Appendix 2: Facility Design Guidelines

Introduction

This appendix is intended to be used as a resource to determine appropriate treatments for bicycle facilities in the City of Spokane Valley. It is organized in two sections:

1. Toolbox. The toolbox describes treatment options and criteria to determine whether the treatment is best suited for a particular facility.
2. Cross Sections. The second section illustrates several existing cross sections of roadways in the City recommended as bicycle facilities, and shows how those cross sections could be adjusted to accommodate different bicycle facilities.

Toolbox

The toolbox provides design guidelines and criteria for seven general types of bicycle treatments:

- Bicycle Friendly Routes (Table 1)
- Bicycle Lanes (Table 2)
- Cycle Tracks (Table 3)
- Bicycle Intersection Treatments (Table 4)
- Mid-Block Crossing Treatments (Table 5)
- Wayfinding (Table 6)
- Shared Use Bicycle Paths (Table 7)

These treatments are not exclusive of one another, and are generally used in combination. For example, a bicycle friendly route or bicycle lane could also include wayfinding and intersection treatments.

Resources:

The following resources are referenced in the toolbox developed for the City of Spokane Valley Bicycle Master Program (BPMP):

- National Association of City Transportation Officials (NACTO) Urban Bikeway Design Guide. Website: http://nacto.org/cities-for-cycling/design-guide/
- Fundamentals of Bicycle Boulevard Planning and Design. Prepared by Alta Planning and Design, IBPI, and Portland State University. July 2009.
- American Association of State Highway and Transportation Officials (AASHTO) Bicycle Guide, 1999 (a draft 2010 update is currently under review and waiting adoption)
- Manual on Uniform Traffic Control Devices (MUTCD), 2009
- National Cooperative Highway Research Program (NCHRP) Report 562. Improving Pedestrian Safety at Unsignalized Crossings. 2006
- Minneapolis Bicycle Facility Manual. May 2010.
- Safety Effects of Marked vs. Unmarked Crosswalks at Uncontrolled Locations. November 2000. Zegeer, Charles, et al.

Unless otherwise noted, photos used in this toolbox were provided by a contracted engineering consultant.

Table 1: Bicycle Friendly Routes

Bicycle Friendly Routes

Description[1]:
Roadways with low speed and low volume that have been optimized for cycling. The treatments recommended for bicycle friendly routes improve through movements for bicyclists and other non-motorized modes, while discouraging through movements by vehicles.

Criteria:

- Streets with traffic volumes less than 3,000 per day, although less than 1,500 is preferred
- Streets where the posted traffic speed is 25 mph or less
- Two lane roadways (centerline is optional)

Typical Applications

a. Shared Lane Markings (or "Sharrows")
Shared lane markings are used to indicate that a facility is intended for shared bicycle and vehicle use. The markings raise awareness to motor vehicle drivers of the presence of bicyclists on a facility and indicate the proper location for bicyclists in the lane (for example, placing sharrows with adequate space for bicyclist to avoid being doored by on-street parking).


Estimated Cost Range: $100 to $250 per marking depending on materials

b. Traffic Calming
Traffic calming techniques are used to reduce the speed of motor vehicles on roadways. Techniques may include: traffic islands (pictured on the left and right respectively), curb extensions, lower speed limit and painted or patterned pavement


Estimated Cost Range: $2,000 to $15,000 plus landscaping for traffic islands

[1] Fundamentals of Bicycle Friendly Route Planning and Design. Published by IBPI, Alta Planning and Design, and Portland State University. July 2009.

Bicycle Friendly Routes

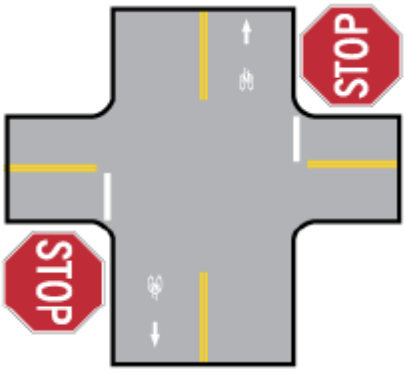
c. Traffic Reduction / Diverters

Traffic reduction is used to maintain or reduce motor vehicle volumes on designated bicycle friendly routes. Applications may include restricted vehicle movements at intersections by means of diverters, barriers, or signed/marked restrictions. (Also see diverters in the intersection treatments table).

Estimated Cost Range: $1,000 to $20,000 (depends on design and materials)

d. Prioritized Bicycle Movement

Prioritizing bicycle movement can be accomplished by stopping motor vehicles at intersections on a designated bicycle friendly route.



Source: Fundamentals of Bicycle Friendly Route Planning and Design, page 22.

Estimated Cost Range: $200 to $1,500 per intersection (depending whether an engineering study is required)

Table 2: Bicycle Lanes

Bicycle Lanes

Description:
Bicycle lanes designate an exclusive part of the roadway to be used by bicyclists only. A Bicycle lane is typically located between the right most traffic lane and the curb or on street parking area.

Criteria:

- Streets where traffic volumes are more than 3,000 per day
- Streets where the posted traffic speed is 25 mph or greater
- Streets with truck traffic

Typical Applications – Bicycle Lane Types

a. Standard Bicycle Lane

Recommended bicycle lane width is between four feet and six feet.[2] A standard bicycle lane is placed to the right of vehicular traffic in the same direction. From left to right, the pictures below show a bicycle lane offset from the curb, a bicycle lane adjacent to on-street parking, and a bicycle lane adjacent to the curb.



Estimated Cost Range: 4,000 to $6,000 per mile

[2] National Association of City Transportation Officials. http://nacto.org/cities-for-cycling/design-guide/bike-lanes/

Bicycle Lanes

b. Climbing Lane

Climbing lanes can be used on bicycle facilities with uphill grades. The climbing lane provides separation between bicyclists and vehicles for uphill roadway sections that are otherwise designated as shared roadways. On uphill sections in particular, the speed differential between bicyclists and motor vehicles increases, which increases the safety risk. There are no standard criteria for when to install a bicycle climbing lane. Some cities recommend climbing lanes on bicycle facilities with grades as low as 1.5% depending on the roadway characteristics and potential conflicts between vehicles and bicyclists, while others might not install a climbing lane unless a facility exceeds a 5% grade. The characteristics of the facility should be considered along with vehicle speeds, volumes, and bicycle volumes.

By providing an uphill bicycle lane, separation is maintained between the two modes and safety is improved. In the downhill direction a bicyclist can likely travel at the speed of traffic, so a shared lane is adequate for the downhill bicyclist.

In the picture below the right lane is traveling uphill with a bicycle climbing lane, and left lane is traveling downhill with a shared bicycle/vehicle lane.

Estimated Cost Range: $4,000 to $6,000 per mile (the cost may increase if existing pavement marking removal is required)

c. Buffered Bicycle Lane

A buffered bicycle lane provides additional separation between the bicycle lane and vehicle travel lane (or in some cases between the bicycle lane and on-street parking). Depending on the existing lane widths, creating a buffered bicycle lane either reduces the width of a vehicle travel lane or removes a vehicle travel lane. A buffered zone between the bicycle lane and vehicle travel lane is recommended when traffic speeds are above 35 mph.

Another alternative is to place the buffered zone between the bicycle lane and on-street parking, which is better suited for locations with high parking turnover rates.

Estimated Cost Range: $5,000 to $10,000 per mile

Bicycle Lanes

d. Left Side Lane

Left side bicycle lanes can be used on one-way streets or on median divided two way streets. This treatment can be considered if there are heavy transit activities, deliveries, or parking turnover on the right side of the street.

Estimated Cost Range: $4,000 to $6,000 per mile (same as a typical bicycle lane)

e. Paved Shoulder

This treatment is typically used in rural areas on roadways with higher speeds. On roadways with over 2,000 ADT and speeds that exceed 35 mph the paved shoulder should be between four and six feet from the face of guardrail. If the roadway speed exceeds 50 mph or there is a high percentage of heavy vehicles, the paved shoulder should be 8 feet wide. As long as the paved shoulder meets the width requirements based on roadway speed, the shoulder may be signed as a bicycle facility.

Estimated Cost Range: Varies depending on the existing roadway conditions.

Typical Applications – Bicycle Lanes at Intersections

f. Right Turn Restrictions or Warnings

To improve the safety of bicyclists using bicycle lanes, right turns across the bicycle lane by vehicles could either be restricted or warning signs used to raise awareness of the bicycle lane and potential conflict with bicyclists.

Estimated Cost Range: $75 to $200 per sign (plus installation)

Bicycle Lanes

g. Transitioning a Through Bicycle Lane

Transitioning a through bicycle lane to the left side of a vehicle right turn lane prior to an intersection reduces the potential for right hook collisions by correctly positioning both the bicyclist and vehicle at the intersection. A “Begin right turn lane, yield to bicycle” sign should be placed at the beginning of the transition zone. One option to increase visibility of the transition zone is to use colored pavement marking through the transition area (shown in image on right).

Note – this treatment is NOT recommended for intersections with double right turn vehicle lanes.

Source of image on right: NACTO website (http://nacto.org/cities-for-cycling/design-guide/intersection-treatments/)Estimated Cost Range: $500 to $4,000 per intersection approach (depending whether green pavement markings are chosen)

h. Combined Bicycle Lane / Turn Lane

With a combined bicycle lane/turn lane, the bicycle lane drops prior to the intersection and the right most lane becomes a shared right turn vehicle lane and through bicycle lane.

Source: NACTO (http://nacto.org/cities-for-cycling/design-guide/intersection-treatments/combined-bike-laneturn-lane/)

Bicycle Lanes

i. Colored Bicycle Lane

Having a colored bicycle lane as it approaches an intersection draws attention to the correct and expected location of bicyclists. The treatment is ideal for intersections with high bicycle and vehicle volumes, or at locations where the position of the bicycle lane changed from the previous block. The FHWA has issued an Interim Approval for the use of green coloring in bicycle lanes. Citing multiple experiments that demonstrated positive operational effects for both bicycle riders and other road users, with no notable negative effects, this approval allows states to apply for approval to use coloring in bicycle lanes and bicycle lane extensions, and States may request approval for all jurisdictions in that State. This Interim Approval does not make the use of green colored pavement mandatory.[3]

Estimated Cost Range: $5 to $15 per square foot depending on material. Depending on wear maintenance costs could include reapplying color every 2 to 10 years.

[3] Interim Approval for Optional Use of Green Colored Pavement for Bicycle Lanes (IA-14). Federal Highway Administration website: http://mutcd.fhwa.dot.gov/resources/interim_approval/ia14/index.htm. Accessed May 9, 2011.

Table 3: Cycle Tracks

Cycle Tracks

Description:
A cycle track is an exclusive bicycle facility separated from vehicle traffic and the sidewalk, and is intended to provide improved comfort and safety for the bicyclist as compared to an on-street bicycle lane. The cycle track can be separated from vehicle traffic using a variety of treatments (curbs, planter strips, on-street parking, pavement markings, or other options). In addition the cycle track should be clearly defined from the sidewalk (grade separated, pavement markings, or an alternate clear indication) to prevent bicycle conflicts with pedestrians.

Criteria:
While the US does not have established standards that define what conditions warrant a cycle track, international documents do provide some guidance. However, in most cases, the criteria are more qualitative than quantitative and each facility should be evaluated independently based on roadway and user characteristics.

For one-way cycle tracks

- Streets with high motor vehicle volumes and/or speeds (factors that would make on-street biking feel uncomfortable). International documents suggest a cycle track may be appropriate where traffic speeds are 40 mph or greater[4] and total two-way traffic volumes are 9,000 vehicles per day or greater.[5]
- Streets with few driveways (there is no specific number; engineering judgment should be used for each facility in question)
- Streets where intersection conflicts can be effectively managed (since cycle tracks are often on the right side of on-street parking, visibility of cyclists approaching intersections can be compromised, parking set backs and other mitigation measures need to be considered at intersections and driveways)

For two-way cycle tracks (in addition to the criteria listed above)

- Streets with destinations mostly on one side
- Streets with less driveways or intersection conflicts on one side
- On one-way streets to reduce the out of direction travel for bicyclists
- On streets where there is not enough room for a one-way cycle track on each side of the roadway

Typical Applications – One Way Cycle Track

[4] Cycling Design Guide. Nottinghamshire County Council. October 2006. Accessed via: http://nacto.org/wp-content/uploads/2011/03/Nottinghamshire-Cycling-Design-Guide-2006.pdf. May 9, 2011
[5] Sustrans Cycling Guidelines and Practical Details. Accessed via: http://nacto.org/wp-content/uploads/2011/03/Sustrans-Cycling-Guidelines-and-Practical-Details.pdf. May 9, 2011.

Cycle Tracks

a. Cross Section and Pavement Markings

A one-way cycle track should be 5 to 7 feet wide with a minimum 3 foot buffer. The buffer can be a variety of treatments including planters, raised curb, on-street parking, pavement markings, bollards, landscaping, or other treatments. Cycle tracks can be at either roadway level or sidewalk level; however, roadway level is typically preferred to help prevent bicycle and pedestrian conflicts. Bicycle markings should be placed in the cycle track (at the beginning of each block and at periodic intervals if necessary) indicating the facility is intended for bicycle use (and not motor vehicle or pedestrian use).

Source: NACTO

Estimated Cost Range: $100,000 to 1,000,000 per mile (cost varies significantly depending on chosen treatments).

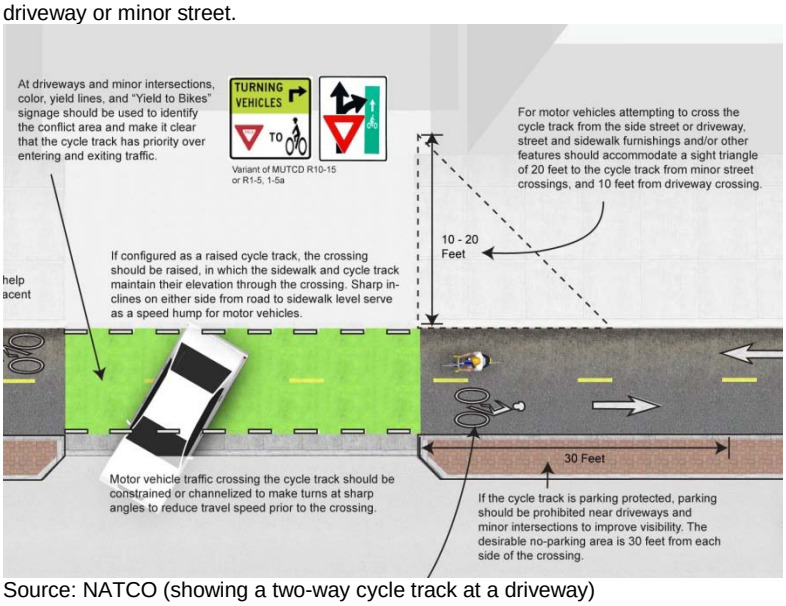
Cycle Tracks

b. Driveway and Side Street Treatments

Vehicles turning into driveways or side streets across cycle tracks presents a unique challenge because drivers may not anticipate a bicyclist approaching since the cycle track is separated from the vehicle lanes. The following treatments can be used to improve the safety of a bicyclist through driveway on a cycle track:

- Installing pavement markings through the driveway to draw attention to entering motorists. Yield signs and pavement markings can also be applied.
- Restrict parking for 30 feet on each side of the driveway to improve visibility.
- Ensure a sight triangle of 20 feet from a minor street to the cycle track, and 10 feet from a driveway to the cycle track.

The picture below shows a recommended clear zone and sight triangle for a cycle track at a driveway. From a driveway there should be a horizontal clear zone of 10 feet from the driveway, and for a minor street there should be a horizontal clear zone of 20 feet from the minor street. In addition, if on-street parking is allowed along the cycle track, it should be prohibited within 30 feet of the driveway or minor street.



Source: NATCO (showing a two-way cycle track at a driveway)

Also see picture in the two-way cycle track section

Estimated Cost Range: See section a (cost of driveway treatments included in overall length of a cycle track)

c. Intersection Treatments

At intersections, cycle tracks present a unique challenge since the bicyclist may be less visible to drivers due to the cycle track being slightly separated from the roadway. Similar treatments used at driveways can also be applied to intersections such as restricting parking to improve visibility, and warning signs for drivers. In addition the following treatments may be applied to improve the safety of the cycle track for bicyclists:

- Cycle track signal phase
- Prohibit right turns
- Install warning signs for right turning motorists to yield to bicyclists.
- Option to bring bicyclists into a wide outside traffic lane just prior to intersection to improve visibility.
- Clearly indicate to turning vehicles the intended path, so drivers do not mistakenly enter the cycle track.

Example right turn warning sign for vehicles (also see image in section g)

Estimated Cost Range: See section a (cost of intersection treatments included in overall length of a cycle track)

Cycle Tracks

d. Two Stage Left Turns

For cyclists who need to turn left at an intersection, a two stage left turn should be provided. Since the cycle track is to the right of the vehicle lanes, a bicyclist wanting to turn left at an intersection needs a way to safety cross the traffic lanes. A two stage left turn bicycle box allows a cycle track user to do exactly that. Using the green phase the bicyclist proceeds through the intersection with the flow of vehicles, but then pulls into a left turn bicycle box at the far end of the intersection. The bicyclist then waits in the box until the perpendicular direction of traffic receives a green indication, and then proceeds with traffic.

Source: NACTO

Pictures of one-way cycle tracks with two-stage left turn boxes.

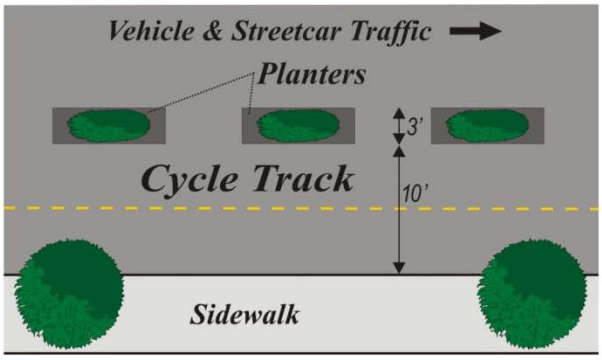
Estimated Cost Range: See section a (cost of two stage left turns included in overall length of a cycle track)

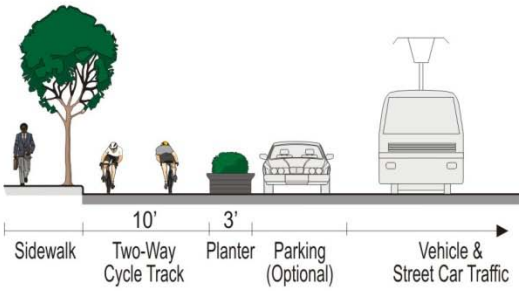
<u>Typical Applications – Two Way Cycle Track</u>

Cycle Tracks

e. Cross Section

A two way cycle track should be a minimum of 10 to 12 feet wide with a dashed yellow line to indicate proper direction.



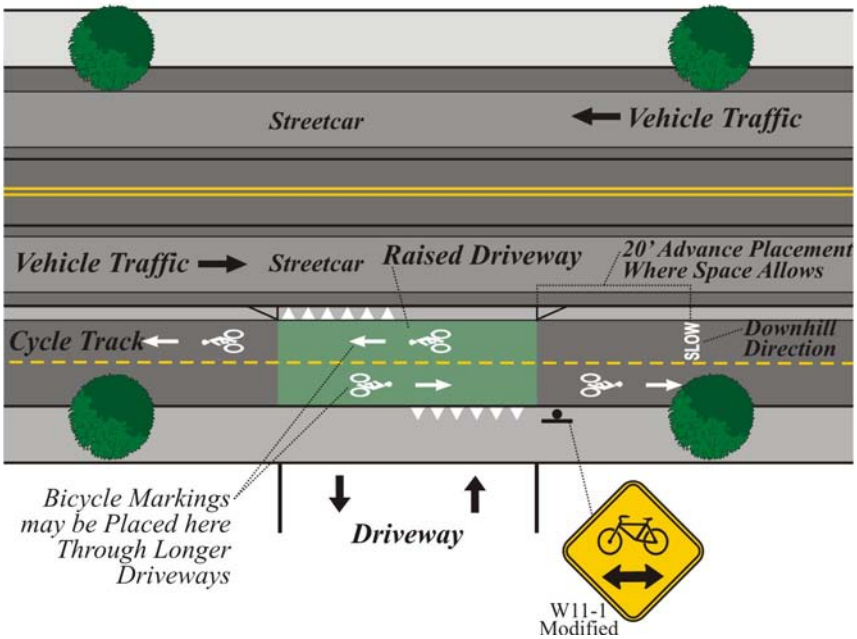


Estimated Cost Range: $150,000 to $1,500,000 per mile (cost varies significantly depending on chosen treatments).

f. Driveway and Side Street Treatments

In addition to the driveway treatments discussed for one-way cycle tracks, a two-way cycle track needs to provide warning indications to motor vehicle drivers (both entering and exiting) to expect bicyclists in the contra flow direction. Yield signs, and markings through the driveways should be used to alert drivers. Prohibiting left turns into driveways across two-way cycle tracks should also be considered.

The image below shows a proposed treatment for a two-way cycle track across a driveway. In this image it is assumed that the left turn into the driveway is prohibited. If the left turn movement into the driveway is allowed, a sign to warn drivers of the two-way cycle track traffic could be considered. Whether the vehicle or bicycle has the right of way is dependent on city or state policies. Typically at driveways, motor vehicle drivers are required to stop and yield to bicyclists (and pedestrians).



Estimated Cost Range: See section e (cost included in overall length of a cycle track)

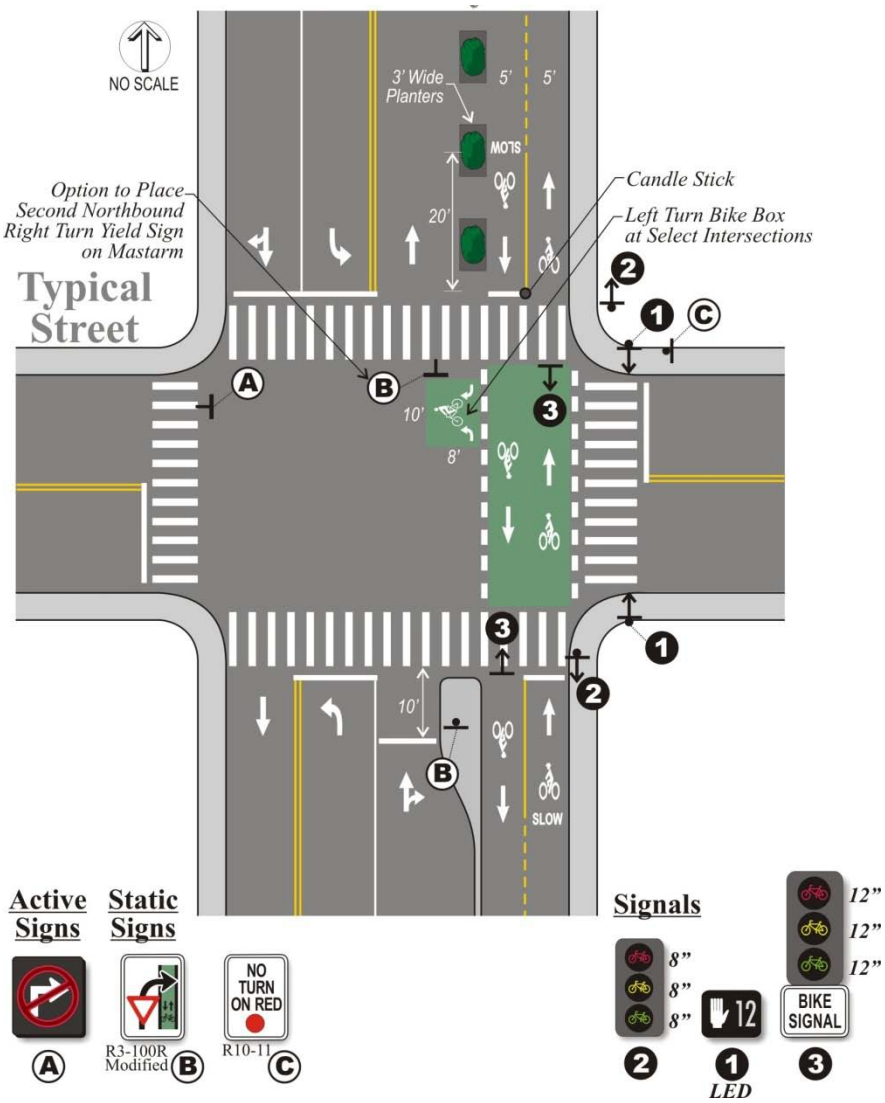
Cycle Tracks

g. Intersection Treatments

In addition to intersection treatments discussed for one-way cycle tracks, intersections with two-way cycle tracks present unique challenges due to the contra flow bicycle lane. Treatment options include:

- Prohibit right turns on red for right turning vehicles from the side street across the cycle track.
- Install bicycle signals with a leading bicycle and pedestrian phase so bicyclists enter the intersection before vehicles to improve visibility.
- Install yield signs for right turning drivers on the main street (with the cycle track)
- Install candle sticks or safe hits at the cycle track entrance to discourage vehicles from turning into the cycle track area.

The image below shows a proposed intersection for a two-way cycle track.



Estimated Cost Range: See section e (cost included in overall length of a cycle track)

Table 4: Bicycle Intersection Treatments

Bicycle Intersection Treatments

Description:
Intersection treatments improve the safety of bicyclists through an intersection. Depending on the characteristics of the cross streets (traffic and bicycle volumes, traffic and bicycle speeds, type of bicycle facility, number of vehicles and/or bikes turning, visibility, surrounding land use, and other factors) a range of treatments may be applicable.

Criteria:

- Locations where a bicycle facility crosses a roadway that may cause bicyclists to feel unsafe without intersection improvements.
- Level of treatment depends on cross street traffic volumes, cross section, and traffic speeds.

Typical Applications

a. Bicycle Boxes
Bicycle boxes provide a designated area at the intersection for bicyclists to get ahead of vehicles during a red traffic signal phase. This improves the visibility of bicyclists and helps prevent right-hook conflicts. Ideal for intersections with high right turning vehicle conflicts, or high bicycle volumes to reduce bicycle signal delay and queues. At intersections where the bicycle box extends across all lanes in the travel direction, left turning bicyclists can position themselves ideally during the red signal phase. This treatment also improves driver compliance at crosswalks, so high pedestrian activity (with high bicycle volumes) is another typical application.

Estimated Cost Range: $5,000 to $6,000 (not including annual maintenance). Markings may need to be replaced every 1 to 10 years depending on wear patterns. Replacement costs would be $5,000 to $6,000 (same as initial installation).

b. Colored / Marked Bicycle Lane through the Intersection
Bicycle lanes marked through intersections help guide bicyclists along the intended travel path and alert drivers to the presence of a bicycle lane (and bicyclists). Applications may include areas where vehicles may encroach on the bicycle lane such as ramp style exits, across signalized intersections that are wide or complex, across driveways, and stop or yield controlled approaches.

Estimated Cost Range: $5 to $15 per square foot depending on material

Bicycle Intersection Treatments

c. Bicycle Signals

Bicycle signals may be used for the following purposes:

- To reduce conflict at intersections where a bicycle movement conflicts with a major vehicle movement
- To improve safety at intersections near schools or parks
- To make it legal for bicycles to enter an intersection during an all-pedestrian phase
- To employ an advance green phase at intersections for bicyclists that reduce conflict and delay
- To allow bicyclists to cross an intersection diagonally at unique locations

Estimated Cost Range: $10,000 to $50,000 per intersection.

d. Two Stage Left Turn Queue Boxes

In addition to using this treatment along cycle track facilities, the two stage left turn queue box may be appropriate along facilities with bicycle lanes. A two stage left turn queue box may be used at intersections with high volumes of left turning bicyclists, especially along multi-lane facilities with high traffic speeds and volumes. This treatment can also be used to assist bicyclists across streetcar or rail tracks.

Source: NACTO

Estimated Cost Range: $5,000 to $6,000

Bicycle Intersection Treatments

e. Traffic Reduction / Diverters (also in the Bicycle Friendly Route section)

Diverters are often used at intersections along bicycle friendly routes to reduce vehicle volumes on a roadway. The diverters allow bicycle through movements but prohibit vehicle through movements.

(sign stating “DO NOT ENTER, except bicycles”)

Estimated Cost Range: $1,000 to $20,000 (depends on design and materials)

Table 5: Mid-Block Crossing Treatments

Mid-Block Crossing Treatments

Description:
Mid-block crossings can be dangerous to bicyclists because drivers are not typically expecting a crossing at a non-intersection location. The need for a mid-block crossing may arise if two bicycle facilities are off-set or if a trail junctions with a roadway mid-block. In these situations, mid-block crossing treatments can be applied to improve the safety of a bicyclist.

Criteria:
Depending on the characteristics of the facility being crossed, different treatments may apply. Criteria to consider includes: vehicle speed, width of the roadway, vehicle volumes, sight distance, and typical driver compliance in the region.

Typical Applications

a. Bicycle Crossing Markings
Bicycle crossing markings can be similar to pedestrian style crossings. However, a bicycle crossing typically has two parallel sets of markings, one for each direction of bicycle travel to help reduce head on bicycle conflicts. Pedestrians can also use the bicycle crossing area.

The picture below shows bicycle/pedestrian crossing markings at a signalized intersection.

Estimated Cost Range: $1,000 to $3,000 (depending on width of crossing). Maintenance is not included in the cost.

b. Median Refuge Island
A median refuge island allows a bicyclist to cross a street in two phases, while waiting in a comfortable space. The treatment is ideal for multilane facilities with two-way traffic where waiting for an acceptable gap in traffic for a single phase crossing would cause undue delay. The desired width for median is 10 feet, although 6 feet is the absolute minimum, and a median should be a minimum of 30 feet long.

Estimated Cost Range: $15,000 to $30,000 per 100 feet

Mid-Block Crossing Treatments

c. Rapid Flashing Beacon

A rapid flashing beacon is used in conjunction with a marked crossing. It is typically activated using a push button and indicates that vehicles need to stop and yield to bicyclists or pedestrians using the designated crossing. A flashing beacon is typically placed on a post on the side of the roadway, but can also be installed over a lane. These examples show pedestrian crossings, however, the warning sign can be modified to show a bicycle, or both a bicycle and pedestrian.

Based on the NCHRP Report 562 and the studies by Charles Zeeger (see resources listed on the last page) the following criteria applies to installing flashing beacons at unsignalized crossing locations:

- When ADT is less than 9,000 – activated flashing beacons are recommended if vehicle speeds exceed 40 mph, or if the facility is 4 lanes with speeds of 35 mph.
- When ADT is between 9,000 to 12,000 – activated flashing beacons are recommended for 3 or more lanes if speeds exceed 35 mph.
- When ADT is greater than 12,000 – activated flashing beacons are recommended for 3 or more lanes if speeds exceed 30 mph.

The pictures below show a few different types of rapid flashing beacon displays. The two on the left use school signs, but could be used for a non-school locations with a pedestrian or bicycle warning sign instead of the school crossing sign.

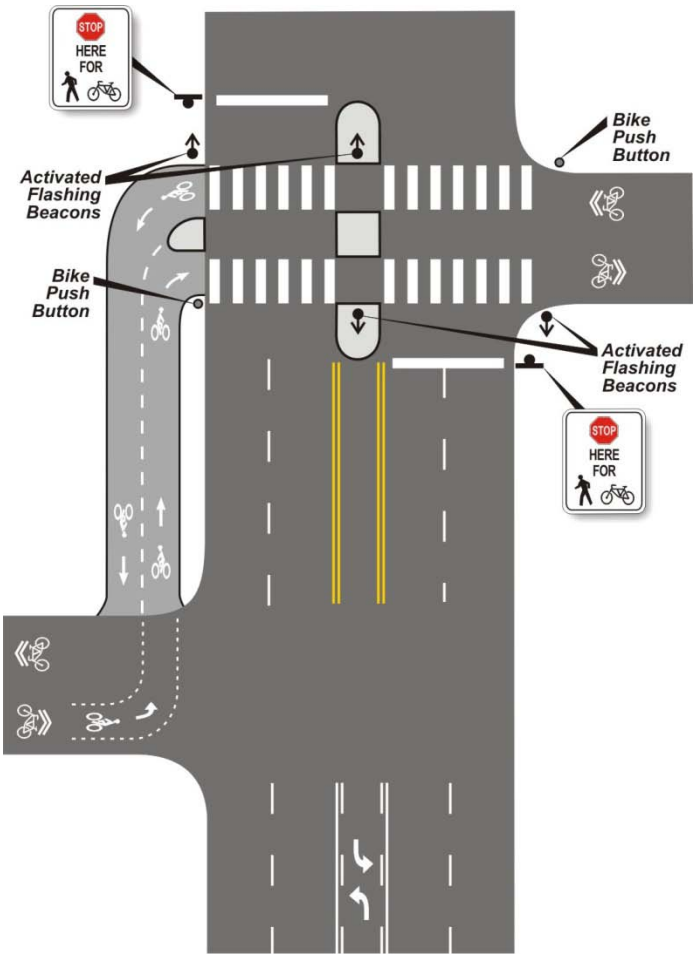
Estimated Cost Range: $10,000 to $20,000 per crossing (includes two to three rapid flashing beacon signs, depending whether there is a median)

Mid-Block Crossing Treatments

d. Off-Set Intersections

At some locations, bicycle friendly routes may continue at an offset across a busy street. One treatment option to safely connect the offset bicycle friendly route is shown below. In this treatment, a two way cycle track is incorporated on one side of the roadway. The cycle track guides bicyclists to cross at a particular location, which may include activated beacons or a signal depending on the roadway characteristics.

Below are two different types of offset intersection crossings. The top image uses a path to the side of the main roadway and the picture on the bottom shows an intersection with center bicycle lanes connecting the off-set intersections.



Estimated Cost Range: Varies based on right of way impact $1,000 and up depending on chosen treatment

Table 6: Wayfinding

Wayfinding

Description:
Wayfinding is meant to be used by bicyclists to communicate directions, distance, and sometimes expected travel time to a particular destination. Wayfinding is typically accomplished through the use of signs, however, pavement markings can supplement the signs. Wayfinding could be applied to all types of bicycle facilities.

Criteria:
Wayfinding can be used to help bicyclists (and vehicle drivers) identify which facilities are designated as bicycle facilities. The wayfinding may convey several factors including:

- Which roadways are designated as bicycle facilities
- Directions to key areas or connections
- Expected travel time by bicycle to key areas or connections

In particular, wayfinding is beneficial at junctions and intersections with other bicycle facilities.

Typical Applications

a. Standard signs to indicate bicycle facilities
Part 9 of the MUTCD (2009 Edition) includes "Traffic Control for Bicycle Facilities". In this section there are several standard wayfinding signs that can be used along bicycle facilities. Some signs simply indicate the presence of a bicycle facility, while other signs provide additional information such as destinations and distances. The pictures below show a sampling of signs from the MUTCD and their respective sign numbers.

R3-17

D1-3c

D11-1

D11-1c

M1-8

M4-14

M4-6


M6-3

Wayfinding

b. Signs with destinations and expected travel times

Below are two examples of wayfinding signs unique to different cities. The sign on the left indicates direction, distance, and expected travel time by bicycle. The sign on the right indicates direction and distance.

Estimated Cost Range: $30 to $75 per sign (plus installation)

c. Pavement markings

Pavement markings can be used to supplement signs. Below is an example of a pavement marking used to indicate the direction of the continued bicycle facility.

Sharrows and bicycle lane symbols can also be considered wayfinding treatments in the sense that they help identify a facility as a bicycle facility.

Estimated Cost Range: $50 to $250 per marking depending on size and material (plus installation)

Wayfinding
d. Maps Portable maps indicating bicycle and pedestrian around the City could be provided to assist bicyclists and pedestrians in wayfinding. Maps could be provided at public facilities such as City Hall and libraries as well as bicycle shops or other interested vendors. In addition, the maps could be available electronically through the City's website. Estimated Cost Range: $0 to $5 for a paper map (in some cities a private vendor sponsors the map which could make it free or low cost to the City of Spokane Valley).
e. Mobile Applications As technology continues to advance, private industries will likely develop apps that can be used on mobile devices to assist bicyclists navigating around the City of Spokane Valley.

Table 7: Shared Use Bicycle Paths

Shared Use Bicycle Paths

Description:
Shared use paths are physically separated from the roadway, and are intended to be used by pedestrians, bicyclists, runners, and other non-motorized users. A shared use path can supplement a thorough system of on street facilities in a city, and connect to the on-street system at end points of the trail as well as midpoints depending on the length and location.

Criteria:
The following characteristics can be used when considering which facilities could serve as appropriate shared use path:

- A shared use path can be provided when on-street facilities are not an option and when separate right of way is available (such as a former railroad line).
- The number of driveways and crossings should be minimized. According to the Idaho Department of Transportation, if there are more than 8 crossings per mile, an on-street facility should be considered instead.
- Where crossings cannot be avoided, special design treatments should be used to treat potential conflicts.

Typical Applications

a. Bicycle and Pedestrian Shared Use Path
The following design criteria should be considered:

- Minimum paved width of a shared use path is 10 feet, although 12 to 14 feet (or more) is preferred especially if the use is expected to be moderate to heavy (AASHTO).
- Two feet of additional clearance should be provided on either side of the path.
- An 8 foot path may be appropriate under some circumstances (bicycle and pedestrian use is expected to be consistently low, the alignment allows for safe and frequent passing opportunities, and maintenance vehicles are not expected to drive on the path which would could subject the pavement edges to damage).
- Markings to separate bicyclists from pedestrians on a shared use path are not necessary, but a centerline marking to separate two-way traffic is appropriate on pathways with heavy peak or seasonal volumes.
- The surface should be asphalt to accommodate all types of non-motorized users.

Below are pictures of a two-way shared use path. On the left, the path runs along an active railroad line on the left and an industrial facility on the right, both separated by a fence. In the photo on the right, the path runs along a neighborhood (left side) and a freeway and light rail line (right side).

Estimated Cost Range: $250,000 to $500,000 per mile (includes asphalt surface, signing, striping, wayfinding, drainage, and limited crossings, does not include design costs).

Shared Use Bicycle Paths

b. Crossings on Shared Use Paths

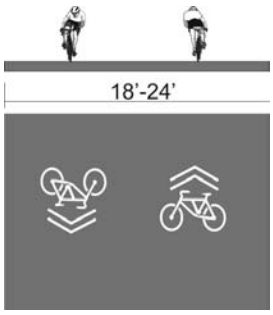
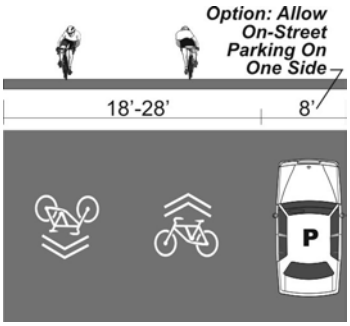
At locations where the shared use path crosses other roadways or driveways, appropriate indications and warnings should be provided for both the path user and roadway user to prevent conflict. The design team should consider the characteristics of the path and roadway at the crossing and determine whether the path user or the roadway user should have the right of way.

In the picture below, path users are required to stop at the roadway crossing.

Cross Sections

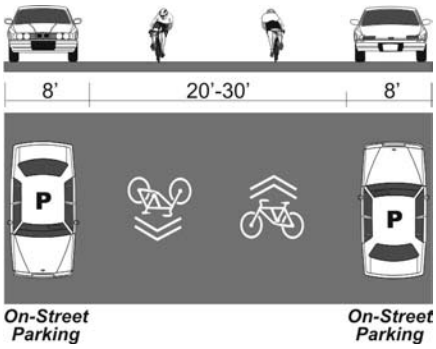
The following tables illustrate how to convert roadways with specific paved widths into bicycle friendly route and different types of bicycle lanes. Each cross section identifies which facilities within the City of Spokane Valley meet the cross section requirements and are recommended as bicycle facilities in the Master Plan (see map 11.5).

Table 8: Cross Sections – Bicycle Friendly Route

Bicycle Friendly Route Cross Sections	
18 to 24 feet Paved Roadway Width  	Roadways: • 12th Ave (sections) • Progress Rd (sections) • Valleyway Ave • 4th Ave (sections) • Pierce Ave (sections) • Long Rd (Centennial Trail to Appleway) Marguerite Rd (sections) • Railroad Ave (Mission Ave to Stanley Rd) • Stanley Rd (Railroad Ave to Broadway Ave) • Boone Ave (University Rd to Pines Rd) • Flora Rd (Maxwell Ave to 400 ft north of Sprague Ave) • Alki Ave (currently less than 18 feet in parts, widening) Design: • No center line markings • Sharrow markings • Depending on the characteristics of the particular roadway, parking could be allowed if traffic volumes are low and there is ample visibility around parked vehicles. Otherwise on-street parking should be prohibited on the paved roadway. • Some roadways may have a gravel shoulder where parking could be permitted.
26 to 36 feet Paved Roadway Width  	Roadways: • 12th Ave (sections) • Valleyway Ave • Adams Rd • Progress Rd (sections) • Mission Ave (Francher Rd to Vista Rd) • Vista Rd (I-90 to Bridgeport Ave) • Locust Rd (Mission Ave to Valleyway Ave) • Farr Rd (Valleyway Ave to Sprague Ave) • Woodruff Rd (8th Ave to 16th Ave) • University Rd (Mission Ave to I-90) • 38th Ave (37th Ave to Pines Rd) • Mamer Rd (Mission Ave to I-90) • 16th Ave (Sullivan Rd to Rotchford Dr) • Rotchford Dr (16th Ave to 4th Ave) • Conklin Rd (Broadway Ave to Sprague Ave) • Flora Rd (Mission Ave to Maxwell Ave, 400 ft north of Sprague Ave to 3rd Ave) • 6th Ave, 4th Ave (west of Park Ave) Design: • Center line marking optional • Sharrow pavement markings • Option to designate on-street parking on one side of the roadway.

Bicycle Friendly Route Cross Sections

36 to 46 feet Paved Roadway Width



Roadways:

- Pierce Ave (sections)
- 24th Ave (sections)
- Blake Rd (sections)
- Park Rd (north of Rutter Ave and south of 8th Ave)
- Farr Rd (Sprage Ave to 8th)
- University Rd (railroad tracks to Montgomery Dr)
- 37th Ave (Bowdish Rd to 38th Ave)
- Conklin Rd (Sprague Ave to 4th Ave)
- Pines Rd (south of 32nd)

Design:

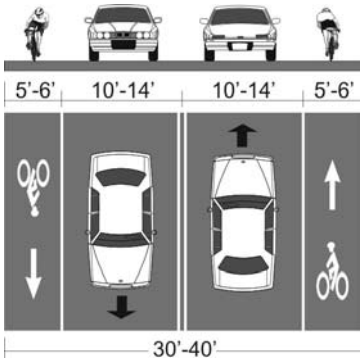
- Center line marking optional (depends on roadway characteristics)
- Sharrow pavement markings
- Parking could be allowed on both sides of the roadway.

Table 9: Cross Sections – Bicycle Lanes (No On-Street Parking)

Bicycle Lane Cross Sections (No On-Street Parking)

30 to 40 feet Paved Roadway Width

(Two-Way Traffic)



Original cross section: 2 lanes

Cross section with bicycle lanes: 2 lanes

Roadways:

- Bowdish Rd (sections)
- Evergreen Rd (sections)
- Flora Rd (sections)
- Barker Rd (sections)
- Wellesley Ave (sections)
- Mission Ave (sections)
- Broadway Ave (sections)
- 32nd Ave (sections)
- 44th Ave
- McDonald Rd (sections)
- 3rd Ave (Francher Rd to west City Limits)
- Montgomery Ave (University Rd to Jackson Ave)
- 8th Ave (west of Park Rd) currently less than 30 feet, widening necessary
- Carnahan Rd (consider climbing lane only)

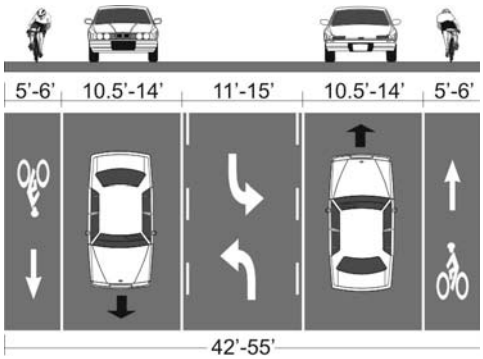
Design:

- 5 to 6 foot bicycle lanes
- For roadways less than 30 feet, widening will be necessary.
- Depending on the characteristics of each roadway, a centerline stripe may not be necessary in some cases.

Bicycle Lane Cross Sections (No On-Street Parking)

42 to 55 feet Paved Roadway Width

(Two-Way Traffic)



Original cross section: 4 lanes (or 3 lanes with TWLTL)

Cross section with bicycle lanes: 3 lanes with TWLTL

Roadways:

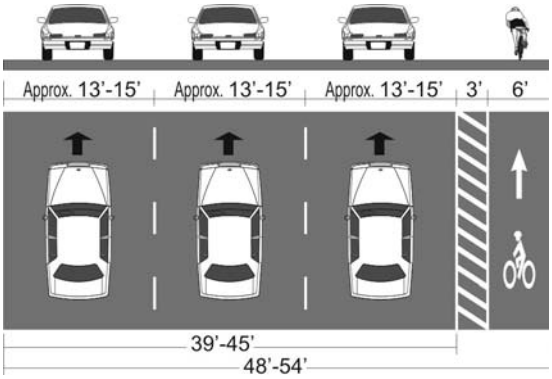
- University Rd (sections)
- McDonald Rd (sections)
- Fancher Rd (sections)
- Mission Ave (sections)
- Broadway Ave (sections)
- Montgomery Ave (Argonne Rd to Woodruff Rd)
- Pines Rd (16th to 32nd Ave)
- Park Rd (sections)
- Montgomery Ave (Jackson Ave to Bowdish Rd)
- Evergreen Rd (sections)
- Barker Rd (sections)
- Mission Ave (sections)
- 32nd Ave (sections)
- McDonald Rd (sections)

Design:

- Convert a 4 lane cross section to 3 lanes including a center two-way left turn lane
- Vehicle lanes range from 10.5' to 14'
- Bicycle lanes range from 5' to 6'

48 to 54 feet Paved Roadway Width

(One-Way Traffic)



Original cross section: 4 lanes

Cross section with bicycle lanes: 3 lanes

Roadways:

- Appleway Blvd (currently striped with bicycle lanes approximately 4 feet wide, 6 feet recommended)

Design:

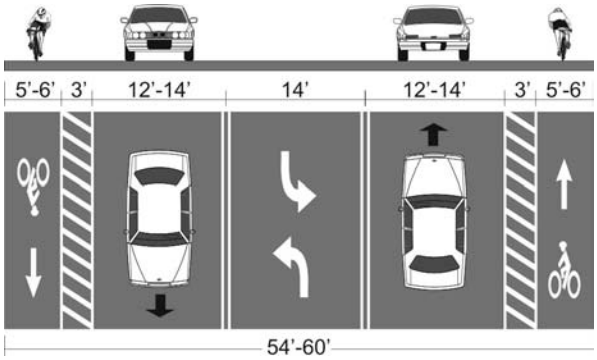
- Bicycle lane with 3 foot buffer
- No on-street parking

Note: In areas where the cross section is 54 feet, 4 vehicle travel lanes could be maintained at an 11 foot width while including the buffered bicycle lane as shown.

Bicycle Lane Cross Sections (No On-Street Parking)

54 to 60 feet Paved Roadway Width

(Two-Way Traffic)



Original cross section: 5 lanes with TWLTL

Cross section with bicycle lanes: 3 lanes with TWLTL

Roadways:

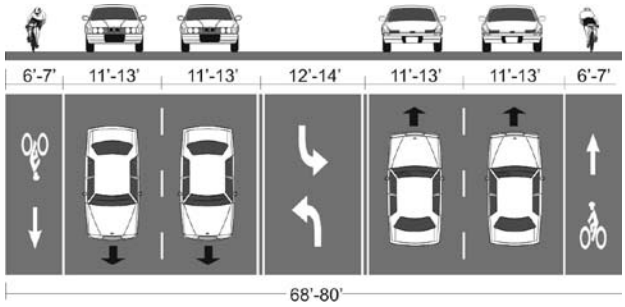
- Euclid Ave (Sullivan Rd to Flora Rd)

Design:

- A buffer zone next to the bicycle lane would make the bicycle lane more comfortable to riders.

68 to 80 feet Paved Roadway Width

(Two-Way Traffic)



Original cross section: 5 lanes with TWLTL

Cross section with bicycle lanes: 5 lanes with TWLTL

Roadways:

- Fancher Rd (sections)
- University Rd (Sprague to 4th)
- Indiana Ave (Sullivan Rd to Desmet)

Design:

- This option narrows existing lanes to maintain the existing cross section while adding bicycle lanes.

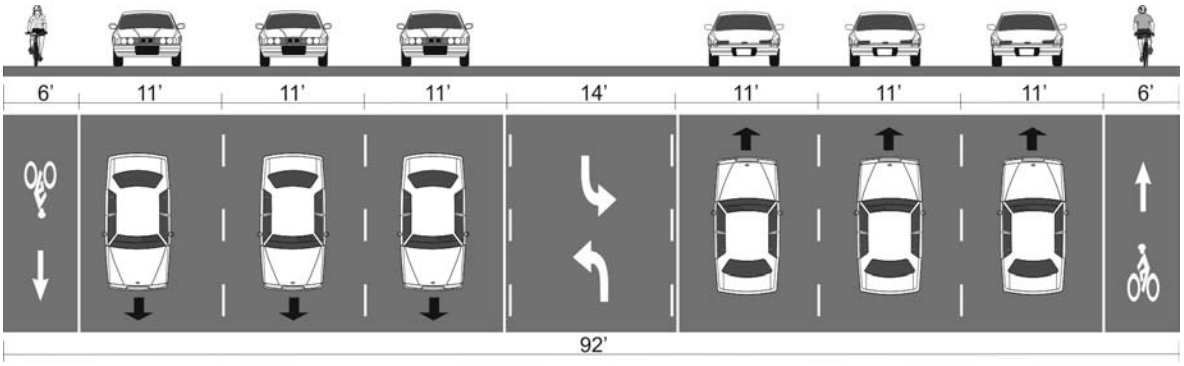
Sections for Sprague

Sprague - 92 Foot Cross Section:

Sprague from University Rd to 300' east of Houk Rd

Original cross section: 7 lanes with TWLTL

Cross section with bicycle lanes: 7 lanes with TWLTL



Bicycle Lane Cross Sections (No On-Street Parking)

Sprague - 86 Foot Cross Section:

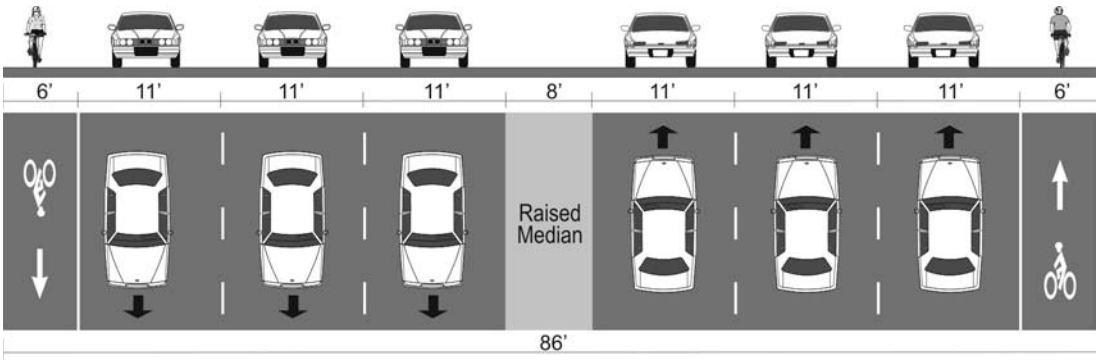
Sprague from 300' east of Houk Rd to about 1,100 feet east of Sullivan Rd

Original cross section: 7 lanes with TWLTL

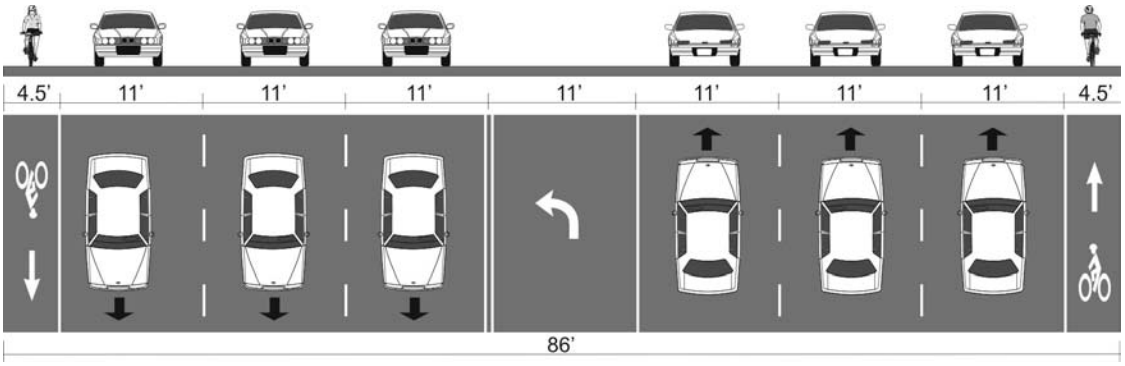
Cross section with bicycle lanes: see options #1 and #2 below.

Note that with option #1 the bicycle lane narrows to 4.5 feet at intersections and mid-block locations where left turns are allowed. Due to the narrow bicycle lanes, a maximum of one mid-block left turn median opening is recommended between signalized intersections.

Option #1 - 7 lanes with raised median (mid-block)

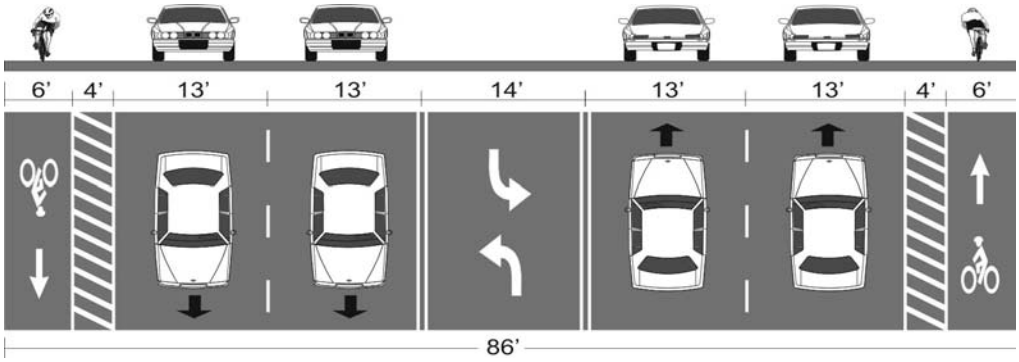


Option #1 - 7 lanes with left turn lane (at signalized intersections and mid-block where left turns are allowed):



Note: a maximum of one mid-block left turn median opening is recommended between signalized intersections.

Option #2 - Reducing to 5 lanes with buffered bicycle lanes



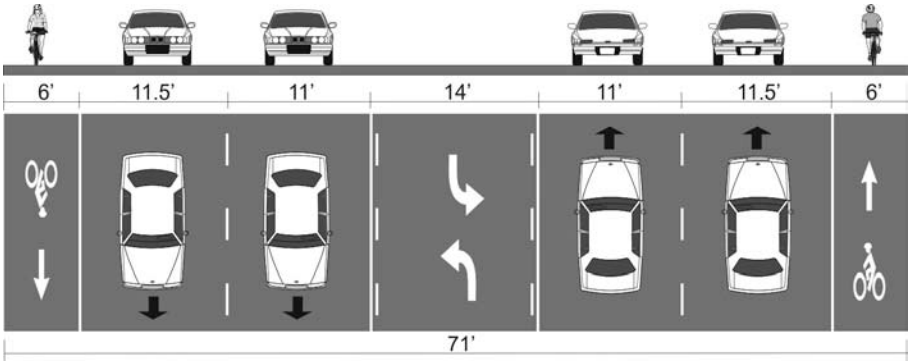
Bicycle Lane Cross Sections (No On-Street Parking)

Sprague - 71 Foot Cross Section:

Sprague from 1,100 feet east of Sullivan Rd to Appleway Ave

Original cross section: 5 lanes with TWLTL

Cross section with bicycle lanes: 5 lanes with median or left turn lane



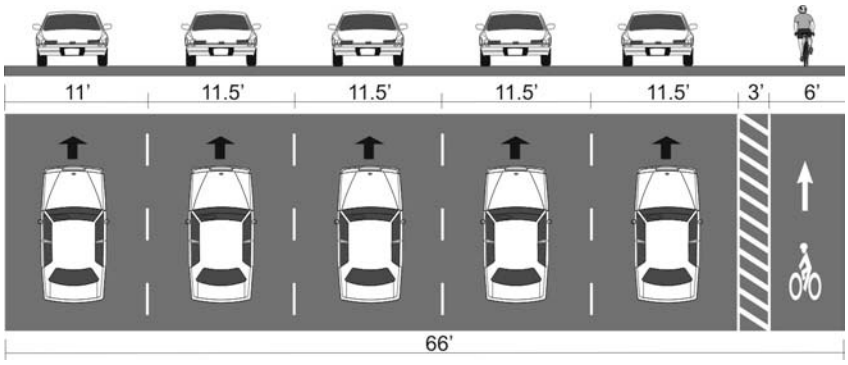
Sprague - 66 Foot One-Way Cross Section:

Sprague east of University Road (westbound only)

Original cross section: 5 lanes

Cross section with bicycle lanes:

Option #1 - 5 lanes with buffered bicycle lane



Option #2 - 4 lanes with buffered bicycle lane

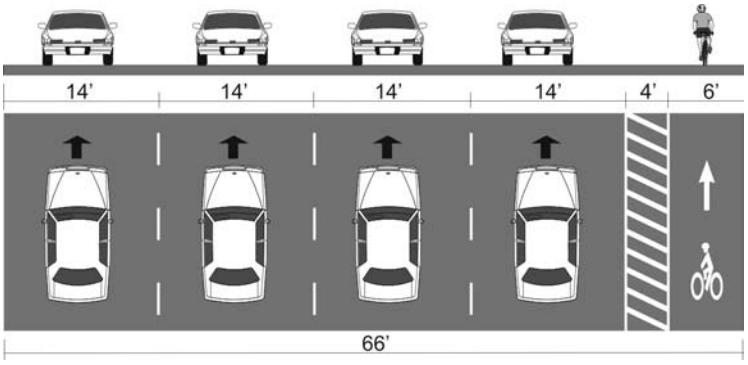


Table 10: Cross Sections – Bicycle Lanes with On-Street Parking

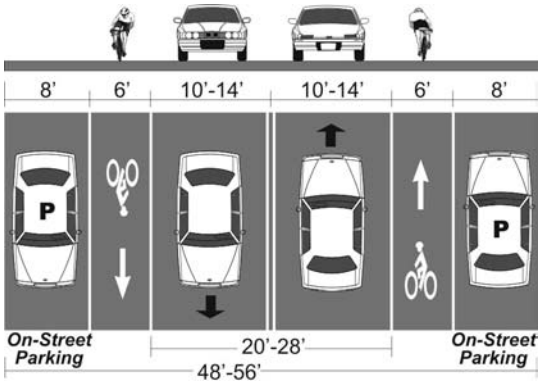
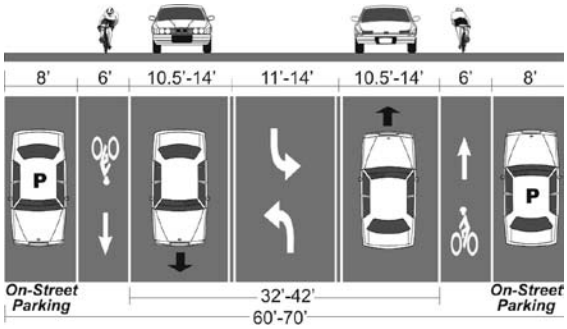
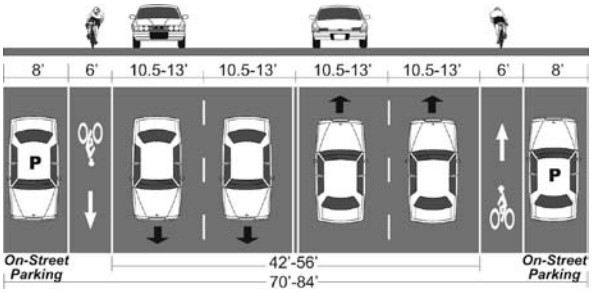
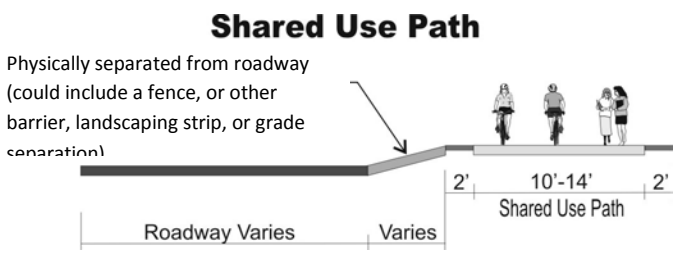
Bicycle Lanes with On-Street Parking	
48 to 56 feet Paved Roadway Width **(Two-Way Traffic with Parking)**  	**Original cross section: 1 lane each direction with a center TWLTL and on-street parking on one side** **Cross section with bicycle lanes: 1 lane each direction with on-street parking (both sides)** Roadways: • Mission Ave (Evergreen Rd to Sullivan Rd) Design: • 6 foot bicycle lanes adjacent to 8 feet wide on-street parking allows bicyclist to maneuver around open car doors while remaining in the bicycle lane. • If the roadway is widened to 62 feet, a 12 foot center TWLTL could be maintained with a 10 foot lane in each direction.
60 to 70 feet Paved Roadway Width **(Two-Way Traffic with Parking)**  **70 to 84 feet Paved Roadway Width** **(Two-Way Traffic with Parking)**  	**Original cross section: varies** **Cross section with bicycle lanes: varies** Roadways: • If on-street parking is desired on roadways in the future, these cross sections could be applied to accommodate both on-street parking and bicycle facilities. Design: • 6 foot bicycle lanes adjacent to 8 feet wide on-street parking allows bicyclist to maneuver around open car doors while remaining in the bicycle lane. • A 2 to 3 foot buffer zone between on-street parking and the bicycle lane could be considered in areas with high parking turnover rates to help prevent dooring accidents (when people open car doors into a bicycle lane causing the bicyclist to crash either by hitting the open car door or swerving abruptly). • For the 84 foot cross section, a five lane cross section would also fit (four 11 foot lanes, and a center 12 foot TWLTL).

Table 11: Cross Section – Shared Use Paths

Shared Use Path Cross Sections	
	**Original cross section: varies** **Cross section with bicycle lanes: Roadway cross section likely remains the same with the addition of a shared use path.** Roadways: • Millwood Path • Trent Path (Railroad ROW) • Sprague Path • Appleway Path • North Greenacres Path • Dishman Mica Path • Pines Rd, (Pinecroft Wy to Trent Ave) • Sullivan Rd, north of the River • Flora Rd, north of Mission Ave Design: • see toolbox section for design recommendations.