

# Appendix E.

## Goals and Objectives

**Bikeway:** A generic term for any road, 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.

*(Source: American Association of State Highway and Transportation Officials Guide for the Development of Bicycle Facilities, 1999)*

This appendix provides general descriptions of the types of bicycle facilities recommended for the Seattle Bicycle Facility Network. There are two main categories of facilities: facilities for network segments and facilities for roadway crossings. Additional detail is provided for these facilities in Appendix F: Guidance for Retrofitting Seattle Streets to Create Dedicated Bicycle Facilities and Appendix H: Roadway Crossing Design for Bicycles.

### Facilities for Network Segments

The Bicycle Facility Network includes a variety of on- and off-road bicycle facilities. On-road 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:

- Surrounding land uses and connectivity to destinations
- Existing right-of-way space
- Number of travel lanes
- Travel lane width
- Traffic volume
- Traffic speed
- Traffic composition (presence of buses and large trucks)
- Presence of on-street parking
- Pedestrian activity

Bicycle facilities recommended for on-road and off-road segments in the Bicycle Facility Network are described below.

### On-Road Bicycle Facilities

#### Bicycle Lanes

A bicycle lane is a portion of the roadway that has been designated by striping, signing<sup>1</sup>, and/or pavement markings for the preferential use of bicyclists. The minimum width for a bicycle lane next to parked cars is five feet (four feet if next to a curb). 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 recommended for arterial roadways in Seattle. Bicycle lanes can provide the following benefits:



<sup>1</sup> The National Committee on Uniform Traffic Control Devices (NCUTCD) voted unanimously, at the January 20<sup>th</sup>, 2006 committee meeting, to allow jurisdictions the flexibility to designate bicycle lanes without bicycle lane signs (R3-17) – striping will be sufficient to designate bicycle lanes.

- 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
- Increase drivers' awareness of bicyclists while driving and when opening doors from an on-street parking space

When on-street parking exists, bicycle lanes should be designed so that bicyclists are encouraged to ride far enough away from parked cars so that they are not at risk of being struck by opening doors. Further, bicycle lanes should not be placed between parked cars and the curb, for the following reasons:

- Motor vehicles entering the arterial roadway from a side street must cross through bicycle traffic to view arterial roadway traffic around the parked cars. This takes driver attention away from bicyclists and blocks bicyclists.
- Drivers of motor vehicles crossing or turning from or to the road with bicycle lanes are primarily focused on motor vehicle traffic on the roadway. Bicyclists in the bike lanes are not in their primary line of sight.
- To make a left turn, bicyclists must merge into the travel lanes from behind a line of parked cars, creating a situation with poor sight lines between motorists and bicyclists. If parking is fully-utilized, this may not even be possible.
- Motor vehicle passengers are not accustomed to looking for bicyclists when they open their doors on the right side of the vehicle.
- If the facility is a two-way bicycle pathway, bicyclists are encouraged to 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.
- Roadway space is not used efficiently. Roadways with on-street parking require some space for car doors to open safely. When one line of cars is moved away from the curb to make room for the bicycle facility, several feet of shy distance (e.g., lateral space) are needed on both sides of that line of parked cars, rather than just on the drivers' side. Overall, more roadway space is needed for car doors to open, so less space can be used for other purposes.

### Shared Lane Markings

Shared lane markings are bicycle symbols that are placed within a vehicular travel lane of the roadway. Unlike bicycle lanes, they do not designate a particular part of the roadway for the use of bicyclists. The bicycle symbols used in shared lane markings include chevrons pointing in the direction of motor vehicle traffic to indicate that bicyclists should also ride in this direction. 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 standard width bicycle lanes
- Connect gaps between other bicycle facilities, such as a narrow section of roadway between road segments with bicycle lanes



Shared lane markings will be used most commonly on arterial roadways. However, the city may experiment with and develop a protocol for using these markings on non-arterial roadways.

### Climbing Lanes

Climbing lanes are a hybrid bicycle facility that includes a five-foot bicycle lane on one side of the roadway (typically in the uphill direction) and a shared lane marking on the other side of the roadway. This allows slower-moving, uphill bicyclists to have a designated bicycle lane space and allows motor vehicles to pass more easily. It also allows faster-moving, downhill bicyclists to have a shared-lane marking, which alerts motorists to expect faster-moving bicyclists in the travel lane, further from parked cars. 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 is particularly applicable in Seattle because of its topography and because it can be used on streets where there is not enough space for standard width bicycle lanes on both sides.



### Bicycle Boulevards

Bicycle boulevards are non-arterial streets 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 stopping while discouraging motor vehicle traffic. Traffic calming and traffic management treatments such as traffic circles, chicanes, and diverters 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.



The city should look to other jurisdictions for examples of bicycle boulevard marking and signing. There is currently no national consensus or best practice for identifying bicycle boulevards. Some jurisdictions utilize signs only, markings only, or a combination of each. It is recommended that a prototype design be developed and evaluated along a two- to three-block section of roadway in Seattle.



Streets with a series of calming features work well as bike routes. Cars have to slow down to bicycle speed.

### Shared Roadways

Shared roadways are regular streets without any designated bicycle facilities. Many non-arterial roadways with low traffic volumes and low speeds are already good places for bicyclists to ride because they are quiet streets. Roadway striping and markings are not necessary to make these streets comfortable for most bicyclists to use. Many of Seattle's arterial roadways are also currently shared roadways, but appropriate facilities described above should be added to the arterial roadways to make them more comfortable for bicycling.



## Other On-Road Bicycle Facilities

### Paved Shoulders

Paved shoulders provide space on the outside of the roadway for bicycle and pedestrian use<sup>2</sup>. There is no minimum width for paved shoulders; however a width of at least four feet is desirable so that bicyclists can use them and be safely passed by a vehicle driving in the adjacent travel lane. On some undeveloped roadways (many of which are in the far northern and southern parts of Seattle), paved shoulders can be provided to make important bicycle connections. In some locations, reconstructing the roadway with shoulders can also include pavement for an on-street parking lane or parking pockets. Paved shoulders also improve safety for motor vehicles and prevent pavement damage at the edge of the travel lanes.

In locations where it is not feasible to add pavement at the edge of a roadway to create a paved shoulder, the city may consider experimenting with striping a dashed shoulder to identify the space where motorists should be prepared to see pedestrians and bicyclists. This treatment can be combined with traffic calming devices such as chicanes to encourage slower vehicular speeds. Motorists would share a 14- to 18-foot center lane area (this width is typical on neighborhood streets with parking on both sides) while a three- to five-foot shoulder on the edges would allow for motorists to pull aside to pass. This treatment would be appropriate for lower volume roadways that do not allow parking on or near the shoulder and do not have sidewalks for pedestrians.

### Wide Outside Lanes

Wide outside travel lanes are typically designed to be 13- to 15-feet wide. This width allows most motor vehicles to pass cyclists within the travel lane, which is not possible in more typical 10- to 12-foot wide travel lanes. Wide outside travel lanes on arterial roadways are generally acceptable for experienced cyclists, but less-experienced bicyclists may not feel comfortable on this type of facility. These travel lanes do not provide the benefit of having a striped area that is exclusively for the use of bicyclists, a feature that bicyclists with all levels of riding experience have reported as desirable<sup>3</sup>. Wide outside lanes also do not have markings to indicate where bicyclists should be positioned when passing through an intersection with a right-turn lane.

### Bus/Bike Only Roadways

Currently, 3rd Avenue in Downtown Seattle is open to buses and bicycles but closed to through-motor vehicles during peak travel periods. In the future, if additional roadways are identified for priority use by transit, the city should work with transit agencies to ensure that the roads are also open to bicycles. It is preferable to have wide outside lanes on these roadways to create safe bus and bicycle passing opportunities.

### Shared Bus/Bike Lanes

More exclusive bus lanes are likely to be added to Seattle 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 for buses and bicyclists to pass each other

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<sup>2</sup> *The City may consider testing new paving materials for roadways (including shoulders). These paving materials should be monitored to determine if they are appropriate for bicycle facilities. While pervious and semi-pervious materials may be desirable, the selection of the material needs to be project-specific and based on analysis of traffic, local drainage, and other engineering factors. At this time the semi-pervious materials used by the City may be tested on shoulders, but they are not appropriate for multi-use trails.*

<sup>3</sup> *Landis, Bruce W. et.al. "Real-Time Human Perceptions: Toward a Bicycle Level of Service" Transportation Research Record 1578, Transportation Research Board, Washington, DC 1997.*

comfortably in the lane. The locations and design of shared bus/bike-only lanes will need to be evaluated on a case-by-case basis.

### Off-Road Bicycle Facilities

#### Multi-Use Trails

Multi-use trails (also referred to as shared-use paths) are an important component of Seattle's bicycle transportation 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 territorial views of the city. Multi-purpose trails are usually paved and should be a minimum of 10-feet wide. Minimum width may be reduced to eight feet where physical or right-of-way constraints are severe. Trail widths of 12, 14, and even 16 feet are appropriate in high-use urban situations.

#### Sidepaths

Sidepaths are essentially trails that are located on the side of 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 some of the following key design features can be achieved:



- Sufficient width is available to build a facility with at least a five-foot buffer between the outside travel lane and edge of pathway (a 42-inch vertical barrier is also acceptable).
- 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 are limited access in 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, lots of trucks) it may be appropriate as a sidewalk may be the only option, especially if bicyclists are traveling up a steep hill. However, bicyclists should not travel faster than the design speed of the sidewalk (which is often the speed of a typical jogger).
- 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 opposed to motor vehicle traffic when they re-enter the street.
- Sidewalks should be a minimum width of six feet for one-way bicycle travel and a minimum of eight feet if two-way travel can be expected.



Due to limited opportunities for alternative facilities and other considerations, this plan recommends considering the use of sidepath and sidewalk facilities for bicycling in a

limited number of specific locations. Special attention will be required in the design process to ensure user safety on sidepaths and sidewalks.

One type of facility that is not recommended in this Plan is a bicycle lane or path at the edge of an arterial roadway between parked cars and the curb. Several reasons for discouraging the use of this type of facility are provided under the description of bicycle lanes.

### Further Study Required

There are a number of roadways that have poor conditions for bicycling, but do not have straightforward opportunities to include bicycle facilities by striping narrower lanes, removing lanes, adding shoulders, or making other physical improvements due to right-of-way constraints and traffic volumes. 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, the city will need to conduct additional, detailed studies that are beyond the scope of this plan.

### 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 bikeway corridor. It is important for the city of Seattle 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 shared lane markings and appropriate warning signs on a facility where a bicycle lane ends and the roadway continues. Transitions should be provided as a part of the bicycle facility design process.