bikeways Network Map and are recommended in the list of early implementation projects (see page __)

Connections between existing paths

9th St--this east/west route provides a residential street connection between the sidepath on Zoo Blvd and the Arkansas River Bicycle Path. This is the only missing link in the path system that extends from downtown west to 119th St.

Wassall St – this east/west bicycle boulevard connects between the Arkansas River Bicycle Path and the Gypsum Creek Bicycle Path. It would also provide a connection to the pedestrian/bicycle bridge crossing of 135.

Residential street bicycle boulevards

Piatt Ave—this corridor provides a north-south route parallel to Grove St and a the Canal Bike Trail between 2nd Ave and 21st St. The route serves as a residential street connection on the east side of I-135.

25th St/Green St/Estelle Ave/2nd Ave/Volutsia Ave/Kellogg Dr/Chautauqua Ave—this north-south route serves as a residential street route between the K-96Path and Lincoln St through Uptown, East Front and Sunnyside neighborhoods. The route provides a connection across 400/54 using a bicycle and pedestrian bridge. The route connects residents to the businesses on E Douglas Ave and E Central Ave. It also

provides north south access to the Atwater Neighborhood City Hall, Lynette Woodard Recreation Center, and an elementary school.

N Keith St//N Belwood St/W Sterling St/N Keith St/W 20th St N N West/Westfield Cir/W Westlawn St/ N Keith St/N Westfield St/Murray St/W Harvest Ln/N Westlink Ave/Delano Ave/N Caddy/W Central Ave/N Maus/W Hardtner St/N Caddy/Tee Ln/Westfield St/Shad Ln/Fairway St to W 2nd St N—This north-south bicycle boulevard follows residential streets and connects neighborhoods in northwest Wichita.

N Shocker Drive/ N Fountain/Unnamed campus roadway/ Perimeter Rd/Belmont Ave/E 24th St N/N Fountain St/ Charron Ln/E Brooks St—this bicycle boulevard provides a residential street connection between the Redbud Bicycle Path, Wichita State University and the K-96 Bicycle Path.

Mixed-facility bicycle boulevards

Murdock Ave/Broadview Ave/8th St/Crestway Ave/9th St—This east-west bicycle boulevard extends east from the Central Riverside Park and connects the Canal Route (I-135) Bicycle Path, Wesley Medical Center, McDonald Park, Edgemoor Park, a library and two elementary schools. The route follows both arterial and residential streets with several facility types: Bicycle Boulevard, bike lanes and shared lane markings.

33rd St/Coolidge Ave/Woodrow St/20th St/N Porter St/N Perry Ave—this bicycle boulevard runs north-south through Benjamin Hills and North Riverside neighborhoods between the Big Arkansas River and the Big Ditch. It provides an extension of the existing Rosalie Bradley Path along the Little Arkansas River. The route consists of Bicycle Boulevard between 13th St and 18th St and shared lane markings between 18th and 33rd St.

Prominent Markings Can Brand the Boulevard and Provide Wayfinding

Bicycle Boulevard Design Considerations

Traffic Volume and Speed

There are a number of design considerations that should be made before implementing a bicycle boulevard, including how best to manage the speed and volume of motor vehicles and establish bicycle priority, how to minimize impacts to nearby residential streets, how to maintain reasonable access for emergency and service vehicles, how to guide bicyclists along the route and get them safely across arterial streets. Streets with existing low volumes (less than 1,000 ADT) are good bicycle boulevard candidates as they typically require minimal or no traffic diversion treatments. These streets may only require traffic calming measures to get speeds down to appropriate speeds and increase the comfort and safety of bicyclists. Where traffic volumes exceed 1,000 ADT, traffic reduction measures should be considered where reasonable alternative routes exist for motorists in addition to traffic calming measures. Lastly, creating arterial street crossings that are accessible, safe, comfortable, and provide quality level of service are essential to a successful bicycle boulevard route.

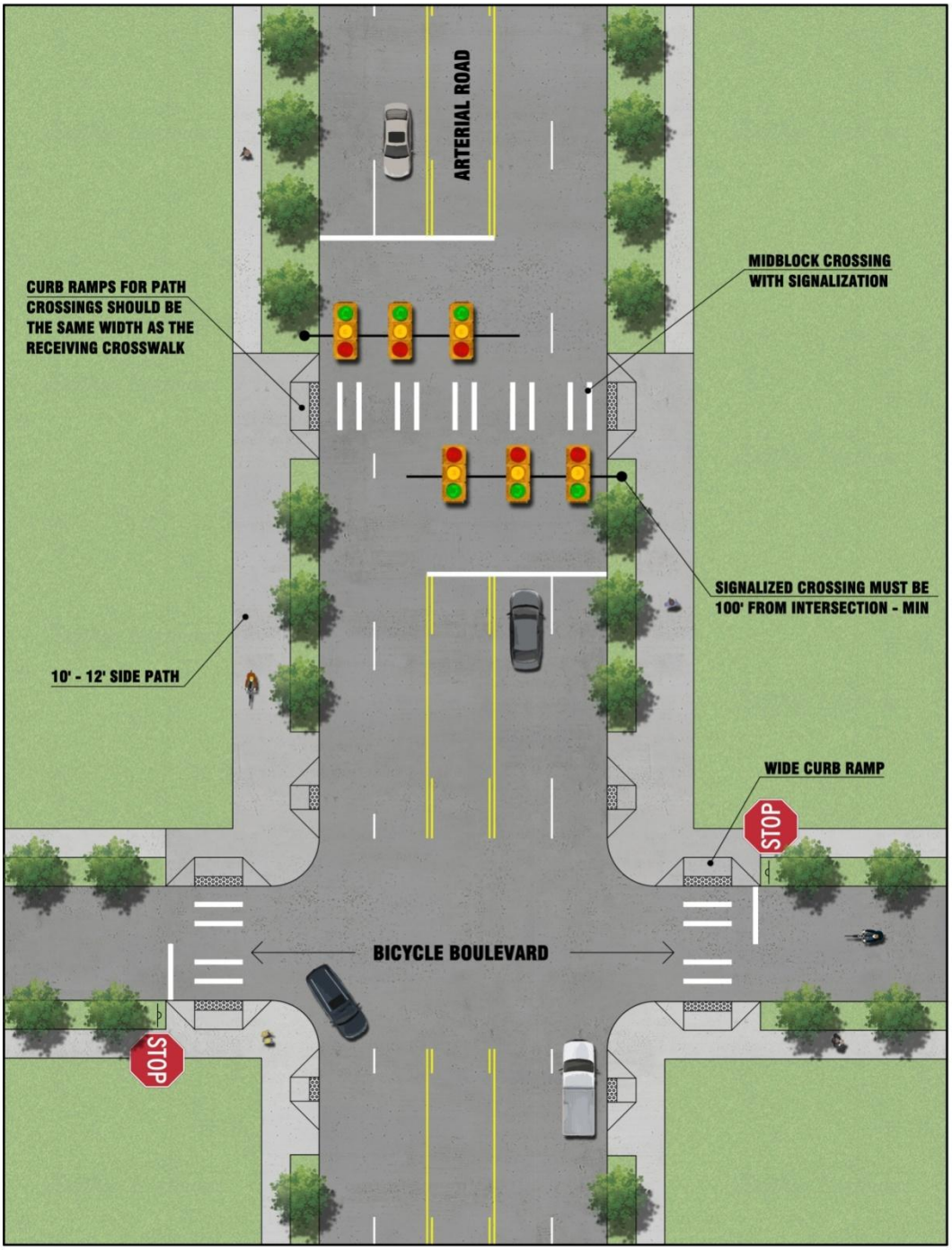
Arterial Crossings

Bicycle boulevards, which most often are developed on low volume residential streets, most commonly intersect arterial roadways at un-signalized locations, however in some cases they may utilize existing signals, or require a new signal depending on motor vehicle traffic volume and posted speed limits, and the width of the roadway. It is essential for bicycle boulevard users to be able to cross arterial roadways safely and without substantial delay or inconvenience. While many intersection crossing treatments for bicyclists were originally based on pedestrian crossing treatments, special consideration should be given to the unique characteristics of cyclists, such as cyclist positioning, crossing times, and vehicle length. Crossing treatments should accommodate groups of cyclists and longer bikes, including tandems, cargo bikes and trailer bikes.

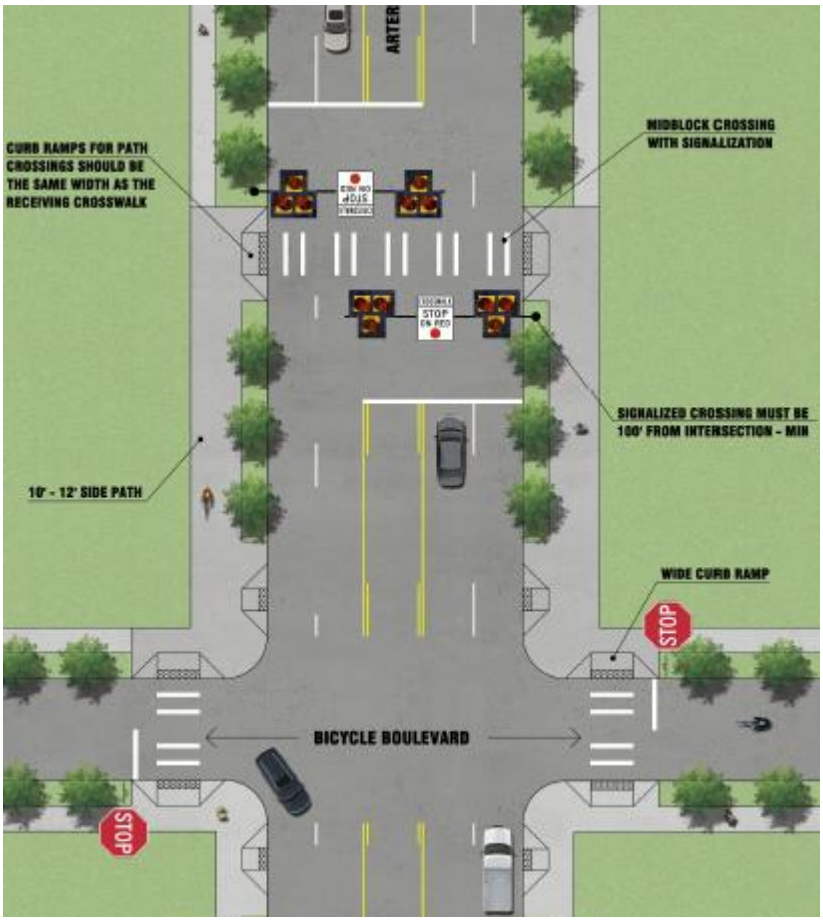
Wichita has installed numerous pedestrian signals throughout the city for facilitating pedestrian crossings of arterial roadways. Many of these pedestrian signals are classified as mid-block signals because they are located a minimum 100 feet away from the nearest stop or yield controlled side street intersecting the arterial (per MUTCD section 4F.02). Several recommended bicycle boulevards intersect with arterial roadways at locations where there are existing mid-block signals. Other recommended bicycle boulevards will require new mid-block signals where motor vehicle traffic volumes and speeds are high and the frequency of sufficient gaps for crossing the roadway is low. Key considerations for crossing locations where there are mid-block signals include:

- Directing cyclists to the crossing location using signage and/or pavement markings and distinctive infrastructure, i.e. widened sidewalks or sidepaths connecting to crossing location

- Widening sidewalks that connect to crossing location to sidepath standard, where feasible. Sidewalks should be able to accommodate both pedestrians and bicyclists while minimizing conflict between the two. In locations where there are high volumes of pedestrians using striping to separate bicycles from pedestrians should be considered.
- Transitioning from street to sidewalk. Where a cyclist is required to transition from the street to a sidewalk or sidepath (and vice versa) there is potential for conflict with motor vehicles, particularly turning vehicles. When needing to cross a lane of traffic in order to access the signal via sidewalk (from street), cyclists should be directed to make this transition using a two-step movement: first transition to sidewalk on right-side of street, then second, across crosswalk to opposite side of street where signal is located.
- Mid-block signals shall be used in conjunction with signs and pavement markings to warn and control traffic at locations where pedestrians/cyclists enter or cross a street (MUTCD).
- For guidance on Pedestrian Hybrid Beacons (HAWK signals) see MUTCD (2009 edition) Section 4f.01.



Pedestrian Signal: Recommended design for crosswalk with standard mid-block signal



Pedestrian Hybrid Beacon AKA "HAWK' (high intensity activated crosswalk. Recommended design for crosswalk with Pedestrian Hybrid Beacon (HAWK)

Bicycle Priority/Advantage

Design elements that prioritize travel on the bicycle boulevard are intended to raise awareness of the route as a bicycle priority thoroughfare and create conditions that reduce unnecessary delay for cyclists. Design treatments include pavement markings and wayfinding signage, adjustments to stop/yield control, and arterial crossing enhancements.

Example of Flipped Stop Sign With Custom Sign Branding the Boulevard

Employing distinctive symbols and/or colors to distinguish the bicycle boulevard from other roadway signs provides visual cues to motorists and cyclists that this is a different type of roadway. Supplementing wayfinding signage with pavement markings helps to further establish bicycle priority, and also encourages proper positioning by bicyclists while sharing the lane with motor vehicles. Unique bicycle boulevard pavement markings such as "bike dots" or extra-large "bike blvd" lettering with bike symbol may be developed. Shared lane markings are being used more

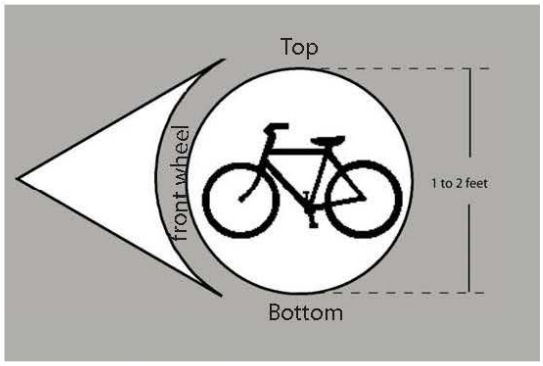
commonly in places like Portland and Seattle.

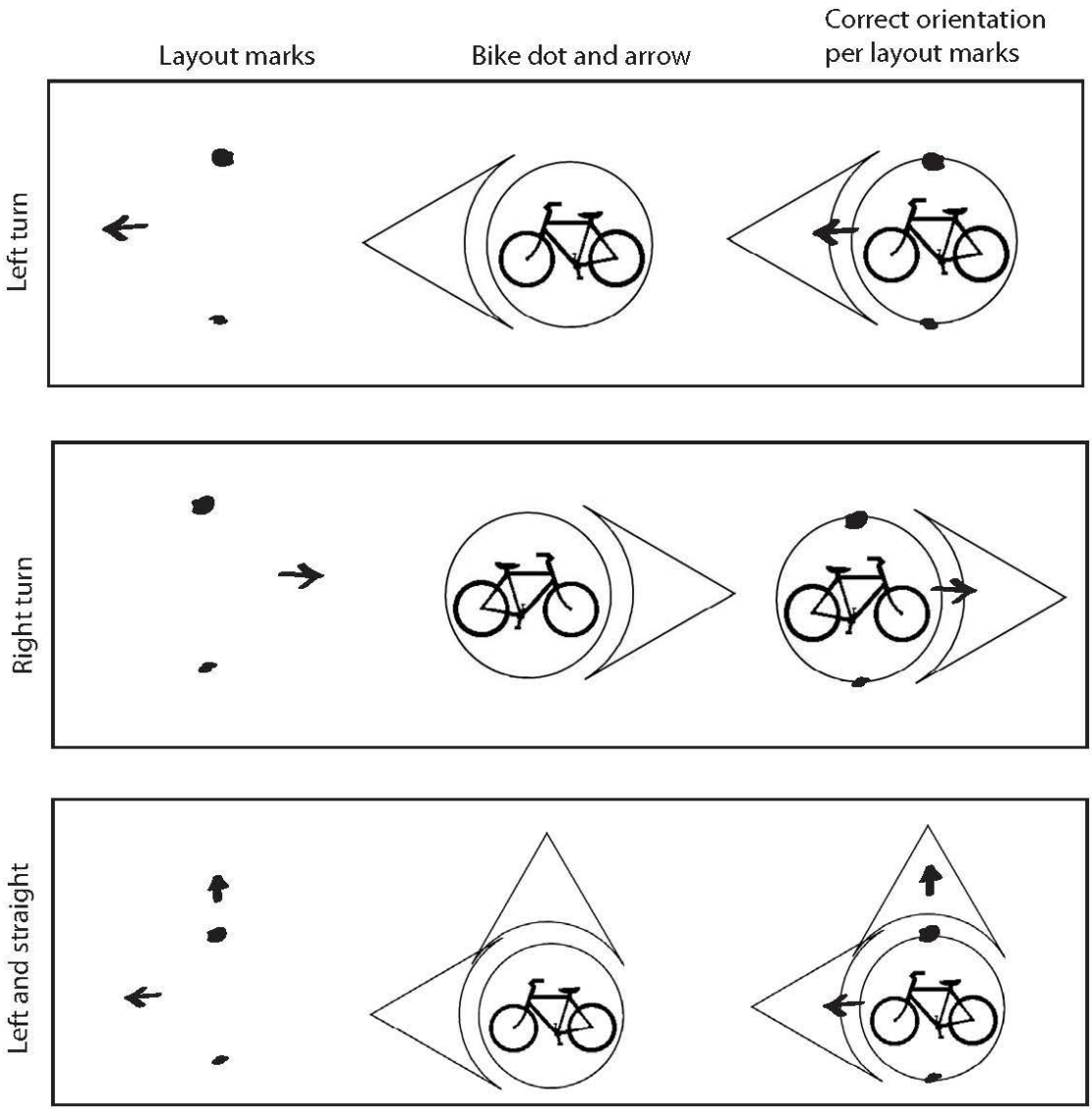
A bike dot directs bicyclists at turns much like a trail of breadcrumbs

Because stop signs increase cycling time and energy expenditure due to frequent starting and stopping, they tend to result in non-compliance by cyclists. Bicyclists should be able to travel continuously for the entire length of the bicycle boulevard with a minimum of stops. Assigning stop or yield signs to control cross traffic is one way to minimize stops for bicyclists. Mini traffic circles may be an alternative to stop and yield controlled intersections. Parking may need to be removed near the intersection to improve sight distance of bicyclists and motorists approaching the intersection. After stop or yield signs are reoriented to cross streets to provide bicycle priority, an increase in motor vehicle volume or speed along the route may occur – this should be mitigated using traffic calming treatments.

Layout Markings for Bike Dot Installtaion

For bike dot installation align the top of dot with the large spray paint dot. Align the bottom of the dot with the small spray paint dot. Align the arrow (s) with the spray painted arrow(s). In some cases there may be two arrows per dot. The front wheel of the bicycle should always be to the left except when there is a right arrow. With all other arrows or no arrows the front wheel of the bicycle should be to the left.





Traffic Calming Strategies on Local Streets and Collectors

There are numerous traffic calming treatments that may be integrated into a bicycle boulevard. Brief definitions are provided below for treatments which are likely to create the highest quality Bicycle Boulevards in Wichita – for more detailed information on each treatment, or to review additional treatments please refer to the resources cited below. NOTE: By means of an interdepartmental team involving members from Planning, Public Works, Police and Fire/Life Safety the city should revisit the existing traffic calming policy to better address Bicycle Boulevard implementation.

• **Mini traffic circles at 4-way intersections**- raised circular islands located in the center of intersections of local streets, intended to reduce speed of vehicles approaching the intersection while minimizing delay. Stop and yield signs may be eliminated when mini traffic circles are used. Signage indicating counter-clockwise circulation should be installed in advance and/or on the traffic circle.	
• **Mini traffic circles with Neckdowns at T-Intersection**. T-intersections require the use of smaller circles, limited parking restrictions within the circle, and approach neckdowns to deflect the movement across the top of the tee which otherwise could not be deflected by the circle.	
• **Chicanes** – raised curb features in the middle of the road (pedestrian refuge) or along the edge (chokers or curb extensions) that create horizontal shifting of travel lanes, which reduces vehicles speeds. Chicanes are typically used on long stretches of straight roadway and are ideal for approaches to signalized intersections where motorists may be inclined to accelerate towards the signal. A "chicaning" effect may also be achieved by alternating the location of on-street parking (on one side of the street) from one block to the next.	

• **Speed tables or raised crosswalk** - long and broad, flat-topped sections of raised roadway (3-4 inches high and 22 feet wide) that slow traffic by requiring motorists to reduce their speed. Speed tables are more comfortable than speed humps for bicyclists to ride over without reducing their speed. A 22 foot table has a motor vehicle design speed of 25 miles per hour.	
• **Speed cushions** – Similar in design to speed humps, speed cushions are rounded raised areas placed in the center of travel lanes to reduce vehicle speeds. They are generally 10 to 14 feet long (in the direction of travel) with. These are designed to allow free passage of larger chassis vehicles such as fire trucks through the flattened area.	
• **Speed humps** – Speed humps are rounded raised areas placed across the roadway to reduce vehicle speeds. They are generally 10 to 14 feet long (in the direction of travel). • **Speed humps with raised islands** are an effective combination on streets with low parking demand.	

Traffic Reduction Strategies

Traffic reduction design elements are intended to maintain existing low volumes or reduce the overall volume of motor vehicle through trips on the bicycle boulevard, while allowing continuous through travel by bicyclists and other non-motorized users. Impacts on nearby local streets and emergency response should be analyzed before implementing traffic reduction elements.

• **Partial Diverters** - restrict motor vehicle access while allowing bicycle and pedestrian access, typically restricting through movements or left turns. This type of treatment is typically placed on minor streets at an intersection with an arterial street to manage motor vehicle volumes on the minor street.	
• **Diagonal Diverters** – restrict through motor vehicle access completely at standard 4-way intersections while allowing bicycle and pedestrian access. This type of treatment is typically placed on minor streets at an intersection with an arterial street to manage motor vehicle volumes on the minor street.	
• **Median Closures** – restrict through motor vehicle access completely at standard 4-way intersections while allowing bicycle and pedestrian access requiring right in and right out motor vehicle movements. This type of treatment is typically placed on minor streets at an intersection with an arterial street to manage motor vehicle volumes on the minor street. This treatment can be used to facilitate bikes crossing the arterial or transitioning from the arterial to the bike boulevard.	

The above traffic calming and traffic reduction design elements have been in use in several communities for many years. However, concerns regarding traffic calming and reduction that occur on the bicycle boulevard are likely to be similar to concerns that are raised when these improvements are implemented anywhere else in the community. Most commonly, residents and officials will raise concerns about four potential issues related to traffic reduction and calming:

- Access to property;
- Impact on traffic patterns;
- Enforcement issues with motorcycles and mopeds; and
- Emergency response.

These are all legitimate concerns that need to be addressed, and can be addressed through a combination of good design and enforcement, if needed. It is important to keep in mind that eliminating or modifying traffic diversion and calming design elements that are part of a larger system may reduce their effectiveness. Poorly designed traffic diversion and calming elements on so-called bicycle boulevards may backfire creating new traffic problems, such as attracting through motor-vehicle traffic to a bicycle boulevard with fewer stops. This reduces the comfort and safety of cyclists, may negatively impact the neighborhood, and negatively influences opinions regarding the utility of bicycle boulevards in general.

To address each of these concerns it is important to involve stakeholders early. For residents living along a planned bicycle boulevard street, and concerned about accessing their property, presenting the design so that they can see how their access is affected is an important first step. Trial installations of design elements can alleviate resident concerns regarding access by allowing them to “try out” design features and allow any necessary modifications to be made before the city commits to a permanent installation. It is also very important during the initiation and conceptual planning phases to highlight the positive attributes of bicycle boulevards and the benefits residents can expect, including fewer cars on their street, fewer speeders, less noise, and generally, a more livable street.

When motor vehicle traffic is restricted or calmed on the bicycle boulevard it may induce an increase in motor vehicle traffic on adjacent streets. It is important to examine the impacts of traffic calming diversion elements both on the proposed bicycle boulevard and nearby streets, and include mitigation (e.g., additional traffic calming on adjacent streets) for any impact in their designs. Again, trial installations can allow residents to “try out” the design features and allow the city to evaluate and address impacts on traffic patterns.

Where traffic diversion is used, enforcing restrictions to motorcycles and mopeds may be needed. However, experiences in other communities have shown such violations to be seldom-it is likely that motorcyclists, like motorists, prefer to use the higher speed parallel streets when they are available nearby.

Traffic-calming elements can be a concern to fire and police personnel if the design substantially increases response times to properties along the bicycle boulevard. Having the support of the fire and police department is critical-without it development of a bicycle boulevard may be delayed or

permanently deferred. Emergency services need to be engaged early in the planning process in order to identify acceptable design elements. Traffic reduction and calming design elements may be designed in such a way that allows a wide-chassis vehicle, such as a fire truck, to pass over, while preventing a similar movement of most passenger vehicles. Again, trial installations of street closures, medians, chicanes, or other design elements that may present an access concern to emergency services may be used to evaluate impacts on emergency responses.

Road Diets and Bus Operations

Four – to Three-lane Road Diet Conversion

The recommended bicycle network for Wichita includes a number of roadways where a four – to three – lane "road diet" conversion is recommended in order to provide roadway space for bicycle lanes. The resulting cross section of recommended road diets would include two vehicle travel lanes plus a center left-turn lane and a bicycle lane on both sides of the roadway. As a result, buses operating in these corridors would stop in-lane when boarding and alighting passengers, possibly causing delay for other vehicles. This memo is intended to provide information on the factors that help determine when bus operations may negatively impact motor vehicle travel speeds.

Recommendations

The factors listed below for consideration of bus turnouts may be used as guidance for determining when bus operations could result in significant impacts to roadway travel speeds in a four- to three-lane conversion scenario. Recommendations in this Plan represent a conservative application of these factors. Corridors where the following transit-related factors are present should be considered for a 4 – to 3-lane conversion:

- Traffic speeds are 35 mph or less
- Bus volumes are 6 or less per hour
- Average peak hour dwell times are less than 30 seconds per bus.
- Passenger volumes are less than 30 boardings an hour

Bus Operations and Effects on Travel Speeds

Research indicates that the presence of heavy vehicles and frequent stop/slower moving vehicles such as buses can result in slower vehicle travel speeds on three-lane cross-sections versus four-lane cross sections.[2] The degree to which vehicles such as buses, which stop frequently, affect travel speeds of other vehicles is a function of traffic volumes and the percent of volume that buses represent in the overall mix of traffic. Using model simulations of two road conversion projects, it was found that approximately 50 percent of the speed reduction occurred at and above 20 percent heavy vehicles for a roadway with volumes of 750 vphpd.[3] These findings indicate that where the volume of buses is low, the impact of bus operations on the travel speeds of other vehicles will be less. Research that specifically addresses the impacts of bus operation factors such as number and spacing of stops, headways, and dwell times on travel speeds on 3-lane roadways is not available.

[2] Knapp, Keith, K. Giese and Woochul Lee, *Urban Four-Lane Undivided to Three-Lane Conversion Guidelines*, August 2003.

[3] Knapp, Keith, K. Giese and Woochul Lee, Urban *Minor Arterial Four-lane Undivided to Three-Lane Conversion Feasibility: An Update*, July 2003.

Bus Turnouts

Bus bays or turnouts may help to reduce travel speed impacts associated with stopped buses. Bus bays are provided primarily on high-volume or high-speed roadways, such as suburban arterial roads. Additionally, bus bays are frequently constructed in heavily congested downtown and shopping areas where large numbers of passengers may board and alight. Turnouts can be in the form of wider parking lanes or separate bus only areas outside of the travel way. The ability to provide bus turnouts is contingent upon available right-of-way or the ability to remove on-street parking. Bus turnouts should be considered where feasible as part of an overall road diet design. Report 19 of the Transit Cooperative Research Program (TCRP) provides guidelines for the location and design of bus stops, including when turnouts should be considered. The report suggests a number of factors that should be used to determine when turnouts should be considered. For Wichita, the most critical among these factors are:[4]

- Traffic speed exceeds 40 mph
- Bus volumes exceed 10 in the peak hour
- Passenger boardings exceed 20-40 per hour
- Average peak hour dwell time exceeds 30 seconds per bus

While one or more of these criteria may be met on any given roadway, best engineering judgment is needed to determine the potential travel speed impacts, and whether or not a bus turnout is the most appropriate treatment for mitigating these impacts.

One critical caveat is the authors of the TCRP Report determined the quantity of traffic in the curb lane created a limitation on the effectiveness of separate turn outs (or bus bay) finding:

"Evidence shows that bus drivers will not use a bus bay when traffic volumes exceed 1000 vehicles per hour per lane. Drivers explain that the heavy volumes make it extremely difficult to maneuver a bus out of a midblock or near-side bay, and that the bus must wait an unacceptable period of time to re-enter the travel lane. Consideration should be given to these concerns when contemplating the design of a bay on a high-volume road. Using acceleration lanes, signal priority, or far-side (versus near-side or midblock) placements are potential solutions[5]."

Figure 1 - Example of Lane Blocking By Bus Operator

[4]TCRP Report 19, page 27. Only the factors most relevant to Boston roadway operations are listed here.
[5] TCRP Report 19, page 27

The report indicated a preferred curbside lane width for bus turnouts to be 10-12 feet separate from traffic.

2011 AASHTO Green Book

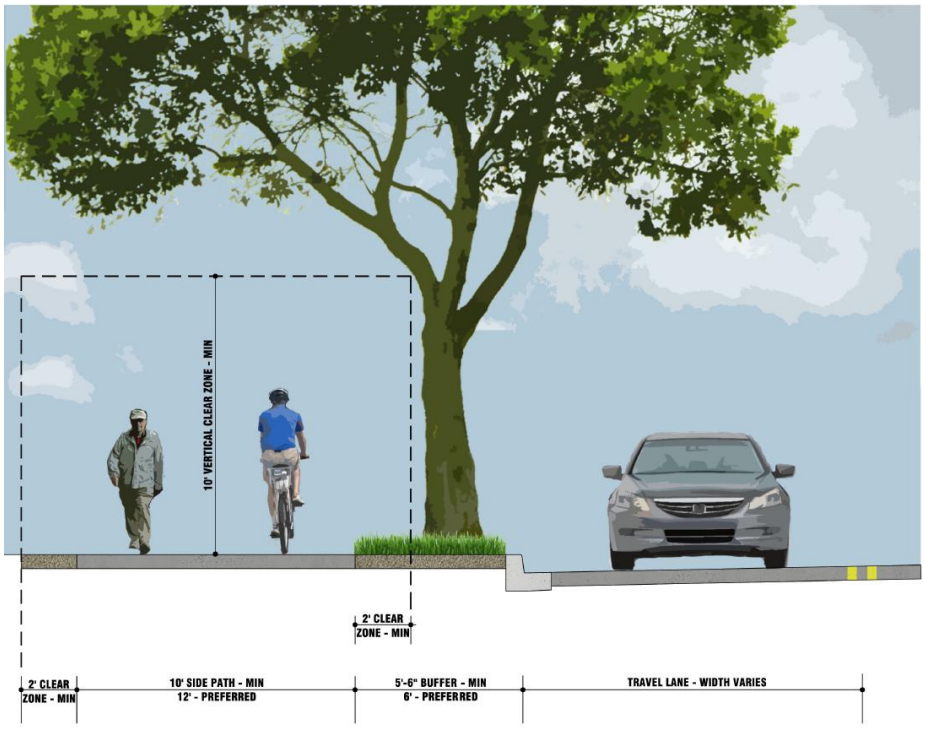
The 2011 AASHTO Green Book provides general guidance for vehicle lane widths and discusses considerations for bus operation on arterial roadways in urban areas. The AASHTO Green Book generally provides design strategies to minimize delay and disruption to traffic flow. The Green Book generally recommends the installation of bus turn outs with acceleration/deceleration lanes to minimize the disruption of traffic flow, but recognizes this is rarely possible on urban arterial roadways.

The Green Book also recognizes the challenges of constrained urban roadways noting that bus operation creates interference with other traffic when the bus stops within the travel lane[6]. It specifically notes "bus operators may not use the turnout if they have difficulty maneuvering back into traffic." Other than suggesting the use of far side stops to minimize conflicts with turning vehicles and accommodate large demand for vehicle storage on near-side approach, the Green Book provides no additional guidance for bus stop design and refers the reader to TCRP Report 19 referenced previously.

[6] Page 500, 2004 AASHTO Green Book

Sidepath Design Approach

A sidepath is a one or two-way shared use path that parallels a roadway. In many cases making connections between path access points, between on-street facilities and a path access point, or to mid-block crossing locations is best accomplished through short sidepath segments, particularly where a dedicated, independent right-of-way is not available. This is particularly true where the most direct connection between two paths or a path and on-street bicycle facility is within an arterial corridor, where it is not possible or desired to have on-street bicycle facilities. AASHTO guidelines recommend sidepaths be a minimum of 10 feet in width (12 feet preferred), with a minimum distance of 5 feet between the path and the roadway curb. Where the separation is less than 5 feet, a physical barrier or railing should be provided between the path and the roadway. The revised AASHTO Guide for the Development of Bicycle Facilities provides a lengthy discussion of the design considerations associated with sidepaths. Below are some illustrations of design considerations important for sidepaths:



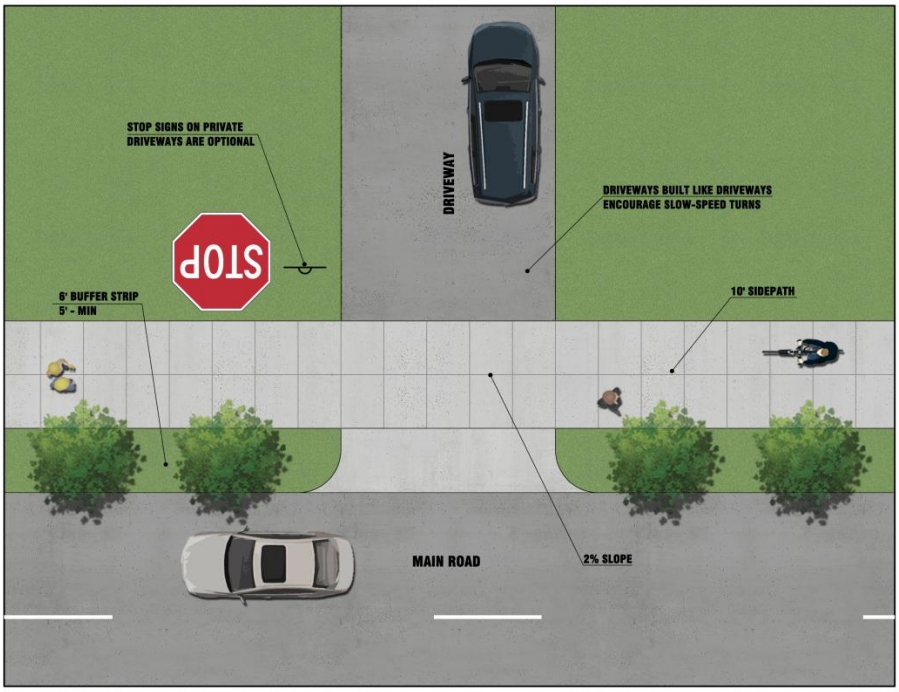
Sidepaths should be a minimum 10 feet wide (12 feet preferred) with a 2’ clear zone on either side of the paved surface (flat & clear of obstructions). Paths should be separated from the roadway by a minimum 5 feet (6 feet preferred).

Sidepaths and Driveways

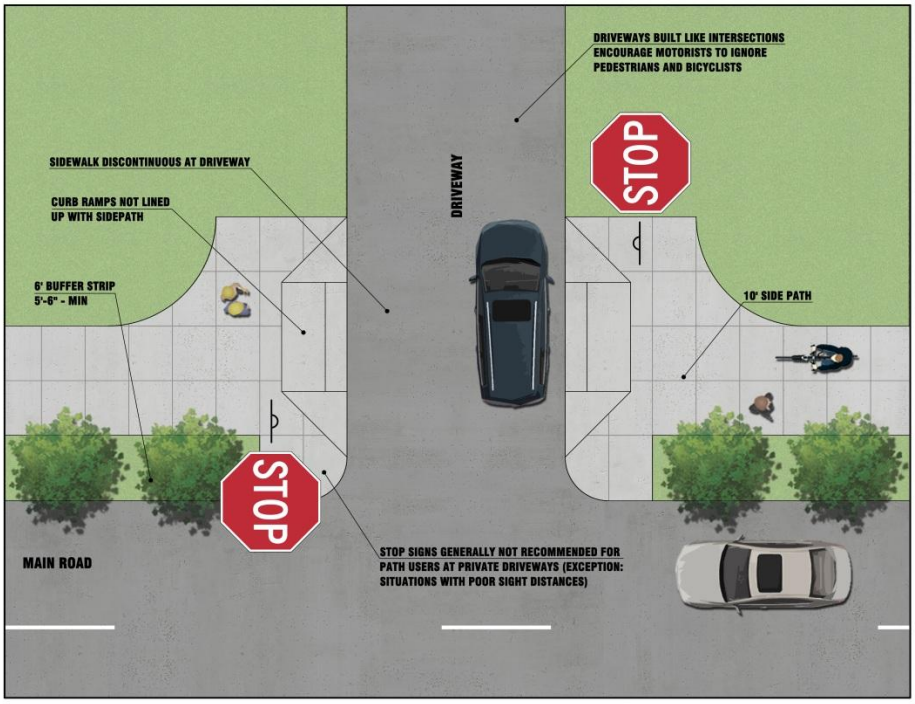
Where sidepaths intersect driveways there is potential for conflict between vehicles exiting and entering the driveway and side path users crossing the driveway. The following figures illustrate the preferred and not preferred approach to driveway and sidepath design at driveway/sidepath intersections.

Further guidance on sidepath design can be found in Chapter 5 of the revised AASHTO Guide for the Development of Bicycle Facilities.

Best Practice (preferred): Driveways should look like driveways



Not Preferred: Driveways should not look like roadways.



Bike Parking

The *Association of Pedestrian and Bicycle Professionals (APBP) Bicycle Parking Guidelines, 2nd Edition* covers virtually everything related to bicycle parking, including recommended racks, site layout, security, aesthetics, weather protection, lighting maintenance etc. Model legislation for determining required parking for new developments is also provided.

The APBP guidelines are applicable in both urban and suburban contexts. The only significant difference will be scale. The number of bicycle parking racks needed at a particular location may be less in suburban and semi-rural areas. This difference in demand will immediately be captured if parking requirements are based on density and distance (addressed in APBP Guidelines). Lower densities and longer distances from population centers will generally result in lower demand for bicycle parking.

Bicycle racks should be designed so that they:

- Support the bicycle at two points above its center of gravity.
- Accommodate high security U-shaped bike locks.
- Accommodate locks securing the frame and one or both wheels (preferably without removing the front wheel from the bicycle.)
- Provide adequate distance [minimum 36” (91cm)] between spaces so that bicycles do not interfere with each other
- Do not contain protruding elements or sharp edges.
- Do not bend wheels or damage other bicycle parts.
- Do not require the user to lift the bicycle off the ground.

Bicycle Wayfinding Protocol and Best Practices

Introduction

This appendix provides guidance for establishing a comprehensive bicycle wayfinding system in Wichita, including current practice; future opportunities; policy and regulatory framework; sign types; sign components; and sign placement. In addition, this document also provides examples of best practices from Chicago and Seattle. The Wichita Bicycle Master Plan recommends developing a bicycle network that consists of on- and off-street facility improvements on more than 332 miles of roadway, in addition to the more than 60 miles of existing bicycle facilities. In order to help ensure that the City realizes the maximum benefit from the proposed and existing facilities wayfinding signage could be utilized. Wayfinding signs provide multiple benefits, including but not limited to the following.

- They provide information about destinations, direction and distance to help bicyclists determine the best routes to take to major destinations.
- They provide information that helps bicyclists understand and use the bicycle network (including on-and off-street facilities) without the use of a map.
- Directional signs also provide additional messaging to motorists to expect bicycles on the roadway.
- The presence of signs encourages bicycling on designated corridors because users feel the signs will direct them to the best route for getting to their destination.

Wichita Current Practice

Bicycle signs have been installed in Wichita along some shared use paths. These signs designate the paths as bicycle routes and help bicyclists identify preferred bicycle routes. Signs are generally installed during new shared use path construction.

Existing bike route sign in Wichita

Wichita Bicycle Network Wayfinding Signage Opportunities

The City of Wichita may wish to consider installing two general categories of signed routes to work in unison and provide bicyclists with a navigable system along designated bicycle routes.

- Named Routes:
  - Paths such as the Arkansas River Bicycle Path
  - Recreational loops such as the loop utilizing the Zoo Blvd Path, Ark River Path, and Westdale Dr. A loop that combines path segments with on-street segments.
  - Bicycle Boulevards. An example might be Piatt Ave from 21st St to 2nd St .

- Un-named Network Routes:
  - Routes between destinations such as transit, schools, business districts, major employment centers, or major path access points.

The type and phasing of facility improvements may vary depending on a number of criteria, including expected user volumes, roadway constraints, vehicle volumes and speeds, feasibility, destinations served, and relative importance in the overall network. Wayfinding can be an important component of establishing the network, because in some cases wayfinding signage could be installed prior to additional recommended facility improvements.

The phasing of signing and other bicycle network improvements do not need to occur at the same time, because wayfinding signs may be used alone (i.e. signed route) or in combination with other treatments such as pavement markings (e.g. bike lanes and shared lane markings). For example, for some lower speed/lower volume roadways installation of wayfinding signage may proceed the striping of bike lanes, and in this sense could be used as an interim step toward implementing additional recommended treatments.

In addition, the City may find it makes sense in some cases to add additional signed routes to the bicycle network without installing a bike lane or shared lane marking. Any decision to do so may be based on the following criteria:

- Alternate routes parallel, and within close proximity (less than a half mile) to a route with bicycle facilities
- Lower volume streets
- Spur routes, or routes that may span a relatively short distance and terminate at a specific destination or loop back into the main route

Policy and Regulatory Framework

Standards and guidance for the use of signage for bicycle purposes is provided by the following documents:

Manual on Uniform Traffic Control Devices (MUTCD) Guidelines

The Manual on Uniform Traffic Control Devices (MUTCD 2009 edition) includes standards for:

- Sign design for directional bicycle signs;
- Sign installation such as minimum height of signs above ground and horizontal placement from edge of the roadway or path; and
- Symbols and appropriate abbreviations for destination names.

The most recent update to the MUTCD in 2009 introduces new sign types and provides additional right-of-way placement guidelines for directional signs.

American Association of State Highway and Transportation Officials (AASHTO) Guide for the Planning, Design and Operation of Bicycle Facilities

The AASHTO Guide provides supplemental information to the MUTCD. The guide explains the use and benefits of different sign types for bicycle wayfinding.

Americans with Disabilities Act (ADA) Guidelines

The ADA Standards of Accessible Design offer guidance on sign assembly placement to maintain the proper vertical and horizontal clearance for pedestrians. These guidelines will apply in locations where sign assemblies need to be placed adjacent to or in the sidewalk.

Sign Types

Bicycle route signs are signs that guide bicyclists along designated contiguous bikeways. The bikeways may consist of on- and/or off-street bicycle facilities. The signed bikeways create a bicycle route and a network of bicycle routes creates the bicycle route system.

The bicycle route sign system, or wayfinding system, is the system of signing bikeways in a consistent, standardized fashion. Bicycle route sign systems are designed for bicyclists who are familiar with the city's landmarks and districts, but unfamiliar with the preferred route to their intended destination(s). The sign system provides bicyclists with direction, destination and distance information. Generally there are three different primary categories of signs that can be provided in order to assist the bicyclist (listed below).

Decision and named route signs from Seattle. On paths, both sign types are used to mark the route and provide direction to destinations on and off the path.

1. **Decision and Spot Decision Signs (D1):**at decision points where two or more routes intersect or where guidance is required
2. **Named Route Signs (M1):**along designated named routes
3. **Route Designation or Confirmation Signs (D11):**to confirm a route choice and provide guidance at a turn in a route

D1-1c

2009 MUTCD Figure 9B-4

M1-8 M1-8a

2009 MUTCD Figure 9B-4

D11-1c

2009 MUTCD Figure 9B-4

Decision Signs (D1-1c series)

Decision signs mark decision points where two or more bicycle routes intersect. Decision signs are installed on the approach to an intersection. Signs include direction, destination and distance (in miles) information.

Sign Placement in the Right-of-Way: Place 30+ feet on the approach to a decision point or intersection of another signed bicycle route. To allow for comfortable merging across travel lanes for left

turns place the decision sign at the appropriate distance from the intersection based on the number of lanes that a bicyclists must merge across:

- No merge: 30 feet
- One lane merge: 100 feet
- Two lane merge: 200 feet

Sign Specs: 36”X6”, white on green and retro-reflective.

Sign Placement on Post: Directional sign organization at a given decision point will be based on the following guidelines:

1. Install D1-1c signs on the approach to intersections where signed routes intersect and where routes lead directly to the intended destination. The bicycle route system can connect business districts, schools, parks, neighborhoods and other important locations that are directly on designated routes.

2. The number of destinations provided on a given post is not to exceed three. This allows for proper vertical clearance to be maintained. Three signs per post is also about the maximum amount of information that can be read by a passing bicyclist.

3. The number of signs on a given post pointing in the same direction is not to exceed two. Limiting destinations to two in one direction is necessary to provide space for destinations in other directions, because this sign type will be installed at intersecting routes.

4. The sign with the nearest destination should go at the top of the assembly with the most distant destination at the bottom. If destinations are equal in distance, the sign with an up arrow should be placed on top. This arrangement allows for the nearest destination to “fall off” the top of the sign and subsequent destinations to move-up as the bicyclists approaches.

5. When directional blades are placed on named routes or they direct users directly to named routes, named route signs (M1-8a and supplementary signs) may be placed on the same sign post below the D1-1c sign(s). Placing multiple sign types on one post will reduce the number of posts used as well as provide all necessary information for bicyclists in one location.

Sign Content: Destination and directional information will be unique on most signs. Determining destinations is important to the function of the network. Distance information will be determined by the spacing of decision points and destination locations.

1. Identify and Rank Destinations:

    - Develop a list of all destinations and rank them in a hierarchy. For example:

- Primary: paths, bridges, business districts, neighborhoods, regional parks, downtown
- Secondary: Institutions, transit stations, other municipalities
- Tertiary Destinations: other public institutions/facilities, airport, designated bicycle streets

- The ranking will help determine the sign content at a given decision point within the network.

2. Provide distance measurements in tenth of a mile increments such as 4.3, 1.2. This allows for detailed destination information in denser urban areas. If mileage on a sign is a whole number, do not include the tenth mile placeholder. For example use "4" rather than "4.0"
3. If a bike route terminates at a location where there is no destination use the name of the final cross street or bike route as the destination.

Directional Spot Signs (D1-1b series)

Spot signs are similar to directional signs but provide direction and destination information only. Use D1-1b signs when a destination is off the signed route or when getting to the route requires additional wayfinding. Spot signs may include the words "To" and "Via" where necessary and may vary in width to accommodate limited space in the right of way. Spot signs do not need to be followed by a confirmation sign.

D1-1b

2009 MUTCD Figure 9B-4

Spot signs may be used where:

1. Guidance to signed bicycle routes from adjacent roadways, sidepaths etc. or access to important facilities such as a path is needed.
2. Guidance from signed bicycle routes when important destinations are a short distance off the signed route. In such cases, a directional sign may indicate the best access point from the signed route to the destination. Use additional spot signs to guide bicyclists to that destination.

Spot sign along bicycle route in Seattle.

2009 MUTCD Figure 9B-4

Named Route Signs (M1-8 series)

The M1-8 or M1-8a signs are placed along named regional on-road routes and paths to assist users in wayfinding along named routes or to confirm that they are traveling on the desired route. The M1-8 or M1-8a signs should be used with supplementary signs such as directional arrows (M5 and M6 series)

and the words “North”, “South”, “East”, “West”, “To”, “End”, “Begin”, etc. (M3, M4 series). The M1-8 series of signs are small in size and are a cost effective way to mark bicycle routes.

When using the M1-8 or M1-8a signs, there are pros and cons to the use of route numbers or route names. If a route already has a colloquial name, the colloquial name should be used instead of what may appear to be an arbitrary route. This will help to avoid confusion. If a colloquial name is not already utilized, then route names are encouraged. Route names can often provide additional contextual information such as destination information i.e. Smith Street Bike Route will likely follow Smith Street and Smith Street passes by X, Y and Z locations. Route numbers do not provide this context and require a bicyclist to look at a map to understand where the route goes. In areas where signed bike routes are dense, the use of numbers can be confusing because a bicyclist may have to ride on several numbered routes to get to a destination. Numbered routes can work well for cross jurisdiction travel, on routes that do not already have a colloquial name or on routes with many turns where a colloquial name is not clear. On an M1 sign, route numbers can be more visible than text from a distance.

Sign Specs: Size: 12”X18”, white on green and retro-reflective. The letters on signs should be 2 to 1.5 high for best visibility.

Sign Placement in the Right-of-Way:

On-path M1-8 or M1-8a signs may be used:

1. At path entrances and exits
2. 30’-50’ after every controlled intersection or street crossing; or
3. Every ¼ mile to mile where there is a gap in signage. Spacing will depend on the density of the street network
4. At transitional locations (such as path-to-road transitions) or in cases where bicyclists will be transitioning to sidewalks

A modified M1-8a sign at the entrance to a shared use path.

On-street M1-8 or M1-8a signs may be placed:

5. 30+ feet before a turn with an M5 or M6 arrow (follow decision sign guidelines for placement at the approach to an intersection)
6. 30-60 feet after the turn to confirm the path
7. At decision points where needed
8. Within proximity to a named route (within a few blocks), similar to a spot sign. Named route signs can be used in conjunction with a supplementary sign such as an arrow and

"To". When farther than a few blocks off the designated route, decision signs can be used to direct users to named route

Sign placement on post: M1-8 or M1-8a signs can be mounted on the same post, below regulatory, warning or destination signs.

1. M1-8 or M1-8a signs may be placed back-to-back or back-to-back with regulatory or warning signs.
2. When multiple M1-8 or M1-8a signs are placed on the same post, they can be stacked depending on height and visibility. The current route should be the top sign.

Route Designation, Turn and Confirmation Signs (D11-1c series)

2009 MUTCD Figure 9B-4

These signs confirm that a bicyclist is on the correct route. The sign is used in two ways:

1. Route Confirmation Sign: Signs are placed on the far side of an intersection following the directions indicated by decision signs and at intervals along the route to confirm that the bicyclist is still on the correct route.

2. Turn Sign: at turns in a route with an arrow (M5 or M6 series sign). In this case D11-1c and an arrow sign are placed on the approach to an intersection.

Confirmation signs will include destination information generally with the text "To" the location indicated on the directional sign. When a confirmation sign is used on a named route, an M1-8 or M1-8a sign may be placed below the confirmation sign.

Sign Specs: 24"X18", white on green and retro-reflective.

A path name sign would be added to street name sign assemblies at intersections of paths and roadways.

Street Name Signs

Install street name signs at path /roadway intersections. This helps path users find path entrances and identify cross streets along paths. Placing bicycle and pedestrian legends on the path name sign indicates to motorists that the information on the sign can be disregarded.

Supplemental Signs

Supplemental signs provide additional

2009 MUTCD Figure 9B-4

information to D11-1 or M1 series signs. Cardinal direction signs (M3 series) and alternate route signs (M4 series) are placed above the M1 series. Arrow signs in the M5 and M6 series are placed below D11-1 and M1 signs to provide directional information.

General Sign Components

The following guidelines outline general rules for the signs

1. For all signs use upper and lower case letters
2. Use Clearview Series C font which is approved for use by the Federal Highway Administration. It strikes a balance between visibility and maximum characters per sign.
3. Use two-inch high capital letters. This size is visible from approximately 80 feet
4. For destination names that are too long to fit on one line, use intuitive abbreviations
5. Do not use periods in the abbreviations of destination names
6. Avoid the use of diagonal arrows when possible
7. Use graffiti film on bicycle route signs that are lower to the ground, particularly on paths. This will increase the longevity of the signs.

Figure 9B-6 from the 2009 MUTCD provides general lateral placement of D1-1 and D11-1 signs at an intersection.

Sign Placement Guidance

Guidance on signage placement is important to providing a legible sign system. Predictable and uniform placement of directional signs at traffic controlled intersections and at intervals helps to provide proper guidance particularly if a turn in a route is to occur.

For bicyclists, a good baseline distance required to read a sign and determine an action is 30 feet from the intersection. Additional engineering judgment is required when placing directional signs to allow for visibility of the sign with parking and vegetation and other possible obstructions.

Roadways

Turn Signs:

1. Follow placement guidelines for decision signs.

Confirmation Signs:

2. 30-60 feet on the far side of the intersection after decision points, preferably within sight of the decision sign.
3. 30-60 feet after stop controlled or signalized intersections.
4. Or after every 1/4 mile to mile of unsigned segment along designated on-street routes depending on the density of the street grid.

Sign content:

1. If there are two destinations in one direction, a confirmation sign may include two lines of text. This may require reduction of the bicycle symbol.

Sign mounting height is also outlined in the MUTCD (section 2A.18), however, due to speed and sight line differences between bicyclists and motor vehicles, minimum post heights are recommended for bicycle signs.

Mounting height guidance:

1. Sidewalk Clearance: 7 feet of clearance from the bottom of the sign to the ground should be allowed. If there are multiple signs per post, and the lowest sign is lower than 7 feet, the lowest sign cannot stick-out more than 4 inches into the sidewalk. If bicycles use the sidewalk the clearance height should be 8 feet.
2. If there is no sidewalk and few obstructions such as parked cars, optimum vertical height for bicycle signs is 7 feet from the bottom of the sign.

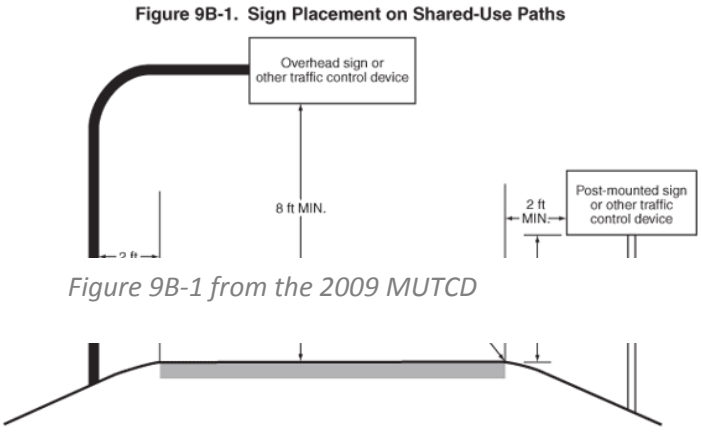


Figure 9B-1 from the 2009 MUTCD

Shared Use Paths

Horizontal, lateral and vertical installation of bicycle signs differs for shared-use paths and roadways. For paths follow lateral and vertical sign placement guidelines in the MUTCD guidelines for signs placed along shared-use paths (Figure 9B-1):

1. 8 foot minimum vertical clearance
2. 2 foot clearance from edge of path to edge of sign
3. 4 foot minimum distance between ground and bottom edge of sign

Best Practices

The cities of Chicago and Seattle provide examples of best practices for bicycle wayfinding. Below are descriptions of their wayfinding systems.

2003 MUTCD guidelines for directional bicycle signs. Right: Chicago developed the D1-1c sign to consolidate direction, destination and distance information onto one sign.

Chicago

The City of Chicago has implemented an extensive directional sign system for bicycles using destination-based signage for the on-street bicycle network. The MUTCD D11-1c and D1-1c series signs were developed by the City of Chicago in an effort to consolidate the amount of signage required by the 2003 MUTCD for bicycle wayfinding using the D11-1, D1-1 and supplemental signs. The D11-1c provides specific destination information, such as "To Evanston" in lieu of the general "BIKE ROUTE" text of the D11-1 sign. This is helpful in distinguishing different routes in a dense bicycle route network. The D11-1c is used by the City of Chicago as a confirmation sign to confirm a route selection. The sign is to be place on the far side of an intersection after a route choice had been made. The D1-1c consolidates direction, destination and distance information onto one small sign. Several D1-1c signs can be installed together at the approach to a decision point to provide information on multiple routes. The D11-1c and the D1-1c were developed by the City of Chicago and later incorporated into the 2009 edition of the MUTCD.

Decision signs preceding an intersecting signed bike route in Chicago.

Seattle

The city of Seattle also has a directional sign system for bicycles. Modeled after the Chicago system, the Seattle system also uses the D11-1c and D1-1c series of signs. Because Seattle has an extensive off street path system, additional signs were required to distinguish named routes. The M1-8 series of signs are used in Seattle to mark named routes. These signs are installed along named routes with supplementary signs from the M2, M3, M4, M5 and M6 series. M1 signs are also installed at decision points on paths with D1-1c or D11-1csigns (see figure).

Many of Seattle's paths are named. In order to include the colloquial route name on the M1-8a sign, adjustments were made to the sign. The route number was replaced with route name within the main body of the sign. The space at the top of the sign was used for a logo. This complete sign system helps bicyclists get to destinations throughout the city and provides

guidance to and along named bicycle routes.

Bicycle Counts

In order to track progress of the plan and the growth of trips by bicycle within the city of Wichita, organized bicycle counts are recommended to be conducted on an annual basis. The following instructions and forms can be used as example materials when considering a bicycle count program.

Bicycle Count Form

The following forms track the following information:

- Count location
- Time (15 min intervals) /Date
- Number of bicyclists
- Direction of travel
- Use of street or sidewalk
- Gender
- Helmet use

Two examples of the 15 minute forms follow below.

December 12

Bicycle Count Form

Time: 6:30 – 6:45 **Location # _____**

Your Name: _____

Directions: *For each cyclist you are counting, please place two hatch marks on this page. The first mark goes directly below in one of the 16 squares, which indicate the cyclist's final direction of travel, whether or not the cyclist is on the street or the sidewalk, and the gender of the cyclist.*

The second mark is placed at the bottom of this page and indicates whether the cyclist was wearing a helmet.

	Northbound		**South**bound		**East**bound		**West**bound	
	Riding on **Street**	Riding on **Sidewalk**	Riding on **Street**	Riding on **Sidewalk**	Riding on **Street**	Riding on **Sidewalk**	Riding on **Street**	Riding on **Sidewalk**
Male								
Female								
Total								

Wearing a Helmet?

Yes ***No***

December 12

Bicycle Count Form

Time: 6:46 – 7:00 **Location # _____**

Your Name: _____

Directions: *For each cyclist you are counting, please place two hatch marks on this page. The first mark goes directly below in one of the 16 squares, which indicate the cyclist's final direction of travel, whether or not the cyclist is on the street or the sidewalk, and the gender of the cyclist.*

The second mark is placed at the bottom of this page and indicates whether the cyclist was wearing a helmet.

	Northbound		**South**bound		**East**bound		**West**bound	
	Riding on **Street**	Riding on **Sidewalk**	Riding on **Street**	Riding on **Sidewalk**	Riding on **Street**	Riding on **Sidewalk**	Riding on **Street**	Riding on **Sidewalk**
Male								
Female								
Total								

Wearing a Helmet?

Yes ***No***

Instructions to Volunteers

Date:
Time:
Count Organizers: Name and phone number

Enclosures: You should have the following in this packet:
1) A map showing your count location
2) Ten count forms (5 double-sided sheets), one for each 15-minute interval during the counts
3) A business-reply envelope to return the completed forms

Other Items Needed: Please make sure to bring:
1) a pen / pencil
2) something to write on (clipboard, portfolio, etc.)
3) some sort of timekeeping device (cell phone, watch)

Introduction*:* This is an annual count taken at (#) key locations throughout the city. Data collected from the counts will be used to monitor success in increasing bicycle use as called for in the Bicycle Master Plan.
Assignments: Each location will have at least one counter. Depending on the number of volunteers, some locations will have more than one counter. In these cases, please use only one set of count forms per location. Since the locations with multiple counters are expected to be busier, it will work best if one person counts and another person fill out the forms.
Conducting the Count: You have been provided with ten copies of the count form (5 sheets, each double-sided).
Each form is the same except that a specific 15-minute time period is printed at the top (i.e. 7:00 – 7:15). ***Please make sure to coordinate the form you use with the correct time period***, as we want to measure variation in bicycle traffic over time. Also, make sure to ***write your name and location number on each form***.
The count itself is very simple: place a hatch mark on the form for each passing cyclist, based on whether they are heading north, south, east or west (the direction in which they are going toward), whether they are riding on the street or on a path (or sidewalk), and whether the rider is a male or a female. Then place a second hatch mark for each cyclist under the "wearing a helmet?" section at the bottom of the page.

Whom do you count? Only count those cyclists passing your post in the direction(s) designated on your map! This includes anyone who is walking their bicycle past your post, kids in trailers, tandem riders, recumbent riders etc. Do not count cyclists riding by on nearby streets unless specifically instructed to do so, as this could lead to double-counting.

Returning the Count Forms: There is a business-reply envelope included with this packet. When you are finished counting, simply fold and place the 5 sheets in the envelope and drop it in the nearest mailbox.

Cancellation / Rescheduling the Count: If it is raining when you wake up on the morning of the count, call the count organizer. There will be a recorded message stating if the count is still on or not. A bit of rain will not be enough to cancel the count, but a steady pour will be.

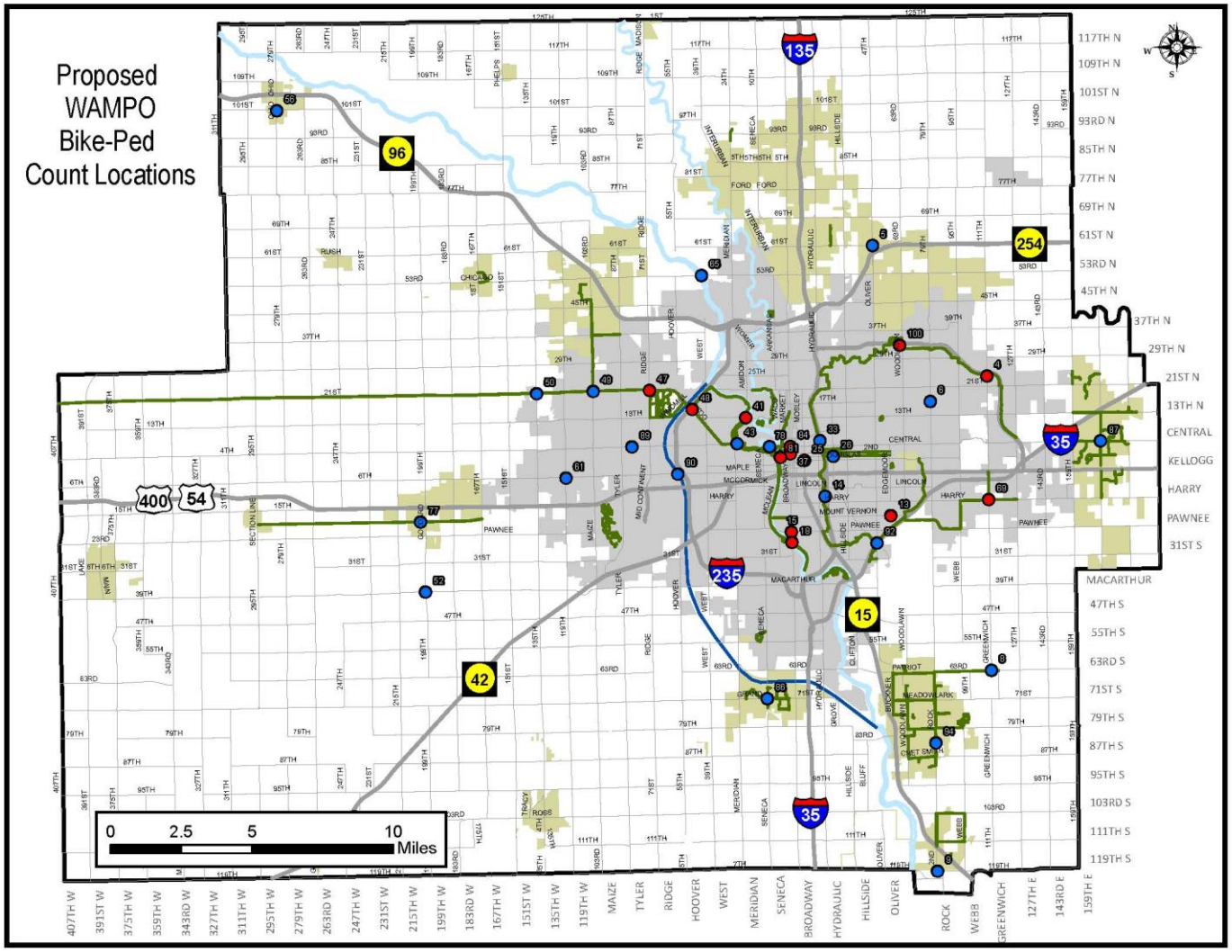
Other Information: The accuracy of the count depends largely on thorough coverage of the (#) points during the entire morning commute. ***Please make sure to get to your location on time!***

If you have any problems or know that you will not be able to make it, call the count organizer ASAP (see top for phone numbers). The count organizers will be coming around to check on you during the counts.

Thanks to everyone involved in this important data collection effort. This would not be possible without your help, and all of the enthusiastic responses indicate that this will be the best count ever!

Happy Counting!

Automated Count Locations Map



CountID	Location
4	Greenwich and K-96 BkePth
5	Oliver at 61st
6	Rock @ 17th St. Rail bed
8	63rd and Greenwich
9	K-53 and 2nd - Mulvane
13	Mt. Vernon and Edgemoor
14	Canal Rte at Ped Bridge
15	Pawnee and Broadway
18	Ark River Path @ Broadway
25	Douglas and Washington
26	1st Street and Grove
33	Canal Trail at Redbud
37	Broadway and 2nd
41	Ark River Path at 13th
43	Ark River Path at Central
47	Trail -21st St and Ridge
48	Zoo and Westdale
49	21st St and Maize Rd
50	21st St and 135th
52	Macarthur and 199th
56	101st and 279th Mt. Hope
61	Maple and 119th
65	53rd St Ark River Bridge
69	Harry and Greenwich
77	Prairie Snst Trail
78	Central at Nims
81	1st at Waco
84	Broadway and Central
86	Main at Grand - Haysville
87	Central and Andover Rd
89	Central at Socora
90	Maple at the Big Ditch
92	Gypsum CkBkPath at Oliver
94	Rock - S. of Madison
100	K-96 Path Gt PlainsNatCtr