North Central Texas Council of Governments

City of Dallas

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2011 DALLAS BIKE PLAN ADDENDUM

COMPLETE STREETS INITIATIVE DESIGN AND POLICY GUIDANCE

JUNE 2011

2011 DALLAS BIKE PLAN COMPLETE STREETS INITIATIVE DESIGN AND POLICY GUIDANCE

INTRODUCTION

One of the goals of the 2011 Dallas Bike Plan is to provide design and policy guidance for bicycle-related elements to be addressed under a comprehensive, multi-modal planning approach in the Complete Streets Design Manual. That overarching design and policy document for City streets will be the single source that engineers and planners can consult for the design of Dallas Bikeway System designated bicycle facilities and bicycle-related amenities in the public right-of-way. In the interim period before the Complete Streets Design Manual is completed, this Addendum will serve as guidance for the implementation of those Dallas Bikeway System segments identified as demonstration/early implementation projects, or for any other segments that happen to be implemented prior to the Manual's completion.

Summary of MUTCD, Texas MUTCD and AASHTO

Much of the design guidance for on-street bicycle facilities included in this Addendum is based on the *Texas Manual on Uniform Traffic Control Devices* (Texas MUTCD) Part 9: Traffic Control for Bicycle Facilities, 2006; the *Manual on Uniform Traffic Control Devices* (MUTCD), 2009; and the American Association of State Highway and Transportation Officials (AASHTO*) Guide for the Development of Bicycle Facilities,* 1999.

Guidance provided in this document is intended to be consistent with these manuals. Application of guidance provided in this document also requires the use of engineering judgment when retrofitting Dallas's streets to provide bicycle facilities.

The *Manual on Uniform Traffic Control Devices* (MUTCD), 2009 Edition is a document issued by the Federal Highway Administration (FHWA) of the United States Department of Transportation (USDOT) to specify the standards by which traffic signs, road surface markings, and signals are designed, installed, and utilized. These specifications include the shapes, colors, fonts, sizes, etc., used in road markings and signs. In the United States, all traffic control devices must generally conform to these standards. The manual is used by state and local agencies as well as private design and construction firms to ensure that the traffic control devices they use conform to the national standard. While some state agencies have developed their own sets of standards, including their own MUTCDs (including Texas Department of Transportation (TxDOT)), these must substantially conform to the federal MUTCD, and must be approved by FHWA. The National Committee on Uniform Traffic Control Devices (NCUTCD) advises the FHWA on additions, revisions, and changes to the MUTCD.

The Texas MUTCD, 2006, Part 9 is based on the national MUTCD. Part 9: Traffic Control for Bicycle Facilities provides guidance on bicycle facilities and is also based, in part, on the 1999 AASHTO *Guide for the Development of Bicycle Facilities.* The Texas MUTCD has not been updated to reflect changes in the 2009 MUTCD. TxDOT has two years to update the Texas MUTCD when a new version of the MUTCD is published (likely in late 2011 or early 2012 in this instance), or they must adopt the national MUTCD.

The American Association of State Highway and Transportation Officials (AASHTO) is a nonprofit, nonpartisan association representing state highway and transportation departments. It publishes a variety of planning and design guides including the AASHTO *Guide for the Development of Bicycle Facilities,* 1999. This guide provides planning and design guidance for on- and off-street bicycle facilities. It is not intended to set absolute standards, but rather to present sound guidelines that will be valuable in attaining good design sensitive to the needs of both bicyclists and other roadway users. The provisions in the Guide are consistent with, and similar to, normal roadway engineering practices. Signs, signals, and pavement markings for bicycle facilities should be used in conjunction with the Texas MUTCD.

1. DALLAS BIKEWAY SYSTEM AND FACILITIES DEFINITION OF TERMS

BICYCLE FACILITY TYPES

Bicycle networks include a variety of on- and off-street bicycle facilities. On-street bicycle facilities serve several purposes, including designating roadway space for bicyclists, channelizing motor vehicles and bicyclists, making bicyclist movements more predictable, indicating the proper direction for bicyclists to travel on the roadway, and indicating the optimal location on the street for riding at mid-block locations and when approaching intersections. Off-road bicycle facilities, including multi-purpose trails, provide a space for bicyclists to be physically separated from roadway traffic. The specific type of facility that is recommended on each segment of the network depends on a wide range of factors, including:

- Existing right-of-way space,
- Width of improved portion of right-of-way (width of street),

- Number of travel lanes,
- Width of travel lanes,
- Traffic volume,
- Traffic speed,
- Traffic composition (presence of buses and large trucks),
- Presence of on-street parking (including peak-hour restrictions),
- Surrounding land uses,
- Connectivity to destinations, and
- Pedestrian activity.

Bicycle facilities recommended for on- and off-street segments in bikeway systems are described below. The graphics are intended to provide illustration of each facility type indicating typical dimensions. The graphics are not shown to scale. The graphics are not intended to convey approval of use as shown for any particular roadway in Dallas. It is the responsibility of the designer to apply these guidelines in the context of each street segment to meet the requirements set forth by the City of Dallas, TxDOT, AASHTO, the Texas MUTCD, and the MUTCD, as applicable.

Bikeway
A generic term for any street, path, or way which in some manner is specifically designated for bicycle travel, regardless of whether such facilities are designated for the exclusive use of bicycles or are to be shared with other transportation modes.

Bicycle Route (or Signed Bicycle Route)
A roadway or bikeway designated by the jurisdiction having authority, either with a unique route designation, or with bicycle route signs, along which bicycle guide signs may provide directional and distance information. (Note: Bicycle route signs can be used on streets with or without other bicycle facilities such as bicycle lanes and shared lane markings.)

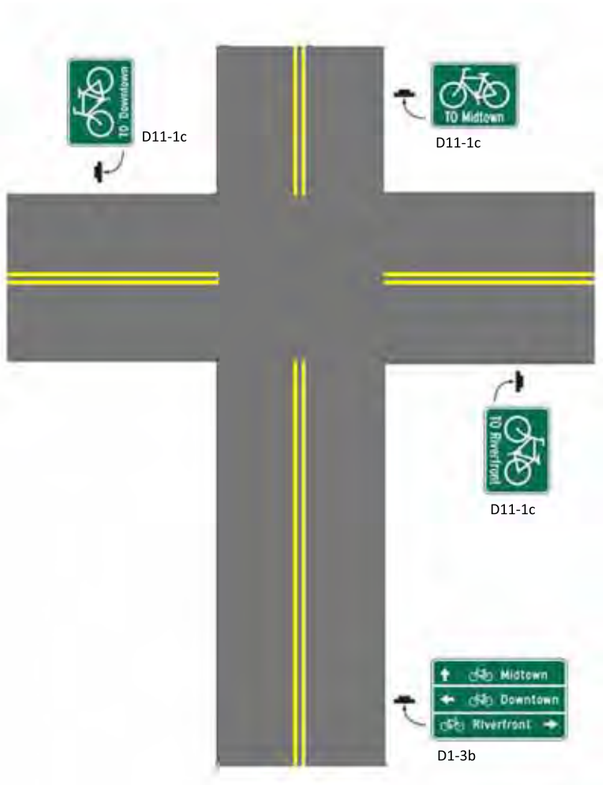


Figure 1. On-street bicycle route signs.

Bicycle Lanes (See Section 3 for additional guidance)
A bicycle (bike) lane is a portion of the roadway that has been designated by striping, signing, and/or pavement markings for the preferential use of bicyclists. The minimum width for a bicycle lane next to a parked car is five feet. Five feet is preferred next to a curb, though four feet from the seam on the gutter pan is adequate on arterials with lower speeds and volumes. Bicycle lanes include a bicycle pavement marking with an arrow to indicate that bicyclists should ride in the same direction as adjacent motor vehicle traffic. These facilities are typically recommended for arterial roadways (streets with channelization). Bicycle lanes can provide the following benefits:

- Increase the comfort of bicyclists on roadways,
- Increase the amount of lateral separation between motor vehicles and bicycles,
- Indicate the appropriate location to ride on the roadway with respect to moving traffic and parked cars, both at mid-block locations and approaching intersections,
- Increase the capacity of roadways that carry mixed bicycle and motor vehicle traffic,
- Increase predictability of bicyclist and motorist movements, and
- Increase drivers' awareness of bicyclists while driving and when opening doors from an on-street parking space.

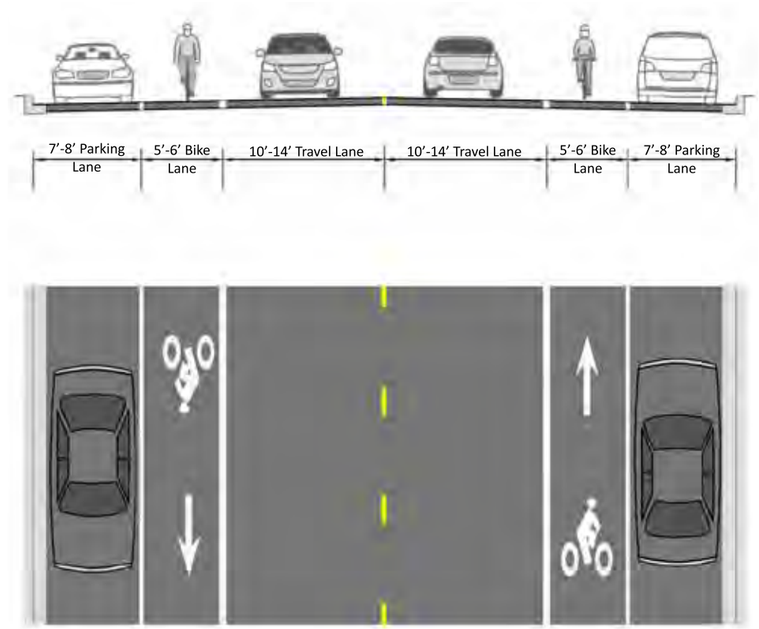


Figure 2. Bike lanes plan and section.

Shared Lane Markings (SLM) (See Section 4 for additional guidance)
Shared lane markings are pavement markings that are placed within the vehicular travel lane of the roadway. Unlike bicycle lanes, they do not designate a particular part of the roadway for the exclusive use of bicyclists. Shared lane markings indicate the location bicyclists should be anticipated to operate within the travel lane. The bicycle symbols used in shared lane markings include two chevrons over a bicycle pointing in the direction of vehicle travel to indicate that bicyclists should also ride in this direction. Shared lane markings may be placed within travel lanes of any width, typically on roadways posted at 35 mph or below. Shared lane markings have the following benefits:

- Provide a visible cue to bicyclists and motorists that bicycles are expected and welcomed on the roadway,
- Indicate the most appropriate location to ride on the roadway with respect to moving traffic and parked cars,
- Can be used on roadways where there is not enough space for dedicated bicycle lanes,
- Connect gaps between other bicycle facilities, such as a narrow section of roadway between road segments with bicycle lanes, and

- Can be used on roadway segments in lieu of bicycle lanes where bicyclists may be operating at higher than normal (12-14 mph) speeds due to downhill grades adjacent to parked vehicles.

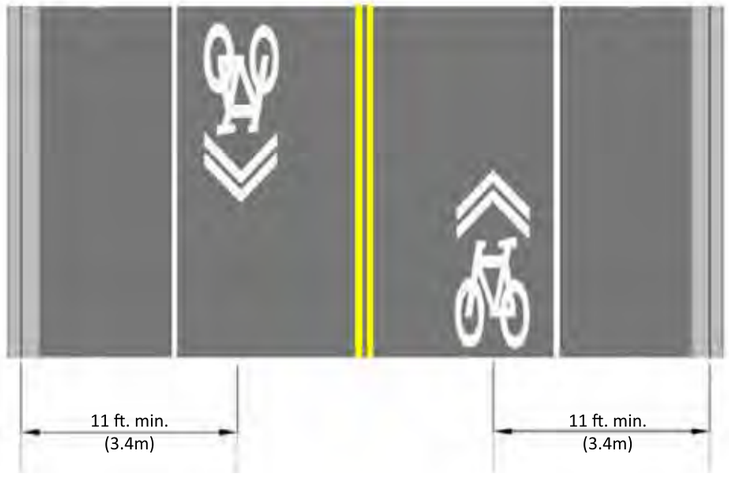


Figure 3. Shared lane markings plan and section.

Climbing Lanes (See Section 3 for additional guidance)
Climbing lanes are a hybrid bicycle facility that includes a bicycle lane on the uphill side of the roadway, and a SLM on the downhill side of the roadway. This allows slower-moving, uphill bicyclists to have a designated bicycle lane while climbing, and allows motor vehicles room to pass more easily. It also allows faster-moving, downhill bicyclists to have a shared lane marking, which alerts motorists to expect bicyclists in the travel lane. The bicycle lane and shared lane markings also indicate the proper direction for bicyclists to travel on either side of the street. This type of facility may also be used on relatively flat streets where there is not enough space for standard bicycle lanes on both sides. This application should be reserved for situations where this is a clear directional advantage for choosing one side of the street to install the bicycle lane as it can reduce bicyclists' comfort in the narrower travel lane. All other guidelines and considerations that apply to bicycle lanes and shared lane markings as described previously also apply to these facilities installed as components of a climbing lane.

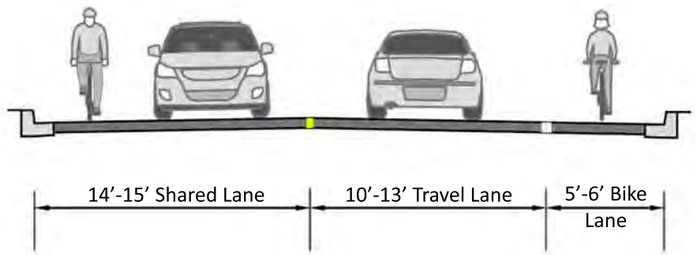


Figure 4. Climbing lane plan and section.

Cycle Track or Buffered Bicycle Lanes
A buffered bicycle (bike) lane is a bike lane that is separated from a travel lane or parking lane by a space of two or more feet (typically up to five feet). It is always one way and is buffered by cross-hatched pavement marking, and if used, a sign for the exclusive use of bicyclists. All other guidelines and considerations that apply to bike lanes described previously also apply to buffered bike lanes.

A cycle track is also a portion of a right-of-way contiguous with the traveled way, which has been designated by pavement markings and, if used, signs for the exclusive use of bicyclists. Cycle tracks are typically one-way (not always), may or may not be at a higher elevation than the adjacent roadway, and are separated from the motor vehicle lane by a physical barrier or buffer such as a curb, planting strip, or parked cars.

Cycle tracks create the following operational and design challenges which should be considered:

- Motor vehicles entering the arterial roadway from a side street that is stop controlled must cross through bicycle traffic to view arterial roadway traffic around the parked cars. This may cause motor vehicles to block the cycle track as they edge forward to see around parked vehicles.
- Drivers of motor vehicles crossing or turning from the road with cycle tracks may not be able to see bicyclists in the cycle tracks if they are blocked by parked vehicles.
- To make a left turn, bicyclists must merge into the travel lanes from behind a line of parked cars (assuming the parking is being used), creating a situation with poor sight lines between motorists and bicyclists. If parking is fully-utilized, this may not even be possible except at signalized intersections where bicyclists are given an exclusive phase to make a left turn.
- Motor vehicle passengers are not accustomed to looking for bicyclists when they open doors and exit on the right side of the vehicle. Consequently, several feet of shy distance (e.g., lateral space) is needed between the parked motor vehicles and the cycle track.
- If the facility is a two-way bicycle trackway, bicyclists may ride in the opposite direction of adjacent motor vehicle traffic, making them vulnerable to motor vehicle drivers who only look to their left when turning right from a side street.

In most cases, cycle tracks should not be placed between parked cars and the curb, unless the aforementioned issues can be addressed.

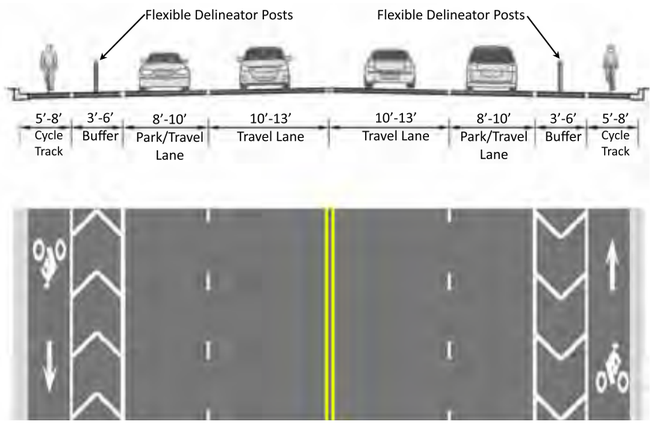


Figure 5. One-way buffered bike lane, no parking, plan and section.

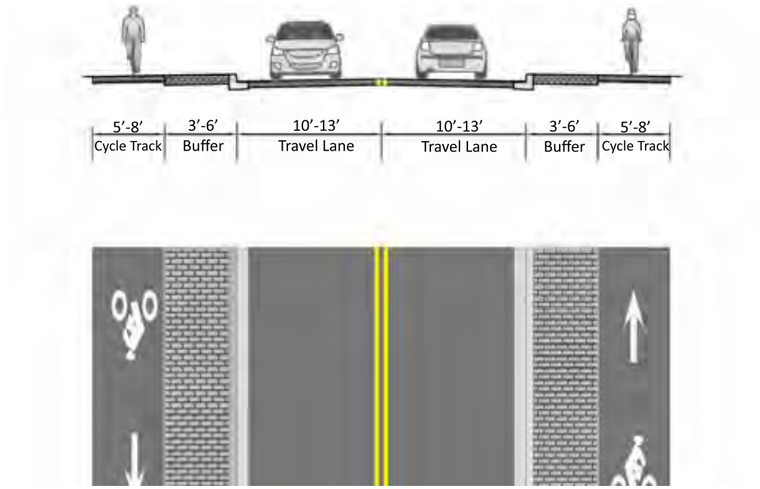
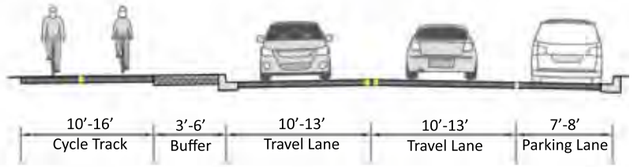


Figure 6. One-way cycle tracks plan and section.



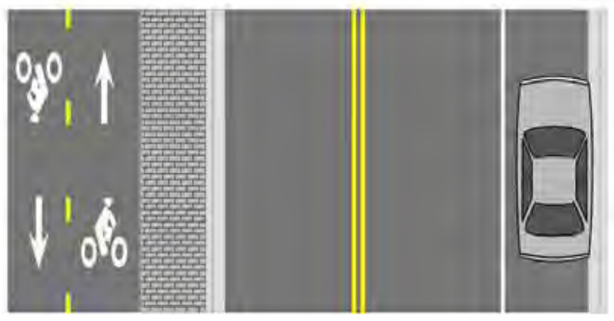


Figure 7. Two-way cycle track plan and section.

Paved Shoulders

Paved shoulders provide space on the outside of travel lanes for bicycle and pedestrian use. Paved shoulders should be a minimum of four feet without the curb; five foot minimum with a curb. The City can evaluate narrowing travel lanes within AASHTO *A Policy on Geometric Design of Highways and Streets, 5th Edition* guidelines to allow pavement to be reallocated to the paved shoulder. On some roadways without curbs, paved shoulders can provide important bicycle connections. Paved shoulders also improve safety for motor vehicles and prevent pavement damage at the edge of the travel lanes.

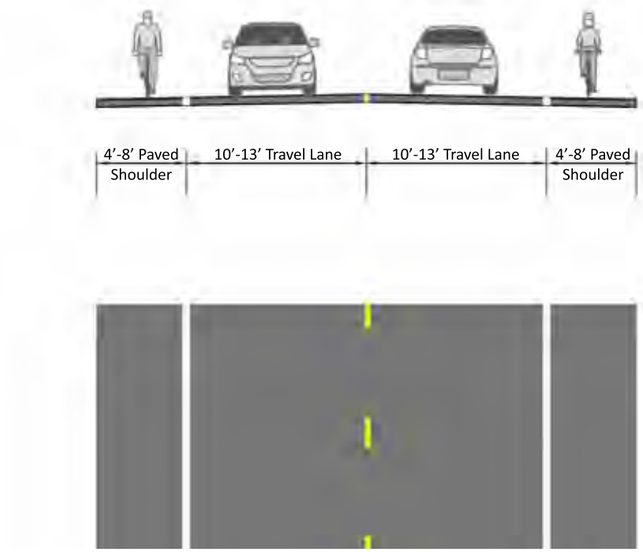


Figure 8. Paved shoulder plan and section.

Shared Bus/Bike Lanes

More exclusive bus lanes are likely to be added to area roadways as the region's transit systems expand. In appropriate locations, these lanes can create car- and truck-free space for both transit vehicles and bicycles. When bus/bike-only lanes are developed, it is desirable for the lanes to be wide enough (15' min.) for buses and bicyclists to pass each other comfortably in the lane. Shared bus/bike lanes that are part of a bikeway system should include shared lane markings. Failure to allow bikes in bus lanes will require bicyclists to use the second travel lane or be banned from the roadway (almost never desirable). If entire roadways are identified for priority use by transit, the roads should also be open to bicycles. It is preferable to have wide outside lanes on these roadways to create safe bus and bicycle passing opportunities. Enforcement of non-bus motor vehicles and parking restrictions in the shared bus/bike lane is important to ensuring the safe and free movement of both bicycles and buses.

Bicycle Boulevards

Bicycle boulevards are non-arterial roadways that are designed to allow bicyclists to travel at a consistent, comfortable speed along low-traffic roadways, and to cross arterials conveniently and safely. This is achieved by introducing treatments that allow bicyclists to travel along the bicycle boulevard with minimal stops while discouraging motor vehicle traffic. Traffic calming and traffic management treatments such as traffic circles, and diverters (barriers that force motor vehicles to turn) are used to discourage motor vehicles from speeding and using the bicycle boulevard as a cut-through. Quick-response traffic signals, median islands, or other crossing treatments are provided to facilitate bicycle crossings of arterial roadways.

Shared Roadways

Shared roadways are roadways without any designated bicycle facilities. Many non-arterial roadways with low traffic volumes and low speeds are already good places for bicyclists to ride. Roadway striping and markings are not necessary to make these streets comfortable for most bicyclists to use. Many arterial roadways are also currently shared roadways, but appropriate facilities described prevously should be incorporated into arterial roadways to make them more comfortable for bicyclists and motorists. Appropriate bicycle signage is required when transitioning from a roadway with a designated bicycle facility to one without any designated bicycle facility (and vice-versa). Bicyclists have the right to use all roads, regardless of whether they have designated bicycle facilities, unless specifically prohibited such as on a controlled access freeway.

Shared Use Paths

Shared use paths are an important component of a bikeway system. These facilities can provide a high-quality bicycling experience because they are separated from motor vehicle traffic and often provide an opportunity for extended landscaping and preservation of green corridors. Shared use paths are usually paved and should be a minimum of 12 feet in width. Minimum width may be reduced to 10 feet where physical or right-of-way constraints are severe. Trail widths of 14, and even 16 feet are appropriate in high-use urban situations.

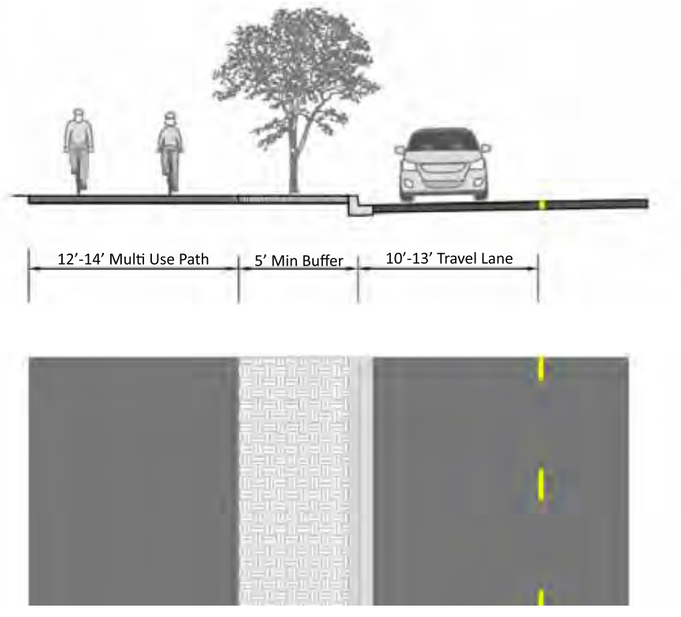


Figure 9. Shared use path plan and section.

Sidepaths
Sidepaths are shared use paths that are located adjacent to a roadway. However, sidepaths are often located only on one side of a road, and are intended to provide two-way bicycle and pedestrian travel. Sometimes this type of facility is the only option in a narrow roadway corridor. Sidepaths can function well if the following key design features can be achieved:

- Sufficient width is available to build a facility with at least a five-foot buffer (or 42-inch vertical barrier).
- The path can be located in an area where conflicts with crossing roadways (which may or may not be signalized) can be minimized. Paths work particularly well where they are parallel to expressways and railroad rights-of-way because they have limited access by nature. However, paths parallel to expressways must be designed carefully; grade separation is preferred at freeway interchanges.
- Crossings of free flow ramps can be avoided, minimized, or made sufficiently safe.

Sidewalks
Sidewalks may be useful for bicycling for a number of reasons:

- Bicycle access is needed but bicycle volumes and/or pedestrian volumes are expected to be low.
- In situations where right-of-way is constrained or there are traffic safety concerns (high speeds, high volumes, numerous trucks etc.), a sidewalk may be the only option, especially if bicyclists are traveling up a steep hill. However, bicyclists should not travel faster than the speed of a typical jogger (5-10 mph) if they use sidewalks. A YIELD TO PEDESTRIANS sign may be desirable to remind bicyclists they are operating in pedestrian priority space.
- They can be designed to accommodate separated, one-way bicycling on each side of the road so that bicyclists can safely and easily transition to and from the road at each end of the segment. Sidewalk bike routes should not result in bicyclists riding opposite to motor vehicle traffic when they re-enter the roadway.
- Sidewalks should be a minimum width of six feet for one-way bicycle travel and a minimum of eight feet if two-way travel is expected.

Due to limited opportunities for alternative facilities and other considerations, the use of sidepath and sidewalk facilities for bicycling should be considered in a limited number of specific locations. Special attention will be required in the design process to ensure user safety on sidepaths and sidewalks.

Transitions Between Different Bicycle Facility Types
Due to existing roadway conditions, surrounding land uses, available right-of-way, and other characteristics, it is often necessary to use different bicycle facilities to provide bicycle access within the same roadway corridor. It is important to provide transitions between different facilities. These transitions can be made safer and more understandable for bicyclists and motorists with appropriate treatments such as spot directional signs, warning signs, pavement markings, curb cuts, etc. An example of a transition treatment could be a shared lane marking connecting two bicycle lanes with appropriate warning signs where the bicycle lane ends and the roadway shared lane marking begins. Transitions should be provided as a part of the bicycle facility design process.

Needs Further Analysis
There are roadways that have poor conditions for bicycling, but do not offer straightforward opportunities to include bicycle facilities through the process of striping narrower lanes, removing lanes, adding shoulders, or making other physical improvements due to right-of-way constraints and traffic volumes. There are other roadways that are scheduled for complete re-construction but are still in the planning phase. Some of these roadways represent critical connections between major destinations in the bicycle facility network. In order to make recommendations on how to improve these roadways for bicyclists, additional, detailed studies that are beyond the scope of this plan should be completed.

2. BICYCLE FACILITY INTERSECTION TREATMENTS

INTERSECTION TREATMENTS

The AASHTO Guide and the MUTCD provide a comprehensive discussion of intersection design for on-road bicycle facilities and off-road trail crossings of roadways. This section provides additional guidance for intersection treatments to supplement the AASHTO Guide and the MUTCD. These treatments include contrasting color pavement, bike boxes, and transitions between bike lanes and shared lanes.

Contrasting Green Color Pavement
The use of contrasting green color is used primarily to highlight areas with a potential for bicycle-vehicle conflicts, such as intersections or merge areas where turning vehicles must cross a through bike lane. Generally, color is applied to sections of bike lanes that previously had been delineated by dotted white lines. Examples of the use of color are shown in Figures 10, 11, and 12.

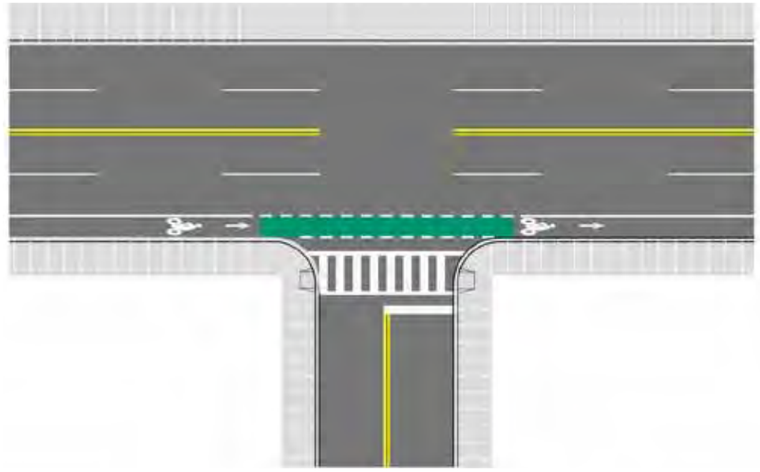


Figure 10. Green bike lane through intersection.

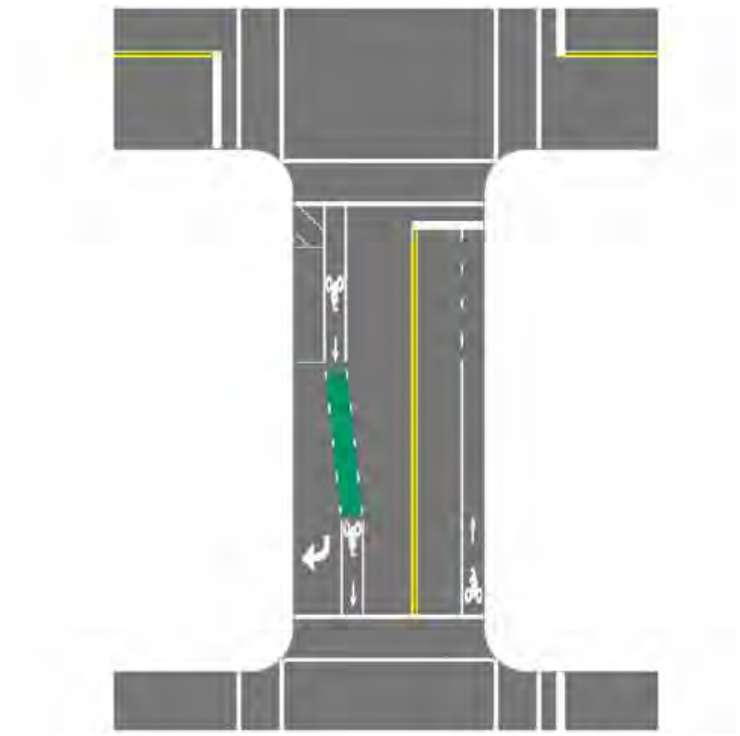


Figure 11. Green bike lane intersection approach design.

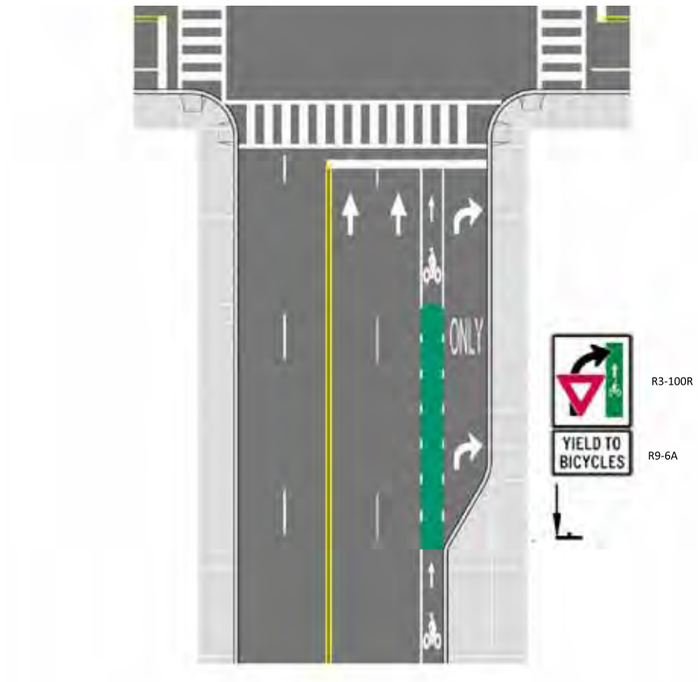


Figure 12. Green bike lane intersection approach design.

MUTCD Status: The use of contrasting color is presently not in the MUTCD, but was given Interim Approval status by FHWA on April 15, 2011. The use of contrasting green color has been shown through experimentation to increase awareness of bicyclists but has thus far not been shown to reduce crash rates in conflict areas. The Interim Approval status requires a jurisdiction to submit a written request to FHWA for its use until such a time as it is included into the MUTCD; an experiment is not required.

Bike Boxes

A bike box is generally a right angle extension to a bike lane at the head of the intersection (see Figure 13). Application of the bike box requires an advanced stop bar for motor vehicles and second stop bar for bicyclists. The box allows bicyclists to get to the head of the traffic queue on a red traffic signal indication, and then proceed first when the traffic signal changes to green. Such a movement is beneficial to bicyclists and eliminates conflicts when, for example, there are many right-turning motor vehicles next to a right side bike lane. Being in the box, and thus at the front of the traffic queue, also tends to make bicyclists more visible to motorists. The bike box may also be appropriate in situations where there is a high volume of left turn movements by bicycles. In some cases, bike boxes have been combined with the use of contrasting colored pavement to reinforce the intended use of the box.

MUTCD Status: The use of bike boxes is presently not in the MUTCD. It is currently on experimental device with multiple experiments occurring around the United States. Advanced stop lines are an approved MUTCD device. It is recommended that an experiment request be submitted to FHWA prior to use of a bike box.

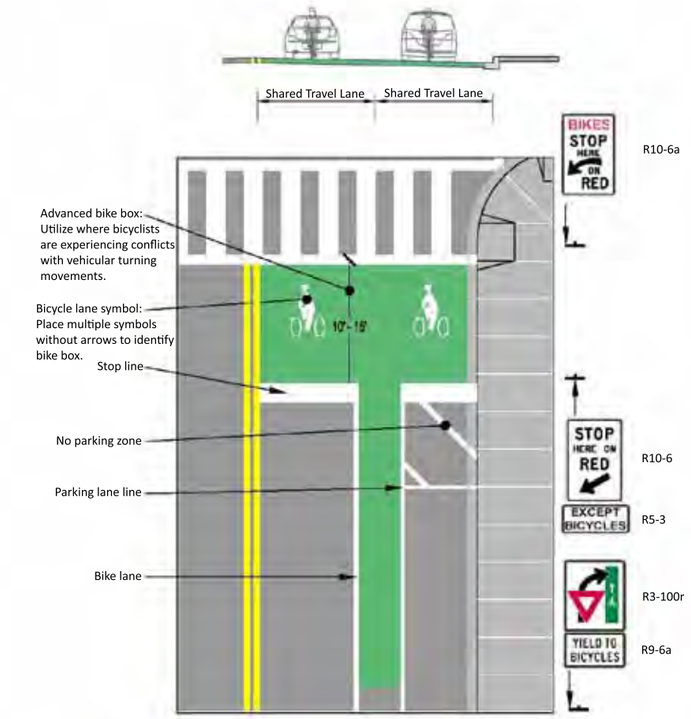


Figure 13. Bike box design plan and cross section.

Bike Detection

Actuated traffic signals should detect bicycles. If a traffic signal does not detect a bicycle, a bicyclist will be unable to activate a green light. If a motor vehicle does not arrive to actuate the signal, the cyclist who chooses to proceed through the intersection can do so only by treating the red light as a STOP sign. The most common type of detector is the inductive loop. Loops are wires installed in a specific configuration beneath the pavement surface that can detect the presence of a conductive metal object.

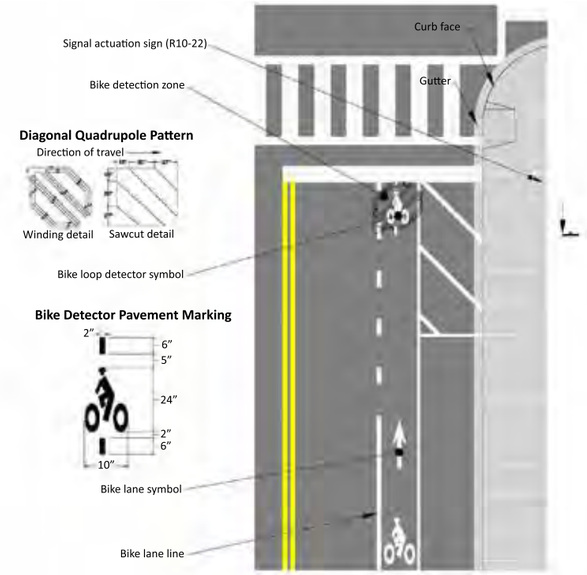
Inductive Loop Configurations

Significant research has been conducted to determine the best loop configurations to detect bicycles. Loop layouts have been developed and tested both in bicycle lanes and shared lanes. The quadruple loop detector can detect a metal-frame or metal-rim bicycle at any location above the loop. It may be necessary to install bicycle specific loop detectors on roadways with bicycle lanes if the motor vehicle loop does not extend into the bicycle lane sufficiently. An example is shown in Figure 14.

A quadruple loop detector with a diagonal configuration (also illustrated in Figure 14) can be used when bicyclists share the lane with motor vehicles.

The most important aspects of detection are the sensitivity setting of the detector amplifier and the location on the loop where the cycle crosses the loop. The use of sensitivity settings depends on local factors like the depth of the inductive loop, size of the adjacent lanes, and the percentage of truck traffic in the adjacent lanes.

At locations without bike lanes, the bicycle detector pavement marking should be installed over the spot that a bicycle must stand in order to activate the signal. This pavement marking can be supplemented by a R10-22 sign to reinforce the message to the bicyclist.



Baltimore Bicycle Facility Design Guide, Figure 5, 2005 Edition

Figure 14. Bike detection.

Transition between bike lane and shared lane marking

One of the most typical transitions between bicycle facilities will be between shared lane markings and bicycle 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 in Section 4. It is recommended that a SHARE THE ROAD sign assembly (W11-1 and W16-1P) be utilized 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).

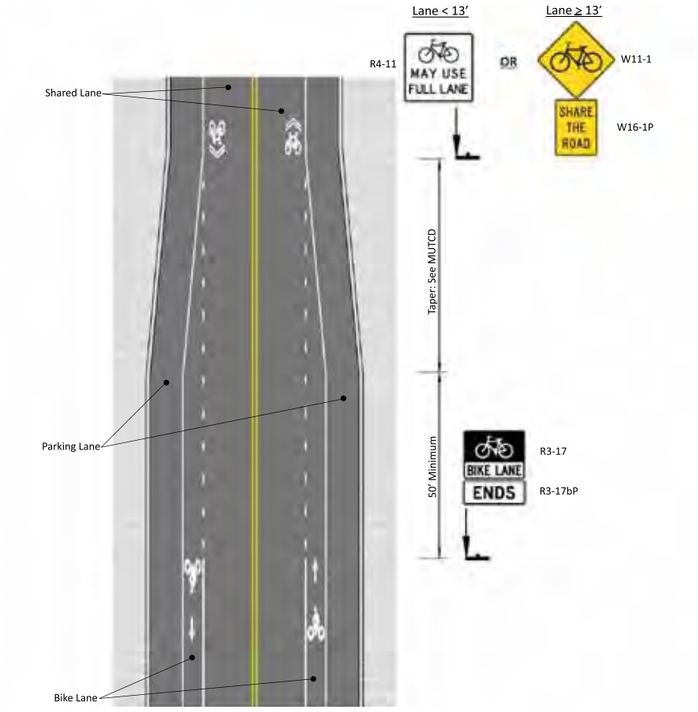


Figure 15. Transition between bike lane and shared lane marking.

INTERSECTION TREATMENTS

3. ADDITIONAL GUIDANCE FOR BICYCLE LANES

BICYCLE LANE PLACEMENT

Bicycle lanes should be one-way facilities and generally 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. However, there may be special situations where it is appropriate to have a two-way bicycle lane for a short distance or a contra-flow bicycle lane, such as a one-way street.

On one-way streets, bicycle lanes should generally 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 due to a special purpose lane such as a transit lane.

Considerations for Bicycle Lane Line Marking Placement
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) 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.

The minimum width of a bicycle lane next to a curb (no parking) is 5 feet from the face of curb but 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.

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 practice.

Considerations for Use of Dotted versus Solid Bicycle Lane Lines
Solid lines should be utilized 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 line with 4 foot gaps) should be used to demarcate areas where motorists are likely to or are to be encouraged to merge into or across the bicycle lane for turning movements. Dotted lines should be used 30-100 feet in advance of intersections where motorists are permitted to turn right. Where there is a parking restriction in advance of an intersection, including bus stops, the dotted should be carried 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 across uncontrolled intersections of any width.

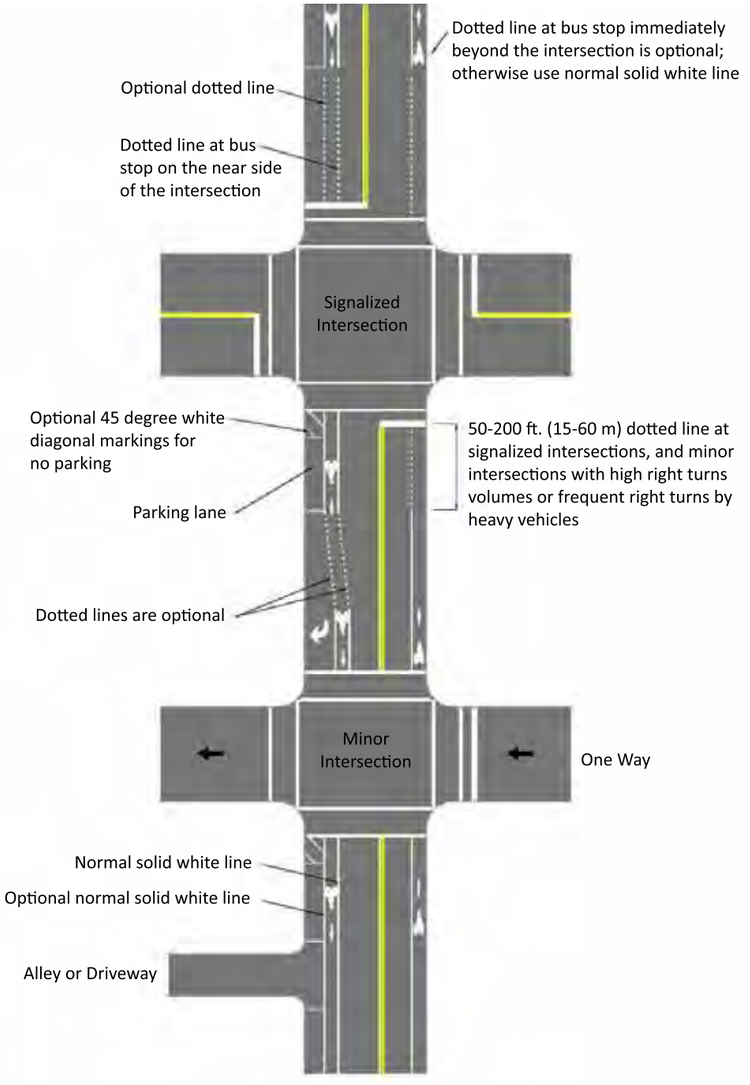


Figure 16. Bike lane intersection plan.

Considerations for Bicycle Lane Symbol Placement
The bicycle lane symbol (bicycle with rider (optional) and 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. Bicycle lane symbols are typically not located within dotted bike lanes to reduce wearing, 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:

- Visibility to motorists and bicyclists (i.e. 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 CLIMBING LANE TREATMENT CRITERIA

The decision to install a climbing bicycle lane should be based upon site conditions. Generally, it is recommended that climbing lanes should be utilized when roadway grades exceed 4% for at least 300 feet. It is recommended that the bicycle lane be striped on the uphill portion. For roadways with bicycle lanes located on one side, consideration should be given to locating the bicycle lane on the uphill side of the roadway unless it creates pedestrian safety issues. If a roadway grade is less than 4%, or if the length of a relatively steep grade is less than 300 feet, maintaining equally spaced wide outside lanes (14 to 15 feet) could be considered in lieu of a climbing bicycle lane.

Considerations for Climbing Lane Transitions
In general, the bicycle lane should be located on the uphill portion of the roadway. For roadways where changes in slope create defined peaks and valleys, it is recommended that the bike lane be switched from side to side unless engineering judgment deems it necessary to maintain a bicycle lane on a consistent side of the roadway.

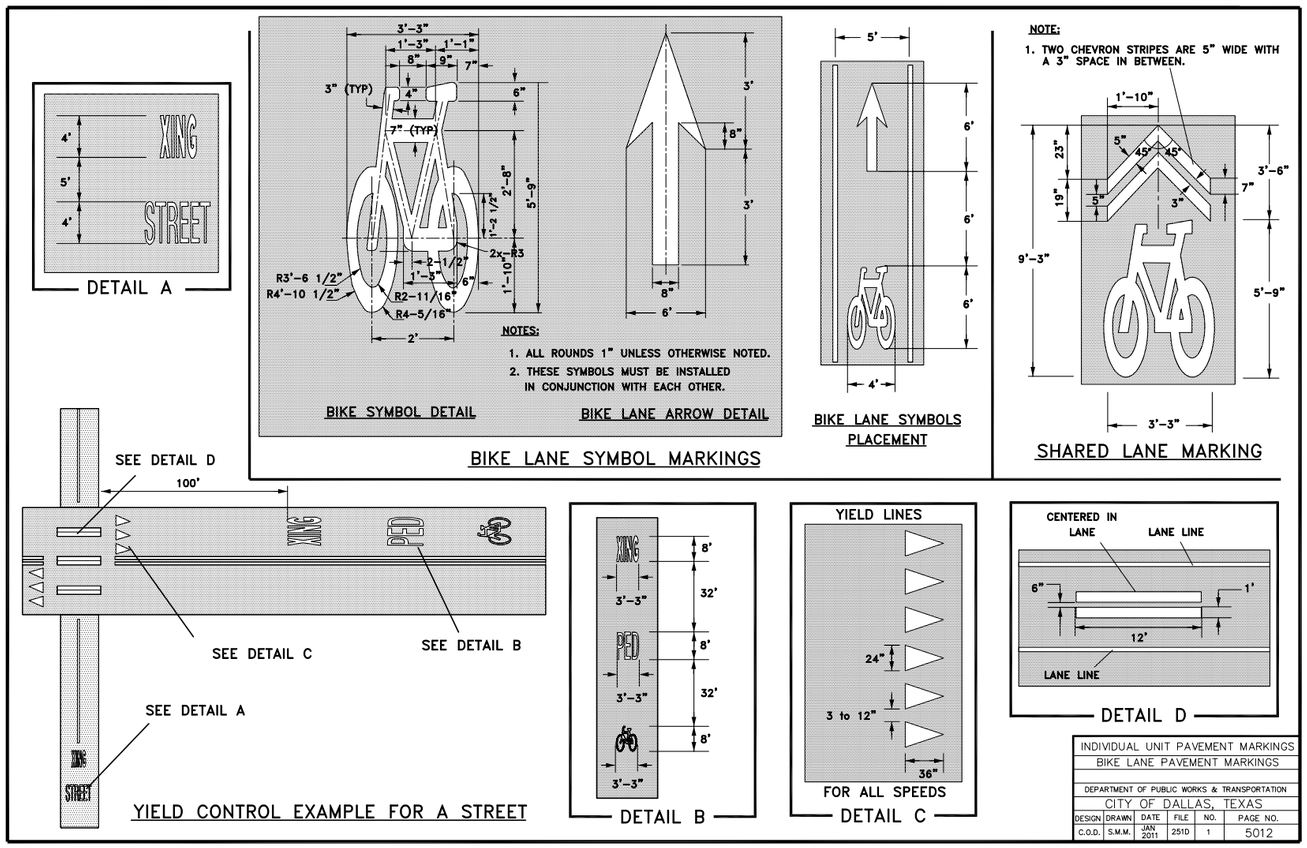


Figure 17. Pavement marking standards.

4. ADDITIONAL GUIDANCE FOR SHARED LANE MARKING

SHARED LANE MARKING PLACEMENT

Installation of shared lane markings is primarily based upon the recommendations found in the 2011 Dallas Bike Plan (Chapter IV). 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. Where there is only space for a bicycle lane on one side of the street, a bike lane should be installed on the uphill side with 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.

Considerations 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 within the same lane 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 steep grades and high bicycle speeds), and
- 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 assembly (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.

TYPICAL SHARED LANE MARKING BICYCLE FACILITY TREATMENTS

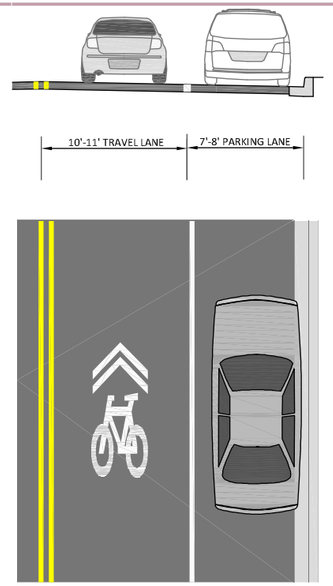


Figure 18. 10’-11’ Outside lane

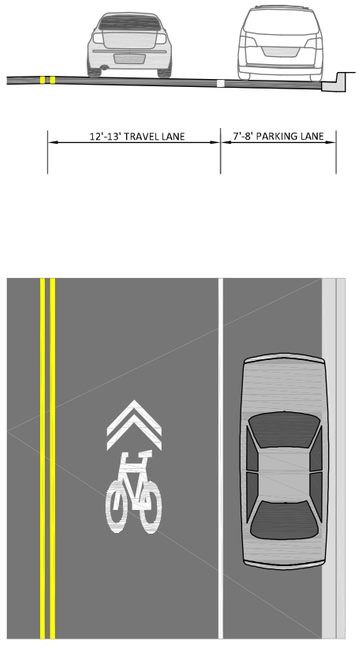


Figure 19. 13’ Outside lane

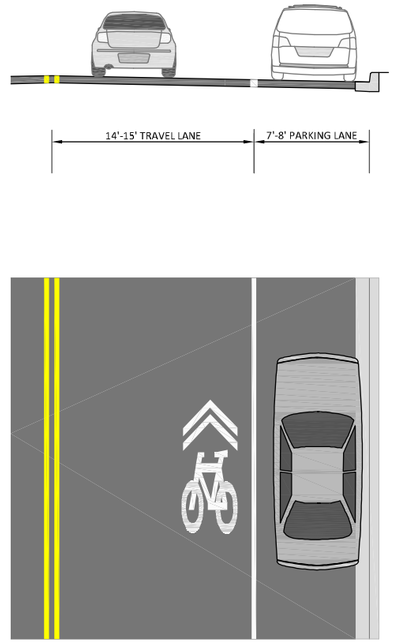


Figure 20. 14’-15’ Outside lane

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 line (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 no 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.

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 S Placement – Non-Arterial Streets

- Shared lane marking installation on non-arterial streets should generally follow the guidelines mentioned previously. However, no parking lane lines 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.

5. BICYCLE ROUTE SIGNAGE: FAMILY OF BICYCLE SIGNS; DESTINATION HIERARCHY

DESIGN GUIDELINES FOR SIGN TYPES

All signs included in the recommended bicycle route signage system are currently found in the guidelines for directional bicycle signage as established in the 2009 Edition of the *Manual on Uniform Traffic Control Devices* (MUTCD). The bicycle route signage system was modeled after the City of Seattle and City of Chicago's systems. This document also provides guidance on the following topics: family of bicycle signs; destination hierarchy; sign placement graphics; and new guidance on trail signing from the 2009 MUTCD.

Bicycle route signs are wayfinding signs that guide bicyclists along preferred, designated routes to destinations within the City of Dallas and throughout the region.

Bicycle route signs should provide bicyclists with direction, destination, and distance information to commercial centers, rail stations, shared use paths and other popular destinations. To assist the bicyclist, the system should provide three general forms of guidance:

- Directional and spot directional signs: placed at decision points where routes intersect or where guidance is required.
- Regional route signs: Placed along designated routes.
- Confirmation signs (also called designation signs): used to confirm route choice

All signs can be used on-street or on shared-use paths. The intent is to create a single, integrated signing system.

Directional and Spot Directional Signs

Directional signs and spot directional signs are placed at decision points where routes intersect or where guidance is required. See Figure 21.

Figure 21. Directional signs

Directional plaques should be placed at decision points where signed routes intersect and where routes lead directly to the intended destination. Placing signs at these locations reinforces the use of designated routes.

The number of destinations provided on a given post should not exceed three. This allows for the proper vertical clearance to be maintained.

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

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 (be removed) the top of the sign and subsequent destinations to move-up as the bicyclists approaches.

When directional plaques are placed on regional routes (routes that continue outside the City of Dallas) or they direct users to regional routes, regional route signs (M1-8a and auxiliary plaques) may be placed on the same sign post below the plaques. 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.

Destinations are ranked:

- Primary: shared-use trails, commercial centers, downtown, regional parks, bridges,
- Secondary: institutions major universities and community colleges, DART rail stations, other municipalities, and
- Tertiary Destinations: other public institutions (TBD on case by case basis, sport stadiums, airports, etc.).

Distances are measured along bicycle routes to the geographical center of downtown and commercial centers, and to the access points to all other destinations such as shared-use trails, regional parks and DART rail stations.

Spot directional signs are similar to directional signs but provide direction and destination information only. They are used when a destination is off the signed route or when getting to the route requires additional wayfinding. They should not be installed on the same posts as directional signs. 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 directional signs do not need to be followed by a confirmation sign.

Spot directional signs may be used where:

- Guidance to signed bicycle routes from adjacent roadways, side paths, etc., or access to important facilities such as bridges is needed.
- 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. Additional spot directional signs can be used to guide bicyclists to that destination.

Regional Route Signs

Regional route signs are placed along designated routes.

Figure 22. Regional route signs.

Regional route signs should be placed along named or numbered regional on-street routes and trails to assist users in wayfinding along the route or to confirm that the user is on the desired route. The signs also include auxiliary signs such as directional arrows and the words "To," "End," "Begin," etc.

On-trails the regional route signs should be used:

- 30'-50' after every intersection or street crossing or every ¼ mile where there is a gap in signage,
- At transitional locations (such as trail-to-road transitions) or in cases where bicyclists will be transitioning to sidewalks, and
- At trail entrances and exits, "Begin" and "End" auxiliary signs should be used above the regional route sign.

On-streets the regional route signs should be placed:

- 30'-100' before a turn (with an auxiliary arrow),
- 30'-60' after the turn to confirm the path,
- At decision points where needed, and
- Within proximity to regional route (within a few blocks), similar to a spot sign. Sign can be used in conjunction with an auxiliary sign such as an arrow or "To." When distance is further than a few blocks directional signs are used to direct users to regional routes.

Organization of signs on posts:

- Regional route signs can be mounted on the same post, below regulatory, warning or destination signs,
- Regional route signs may be placed back-to-back or with regulatory or warning signs, and
- When multiple regional route signs are placed on the same post, they can be stacked depending on height and visibility. The current route should be the top sign. See Figure 25 for system layout examples.

Confirmation Signs

Confirmation signs are used to confirm route choice, and should include destination information generally with the text "To" the location indicated on the directional plaque. In cases where a confirmation sign is found on a regional route, the route must be confirmed after a turn has been made, and a regional route sign may be placed below the confirmation sign.

Figure 23. Confirmation signs.

Confirmations signs should be placed:

- 30'-60' after decision points (preferably within sight of directional sign),
- 30'-60'after major intersections, or
- After every ¼ mile of unsigned segment along designated on-street routes.

Additional Sign Guidance

If possible, place sign on an existing post to minimize visual clutter and reduce costs.

If a sign assembly includes signs of different sizes, guidelines will apply to the widest sign. For example if a D1-1 is to be mounted above a M1-8, guidelines will apply to the D1-1.

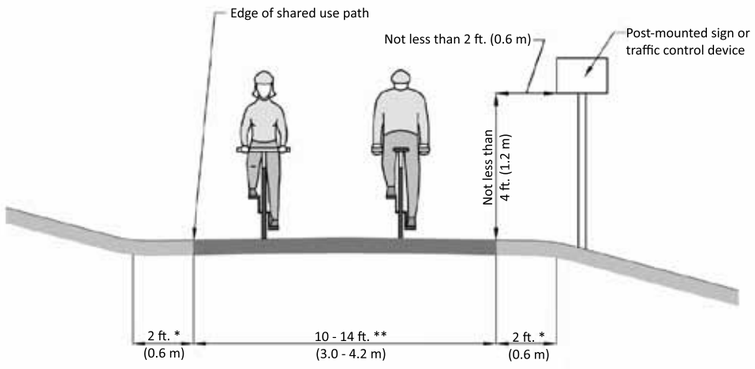


Figure 24. Section desplaying sign guidelines.
AASHTO *Guide for the Development of Bicycle Facilities*, 1999.

Figure 25. Sign placement.

FAMILY OF BICYCLE SIGNS - SIGNS AND SIGN SPECIFICATIONS

The following signs are to be used in conjunction with other wayfinding signs.

Figure 26. Directional signs.

Figure 27. Regional route sign.

Figure 28. Regional route sign.

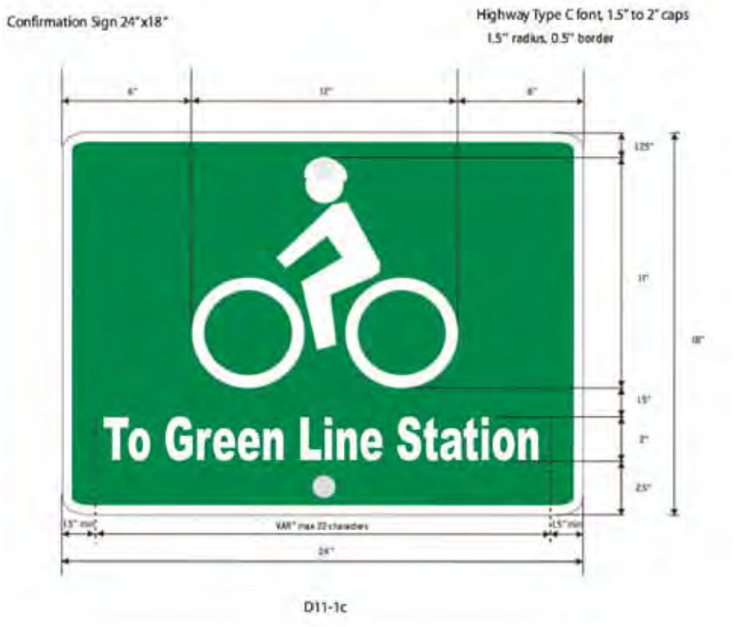


Figure 29. Confirmation sign.

Figure 30. Family of bicycle signs.

DESTINATION HIERARCHY

When using directional signs (commonly called plaques), put a primary destination on the top plaque, If needed, the secondary destination should go on the middle plaque, and, if needed, the tertiary destination on the bottom plaque. In most cases, there should be no more than three plaques at any given location.

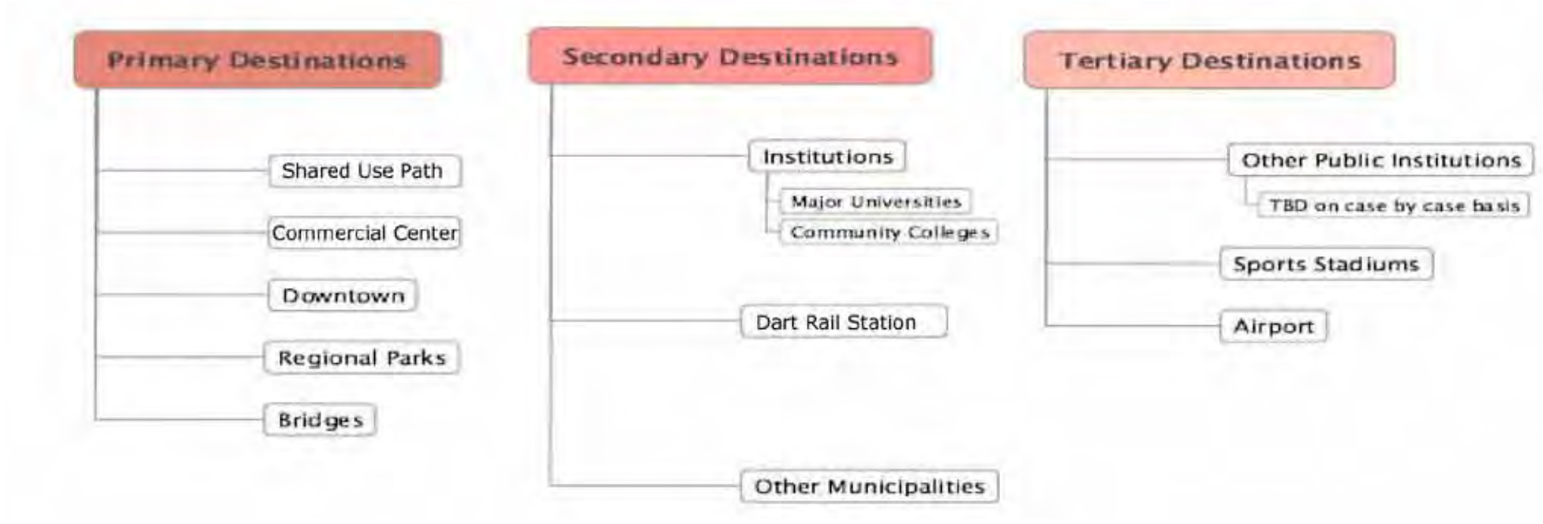


Figure 31. Destination hierarchy.

6. BICYCLE DOT GUIDANCE

Bicycle dots are pavement markings intended to supplement, complement or be used in lieu of bicycle route signs. Unlike shared lane markings, bicycle dots are not intended to provide guidance on bicycle positioning within the roadway, nor are they intended to affect bicyclists' or motorists' operational behaviors. They are a tool intended to provide guidance in route finding.

Bicycle dots are not in the Texas *Manual on Uniform Traffic Control Devices* (MUTCD) Part 9: Traffic Control for Bicycle Facilities, 2006; the *Manual on Uniform Traffic Control Devices* (MUTCD), 2009; or the American Association of State Highway and Transportation Officials (AASHTO) *Guide for the Development of Bicycle Facilities,* 1999. Application of guidance provided in this document requires "experimental status" through the Texas Department of Transportation (TxDOT) and the Federal Highway Administration (FHWA) in conjunction with the use of engineering judgment. Bicycle dots have been used in Seattle, Washington and Portland, Oregon.

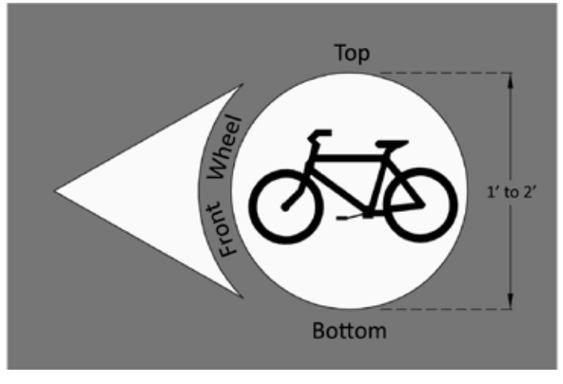


Figure 32. Bicycle dot symbol details.

Bicycle dots and the accompanying arrows may be used:

1. In lieu of signed routes that are not regional routes. Bicycle dots should provide guidance where routes turn, and to confirm the route after the turn. Where two routes intersect bicycle dots should be supplemented with directional signage.
2. On signed regional routes at locations where route-finding guidance is needed but installing a sign is not feasible due to limited space or potential sign clutter.
3. In marked crosswalks where trail crossings intersect a roadway to guide bicyclists across the marked crosswalk.
4. Transitions from road to sidewalk or side path and vice-versa.
5. Miscellaneous spot locations based on engineering judgment.

BICYCLE DOT PLACEMENT

Placement Guidelines

Bicycle dots on **non-arterial** streets:

1. Place a bicycle dot with appropriate arrow marking(s) 30' before the intersection at intersection approaches.
2. Place a bicycle dot approximately 50' from back of the sidewalk (sidewalk on cross street; property side of sidewalk) when used to confirm a turn.
3. On streets with 2 parking lanes and 1 lane of travel place bicycle dots 11' from the curb.
4. On streets with no parking place bicycle dots in the middle of the lane assuming there are 2 lanes of travel.
5. If the width of street is 30' or less, combine confirmation and directional bicycle dots (see Figure 33). Dots should be placed at 50' from the intersection. If width of street is greater than 30', confirmation bicycle dots and directional bicycle dots should be separate as per guidelines 1 and 2.

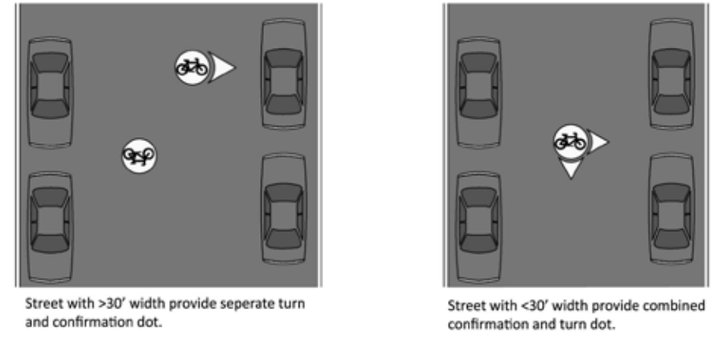


Figure 33. Bicycle dots on non-arterial streets.

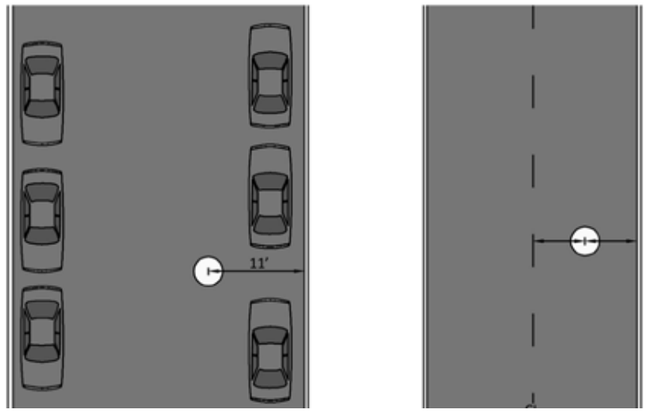


Figure 34. Bicycle dots on non-arterial streets.

Bicycle dots on **arterial** streets:

- 30' before a right turn (with appropriate supplemental arrow).
- 30' before any channelization if the turn requires merging into any lane other than the right most lane. This distance allows for bicyclists to position themselves in the proper lane in order to make the turn.
- 50' after a turn to confirm the route.
- 50' after major intersections to confirm the route.
- Every ¼ mile of straight segment to confirm the route.
- On arterials streets with parking lanes place Bicycle dots 11' from the curb.
- On arterial streets with no parking place bicycle dots in the middle of the right most lane.

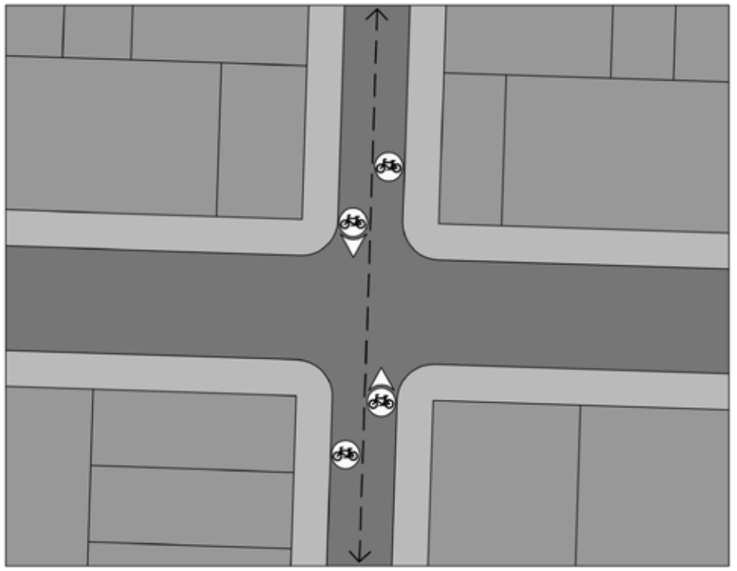


Figure 35. Bicycle dot placement on arterial streets.

Placement at Major Intersection Crossing
Bicycle dot placement at arterial crossing (with or without signal):

- Place bicycle dot with arrow at approach to intersection. Place 30' from back (property side) of sidewalk.
- On far side of intersection with positive traffic control place confirmation bicycle dot 50' from back (property side) of sidewalk on cross street.

7. BICYCLE PARKING GUIDELINES

BICYCLE PARKING GUIDELINES

The Association of Pedestrian and Bicycle Professionals (APBP) *Bicycle Parking Guidelines*, 2nd Edition has been made available by NCTCOG as the model for bicycle parking guidelines for all jurisdictions (including the City of Dallas) in the region. The manual covers virtually all aspects related to bicycle parking, including recommended racks, site layout, security, aesthetics, weather protection, lighting, maintenance, etc. It also provides model legislation for determining required parking for new developments.

The APBP guidelines are applicable in both urban and suburban contexts. 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.

8. ROADWAY CROSSING GUIDELINES FOR BICYCLE FACILITIES

ROADWAY CROSSING TREATMENTS

Roadway crossings are critical to the safety and convenience of a bicycle network. Many arterial streets are challenging to cross, particularly during peak travel periods. In order to make it possible for bicyclists to travel throughout the City of Dallas, there must be safe places to cross major streets. The section below describes the types of treatments that are recommended to help bicyclists cross these major roadways. Selection of the appropriate roadway crossing treatment depends on a number of factors:

- Roadway width/number of lanes,
- Motor vehicle traffic volumes,
- Motor vehicle speed,
- Sight-distance,
- On-street parking, and
- Presence of traffic signals at the intersection or at nearby intersections.

An appropriate combination of physical improvements should be recommended for each crossing location in a bicycle network. These crossing improvements include traffic signals, geometric improvements, signs, and markings. Specific types of recommended improvements are described below.

Signalized Intersections
Signalized intersections allow bicyclists to cross arterial streets without needing to select a gap in moving traffic. Traffic signals make it easier to cross the street, though it is important to make improvements to reduce conflicts between bicyclists and turning vehicles. All new signals must meet MUTCD warrants.

Mid-block Crosswalk Signals
Mid-block crosswalk signals allow pedestrians and bicyclists to stop traffic to cross arterial streets. Most mid-block crosswalk signals in the bicycle network will be for trail crossings. Pushbuttons should respond with minimal delay, be placed in convenient locations for bicyclists, and abide by other

American with Disabilities Act (ADA) standards. Other passive methods for signal activation may also be considered. All new signals must meet MUTCD warrants.

Curb Extensions
Curb extensions shorten bicyclist and pedestrian crossing distance (exposure time), and increase the visibility of non-motorized users at roadway crossings. By narrowing the curb-to-curb width of a roadway, curb extensions may also help reduce motor vehicle speeds and improve bicyclist and pedestrian safety. Curb extensions are appropriate only for locations that have full time, on-street parking.

Curb Radius Reduction
Wide curb radii allow motorists to make higher-speed turning movements. Reducing the curb radii at the corners of an intersection helps to slow turning vehicles, improves sight distance between bicyclists and motorists, and shortens the crossing distance for bicyclists and pedestrians. The choice of a curb radius is dependent on the design vehicle and speed, and whether the street is a local residential street, a neighborhood collector, or a major arterial. The appropriate radius for each corner of an intersection should be designed independently based on specific needs, including accommodating bus and emergency vehicles.

Median Islands
Median islands (or crossing islands) allow bicyclists and pedestrians to cross one direction of motor vehicle traffic at a time. Arterial roadway intersections that have low demand for left-turn movements can be potential candidates for adding median islands. Median islands can be constructed on these roadways by using the available center turn lane area, or by removing parking from one side of the street and shifting the travel lanes. Median islands are likely to be a medium- or long-term improvement on roadways where significant channelization changes are needed to provide enough space for the median island.

Overpasses and Underpasses
Overpasses and underpasses separate bicycle and pedestrian traffic from vehicular traffic, allowing bicyclists and pedestrians to cross freeways, busy streets, and railroad tracks without potential conflicts. They can also be used to cross ravines, canals, and streams. However, for crossing streets or railroad tracks, they should be used with great caution as they are expensive to construct. In addition, underpasses are prone to security concerns due to limited visibility and the inconvenience of out-of-direction travel is high (up to 1,000 feet or more) because of the need to provide accessible ramps. Many bicyclists and pedestrians will not go this extra distance and will instead cross at-grade. To be effective, there should be a self-enforcing feature that requires the bicyclist or pedestrian to use the bridge, such as topography, or fencing. Consequently, overpasses and underpasses should be reserved for locations where there is a high demand for bicycle and pedestrian crossings and there are no other more attractive options. Adequate width (for users to pass each other comfortably), lighting, and surveillance should also be provided to increase security of these crossings.

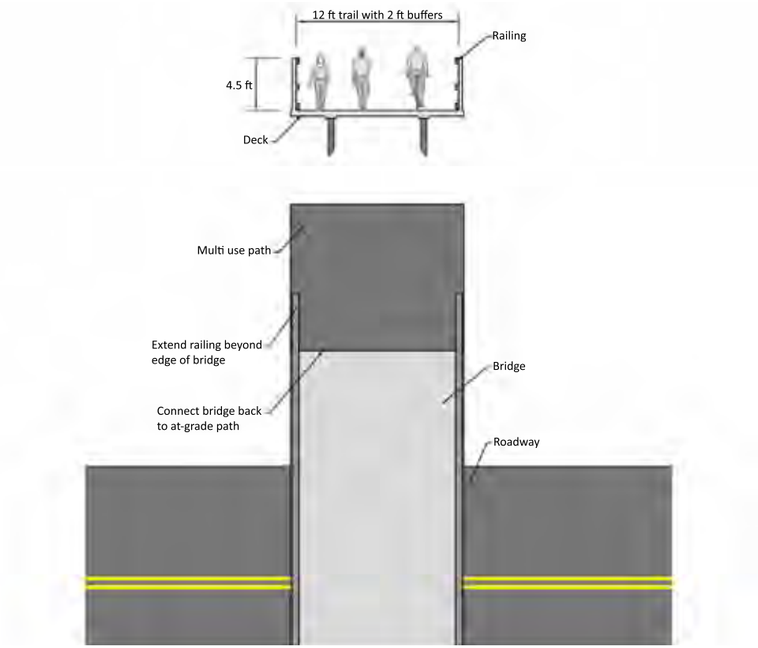


Figure 36. Grade separated crossing design plan and cross section.

Pedestrian/Bicycle Crossing Warning Signs
Bicycle and pedestrian warning signs are recommended at trail crossings. These signs can increase driver awareness of bicyclists and pedestrians, especially at mid-block locations where bicyclists and pedestrians may not be expected. These signs will be most effective when combined with other treatments, such as marked crosswalks, curb extensions, median islands, etc. Signs should be used judiciously—too many signs can cause visual clutter and lead to non-compliance.

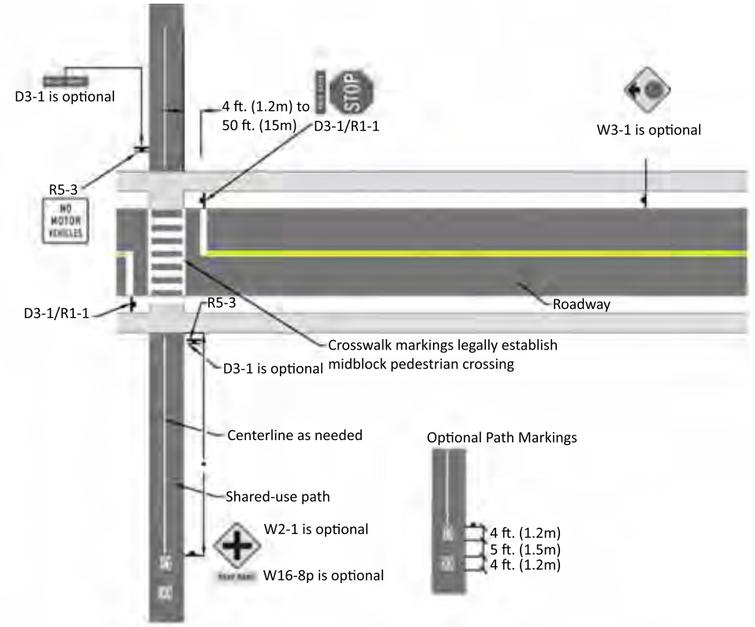


Figure 37. Trail and roadway intersection plan.

Sight-distance Improvements
Sight-distance obstructions can increase the risk of bicyclists being struck by vehicles at roadway crossings. Locations may have on-street parking, landscaping, light poles, bus stop shelters, and other features obstructing the line of sight between drivers and bicyclists. While these features can make a street more attractive and serve other valuable functions, they should be placed in locations that do not obscure drivers' views of bicyclists.

Parking is already restricted within 30 feet of intersections. Enforcement of this law should be improved and targeted on arterial roadways with bicycle lanes and at intersections where signed bicycle routes cross arterial roadways. At certain locations, it may be appropriate to restrict parking further than the 30 feet to achieve the desired improvement in sight distance.

9. BICYCLE AND TRANSIT INTEGRATION

BICYCLE PARKING AND ACCESS CONSIDERATIONS

Recommended Guidelines for Bicycle Parking at Transit Stations.
DART, like many transit agencies across the country, provides bicycle parking at transit stations. Bicycle parking is attractive for several reasons:

- It promotes transit ridership,
- It is relatively cheap to install,
- It can be installed on an as-needed basis when demand increases (assuming there is space),
- It can accommodate several bicycles (passengers) in a relatively small footprint, and
- It saves the cost of constructing expensive parking garages.

Simply providing a few racks and lockers at transit stops, however, is not enough to realize the full potential for accessing transit by bicycle. It requires a thoughtful and purposeful approach that addresses user concerns about security and attracts the maximum number of bicyclists.

The Association of Pedestrian and Bicycle Professionals (APBP) has a comprehensive publication on bicycle parking titled APBP *Bicycle Parking Guidelines*, 2nd Edition that should be adopted by DART for use at all transit stations. The manual covers virtually all aspects related to bicycle parking including recommended rack types, site location and layout, security, aesthetics, weather protection, lighting, maintenance, etc.

The City of Dallas and other DART member cities should coordinate with DART to incorporate into station area planning the parking recommendations for transit stations from the APBP *Bicycle Parking Guidelines*. They call for the following:

- Long-term bicycle parking requirement: Spaces for 5% of projected a.m. peak period daily ridership. Long-term parking racks provide a high level of security and are typically in cages, and bicycle rooms, as well as lockers located in-doors and out-doors.
- Short-term bicycle parking requirement: Spaces for 1.5% of a.m. peak period daily ridership. Short-term parking usually consists of simple bicycle racks that are convenient and utilitarian but do not provide a high level of security.

When installing bicycle parking at stations, it is desirable to include some excess capacity to accommodate future bicyclists. Some people may decide against riding simply because they feel that there is insufficient available bicycle parking.

Bicycle parking needs should also be considered at heavily used bus stations using the same formula. Separate studies may be required to determine parking needs on a station specific basis.

Not all stations will require this amount (see previous discussion) in the short run. If fewer spaces are provided, they should be regularly monitored with more spaces provided as demand increases. In all cases, ground space should be set aside to meet these parking requirements in the future.

The APBP *Bicycle Parking Guidelines* provides guidance for installing and managing bicycle lockers. This document also points out some of their shortfalls – they can be used for nefarious activities (e.g. storage), they may be rented but seldom used, there often is a waiting list for those wanting to rent a locker, renters are generally restricted to one location (unless they rent lockers at multiple stations), and they can be a challenge to administer.

Another approach that is gaining widespread acceptance is to install high capacity bike parking facilities. While there are different designs, they are essentially free-standing, unattended, see-through buildings that require a key card or similar device to enter. Once inside, personal locks secure bikes to traditional racks (see Figure 38). This approach has several advantages:

- Transit passes (monthly or yearly) can be used to access the buildings, thus avoiding the need to issue individual keys.
- The transparency of the buildings allows for easy surveillance.
- Anyone with a transit pass can use any facility – they are not limited to renting a single locker at just one facility.

There are generally fewer moving parts, which makes them easier to maintain.

DART could either manage the high capacity bike parking facilities or contract with a vendor such as a bike station. An additional fee could be added to the cost of the monthly/yearly/daily passes to cover some of the operating costs. However, the amount of this fee should be balanced against the potential to deter cyclists from riding to transit stations. For example, the City of Portland has been experiencing relatively low bike parking utilization rates and the fee amount was determined to be a contributing factor.

Figure 38. Example of a lock-up facility.

Recommended Criteria for Implementing Bicycle Parking and Access Improvements to Transit Stations
DART should consider installing appropriate bicycle parking at new stations and in conjunction with major retrofitting of existing stations. Space for future bicycle parking should be included in station designs from the onset of a project, regardless of how many bicycle parking spots are installed.

DART should also prioritize existing stations to determine which stations should be targeted for enhanced bicycle parking. This should be done in conjunction with local jurisdictions so that bikeway system improvements to provide bicycle access to the stations can be completed at the same time. To accomplish this, DART and the local jurisdiction will need to agree on mutually acceptable criteria for setting priorities. A good way to start is by counting the number of bicycles currently parking at each station (count bicycles at racks and elsewhere at the stations). However, this information should be used with care since it may be misleading in situations where there are no facilities leading to the stations from adjacent neighborhoods (i.e. lack of bicycles does not always mean lack of demand). Another good approach is to develop a prioritization map for the City or region that uses a variety of factors to determine where there will likely be demand for bicycle facilities (see City of Dallas prioritization map Figure 42).

This still leaves the need to prioritize stations that should be targeted for access and parking improvements. DART and local jurisdictions are encouraged to adopt the following criteria:

- Density: Higher density neighborhoods generally have higher numbers of people that live within bicycling distance of a transit station.
- Ridership: Stations with the highest a.m. peak period daily ridership have more people who will potentially bicycle.
- Distance from centers: Stations closest to a downtown or neighborhood commercial area are likely to attract more bicycling while stations further out will tend to serve a different, more automobile-oriented clientele.
- Proximity to bicycle facilities: Stations close to multi-use trails and future on-road bicycle facilities will likely experience higher levels of passengers accessing the station by bicycle.
- Other transit connections: The level of connectivity to other transit services (other trains, buses) at the station indicates the station's ability to serve a wide-ranging area.
- Origin vs. destination: Some stations are at the origin of a journey while others are at the destination or end of a journey. Stations that serve both functions are often good candidates for capturing bicycle trips.

10. DALLAS BIKEWAY SYSTEM MASTER PLAN - NETWORK FACILITY IDENTIFICATION AND CROSS-SECTION REFERENCE MAPS

DALLAS BIKEWAY SYSTEM

The Dallas Bikeway System as shown on the facility maps provides a variety of facility types needed to meet the needs of all types of bicyclists. It identifies the location and initial facility recommendation for approximately 468 miles of on-street bicycle facilities, which is only one component of the overall 1,224 mile bikeway system. Included on the maps are transit lines and inter-jurisdictional connection points as well as select intersections where improvements are needed to complete the bikeway system.

The recommendations on the facilities map are accompanied by additional maps and information that provide more detailed guidance on how to design and prioritize projects.

- Trinity River Corridor map: These maps provide a more detailed look at the recommended facilities in the Trinity River Corridor as shown on the facilities map. The intent is to highlight the importance of creating safe, accessible bicycle access across this corridor (see Figures 39-41).
- Priorities map: This map overlays the facilities map with three levels of priority: near-term (2012-2014), medium-term (2015-1017), and long-term (2018-2021) projects (see Figure 42).
- Cross section maps: On these maps, each of the 468 miles of roadway segment with a recommended facility on the facilities map is coded to reflect one of 72 cross sections - e.g. bike lane, shared lane marking, cycle track, etc. (See pages 24-35 for cross section drawings).
- Required action list: Each of the 468 miles of roadway segments with a recommended facility is accompanied by a recommended action to implement the recommendation. For example, to create space to install bike lanes, it may be necessary to reduce the number of general purpose travel lanes (road diet) (provided seperately from Plan).

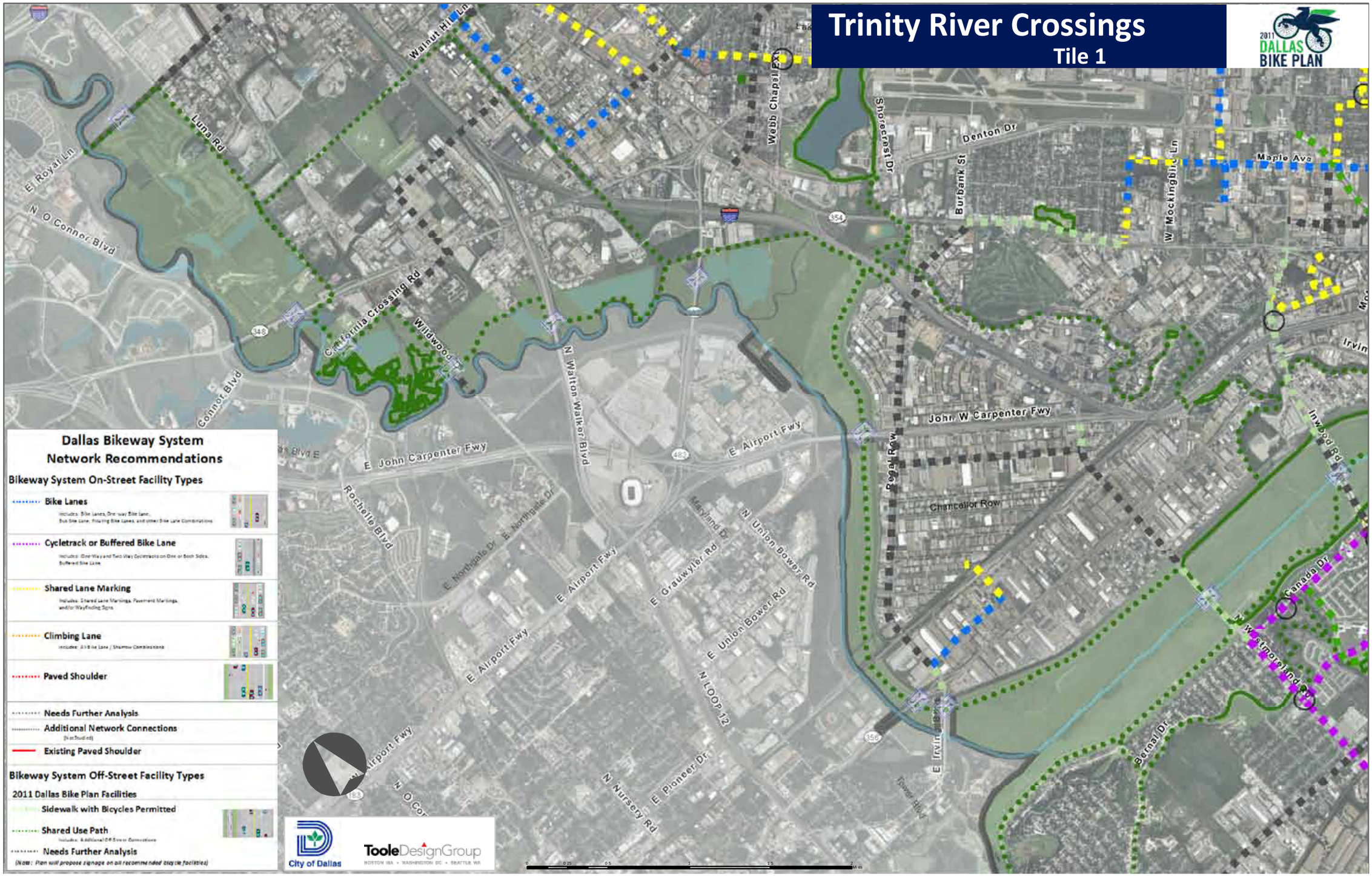


Figure 39. Trinity River Crossings Tile 1.

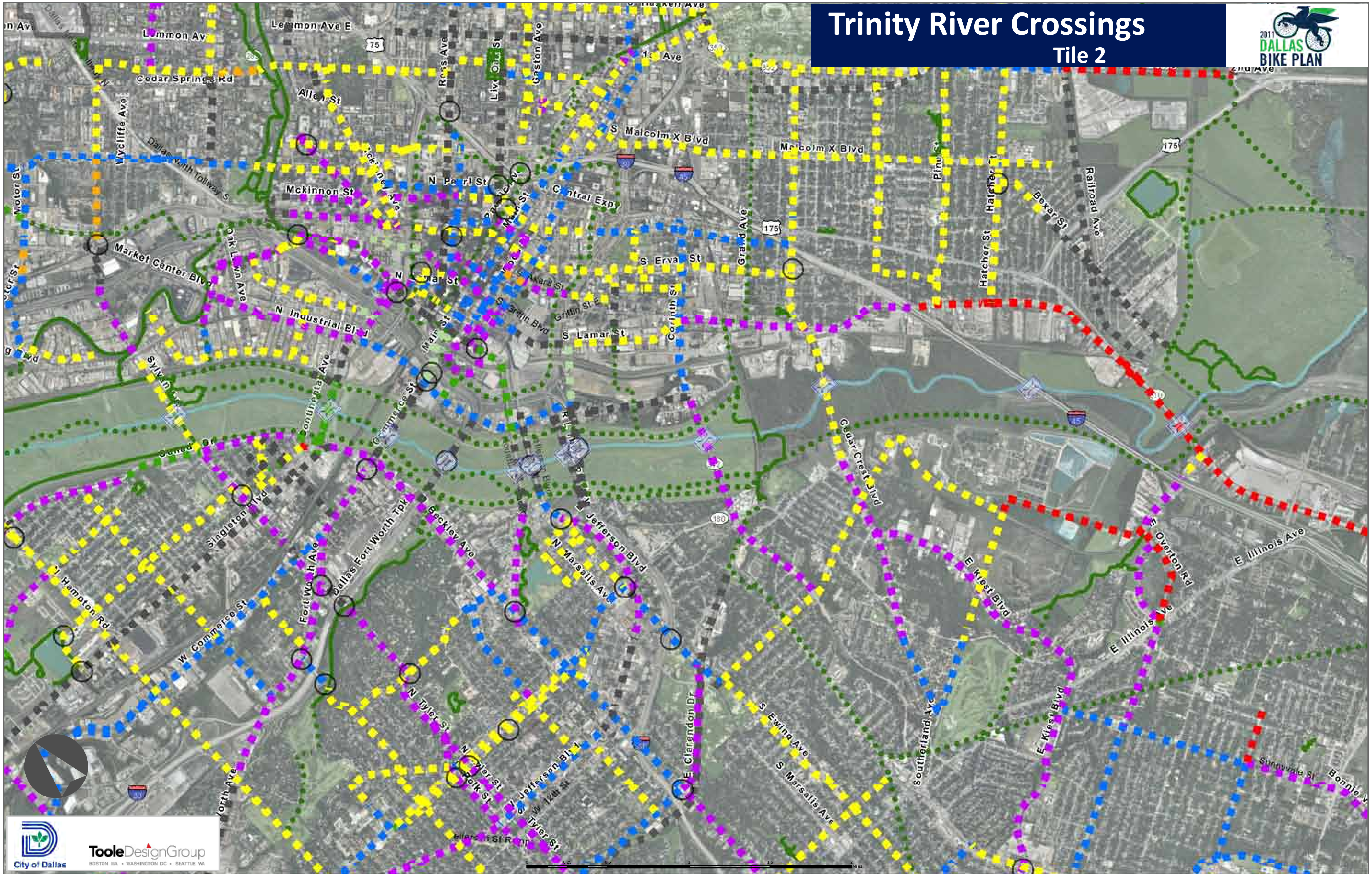


Figure 40. Trinity River Crossings Tile 2.

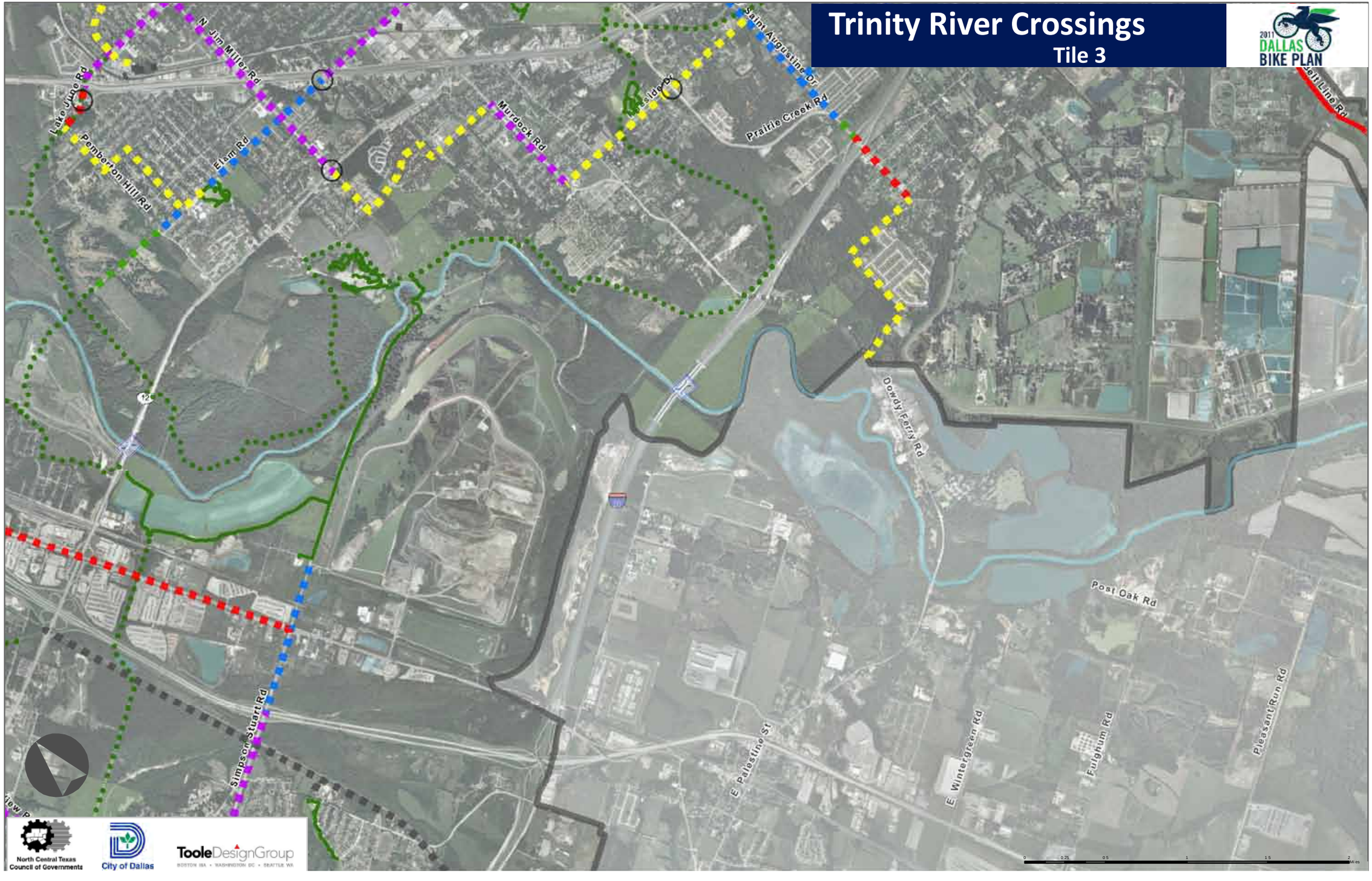


Figure 41. Trinity River Crossings Tile 3.

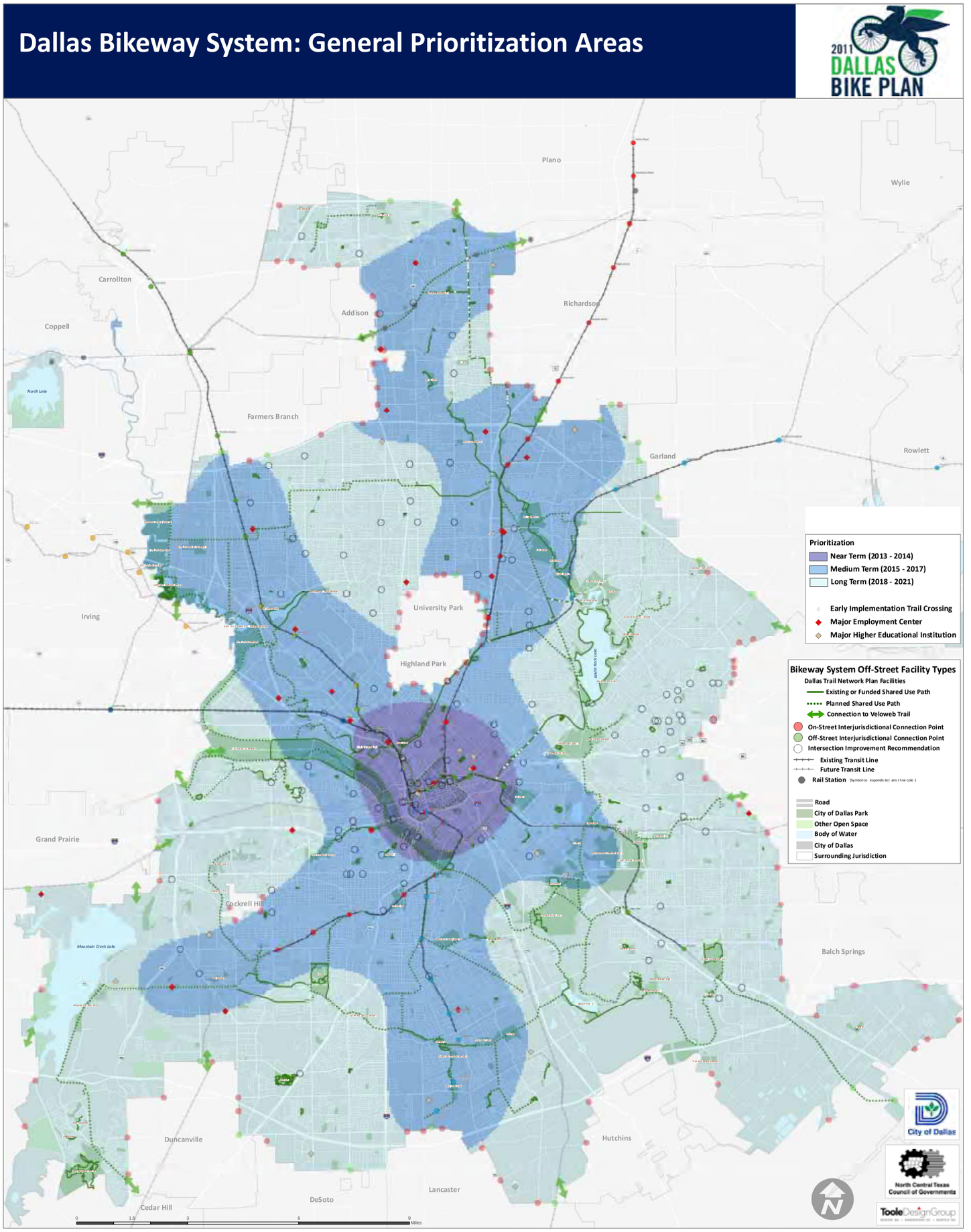


Figure 42. Dallas Bikeway System: General Prioritization Areas.

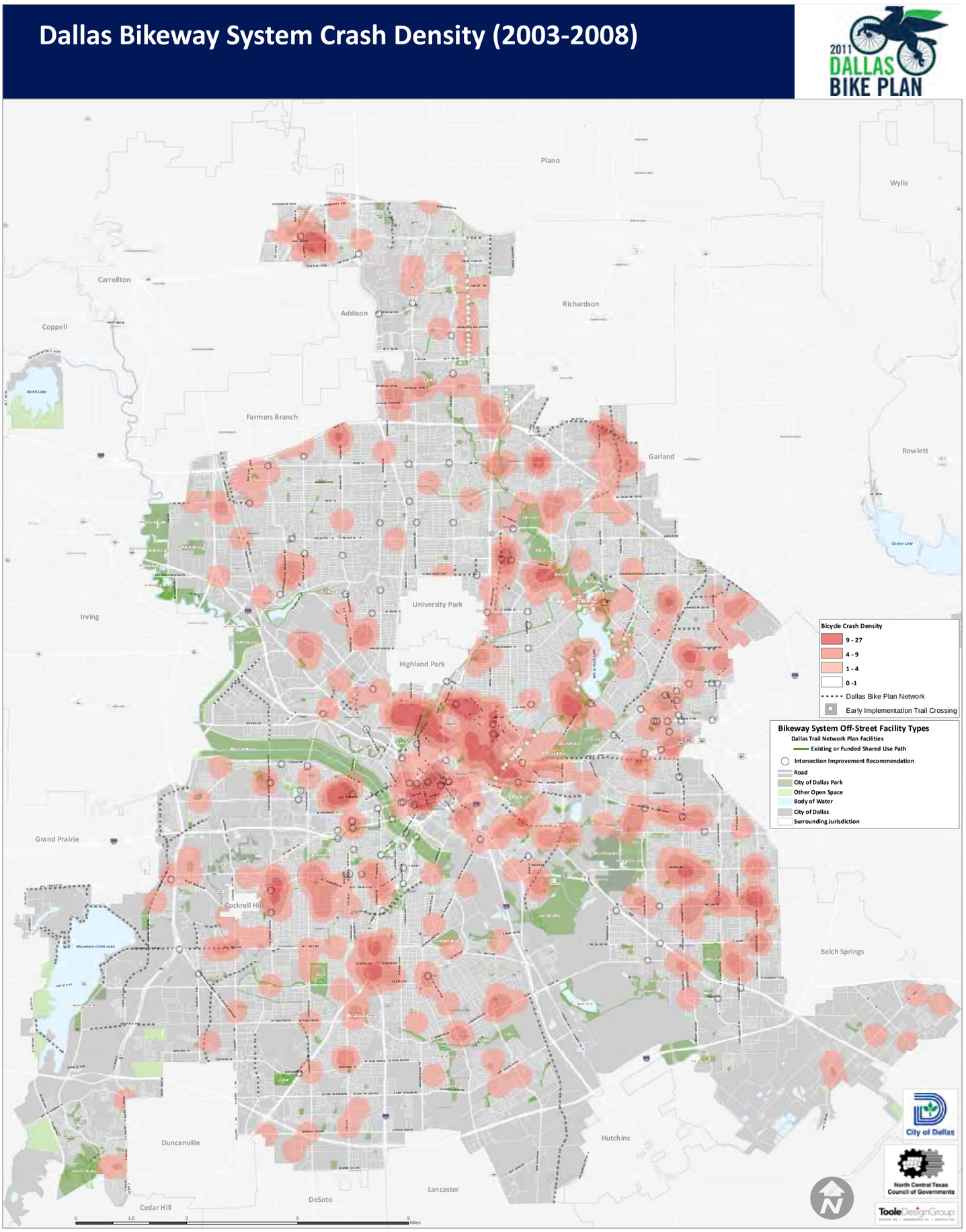
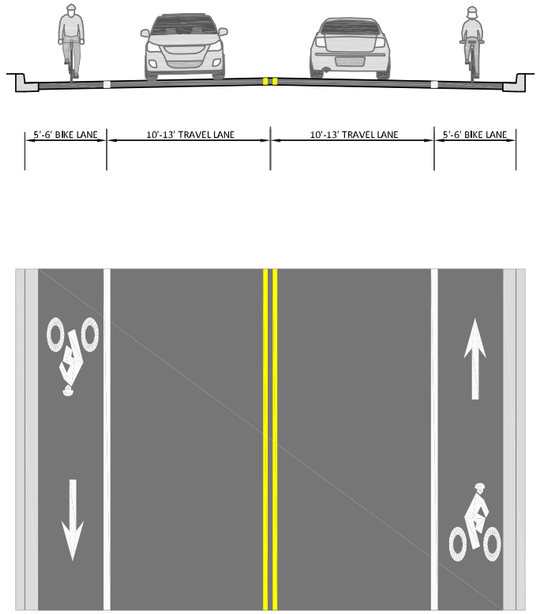


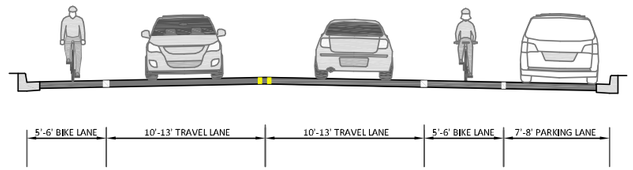
Figure 43. Bicycle crash density (2003-2008).

CROSS SECTION DRAWINGS

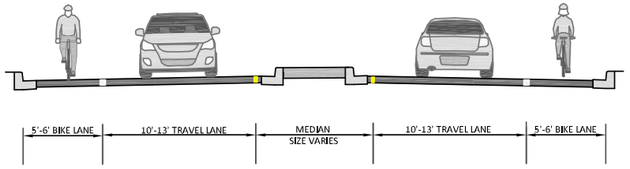
The figure numbers for each of the cross sections are keyed to the bicycle facility and street type recommendations maps.



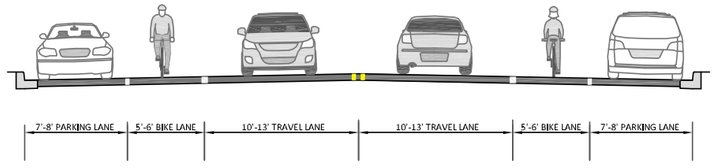
A.1 2 Lane Bike Lanes No Parking



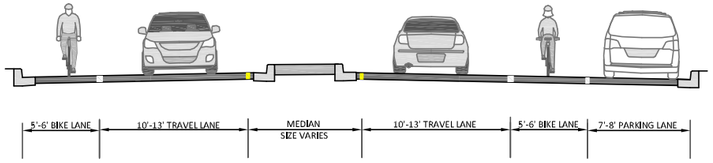
A.2 2 Lane Bike Lanes Parking One Side



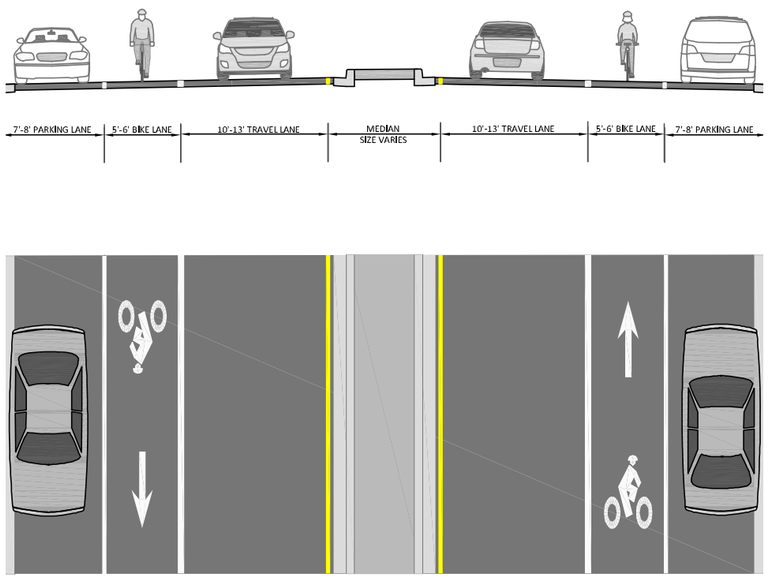
A.3 2 Lane Bike Lanes with Median No Parking



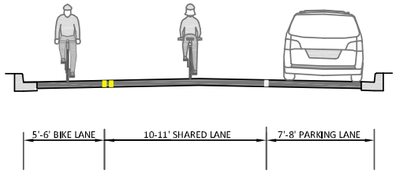
A.4 2 Lane Bike Lanes Parking Both Sides

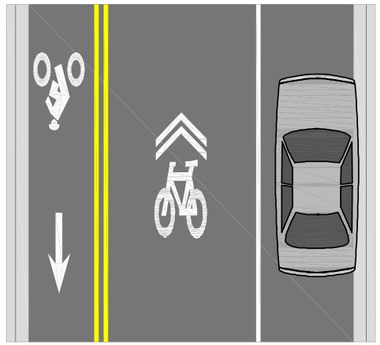


A.5 2 Lane Bike Lanes with Median Parking One Side

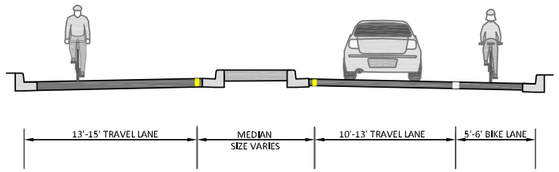


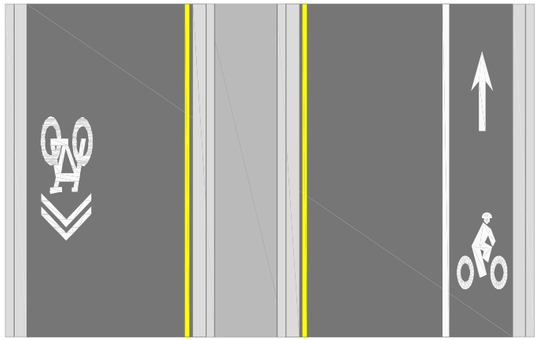
A.6 2 Lane Bike Lanes with Median Parking Both Sides



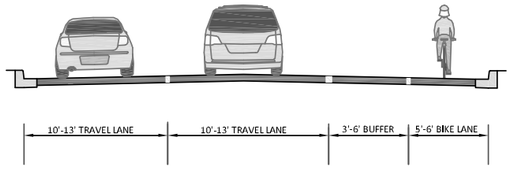


AA.1 1 Lane Counter Flow Bike Lane Parking One Side

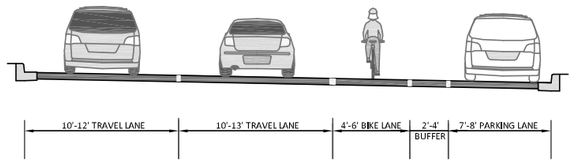


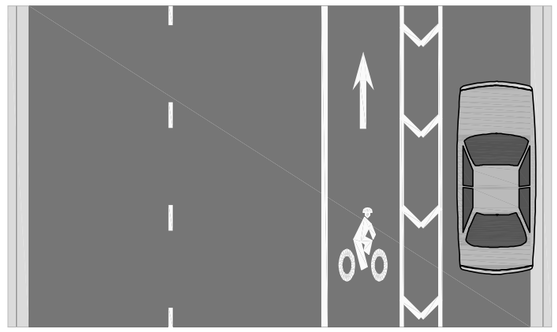


B.1 2 Lane Bike Lane/Shared Lane Marking with Median No Parking



BB.1 One Way 2 Lane Buffered Bike Lanes No Parking





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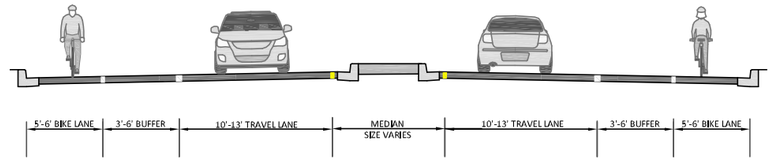
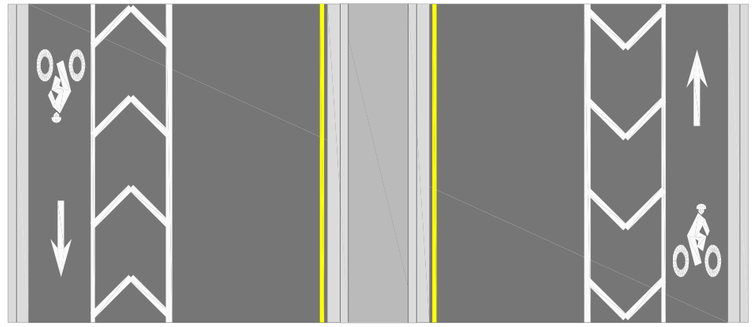
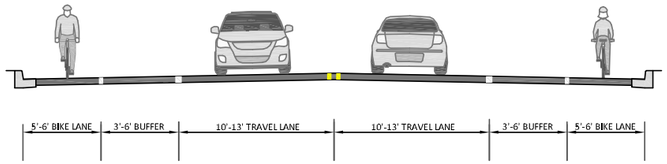
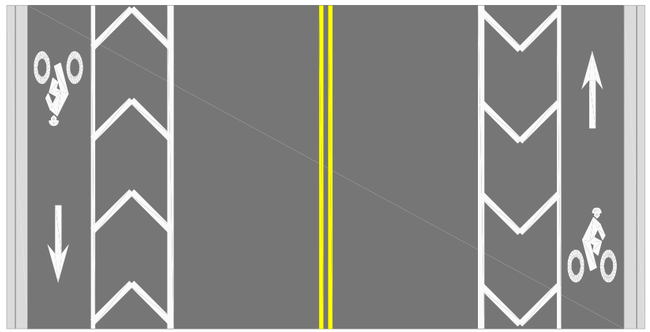




C.1 2 Lane Buffered Bike Lanes with Median No Parking





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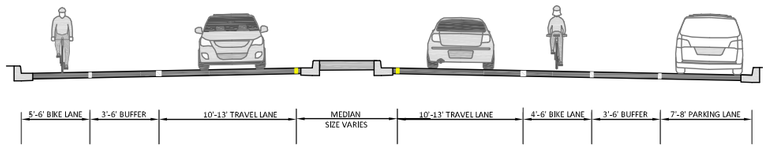
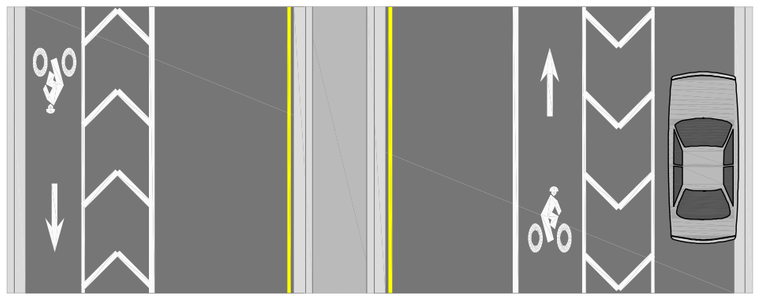
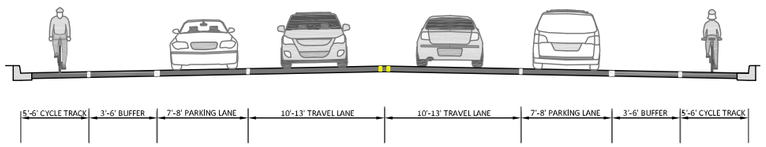
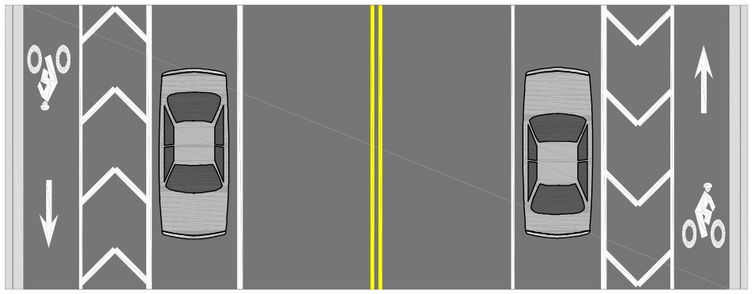


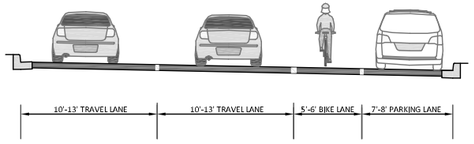


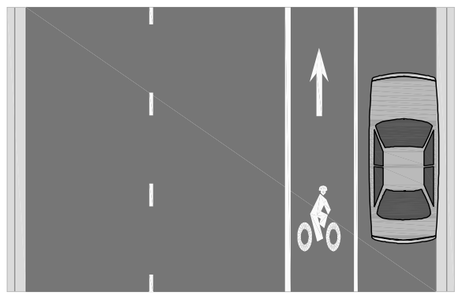
C.3 2 Lane Buffered Bike Lanes with Median Parking One Side



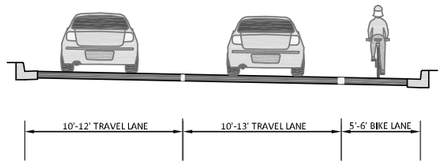


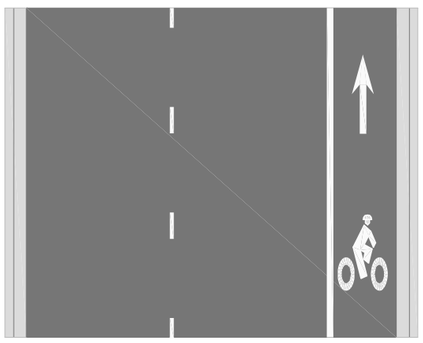
C.4 2 Lane Cycle Track Parking Both Sides





CC.1 One Way 2 Lane Bike Lanes Parking One Side





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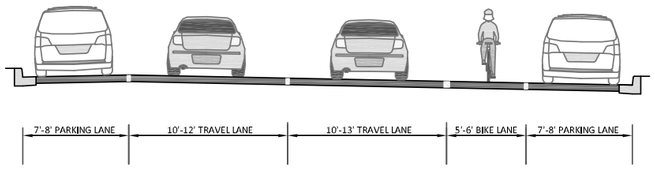
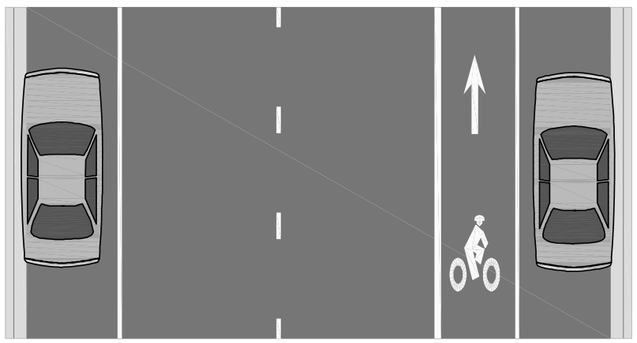
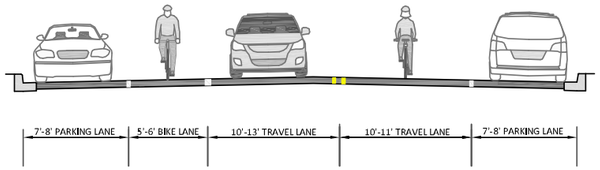
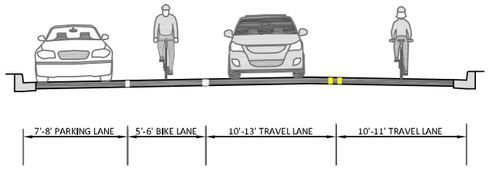




CC.3 One Way 2 Lane Bike Lanes Parking Both Sides



D.1 2 Lane Climbing Lane Parking Both Sides



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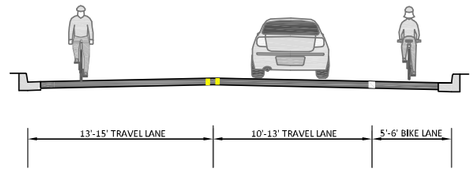

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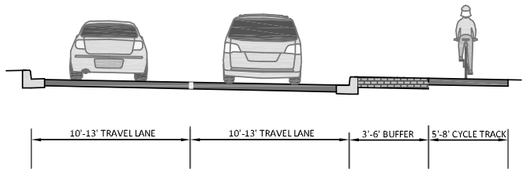
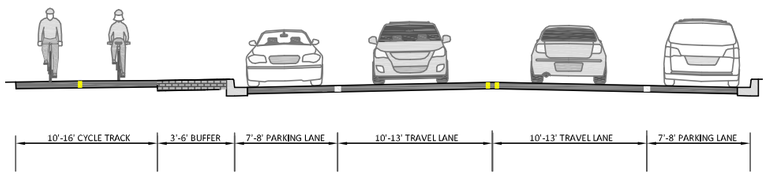


DD.1 2 Lane Cycle Track One Side One Way No Parking



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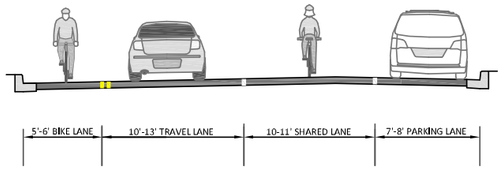
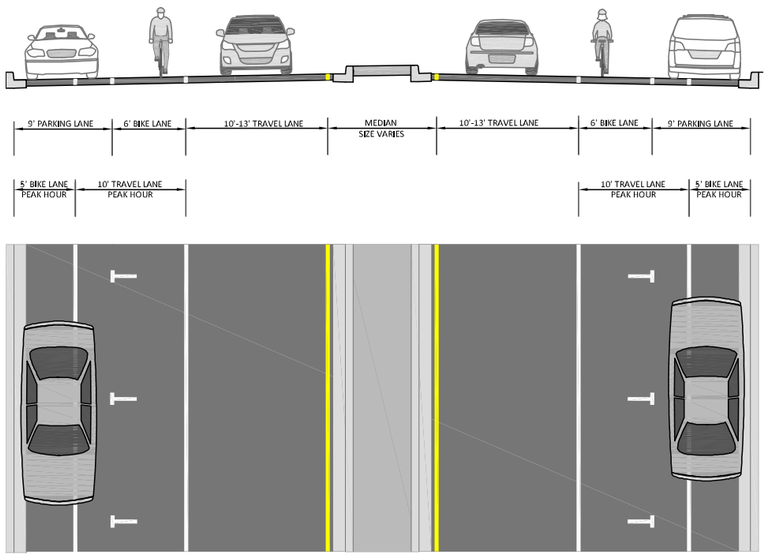
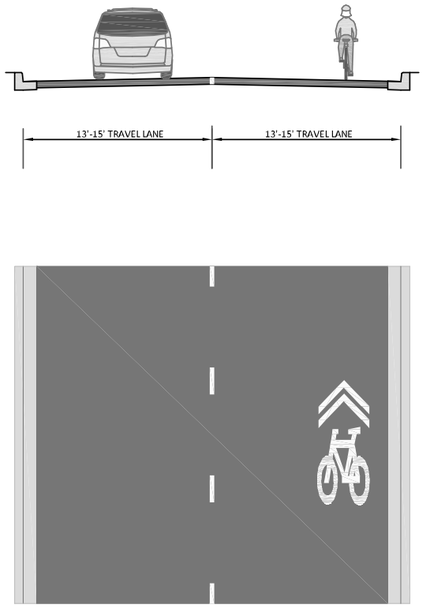


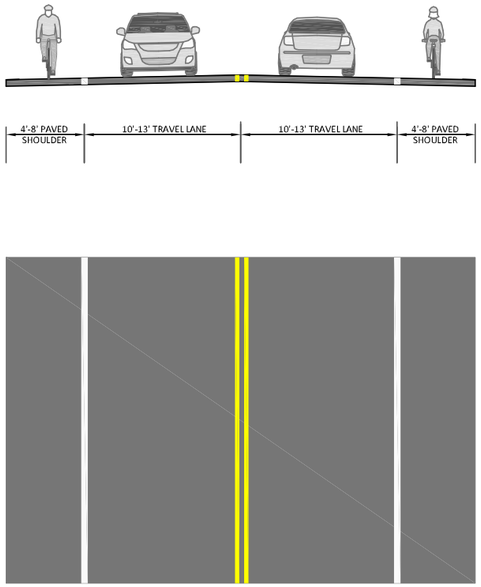
EE.1 2 Lane Counter Flow Bike Lane Parking One Side



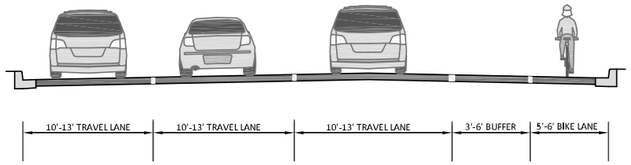
F.1 2 Lane Floating Bike Lanes with Median Parking Both Sides



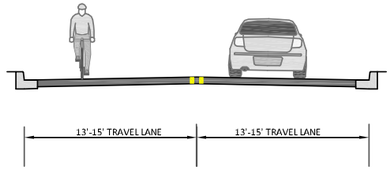
FF.1 One Way 2 Lane Shared Lane Marking No Parking



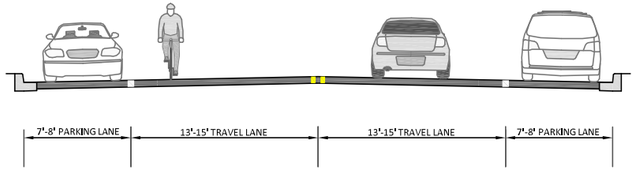
G.1 2 Lane Paved Shoulder No Parking



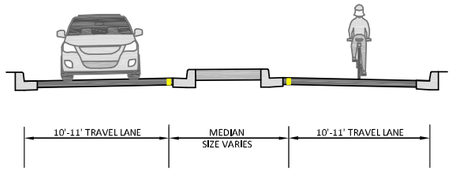
GG.1 One Way 3 Lane Buffered Bike Lanes No Parking

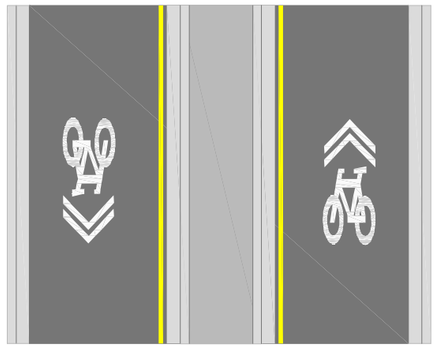


H.1 2 Lane Shared Lane Marking No Parking

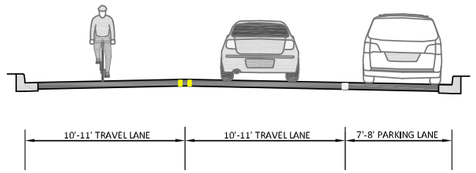


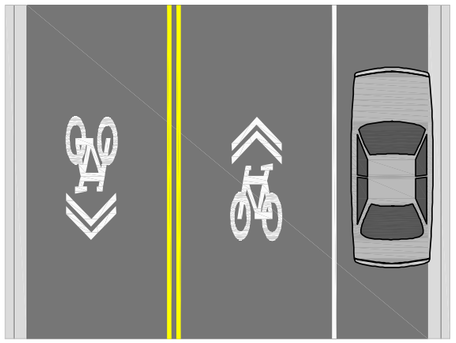
H.2 2 Lane Shared Lane Marking Parking Both Sides



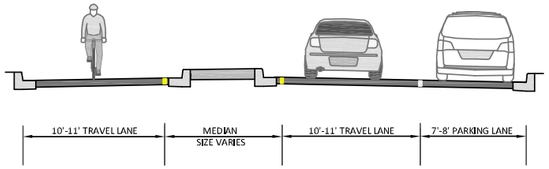


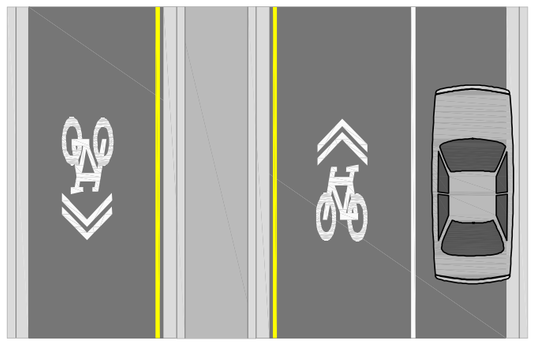
H.3 2 Lane Shared Lane Marking with Median No Parking



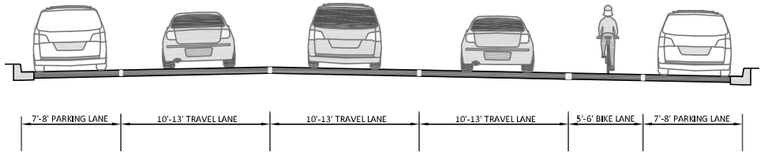


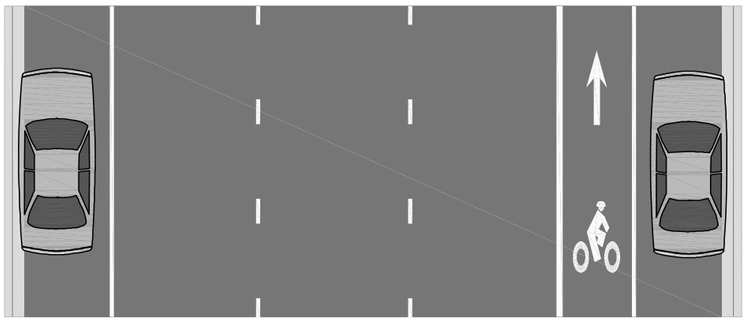
H.4 2 Lane Shared Lane Marking Parking One Side



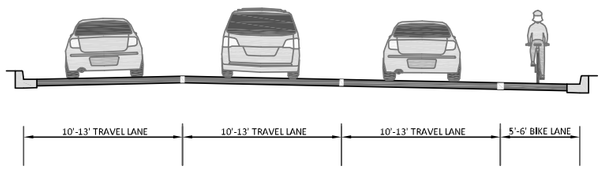


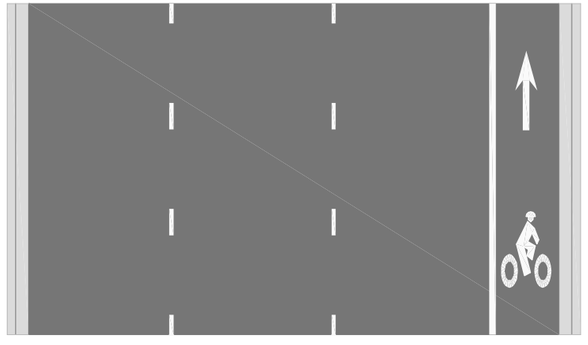
H.5 2 Lane Shared Lane Marking with Median Parking One Side



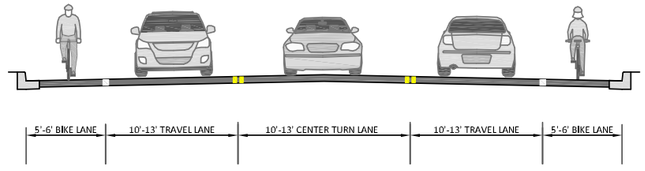


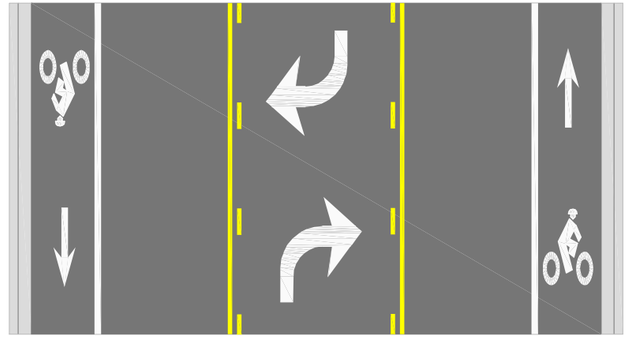
HH.1 One Way 3 Lane Bike Lanes Parking Both Sides



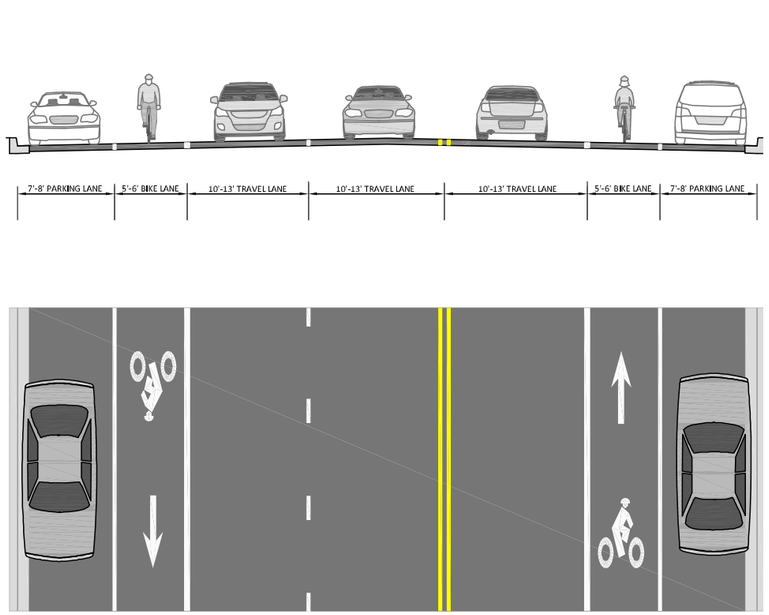


HH.2 One Way 3 Lane Bike Lanes No Parking

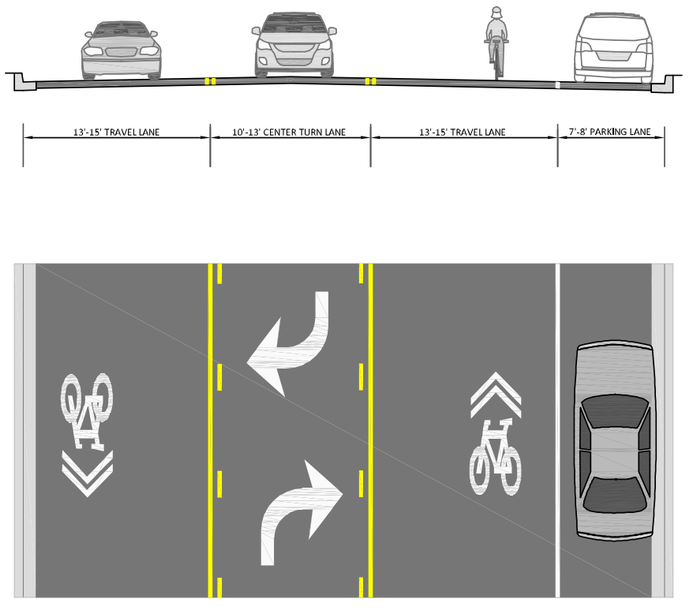




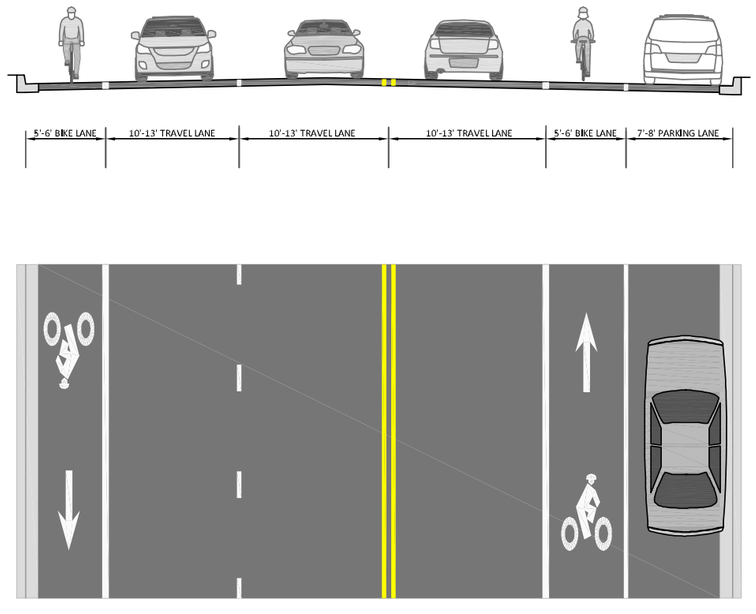
I.1 3 Lane Bike Lanes with Center-Turn-Lane No Parking



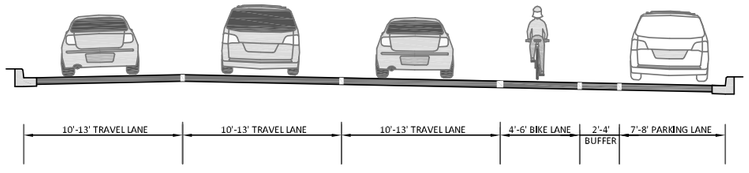
I.2 3 Lane Bike Lanes Parking Both Sides



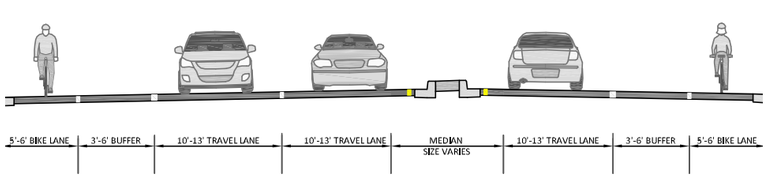
L.3 3 Lane Shared Lane Marking with Center-Turn-Lane Parking One Side



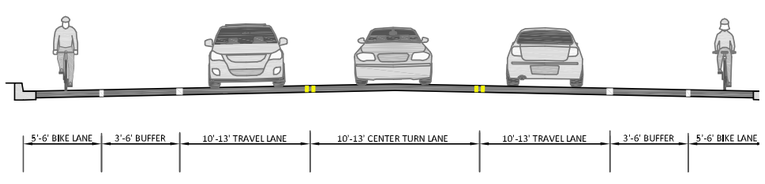
I.4 3 Lane Bike Lanes Parking One Side



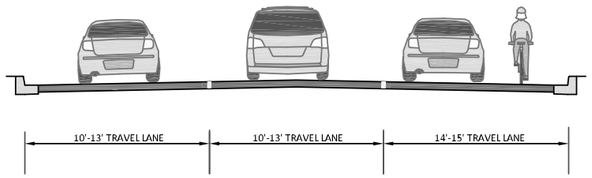
II.1 3 Lane Buffered Bike Lanes Parking One Side

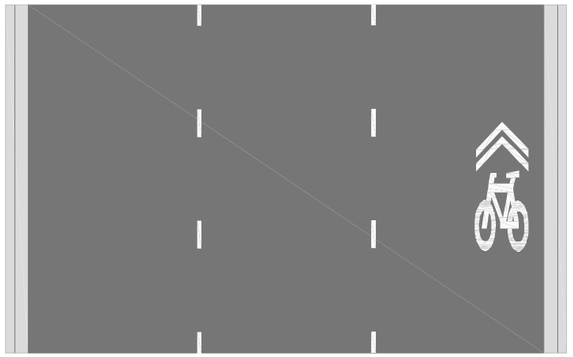


J.1 3 Lane Buffered Bike Lanes with Median No Parking

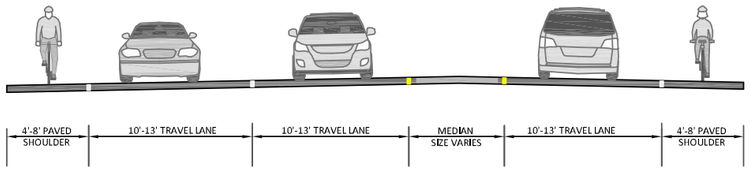


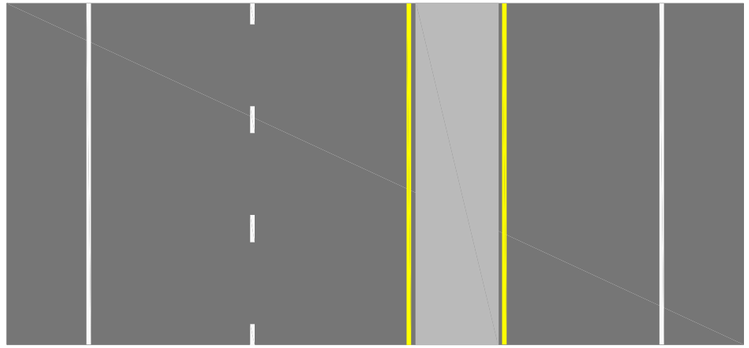
J.2 3 Lane Buffered Bike Lanes with Center-Turn-Lane No Parking



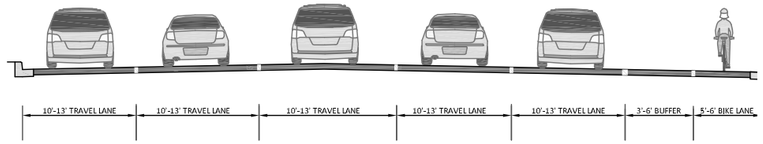


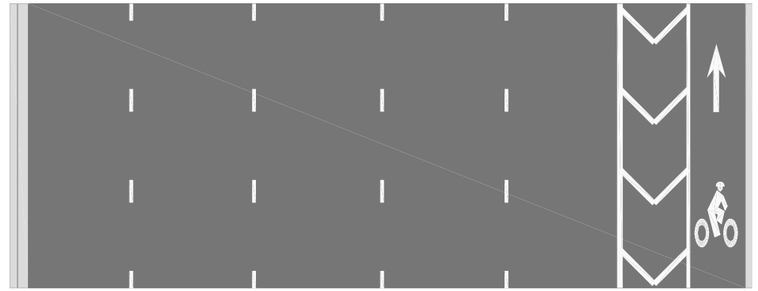
JJ.1 3 Lane Sharrows No Parking



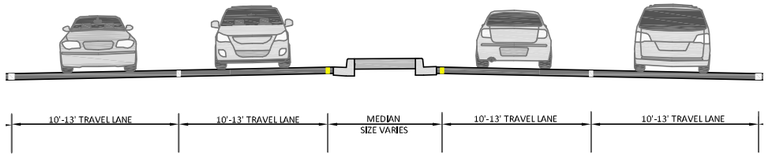


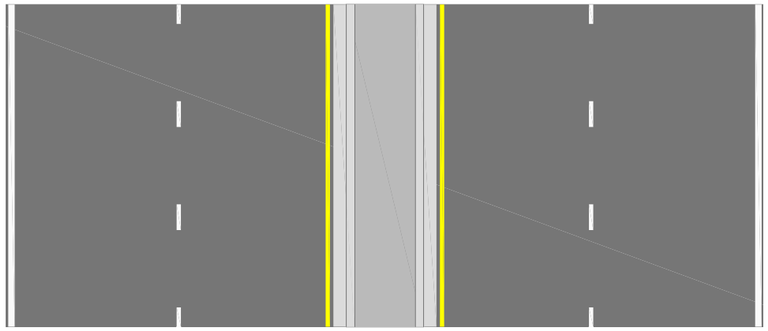
K.1 3 Lane Paved Shoulder with Median No Parking



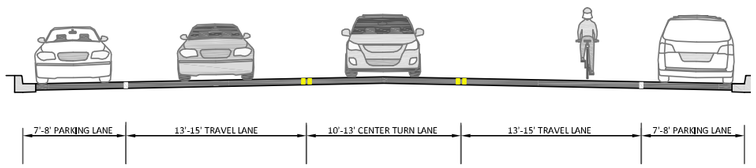


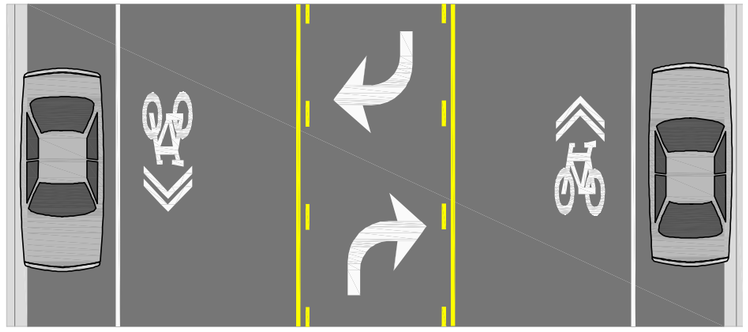
KK.1 One Way 5 Lane Buffered Bike Lanes No Parking



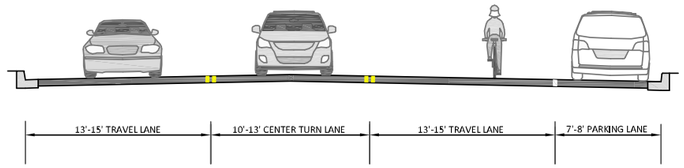


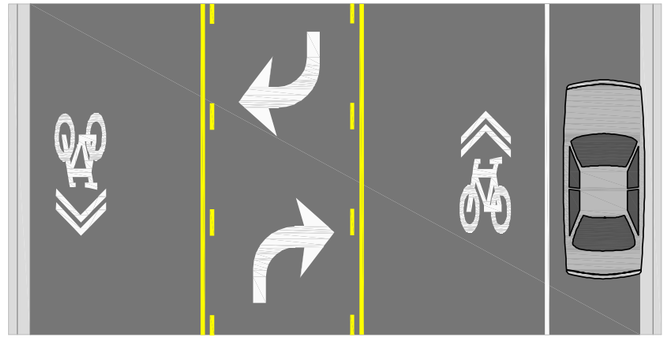
M.1 4 Lane Bike Lanes with Median No Parking



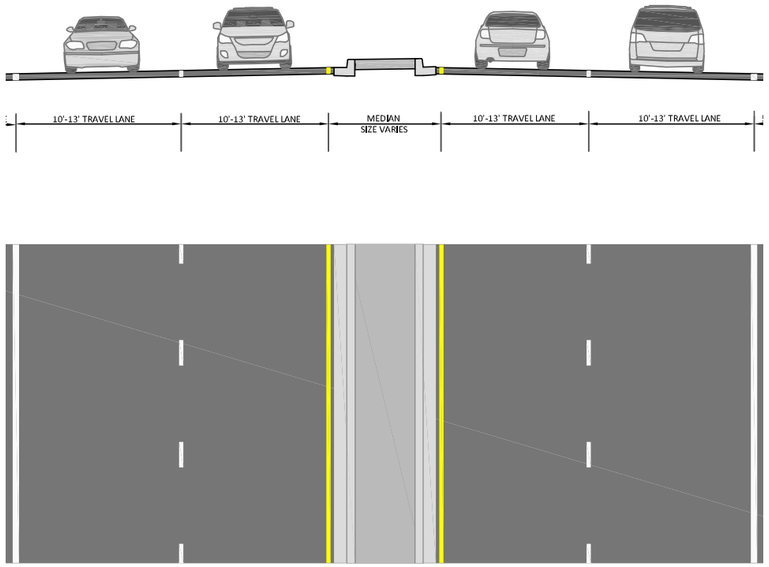


L.2 3 Lane Shared Lane Marking with Center-Turn-Lane Parking Both Sides

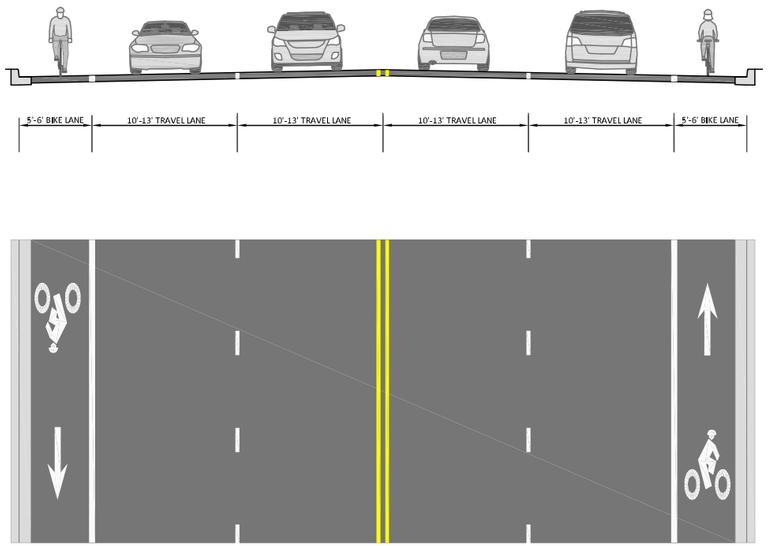




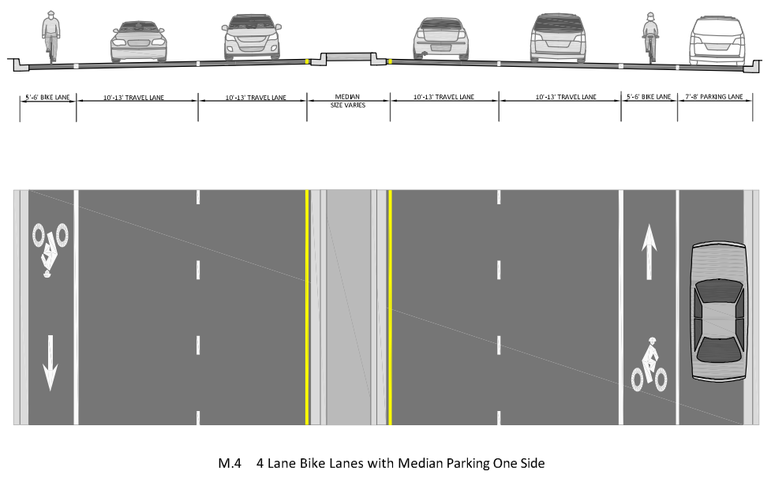
L.3 3 Lane Shared Lane Marking with Center-Turn-Lane Parking One Side



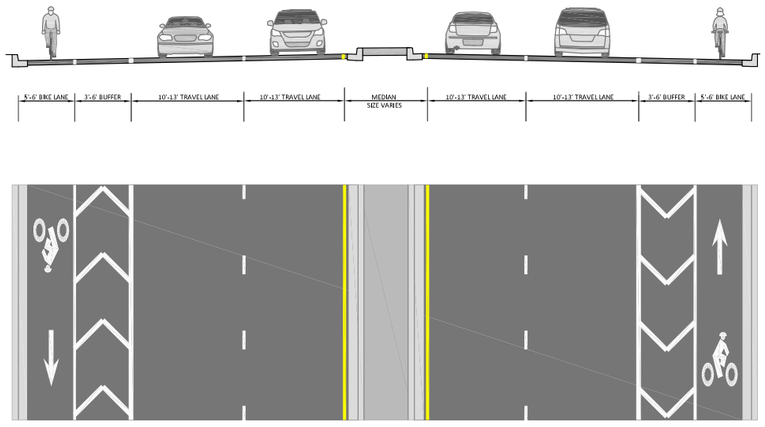
M.2 4 Lane Bike Lanes with Median Parking Both Sides



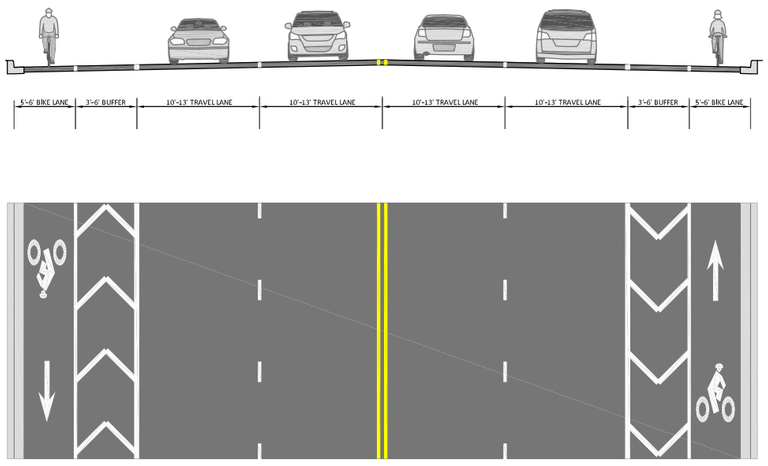
M.3 4 Lane Bike Lanes No Parking



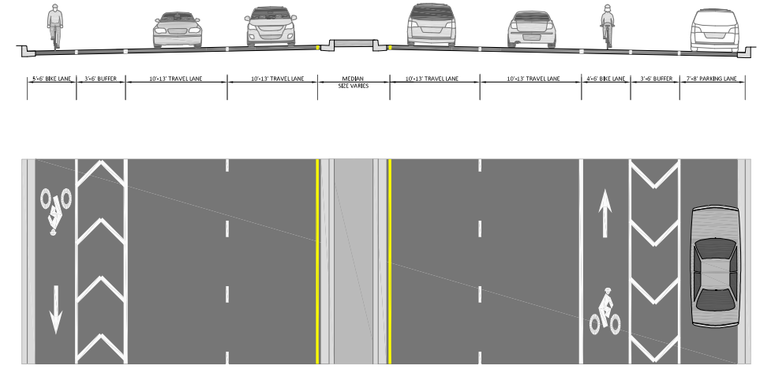
M.4 4 Lane Bike Lanes with Median Parking One Side



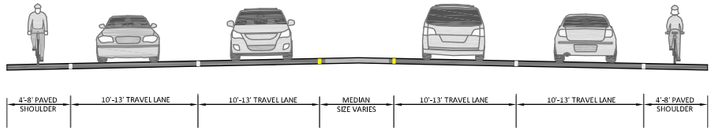
N.1 4 Lane Buffered Bike Lanes with Median No Parking

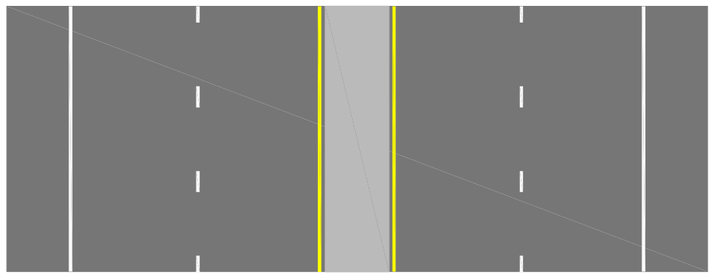


N.2 4 Lane Buffered Bike Lanes No Parking

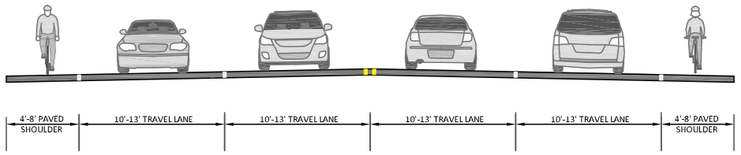


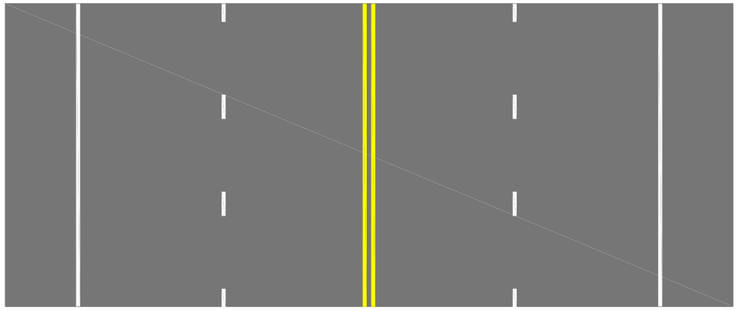
N.3 4 Lane Buffered Bike Lanes with Median Parking One Side



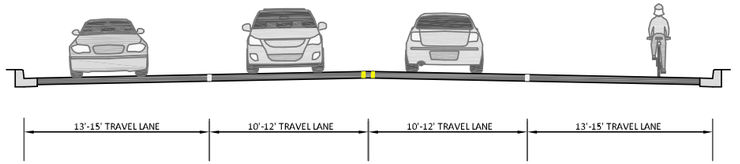


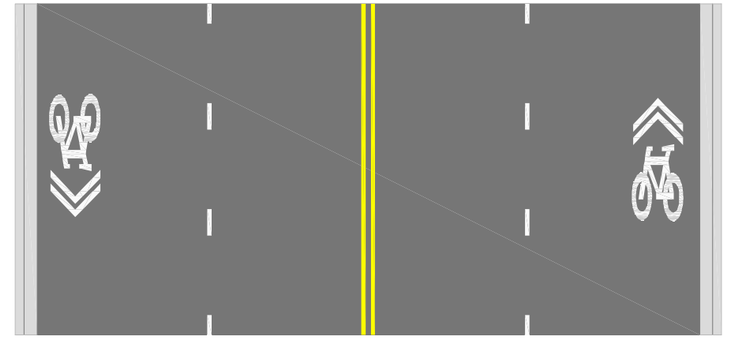
O.1 4 Lane Paved Shoulder with Median No Parking



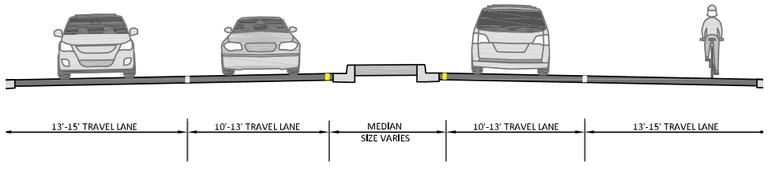


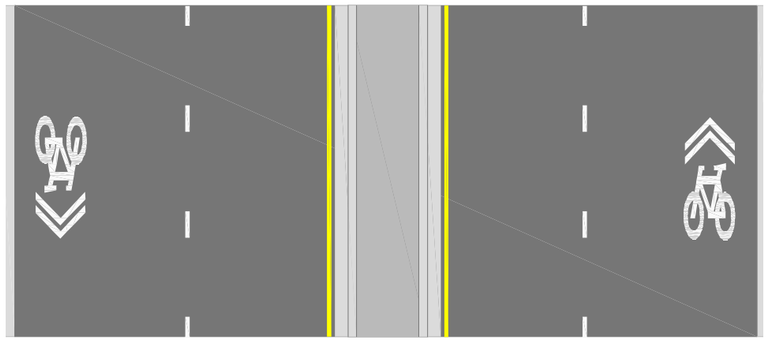
0.2 4 Lane Paved Shoulder No Parking



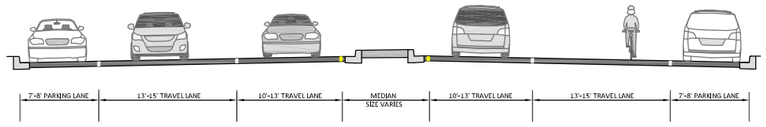


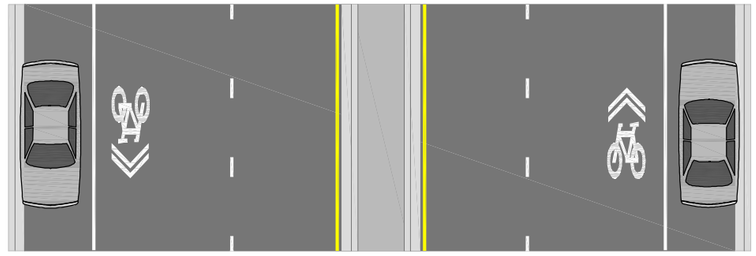
P.1 4 Lane Shared Lane Marking No Parking



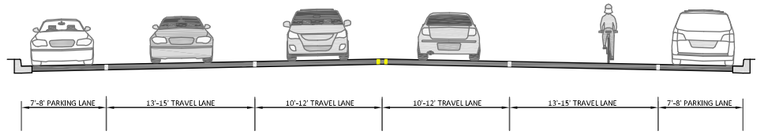


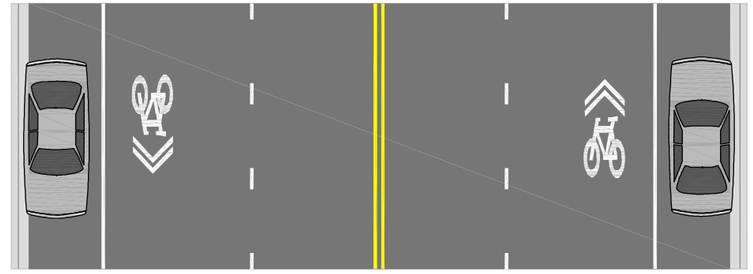
P.2 4 Lane Shared Lane Marking with Median No Parking



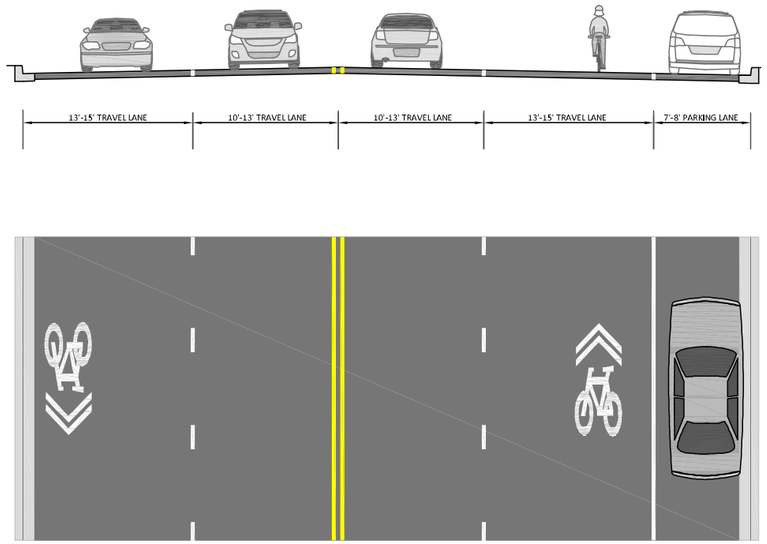


P.3 4 Lane Shared Lane Marking with Median Parking Both Sides

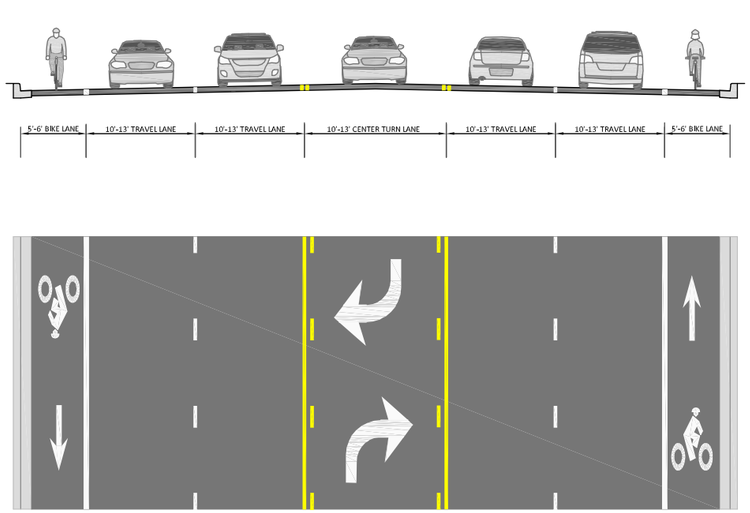




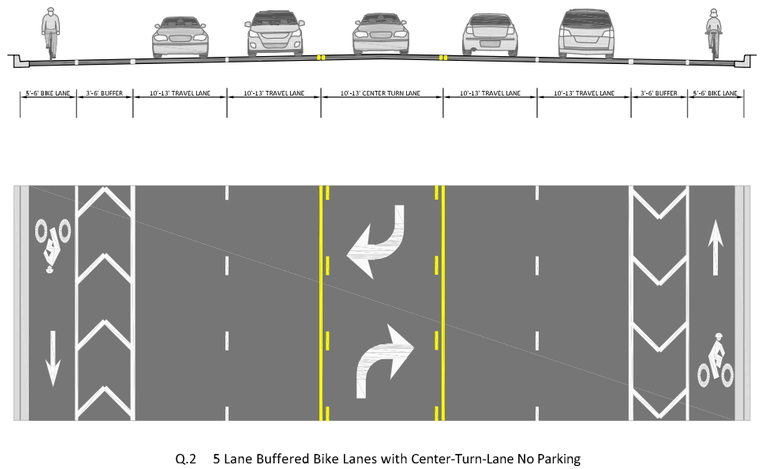
P.4 4 Lane Shared Lane Marking Parking Both Sides



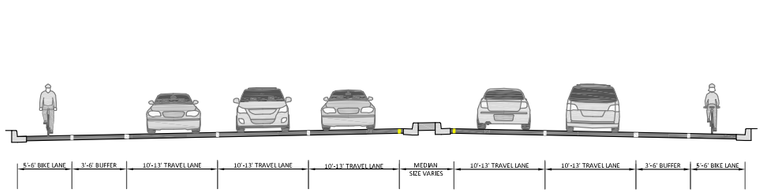
P.5 4 Lane Shared Lane Marking Parking One Side



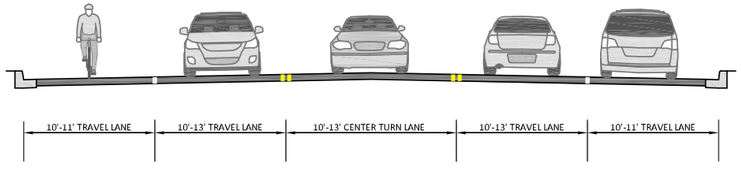
Q.1 5 Lane Bike Lanes with Center-Turn-Lane No Parking



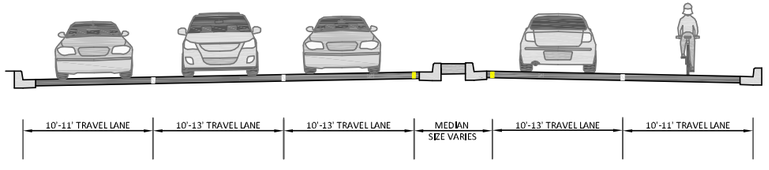
Q.2 5 Lane Buffered Bike Lanes with Center-Turn-Lane No Parking



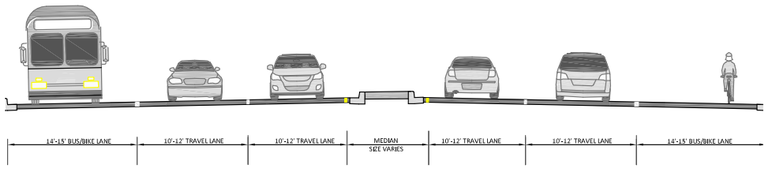
Q.3 5 Lane Buffered Bike Lanes with Median No Parking



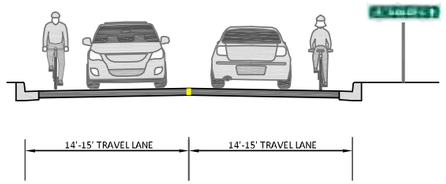
R.1 5 Lane Shared Lane Marking with Center-Turn-Lane No Parking

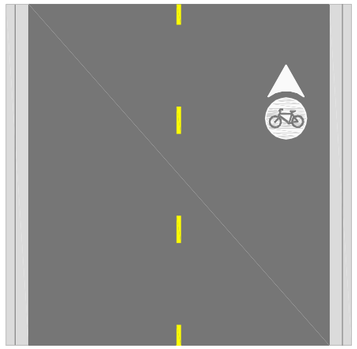


R.2 5 Lane Shared Lane Marking with Median No Parking

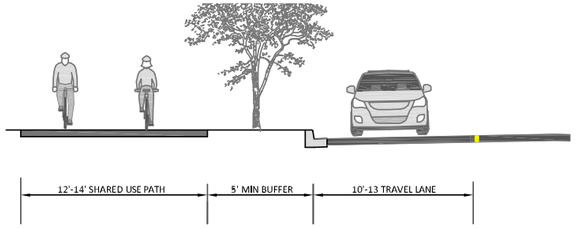


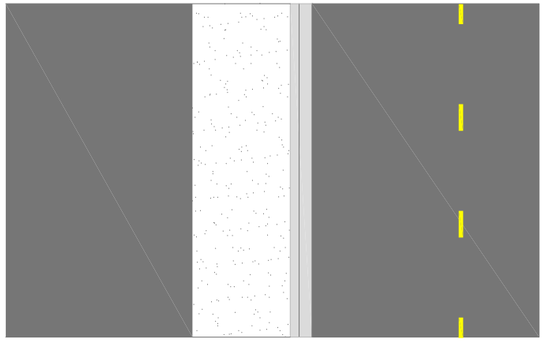
S.1 6 Lane Bus Bike Lanes with Median No Parking



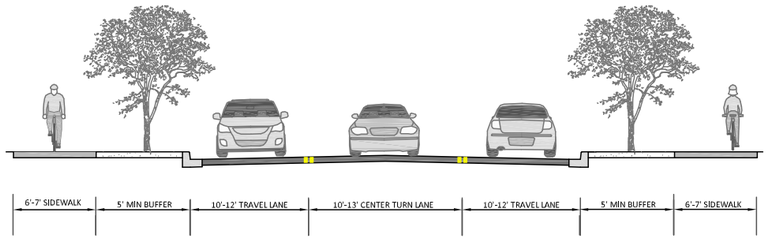


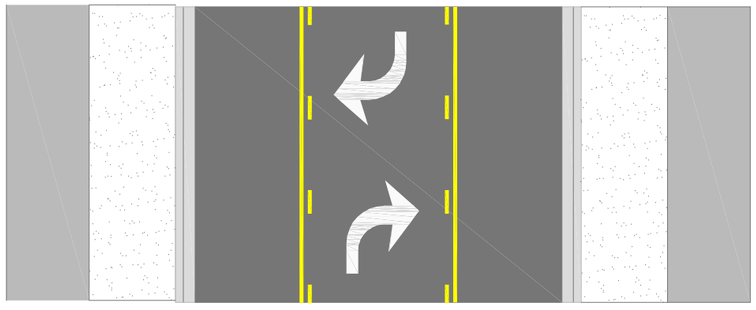
SRD Shared Roadway



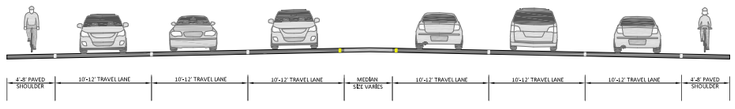


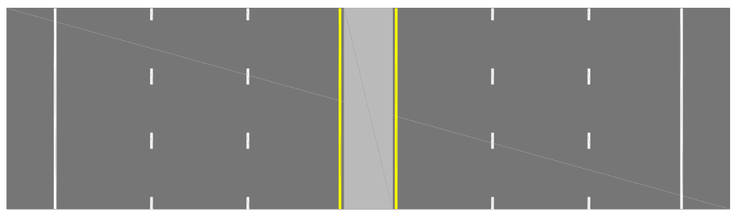
SUP SHARED USE PATH



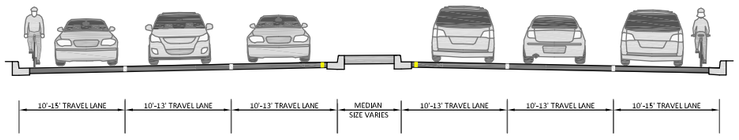


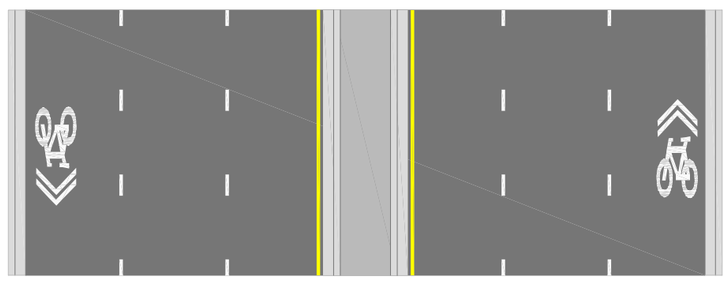
THREE TRAVEL LANES WITH SIDEWALK (BIKES PERMITTED)





T.1 6 Lane Paved Shoulder with Median No Parking





U.1 6 Lane Sharrows with Median No Parking

11. FUNDING

FEDERAL FUNDING

Bicycle and pedestrian transportation facility projects are broadly eligible for funding from almost all major federal-aid highway, transit, safety, and other programs. Bicycle and pedestrian projects must be principally for transportation, rather than recreation purposes and must be designed and located pursuant to the transportation plans required of states and Metropolitan Planning Organizations to be eligible for such funds.

The current national transportation bill, the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU), was enacted in August of 2005. SAFETEA-LU establishes all of the federal transportation funding initiatives. SAFETEA-LU expired in 2009, but is currently under extension. It is anticipated that a new transportation bill should be signed into law sometime between now and the year 2013. At that time, federal funding programs may change, and additional initiatives have the potential to be introduced. The U.S. DOT Secretary, Ray LaHood, has indicated that new initiatives for bicycle and pedestrian transportation funding may be introduced, and levels of funding in existing programs may establish higher allocations of funds towards bicycle and pedestrian projects.

The following is a list of current federal funding programs available for bicycle and pedestrian projects and programs.

Federal Highway Administration (administered by the State of Texas)

National Highway System (NHS) funds may be used to construct bicycle and pedestrian facilities within NHS corridors including projects within interstate rights-of-way. Shared use paths along interstate corridors are eligible for the use of NHS funds, as are bike lane, shoulder and sidewalk improvements on major arterial roads that are part of the NHS, and bicycle and/or pedestrian bridges and tunnels that cross NHS facilities. *Matching funds: 80 percent federal; 20 percent non-federal.*

Surface Transportation Program (STP) funds provide states with flexible funds which may be used for a wide variety of projects on any Federal-aid Highway including the NHS, bridges on any public road, and transit facilities. Bicycle and pedestrian improvements are eligible activities under the STP. This covers a wide variety of projects such as on-road facilities, off-road trails, sidewalks, crosswalks, bicycle and pedestrian signals, parking, and other ancillary facilities. The modification of sidewalks to comply with the requirements of the Americans with Disabilities Act is an eligible activity. STP-funded bicycle and pedestrian facilities may be located on local and collector roads which are not part of the Federal-aid Highway System. In addition, bicycle-related non-construction projects, such as maps, coordinator positions, and encouragement programs, are eligible for STP funds. *Matching funds*: *80 percent federal; 20 percent non-federal.*

Highway Safety Improvement Program (HSIP) funds are a 10% set-aside of a state's STP funds to carry out hazard elimination activities. HSIP funds can be used for pedestrian and bicycle safety improvements. States may obligate funds under the HSIP to carry out, 1) any highway safety improvement project on any public road or publicly owned bicycle or pedestrian pathway or trail; or 2) as provided under Flexible Funding for States With a Strategic Highway Safety Plan, other safety projects. *Matching funds*: *80 percent federal; 20 percent non-federal.*

Safe Routes to School Program (SRTS) provides funds to states to substantially improve the ability of primary and middle school students to walk and bicycle to school safely. Funds are apportioned to each state based on their relative share of enrollment in primary and middle schools. The program establishes two distinct types of funding opportunities: infrastructure projects (engineering improvements) and non-infrastructure related activities (such as education, enforcement, and encouragement programs). Infrastructure funds can be utilized for on and off-street bicycle and pedestrian facilities on any public right-of-way within a two-mile radius of an eligible school. 70 – 90% of funds are dedicated to infrastructure projects, with the remaining 10 – 30% of funds dedicated to non-infrastructure projects. Since 2005, over $16 million in SRTS grants in over 20 communities have been awarded to DFW region. *Matching funds: 100 percent federal.*

Transportation Enhancement (TE), formerly referred to as the Statewide Transportation Enhancement Program (STEP) in the state of Texas, program funds are a 10% set-aside of a state's STP funds. Projects must meet at least one of 12 eligible activities, of which three relate specifically to bicycle and pedestrian transportation: 1) provision of facilities for bicyclists and pedestrians, 2) provision of safety and educational activities for pedestrians and bicyclists, and 3) preservation of abandoned railroad corridors (including the conversion and use for pedestrian or bicycle trails). Projects using TE funds need not be located on the Federal-aid Highway System and may be non-construction activities. However, enhancement projects should relate to surface transportation and have typically been limited by states to construction projects, planning activities, and related publications rather than salaries and administrative costs. *Matching funds*: *80 percent federal; 20 percent non-federal.*

Congestion Mitigation and Air Quality Improvement Program (CMAQ) assists areas designated as non attainment or maintenance under the Clean Air Act Amendments of 1990 to achieve and maintain healthful levels of air quality by funding transportation projects and programs. Projects must be likely to contribute to the attainment of national ambient air quality standards (or the maintenance of such standards where this status has been reached) based on an emissions analysis. A major source of funding for many bicycle related construction and safety projects, CMAQ is administered locally by NCTCOG and its Transportation Improvement Program (TIP). Eligible activities include the construction of bicycle and pedestrian facilities, non-construction projects related to safe bicycle use, and many other projects and programs related to the implementation of bicycle and pedestrian transportation. *Matching funds*: *80 percent federal; 20 percent non-federal.*

Recreational Trails Program (RTP) provides funds to states to develop and maintain recreational trails and trail-related facilities for both non-motorized and motorized recreational trail uses. Each state administers its own program – Texas Parks and Wildlife administers the RTP for the State of Texas. Of the funds apportioned to a state, 30 percent must be used for motorized trail uses, 30 percent for non-motorized trail uses and 40 percent for diverse trail uses. Eligible activities include maintenance and restoration of existing trails, development and rehabilitation of trailside and trailhead facilities and trail linkages, purchase and lease of trail construction and maintenance equipment, construction of new trails (with restrictions for new trails on federal lands), acquisition of easements or property for trails, assessment of trail conditions for accessibility and maintenance, operation of educational programs to promote safety and environmental protection as those objectives relate to the use of recreational trails. *Matching funds*: *80 percent federal; 20 percent non-federal.*

Highway Bridge Replacement and Rehabilitation Program (HBP) or (BRR) funds the replacement or rehabilitation of highway bridges. If a highway bridge deck is being replaced, and bicyclists are permitted at each end, then the bridge project must include safe bicycle accommodations (at reasonable cost). *Matching funds*: *80 percent federal; 20 percent non-federal.*

Metropolitan planning funds (PLA) are a one percent set-aside of the funds authorized for the IM, NHS, STP, CMAQ, and bridge programs that are available only for metropolitan transportation planning. The funds are allocated to each state based on the population of urbanized areas in each State. Funds may be used for bicycle and pedestrian related plans that are part of the metropolitan transportation planning process. *Matching funds*: *80 percent federal; 20 percent non-federal.*

Federal Lands Highways Program (FLH) provides funding for a coordinated program of public roads and transit facilities serving federal and Indian lands. Provision for pedestrians and bicycles are eligible activities in conjunction with projects on each of the classes of Federal Lands Highways: Forest Highways, Indian Reservation Roads, Park Roads and Parkways, Refuge Roads, and Public Lands Highways. Project selection is determined by the appropriate Federal Land Agency or tribal government. *Matching funds*: *100 percent federal*

National Scenic Byways Program (BYW) recognizes roads having

outstanding scenic, historic, cultural, natural, recreational and archaeological qualities by designating them as National Scenic Byways or All-American Roads. Funds may be spent on a variety of activities including "construction along a scenic byway of a facility for pedestrians and bicyclists, rest area, turnout, highway shoulder improvement Passing lane, overlook, or interpretive facility." Projects must be either associated with a National Scenic Byway, All-American Road, or a State Scenic Byway. *Matching funds*: *80 percent federal; 20 percent non-federal.*

State and Community Highway Safety Grant Program (Section 402) supports state highway safety programs designed to reduce traffic crashes and resulting deaths, injuries, and property damage. States are eligible for these funds (known as Section 402 funds) by submitting a Performance Plan, with goals and performance measures, and a Highway Safety Plan describing actions to achieve the Performance Plan. Grant funds are provided to states each year according to a statutory formula based on population and road mileage. Funds may be used for a wide variety of highway safety activities and programs including those that improve pedestrian and bicycle safety. States have funded a wide variety of enforcement and educational activities with Section 402 funds including safety brochures; "Share the Road" materials; bicycle training courses for children, adults, and police departments; training courses for traffic engineers; helmet promotions; and safety-related events. *Matching funds*: *80 percent federal; 20 percent non-federal.*

FEDERAL TRANSIT ADMINISTRATION

There are a number of Federal Transit Administration (FTA) sponsored programs that allow for pedestrian and bicycle funding. **Urbanized Area Formula Grants, Capital Investment Grants and Loans**, and **Formula Program for Other Urbanized Area** transit funds allow funds to be used for improving bicycle and pedestrian access to transit facilities and vehicles. At least one percent of Urbanized Area Formula funds appropriated to areas with more than 200,000 population must be used for transit enhancement activities, which includes nine eligible activities such as pedestrian access and walkways, and bicycle access, including bicycle storage facilities and installing equipment transporting bicycles on mass transportation vehicles. NCTCOG, in collaboration with transit operators, has the responsibility to determine how the funds in this category are allocated to transit projects, and to ensure that one percent of the urbanized area's apportionment (as opposed to one percent of each transit agency's funds) is expended on projects and project elements that qualify as enhancements. *Matching funds: 80 – 95 percent federal; 5 – 20 percent non-federal.*

Job Access and Reverse Commute (JARC) grants program provides competitive grants to local governments and non-profit organizations to develop transportation services to connect welfare recipients and low-income persons to employment and support services. Programs, which must be approved by a transit agency, may include activities that encourage bicycling. Project selection is made by NCTCOG in the DFW region. *Matching funds*: *50 percent federal*

ADDITIONAL FEDERAL FUNDING

Transportation and Community and System Preservation (TCSP) Program is a competitive grant program designed to support projects that show how transportation projects and plans, community development, and preservation activities can be integrated to create communities with a higher quality of life. The annual grant program is administered by the FHWA, in partnership with the FTA and Environmental Protection Agency (EPA), and may be used to fund state, MPO, or local government agencies. Bicycling, walking, and traffic calming projects are eligible activities and may well feature as an integral part of many proposed projects that address larger land use and transportation issues. *Matching funds: 80 percent federal; 20 percent non-federal.*

Interstate Maintenance (IM) funding is targeted at maintaining and improving the interstate highway system. IM funds may be used for resurfacing, restoration, rehabilitation, and reconstruction (4R) projects, including pedestrian and bicycle facilities that are incorporated in the design of new interchanges and overcrossings. *Matching funds*: *90 percent federal; 10 percent non-federal.*

High Priority Projects (HPP) funds are designated for specific projects identified in SAFETEA-LU by Congress. The funds designated for the project in this program are available only for these HPP projects.

Statewide Planning funds are a two percent set-aside of the funds states receive for the IM, NHS, STP, CMAQ and Bridge programs that are available only for planning, research, and technology transfer activities. This list includes the Statewide Long Range Transportation Plan and Transportation Improvement Program, and may include bicycle- and pedestrian-related plans, research, and technology transfer activities. *Matching funds*: *80 percent federal; 20 percent non-federal.*

Land and Water Conservation Fund (LWCF) program is administered by state agencies in cooperation with the National Park Service. Program funds are intended for the acquisition and development of outdoor recreation areas; trails are one priority of this program. *Matching funds*: *50 percent federal; 50 percent non-federal.*

Emergency Relief funds are available for the reconstruction of highways, roads, and trails in any part of the United States that the Secretary finds has suffered serious damage as a result of natural disaster over a wide area (e.g. flood, hurricane, tidal wave, earthquake) or catastrophic failure from any external cause. The restoration of bicycle and pedestrian facilities, including shared-use paths, is an eligible activity for Emergency Relief funds.

U.S. Department of Housing and Urban Development (HUD) **Community Development Block Grants** (CDBG) program provides annual grants on a formula basis to entitled cities and counties to develop viable urban communities by providing decent housing and a suitable living environment, and by expanding economic opportunities, principally for low- and moderate-income persons. Eligible activities include the construction of public facilities and improvements, such as water and sewer facilities, streets, neighborhood centers, and the conversion of school buildings for eligible purposes. In the DFW region, the cities of Allen, Arlington, Carrollton, Dallas, Denton, Euless, Frisco, Fort Wort, Garland, Grand Prairie, Irving, Lewisville, McKinney, Mesquite, North Richland Hills, Plano, Rowlett, and the counties of Dallas and Tarrant are designated entitlement communities and have the opportunity to use their allocated CDBG funds to fund sidewalk and bikeway improvements within their designated communities. *No matching funds required, but leverage funds, i.e., funding from other federal and non-federal soures and in-kind are desirable.*

The **Urban and Community Forestry** (UCF) program of the U.S. Forest Service and administered through the U.S. Department of Agriculture, UCF provides technical, financial, research and educational services to local government, non-profit organizations community groups, educational institutions, and tribal governments.

Though not a source of funding, the **Rivers, Trails, and Conservation Assistance Program** (RTCA) is a technical assistance arm of the National Park Service dedicated to helping local groups and communities preserve and develop open space, trails and greenways. RTCA is an important resource center for many trail builders in urban, rural and suburban areas. Instead of money, RTCA supplies a staff person with extensive experience in community-based conservation to work with a local group on a project.

Though not a source of funding, the **National Recreation Trails** (NRT) designation from the Secretary of the Interior recognizes exemplary existing trails of local or regional significance. NRT designation provides benefits, including access to technical assistance from NRT partners and listing in a database of National Recreation Trails. In addition, some potential support sources will take NRT designation into account when making funding decisions. The NRT program is open to applications.

The following table is taken from the FHWA website (last updated in October, 2008) and summarizes the federal funding opportunities for bicycle and pedestrian facilities.

	NHS	STP	HSIP	SRTS	TEA	CMAQ	RTP	FTA	TE	BRI	402	PLA	TCSP	JOBS	FLH	BYW
Bicycle and pedestrian plan		*				*						*	*			
Bicycle lanes on roadway	*	*	*	*	*	*		*	*	*					*	*
Paved shoulders	*	*	*	*	*	*				*					*	*
Signed bike route	*	*		*	*	*									*	*
Shared use path/trail	*	*		*	*	*	*			*					*	*
Single track hike/bike trail							*									
Spot improvement program		*	*	*	*	*										
Maps		*		*		*					*					
Bike racks on buses		*			*	*		*	*							
Bicycle parking facilities		*		*	*	*		*	*							*
Trail/highway intersection	*	*	*	*	*	*	*								*	*
Bicycle storage/ service center		*		*	*	*		*	*				*	*		
Sidewalks, new or retrofit	*	*	*	*	*	*		*	*	*					*	*
Crosswalks, new or retrofit	*	*	*	*	*	*		*	*						*	*
Signal improvements	*	*	*	*	*	*										
Curb cuts and ramps	*	*	*	*	*	*										
Traffic calming		*	*	*									*			
Coordinator position		*		*		*							*			
Safety/education position		*		*		*					*					
Police patrol		*		*							*					
Helmet promotion		*		*	*						*					
Safety brochure/book		*		*	*	*	*				*					
Training		*		*	*	*	*				*					

KEY

NHS National Highway System
STP Surface Transportation Program
HSIP Highway Safety Improvement Program
SRTS Safe Routes to School Program
TEA Transportation Enhancement Activities
CMAQ Congestion Mitigation/Air Quality Program
RTP Recreational Trails Program
FTA Federal Transit Capital, Urban & Rural Funds
TE Transit Enhancements
BRI Bridge
402 State and Community Traffic Safety Program
PLA State/Metropolitan Planning Funds
TCSP Transportation and Community and System Preservation Pilot Program
JOBS Access to Jobs/Reverse Commute Program
FLH Federal Lands Highway Program
BYW Scenic Byways

Figure 44. Federal funding opportunities for bicycle and pedestrian facilities, (2008, October). Retrieved from http://www.dot.gov

12. DALLAS BIKE PLAN RECOMMENDED COMPLETE STREETS INITIATIVE INTEGRATED POLICIES AND IMPLEMENTATION MEASURES

The following bicycle policies should be addressed in the Complete Streets Design Manual being developed by the City of Dallas in 2011.

The *forward*Dallas! Comprehensive Plan provides some very specific policy direction for promoting bicycling. While these policies are consistent with this Plan, they will be specifically addressed and coordinated with all transportation modes under the Complete Streets Design Manual.

Policy 4.2.2.1 Promote a network of on-street and off-street walking and biking paths.

COMPLETE STREETS IMPLEMENTATION MEASURES

4.2.2.2 Regularly update the bike Plan to provide for the enhanced bike access in mixed-use building blocks and explore ways to better integrate the bike Plan with the Thoroughfare Plan.

4.2.2.3 Use context sensitive design standards for public street improvements to ensure safe and convenient bike and pedestrian movement.

4.2.2.4 Incorporate bike and pedestrian amenities into public facilities and rights-of-way, and stream corridors, including wider sidewalks, trees, pedestrian lights, bike racks and street signs designed with reflective materials. Use a combination of local, state, federal and private funding to install such amenities.

4.2.2.5 Revise plat regulations to encourage development to incorporate convenient and reasonable direct pedestrian and bike routes from business to local destinations and nearby residential areas.

4.2.2.6 Create new zoning districts and amend existing districts to encourage new projects to provide enhanced pedestrian and bike amenities such as wider sidewalks, trees, pedestrian lighting, safe bike routes and bike racks.

4.2.2.7 Conduct area plans to identify and implement targeted thoroughfare amendments to encourage distribution of traffic volumes in situations where impacts on residential streets can be minimized, in order to reduce congestion and increase bike and pedestrian safety. Area plans should identify locations to encourage the use of bike and pedestrian-friendly options.[1]

1 *forward*Dallas! Policy Plan, 2006 (II-4-20)

CONSTRUCTION, PHYSICAL NETWORK AND MAINTENANCE

End 14 foot wide outside lane policy and replace it with new, designated on-street bicycle facility types and way-finding signage.
The current city and state policy is to construct 14 foot wide outside curb lanes when constructing or re-constructing a roadway. While this has the benefit of providing a wide lane for bicyclists, it does not provide enough space to install other types of bicycle facilities such as bike lanes. For example, adding a bike lane to a 15 foot wide lane results in a 10 foot travel lane and a 5 foot bike lane. While acceptable in some situations, a 10 foot lane may be too narrow for transit and truck routes.

The proposed policy would require roadways to be constructed to include the new, designated on-street bicycle facility type as called for in the 2011 Dallas Bike Plan. Streets not in the Plan will still need to accommodate bicyclists and should follow the new Complete Streets Design Manual once it is developed and adopted. In all cases where streets being constructed are not part of the Plan, the type of facility installed should be context sensitive which means that the facility must be appropriate for the street; fitting in with other modes, the neighborhood and connecting to other facilities.

In addition to adopting this new policy, the role of the City will be to work with TxDOT to formally adopt this policy for all of their projects within the City of Dallas. Additionally, NCTCOG can play an important role by requiring all projects to include appropriate bicycle facilities when it makes funding recommendations.

Implement routine accommodation of bicycle facilities in the Dallas Bikeway System Network, wherever possible, by integrating the practice with City Streets Department and Transportation Operations maintenance plans and budgets.
The City should try to include bicycle facilities as part of wherever possible and more cost-effective roadway re-construction, pavement management and re-striping projects. This will require close consultation and involvement of relevant City departments with the City Bicycle Planning Program. Each project that involves restriping should have a pre-planning meeting with the City bicycle planning program where the project is reviewed for compliance with the Dallas Bikeway System Network.

This may require additional budget for materials and labor (cost of materials is far higher in bids for bike lanes versus, buffered bike lanes).

Establish a comprehensive policy on bicycle parking at DART light rail/transit stations and at TRE (Trinity Railway Express) stations.
Consistent with the trend in other US cities over the past twenty-five years, an increasing linkage has developed between the City of Dallas, DART and active bicyclists. Strengthening this connection between bicycling and transit will increase the utility of both transportation modes in Dallas.

There is significant potential for increasing the number of passengers accessing transit by bicycle. Bicyclists will typically ride three to five miles to access transit. In Denmark and the Netherlands, bicycles comprise up to 40% of transit access trips at some locations.

As on-street bicycle facilities leading to stations are completed, demand for bicycle parking at the stations can be expected to significantly increase. This includes providing adequate bicycle parking racks and lock-up facilities[2] at existing stations and reserving adequate space for bicycle parking facilities at future stations.

The Association of Pedestrian and Bicycle Professionals (APBP) has an excellent publication on bicycle parking that should be used to develop policies on bicycle parking at transit stations. Additionally, the Federal Highway Administration has a publication entitled *Pedestrian Safety Guide for Transit Agencies* that, while focused on pedestrians, offers valuable guidance that is also applicable to the development of policies for bicyclists at transit stations.

A comprehensive policy on bicycle parking at transit stations should include the following:

- Number and type of bicycle racks and higher security lock up facilities needed,
- Space requirements for accommodating bicycle parking,
- Security issues to consider when locating bicycle parking racks,
- Ways to minimize conflicts with pedestrians, and
- Lighting requirements.

Bicycle parking needs should also be considered at heavily used bus stops. This will require a separate study to determine if additional bicycle parking is needed at a specific bus stop.

As new transit stations are developed in the future, bicycle parking demand should be evaluated to determine the space needed for bicycle parking facilities. Space for bicycle parking should be included in station designs from the onset of a project.

Establishing these policies will require an interagency agreement between DART and the City. The best strategy will be for the City to meet with DART, explain the desired outcomes with regard to bicycle parking at transit stations, and then work with them to develop an interagency agreement. The City may consider partnering with other DART member cities and the NCTCOG to facilitate coordination with DART.

2 See-through building with bike racks inside. Requires key card to enter - once inside, personal locks secure bikes to traditional racks.

Establish a policy and program for the removal of the existing signed route system.
Dallas currently has about 365 miles of signed, on-street bicycle routes. However, they are out of date and no longer consistent with the 2009 *Manual on Uniform Traffic Control Devices* which provides new guidance on way-finding signing. As facilities recommended in the 2011 Dallas Bike Plan are installed, there will be a need for a policy and program for removing old signs and installing new ones.

In developing a new policy and program guidelines, several factors should be kept in mind:

- Designing, fabricating, locating and installing new way-finding signs in urban areas will cost between ten and twenty thousand dollars per mile.
- Existing signs provide valuable way-finding guidance for bicyclists.
- Removing all the signs at once will likely create gaps in the system that will last for years as the bikeway network is installed over a ten year period.
- Some confusion will occur if old signs are left in place on some routes while new ones are installed along with the installation of new bicycle facilities.

There are at least three models to consider when establishing policies and programs for the replacement of existing signs:

- As facilities recommended in the 2011 Dallas Bike Plan are installed, existing way-finding signs could be removed and new ones installed. In some cases they will be the same routes, in many cases new routes.
- All existing signs could be immediately removed and new signs installed in conjunction with new facilities.
- Immediately install new signs on all on-street routes in the network that will have shared lane markings. This will allow for the removal of much of the existing signed system. Then, as other facilities are installed, the remaining existing signs could be removed.

Adequate budget for new signs will be required to support whatever policy approach is pursued.

Establish a bicycle facility maintenance program including annual maintenance and spot maintenance programs.
Bicycle facility maintenance requires clear maintenance responsibilities. This will require written maintenance protocols that are budgeted and funded. Figure 45 provides general guidance on the frequency of on-street maintenance activities, though maintenance needs will vary for different types of facilities and different locations.

Action	Spot Maintenance	Routine Maintenance
Action 4.4.1: Sweep bicycle lanes and other on-road bicycle facilities	Perform spot sweeping if debris collects in bicycle lanes and cycle tracks after major rain storms.	• Sweep bicycle lanes two times per year. • Heavily used facilities should be given consideration for higher frequency sweeping. • If adjacent travel lanes are swept, sweepers should reach as close to the curb as possible and make sure material is not deposited where bicyclists ride.
Action 4.4.2: Repair and replace pavement	• Fill potholes. • Remove surface irregularities.	• Resurface bicycle facilities as part of street repaving projects. • Include bicycle facilities as a factor in determining the City repaving schedule.
Action 4.4.3: Drainage improvements	• Unplug individual drains. • Update/modify existing grates.	• Include bicycle facilities as a factor in determining the City schedule for repairing/ upgrading drains.
Action 4.4.4: Replace signs	• Replace missing or damaged warning, regulatory or way-finding signs.	• Replace signs based on manufacturer recommendations related to reflectivity and readability (every 15 to 20 years).
Action 4.4.5: Ensure bicycle detection in traffic signals	• Respond to citizen complaints about loops that do not detect bikes.	• Test sensitivity of inductive loops at each approach to all intersections in the city with actuated signals including left-turn lanes, to ensure that bicycles can be detected.
Action 4.4.6: Provide adequate lighting	• Replace burned out and broken lighting fixtures.	• Lighting is evaluated on a systematic basis.

Figure 45. General guidance on the frequency of on-street maintenance activities

In addition to maintenance activities outlined in Figure 45 there are spot maintenance problems that should be addressed. Areas to consider include:

Filling seams between concrete pavement sections of streets:
There are many streets in the City where the concrete seam is located at or near the most appropriate place for bicyclists to ride (typically on the right side of the outside travel lane near the on-street parking). This can create a problem, particularly for bicyclists with narrow, road bike tires. In the short-term these seams should be filled on the most important streets for bicycle connectivity. As streets are repaved in the future, seams should be located away from where bicyclists would typically ride.

Physical improvements to improve railroad crossings: Roadways and multi-purpose trails should be designed to allow bicyclists to cross railroad lines perpendicular to the rails (or as close to perpendicular as possible). This may include adding pavement, modifying striping and markings, and posting warning signs. All new roadways and rail lines should be designed to provide bicyclists with safe rail crossings.

Reduce problems caused by steel plates:
Whenever steel plates are placed in the roadway, they should be shimmed and textured with a no-skid surface to reduce slipping hazards. The locations of these plates should also be highlighted by pavement marking so that bicyclists can prepare to cross them. City inspectors should monitor the installation of steel plates by both City work crews and contractors.

Provide economic incentives for employer/retailer provision of end-of-trip facilities and off-street bicycle connections to the bikeway system as part of development.
The rates of bicycle parking based directly on unit count, the proportion of building square footage and building occupancy are best indicators of demand. Additionally, these units of measurement are commonly used during plan review and can therefore be easily integrated into the planning process.

In addition to required parking, consideration should be given to providing incentives for providing additional bicycle parking at locations where high use is expected, and for the provision of showers and lockers.

A common incentive is to trade required motor vehicle parking for other end of trip facilities such as showers and lockers and off-street connections to the bikeway system. The unit cost for providing motor vehicle parking in parking garages is typically between twenty-five and thirty thousand dollars. Trading just a few required parking spaces for end of trip facilities can be a very effective incentive if it saves money for the developer.

Another common incentive is to allow additional square footage if end of trip facilities are provided. At a minimum, the space required for showers and lockers should not count against total square footage allowed. In the case of mixed-use developments, it may be possible to allow additional housing units if end of trip facilities are provided.

Creating these or other incentives will require changes to the zoning code. The best strategy will be for the City to meet with the development community, explain the desired outcomes with regard to end of trip facilities, and then ask them what incentives will be most effective. Once all parties agree, it will be much easier to make the necessary zoning changes.

LAWS AND REGULATIONS

Action 5.8: Establish state policy on inclusion of bicycle facilities on new and existing TxDOT facilities.
Previous actions 5.5 mentioned, on March 15, 2010, Secretary of the United States Department of Transportation Ray LaHood released a signed policy statement summarizing key federal statutes and regulations regarding walking and bicycling. In it, he reiterated the DOT policy to "incorporate safe and convenient walking and bicycling facilities into transportation projects. Every transportation agency, including DOT, has the responsibility to improve conditions and opportunities for walking and bicycling and to integrate walking and bicycling into their transportation system."[3] He goes on to cite federal statutes that require state and Metropolitan Planning Organizations "to integrate walking and bicycling facilities and programs in their transportation plans to ensure the operability of an intermodal transportation system."[4]

The NCTCOG, with the support of the City, should work with TxDOT to coordinate local efforts to implement this federal directive at the state and regional levels. NCTCOG is also in the position to involve other jurisdictions in the discussion.

Action 5.9: Limits on no sidewalk use for bicyclists.
Limiting bicycle use on sidewalks is always controversial. However, many cities have some restrictions on sidewalk bicycling, especially in Central Business Districts (CBD) where pedestrian traffic is high and safety is a major concern. As bicycle use increases in Dallas, there may be increased interest in regulating bicycles on sidewalks. As the discussion moves forward, there are several things to consider:

- Network connectivity: sidewalk bikeways at spot locations are necessary to create a connected bikeway network. While they could be eliminated over time as streets and bridges are rebuilt and replaced, bicyclists should not be banned from using these sidewalks if there are no other viable, on-street alternatives for novice and children bicyclists.
- Sidewalk safety: There are legitimate concerns about bicyclists' safety on some sidewalk bikeways. Sight triangles at driveway crossings may be limited. Many sidewalks have a design speed of three to five miles per hour. Where sight lines are limited, consideration should be given to posting advisory speed limits for bicyclists at spot locations as needed.
- Children: Often, the sidewalk is the only viable option for small children. Sidewalks can be a good option for children if they do not exceed the design speed of the facility.
- One-way streets: Accessing destinations on one-way streets can pose a problem for bicyclists who may be tempted to ride the wrong-way if they are not allowed to ride on the sidewalk. Wrong-way riding is a leading cause of bicycle/motor vehicle crashes.
- Pedestrian safety: There are legitimate concerns about pedestrian safety at locations where there are high pedestrian volumes such as neighborhood business districts. In most cases, problems are caused when there is a large speed differential between pedestrians and bicyclists (i.e. bicyclists going too fast). While a cause for concern, the actual number of reported bicycle/pedestrian crashes and injuries is extremely low in this environment, especially when compared to other types of crashes involving motor vehicles.

Recommendations: Consider posting advisory speed limits on a case by case basis, especially at locations where sidewalk bikeways provide important links in the bikeway network. Banning bicycles should be considered in neighborhood commercial areas on a case by case basis, and only when there is a demonstrated problem and other measures such as advisory signing has not proven to be effective.

3 United States Department of Transportation Policy Statement on Bicycle and pedestrian Accommodation Regulations and Recommendations; Signed on March 11, 2010 and announced March 15, 2010 (1)

4 United States Department of Transportation Policy Statement on Bicycle and pedestrian Accommodation Regulations and Recommendations; Signed on March 11, 2010 and announced March 15, 2010 (3)