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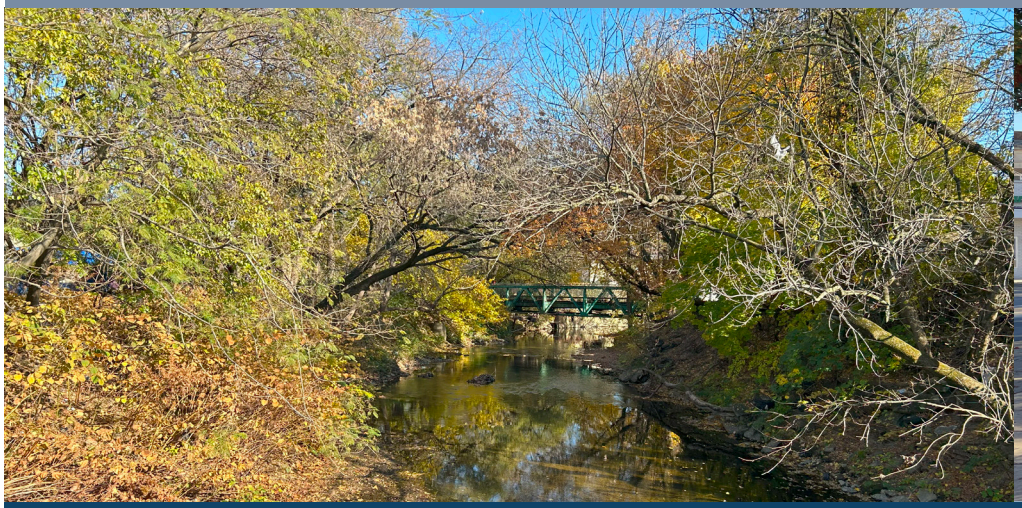
DELAWARE VALLEY dvrpc REGIONAL PLANNING COMMISSION

Delaware County Trail Crossings Toolkit



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Executive Summary

Trails enhance a community's access to recreational opportunities and have the potential to expand non-motorized transportation options for residents. By extension, safe trail crossings are vital for trail users to navigate the trail network. The Delaware County Planning Department asked the Delaware Valley Regional Planning Commision (DVRPC) to develop guidelines for various types of trail crossings and recommendations for five distinct locations identified throughout the county's trails system. Expanding and enhancing the trail network in Delaware County's dense urban and suburban communities requires safe trail crossings to enable users to cross over large and small roadways. This document is designed as a toolkit for the county and its partners to reference when designing safe trail crossings in the future. It is organized into the following chapters:

- Chapter 1 | Planning Context
- Chapter 2 | Trail Crossing Types Methodology
- Chapter 3 | Recommendations
- Appendices.

Trail Crossing Types

While each crossing location has its own unique safety concerns, there are patterns in the type of concern depending on the speed, traffic volume, and roadway width of the intersecting roadway. Based on these similarities, the toolkit provides comprehensive strategies that can be replicated throughout the county. The toolkit offers five data-driven trail crossing types:

- Trail Meets Major Roadway at an Intersection
- Trail Meets Major Roadway at the Mid-Block
- Trail Meets Minor Roadway at an Intersection
- Trail Meets Minor Roadway at the Mid-Block
- Trail Meets a Transit Right-of-Way

Major roadways are defined as higher-stress roadways with two or more travel lanes in each direction and minor roadways are typically lower-stress roadways with one travel lane in each direction.

Recommendations

Best practices in trail crossing design can be organized by the benefit each intervention provides: traffic calming, physical separation, and increased visibility/mutual awareness. **Traffic calming** interventions like speed humps and narrowing roadways dissuade drivers from speeding in the area, while interventions like refuge islands and perpendicular crossings create **physical separation** from drivers and **increase visibility** of vulnerable trail users. These recommendations, largely adapted from the Federal Highway Administration's *STEP: Improving Visibility at the Trail Crossing*, are then further organized into the identified trail crossing types to which they are most applicable.[1] Crossings on major roadways or at the mid-block typically require higher protection than crossings on minor roadways or at an intersection. Toolkit users are encouraged to use higher protection interventions where feasible.

[1] Federal Highway Administration (FHWA). "Improving Visibility at Trail Crossings." 2021. https://safety.fhwa.dot.gov/ped_bike/step/resources/docs/step_improving_visibilty_at_trail_crossings.pdf. Accessed September 15th, 2023.

Introduction

Background

The *Delaware County 2035 Open Space, Recreation, and Greenway Plan* and *2015 Countywide Greenway Plan* outline three goals related to natural and open spaces: conserve, enhance, and connect.[2] The D*elaware County Trail Crossing Toolkit* builds on the goal to connect, which aims to "develop a greenway network that connects natural features and people to community and regional destinations" by providing crossing practices that can be applied to the Countywide Primary Trail Network. The Countywide Primary Trail Network consists of proposed and existing trails significant to building a comprehensive county and regional Circuit Trail network. The Circuit is a multi-use trail network in the Greater Philadelphia region, featuring over 390 miles of completed trails and 800 miles of proposed trails.

Purpose

The Delaware County Trail Crossing Toolkit compiles and organizes crossing best practices based on five trail crossing types. Toolkit users, such as county and municipal planners, landscape architects, road engineers, and trail advocates, will be able to identify the most appropriate crossing designs for a given crossing and apply the recommended improvements. Example concept designs and case studies are provided to illustrate how each type's recommendations can be applied.

Steering Committee

The Delaware County Trails Alliance, a county-led group of individuals and organizations involved in trail development, management, and advocacy, functioned as the project's steering committee. The project team attended four of the group's quarterly meetings to gather feedback and insight on local trail development practices and progress. When applicable, members of the group were engaged outside of regular meetings to learn more about trail development in project-identified concept areas. Members of the Delaware County Trails Alliance include county, muncipal, community, and transportation agency representatives (Appendix B).

Toolkit Organization: How to Use

This toolkit is organized into three chapters to help users understand the Delaware County context, the range in trail crossing types, and design considerations.

	Purpose	How to Use
Chapter 1 | Planning Context	Defines trail and explores Delaware County's trail network.	Gain understanding of Delaware County's trail network.
Chapter 2 | Trail Crossing Types Methodology	Explains how the trail crossing types were developed, which can be used to analyze trail crossing	Identify which crossing type suits the crossing within your project area.
Chapter 3 | Recommendations	Consists of three components: general trail crossing considerations, recommendations based on trail crossing type, and concept plan and/or case study for each trail crossing type.	Select the interventions based on the appropriate trail crossing type.
Appendix	Provides additional resources to assist with safe trail crossing design.	Find map of identified trail crossings and references.

[2] Delaware County Department of Planning. *Delaware County 2035 Open Space, Recreation, and Greenway Plan*. 2015. https://delcopa.gov/planning/pubs/delco2035/OpenSpaceandRecreationPlan.html. Accessed September 18, 2024.

CHAPTER 1:

Planning Context

When studying trail crossings, it is important to consider the larger context for trail planning, development, and use to ensure the recommendations acknowledge regional trends and local perspectives. Delaware County's Primary Trail Network and the Circuit Trails have been subject to several planning efforts, which have helped to inform this toolkit. This chapter provides background on Delaware County's Primary Trail Network and introduces common trail crossing vernacular.

What is a Trail?

In everyday conversation, the term "trail" generally refers to any narrow transportation or recreation facility used by pedestrians or non-motorized wheeled vehicles, like bicycles. There are also equestrian trails for people riding horses and other types of special-purpose trails. Trails can also refer to linear facilities for motorized vehicles smaller than cars, such as ATVs and dirt bikes. Some trails serve multiple types of users, while others are dedicated to a single type or a small number of uses. Trails are generally separate from, but may parallel, roadways used by motor vehicles.

Multi-Use Paths and Trails

This Toolkit mainly focuses on "multi-use trails" or "shared use paths," which are generally defined as off-road facilities that accommodate all types of non-motorized uses (and, increasingly common, lower-speed motorized uses, such as e-bikes). They can be paved or unpaved but should be at least 10-feet wide to accommodate users passing in either direction while maintaining space for lower-speed travelers. Multi-use trails should comply with the Americans with Disabilities Act (ADA). Motorized vehicles that can operate at high speeds are generally prohibited to maintain the safety of users.

Accessibility and accommodation of multiple user types means multi-use trails can serve as recreational facilities and provide access to transit, employment, retail, education, or other services. It is not uncommon for one trail to serve multiple community needs. Their separation from higher-speed motorized traffic means that trails can be the most comfortable, least stressful option for many users. Because of these factors, trails can often be destinations in and of themselves where friends, neighbors, and family can gather.

Guidelines for shared-use path design are found in the American Association of State Highway and Transportation Officials' *Guide for the Development of Bicycle Facilities*.[3] The U.S. Access Board also provides important guidance for compliance with the ADA. Most federal and state funding sources require adherence to these guidelines for the design and construction of a shared-use path.

Pedestrian Paths

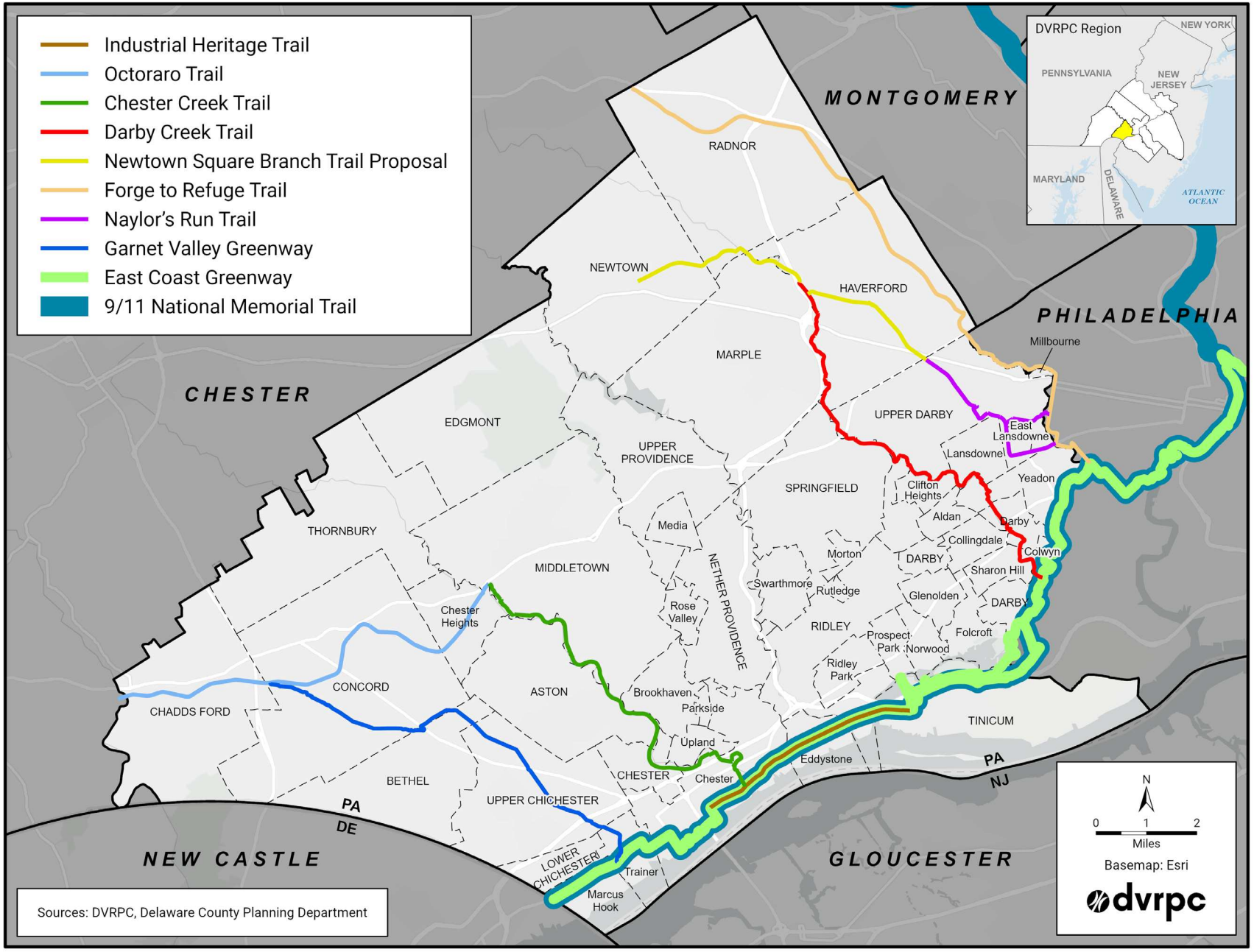
Pedestrian paths are generally expected to be used only by those on foot or, in some cases, by those with mobility devices. Cyclists and other users may be prohibited. Sidewalks are a good example of this type of facility, but they can also include narrower paths in parks or other areas. Generally, a width of about six feet is suitable and comfortable for expected users. Sometimes, pedestrian paths or sidewalks along roadways supplement bicycle facilities, such as bike lanes or cycle tracks, creating a combined facility that serves multiple non-motorized user types.

What is a Trail Crossing?

A trail crossing is defined as a location where a designated bicycle or pedestrian path crosses a public road, highway, railroad track, or other vehicle right-of-way. This toolkit focuses on trail crossings that are at-grade

[3] American Association of State Highway and Transportation Officials (AASHTO). *Guide for the Development of Bicycle Facilities*, 4th ed. (Washington, D.C.: AASHTO, 2012).

Figure 1: DVRPC Circuit Trails Network in Delaware County



with the roadway intersection, not crossing underground or above the right-of-way via a bridge. Trail crossing types vary based on the roadway configuration and the trail. Formal trail crossings are either marked, signed, or controlled through a traffic signal.

In 2021, the Federal Highway Administration (FHWA) developed the *Safe Transportation for Every Pedestrian (STEP): Improving Visibility at Trail Crossing* guidance document. The FHWA provides four trail crossing types: mid-block, adjacent, complex, and trailhead access. These crossing types inform the trail crossing types DVRPC developed for this toolkit.

Adjacent Path Crossings: This type of crossing occurs when a path that runs parallel or adjacent to a roadway crosses an existing roadway or intersection. This type of crossing often involves turning vehicles, which presents unique safety challenges. It is important to implement traffic signals, signage, and adequate distance between the roadway intersection and the trail crossing.[4] These trail crossings can meet the roadway at an intersection or at the midblock.

Midblock Crossings: This is the most common type of crossing. It typically involves crossing a roadway or railroad when there are no other intersections or crossings. Midblock crossings may be perpendicular, which occur when the trail and the roadway intersect at 90-degree angles, or askew, which is when the trail and the roadway intersect at a different angle.[5]

Complex Crossings: Complex Crossings are often defined as crossings that cannot be categorized as midblock or adjacent path crossings. A "complex trail crossing" typically refers to a point on a trail or pathway system where multiple trails intersect or cross one another in a way that may require hikers, cyclists, or other users to decide which direction to take. These crossings can vary in complexity, and their design can range from simple junctions to intricate intersections. Complex trail crossings are often found in larger trail networks or recreational areas where multiple trails are interconnected. They may involve various types of signs, markers, or trail maps to help users navigate the intersection safely and choose the appropriate path. The complexity of a trail crossing depends on factors such as the number of intersecting trails, the presence of obstacles like rivers or roads, and the availability of directional signage.[6]

Trail Access Crossings: This crossing type occurs where a trailhead or access point is across the roadway from a popular destination area, such as a school or transit stop. While these crossings may have elements of another crossing type, additional treatments may be needed to enhance visibility or slow vehicle speeds.[7]

Delaware County's Existing and Planned Trail System

In the Delaware County Planning Commission's *Volume II: Countywide Greenway Plan,* published in 2015, Delaware County identified a network of Primary Trails comprising existing and conceptual segments. The Primary Trail Network serves as the main spokes to the countywide network of trails, allowing municipalities to add segments to the spoke or build a trail that connects to it (Figure 1). The central goal of establishing a Primary Trail Network in Delaware County is to establish a "network of interconnected, non-motorized travel and recreation connections near and between all corners of Delaware County, as well as to existing and proposed trails in adjacent counties."[8] This long-term vision of connectivity aligns with the long-term goals of the greater regional Circuit Trail Network.

[4] FHWA. "Improving Visibility at Trail Crossings."

[5] Rails to Trails Conservancy. "Crossings." https://www.railstotrails.org/trail-building-toolbox/crossings/. Accessed September 18, 2024.

[6] Federal Highway Administration. "Improving Visibility at Trail Crossings."

[7] FHWA. "Improving Visibility at Trail Crossings."

[8] Delaware County Planning Commission. "Chapter 3: Primary Trail Network." *Delaware County 2035 Open Space, Recreation, and Greenway Plan Volume II: Countywide Greenway Plan.* 2015. https://www.delcopa.gov/planning/pdf/greenspace/Chapter_3_Vol-II_CountywideGreenwayPlan.pdf. Accessed September 1, 2023.

Regional Trail Context: Several regional and national trails and trail networks travel through Delaware County. These are significant long-distance trails with the propensity for local use and travel to and from locations outside the immediate area. This section includes descriptions of each relevant trail within the Primary Trail Network.

Circuit Trails: The Circuit Trail network is an envisioned 800-mile+ regional network of multi-use trails in the Greater Philadelphia metropolitan area, including Delaware County. This network includes several significant existing and proposed trails within the county. These include the Chester Creek Trail, the Darby Creek Trail, the Newtown Square Branch, and the Forge to Refuge Trail. More information is available at the DVRPC Circuit Trail website.[9]

East Coast Greenway: The East Coast Greenway is an envisioned off-road route extending from Key West, Florida, to Calais, Maine. Many Greenway segments are currently complete, including several within Delaware County. An existing portion of the Greenway enters the county from the south in Marcus Hook using on-road bike lanes heading north on West 10th Street. The Greenway route continues along 10th Street before routing toward the Delaware River via Highland Avenue, picking up the Chester City Waterfront trail for 1.3 miles. Moving north beyond the Chester City Waterfront Trail, the Greenway will proceed along West Second Street after connecting from Flower Street. This proposed segment will run roughly 5 miles along Route 291 with an existing crossing over the Crum Creek and Darby Creek before linking up with the John Heinz National Wildlife Refuge off-road facility and the Cobbs Creek Trail beyond the County border.

9/11 National Memorial Trail: The 9/11 National Memorial Trail is a 1,300-mile system of trails and roadways linking the September 11th Memorial and Museum in New York City, the National 9/11 Pentagon Memorial in Arlington, VA, and the Flight 93 National Memorial in Shanksville, PA. The trail is a tribute to the victims and heroes who perished on September 11, 2001, and all who responded. Within Delaware County, the 9/11 National Memorial Trail follows an identical route to the existing and proposed segments of the East Coast Greenway, stretching from the southern border of the county in Marcus Hook to the Cobbs Creek Trail and beyond into Philadelphia County.

Octoraro Trail: The Octoraro Greenway is planned to run through Concord Township and Chester Heights Borough, ending at the SEPTA Wawa regional rail station. From this point, it could link with the proposed Chester Creek Trail, which continues southward. However, progress on the Greenway has been slow, as much of the historic rail alignment lies within private property. The feasibility of the project largely hinges on securing rights-of-way (ROW) for most of the trail's proposed nine-mile stretch.

Chester Creek Trail: The Chester Creek Trail follows a formal rail line running north to south through the county and parallel along Chester Creek. When completed, the trail will extend from the SEPTA Wawa Station to Upland, Pennsylvania, consisting of 8.90 miles of trail. Trail construction has been broken into three phases, the first of which, consisting of the middle section of the proposed trail (2.8 miles in length), was completed in late 2016. Engineering and design work for the next two miles of trail is in progress, which will bring the trail further into Aston Township. The primary trail connections will include the Octoraro Greenway and the East Coast Greenway.

Darby Creek Trail: The Darby Creek Trail consists of three major sections that run alongside Darby Creek through heavily wooded areas and neighborhoods. A 1.26-mile paved section winds through the western neighborhoods of Haverford Township, beginning near Hilltop Road and running south to Merry Place Playground on Glendale Road. This trail segment is the middle section of the full trail proposed by Haverford Township, which includes extending the trail north to Haverford Reserve and south to Glendale Park.

[9] DVRPC. "The Circuit Trails." www.dvrpc.org/webmaps/thecircuit/. Accessed September 18, 2024.

Newtown Square Branch Trail Proposal: Predominantly an unused rail right-of-way, the Newtown Square Branch Rail Trail runs northwest to southeast through Newtown, Radnor, Marple, Haverford, and Upper Darby Townships. The ROW can be converted into a multi-use trail, beginning at Route 252 near Goshen Road and ending near 69th Street in Upper Darby. A 0.75-mile stretch of trail is completed between Manoa Road and Eagle Road, with engineering and design work underway for an additional 0.40-mile segment to the southeast. The branch trail will extend a total of 2.9 miles when completed, linking the Darby Creek trail to Naylor's Run Trail.

Forge to Refuge: This proposed trail from Valley Forge National Park in King of Prussia to the John Heinz Wildlife Refuge in Southwest Philadelphia is an ambitious multi-municipal trail that will connect five municipalities and extend roughly 30 miles in length. Currently, the built sections of the trail include two segments, only one of which is in Delaware County. The northernmost section of the trail is known as the Radnor Trail, which is 2.4 miles long and built on a former rail bed extending from Sugartown Road and S. Radnor Chester Road.

Naylor's Run: Led by Upper Darby Township, Naylor's Run is envisioned as a trail segment between Manor Avenue in the north and Baltimore Pike to the south. The plans for this trail use an abandoned rail bed in Upper Darby, which connects the Newtown Square Branch to Millbourne Borough and could ultimately join the Cobbs Creek Trail to the Forge to Refuge Trail.

Regional Planning Context

The Circuit Trails are a vast regional network of hundreds of miles of multi-use trails in the Greater Philadelphia and southern New Jersey region. They connect urban, suburban, and rural communities and provide a place for healthy transportation and recreation by connecting these diverse communities to green space. The network currently comprises roughly 400 miles of connected trails, intending to reach 800+ miles once completed.

Figures 2 and 3 represent the existing and planned network of the Circuit Trail system within Delaware County and Delaware County Primary Trail Crossing Network. All planned and existing Circuit Trails overlap with the county-identified Priority Trail Network. The Priority Trails that extend beyond the Circuit Trail Network are represented by the red lines. Each dot on the map represents where a trail crosses a road or intersection and is color-coordinated with the status/categorization of the trail. Trails are categorized as either existing, in progress, pipeline, or planned, as defined below.

1. **Existing:** These trails are built and open for use.
2. **In Progress:** These trails are currently being designed or built.
3. **Pipeline:** DVRPC, local governments, and nonprofit organizations are actively working to move these trails forward by conducting studies, acquiring rights-of-way, engaging local communities, and laying the groundwork to obtain funding for future design and construction.
4. **Planned:** These trails are documented in local, county, or regional plans. They represent opportunities for regional-scale, multi-use trails.

Dots or crossings that are haloed in yellow on the map represent crossings that the County has identified as priority crossings.

There are currently 15.94 miles of completed Circuit Trails in Delaware County, with 9.85 miles that are currently "in progress," meaning they are either under design or construction. Of the miles currently "in progress," 1.29 are actively under construction as of Fall 2023.

Trail Ownership and Maintenance

The existing, upcoming, and conceptual trail segments of the proposed trail network in Delaware County fall within the jurisdictions of multiple municipal, county, and state agencies. Coordination between these entities will be important to implementing future trail segments and the ongoing maintenance and improvements to existing segments. Coordination allows for collaborative planning and decision-making between multiple agencies as individual projects advance. It can also help to develop coordinated responses to network-wide needs and challenges.

Figure 2: Delaware County Circuit Trails and Crossings

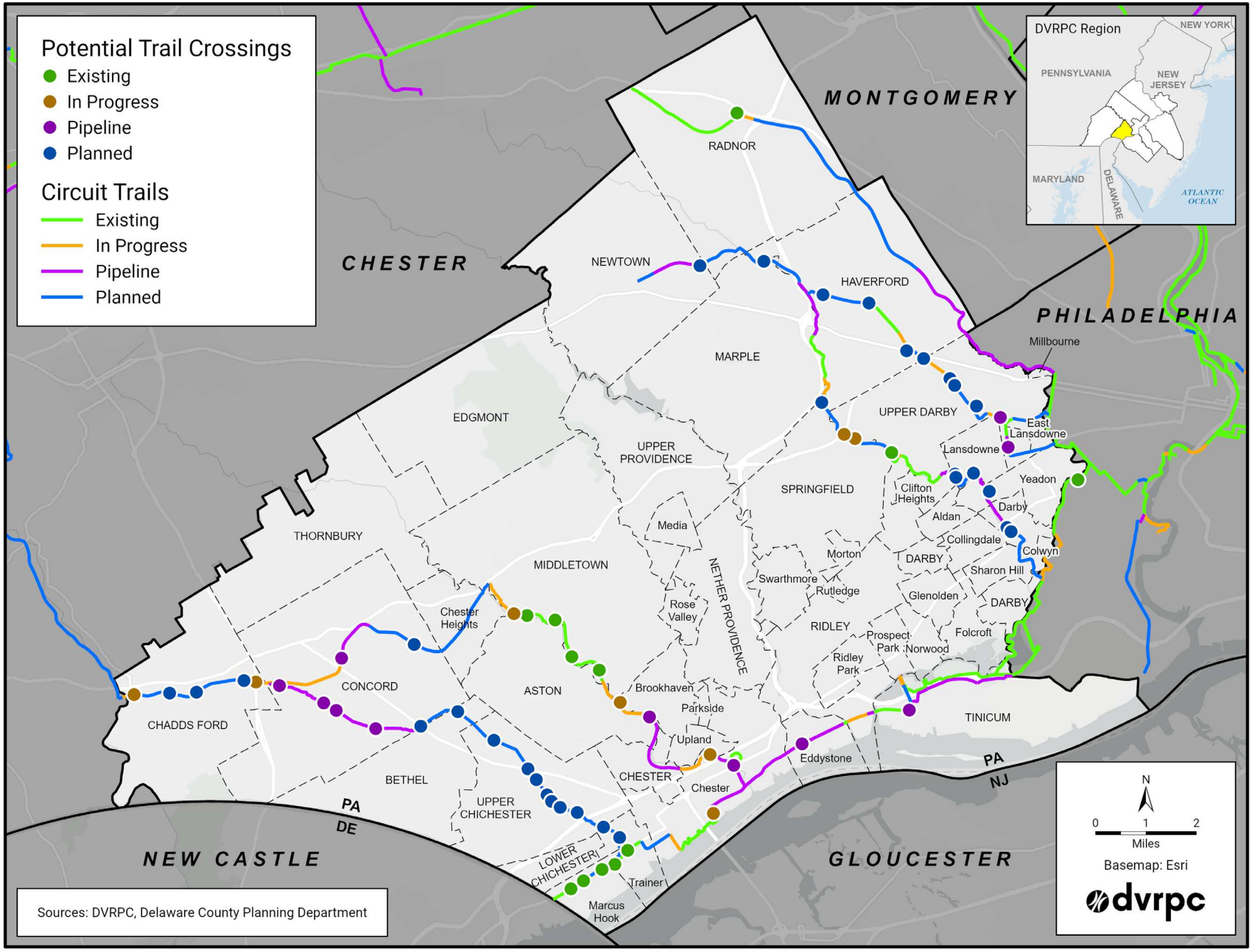
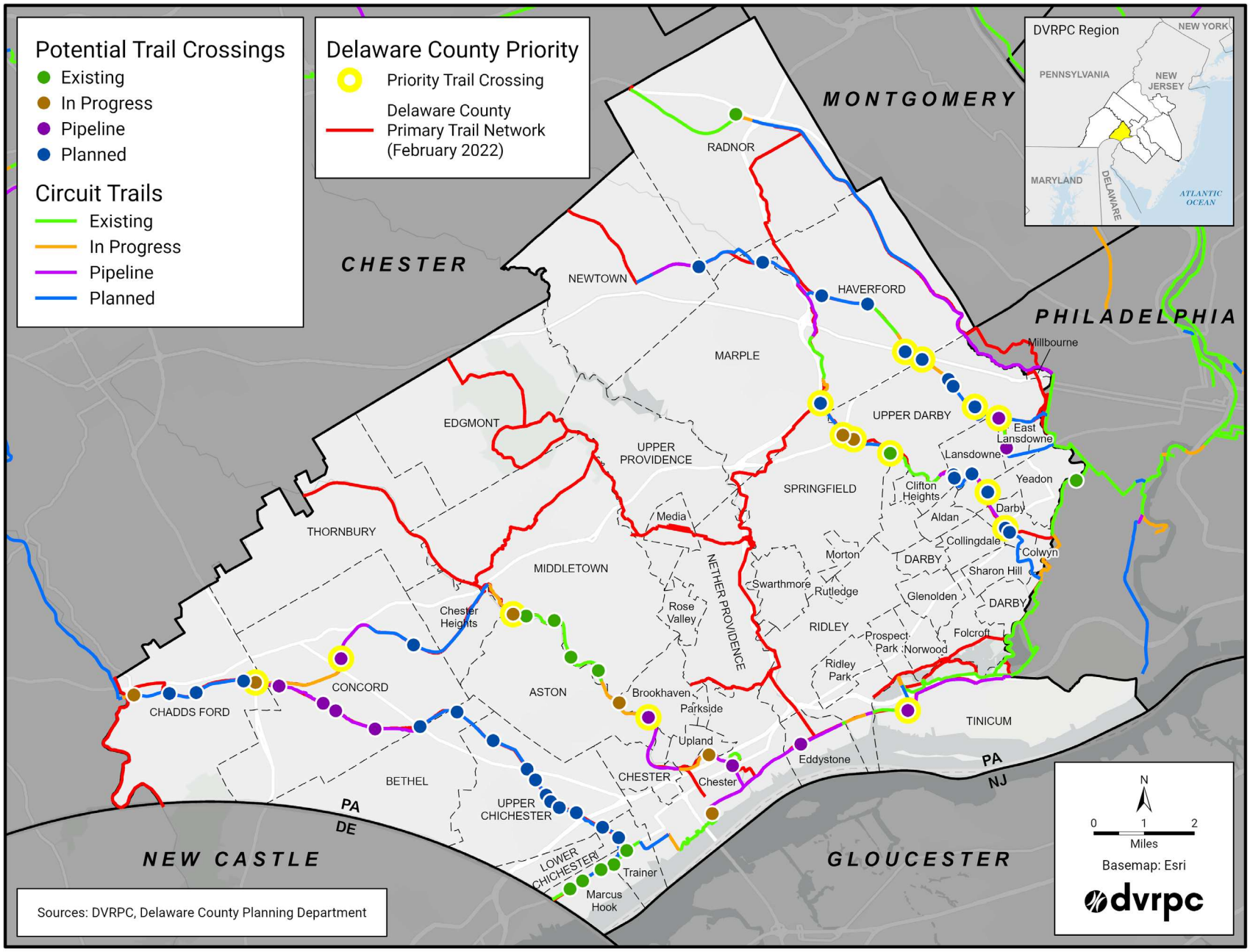


Figure 3: Delaware County Circuit Trails and Primary Trails



Many of the trail crossings in Delaware County encounter a state-owned road or one that falls under PennDOT jurisdiction. Before undertaking any trail crossing plans or construction, local governments and organizations must contact the PennDOT Bicycle & Pedestrian Coordinator through the appropriate district office (Delaware County is in District 6-0). In the event that a local government plans to have one or more trails that will cross state highways, a Shared Use Path Crossing Agreement with PennDOT is needed. PennDOT has been working on a Midblock and Trail Crossing Policy guidance that is currently under the final stages of review by the Federal Highway Administration (FHWA). The policy is expected to be published in 2025 and would supersede the guidance of state-owned roads provided in this document.

CHAPTER 2:

Trail Crossing Type Methodology

The purpose of this section is to describe the development of trail crossing types, which can be used to help the user identify the trail crossing type most closely related to any desired trail crossing. The DVRPC project team categorized trail crossings into five categories based on the types of roadways trails cross and the location of the crossing relative to nearby local and state-owned intersections. The resulting categories were:

- Trail Meets Major Roadway at an Intersection,
- Trail Meets Major Roadway at the Mid-Block,
- Trail Meets Minor Roadway at an Intersection,
- Trail Meets Minor Roadway at the Mid-Block, and
- Trail Meets a Transit Right-of-Way.

The project team also collected additional information about the trails and roadways and documented them in a geospatial dataset to support the selection of case-study locations. This methodology can be used to replicate the analysis for trail crossings not listed in Appendix A.

Trail Crossing Data

The project team used the following roadway data to manually categorize trail crossings:

Level of Traffic Stress (LTS): LTS is a road classification scheme based on the estimated comfort of bicyclists in the traffic stream. DVRPC's LTS assignment is based on the number of lanes, effective vehicle speed, and the presence and type of bicycle facility on the road segment. LTS ranges from one to four, with one indicating a roadway that would be comfortable for most people biking and four only bikeable for the most confident cyclists. Roads with LTS 1 or 2 were typically categorized as minor roads, while those with LTS 3 or 4 were typically categorized as major roads.

Road functional class: The functional class of the roadway describes the road's intended purpose, general geometry, and the relative priority of mobility and land-use access. The functional class of intersecting roads can be used to broadly categorize the type of crossing trail users will encounter. Minor collectors and local roads were considered minor roads, while major collectors and arterials were considered major roads.

Roadway volumes: Average annual daily travel (AADT) on roads offers insights into how heavily used a roadway is at a crossing and, thus, the required traffic control types. Higher AADT roads were categorized as major roadways.

Roadway speed: The posted speed on the road relates to the amount of warning vehicles need to safely slow or stop for pedestrian crossings. Major roads typically have speed limits that exceed 35 miles per hour.

Number of lanes: Recommended treatments may vary based on the distance required for pedestrians and bicyclists to cross. The number of lanes was used as a proxy for roadway width. Roads with more than two travel lanes total were considered major roads.

Crossing location: Mid-block and intersection crossings call for different design considerations and are likely to have significant differences in signalization, crosswalks, turning movements, and lighting.

Right-of-way type: Most of the trail crossings identified in Delaware County require users to cross roadways. Some, however, cross transit rights-of-way and may benefit from different treatments.

The project team also collected data on the following to help select case study locations and to assess preferred design interventions at specific crossing locations:

Trail status: Designs for trail crossings may be more or less implementable depending on the status of a trail. Existing trails may have limitations on crossing interventions that are realistic for implementation based on the configuration of the trail and road or other physical features. Early planning can influence placement and design for planned and pipeline trails to avoid constraints that would make crossings difficult or less safe.

Nearby crashes: Assessing the instances of crashes, especially those involving pedestrians and cyclists, near trail crossings can help the project team understand if existing conditions are unsafe and if they need to be remediated through road design.

Pedestrian connections: Trails that cross roadways away from existing pedestrian infrastructure may require different treatment than those that are already connected to a robust sidewalk network.

Five Trail Crossing Types

The project team developed the five trail crossing types based on the characteristics of the adjacent roadway and where the trail intersects with the roadway (Table 1). These five crossing types are driven by two main characteristics: whether the road is major or minor, and whether the trail meets the road mid-block or at an intersection.

Major vs. minor roads: The categories of major and minor roads are based on quantitative data but still rely on subjective judgment. For this study, the project team considered major roads to be arterials and major collectors with high or medium volumes, more than two travel lanes, posted speeds over 35 miles per hour, and LTS ratings of 3 or 4. By contrast, minor roads are local roads or minor collectors with low volumes, two travel lanes, posted speeds under 35 miles per hour, and LTS ratings of 1 or 2. When roads do not fall neatly into either category, the project team used planning judgment and perceptions from site visits to categorize a road into the most appropriate type.

Trails meet at the mid-block vs. intersection: Crossings are considered mid-block when they do not intersect the roadway at a controlled intersection. Several of the trail crossings prioritized for conceptual design in this report are in the early stages of planning, and their exact crossing locations have not been finalized. When preliminary crossing locations are at mid-block locations, the project team recommends moving them to an intersection unless no intersection is within close proximity. As a result, some crossings categorized as "mid-block" are shown with designs that change the trail alignment to allow trail users to cross at a controlled intersection.

Table 1: Trail Crossing Type Criteria

	Trail Meets Major Roadway at an Intersection	Trail Meets Major Roadway at the Mid-Block	Trail Meets Minor Roadway at an Intersection	Trail Meets Minor Roadway at the Mid-Block	Trail Meets a Transit Right-of-Way
PAGE	20	28	36	44	52
LTS	3 or 4	3 or 4	1 or 2	1 or 2	N/A
ROW Type	Roadway	Roadway	Roadway	Roadway	Railroad or Busway
Functional Class	Arterial/Major Collector	Arterial/Major Collector	Local/Minor Collector	Local/Minor Collector	N/A
Road Volume	High/Med	High/Med	Low	Low	N/A
Crossing Location	Intersection	Mid-Block	Intersection	Mid-Block	Railroad
Speed	High	High	Low	Low	N/A
Road Width	> 2 Lanes	> 2 Lanes	2 Lanes	2 Lanes	N/A

Source: DVRPC

CHAPTER 3:

Recommendations

This chapter consists of two sections: general recommendations and crossing type-specific recommendations. The first provides an overview of recommended best practices compiled from several guidance documents developed to help improve traffic calming, physical separation, and awareness of bicycle, pedestrian, and trail users. The second further organizes the identified treatments by the crossing types explained in the previous chapter.

General Recommendations

Although trail crossing safety is a relatively under-studied topic, research on bicycle and pedestrian crossing treatments has received more attention in recent years. Understanding roadway context is key to determining the appropriate crossing treatment. Street volume, lane width, speed, land use, trail use, user demographics, and crossing angle seriously impact crossing safety. The following section largely synthesizes bicycle, pedestrian, and trail crossing practices from the National Association of City Transportation Official's *Don't Give Up at the Intersection: Designing All Ages and Abilities Bicycle Crossings* and the FHWA's *Safe Transportation for Every Pedestrian (STEP): Improving Visibility at Trail Crossing* guidelines.[1] Crossing treatments are categorized by the following interventions: physical separation, traffic calming, and mutual awareness. Figure 4 identifies which treatments align with a particular intervention, expanding on a methodology outlined by the FHWA. The chapter will address how these interventions could be applied to each trail crossing type. Recommendations in the following chapters combine methods from these guidelines with regional best practices.

[1] National Association of City Transportation Officials (NACTO). *Don't Give Up at the Intersection: Designing All Ages and Abilities Bicycle Crossings*. 2019. https://nacto.org/publication/dont-give-up-at-the-intersection/. Accessed September 19, 2024; FHWA. "Improving Visibility at Trail Crossings."

Identified Benefits of Treatments
Source: DVRPC; Adapted from FHWA STEP: Improving visibility at Trail Crossing

Physical Separation

Separated bicycle, pedestrian, and trail facilities prioritize vulnerable roadway users by providing facilities away from vehicular traffic, which decreases the interaction between vulnerable roadway users and motorists. Physical separation can also increase mutual awareness by creating an environment where different roadway users can anticipate each other's presence.

Expand the pedestrian network. Treatments like curb extensions and pedestrian refuge islands (shown in Figure 4) reduce the distance trail users travel in conflict with vehicles while crossing a roadway. These treatments can be tested with temporary materials like paint and delineators. However, greater safety benefits are achieved with more permanent fixtures.

- Curb extension: Expands the sidewalk by taking space from the

Figure 4: Pedestrian Refuge Island and Curb Extension

Source: Dan Burden, PedBikeImages

Figure 5: Raised Crosswalk and Curb Extensions

Source: Dan Burden, PedBikeImages

adjacent sidewalk or road shoulder.

- Pedestrian refuge island: Provides a patch of sidewalk in the middle of the roadway for trail users to rest while crossing wide roadways.

Traffic Calming

Traffic calming refers to treatments that reduce crashes by decreasing vehicle speeds and instances of reckless driving. Depending on the trail crossing's distance to a roadway intersection, a combination of through and turning movement traffic calming treatments should be employed to achieve the safest results.

Through Movement

Through movement traffic calming treatments encourage slower speeds by narrowing, shifting, or briefly elevating travel lanes.

Add vertical deflection. Vertical deflection, like speed humps, force drivers to slow down in anticipation of an increase in elevation. Vertical deflection treatments vary in width and height to accommodate different roadway users, such as bicyclists and emergency vehicles. Some of these treatments include speed cushions, speed tables, raised crosswalks, and raised bike crossings (Figure 5). Cost-effective, temporary vertical deflection treatments are available.

Reduce lane widths. Narrow roadways signal to drivers that they should travel more cautiously. This can be achieved by narrowing travel lane widths, planting street trees, or adding delineators, which create the illusion of a narrow roadway. Pedestrian refuge islands and curb extensions briefly narrow a roadway directly where pedestrian, bicycle, or trail users cross the roadway (Figure 5) and can be implemented to create a horizontal deflection, slightly shifting the direction of vehicles and causing traffic speeds to decrease. In the short term, roadway widths can be reduced through repaving efforts or with street paint to reduce lane widths, create a refuge island, or create curb extensions. Temporary treatments can be further enforced with delineators, armadillos, and jersey barriers.

Turning Movement

Vehicle turning movements at roadway intersections can be dangerous for nearby bicyclists, pedestrians, and other trail users. At an intersection, various roadway users change directions, increasing the chance of conflict. This is especially apparent at intersections with a trail crossing in close

proximity. Treatments that enforce reduced turning speeds and increase mutual awareness help improve safety for vulnerable users.

Reduce existing curb radii. Larger curb radii allow for larger truck movements but also encourage quicker turning speeds for smaller vehicles. Vehicle turning speeds can be decreased by reducing the curb radii. Paint and delineators can be used to temporarily reduce radii.

Add a turning island or wedge. Turning islands help reduce an intersection's turning radius while buffering bicycle users from vehicles as they navigate a turn.

Add a hardened centerline. Hardened centerlines mitigate travel speeds for left-turning movements by implementing a vertical fixture on the centerline. The fixture forces vehicles to navigate around the turn without cutting the corner.

Ban right turn on red. Banning right turns at red lights reduces potential conflicts between pedestrians and turning vehicles.

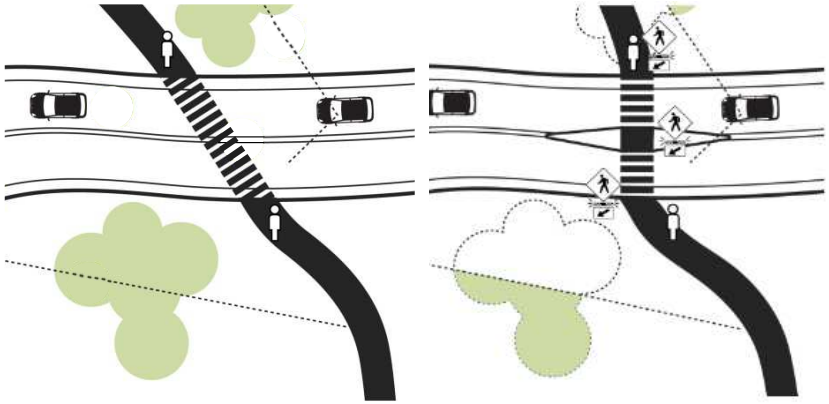
Mutual Awareness

Some roadway configurations minimize vehicles' awareness of roadway users outside of vehicles. Conditions can be improved by increasing the visibility of trail users through adjustments in signage, materials, and roadway configurations.

Alter the roadway geometry. The roadway and trail should intersect at a 90-degree angle, which allows for better visibility of crossing vehicles and trail users (Figure 6).

Clear obstructions around crossing. Removing parking spaces directly adjacent to an intersection (daylighting) and setting back the stop bar improves visibility for roadway and trail users. Recessing the stop bar shifts trail users from the driver's peripheral vision to the front of their sight and creates a space for bicyclists to idle in front of vehicles. Vegetation should also be maintained so it does not block users' lines of sight.

Figure 6: Straightening Trail Crossings & Clearing Visual Obstructions



Source: Amended from FHWA, "Safe Transportation for Every Pedestrian (STEP): Improving Visibility at Trail Crossing"

Maintain appropriate signage and pavement markings. Signage and pavement markings supplement other treatments by increasing users' awareness of other roadway users and upcoming crossings. Some of these signs include yield signs, high-visibility beacons, and pedestrian crossing pavement markings. For more details on appropriate signage, refer to the FHWA's Manual on Uniform Traffic Control Devices (MUTCD).[2]

Maintain or provide crossing pavement markings. Pavement markings such as crosswalks and crossbikes (green crosswalk symbol for bikes) create a designated space where vehicles can anticipate vulnerable users to cross.

Update roadway signalization to prioritize trail users. Increasing the duration of the walk phase at signalized intersections provides more time for children, older adults, and individuals with disabilities to cross safely. Additionally, Leading Pedestrian Intervals (LPIs) increase walk times and

[2] Federal Highway Administration (FHWA). *Manual on Uniform Traffic Control Devices for Streets and Highways*, 11th ed. (Washington, D.C.: U.S. Department of Transportation, 2023).

minimize conflict with potential turning vehicles by allowing pedestrians to begin crossing slightly before the conflicting travel lane turns green.

Use of appropriate surfaces and materials. Materials signal a change in roadway usage to roadway users. For example, changing the crossing material to a stone paver visually signals to drivers that pedestrians or other trail users will be crossing. A raised crosswalk briefly lifts vehicles and pedestrians to the same grade above the roadway. Detectable warning surfaces alert visually impaired trail users of an upcoming surface change.

How to Determine Appropriate Recommendations

The toolkit offers a summary of recommended trail crossing treatments by crossing type in Table 2: Intersection Crossing on a Major Roadway, Mid-Block Crossing on a Major Roadway, Intersection Crossing on a Minor Roadway, Mid-Block Crossing on a Minor Roadway, and Transit Crossings. The following trail crossing type sections offer (1) a table outlining the benefits and design considerations associated with the identified treatments and (2) a corresponding concept design or case study describing how the treatments can be applied to a real crossing location in Delaware County.

The benefits are depicted using three dots where:

- **Purple:** Traffic Calming
- **Blue:** Physical Separation
- **Green:** Increased Visibility

If a desired crossing is a part of Delaware County's Primary Trail Network, the crossing may be listed in the regional trail crossings map (see Appendix A). Once the crossing type is identified, the user can review the menu of recommended treatments and select appropriate interventions for your crossing. Keep in mind that trail crossing locations associated with the same crossing type may require different treatments depending on the context of the site. For example, curb extensions may not be feasible on some major roadways due to a lack of available roadway space. In instances where a crossing does not coincide with a designated trail crossing type, discretion should be used to identify whether the crossing requires higher or lower protection interventions.

Table 2: Trail Crossing Type Recommended Treatments

CONCEPT AREA SPECIFIC INTERVENTIONS

INTERVENTION	BENEFITS				CROSSING TYPES							
GENERAL TREATMENTS	Traffic Calming: Through Lane	Traffic Calming: Turning	Physical Separation	Increase Visibility/ Mutual Awareness	Trail Meets Major Roadway at an Intersection			Trail Meets Major Roadway at the Mid-Block	Trail Meets Minor Roadway at an Intersection		Trail Meets Minor Roadway at the Mid-Block	Trail Meets a Transit ROW
					Township Line Road & Darby Road	West Chester Pike & Gilmore Road	State Road & Township Line Road	Dresher Road	Rosemont Road & Bloomfield Avenue	Burmont Road & Warrior Road	Saulin Blvd & Chester Valley Trail	Lower State Road
Lighting				■	■	■	■	■	■	■	■	■
Detectable Warning Surfaces				■	■	■	■	■	■	■	■	■
Perpendicular Crossing/ Realign Trail Approach				■	■	■	■	■	■	■	■	■
Set Back Stop Bar				■	■	■	■	□	■	□		■
Physically Narrow Lanes	■			□	□	□	□	■	■	□	■	
Reduce Curb Radii		■		□	■	■	■		■	■		
Curb Extensions			■	□	□	■	■	□	■	□	□	
Refuge Island	■		■	■	□	■	■	■	□	□	■	
Hardened Centerline		■	■	□	□	□	□					
Vertical Deflection	■			□					□	■	□	
Raised Crosswalk	■	■	■	■					■	□	□	
Crossing Material	■		■	■					□	□	□	
Street Trees	■			□	□	□	□	□	□	□	□	
Trim Vegetation				■	■	□	■	□	□	□	■	■
Parking Restrictions				■	■	■	□	□	□	□	□	
At-Grade Crossing Facility				■								■
SIGNAGE, MARKINGS, AND SIGNALIZATION												
Crossbike/ Crosswalk Marking				■	■	■	■	■	■	■	■	
Yield Marking	■	■		■					□	■	■	
Motorist Stop/Yield Signs	■	■		■	■	■	□	■	■	■	■	
Trail Crossing Warning Signs	■	■		■	■	■	■	■	■	■	■	
Rectangular Rapid Flashing Beacons (RRFB)	■	■		■	■	□	□	■	□	■	■	
'Bikes Use Ped Signal' sign		■		□	■	■	■	□	□	□	□	
No Right on Red Sign		■		■	■	■	■		□	□		
Rail Crossing Signs				■								■
Stop Sign for Trail Users				■	□	□	□	□	■	□	□	■
Pedestrian Countdown Signal Head			■	■	■	■	■	□	□	□	□	
Increase Walking Times			■	□	■	■	■	□	□	□	□	
Leading Pedestrian Interval (LPI)			■	■	■	■	■	□				
Pedestran Coordinated Signal			■	■	■	■	■	■				
Bicycle Actuated Signal			■	■	■	□	□	□	□	□	□	
Protected-Permissive Bike Signals			■	■	■	■	□					

General	■
Recommended, but not in concept plan	□

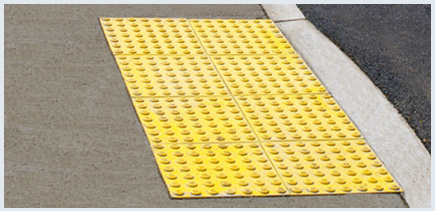
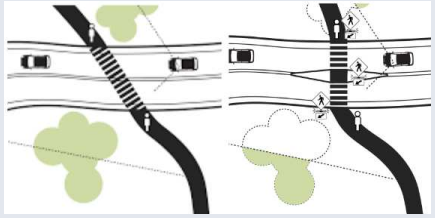
Adapted from FHWA STEP Improving Visibility at Trail Crossing (see page 4)

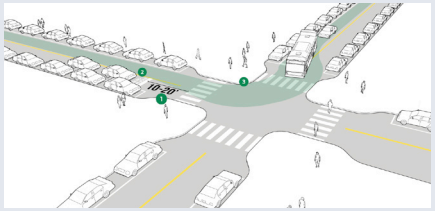
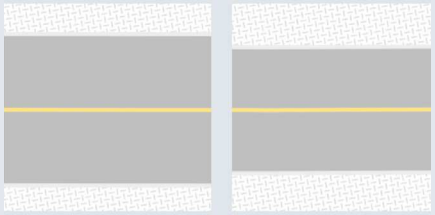
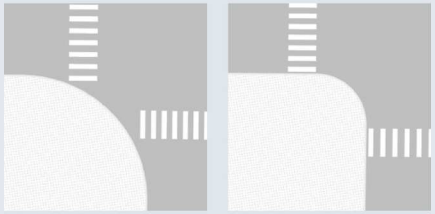
Crossing Type 1: Trail Meets Major Roadway at an Intersection

Traffic Calming ● Physical Separation ● Increased Visibility

Criteria	Criteria
LTS	3 or 4
ROW Type	Roadway
Functional Class	Arterial/Major Collector
Road Volume	High/Med
Crossing Location	Intersection
Speed	High
# of Lanes	> 2 Lanes

Major roadways pose higher safety concerns for crossing trail users due to high vehicle travel speeds, the higher volume of vehicles, and wide crossing distances across multiple lanes. Drivers are more likely to anticipate a potential pedestrian at an intersection compared to a mid-block crossing because they are often accompanied by crosswalk markings and drivers are forced to stop at traffic signals. Major roadways are often maintained by PennDOT and consistent with roadway infrastructure standards. The toolkit below recommends specific interventions to increase driver awareness and trail user safety.

Treatment	Benefit	Specific Considerations
Lighting  Source: Dan Burden, PedBikeImage	○ ○ ●	• Ensure roadway lighting is working and appropriately spaced. • Install pedestrian-scale lighting to illuminate the trail and potential users. FHWA recommends an illuminance of 2 lux vertical and luminance of 1–1.5 cd/m^2 for urban roadways with low/medium pedestrian volumes per FHWA recommendations. Additional design recommendations can be found in Research Report: Street Lighting for Pedestrian Safety (pg 31) and Pedestrian Lighting Primer.
Detectable Warning Surfaces/ Curb Ramps  Source: WikiCommons	○ ○ ●	• Ensure American Disabilities Act (ADA)-compliant detectable warning surfaces and ramps at each crosswalk. • Install curb ramps perpendicular to the crosswalk.
Perpendicular Crossing/ Realign Trail Approach  Source: FHWA	○ ○ ●	• Ensure the trail approaches the roadway or sidewalk at a 90° angle. More complex trail connections where the trail does not connect directly across the road should still aim for a pedicular approach to the nearest roadway or sidewalk. • Consider repaving existing trail approaches to allow for a safe approach angle.

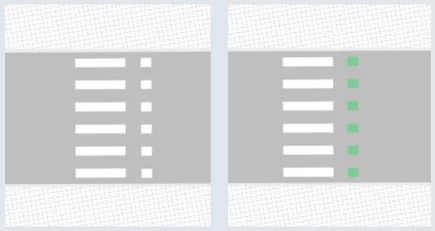
Treatment	Benefit	Specific Considerations
Set Back Stop Bar  Source: NACTO	● ● ●	• Shift the stop bar back from the intersection by 10–20 ft to allow for a shorter, perpendicular trail crossing. • Consider decreasing turning radii or adding a curb extension before finalizing the location of the stop bar.
Physically Narrow Lanes  Source: Remix	● ● ●	• Narrow lanes to minimize the distance that trail users must cross in conflict with vehicles. • Consider truck routes where travel lanes can not be smaller than 11 ft. In some contexts, lanes may be reduced briefly to 10 ft at pinch points. • Coordinate with PennDOT on state-owned roadways.
Reducing Curb Radii  Source: Remix	● ● ●	• Reduce the curb radii at an intersection to slow down the turning movement of vehicles, which also minimizes the time trail users' spend in the roadway in conflict with vehicles by the shortening crossing. • Consider whether the roadway is frequented by truck traffic and what design vehicle to test. For example, large trucks will not need the same access to a neighborhood roadway as a highway.
Curb Extensions  Source: Dan Burden, PedBikeImage	● ● ●	• Expand the curb by taking shoulder space and/or reducing vehicle travel lanes. Curbs can be expanded to the entire or partial extent of available width to improve safety while maintaining truck access, if needed. • Use paint and delineators to test potential curb extensions.

Treatment	Benefit	Specific Considerations
Refuge Island  Source: Dan Burden, PedBikeImage	●●●	• Reconfigure the existing cartway to accommodate a pedestrian refuge island. For example, islands may replace a portion of a center turn lane or be accommodated through reductions in the size or number of travel lanes and shoulders. FHWA guidance suggests a minimum width of 8 ft. • Consider extending existing center medians to include the crossing area.
Hardened Centerline  Source: Google Streetview	●●○	• Use concrete and/or delineators to create visual friction, which can encourage slower vehicular left-turn speeds. • Consider replacement costs when selecting materials.
Street Trees  Source: Reed Huegerich, PedBikeImage	●○○	• Use street trees to create visual friction and reduce traffic speeds. • Ensure the tree bed is appropriately spaced and is far enough from crossings so the tree does not block trail users from vehicle sight lines.
Trim Vegetation	-	• Trim overgrown vegetation to ensure adequate sight lines for vehicles and trail users. • Obtain permission from local property owners to trim vegetation.
Parking Restrictions	-	• Restrict parking within 25 ft of either side of the trailhead during trail operating hours (ie. daylighting).

Signage, Markings, and Signalization . *Signalization and signage changes will likely result in a change in traffic flow and may need to be evaluated through traffic modeling*

Markings

Crossbike/ Crosswalk Marking



Source: Remix

- Improve the visibility of trail users along major roadways with a combination of crossbike and crosswalk markings.
- Emphasize the safest crossing recommended for trail users.
- Ensure crosswalks are aminimum of 8 ft but preferably 10 ft to meet AASHTO and Circuit Trail standards.
- Use green paint to indicate crossing bicyclists.

Signage

Yield Signs

MUTCD R1-2 & R1-5

Source: WikiCommons, MUTCD

Stop Signs for Trail Users

MUTCD R1-1

Source: WikiCommons, MUTCD, FHWA

Trail Crossing Warning Signs

MUTCD W11-15 & W11-2

Source: WikiCommons, MUTCD

Rectangular Rapid Flashing Beacons (RRFBs)

Source: Toole Design Group, Pedbikeimages

'Bikes Use Ped Signal'

MUTCD R9-5 Sign

Source: WikiCommons, MUTCD

No Turn on Red Sign

Source: WikiCommons, MUTCD

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Signage, Markings, and Signalization . *Signalization and signage changes will likely result in a change in traffic flow and may need to be evaluated through traffic modeling*			
Signalization			
Pedestrian Signalization & Countdown Signal Head	 Source: James Wagner, Pedbikeimages	**Increase Walking Time**	• Increase walk time of pre-timed or push-button actuated pedestrian signals. • Calculate by dividing the crossing distance by the walking speed. FHWA and ADA guidelines recommend using a walking speed of 3–3.5 sec/ft to accommodate slower walking speeds (FHWA Traffic Signal Timing Manual: Chapter 5 - Office of Operations).
Leading Pedestrian Interval (LPI) or Leading Bike Interval	• Allow pedestrians or bicyclists to begin crossing the roadway before parallel vehicle traffic, increasing visibility and minimizing conflicts. • Give extra consideration to LPIs on busier roadways. • Consider PennDOT's recommendation for LPI to last between 3 to 6 seconds.	**Protected-Permissive Bike Signals**	• Re-time roadway signals to allow bike travel to flow simultaneously with parallel through vehicular traffic while halting conflicting turning movements.
Pedestrian Coordinated Signal or Pedestrian Scramble	• Allow all directions to cross at the same time.	**Bicycle Actuated Signal**	• Install a device to detect the presence of a bicycle and alter the signal cycle accordingly.

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Crossing Type 1 Concept Design | Township Line Road and Darby Road

Location | Havertown, Haverford Township, and Upper Darby Township
Trail(s) | Naylor's Run Trail and Pennsy Trail

Concept Area Background

In anticipation of the extension of the Naylor's Run and Pennsy Trails, the project team was asked to explore a northern connection. The intersection of Township Line Road and Darby Road/Lansdowne Avenue is located just north of the proposed connection. Delaware County and Haverford Township will need to identify the trail path between the West Chester Pike concept area and this crossing. The recommendations involve improving driver awareness of, and shortening crossing distances for, potential trail users. Recommendations that impact signal timing (5, 7, 8, and 9) should be further evaluated to estimate the impact on vehicle delay. Please refer to Table 2 on page 18 for a more exhaustive list of suggested interventions.

Recommendations

1. Set back stop bars to allow crosswalks to be perpendicular, shortening the crossing distance.
2. Move curb ramps to align with crosswalks and avoid dumping users into the middle of the intersection.
3. Reduce curb radii on the southen corners to slow turning vehicles.
4. Trim vegetation near trail entrance at intersection to improve visibility.
5. Add sign for No Right Turn on Red in all directions to ensure bicyclists and pedestrians have protected signal phase to cross.
6. Add crossbike markings to two crosswalks to encourage trail users to cross in a desired direction. This direction was chosen because there appears to be room to expand the sidewalk area for trail users to wait to cross at the intersection at three corners. The southwest corner has high fencing next to the sidewalk to protect electrical equipment and is not recommended as a preferred place to wait to cross.
7. Add pedestrian signals and ensure they have their own phase; consider restricting left turns from Township Line Road to only when they have a green arrow, which will help to avoid bike and pedestrian conflicts. A potential pedestrian scramble could allow trail users to cross at all directions.
8. Consider increasing pedestrian phase times and implementing a leading pedestrian interval.
9. Consider implementing a bicycle actuated signal.
10. Add the following signage to increase driver awareness of vehicles: trail crossing signs, yield signs, RRFB, and 'bikes use pedestrian signal' signs.
11. Add overhead lighting along the crosswalks and at each trailhead to improve visibility.

Figure 7: Township Line Road & Darby Road Concept Design

Source: DVRPC & Remix

Crossing Type 1 Concept Design | West Chester Pike and Gilmore Road

Location | Havertown and Haverford Township
Trail(s) | Pennsy Trail and Naylor's Run Trail

Concept Area Background

In anticipation of the extension of the Pennsy Trail, Delaware County asked the project team to explore a connection across West Chester Pike. The project team identified crossing West Chester Pike at Gilmore Road as the most feasible crossing because it is the least restricted by adjacent private property and allows the southern sidewalk to be expanded to meet AASHTO requirements. By definition, this example is not a mid-block crossing. However, given the safety benefits, any proposed mid-block crossing that can be redirected to an intersection should. Recommendations that impact signal timing (6, 9, 10) should be further evaluated to estimate the impact on vehicle delay. Please refer to Table 2 on page 18 for a more exhaustive list of suggested interventions.

Recommendations

1. Realign the trail through Llanerch Shopping Center parking lot to the northwestern sidewalk where trail users can cross West Chester Pike at the intersection.
2. Create curb extensions by reclaiming adjacent shoulders.
3. Pull back stop bars to allow crosswalks to be straightened, shortening crossing distance.
4. Straighten the pedestrian path on the existing pedestrian island on the west side of the intersection. Shift curb ramps to align with crosswalks so trail users enter the crosswalk perpendicular to the roadway.
5. Widen the southbound sidewalk and eastbound sidewalk to 10 ft.
6. Eliminate right turn on red from all directions to ensure bicyclists and pedestrians have protected signal phase to cross.
7. Reduce curb radii of the southern corners to slow turning vehicles.
8. Add crossbike markings to two crosswalks to encourage trail users to cross in a desired direction. This direction was chosen because the western pedestrian island is slightly wider and the eastbound sidewalk has more available space to expand the sidewalk.
9. Add pedestrian signal heads; consider providing trail uses with their own phase and increasing walk times.
10. Consider installing an LPI.
11. Add overhead lighting along the crosswalks and at each trailhead to improve visibility.
12. Add trail crossing signs, yield signs, and "Bicycles Use Ped Signal" signage (MUTCD R9-5) in all directions to make drivers aware of the trail's presence.

Figure 8: West Chester Pike & Gilmore Road Concept Design

Crossing Type 1 Concept Design | State Road and Township Line Road

Location | Drexel Hill
Trail(s) | Darby Creek Trail

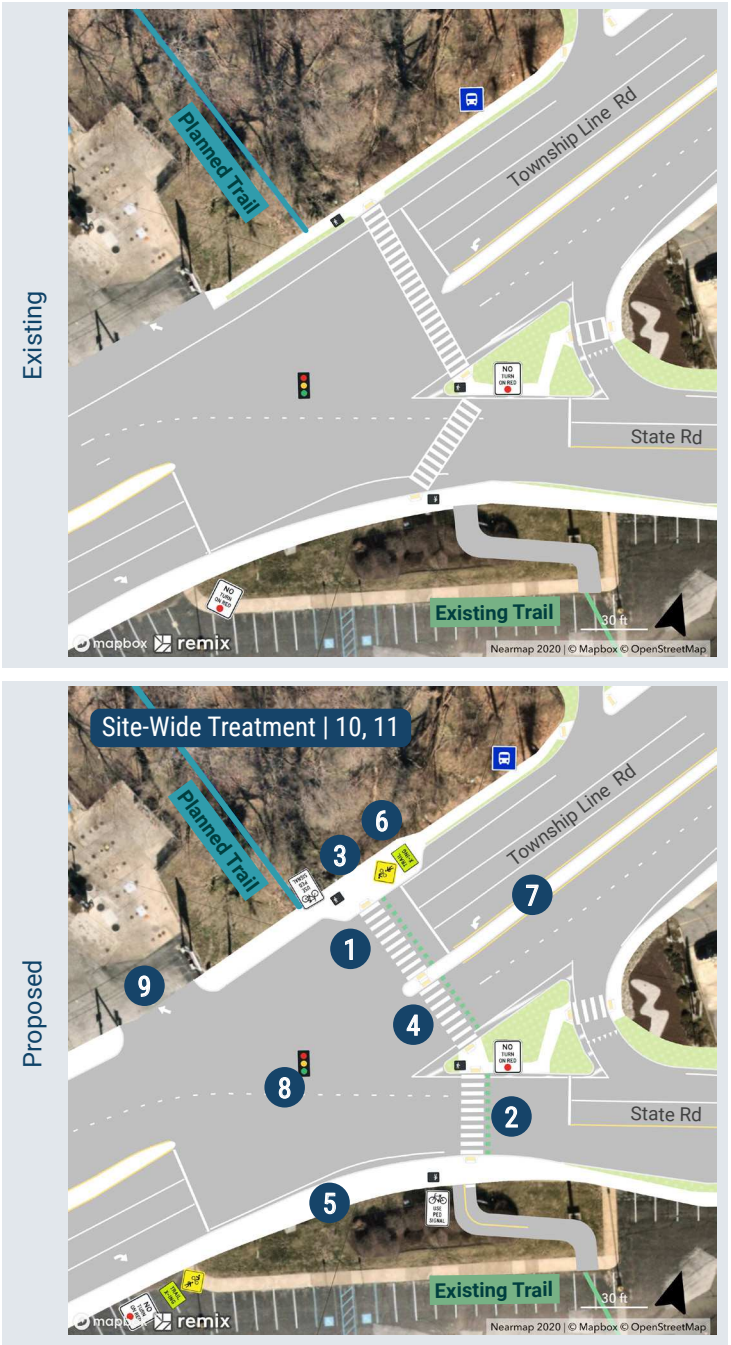
Concept Area Background

In anticipation of a potential extension of the Darby Creek Trail, the project team analyzed the crossing of State Road and Township Line Road in Drexel Hill. The roadways do not intersect perpendicular to each other, creating visibility and crossing concerns for trail users. Recommendations primarily focus on reducing the trail users' time in conflict with vehicles by expanding the pedestrian network and improving signalization. Please refer to Table 2 on page 18 for a more exhaustive list of suggested interventions.

Recommendations

1. Stripe crosswalks and align curb ramps so that they are perpendicular to the roadway. The stop bar may need to be set back to achieve the desired design.
2. Align the southern crossing to the existing trail head.
3. Trim vegetation near trail entrance to intersection to improve visibility.
4. Add crossbike markings to crosswalks to increase vehicle awareness of crossing.
5. Increase the sidewalk width by reallocating the shoulder space, which minimizes crossing distances and reduces the turning radius for vehicles turning right onto State Road.
6. Add curb extension to the northernmost crosswalk.
7. Extend median to serve as pedestrian island
8. Add pedestrian and bicycle signals and ensure they have their own phase; consider restricting left turns from Township Line Road to only when they have a green arrow to avoid bicycle and pedestrian conflicts.
9. Encourage Speedway gas station to minimize its driveway width, which reduces the area drivers are in conflict with trail users and increases trail users' awareness of entering drivers.
10. Add overhead lighting along the crosswalks and at each trailhead to improve visibility.
11. Add trail crossing signs in all directions to make drivers aware of the presence of the trail. Additional signage can be added directing biyclists to use the pedestrian signal and prohibiting drivers from turn at a red light.

Figure 9: State Road & Township Line Road Concept Design

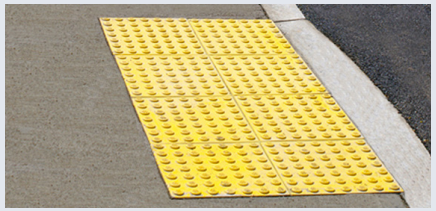


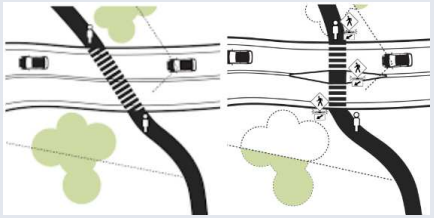
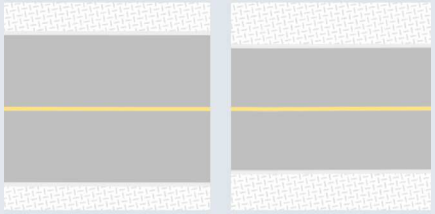
Crossing Type 2: Trail Meets Major Roadway at the Mid-Block

Traffic Calming · Physical Separation · Increased Visibility

Criteria	Criteria
LTS	3 or 4
ROW Type	Roadway
Functional Class	Arterial/Major Collector
Road Volume	High/Med
Crossing Location	Mid-block
Speed	High
# of Lanes	> 2 Lanes

Some trail crossings occur outside of an intersection, which causes unique safety concerns. Major roadways pose higher safety concerns for crossing trail users due to the high speed vehicle travel speeds, the higher volume of vehicles, and wide crossing distances across multiple lanes. Crossing a roadway at the mid-block heightens these concerns because vehicles are not forced to stop at a traffic signal, nor are there typically dedicated times for pedestrians or cyclists to cross. Drivers on major roadways often do not expect pedestrians, especially outside intersections. The toolkit below recommends specific interventions to increase driver awareness and trail user safety. Major roadways are likely maintained by PennDOT and are consistant with specific roadway infrastructure standards. Whenever possible, trails should cross major roadways at an intersection. The nearest crossing can be a maximum of 300 ft from the trail to be considered acceptable. The interventions listed below are specific to crossings that remain at the mid-block. However, the toolkit gives examples of potential solutions if a potential mid-block crossing is moved to the intersection (see Trail Crossing 1 interventions) or if it remains at the mid-block. The project team should conduct an engineering study and refer to PennDOT guidance to determine if a mid-block crossing along a major roadway is the most appropriate treatment.

Treatment		Benefit	Specific Considerations
Lighting	 Source: Dan Burden, PedBikeImage	● ● ●	• Ensure roadway lighting is working and appropriately spaced. • Install pedestrian-scale lighting to illuminate the trail and potential users. FHWA recommends an illuminance of 2 lux vertical and luminance of 1–1.5 cd/m^2 for urban roadways with low/medium pedestrian volumes per FHWA recommendations. Additional design recommendations can be found in Research Report: Street Lighting for Pedestrian Safety (pg 31) and Pedestrian Lighting Primer.
Detectable Warning Surfaces/ Curb Ramps	 Source: WikiCommons	● ● ●	• Ensure American Disabilities Act (ADA)-compliant detectable warning surfaces and ramps at each crosswalk. • Install curb ramps perpendicular to the crosswalk.

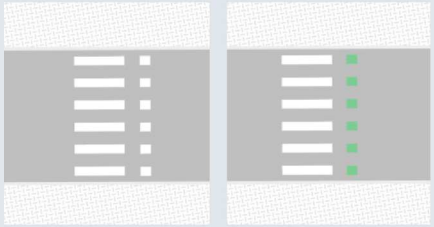
Treatment	Benefit	Specific Considerations
Perpendicular Crossing/ Realign Trail Approach  Source: FHWA	● ● ●	• Ensure the trail approaches the roadway or sidewalk at a 90° angle. More complex trail alignments where the trail does not connect directly across the road should still aim for a pedicular approach to the nearest roadway or sidewalk. • Consider repaving existing trail approaches to allow for a safe approach angle.
Physically Narrow Lanes  Source: Remix	● ● ●	• Narrow lanes to minimize the distance that trail users must cross in conflict with vehicles. • Consider truck routes where travel lanes can not be smaller than 11 ft. In some contexts, lanes may be reduced briefly to 10 ft at pinch points. • Coordinate with PennDOT on state-owned roadways.
Curb Extensions  Source: Dan Burden, PedBikeImage	● ● ●	• Expand the curb by taking shoulder space and/or reducing vehicle travel lanes. Curbs can be expanded to the entire or partial extent of available width to improve safety while maintaining truck access, if needed. • Use paint and delineators to test potential curb extensions.
Refuge Island  Source: Dan Burden, PedBikeImage	● ● ●	• Reconfigure the existing cartway to accommodate a pedestrian refuge island. For example, islands may replace a portion of a center turn lane or be accommodated through reductions in the size or number of travel lanes and shoulders. FHWA guidance suggests a minimum width of 8 ft. • Consider extending existing center medians to include the crossing area.

Treatment		Benefit	Specific Considerations
Street Trees	 Source: Reed Huegerich, PedBikeImage	● ○ ○	• Use street trees to create visual friction and reduce traffic speeds. • Ensure the tree bed is appropriately spaced and is far enough from crossings so the tree does not block trail users from vehicle sight lines.
Trim Vegetation	-	○ ○ ●	• Trim overgrown vegetation to ensure adequate sight lines for vehicles and trail users. • Obtain permission from local property owners to trim vegetation.
Parking Restriction	-	○ ○ ●	• Restrict parking within 25 ft of either side of the trailhead during trail operating hours (ie. daylighting).

Signage, Markings, and Signalization . *Signalization and signage changes will likely result in a change in traffic flow and may need to be evaluated through traffic modeling*

Markings

Crossbike/ Crosswalk Marking



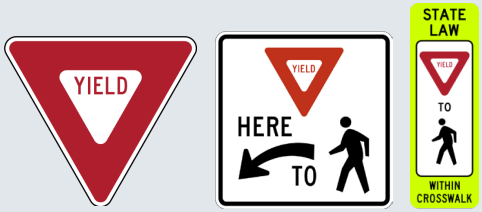
Source: Remix

- Improve the visibility of trail users along major roadways with a combination of crossbike and crosswalk markings.
- Emphasize the safest crossing recommended for trail users.
- Ensure crosswalks are aminimum of 8 ft but preferably 10 ft to meet AASHTO and Circuit Trail standards.
- Use green paint to indicate crossing bicyclists.

Signage

Yield Signs

MUTCD R1-2, R1-5 & R-6



Source: WikiCommons, MUTCD

Stop Signs for Trail Users

MUTCD R1-1

Source: WikiCommons, MUTCD, FHWA

Trail Crossing Warning Signs

MUTCD W11-15 & W11-2

Source: WikiCommons, MUTCD

Rectangular Rapid Flashing Beacons (RRFBs)

Source: Toole Design Group, Pedbikeimages

'Bikes Use Ped Signal'

MUTCD R9-5 Sign

Source: WikiCommons, MUTCD

Signage, Markings, and Signalization . *Signalization and signage changes will likely result in a change in traffic flow and may need to be evaluated through traffic modeling*			
Signalization			
Pedestrian Signalization & Countdown Signal Head	 Source: James Wagner, Pedbikeimages	**Increase Walking Time**	• Increase walk time of pre-timed or push-button actuated pedestrian signals. • Calculate by dividing the crossing distance by the walking speed. FHWA and ADA guidelines recommend using a walking speed of 3–3.5 sec/ft to accommodate slower walking speeds (FHWA Traffic Signal Timing Manual: Chapter 5 - Office of Operations).
Pedestrian Coordinated Signal or Pedestrian Scramble	• Allow all directions to cross at the same time.	**Bicycle Actuated Signal**	• Install a device to detect the presence of a bicycle and alter the signal cycle accordingly.

Crossing Type 2 Case Study | Dresher Road

Location | Horsham, Montgomery County
Trail(s) | Horsham Power Line Trail

Concept Area Background

Since the previous example recommended shifting the crossing to an intersection, this case study is included to provide an example of a true mid-block crossing. True mid-block crossings on major roadways are less common in the DVRPC region, due to the safety risk. Please refer to Table 2 on page 18 for a more exhaustive list of suggested interventions.

Highlighted Improvements

1. Reallocate lane and shoulder width to create a center lane and pedestrian island.
2. Push-button actuation of the RRFB on either side of the crossing and the center island along with dectectable warning surfaces.
3. Added delineators on the pedestrian island to create visual friction and urge drivers to slow down.
4. Added "yield to pedestrian" signage and yield markings.
5. Lighting is positioned over the RRFB signage at the crossing.

Dresher Road
Source: Google Street View

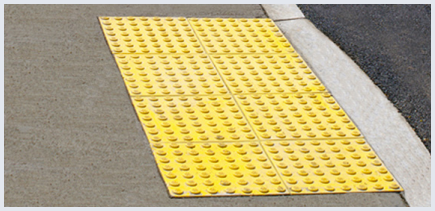
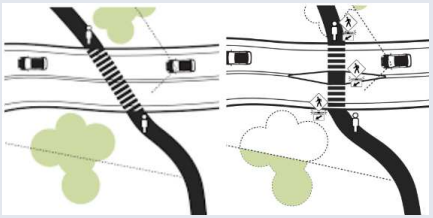
Figure 10: Dresher Road Case Study Area

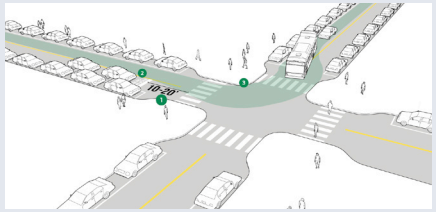
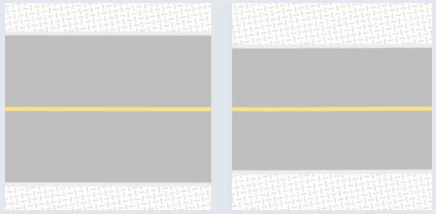
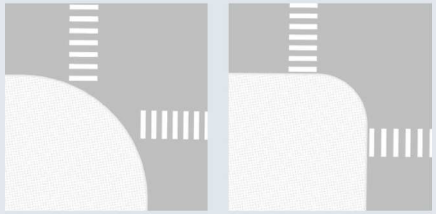
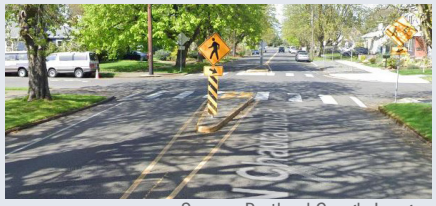
Crossing Type 3: Trail Meets Minor Roadway at an Intersection

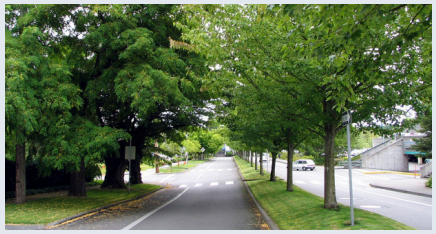
Traffic Calming ● Physical Separation ● Increased Visibility ●

Criteria	Criteria
LTS	1 or 2
ROW Type	Roadway
Functional Class	Local/Minor Collector
Road Volume	Low
Crossing Location	Intersection
Speed	Low
# of Lanes	2 Lanes

Low-speed, low-volume roadways pose minimal concerns to trail users. Safety at intersections can be improved by increasing vehicle awareness for crossing pedestrians and cyclists and increasing the presence of pedestrian infrastructure. If a two-lane roadway appears to have higher volume and speeds, higher protection interventions from the major road crossing type's toolkit can be applied. Minor roadways are more likely to be stop sign-controlled rather than signalized. Therefore, the recommendations and concept designs more heavily rely on signage. As traffic volumes, speeding, and trail use increase, a community may wish to explore pursuing signalization.

Treatment		Benefit	Specific Considerations
Lighting	 Source: Dan Burden, PedBikeImages	○ ○ ●	• Ensure roadway lighting is working and appropriately spaced. • Install pedestrian-scale lighting to illuminate the trail and potential users. FHWA recommends an illuminance of 2 lux vertical and luminance of 1–1.5 cd/m^2 for urban roadways with low/medium pedestrian volumes per FHWA recommendations. Additional design recommendations can be found in Research Report: Street Lighting for Pedestrian Safety (pg 31) and Pedestrian Lighting Primer.
Detectable Warning Surfaces/ Curb Ramps	 Source: WikiCommons	○ ○ ●	• Ensure American Disabilities Act (ADA)-compliant detectable warning surfaces and ramps at each crosswalk. • Install curb ramps perpendicular to the crosswalk.
Perpendicular Crossing/ Realign Trail Approach	 Source: FHWA	○ ○ ●	• Ensure that the trail approaches the roadway or sidewalk at a 90° angle. More complex trail connections where the trail does not connect directly across the road should still aim to have a pedicular approach to the nearest roadway or sidewalk. • Consider repaving existing trail approaches to allow for a safe approach angle.

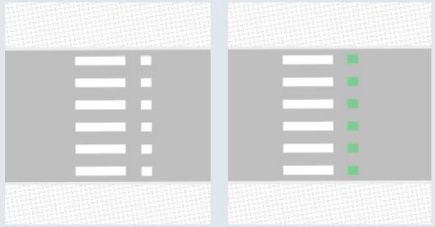
Treatment	Benefit	Specific Considerations
Set Back Stop Bar  Source: NACTO	○ ○ ●	• Shift the stop bar from the intersection by 10–20 ft to allow for a shorter, perpendicular trail crossing. • Consider decreasing turning radii or adding a curb extension before finalizing the location of the stop bar.
Physically Narrow Lanes  Source: Remix	● ○ ○	• Narrow lanes to minimize the distance that trail users must cross in conflict with vehicles. • Consider that some minor roadways may be reduced to 10 ft depending on truck or bus volumes. Higher heavy vehicle volumes may require a minimum of 11ft. • Coordinate with PennDOT on state-owned roadways.
Reducing Curb Radii  Source: Remix	● ○ ○	• Reduce the curb radii at an intersection to slow down the turning movement of vehicles, which also minimizes the time trail users' spend in the roadway in conflict with vehicles by the shortening crossing. • Consider whether the roadway is frequented by truck traffic and what design vehicle to test. For example, large trucks will not need the same access to a neighborhood roadway as a highway.
Curb Extensions  Source: Dan Burden, PedBikeImages	○ ● ○	• Expand the curb by taking shoulder space and/or reducing vehicle travel lanes. Curbs can be expanded to the entire or partial extent of available width to improve safety while maintaining truck access, if needed. • Use paint and delineators to test potential curb extensions.
Pedestrian Refuge  Source: Portland,Google Images	● ● ○	• Encourage slower travel speeds on lower-stress roadways and provide space for trail users out of conflict with drivers. • Consider reconfiguring the existing cartway to create space for this facility. For example, they may replace a portion of a center turn lane or be accommodated by reducing the size or number of travel lanes and shoulders.

Treatment		Benefit	Specific Considerations
Vertical Deflection	 Source: NACTO	● ○ ○	• Vertical deflection is typically implemented directly before the trail crossing. Municipalities can decide which form for vertical deflection is most appropriate for the roadway, such as speed humps, speed slots, and speed tables. Different vertical deflections offer different vehicle clearances.
Raised Crosswalk	 Source: Dan Burden, PedBikeImages	● ● ●	• Install crossing at sidewalk height to increase visibility of trail users and slow vehicle traffic. • Supplement with additional vertical deflection in either direction to ensure slow travel speeds. • Consider decorative materials to make the crosswalk stand out, if budget allows.
Crossing Material	 Source: Dan Burden, PedBikeImages	● ○ ●	• Use decorative or painted crossing material to increase drivers' awareness of crossing locations.
Street Trees	 Source: Dan Burden, PedBikeImages	● ○ ○	• Use street trees to create visual friction and reduce traffic speeds. • Ensure the tree bed is appropriately spaced and is far enough from crossings so the tree does not block trail users from vehicle sight lines.
Trim Vegetation	-	○ ○ ●	• Trim overgrown vegetation to ensure adequate sight lines for vehicles and trail users. • Obtain permission from local property owners to trim vegetation.
Parking Restrictions	-	○ ○ ●	• Restrict parking within 25 ft of either side of the trailhead during trail operating hours (ie. daylighting).

Signage, Markings, and Signalization . *Signalization and signage changes will likely result in a change in traffic flow and may need to be evaluated through traffic modeling*

Markings

Crossbike/ Crosswalk Marking



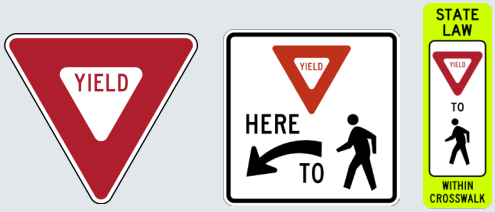
Source: Remix

- Improve the visibility of trail users with a combination of crossbike and crosswalk markings.
- Emphasize the safest crossing recommended for trail users.
- Ensure crosswalks are aminimum of 8 ft but preferably 10 ft to meet AASHTO and Circuit Trail standards.
- Use green paint to indicate crossing bicyclists.

Signage

Yield Signs

MUTCD R1-2, R1-5 & R-6



Source: WikiCommons, MUTCD

Stop Signs for Vehicles & Trail Users

MUTCD R1-1 & R1-6a

Source: WikiCommons, MUTCD, FHWA

Trail Crossing Warning Signs

MUTCD W11-15 & W11-2

Source: WikiCommons, MUTCD

Rectangular Rapid Flashing Beacons (RRFBs)

Source: Toole Design Group, Pedbikeimages

'Bikes Use Ped Signal'

MUTCD R9-5 Sign

Source: WikiCommons, MUTCD

No Turn on Red Sign

Source: WikiCommons, MUTCD

Signage, Markings, and Signalization . *Signalization and signage changes will likely result in a change in traffic flow and may need to be evaluated through traffic modeling*		
Yield Markings	 Source: Remix	
Signalization		
Pedestrian Signalization & Countdown Signal Head	 Source: James Wagner, Pedbikeimages	**Increase Walking Time** • Increase the walk time of pre-timed or push-button actuated pedestrian signals. • Calculate by dividing the crossing distance by the walking speed. FHWA and ADA guidelines recommend using a walking speed of 3–3.5 sec/ft to accommodate slower walking speeds (FHWA Traffic Signal Timing Manual: Chapter 5 - Office of Operations).
Bicycle Actuated Signal	• Install a device to detect the presence of a bicycle and alter the signal cycle accordingly.	

Crossing Type 3 Concept Design | Rosemont Road and Bloomfield Avenue

Location | Drexel Hill
Trail(s) | Darby Creek Trail

Concept Area Background

In anticipation of an extension of Darby Creek Trail north of Rosemont Avenue, the project team analyzed potential improvements to the existing crossing. The planned extension will continue parallel to the Drexelbrook Catering & Event Center off Bloomfield Avenue. Following a conversation with the Delaware County Planning Department, the project team recommends that the trail begin north of the existing proposed location. Refer to Appendix Figure A-2 for more detail. Please refer to Table 2 on page 18 for a more exhaustive list of suggested interventions.

Recommendations

1. Add overhead lightning above the crosswalk and along Bloomfield Avenue to improve visibility.
2. Realign the crosswalks to be perpendicular to the curb and upgrade to continental crosswalk markings.
3. Extend the northwestern curb to shorten crossing and reduce the roadway width of the northern approach. Lane narrowing may be required to achieve the desired design.
4. Minimize the northern corner radii.
5. Add stop bars in three directions set back from the crosswalks.
6. Where possible, increase sidewalk width to 10 ft.
7. Consider extending the western crosswalk on Rosemont Road by roughly 400 ft to the existing pedestrian path. Consider extending northern sidewalks on Bloomfield Avenue to the proposed trail entrance at the existing driveway/cut-through (see Appendix Figure A-2).
8. Convert Bloomfield Avenue into a shared-use bicycle facility to navigate bicyclists to the potential trailhead.
9. Place an additional stop sign eastbound on Rosemont Avenue and Bloomfield Avenue to stop trail users.
10. Add trail crossing signs to increase drivers' awareness of the trail crossing.
11. Consider implementing raised crosswalks along the western crosswalk crossing Rosemont Avenue.

Figure 11: Rosemont Road & Bloomfield Avenue Concept Design

Crossing Type 3 Concept Design | Burmont Road and Warrior Road

Location | Haverford Township
Trail(s) | Darby Creek Trail

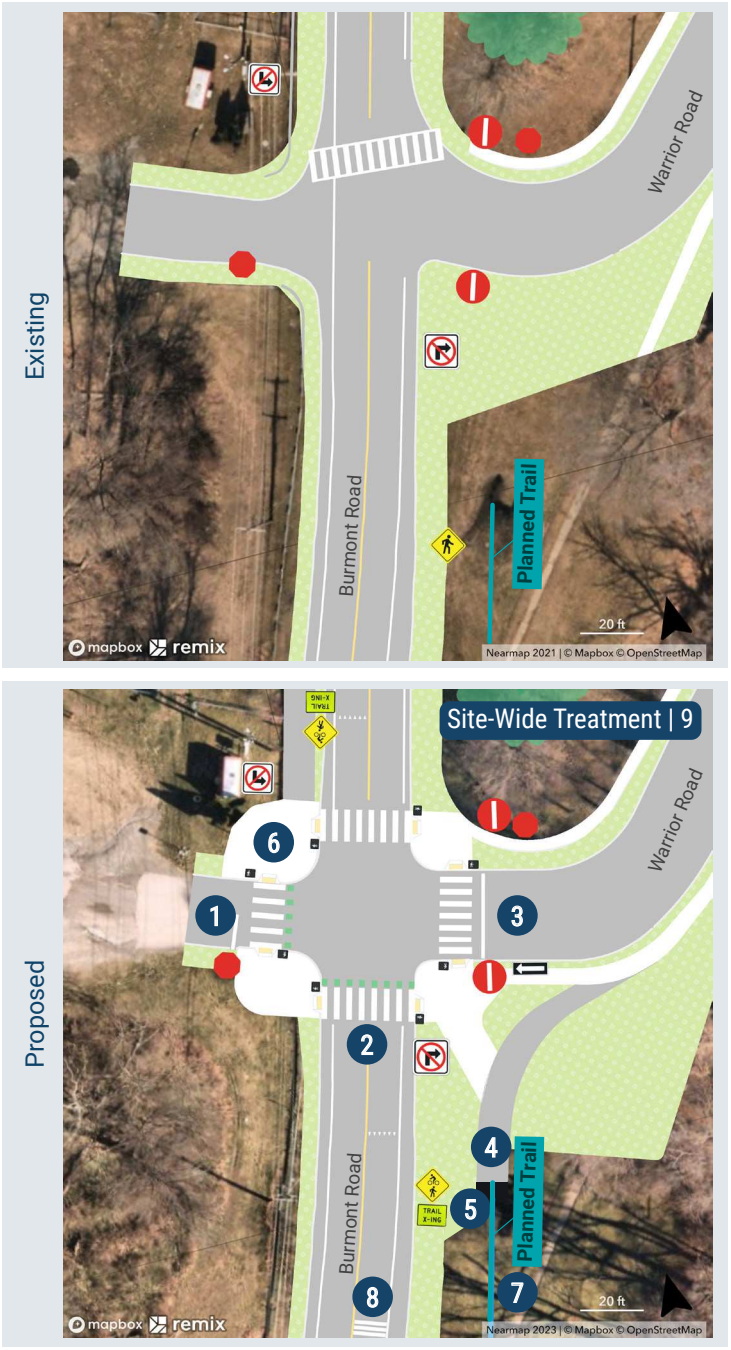
Concept Area Background

In anticipation of an extension of the Darby Creek Trail north of where Warrior Road intersects with Burmont Road, the project team studied and developed potential improvements to the existing conditions. The planned extension is expected to run parallel to the western side of Burmont Road and will continue southeast of Burmont and Warrior roads, running alongside Darby Creek. Please refer to Table 2 on page 18 for a more exhaustive list of suggested interventions.

Recommendations

1. Add continental crosswalks south of the intersection along Burmont Road, west of the intersection at the entrance of the parking lot, and east of the intersection on Warrior Road.
2. Add crossbike markings next to the crosswalks to increase vehicle awareness of cyclists at the crossing.
3. Realign Warrior Road so that it meets Burmont Road at a 90 degree angle. This will greatly reduce the corner radii. This can help to reduce speeds and allow drivers a better sight line to pedestrians in the crosswalk.
4. Guide trail users south across the parking lot and east across Burmont Road
5. Consider adding an RRFB (not shown in concept design).
6. Remove guide rails along the northern side of the trail.
7. Guide trail users traveling from south to north parallel to Burmont Road until they reach the proposed Darby Creek Trail extension.
8. Add rumble strips on Burmont Road to slow down vehicular traffic prior to the trail crossing.
9. Add overhead lighting along the crosswalks and at each trailhead to improve visibility.

Figure 12: Burmont Road & Warrior Road Concept Design

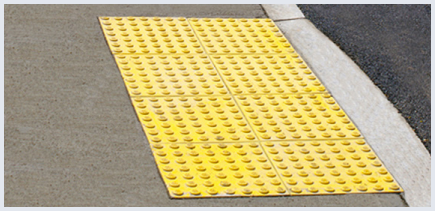
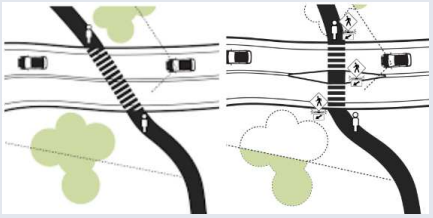


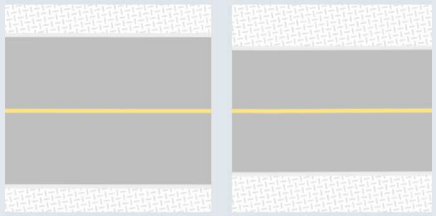
Crossing Type 4: Trail Meets Minor Roadway at the Mid-Block

Traffic Calming · Physical Separation · Increased Visibility

Criteria	Criteria
LTS	1 or 2
ROW Type	Roadway
Functional Class	Local/Minor Collector
Road Volume	Low
Crossing Location	Mid-block
Speed	Low
# of Lanes	2 Lanes

Minor roadways can range from minor collectors to residential roadways. Although minor roadways experience lower traffic volumes and vehicle speeds, drivers may be less likely to anticipate a pedestrian crossing mid-block. The toolkit below recommends specific interventions to increase driver awareness and trail user safety. In the case that a two-lane roadway appears to have higher traffic volumes and speeds, higher protection interventions from the major road crossing type's toolkit can be applied.

Treatment		Benefit	Specific Considerations
Lighting	 Source: Dan Burden, PedBikeImages	● ● ●	• Ensure roadway lighting is working and appropriately spaced. • Install pedestrian-scale lighting to illuminate the trail and potential users. FHWA recommends an illuminance of 2 lux vertical and luminance of 1–1.5 cd/m² for urban roadways with low/medium pedestrian volumes per FHWA recommendations. Additional design recommendations can be found in Research Report: Street Lighting for Pedestrian Safety (pg 31) and Pedestrian Lighting Primer.
Detectable Warning Surfaces/ Curb Ramps	 Source: WikiCommons	● ● ●	• Ensure American Disabilities Act (ADA)-compliant detectable warning surfaces and ramps at each crosswalk. • Install curb ramps perpendicular to the crosswalk.
Perpendicular Crossing/ Realign Trail Approach	 Source: FHWA	● ● ●	• Ensure the trail approaches the roadway or sidewalk at a 90° angle. More complex trail connections where the trail does not connect directly across the road should still aim for a pedicular approach to the nearest roadway or sidewalk. • Consider repaving existing trail approaches to allow for a safe approach angle.

Treatment		Benefit	Specific Considerations
Physically Narrow Lanes	 Source: Remix	●○○	• Narrow lanes to minimize the distance that trail users must cross in conflict with vehicles. • Consider that some minor roadways may be reduced to 10 ft depending on truck or bus volumes. Higher heavy vehicle volumes may require a minimum of 11ft. • Coordinate with PennDOT on state-owned roadways.
Curb Extensions	 Source: NACTO	○●○	• Expand the curb by taking shoulder space and/or reducing vehicle travel lanes. Curbs can be expanded to the entire or partial extent of available width to improve safety while maintaining truck access, if needed. • Use paint and delineators to test potential curb extensions.
Pedestrian Refuge	 Source: Dan Burden, PedBikeImage	●●○	• Encourage slower travel speeds on lower-stress roadways at the mid-block and provide space for trail users out of conflict with drivers. • Consider reconfiguring the existing cartway to create space for this facility. For example, they may replace a portion of a center turn lane or be accommodated by reducing the size or number of travel lanes and shoulders.
Vertical Deflection	 Source: NACTO	●○○	• Vertical deflection is typically implemented directly before the trail crossing. Municipalities can decide which form for vertical deflection is most appropriate for the roadway, such as speed humps, speed slots, and speed tables. Different vertical deflections offer different vehicle clearances.

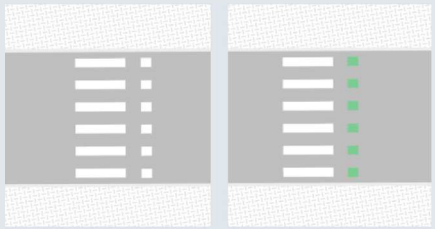
Treatment		Benefit	Specific Considerations
Raised Crosswalk	 Source: Dan Burden, PedBikeImages	●●●	• Install crossing at sidewalk height to increase visibility of trail users and slow vehicle traffic. • Supplement with additional vertical deflection in either direction to ensure slow travel speeds. • Consider decorative materials to make the crosswalk stand out, if budget allows. .
Crossing Material	 Source: Dan Burden, PedBikeImages	●●●	• Use decorative or painted crossing material to increase drivers' awareness of crossing locations.
Street Trees	 Source: Dan Burden, PedBikeImages	●○○	• Use street trees to create visual friction and reduce traffic speeds. • Ensure the tree bed is appropriately spaced and is far enough from crossings so the tree does not block trail users from vehicle sight lines.
Trim Vegetation	-	○○●	• Trim overgrown vegetation to ensure adequate sight lines for vehicles and trail users. • Obtain permission from local property owners to trim vegetation.

Treatment	Benefit	Specific Considerations
Parking Restrictions	-	• Restrict parking within 25 ft of either side of the trailhead during trail operating hours (ie. daylighting).

Signage, Markings, and Signalization . *Signalization and signage changes will likely result in a change in traffic flow and may need to be evaluated through traffic modeling*

Markings

Crossbike/ Crosswalk Marking



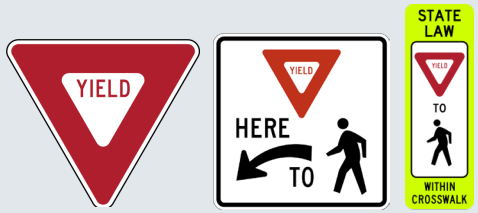
Source: Remix

- Improve the visibility of trail users with a combination of crossbike and crosswalk markings.
- Emphasize the safest crossing recommended for trail users.
- Ensure crosswalks are aminimum of 8 ft but preferably 10 ft to meet AASHTO and Circuit Trail standards.
- Use green paint to indicate crossing bicyclists.

Signage

Yield Signs

MUTCD R1-2, R1-5 & R-6



Source: WikiCommons, MUTCD

Stop Signs for Vehicles & Trail Users

MUTCD R1-1 & R1-6a

Source: WikiCommons, MUTCD, FHWA

Trail Crossing Warning Signs

MUTCD W11-15 & W11-2

Source: WikiCommons, MUTCD

Rectangular Rapid Flashing Beacons (RRFBs)

Source: Toole Design Group, Pedbikeimages

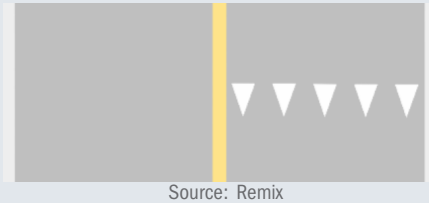
Signage, Markings, and Signalization . *Signalization and signage changes will likely result in a change in traffic flow and may need to be evaluated through traffic modeling*

'Bikes Use Ped Signal'

MUTCD R9-5 Sign

Source: WikiCommons, MUTCD

Yield Markings



Source: Remix

Signalization

Pedestrian Signalization & Countdown Signal Head

Source: James Wagner, Pedbikeimages

Increase Walking Time

- Increase walk time of pre-timed or push-button actuated pedestrian signals.
- Calculate by dividing the crossing distance by the walking speed. FHWA and ADA guidelines recommend using a walking speed of 3–3.5 sec/ft to accommodate slower walking speeds (FHWA Traffic Signal Timing Manual: Chapter 5 - Office of Operations).

Bicycle Actuated Signal

- Install a device to detect the presence of a bicycle and alter the signal cycle accordingly.

Crossing Type 4 Case Study | Saulin Boulevard

Location | Upper Merion Township, Montgomery County
Trail(s) | Chester Valley Trail

Concept Area Background

In the absence of a concept plan for a proposed mid-block crossing on a minor road, an existing crossing is presented as a case study. In 2023, the extension of the Chester Valley Trail was completed parallel to Saulin Boulevard. The extension provides connections to the Schuylkill River Trail in Norristown and potential connections to the Valley Forge National Historical Park. The crossing itself is located east of the Henderson Square Shopping Center, providing access to a local grocery store. Please refer to Table 2 on page 18 for a more exhaustive list of suggested interventions.

Highlighted Improvements

1. Replaced southbound through lane with a concrete center median, which functions similarly to a pedestrian refuge island. This was achieved through narrowing the travel lane width.
2. Created a perpendicular crossing despite the trail continuing parallel to the roadway.
3. Added overhead lighting directly atop the crossing.
4. Added guard rail to further separate trail users.
5. Added appropriate signage, including RRFB, yield-to-pedestrian signs, and yield-to-pedestrian markings.
6. Additional directional signs are added to indicate to drivers that a turn is approaching.

Saulin Boulevard
Source: Google Street View

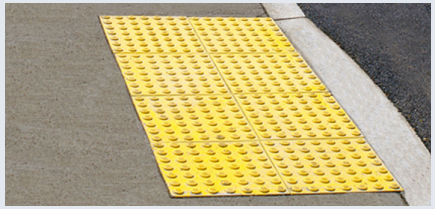
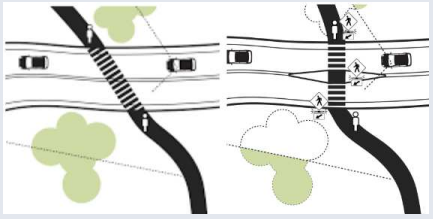
Figure 13: Saulin Boulevard Case Study

Crossing Type 5: Trail Meets a Transit ROW

Traffic Calming ● Physical Separation ● Increased Visibility

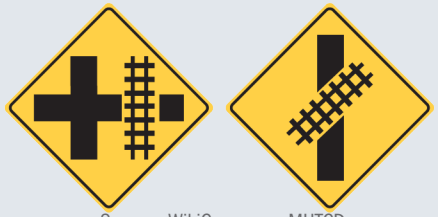
Criteria	Criteria
LTS	N/A
ROW Type	Railroad or Busway
Functional Class	N/A
Road Volume	N/A
Crossing Location	Railroad
Speed	N/A
# of Lanes	N/A

Transit crossings refer to trail crossings that intersect with transit rights of way like railways and trolleyways. These crossings are unique to the other cross types because not all transit crossings interact with roadways. Safety interventions primarily focus on increasing trail users' awareness of the transit crossing and providing separation from oncoming transit. Any crossing over rail or trolley tracks in Delaware County will likely enter SEPTA property. Fewer resources are available to guide the design of transit crossings. Trail designers should coordinate closely with SEPTA to ensure that the crossing is consistent with SEPTA standards and does not interfere with transit operations.

Treatment		Benefit	Specific Considerations
Lighting	 Source: Dan Burden, PedBikeImages	○○●	• Ensure that any existing lighting is working and appropriately spaced. • Install pedestrian-scale lighting to illuminate the trail and potential users. • Consider design recommendations found in Research Report: Street Lighting for Pedestrian Safety (pg 31) and Pedestrian Lighting Primer (pg 24).
Detectable Warning Surfaces/ Curb Ramps	 Source: WikiCommons	○○●	• Ensure American Disabilities Act (ADA)-compliant detectable warning surfaces are offset from the railway. • Meet rail crossing requirements which state that detectable warning surfaces should be 6–15 ft from the center of the rail (Access Board Chapter R3: Technical Requirements, R305.2.5 Pedestrian At-Grade Rail Crossings).
Perpendicular Crossing/ Realign Trail Approach	 Source: FHWA	○○●	• Ensure that the trail approaches the railway at a 90° angle. More complex trail connections where the trail does not connect directly across the rail should still aim for a perpendicular approach. • Consider repaving existing trail approaches to allow for a safe crossing angle.

Treatment		Benefit	Specific Considerations
At-Grade Rail Crossing	 Source: Google Street View	● ● ●	• Provide a smooth passage over trail tracks as outlined in the the Federal Highway Administration's MUTCD 11th Edition guidance
Set Back Stop Bar	-	● ● ●	• Shift the trail stop bar to allow for safe railway clearances.
Trim Vegetation	-	● ● ●	• Obtain permission from local property owners to trim vegetation.

Signage. *Signage changes will likely result in a change in traffic flow and may need to be evaluated through traffic modeling*

Railroad Crossing Sign MUTCD W10-1 R	 Source: WikiCommons, MUTCD	Stop Sign for Trail Users MUTCD R-1-1 & R1-2	 Source: WikiCommons, MUTCD, FHWA
Rail Transit Grade Crossing X-W10-2 and Similar Signage	 Source: WikiCommons, MUTCD,	Railroad Crossing Sign MUTCD R15-1	 Source: WikiCommons, MUTCD

Crossing Type 5 Case Study | Lower State Road

Municipality | Doylestown Township, Bucks County
Trail(s) | Lower State Road Trail

Concept Area Background

In the absence of an existing case study in Delaware County, an existing transit crossing in another part of the DVRPC region was examined. The Doylestown Bike/Hike Trail, constructed in 2017, transverses SEPTA Route 55 Trolley tracks. The trail runs parallel to Lower State Road without crossing the roadway. Instead, the crossing focuses on facilitating safe trail movements across the tracks. This extension connects Doylestown to the 202 Trail and the Neshaminy Creek Trail. Please refer to Table 2 on page 18 for a more exhaustive list of suggested interventions.

Highlighted Improvements

1. The trail crosses perpendicular to the trolley tracks to increase visibility.
2. Rectangular detectable warning surfaces are placed slightly offset of the trail crossing.
3. The trail crossing is raised slightly, allowing for relatively flush travel across the tracks/flangeway.
4. Trim vegetation to increase trail user's visibility.
5. Several rail crossing signs are used throughout the crossing area to increase trail users' awareness of the presence of the track and potential approaching trolley vehicles. These signs include trolley-actuated pedestrian warning heads and MUTCD W10-1 R Railroad Crossing signs.

Fox Chase Lorimer Trail
Source: Google Street View

Figure 14: Fox Chase SEPTA Station and Fox Chase Lorimer Trail

Appendices

A: Reference Maps

B: Relevant Resources

DELAWARE VALLEY dvrpc REGIONAL PLANNING COMMISSION

APPENDIX A:

Reference Maps

The following section consists of reference maps to help identify opportunities of future crossing recommendations.

Identified Trail Crossing Locations

Using the process described in Chapter 2, the project team developed a list of trail crossings throughout Delaware County. Figure A-1 depicts each trail crossing location on a map and its corresponding trail crossing type (Listed in Table A-1).

Figure A-1: Identified Trail Crossing Locations

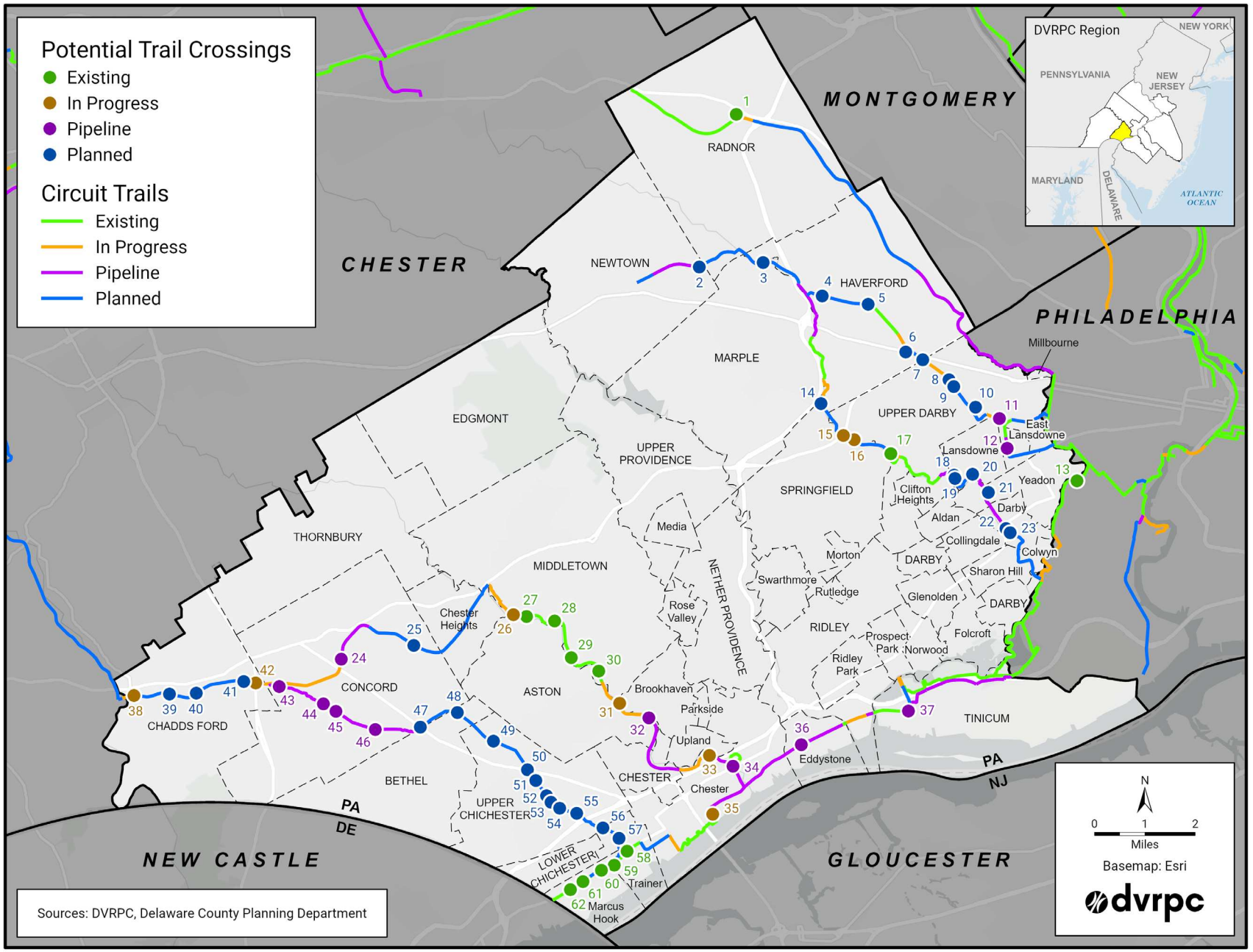


Table A-1: Corresponding Trail Crossing Types

MAP NUMBER	TRAIL STATUS	TRAIL	CROSSING LOCATION	CROSSING TYPE	LTS	ROW TYPE	FUNCTIONAL CLASS	SPEED LIMIT	LANES
1	EXISTING	RADNOR	RADNOR CHESTER RD	INTERSECTION	3	ROADWAY	16	25	2
2	PLANNED	NEWTOWN SQUARE BRANCH	BRYN MAWR AVE	MID-BLOCK	4	ROADWAY	16	35	2
3	PLANNED	NEWTOWN SQUARE BRANCH	N SPROUL RD	MID-BLOCK	3	ROADWAY	16	35	2
4	PLANNED	NEWTOWN SQUARE BRANCH	ELLIS RD	MID-BLOCK	3	ROADWAY	17	30	2
5	PLANNED	PENNSY	N EAGLE RD	INTERSECTION	4	ROADWAY	16	35	4
6	PLANNED	NAYLOR'S RUN	WEST CHESTER PIKE/DARBY ROAD	MID-BLOCK	4	MAJOR	14	40	4
7	PLANNED	NAYLOR'S RUN	TOWNSHIP LINE ROAD/ DARBY ROAD / LANSDOWNE AVENUE	INTERSECTION	4	MAJOR	14	35	5
8	PLANNED	NAYLOR'S RUN	S CEDAR LN	MID-BLOCK	1	ROADWAY	99	25	2
9	PLANNED	NAYLOR'S RUN	S STATE RD	MID-BLOCK	3	ROADWAY	14	35	2
10	PLANNED	NAYLOR'S RUN	GARRETT ROAD	MID-BLOCK	4	ROADWAY	14	35	3
11	PIPELINE	NAYLOR'S RUN	MARSHALL ROAD	INTERSECTION	3	ROADWAY	16	25	2
12	PIPELINE	NAYLOR'S RUN	PEMBROKE AVE	MID-BLOCK	3	ROADWAY	17	25	2
13	EXISTING	COBBS CREEK	CROSSES GRAVEYARD EXIT	MID-BLOCK	1	ROADWAY	99	25	2
14	PLANNED	DARBY CREEK	GLENDALE ROAD / EAGLE ROAD	INTERSECTION	3	MINOR	16	35	2
15	IN PROGRESS	NEWTOWN SQUARE RR/ PECO ROW / PENNSY TRAIL / NAYLOR'S RUN TRAIL	STATE ROAD	INTERSECTION	4	MAJOR	14	35	4
16	IN PROGRESS	DARBY CREEK	SEPTA MEDIA TROLLEY LINE AT OR NEAR DREXELINE STATION	RAILROAD	0	TRANSIT	99	0	0
17	EXISTING	DARBY CREEK	ROSEMONT ROAD AND BLOOMFIELD AVENUE	INTERSECTION	0	MINOR	19	0	2
18	PLANNED	DARBY CREEK	E BALTIMORE AVE	INTERSECTION	4	ROADWAY	14	25	2
19	PLANNED	DARBY CREEK	SCOTTDALE RD	INTERSECTION	1	ROADWAY	99	25	2
20	PLANNED	DARBY CREEK	SCOTTDALE RD	INTERSECTION	1	ROADWAY	99	25	2
21	PLANNED	DARBY CREEK	PROVIDENCE ROAD	MID-BLOCK	3	ROADWAY	16	35	2
22	PLANNED	DARBY CREEK	MACDADE BLVD	INTERSECTION	4	ROADWAY	14	35	4
23	PLANNED	DARBY CREEK	CHESTER PIKE	INTERSECTION	4	ROADWAY	17	25	2

Source: DVRPC

MAP NUMBER	TRAIL STATUS	TRAIL	CROSSING LOCATION	CROSSING TYPE	LTS	ROW TYPE	FUNCTIONAL CLASS	SPEED LIMIT	LANES
24	PIPELINE	OCTORARO	CONCORD ROAD	MID-BLOCK	4	ROADWAY	16	35	2
25	PLANNED	OCTORARO	IVY MILLS RD	INTERSECTION	4	ROADWAY	19	40	2
26	IN PROGRESS	CHESTER CREEK	LENNI ROAD	MID-BLOCK	3	ROADWAY	17	25	2
27	EXISTING	CHESTER CREEK	LUNDGREN RD	COMPLEX	3	ROADWAY	19	25	2
28	EXISTING	CHESTER CREEK	MOUNT RD	MID-BLOCK	1	ROADWAY	99	25	2
29	EXISTING	CHESTER CREEK	MOUNT ALVERNO RD	INTESECTION	2	ROADWAY	99	25	2
30	EXISTING	CHESTER CREEK	W KNOWLTON RD	MID-BLOCK	3	ROADWAY	17	35	2
31	IN PROGRESS	CHESTER CREEK	DUTTON MILL RD	MID-BLOCK	3	ROADWAY	16	35	2
32	PIPELINE	CHESTER CREEK	BRIDGEWATER ROAD	MID-BLOCK	3	ROADWAY	17	35	2
33	IN PROGRESS	CHESTER CREEK	KERLIN ST	INTERSECTION	3	ROADWAY	16	25	2
34	PIPELINE	CHESTER CREEK	W 9TH ST	INTERSECTION	1	ROADWAY	99	25	2
35	IN PROGRESS	EAST COAST GREENWAY	DELAWARE AVE	INTERSECTION	1	ROADWAY	99	25	2
36	PIPELINE	INDUSTRIAL HERITAGE TRAIL	INDUSTRIAL HWY	INTERSECTION	1	ROADWAY	17	35	4
37	PIPELINE	EAST COAST GREENWAY	ROUTE 420/291	INTERSECTION	4	ROADWAY	16	35	6
38	IN PROGRESS	OCTORARO	S CREEK RD	MID-BLOCK	4	ROADWAY	17	40	2
39	PLANNED	OCTORARO	RING RD	MID-BLOCK	4	ROADWAY	19	40	2
40	PLANNED	OCTORARO	HEYBURN RD	MID-BLOCK	2	ROADWAY	99	25	2
41	PLANNED	OCTORARO	EVERGREEN PL	MID-BLOCK	1	ROADWAY	99	25	2
42	IN PROGRESS	OCTORARO	ROUTE 202	MID-BLOCK	4	ROADWAY	14	45	4
43	PIPELINE	GARNET VALLEY GREENWAY	MARSHALL RD	MID-BLOCK	4	ROADWAY	17	35	2
44	PIPELINE	GARNET VALLEY GREENWAY	TEMPLE ROAD	MID-BLOCK	4	ROADWAY	17	25	2
45	PIPELINE	GARNET VALLEY GREENWAY	SMITHBRIDGE RD	MID-BLOCK	4	ROADWAY	16	45	2
46	PIPELINE	GARNET VALLEY GREENWAY	BETHEL RD	MID-BLOCK	3	ROADWAY	19	40	2
47	PLANNED	GARNET VALLEY GREENWAY	CONCHESTER RD	INTERSECTION	4	ROADWAY	14	45	2
48	PLANNED	GARNET VALLEY GREENWAY	FOULK RD	MID-BLOCK	4	ROADWAY	16	35	2
49	PLANNED	GARNET VALLEY GREENWAY	CHICHESTER AVE	INTERSECTION	4	ROADWAY	16	35	2
50	PLANNED	GARNET VALLEY GREENWAY	CONCHESTER HWY	MID-BLOCK	4	ROADWAY	14	35	2
51	PLANNED	GARNET VALLEY GREENWAY	FLORA LN	INTERSECTION	1	ROADWAY	99	25	2
52	PLANNED	GARNET VALLEY GREENWAY	DUTTON ST	MID-BLOCK	1	ROADWAY	99	25	2
53	PLANNED	GARNET VALLEY GREENWAY	RIVIERA SOUTH LN	MID-BLOCK	1	ROADWAY	99	25	2
54	PLANNED	GARNET VALLEY GREENWAY	MEETINGHOUSE RD	MID-BLOCK	3	ROADWAY	16	35	2
55	PLANNED	GARNET VALLEY GREENWAY	MARKET ST	MID-BLOCK	4	ROADWAY	14	40	2

Source: DVRPC

MAP NUMBER	TRAIL STATUS	TRAIL	CROSSING LOCATION	CROSSING TYPE	LTS	ROW TYPE	FUNCTIONAL CLASS	SPEED LIMIT	LANES
56	PLANNED	GARNET VALLEY GREENWAY	E LAUGHEAD AVE	INTERSECTION	1	ROADWAY	17	45	2
57	PLANNED	GARNET VALLEY GREENWAY	E RIDGE RD	MID-BLOCK	1	ROADWAY	16	35	2
58	EXISTING	MARCUS HOOK BIKE LANES	MAIN ST	INTERSECTION	3	ROADWAY	14	35	2
59	EXISTING	MARCUS HOOK BIKE LANES	WALNUT ST	INTERSECTION	1	ROADWAY	99	25	3
60	EXISTING	MARCUS HOOK BIKE LANES	E 10TH ST	MID-BLOCK	4	RAIL	14	25	3
61	EXISTING	MARCUS HOOK BIKE LANES	HEWES RD	INTERSECTION	4	ROADWAY	14	35	3
62	EXISTING	MARCUS HOOK BIKE LANES	BLUE BAL RD	INTERSECTION	1	ROADWAY	14	35	3

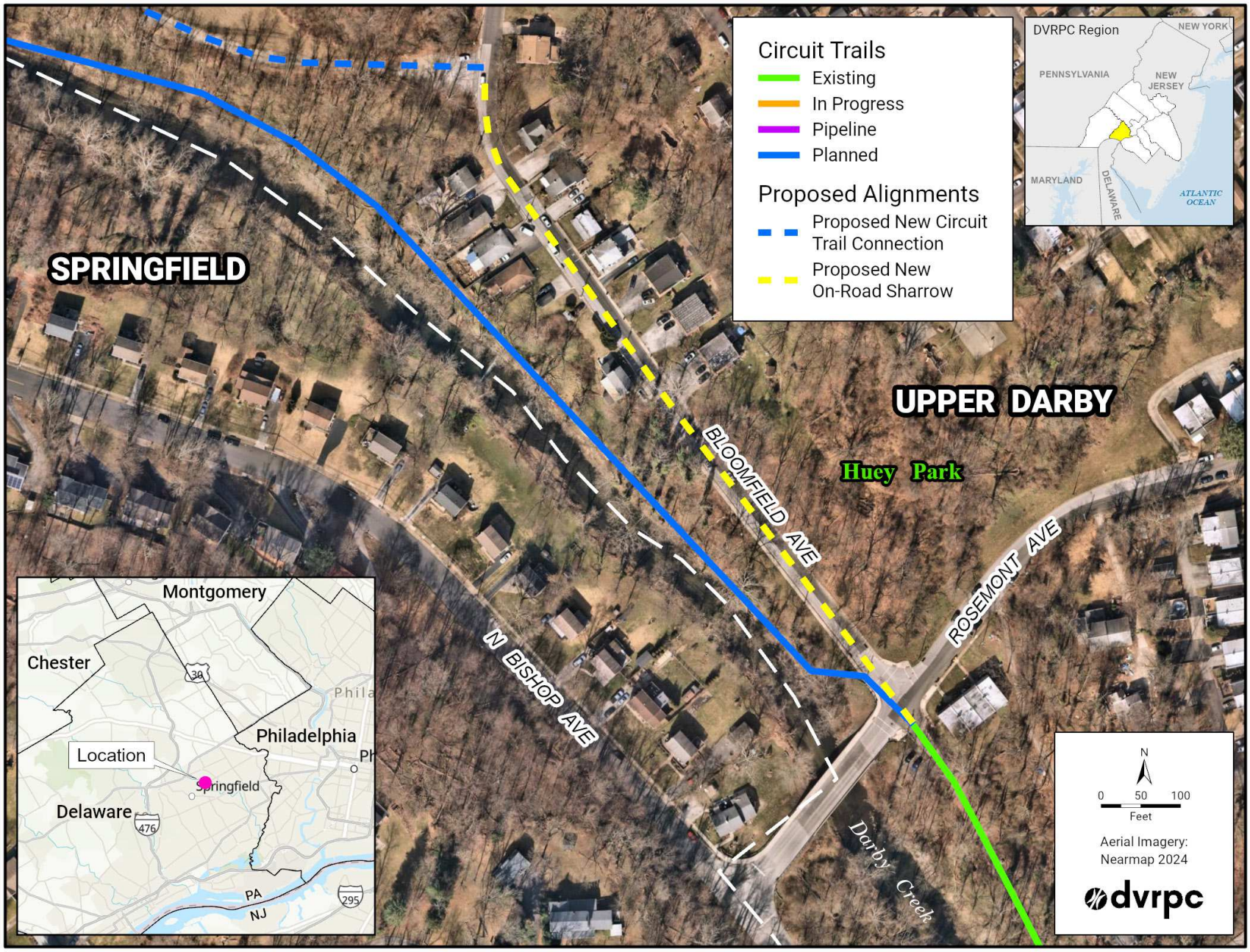
Source: DVRPC

Rosemont and Bloomfield Avenue

In 2018, Upper Darby Township published the *Pilgram Park Trail Feasibility Study*, which recommends that the planned trail segment be rerouted along an existing access road.[1] The following figure details recommended changes to the Circuit Trail introduced in Chapter 3 corresponding with the proposed design. Trail users would then use the proposed extended sidewalk and on-street sharrow facility to connect to the existing trail.

[1] *Pilgram Park Trail Feasibility Study*. Upper Darby Township, Delaware County, PA. https://www.upperdarby.org/media/Business/Redevlopments/PilgrimParkTrail/Download%20the%20Pilgrim%20Park%20Trail%20Feasibility%20Study.pdf

Figure A-2: Rosemont Avenue & Bloomfield Avenue Reference Map



APPENDIX B:

Relevant Resources

Bicycle and Trail Resources

The following section provides a list of references to refer to :

- Manual on Uniform Traffic Control Devices, 11th Edition. December 2023. https://mutcd.fhwa.dot.gov/kno_11th_Edition.htm;
- Federal Highway Administration (FHWA). "Improving Visibility at Trail Crossings." 2021. https://safety.fhwa.dot.gov/ped_bike/step/resources/docs/step_improving_visibilty_at_trail_crossings.pdf;
- American Association of State Highway and Transportation Officials (AASHTO). "*Guide for the Development of Bicycle Facilities;*
- *Crossings: Rails-to-Trails Conservancy, 4th Edition.*" https://store.transportation.org/item/collectiondetail/116;
- U.S. Department of Transportation. *Research Report: Street Lighting for Pedestrian Safety*. December 2020. https://safety.fhwa.dot.gov/roadway_dept/night_visib/docs/StreetLightingPedestrianSafety.pdf;
- U.S. Department of Transportation. Pedestrian Lighting Primer;
- Federal Highway Administration. Informational Brief: Treatments for Uncontrolled Marked Crosswalks;
- U.S. Access Board. *Public Right-of-Way Accessibility Guidelines Chapter R3: Technical Requirements, R305.2.5 Pedestrian At Grade Rail Crossings*. https://www.access-board.gov/prowag/proposed/chapter-r3-technical-requirements/; and
- U.S. Department of Transportation. Traffic Signal Timing Manual. https://ops.fhwa.dot.gov/publications/fhwahop08024/index.htm.

Delaware County Trails Alliance Membership

Members of the Trails Alliance include:

- Delaware County Planning Department,
- Alta,
- Bicycle Coalition of Greater Philadelphia,
- Bike Delco Action Team,
- Campbell Thomas & Co.,
- CEDA, Riverfront Alliance of Delaware County,
- Chadds Ford Township,
- Concord Township,
- Concord Township Public Works,
- Delaware County Transportation Management Association (DCTMA),
- Delaware County Council,
- Delaware County Innovation & Mapping,
- Delaware County Office of Sustainability,
- Delaware County Park Board / 9th Street YCC,
- Delaware County Parks Deptartment,
- Delaware County Planning Department,
- Delaware County Public Relations,
- Delaware Valley Regional Planning Commission (DVRPC),
- East Coast Greenway Alliance,
- Forge-Refuge Trail Coalition,
- Friends of Chester Creek Trail,
- Friends of Haverford Trails,
- Friends of Marple-Newtown Trails,
- Friends of Smedley Park,
- Friends of Upper Darby Trails,
- Haverford Township,
- Lansdowne Borough,
- Lansdowne Borough Council,
- Middletown Township,
- Nether Providence Township,
- Newtown Twp. Trails & Greenways Committee,
- PA Deptartment of Conservation & Natural Resources,
- PA Environmental Council,
- PennDOT District 6,
- Pennoni,
- Radnor Township, and
- Upper Darby Township.

Delaware County Trail Crossing Toolkit

Publication Number:
24151

Date Published:
April 2025

Geographic Area Covered:
Delaware County; Havertown; Haverford Township; Drexel Hill

Key Words:
Trail Crossing; Intersection Improvements; Crossing Improvements; Mid-Block

Abstract:
DVRPC was asked by the Delaware County Planning Department to develop a toolkit of best trail crossing practices. The project team developed recommendations for five data-driven trail crossing types: trail meets major roadway at an intersection, trail meets major roadway at the mid-block, trail meets minor roadway at an intersection, trail meets minor roadway at the mid-block, and trail meets a transit right-of-way. Each trail crossing crossing type offers a concept design plan and/or case study applying idenfitied best practices.

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DVRPC's vision for the Greater Philadelphia Region is a prosperous, innovative, equitable, resilient, and sustainable region that increases mobility choices by investing in a safe and modern transportation system; that protects and preserves our natural resources while creating healthy communities; and that fosters greater opportunities for all.

DVRPC's mission is to achieve this vision by convening the widest array of partners to inform and facilitate data-driven decision-making. We are engaged across the region, and strive to be leaders and innovators, exploring new ideas and creating best practices.

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