3.3.4 Trail Traffic and Transportation Design

Multi-use trails have certain design standards, which vary depending on the agency that is constructing or managing them. Paved trails on the creek trail system should be designed to meet the standards for a Caltrans Class 1 Bikeway, which are defined in the California Department of Transportation Highway Design Manual Section 1003.1. Generally, converting existing Water Agency service roads to paved multi-use trails will result in trails that comply with these standards. The configuration of points where the creek and associated trail system cross a street or a rail line are important to resolve for safety and traffic flow purposes. Crossing types include surface crossings, undercrossings, and in certain instances, overcrossings. This section identifies general transportation design principles and standards for these crossings, and further specifies how they should be configured for the creek trail system.

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Trail Intersection Operations. Based on research conducted by the University of North Carolina Highway Safety Research Center, the following principles were developed for the operation of trail intersections.

- Four-way stops are ineffective and can constitute a hazard. Motorists tend to stop, and bicyclists rarely do. This creates a false sense of security that can lead to a collision.
- High Speed Roadways – Assignment of right-of-way is critical. For crossings on roadways with speeds of 40 mph and greater, right-of-way is always assigned to the motorist.
- Medium Speed Roadways – Right-of-way can be assigned to trail users when their volumes exceed vehicular volumes and motorist speeds are at about 30 mph. Traffic calming devices should supplement the right-of-way assignment and be used to further slow the speed of motorists.
- Low Speed Roadways – Right-of-way can be assigned to trail users when their volumes exceed vehicular volumes and motorist speeds are 20 mph or less. In this case supplemental traffic calming devices are not necessary.

However, it should be noted that the volume of trail users in the City of Santa Rosa is rarely higher than the conflicting vehicular volume. Therefore, right-of-way is generally assigned to the motorist rather than the trail users.

The following are suggested techniques for enhancing crossing safety at trail/roadway intersections.

- Provide adequate stopping sight distances for motorists and trail users.
- Reduce conflict speeds by controlling the approach speed for either or both the trail user and the motorist.
- Reduce conflicts at intersections by routing trail crossings through existing crosswalks, or placing crossings outside of the influence of intersections.
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- Even on 2-lane roads, medians can help by acting as a traffic calming feature and separating conflicts in time and space.
- Trail crossings should be perpendicular. But, when needed, it is possible to skew the crossing to 75 degrees and still only lengthen the crossing distance by about 4 percent.
- Properly placed overpasses on trails will be well used, especially if at-grade crossings are complex, require excessive waits, or pose high speed conflicts. Long approaches to overpasses may be needed to meet ADA requirements.
- Signal cycles must be responsive to bicyclists, and should not require an excessive wait.

MUTCD 2003. The Manual on Uniform Traffic Control Devices (MUTCD) 2003, the national standard for designing, applying, and planning traffic control devices, includes guidelines for typical signs and markings for shared use paths as well as appropriate right-of-way and traffic control. Federal law requires all public agencies to conform to the MUTCD. MUTCD 2003 provides standards for use of a stop or yield sign and guidelines for assigning right-of-way.

Surface Street Crossings. This is a case where trail users must cross a street to enter or continue on the trail system. Surface crossings also function as potential creek trail entry points, typically with potential entries at the four corners of the street/creek crossing (upstream and downstream on the right bank and the left bank). There are approximately 200 roadway crossings in the citywide creek path system. Traffic volumes on the intersecting roadways range from low to moderate to high-volumes. Seven prototype crossing treatments have been developed to enhance crossing safety over the range of roadway types that intersect the pathway network. The crossing prototypes are listed in Table 3 and shown in Figures 10-16.

Features for all proposed roadway crossings include warning and/or control signs both for vehicles and pathway users. The type, location, and other criteria are identified in the Manual for Uniform Traffic Control Devices (MUTCD) and are illustrated on Figures 10-16. At each crossing location, consideration must be given for adequate warning distance based on vehicle speeds and sight distance. On higher volume roadways, catching the attention of motorists desensitized to roadway signs may require additional high visibility devices such as flashing light systems, pavement legends, roadway striping, or changes in pavement texture. Signing for path users includes a standard “STOP” sign and pavement marking combined with bollards, and in some cases where adequate space is available, a curve in the path to slow bicyclists on their approach to the street crossing. Care must be taken not to place too many signs at crossings or they will result in sign clutter and will negate their impact.

Directional signing may be useful for path users and motorists alike. For motorists, a sign reading “Santa Rosa Creek Pathway Xing” along with a path emblem or logo helps to both warn and promote use of the path itself. For path users, directional signs and street names at crossings help direct people to their destinations.
Many of the existing and proposed pathway segments emerge near a controlled roadway intersection. In these cases, a determination was made regarding the need to route pathway users to the existing intersection, or to develop a new mid-block crossing. A distance of approximately 200 to 300 feet was used in this evaluation, as the maximum distance pedestrians would travel out of their way to use an existing crossing. This distance was selected because it is generally outside of the influence of existing intersections and is a distance which may deter pedestrians from walking out of their directed path.

Where pathway users are expected to route to an existing intersection, a barrier and directional signing will be required to keep them from crossing at the unmarked location. At the existing intersection crosswalk, all path users will technically become pedestrians.
### Table 3. Prototype Roadway Crossing Treatments

<table>
<thead>
<tr>
<th>Roadway Type</th>
<th>ADT</th>
<th>Treatment Type</th>
<th>Treatment Features (Roadway)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local 2-Lane, Slow Speeds</td>
<td>≤ 5,000</td>
<td>I</td>
<td>Pedestrian Warning Signs</td>
</tr>
<tr>
<td>Collector 2-Lane, Slow Speeds</td>
<td>≤ 7,500</td>
<td>II</td>
<td>Advanced Warning Signs, Pedestrian Warning Signs, Pavement Stencils</td>
</tr>
<tr>
<td>Collector 2-Lane, Moderate Speeds</td>
<td>≤ 7,500</td>
<td>III</td>
<td>Advanced Warning Signs, Pedestrian Warning Signs, Pavement Stencils, Crosswalk Striping</td>
</tr>
<tr>
<td>Arterial 2-Lane, Higher Speeds</td>
<td>≥ 7,500</td>
<td>IV</td>
<td>Advanced Warning Signs, Pedestrian Warning Signs, Pavement Stencils, Crosswalk Striping, Pedestrian Refuge, Optional Advanced Warning Devices</td>
</tr>
<tr>
<td>Arterial 3-Lane, Higher Speeds</td>
<td>≥ 7,500</td>
<td>V</td>
<td>Advanced Warning Signs, Pedestrian Warning Signs, Pavement Stencils, Crosswalk Striping, Pedestrian Refuge, Optional Advanced Warning Devices</td>
</tr>
<tr>
<td>Arterial 4 or More Lane, Moderate Speeds</td>
<td>≥ 10,000</td>
<td>VI</td>
<td>Advanced Warning Signs, Pedestrian Warning Signs, Pavement Stencils, Crosswalk Striping, Pedestrian Refuge</td>
</tr>
<tr>
<td>Arterial 4 or More Lanes, Higher Speeds</td>
<td>≥ 10,000</td>
<td>VII</td>
<td>Advanced Warning Signs, Pedestrian Warning Signs, Pavement Stencils, Crosswalk Striping, Pedestrian Refuge, Advanced Warning Devices</td>
</tr>
</tbody>
</table>

Note: Each roadway crossing presents a unique set of features. Existing conditions at each location were reviewed and an appropriate treatment was identified. In some cases, prototypes were adapted to meet the unique circumstances of a crossing location.
Figure 10. Type I: Local Crossing Treatment
2-lane; ≤ 5,000 ADT; slow speeds
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**Figure 11. Type II: Collector Crossing Treatment**

2-lane; ≤ 7,500 ADT; slow speeds
Figure 12. Type III: Collector Crossing Treatment
2-lane; ≤ 7,500 ADT; moderate speeds
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Figure 13. Type IV: Collector/Arterial Crossing Treatment
2-lane; ≥ 7,500 ADT; higher speeds
Figure 14. Type V: Collector/Arterial Crossing Treatment
3-lane; ≥ 7,500 ADT; higher speeds
Figure 15. Type VI: Regional Crossing Treatment
4 or more lanes; ≥ 10,000 ADT; moderate speeds
Figure 16. Type VII: Regional Crossing Treatment
4 or more lanes; ≥ 10,000 ADT; higher speeds
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Signs warning motorists of the presence of bicycles may be needed, as well as right turn on red prohibitions "when pedestrians and bicyclists present." High-speed curve geometry and free right turns should be replaced with tighter radii to help slow vehicles, or enhanced with pavement texture or slightly raised speed tables.

One of the key problems with using existing intersections is that it requires bicyclists to transition from a separated two-way facility to pedestrian facilities such as sidewalks and crosswalks, normally reserved for pedestrians. Widening and striping the sidewalk (if possible) between the path and intersection may help to alleviate some of these concerns. Ultimately, users will cross at the trailhead unless there is a significant reason for them to divert to the closest crossing.

**Surface Rail Crossings.** Creek trail crossings at a rail line should, if possible, be redirected to the nearest existing public street. Establishment of a new public crossing requires approval by the Public Utilities Commission.

**Under-Crossings.** Ideally, in order to reduce potential conflicts between trail users and vehicles at points where the creek trail crosses existing streets, and if there is physical space, trails will pass under bridges. There are a variety of existing under-crossing types on the existing creek trail and service roads. Some of these are "dry season under-crossings", where trail users can cross under the street below a bridge only when water levels are low. Under-crossings should be designed or modified to meet ADA standards, with slope gradients a maximum of 5%, or up to 8.33% if resting platforms are provided at the intervals specified in detailed access standards. All ramps should be paved, even if they are connecting unpaved trail segments. Railings should be provided where there are steep drop-offs (e.g. over 2 feet and over 1:1 side slope). Ideally under-crossings should feature good visibility of the trail from the adjacent road and nearby trail for security purposes, which is primarily a function of design of the vehicular bridge that creates the under-crossing.

**Trail Entries.** Most of the trail system entry points occur where a public street crosses the creek and creek trail. If trails occur on both banks of the creek, entries could occur at the four corners of the street/creek crossing (upstream and downstream on the right bank and the left bank). Figure 17 illustrates various types of existing entry structures. The standard configuration of these entries from a traffic circulation standpoint is discussed earlier in this chapter. Other entry points occur where public streets dead end at or abut the creek. Still others are in public parks or school grounds. The specific current entry point conditions and changes proposed to accommodate public access are detailed in Appendix E. Most entries are in locations where there is currently a paved or unpaved gravel service road. Generally, providing new public access entails removing chain link gates or creating openings in chain link fences and placing removable locking bollards (posts) in the opening to prevent entry by unauthorized vehicles. In the case of mid-block entries, many creek reaches will require installation of a culvert to allow the entry to cross the drainage ditch that typically occupies the outside of the Modified or Modified Natural Creek corridor. Where there is a significant grade drop between the adjacent land or public road a ramp would be needed to accommodate trail users at an ADA compliant grade. The ramp might also need to accommodate emergency vehicles, or at least small maintenance and patrol vehicles. Alternatively, an adjacent or nearby entry point or ramp that has a steeper grade than the public access ramp could be provided.
Figure 17. Entry Structures

<table>
<thead>
<tr>
<th><strong>Bollards</strong></th>
<th><strong>Chain link gate with pedestrian walkaround – Austin Creek</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Chain link gate, no access</strong></td>
<td><strong>Curb barrier</strong></td>
</tr>
<tr>
<td><strong>Open channel access</strong></td>
<td><strong>Sidewalk along creek</strong></td>
</tr>
</tbody>
</table>

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Figure 17. Entry Structures (cont'd)

Stepover gate  Walkaround structure