

## Appendix H.

### Roadway Crossing Design for Bicycles

This appendix includes guidelines for bicycle roadway crossings. Two main categories of crossings are discussed: multi-use trail crossings of roadways and bikeway crossings of arterial roadways.

#### Traffic Control and Right-of-Way Assignment for Multi-Use Trail Crossings

This section describes the policy for traffic control and right-of-way assignment for trail/roadway crossings. There are two primary categories of trail crossings. The first type of crossing is where the trail crosses at least one street at an intersection of two or more streets. The second type of trail/roadway crossing is mid-block (e.g., typically at least 30 to 50 feet from an intersection).

#### Trail Crossings at Intersections

When trails cross roadways at intersections, the trail should generally be assigned the same traffic control as the parallel roadway (i.e., if the adjacent roadway has a green signal, the trail should also have a green/walk signal). This applies at intersections with all types of traffic control. The AASHTO Bicycle Guide describes these types of intersections as “adjacent path crossings” (see Figure H-1: Example of an adjacent path intersection depicting typical vehicle movements across the path, below).

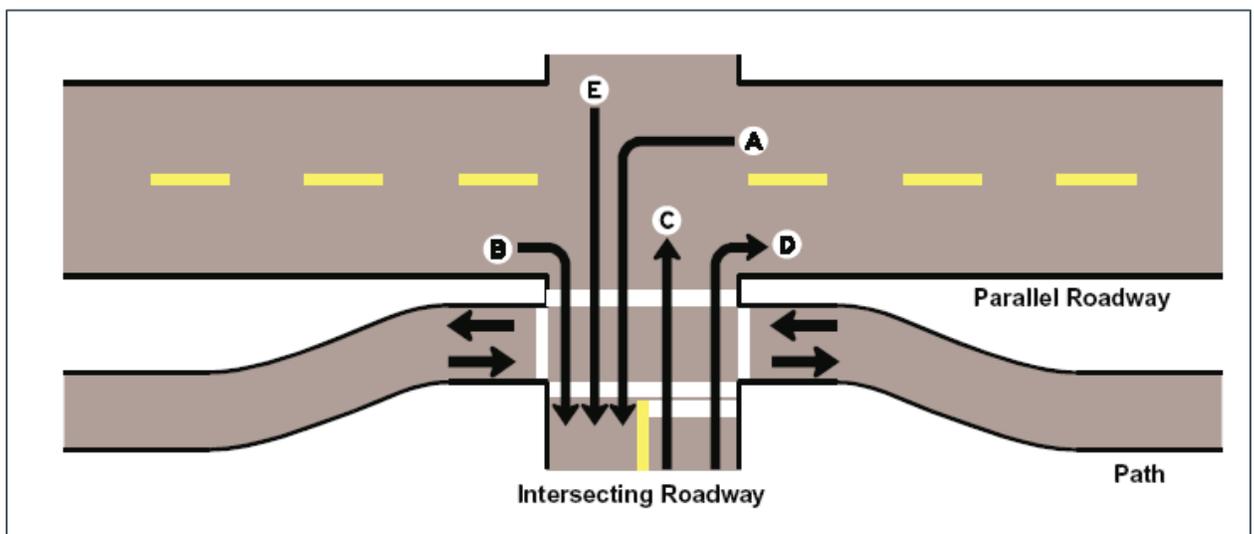


Figure H-1. Example of an adjacent path intersection depicting typical vehicle movements across the path  
Source: AASHTO Guide for the Development of Bicycle Facilities, 1999.

#### Signalized Intersections

At signalized intersections, if the parallel roadway has signals that are set to recall to green every cycle, the pedestrian signal heads for the trail should be set to recall to walk. The walk interval should be maximized within the green interval:

$$\text{WALK interval} = \text{Green Interval} - \text{Flashing Don't Walk Interval}$$

As required by the Manual on Uniform Traffic Control Devices (MUTCD), the walk signal for any trail shall not conflict with a protected left- or right-turn interval. The trail signal should change to a walk or green signal as soon as the protected turn phase ends. Therefore, when the trail crosses the intersection parallel to a major street that has a long

green interval with a protected turn phase, trail users should still see WALK signals for a significant portion of each signal cycle.

Consideration should be given to providing a leading pedestrian interval at trail crossings (i.e., three seconds of green/walk signal time are given to trail users before any potentially-conflicting motor vehicle movements are given a green signal). This allows pedestrians and bicyclists to have a head start into the roadway to become more visible to turning traffic.

Where the signals for the parallel roadway are actuated, the trail crossing will also need to be actuated. For trail crossings, the minimum WALK interval should be 10 seconds. The USE PED SIGNAL sign (R9-5) should be used at trail crossings at signalized intersections. Countdown pedestrian signals should be installed at all signalized trail crossings as signal heads are replaced.

### 4-way Stop-controlled Intersections

Intersections with 4-way stops should generally be avoided. However, if trails cross at intersections with four way stops, additional stop signs should be added as needed to ensure that there is at least one appropriately-placed STOP sign at each trail approach.

Consideration should be given to removing stop signs for the trail and the parallel roadway leaving the intersection 2-way stop controlled for the intersecting roadway. An engineering study should be conducted before removing or adding any stop signs.

### 2-way Stop-controlled Intersections

At intersections with STOP signs controlling only one of the approaches, the trail should be assigned the same right-of-way as the parallel street. Stop signs should not be placed on the trail approaches to the intersecting roadway if the parallel street has no stop signs. The trail should have the same control as the parallel street.

If the two streets have the same roadway classification, and the stop signs face the intersecting street that is parallel to the trail, consideration should be given to reversing the stop sign placement, giving the right-of-way to the trail and the parallel street. An engineering study should be conducted before reversing the stop sign placement. Appropriate warning signs and markings should be placed on the trail and roadway.

### Mid-block Trail Crossings

At mid-block trail crossings, traffic control should generally be one of the following:

- Traffic Signal.
- Stop signs facing the trail.
- Stop signs facing the roadway.
- Yield signs facing the trail.
- Yield signs facing the roadway.

The decision of whether or not to use a traffic signal at a mid-block trail crossing should be primarily based on the installation criteria and procedures for pedestrian traffic signals found in SDOT's Director's Rule 04-01. All trail users (including bicyclists) should be included in calculating the "pedestrian volume" for the warrant procedure outlined in Rule 04-01. When a trail crossing meets the warrants outlined in Rule 04-01, there may be other reasons why a signal is not necessary at the crossing. Engineering judgment should be applied in making the final decision of whether or not to install a signal.

Where a decision has been made not to install a traffic signal at a mid-block trail crossing, STOP or YIELD signs should be used to assign the right-of-way to the trail or the roadway.

The assignment of priority at a shared-use path/roadway intersection should be assigned with consideration of the following:

- The relative importance of the trail and the roadway.
- The relative volumes of trail and roadway traffic.
- The relative speeds of trail and roadway users.

The City of Seattle has four classifications of streets:

- Principal Arterials.
- Minor Arterials.
- Collector Arterials.
- Access Streets (residential and commercial).

As part of the Seattle Bicycle Master Plan, two classifications of signed routes are proposed; regional signed routes and local signed routes. Major trails in the city will be included in the signed route system. As such, there are three proposed classifications for trails:

- Regional Trails (trails that are part of regional signed routes).
- Local Through Trails (trails that are part of the local signed route system).
- Minor Trails (other trails including short connectors and trails in small parks).

The street and trail classifications described above make it possible to quantify the relative importance at each trail/roadway crossing. The following guidelines should be used to assign right-of-way:

- **Regional Trails** are effectively principal arterials for bicyclists, but trail user speed is generally lower than that on *Principal Arterial* streets. Therefore, *Regional Trails* should generally be given priority over *Minor Arterials*, *Collector Arterials*, and *Access Streets*. However, if the traffic volume on the street being crossed exceeds the traffic volume on the trail by 20% or more, the street should be given priority.
- **Local Through Trails** are like minor arterials for bicyclists, but trail user speed is generally lower than that on *Minor Arterial* streets. Therefore, *Local Through Trails* should generally be given priority over *Collector Arterials* and *Access Streets*. Again, if the traffic volume on the street being crossed exceeds the traffic volume on the trail by 20% or more, the street should be given priority.
- **Minor Trails** have roughly the same importance as *Access Streets*. Therefore, *Minor Trails* should normally not be given priority over any classification of *Arterial*. Where *Minor Trails* cross *Access Streets*, the priority should be assigned to the facility that has the most volume.

When new trails are built, they are often built in segments; so the initial trail user volume is often low. Thus, based on the guidelines above, the right-of-way will likely be initially assigned to the streets that the trail crosses. However, as trail volumes grow over time, the appropriate assignment of right-of-way may shift. To ensure the appropriate right-of-way assignment, trail/roadway crossings should be evaluated every few years.

Once priority has been assigned, the least restrictive control that is appropriate should be placed on the lower priority approaches. STOP signs should not be used where YIELD signs would be acceptable. The acceptability of YIELD signs depends primarily on sight distance, which should be evaluated through an engineering study using standard engineering practices.

### Pavement Markings

All trail crossing areas should be marked with a crosswalk according to the rules set forth in SDOT Director’s Rule 04-01.

Advanced “TRAIL XING” word pavement markings should be utilized at all crossings where the trail crossing is determined to be unexpected.

### Trail Warning Signs

All signs related to pedestrian/bicycle activity should be fluorescent yellow-green. It is recommended that the trail crossing warning sign be utilized at all trail crossings that are uncontrolled for motorists. The crossing sign at the trail shall be supplemented with the downward arrow subplate (see Figure H-2: Trail Warning Signs).



Figure H-2. Trail Warning Signs

### Advanced Warning Signs

It is recommended that advanced warning signs be used at most crossing locations, especially those locations with restricted sight distance or areas where it is determined that the trail crossing would be unexpected. Advanced warning signs might not be used in highly urbanized situations where there are short blocks or where two or more marked crosswalks are close together. It is recommended that all advanced warning signs include the “distance ahead” subplate (W16-2a) or the “AHEAD” subplate (W16-9p).

The subplates in Figure H-3: Advanced Warning Sign Subplates should be added to advanced warning signs. Figure H-4: Example Trail-roadway Crossing with Trail Yield Treatment shows the crossing from a trail user’s perspective.



Figure H-3. Advanced Warning Sign Subplates



Figure H-4. Example Trail-roadway Crossing with Trail Yield Treatment

## Bicycle Routes on Streets

### Appropriate Arterial Crossing Treatments for Bikeways

The following treatment should be used for appropriate crossing treatment when a signed bike route or bicycle boulevard crosses an arterial street.

There are six possible design treatments that are recommended (see descriptions in previous section):

- Mark crosswalk, no other improvements needed.
- Curb extensions into the parking lane to narrow the crossing width for bicyclists and pedestrians.
- Raised median placed in center turn lane.
- Raised median island created by tapering out the parking lane.
- Traffic signal (possibly with curb extensions if on-street parking exists).
- Raised island with 2-step traffic signal with off-set crosswalk markings (short section of trail down the center of the median separates the crosswalks by at least 15 feet).

The feasibility of installing these facility types at a given location should be determined by the criteria and guidelines for pedestrian crossing safety established in the SDOT Director's Rule 04-01 available at: <http://www.seattle.gov/transportation/crosswalkrule.htm>.

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