

DESIGN GUIDELINES

APPENDIX



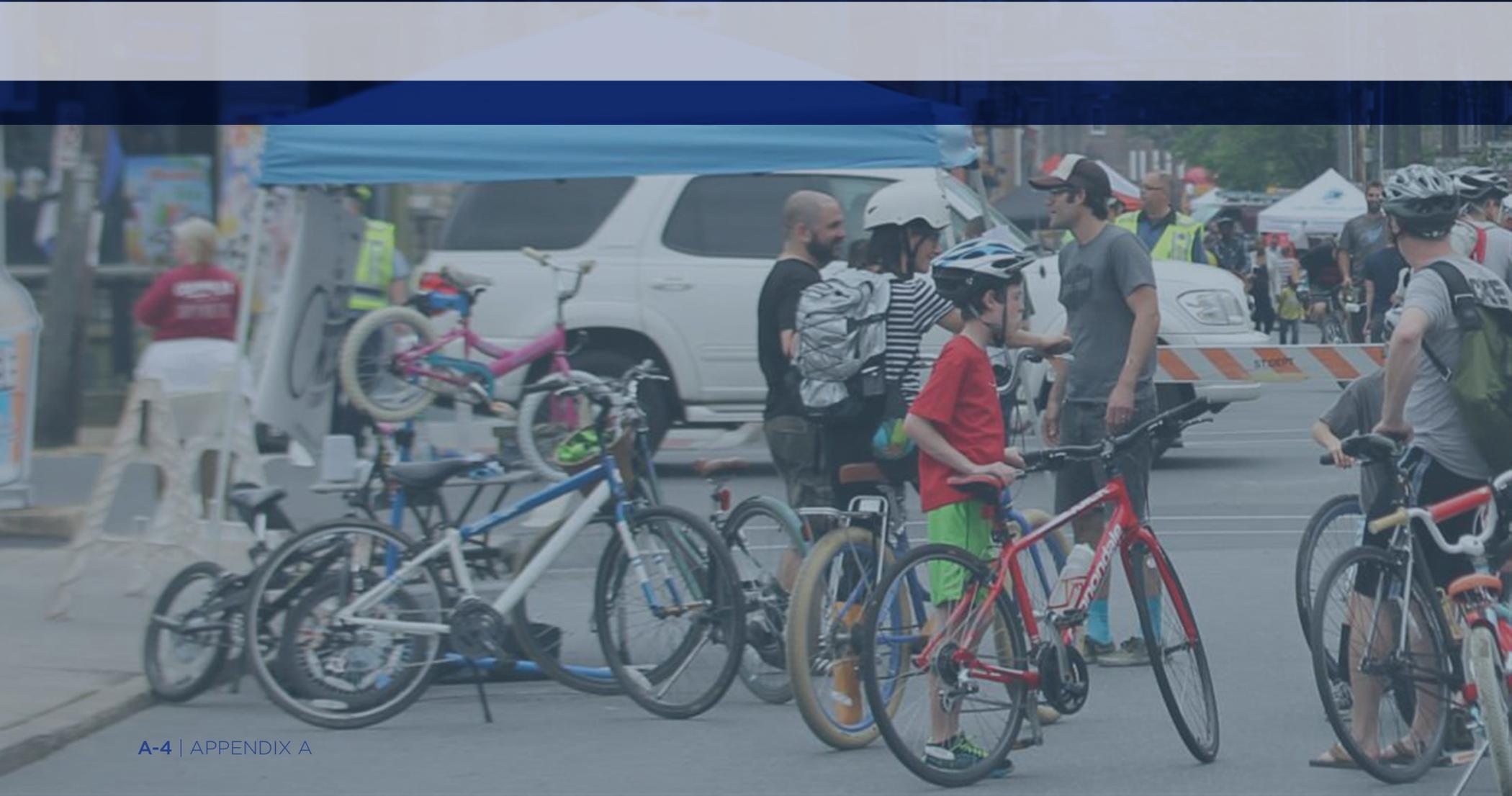
CONTENTS

Introduction	A-5
What Are Design Guidelines?.....	A-6
Abbreviated References	A-7
Guidance Basis	A-8
User Types	A-11
User Types	A-12
Shared Use Trails	A-15
General Design Practices.....	A-16
Shared Use Paths Within Utility Corridors	A-18
Shared Use Paths Along Rail Corridors	A-20
Accessibility of Shared Use Paths.....	A-22
Natural Surface Trails	A-24
Vegetative Screening	A-26
Trail Edge Definition	A-28
Drainage and Erosion Control	A-30
Bollards	A-32
Bollard Alternatives	A-34
Trail Bridges	A-36
Boardwalks.....	A-38
Restroom Access	A-40
Access to Potable Water	A-41
Lighting.....	A-42
Seating.....	A-43
Trash + Recycling Receptacles.....	A-44

Architectural Elements	A-45
Bicycle Amenities	A-46
Plantings	A-51
Wayfinding	A-52
Trail Crossing Treatments.	A-55
Marked + Signed Crosswalk	A-56
Marked Crosswalk with Yield Lines.	A-58
Median Refuge Island Crossing	A-60
Raised crosswalk.	A-62
Rectangular Rapid Flashing Beacon Crossing	A-64
Full Traffic Signal Crossing	A-66
Green Infrastructure	A-69
Stormwater Planters.	A-70
Stormwater Curb Extensions (Bump Outs)	A-72
Permeable Pavement.	A-74
Rain Garden	A-76
Bioswales	A-78
On-Road Facilities.	A-81
Yield Roadway	A-82
Advisory Shoulders.	A-84
Pedestrian Lane.	A-86
Marked Shared Roadways.	A-88
Signed Shared Roadways	A-90
Bicycle Boulevards	A-92

Shoulder Bikeways	A-94
Bike Lane.	A-96
Buffered Bike Lane	A-98
Separated Bike Lane (Directional)	A-100
Separated Bike Lane (Bidirectional).	A-102
Sidepath	A-104
On-Road Crossing + Intersection Treatments	A-107
Shared Roadway Major Street Crossings	A-108
Shoulder Bikeway/Bike Lane Crossings.	A-110
Shoulder Bikeway/Bike Lanes at Entrance + Exit Ramps	A-112
Directional Separated Bike Lane Crossings	A-114
Bidirectional Separated Bike Lane Crossings	A-116
Sidepath Crossings.	A-118
Bike Box	A-120
Two-Stage Turn Boxes	A-122
Roundabouts	A-124
Protected Intersection	A-126
Grade Separated Crossings	A-128
Horizontal Traffic Calming	A-130





INTRODUCTION



WHAT ARE DESIGN GUIDELINES?

The Design Guidelines in Appendix A of this Active Transportation Plan are intended to be used by Lancaster County communities to assist in designing transportation systems that serve all users. The guidelines will help to implement the Lancaster Active Transportation Plan and create communities with accessible and comfortable active transportation options for people of all ages and abilities.

The design recommendations are not intended to impose standards, but to offer guidance. The guidelines listed here are a collection of national and regional design resources, best practices, methods, and guidelines which help the design of facilities and amenities. This list is not exhaustive. Municipalities should consider consulting publications directly to ensure that the most current version is used. PennDOT should also be consulted, especially when improvements are proposed on a state-owned roadway. Municipalities and PennDOT may have additional or different requirements or guidelines.



Photo Credit: © Michelle Johnsen, The Common Wheel

ABBREVIATED REFERENCES

For easy reference, abbreviated titles are used within the body of this document for common resources. The table below includes both the abbreviated title used in this document and full document title.

<i>Abbreviated Title</i>	<i>Full Reference</i>
ADA (ADAAG)	Americans with Disabilities Act of 1990, as amended – <i>ADA Accessibility Guidelines</i>
ABA	Architectural Barriers Act of 1968, as amended
<i>AASHTO Bike Guide</i>	AASHTO. <i>Guide for the Development of Bicycle Facilities</i> , 4th Edition. 2012.
<i>AASHTO Green Book</i>	AASHTO. <i>A Policy on the Geometric Design of Highways and Streets</i> . 2011.
<i>AASHTO Pedestrian Guide</i>	AASHTO. <i>Guide for the Planning, Design, and Operation of Pedestrian Facilities</i> , 1st Edition. 2004.
<i>FHWA Multimodal Networks</i>	FHWA. <i>Achieving Multimodal Networks: Applying Design Flexibility and Reducing Conflicts</i> . 2016.
<i>FHWA MUTCD</i>	FHWA. <i>Manual on Uniform Traffic Control Devices</i> . 2009.
<i>FHWA Rural Guide</i>	FHWA. <i>Small Town and Rural Multimodal Networks</i> . 2016.
<i>FHWA Separated Bike Lane Guide</i>	FHWA. <i>Separated Bike Lane Planning and Design Guide</i> . 2015.
<i>HDM</i>	<i>NYS DOT Highway Design Manual</i>
<i>NACTO Bike Guide</i>	NACTO. <i>Urban Bikeway Design Guide</i> , 2nd Edition. 2012.
<i>PROWAG</i>	US Access Board. <i>Proposed Guidelines for Pedestrian Facilities in the Public Right-of-Way</i> . 2011.



GUIDANCE BASIS

The following guidelines are referred to in this guide.

NATIONAL GUIDELINES

The *Manual on Uniform Traffic Control Devices*, or *MUTCD*, defines the standards used by road managers nationwide to install and maintain traffic control devices on all public streets, highways, bikeways, and private roads open to public travel.

The *American Association of State Highway and Transportation Officials (AASHTO) Guide for the Development of Bicycle Facilities 2012* provides guidance on dimensions, use, and layout of specific bicycle facilities. The *Guide for the Planning, Design, and Operation of Pedestrian Facilities 2004* provides guidance for pedestrian facilities.

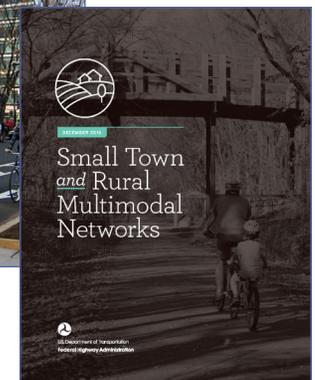
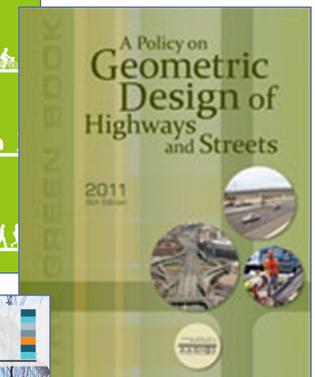
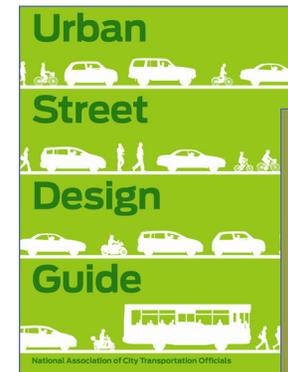
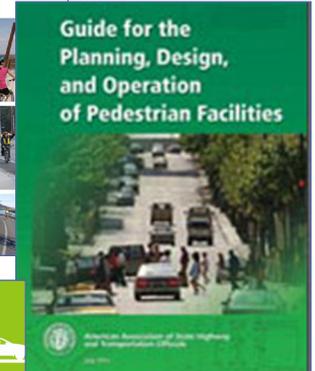
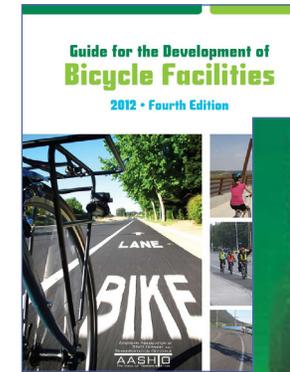
The *National Association of City Transportation Officials (NACTO) Urban Bikeway Design Guide 2012* offers guidance on the current state of practice in the design of urban areas. The *Urban Street Design Guide* offers guidance on different types of urban street design, including recommendations for intersections, interim design strategies, and treatments for pedestrians, bicyclists, and transit.

The AASHTO *A Policy on Geometric Design of Highways and Streets 2011* commonly referred to as the “*Green Book*,” contains the current design research and practices for highway and street geometric design.

FHWA’s *Separated Bike Lane Planning and Design Guide 2015* offers guidance on separated bike lanes (also known as protected bike lanes, or cycle tracks). The guide includes information on design and implementation of facilities including intersection treatments and interactions with parking, transit, and loading.

FHWA’s *Small Town and Rural Multimodal Networks 2016* document is a design resource and idea book to help small towns and rural communities support safe, accessible, comfortable, and active travel for people of all ages and abilities.

The *United State’s Access Board’s Proposed Rights-of-Way Accessibility Guidelines (PROWAG)* provides guidelines for the design, construction, and alteration of pedestrian facilities in the public right-of-way. These guidelines ensure that sidewalks, pedestrian street crossings, pedestrian signals, and other facilities for pedestrian circulation and use, constructed or altered in the public right-of-way by state and local governments, are readily accessible to and usable by pedestrians with disabilities.



STATE AND LOCAL GUIDELINES

Pennsylvania Trail Design & Development Principles was created with funding from the PA Department of Conservation and Natural Resources (DCNR) and Federal Highway Administration (FHWA) to provide guidelines on planning, design, constructing, and management of non-motorized trails while preserving and protecting resources and environments in Pennsylvania. Guidance is given for the design of all types of non-motorized trails, from alignment to surface type.

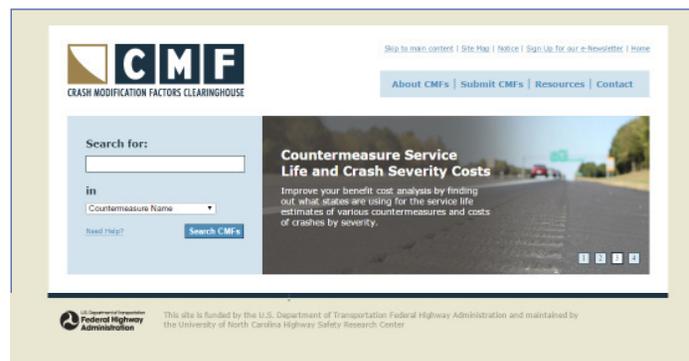
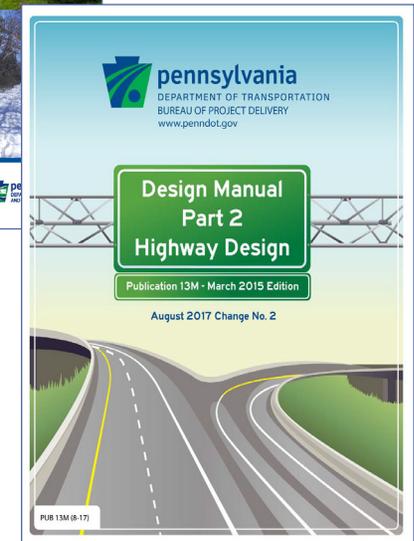
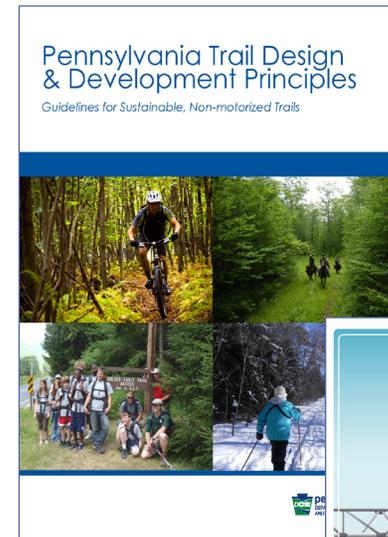
PennDOT Design Manual - Part 2: Highway Design provides guidance for the design within the PennDOT right-of-way. This guide references primarily Chapter 2: Pedestrian Facilities and the American with Disabilities Act, Chapter 16 Bicycle Facilities, and Chapter 19: Considerations for Alternative Transportation Modes.

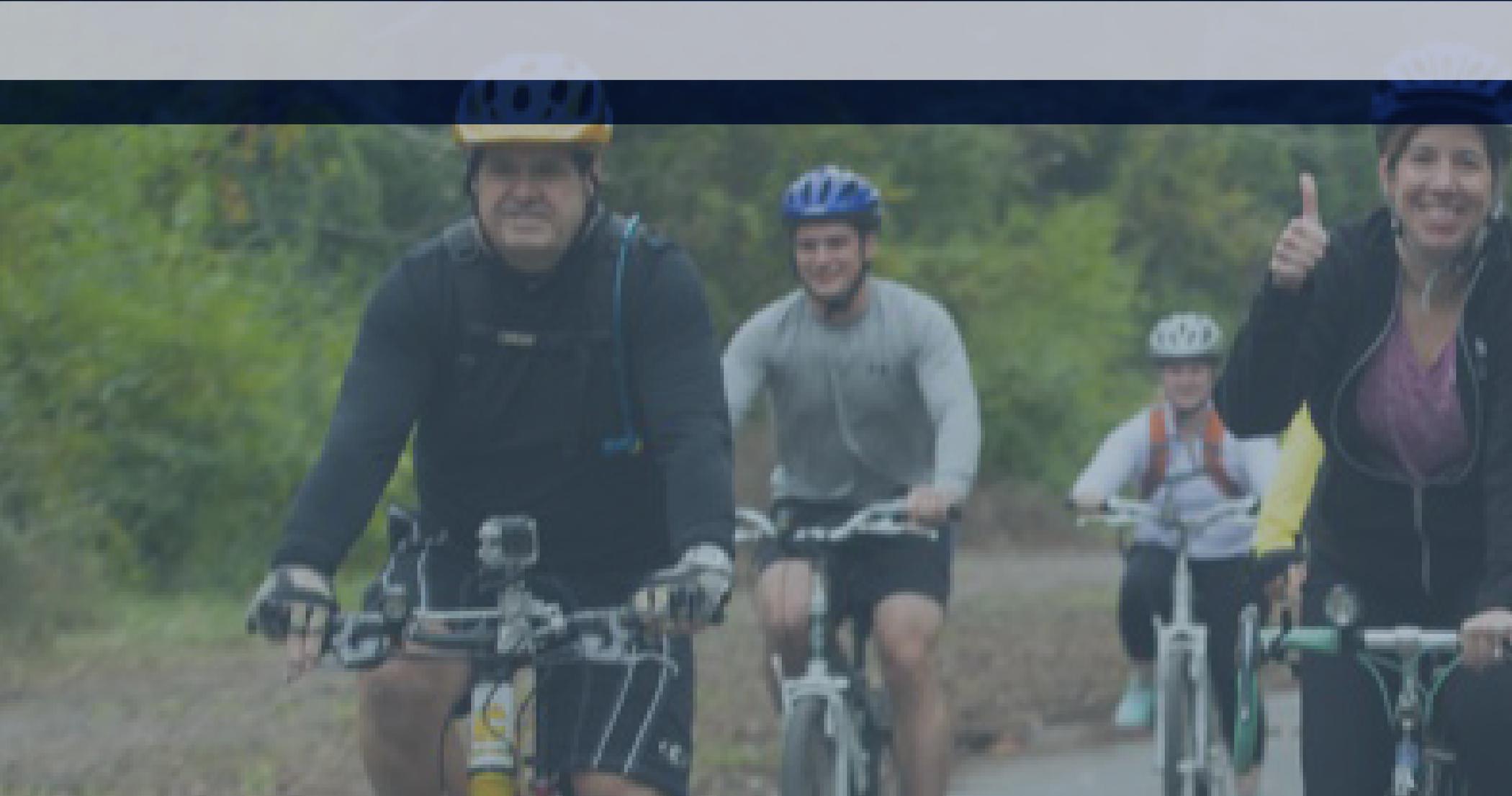
PennDOT's *2001 Pennsylvania Traffic Calming Handbook* covers a variety of traffic calming techniques including cost estimates for installation and construction.

The Lancaster County Planning Commission *Complete Streets Guide* explains what Complete Streets are and how to develop a Complete Streets policy at the local level. The *Guide* also outlines a 3-step process to help municipalities identify the right Complete Streets approach for different streets in their community.

IMPACT ON SAFETY AND CRASHES

The FHWA Crash Modification Factor Clearinghouse (<http://www.cmfclearinghouse.org/>) is a web-based database of Crash Modification Factors (CMF) to help transportation engineers identify the most appropriate countermeasure for their safety needs. Where available and appropriate, CMFs or similar study results may be referenced.





USER TYPES



USER TYPES

Trails serve a variety of user types. The specific user types accommodated may change to reflect local community amenities and desires. The most common user types, along with key design characteristics, are identified on the following pages.

PEDESTRIANS

Pedestrians have a variety of characteristics and the transportation network should accommodate a variety of needs, abilities, and possible impairments. Age is one major factor that affects pedestrians' physical characteristics, walking speed, and environmental perception. Children have low eye height and walk at slower speeds than adults. They also perceive the environment differently at various stages of cognitive development. Older adults walk more slowly and may require assistive devices for walking stability, sight, and hearing.



USERS OF MOBILITY DEVICES

A mobility device is designed to assist walking or otherwise improve the mobility of people with a mobility impairment. Wheelchairs or mobility scooters are used for more severe disability or longer journeys which would otherwise be undertaken on foot.

KEY CONSIDERATION

- Maneuvering around a turn requires additional space for wheelchair devices. Providing adequate space for 180 degree turns at appropriate locations is a required element for accessible design.



STROLLER USERS

Strollers are wheeled devices pushed by pedestrians to transport babies or small children. Stroller models vary greatly in their design and capacity. Some strollers are designed to accommodate a single child, others can carry three or more. The design needs of strollers depend on the wheel size, geometry, and ability of the adult who is pushing the stroller.

KEY CONSIDERATIONS

- Strollers commonly have small pivoting front wheels for easy maneuverability, but these wheels may limit their use on unpaved surfaces or rough pavement.
- Curb ramps are valuable to these users. Lateral overturning is one main safety concern for stroller users.



BICYCLISTS

Bicyclists and their bicycles exist in a variety of sizes and configurations. These variations occur in the types of vehicle (such as a conventional bicycle, a recumbent bicycle or a tricycle), and behavioral characteristics (such as the comfort level of the bicyclist). The design of a shared use path should consider expected bicycle types on the facility and utilize the appropriate dimensions.

KEY CONSIDERATION

- The expected speed that different types of bicyclists can maintain under various conditions also influences the design of facilities such as shared use paths.

FOUR TYPES OF BICYCLISTS

STRONG AND FEARLESS

Willing to ride on any roadway. Comfortable taking the lane and riding in a vehicular manner on major streets without designated bike facilities.

ENTHUSIASTIC AND CONFIDENT

Confident riding in most roadway situations but prefer to have a designated facility. Comfortable riding on major streets with a bike lane.

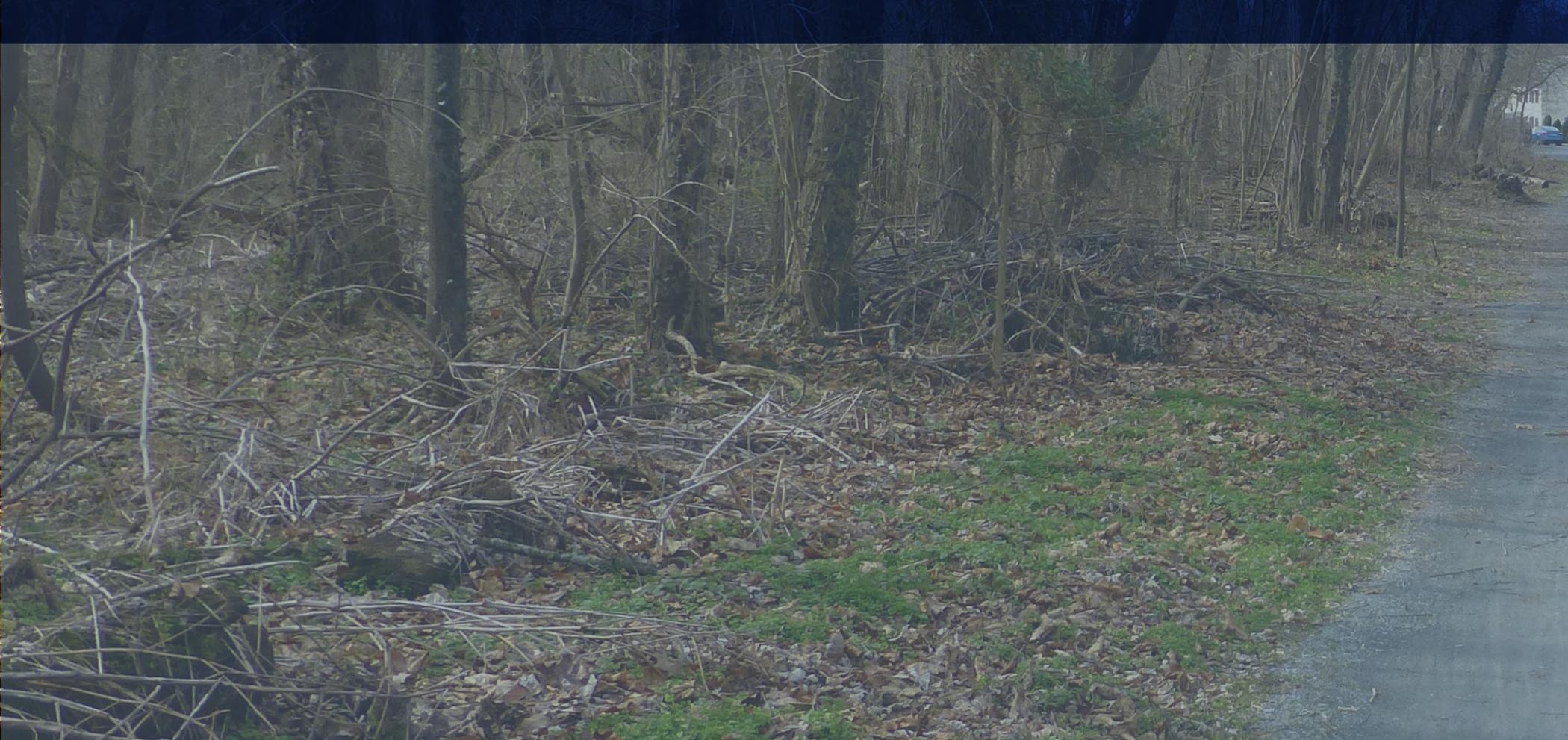
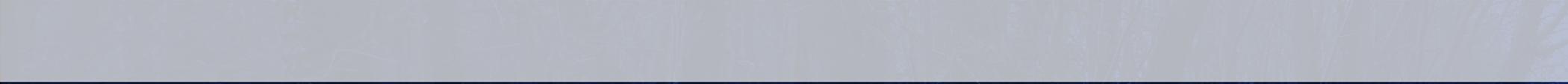
INTERESTED BUT CONCERNED

Cautious and has some inclination towards biking but are held back by concern over sharing the road with cars. Prefer separated pathways or low traffic neighborhood streets.

NO WAY NO HOW

Residents who simply aren't interested at all in biking, may be physically unable or don't know how to ride a bike, and they are unlikely to adopt biking.







SHARED USE TRAILS



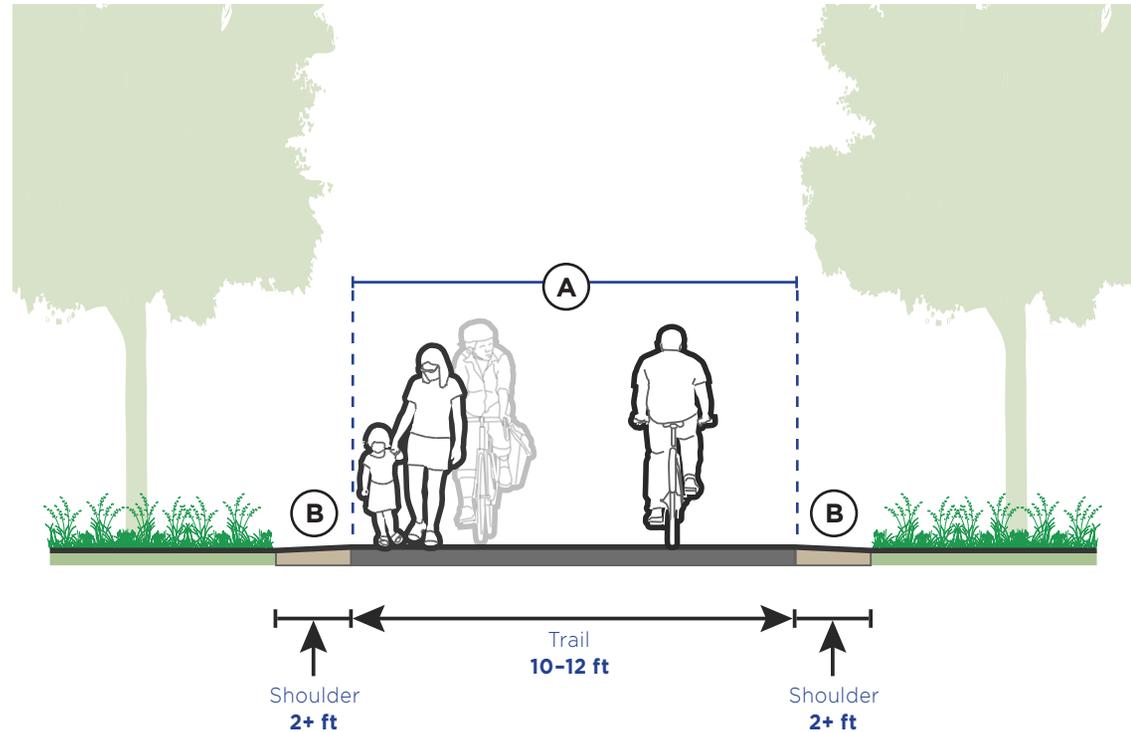
GENERAL DESIGN PRACTICES

A shared use path provides a travel area separate from motorized traffic for bicyclists, pedestrians, skaters, wheelchair users, joggers, and other users. Shared use paths are desirable for bicyclists of all skill levels preferring separation from traffic. These off-road travelways generally provide routes and connections not provided by existing roadways. Most shared use paths are designed for two-way travel of multiple user types.

TYPICAL APPLICATION

Shared use paths are typically located in independent rights-of-way, separate from roadways.

Refer to guidance on sidepaths for information on shared use paths adjacent to roadways (page A-108).



DESIGN FEATURES

- A** Standard shared use path width is 12 ft, which is suitable for heavy use with high concentrations of multiple user types. This width is needed to enable a bicyclist to pass another path user going the same direction, while another path user is approaching from the opposite direction. Where volumes are extremely high, an additional path of 5 ft can be provided to separate pedestrian circulation.

 - The minimum width of a shared use path is 10 ft, which is adequate for moderate use, or a low level of mixing between bicyclists and pedestrians (AASHTO *Bike Guide* Section 5.2.1).

- In rare circumstances a constrained minimum width of 8 ft may be used. This should only be considered in constrained conditions, for short distances (AASHTO *Bike Guide* Section 5.2.1).
- B** A 2 ft or greater shoulder on both sides of the path should be provided free of obstacles.

 - *MUTCD* requires 2 ft lateral clearance from the edge of path for post mounted sign faces or other traffic control devices. Standard clearance of overhead signs and traffic control devices should be 8 ft.



FURTHER CONSIDERATIONS

- Under most conditions, centerline markings are not necessary. Centerline markings should only be used if necessary for clarifying user positioning or preferred operating procedure: solid line = no passing, dashed line = lane placement
- Paths with a high volume of bidirectional traffic should include a centerline. This can help communicate that users should expect traffic in both directions and encourage users to travel on the right and pass on the left.
- Where there is a sharp blind curve, painting a solid yellow line with directional arrows reduces the risk of head-on collisions.
- Word pavement markings should be applied differently on a path context than on a roadway.
- Small scale signs should be used in path environments (*MUTCD* 9B.02).
- Terminate the path where it is easily accessible to and from the street system, preferably at a trailhead, controlled intersection or at the beginning of a dead-end street.
- Planners and designers should also reference *Standards and Guidelines for Trails* where applicable.

MAINTENANCE

Trail width can influence maintenance vehicle access. Asphalt is the most common surface for bicycle paths. The use of concrete for paths has proven to be more durable over the long term. Saw cut concrete joints rather than troweled improve the experience of path users.

REFERENCES

AASHTO. *Guide for the Development of Bicycle Facilities*. 2012.
 FHWA. *Manual on Uniform Traffic Control Devices*. 2009.
 Flink, C. *Greenways: A Guide To Planning Design And Development*. 1993.

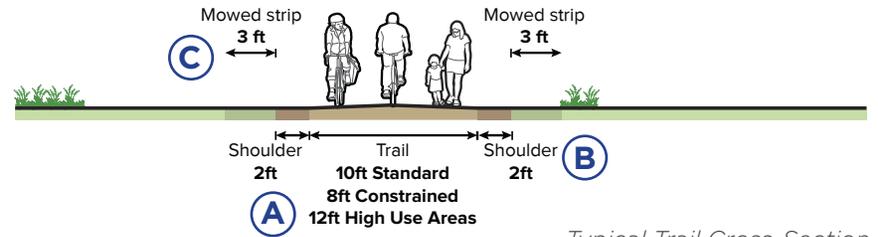
SHARED USE PATHS WITHIN UTILITY CORRIDORS

TYPICAL APPLICATION

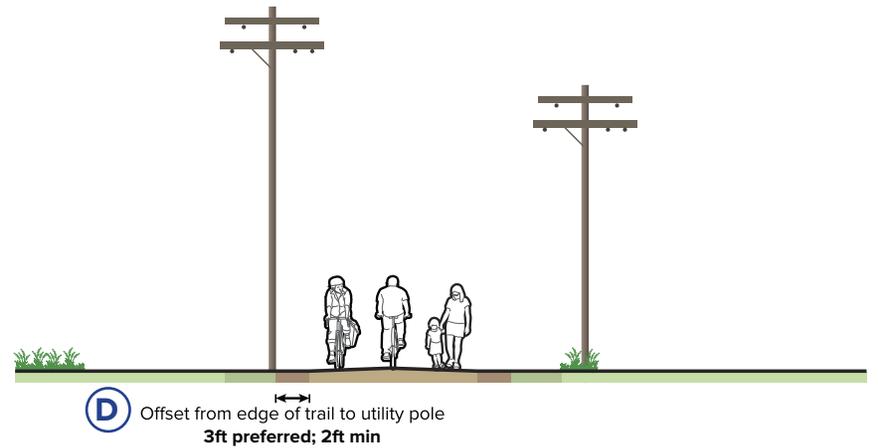
These guidelines are for sections of trails within utility corridors.

DESIGN FEATURES

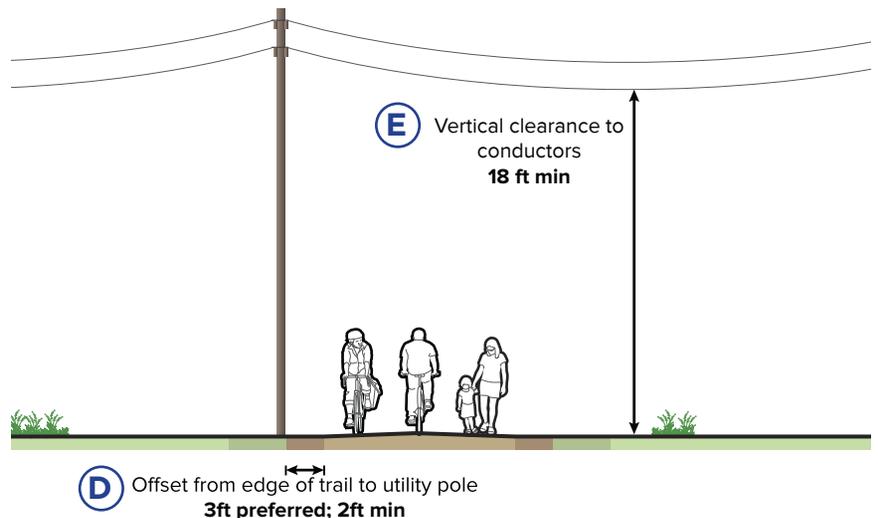
- (A)** Typical trail width will be 10 ft; in constrained areas, the width may be reduced to 8 ft, in high-volume locations (usually in more urban areas) the width may increase to 12 ft.
- (B)** Shoulders 2 ft in width will be provided on both edges of the trail. These areas will be graded as an extension of the trail surface, to allow riders to recover should they leave the trail. The shoulder surfaces may be grass or stone dust, depending on local conditions.
- (C)** A mowed area 3 ft wide will be maintained on either side of the trail surface. Where the shoulders are grass, they will be part of the mowed area.
- (D)** Preferred offset from the trail surface to utility poles and other equipment is 3 ft (the width of the shoulder); the minimum offset is 2 ft.
- (E)** When trail crosses beneath the conductors, a minimum clearance of 18 ft to the lowpoint of the conductors will be maintained. Clearances shall meet requirements of National Electric Safety Code.
- (F)** The trail shall meet minimum requirements of the latest version of the AASHTO *Guide for the Development of Bicycle Facilities*.



Typical Trail Cross-Section



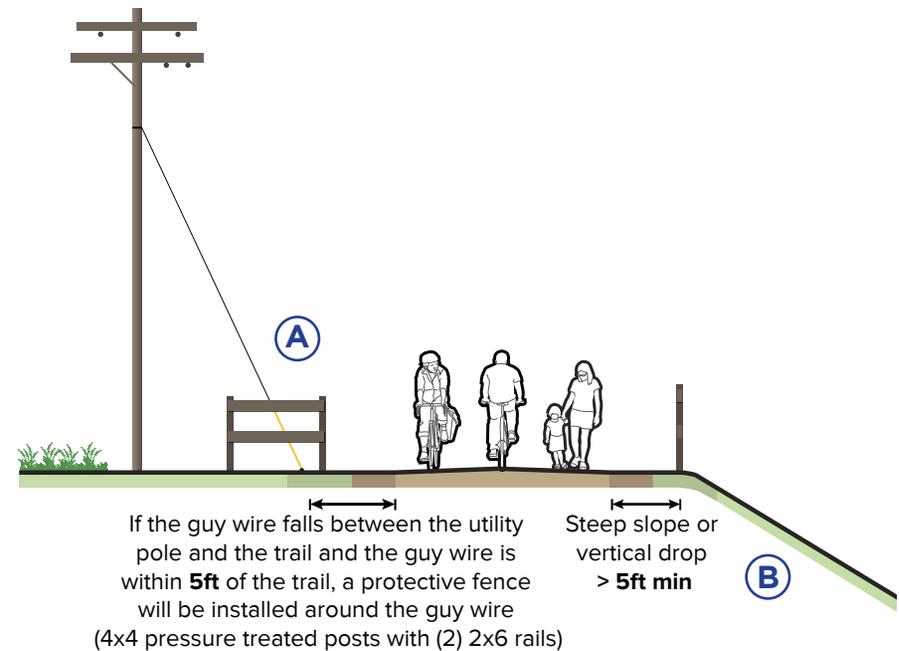
Typical Corridor Cross-Section



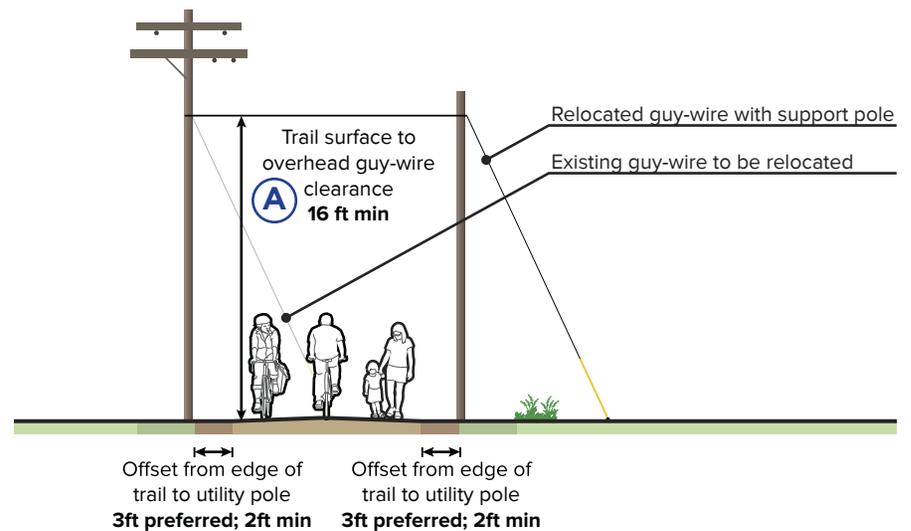
Typical Corridor Crossing Cross-Section

DESIGN FEATURES

- A** Where guy-wires extend from utility poles towards the trail, a minimum buffer of 4 ft (including shoulders) to the trail surface to the anchor point of the guy-wire will be maintained. If this is not possible, the guy-wire will be crossed over the trail to a support pole. 16ft minimum.
- B** Where the edge of the trail is less than 4 ft (including shoulders) from a steep slope or a vertical drop exceeding 3 ft, a fence will be installed as a barrier to protect trail users. The fence will be designed to be easily dismantled.
 - The trail will be designed to accommodate H-20 loads for emergency and maintenance vehicles. Bridges constructed for the trail will be designed to H-5 loading criteria and signed appropriately.
 - Trail entrances will be designed to discourage vehicular access while allowing free entry to emergency and maintenance vehicles. Bollards or gates will not be used, unless local conditions warrant it.
 - Signage and other trail amenities will be located outside the shoulders and in areas which minimize conflicts with utility maintenance access.
 - Emergency and maintenance access points for the trail will be determined during planning to ensure all sections are accessible.
 - Ground-mounted equipment may be enclosed by chain link fencing of minimum 6 ft height (with barbed wire where appropriate), and will display safety signage. Open air substations shall have 7 ft chain link fence with barbed wire.



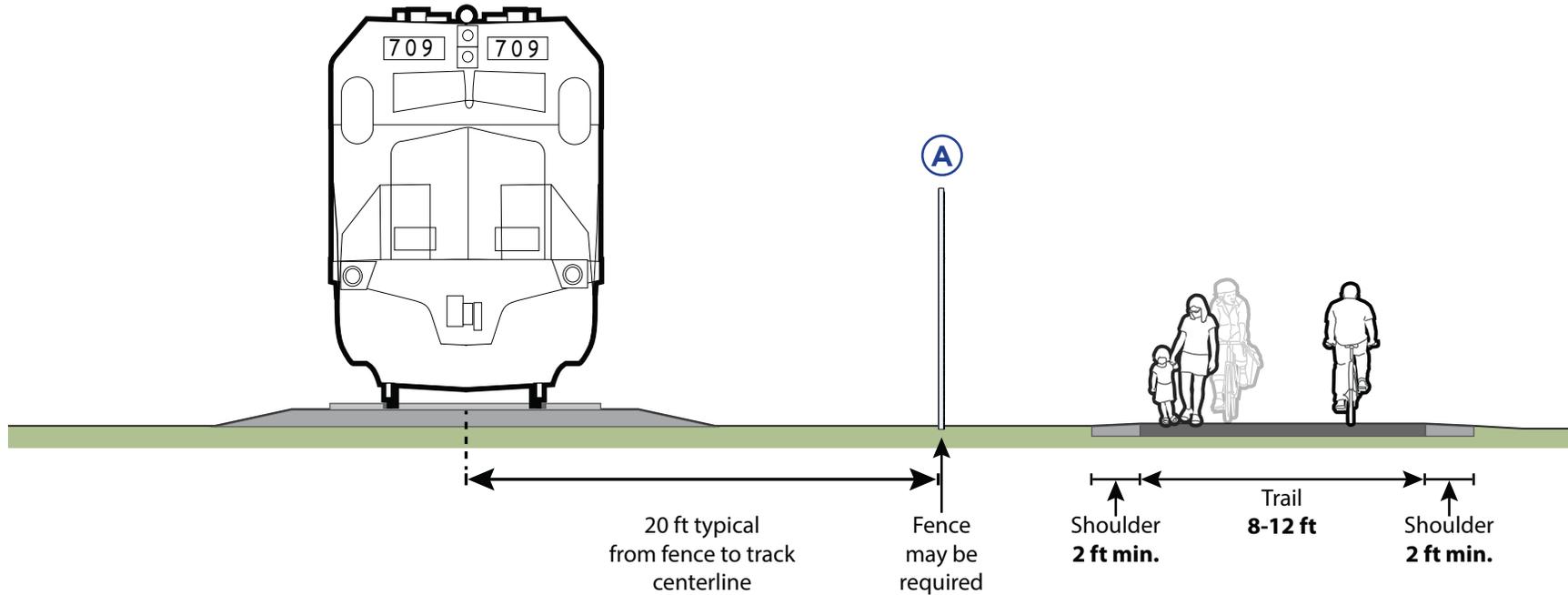
Typical Trail Location at Utility Pole Guy-wire



Typical Trail Location at Relocated Guy-wire

SHARED USE PATHS ALONG RAIL CORRIDORS

“Rails-with-Trails” are shared use paths located adjacent to active rail lines. Rail-with-trail designs vary widely, depending on factors such as their proximity to trains, the frequency and speed of rail service, and the presence of at-grade crossings.



TYPICAL APPLICATION

Many rails-with-trails have segments of trail that are within 30 ft of active railroad tracks (*RTC* 2013).

In some cases, space needs to be preserved for future planned freight, transit or commuter rail service. In other cases, limited right-of-way width, inadequate setbacks, concerns about safety/trespassing, and numerous crossings may affect a project’s feasibility.

DESIGN FEATURES

- Shared use paths along rail corridors should meet or exceed general design standards. If additional width allows, wider paths, and landscaping are desirable.
- Ⓐ If required, fencing should be a minimum of 5 ft in height with higher fencing than usual next to sensitive areas such as switching yards.
- The FHWA *Rails-with-Trails* document offers is no consensus on an appropriate setback distance between the paved edge of a shared use path and the centerline of the closest active trail track. Setbacks from the active rail line will vary depending on the speed and frequency of trains, topography, sight distances, and available right-of-way (FHWA 2002).



Rail with trail (Source: Michael Hicks, CC BY 2.0 via Flickr)



Hiawatha LRT Trail, Minneapolis, MN (Source: airbus777, CC BY 2.0 via Flickr)

FURTHER CONSIDERATIONS

- Railroads may require fencing with rail-with-trail projects. Concerns with trespassing and security can vary with the volume and speed of train traffic on the adjacent rail line and the setting of the shared use path, i.e. whether the section of track is in an urban or rural setting.
- Refer to the AASHTO *Bike Guide* for guidance for “Railroad Grade Crossings” in (Section 4.12.1), addressing crossing angle, surfaces, bikeway width and flange opening.
- Refer to the *MUTCD* Chapter 8D for guidance on shared use pathways that cross railroad corridors at grade.

MAINTENANCE

Proper management and maintenance is an important factor in creating a safe environment for trail users. Asphalt is the most common surface for bicycle paths. The use of concrete for paths has proven to be more durable over the long term. Saw cut concrete joints rather than troweled improve the experience of path users.

REFERENCES

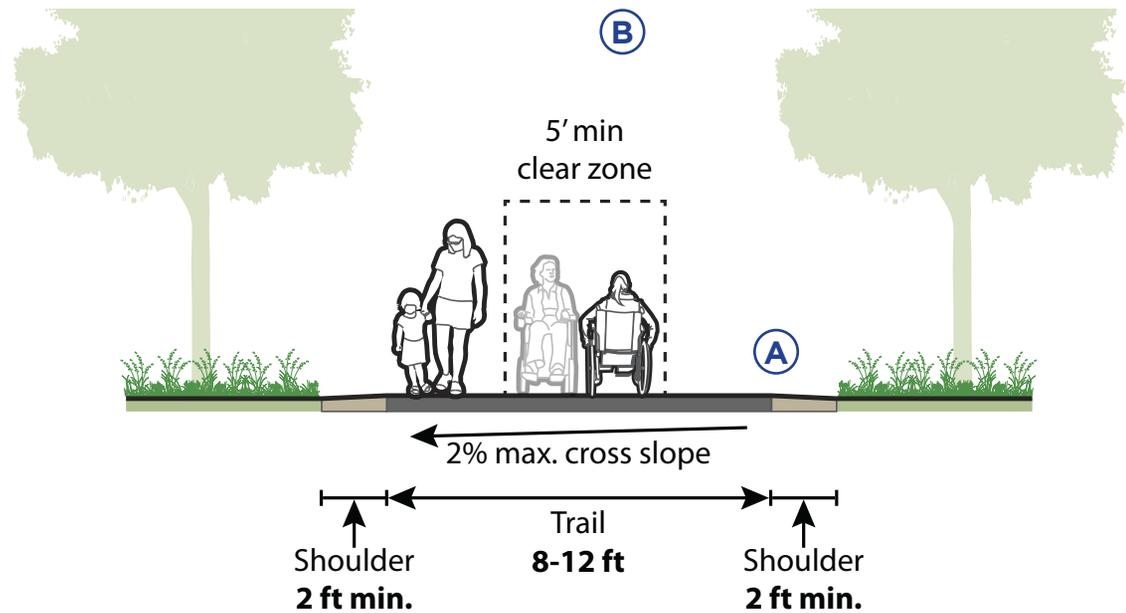
AASHTO. *Guide for the Development of Bicycle Facilities*. 2012.
 FHWA. *Manual on Uniform Traffic Control Devices*. 2009.
 FHWA. *Rails-with-Trails: Lessons Learned*. 2002.
 Rails to trails conservancy (RTC). *America’s Rails-with-Trails*. 2013.

ACCESSIBILITY OF SHARED USE PATHS

New shared use paths must meet accessibility guidelines to ensure that paths, street crossings, signals, and other facilities for pedestrian circulation and use are readily accessible to and usable by pedestrians with disabilities.

TYPICAL APPLICATION

Constructing outdoor shared use paths and trails may have limitations that make meeting ADA guidelines difficult and sometimes prohibitive. Prohibitive impacts include harm to significant cultural or natural resources; a significant change in the intended purpose of the trail; requirements of construction methods that are against federal, state, or local regulations; or terrain characteristics that prevent compliance.



DESIGN FEATURES

- Path surfaces must be firm, stable surfaces, and are generally limited to hard surface such as asphalt, concrete, wood, or compacted gravel. Some surface materials must be periodically maintained to meet accessibility requirements.
- The path running slope should be less than 5% maximum without landings. Where the shared use path is contained within a street or highway border, its grade shall not exceed the general grade established for the adjacent street or highway.

- Ⓐ The path cross slope must not exceed 2%. Design with a 1.5% cross slope target is recommended to account for variation in construction tolerances.
- Ⓑ Paths must provide a 5 ft minimum clear width to serve as an accessible pedestrian access route. Most shared used paths designed for bicycle access will meet this requirement (*PROWAG 2011*).
 - On trails designated as accessible, provide rest areas or widened areas on the trail, optimally every 300 ft.



Some gravel and crusher fine trail material types are considered to be ADA compliant (Source: National Trails Training Partnership)



Trails should always use materials and be constructed such that they are well drained and dry as much as possible (Source: National Trails Training Partnership)

FURTHER CONSIDERATIONS

- Trailhead signage should provide accessibility information, such as trail gradient/profile, distances, tread conditions, location of drinking fountains, and rest stops.
- At trailheads there should be at least one accessible parking area per every 25 vehicle spaces.
- Trail amenities, drinking fountains and pedestrian-actuated push buttons should be placed no higher than four ft off the ground.

MAINTENANCE

The trail surface should be solid, and free of obstacles and tripping hazards. Trail edge vegetation/screening, and signage should be maintained and located so as not to present obstacles for visually impaired trail users.

REFERENCES

United States Access Board. *Public Rights-of-Way Accessibility Guidelines (PROWAG)*. 2011.

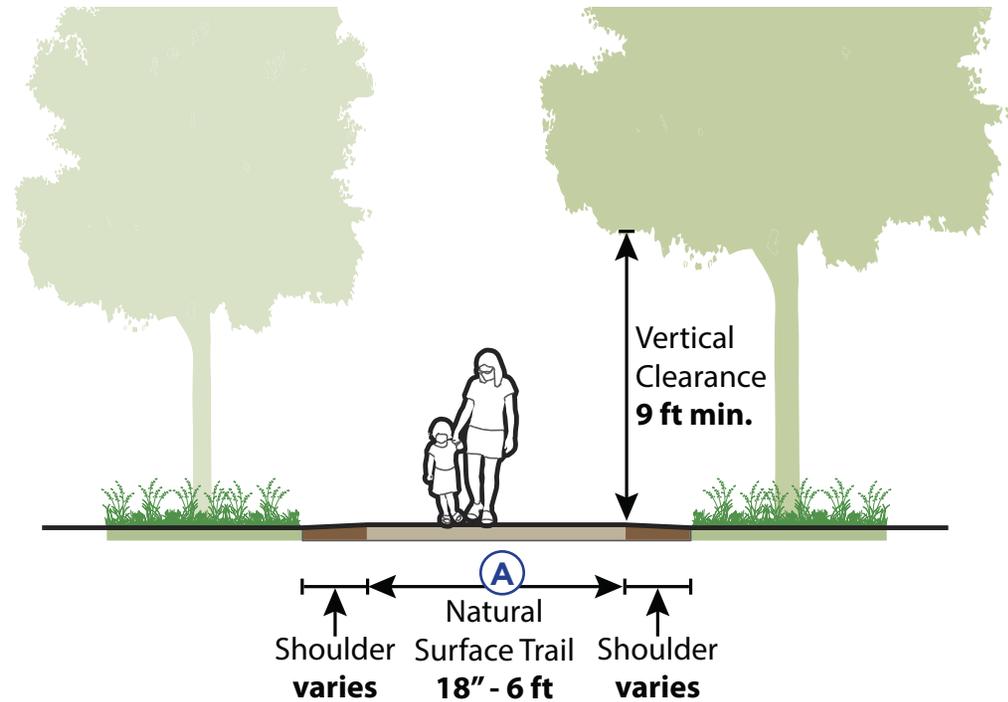


NATURAL SURFACE TRAILS

Sometimes referred to as footpaths or hiking trails, the natural surface trail is used along corridors that are environmentally-sensitive but can support bare earth, wood chip, or boardwalk trails.

TYPICAL APPLICATION

Natural surface trails are a low-impact solution and found in areas with limited development or where a more primitive experience is desired.



DESIGN FEATURES

- A** Trails can vary in width from 18 in to 6 ft or greater; vertical clearance should be maintained at 9 ft above grade.
 - Base preparation varies from machine-worked surfaces to those worn only by usage.
 - Trail surface can be made of dirt, rock, soil, forest litter, or other native materials. Some trails use crushed stone (a.k.a. “crush and run”) that contains about 4% fines by weight, and compacts with use.
- Provide positive drainage for trail tread without extensive removal of existing vegetation; maximum slope is 5% (typical).



Smooth crusher fines can be a good surface material for natural surface trails for all user types (Source: National Trails Training Partnership)



Trail surface material can be further stabilized with a variety of products (Source: National Trails Training Partnership)

FURTHER CONSIDERATIONS

- Consider implications for accessibility when weighing options for surface treatments. Refer to guidance on Accessible Shared Use Paths for more information (page A-19).
- Trail erosion control measures include edging along the low side of the trail, steps and terraces to contain surface material, and water bars to direct surface water off the trail; use bedrock surface where possible to reduce erosion. Refer to the US Forest Service 2007 *Trail Construction and Maintenance Notebook* for detailed guidance on erosion control methods.

MAINTENANCE

If trails remain unused during storm events, and are constructed correctly, they can remain virtually maintenance free. Use signs on-site that discourage use in wet weather, or just after wet weather.

REFERENCES

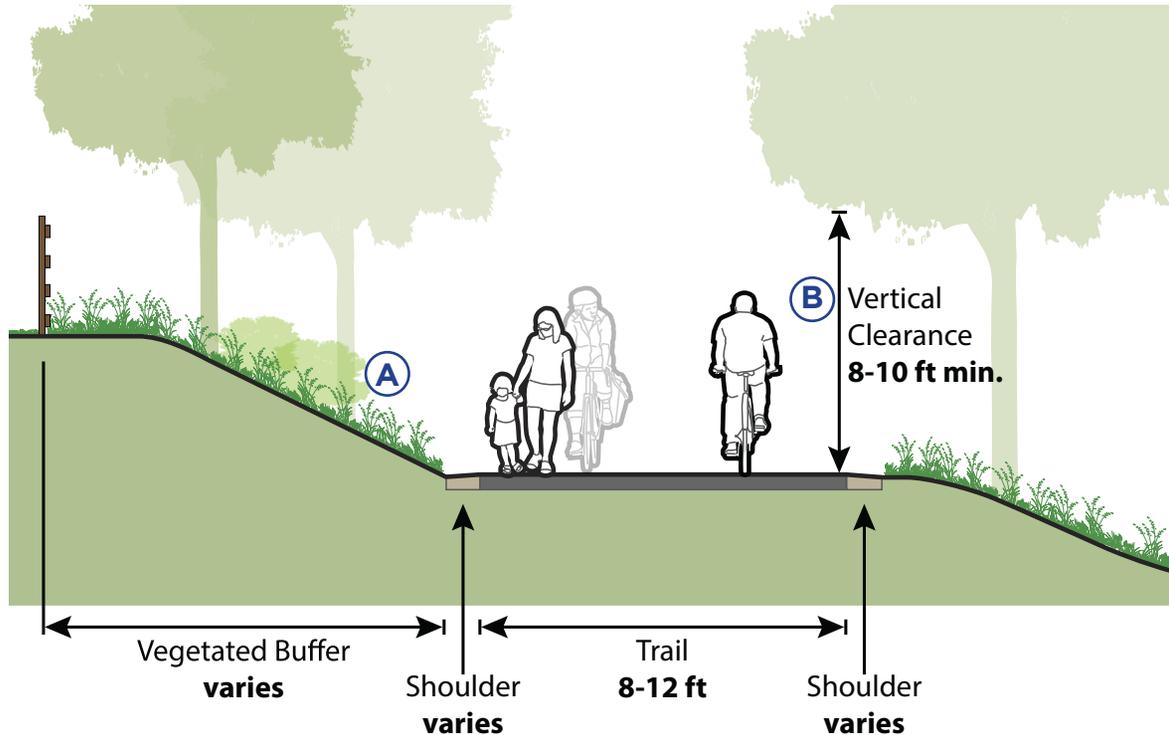
International Mountain Bicycling Association (IMBA). *Trail Solutions: IMBA's Guide to Building Sweet Singletrack*. 2004.
 US Forest Service. *Trail Construction and Maintenance Notebook*. 2007.

VEGETATIVE SCREENING

Landscape features, including trees and shrubs along paths, can enhance the visual environment and improve the path user experience. Trees and shrubs can also shade users from sun and shelter users from rain.

TYPICAL APPLICATION

When possible, landscaping is the first choice for creating separation between the trail and adjacent properties. Vegetative buffers create a natural privacy screen, provide habitat for wildlife, and stabilize erodible soils. Select landscaping material (e.g. vegetation with thorns) can deter unwanted access or exit points, entrapment areas, and undesired off-path routes.



DESIGN FEATURES

- Ⓐ All groundcover and shrubs to be trimmed to a maximum of 24 in above ground level height.
 - Where vegetative screens are recommended to provide privacy for private properties, they are not to exceed 4 ft in height.

- Ⓑ Trees should be trimmed to provide a minimum of 8 ft of vertical clearance, 10 ft preferred (AASHTO *Bike Guide*).
 - Tree canopies should not obstruct pathway illumination.
 - Select and place trail vegetation to provide seasonal comfort; shade in the warmer months and sunlight in colder months.



Example of vegetative screening along a trail corridor



Native and culturally significant plants should be selected for trail screening.

FURTHER CONSIDERATIONS

Select plant species based on the desired effect or function along trail segments. For example, consider the use of plant species that assist with stormwater management along trail edges. In some situations, vegetative buffers alone may not create the desired degree of separation. Where separation is desired to protect users from hazardous materials, deep water or swift currents, or steep slopes, consider additional treatments.

MAINTENANCE

Use native plant species and plants appropriate to the region that are already adapted to the local soil and climate. Maintain the vegetation buffer so that it does not impede views or interfere with trail circulation.

REFERENCES

AASHTO. *Guide for the Development of Bicycle Facilities*. 2012.

TRAIL EDGE DEFINITION

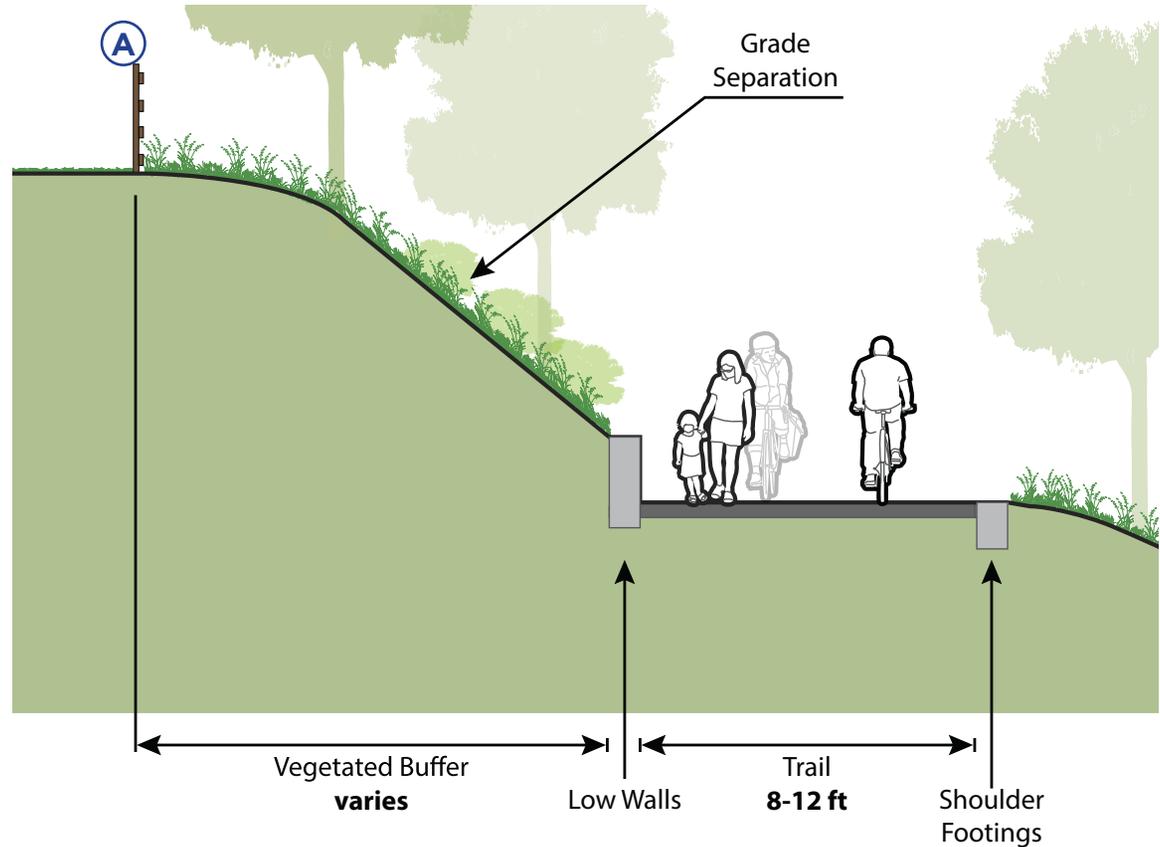
Vegetation, topography, ditches, fencing, railings, or walls may be used to clearly mark trail edges. Such features serve multiple purposes, including:

- Providing visual separation/ privacy screens,
- Delineating public space from private property adjacent to the trail,
- Discouraging the development of informal access trails, and/or
- Separating users from hazardous drop-offs or land uses such as active rail lines.

Signage is also an option for defining a trail edge that has been effectively used.

TYPICAL APPLICATION

If separation is desired purely for privacy reasons, vegetative buffers or the use of topography are recommended where possible. For physical separation aimed at preventing trespassing or guarding against hazardous slopes, consider the use of topography, ditches, semi-transparent fencing or railings, and hostile vegetation.



DESIGN FEATURES

A Fencing should strike a balance between adjacent residents' privacy and informal surveillance of the trail. Permeable fencing of four ft tall or less can provide a barrier sufficient to denote property boundaries or to deter most access. Opaque fencing or walls can degrade the experience of trail users, obscure views, and create a "tunnel" effect that makes trail users feel trapped.

- Railings on bridges, boardwalks, and at the edges of steep drop-offs should be at least 42 in above the surface. A 54 in railing height is recommended where more hazardous conditions exist, such as on a bridge over a highway (AASHTO *Bike Guide*).



Low wall at Parkersburg Riverpoint Park (Source: Redi-Rock International, CC BY 2.0 via Flickr)

FURTHER CONSIDERATIONS

Wildlife passage and safety for trail users are important factors in determining appropriate trail edge treatments. Although the public often perceives fencing as a means of providing safety by prevention of unwanted access, fencing that blocks visual access completely can have the opposite effect by impairing informal trail surveillance. Trail segments adjacent to active rail lines may require fencing, at the discretion of the owner and operator of the rail corridor.

MAINTENANCE

Use native plant species to reduce maintenance costs and enhance local identity. When possible, consider using locally sourced materials for fencing such as timber from trees native to the region.

REFERENCES

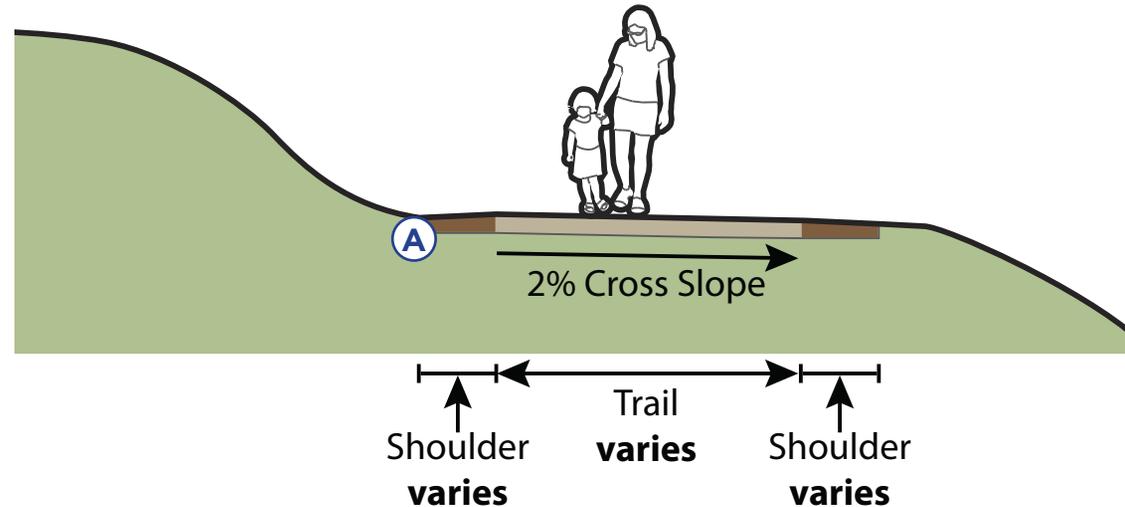
AASHTO. *Guide for the Development of Bicycle Facilities*. 2012.

DRAINAGE AND EROSION CONTROL

Drainage and erosion control are necessary to maintain a stable walkway and trail surface.

TYPICAL APPLICATION

Following land contours helps reduce erosion problems, minimizes maintenance and increases comfort levels on all trail types. Drainage impacts should be considered for all shared use paths, including paved and natural surface trails.



DESIGN FEATURES

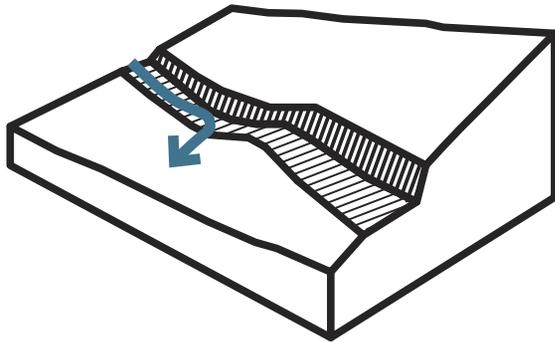
Paved Surfaces:

- A** A 2% cross slope will resolve most drainage issues on a paved path and should be used for both the trail and its shoulders. A maximum 1V:6H slope may be used for the shoulders although 2% is preferred. For sections of cut where uphill water is collected in a ditch and directed to a catch basin, water should be directed under the trail in a drainage pipe of suitable dimensions.

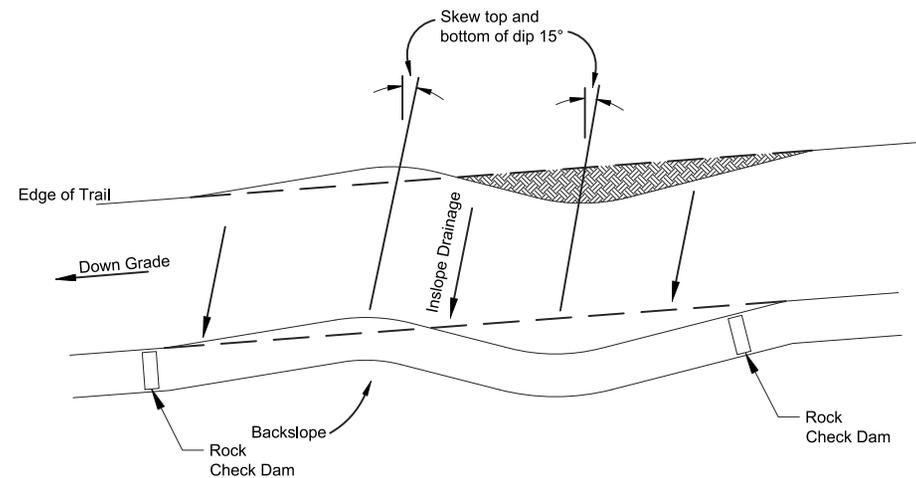
Natural Surfaces:

- Erosion will occur on natural surface trails. Natural surface trails should be designed to accommodate erosion by shaping the tread to limit how much erosion occurs and to maintain a stable walkway and trail surface. The goal is to outslope the trail so that water sheets across, instead of down, its tread.

- Designing trails with rolling grades is the preferred way to build sustainable natural surface trails. “Rolling grade” describes the series of dips, crests, climbs and drainage crossings linked in response to the existing landforms on the site to form a sustainable trail (US Forest Service 2007).
- Frequent grade reversals (grade dips, grade brakes, drain dips or rolling dips) are a critical element for controlling erosion on sustainable trails. A general rule-of-thumb is to incorporate a grade reversal every 20 to 50 linear ft along the trail to divide the trail into smaller watersheds so the drainage characteristics from one section will not affect another section.



Rolling grade diagram, draining outward



Inslope rolling grade drainage

FURTHER CONSIDERATIONS

Grade reversals have the added benefit of adding interest to any trail. Retaining walls or other structural elements may also be required for stable construction and to protect the trail from erosion and flood damage.

MAINTENANCE

Asphalt is the most common surface for bicycle paths. The use of concrete for paths has proven to be more durable over the long term. Saw cut concrete joints rather than troweled improve the experience of path users.

REFERENCES

US Forest Service. *Trail Construction and Maintenance Notebook*. 2007.

BOLLARDS

Bollards are physical barriers designed to restrict motor vehicle access to trails. Bollards should never be a default treatment, and should not be used unless there is a documented history of intrusion by unauthorized cars, trucks, or other unauthorized vehicles. Refer to Bollard Alternatives (page A-34) for guidance on alternative design solutions to this concern.

TYPICAL APPLICATION

Bollards should only be used under specific circumstances, properly placed, marked and designed to be as safe and conspicuous as possible when there is a demonstrated danger of people mistaking the trail for a roadway and there isn't a feasible alternative design.



DESIGN FEATURES

- A Bollards must be easily visible, especially in low light conditions. The *MUTCD* requires retroreflectorization of any obstruction in the traveled way of a shared-use path (Section 9C.03). This includes posts along the edge of a path.
 - Must not restrict access for people with disabilities.
 - Should have sufficient sight distance to allow users to adjust speed. Insufficient sight distance increases the likelihood that bollards will be dangerous hazards.
 - Should permit passage, without dismounting, for adult tricycles, bicycles towing trailers, and tandem bicycles. All users legally permitted to use the facility should be accommodated.

- Bollards must be at least 3.2 ft tall and should be placed at least 20 ft from the intersection. This will allow trail users to cross the intersection before negotiating the barrier posts.
- *MUTCD* Figure 9C-2 defines a diamond-shaped marking that should be used around bollards or other obstructions within a path.



Trail bollards at street crossing



Interurban Trail, Seattle, WA (Source: SounderBruce, CC BY-SA 2.0 via Flickr)

FURTHER CONSIDERATIONS

- Even properly installed bollards constitute a serious and potentially fatal safety hazard to trail users and should only be used when there is a known history of use of unauthorized motor vehicles
- Bollards should be designed to be knock-down, removable, or hinged to permit entrance by emergency and service vehicles. A knocked-down bollard must be reinstalled or removed immediately to avoid additional safety hazards.
- One bollard is generally sufficient to indicate that a path is not open to motorized vehicles. The post should be placed in the center of the trail tread. Where more than one post is necessary, there should be a 6 ft minimum on center spacing between bollards. Always use one or three bollards, never two (*RTC* 2001).
- Bollards should be set back a minimum of 20 ft from edge of road.

REFERENCES

FHWA. *Manual on Uniform Traffic Control Devices*. 2009.

Rails-to-Trails Conservancy (*RTC*). *Trails for the Twenty-First Century*, 2nd Edition. 2001.

Guide for the Planning, Design, and Operation of Bicycle Facilities, American Association of State Highway Transportation Officials, 4th Edition: 2012.

PA DCNR. *Pennsylvania Trail Design & Development Principles: Guidelines for Sustainable, Non-motorized Trails*.

BOLLARD ALTERNATIVES

The routine use of bollards and other similar barriers to restrict motor vehicle traffic is not recommended (AASHTO *Bike Guide* p. 5-46). Bollards are often ineffective at preventing undesired motor vehicle access to shared use paths, and create obstacles to legitimate trail users.

Alternative design strategies use signage, landscaping and curb cut design to reduce the likelihood of motor vehicle access.

TYPICAL APPLICATION

At the entrance to shared use paths, or at roadway crossings, where motor vehicle use is prohibited and should be discouraged.

Where the need for bollards or other vertical barriers in the pathway can be justified despite their risks and access issues, refer to the guidance on Bollards (page A-32) and the AASHTO *Bike Guide* Section 5.3.5.



DESIGN FEATURES

- A** “No Motor Vehicles” signage (*MUTCD* R5-3) may be used to reinforce regulatory access rules.
 - Design path entries to not be mistaken for vehicle access point, and to make intentional access by motor vehicles difficult.
- B** At intersections, split the path tread into two sections separated by low landscaping. Each tread should be 7 ft to allow for side-by-side riding, while appearing too narrow for motor vehicle access.
 - Emergency vehicles can still enter by straddling the landscaping median.
- C** Vertical curb cuts should be used to discourage motor vehicle access.
 - Consider targeted surveillance and enforcement at specific intrusion locations.



Bollard alternative, split trail entrance/exit

FURTHER CONSIDERATIONS

- Bollards or other barriers should not be used unless there is a documented history of unauthorized intrusion by motor vehicles. If unauthorized use persists, assess whether the problems posed by unauthorized access exceed the risks and issues posed by bollards and other barriers.

MAINTENANCE

Landscaping separation between trails should be maintained to a height easily straddled by emergency vehicles.

REFERENCES

AASHTO. *Guide for the Development of Bicycle Facilities*. 2012.

TRAIL BRIDGES

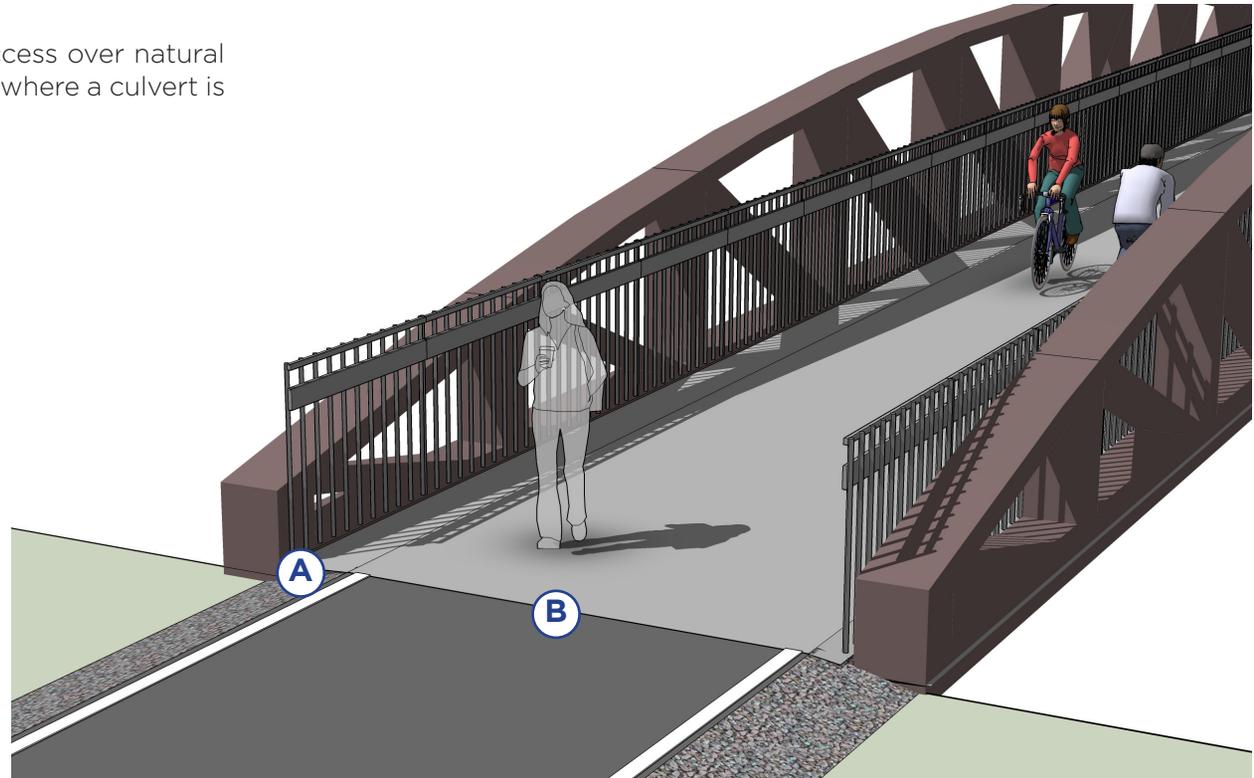
Shared use path bridges provide trail access over natural features such as streams and rivers. The type and size of bridge can vary widely depending on the trail type and specific site requirements. Bridges often used for multi-use trails include suspension bridges, prefabricated span bridges and simple log bridges. When determining bridge design for multi-use trails, it is important to consider emergency and maintenance vehicle access.

TYPICAL APPLICATION

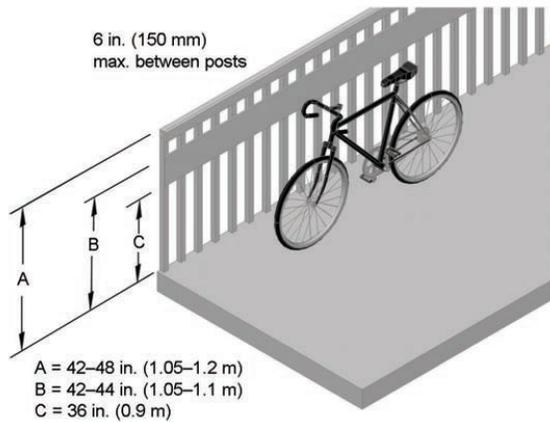
Bridges are used to provide trail access over natural features such as streams and rivers, where a culvert is not an option.

DESIGN FEATURES

- A** The clear width of the bridge should allow for 2 ft of clearance on each side of the pathway.
- B** Bridge deck height should match that of the path surface to provide a smooth transition.
 - Bicycle and shared-use paths should include a 54 in guide rail where hazardous conditions exist.
 - Refer to AASHTO *Bike Guide* Figure 5-11 for specifications for a bridge “rub rail.”
 - A minimum vertical clearance of 10 ft is desirable for motor vehicle access.



- A trail bridge should support 6.25 tons if motor vehicle access is permitted (AASHTO 2002).



Source: AASHTO *Guide for the Development of Bicycle Facilities* (2012), Figure 5-11.



Vasona Lake County Park Bridge, Los Gatos, CA

FURTHER CONSIDERATIONS

- If a corridor already contains a structure, such as an abandoned rail bridge, an engineer should be consulted to assess the structural integrity before deciding to remove or reuse it.
- All abutment design should be sealed by a qualified structural engineer and all relevant permits should be filed.

REFERENCES

AASHTO. *Guide for the Development of Bicycle Facilities*. 2012.
AASHTO. *Standard Specifications for Highway Bridges*. 2002.

BOARDWALKS

A boardwalk is a constructed pathway, slightly elevated over a natural surface otherwise unsuitable or inappropriate for at grade path construction. Boardwalks are usually constructed of wooden planks or recycled material that form the top layer of the boardwalk. A number of low-impact support systems are also available that reduce the disturbance within wetland areas to the greatest extent possible.

TYPICAL APPLICATION

May be required when crossing streams, rivers, creeks, as well as for travel through wetlands or other poorly drained areas.

DESIGN FEATURES

- Boardwalk width should be a minimum of 10 ft when no rail is used. A 12 ft width is preferred in areas with average anticipated use and whenever rails are used.
- A 6 in curb rail is recommended, however, a 42 in guiderail is required at locations where there is a 30 in or greater difference in the low water bridge elevation and the ground elevation below (AASHTO 2012).
- If access by vehicles is desired, boardwalks should be designed to structurally support the weight of a small truck or a light-weight vehicle.





Mine Creek Trail, Raleigh, NC

FURTHER CONSIDERATIONS

- Recycled decking has gained popularity in recent years since it lasts much longer than wood, especially in wet conditions.
- Permitting within wetlands and water crossings is a consideration. In general, building in wetlands is subject to regulations and should be avoided (FHWA 2001).
- Consult a structural engineer for member sizing and post footing design. The foundation normally consists of wooden posts or auger piers (screw anchors). Screw anchors provide greater support and last much longer.
- Decking should be either non-toxic treated wood or recycled plastic. Cable rails are attractive and more visually transparent but may require maintenance to tighten the cables if the trail has snow storage requirements.

REFERENCES

- AASHTO. *Guide for the Development of Bicycle Facilities*. 2012.
FHWA. *Wetland Trail Design and Construction*. 2001.



RESTROOM ACCESS

Careful consideration should be given to a number of factors before locating restrooms, including available land, size of trailhead, frequency of use, existing restroom facilities within the trail system, utility availability, and user need.

Prior to undertaking any restroom building design, consultation with a structural and civil engineer, and review of state building codes, health and safety codes, ADAAG and Public Rights-of-Way Accessibility Guidelines (*PROWAG*) standards, and local development codes is required. The space required for each restroom building depends on the number of toilets to be provided.

Public restrooms require considerable maintenance and service. Access to these resources should be a strong consideration when planning for restroom buildings.

Partnerships with adjacent private business can be secured to increase frequency of restroom and water facilities for trail users.

TYPICAL APPLICATION

Restrooms should be strategically located along trail

Use wayfinding guide signs to indicate distance and bike/walk timing to the next available comfort station.

MAINTENANCE

Determine a locking schedule for restrooms to prevent habitation.

Monitor daily for vandalism, supply requirements, and cleanliness.

DESIGN FEATURES

- Local, state, and federal codes take precedence for all restroom facilities.
- Prioritize location of restrooms at trailheads and within existing parks, and review gaps for placement at other trailheads or locations within the system.
- Restroom structures should be located adjacent to vehicular access points for security, maintenance, and access to water and sewer (unless they are self-composting).
- Restrooms should make use of natural light and ventilation to the extent possible.
- Place bicycle parking close to restroom structures so that bicyclists do not impede trail access. Inadequate bicycle parking encourages informal propping of bicycles at or against restroom buildings.
- Always provide restroom facilities outside of floodprone areas.
- Composting toilets should be considered in remote areas or where utility connections are unavailable.

ACCESS TO POTABLE WATER

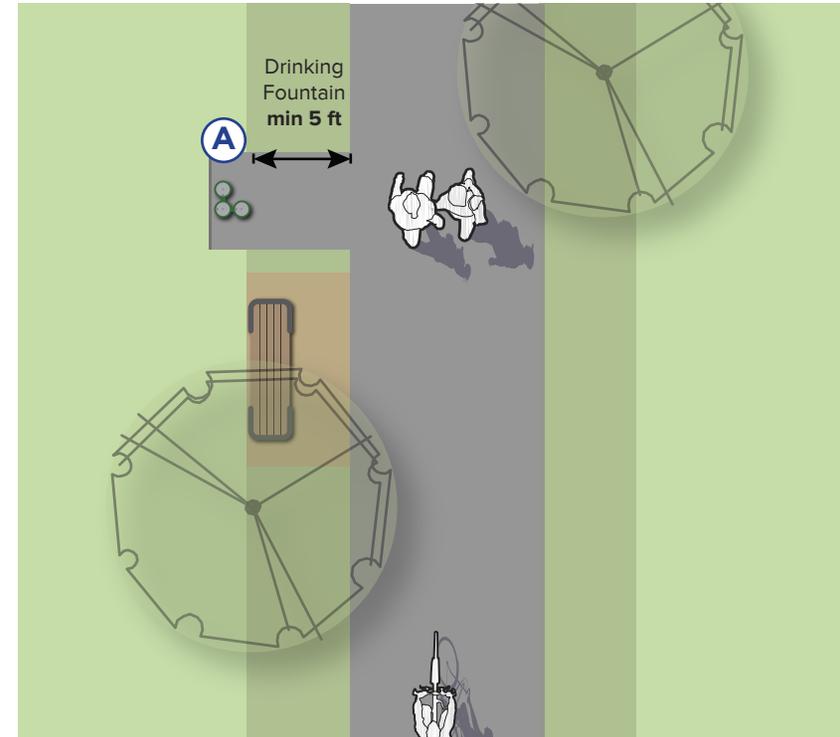
Access to potable water is crucial to safety and trail enjoyment for multiple user types. Water access points should be available at trailheads. Between trailheads, wayfinding signs will lead users to potable water sources that may be accessible through public spaces such as parks, convenience stores, restaurants, and other trail-friendly businesses.

TYPICAL APPLICATION

Potable sources of water should be identified along the trail alignment with spacing of five miles or less. As a best practice, spacing for drinking water access for long-distance trails ranges from 5-15 miles. If potable water access points are more than five miles apart, signs should be placed at potable water access points to indicate distance to next source.

DESIGN FEATURES

- A Locate drinking fountains at least 5ft from trail edge.
 - Standard, accessible, and dog height bowls should be installed to accommodate all trail users.
 - Drinking fountains should be placed on a well drained surface (for example: 2% sloped concrete slab, with 3 in gravel strip to prevent erosion).
 - Consider the use of durable and vandalism-resistant materials such as steel, or stone.
 - Ensure the use of “auto off” features to prevent waste, bowl overflow, and open lines.



MAINTENANCE

Include hose bib connections for maintenance purposes.

Schedule regular inspections to monitor leaks, clogged drains, cracked pipes, and vandalism.

REFERENCES

United States Access Board. *Public Rights-of-Way Accessibility Guidelines (PROWAG)*. 2011.

North Country Trail Handbook for Trail Design, Maintenance and Construction. 1998, NPS.

LIGHTING

Lighting for trails should be analyzed per segment context with full consideration for safety needs, sensitive habitats, trail function, and maintenance commitments. In general, lighting is not appropriate for trails in remote areas, trails with low use, or where there is little to no development.

Lighting can improve visibility along the trail and intersection crossings at night for commuters. If a trail is determined to be unlit and closes at sundown, extended hours for commuters should be considered, particularly during winter months when trips to and from work are often underway before sunrise and after sunset. Lighting may also be necessary for daytime use in trail tunnels and underpasses.

TYPICAL APPLICATION

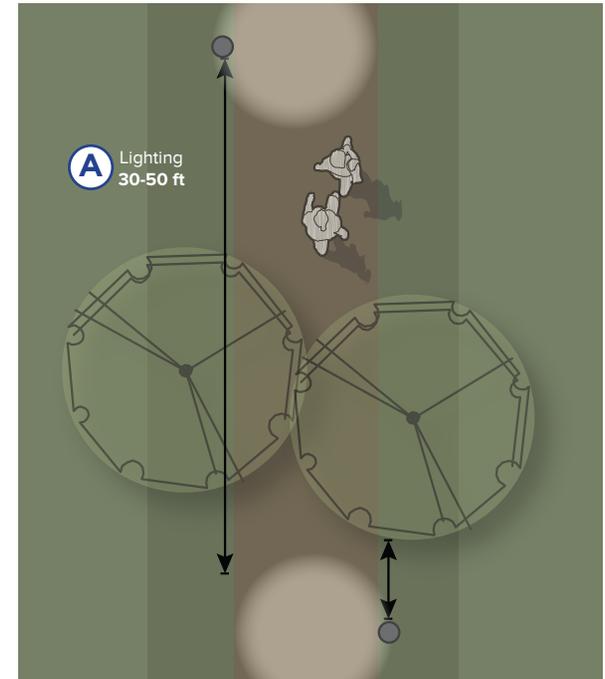
Recommended locations for lighting include parking areas, restroom facilities, major trail intersections, bridges, underpasses, tunnels, and street crossings.

DESIGN FEATURES

- Ⓐ Design lighting levels appropriate to each situation.
 - Lighting should be at pedestrian scale and depends on the type and intensity of lights. 30–50 ft spacing is common for pedestrian scale lighting.
 - Lighting should avoid trees and be placed outside of canopy edge where possible.
 - Solar powered lighting is available where utility connection is difficult or when alternative energy sources are desired. Daylight hours should be analyzed per season prior to specifying solar lighting.
 - Avoid light fixtures at eye level that could impair visibility.
 - Dependent upon trail hours, consider uses in urban and/or commercial land use areas.

FURTHER CONSIDERATIONS

- Local jurisdiction ordinances should be consulted to determine lighting requirements and limitations.
- Lighting placement and fixtures should minimize light pollution for adjacent neighborhoods and environments. According to IDA (International Dark-Sky Association), light pollution can contribute to the disturbance of ecosystem cycles,



MAINTENANCE

Low-cost light emitting diodes (LED) offer a wide range of light levels and can reduce long term utility costs.

REFERENCES

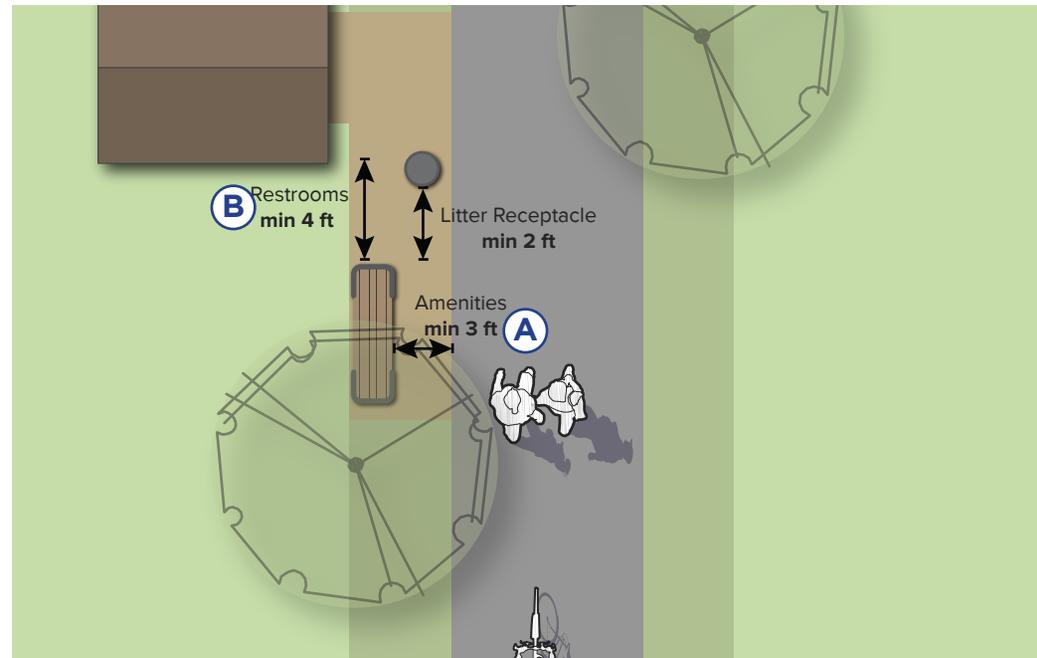
IDA (International Dark Sky Association)

SEATING

Seating along trails provides a place for trail users to rest, congregate, contemplate, or people-watch along trails and throughout the trail system. Benches can be designed to create identity in a place or along the trail or be strictly utilitarian. Picnic tables provide places for trail users to congregate for meals or to just relax.

TYPICAL APPLICATION

Locate benches at all trailheads, picnic areas and at regular intervals along the trail.



DESIGN FEATURES

- (A) Locate all seating (and other site furniture) a minimum of 3ft from the edge of the trail.
- (B) Locate benches a minimum of 4 ft from restrooms, phone booths and drinking fountains and a minimum of 2 ft from trash receptacles, light poles and sign posts.
 - Seating should be placed in shaded area, especially where there is minimal shade available.
 - Drainage should slope away from the bench and the trail.

FURTHER CONSIDERATIONS

- Placement of bench should provide interesting views, be close to an educational or historical trail element, and offer shade or shelter from seasonal winds.
- All seating placement should consider accessibility, including grade leading to seating areas. Wheelchair access should be possible at some seating areas, especially along ADA accessible trail sections. ADA Standards for Accessible Design seating and turn radius should be considered for access to seating.

MAINTENANCE

Site furnishing should be securely anchored to the ground.

REFERENCES

ADA Standards for Accessible Design, 2010

TRASH + RECYCLING RECEPTACLES

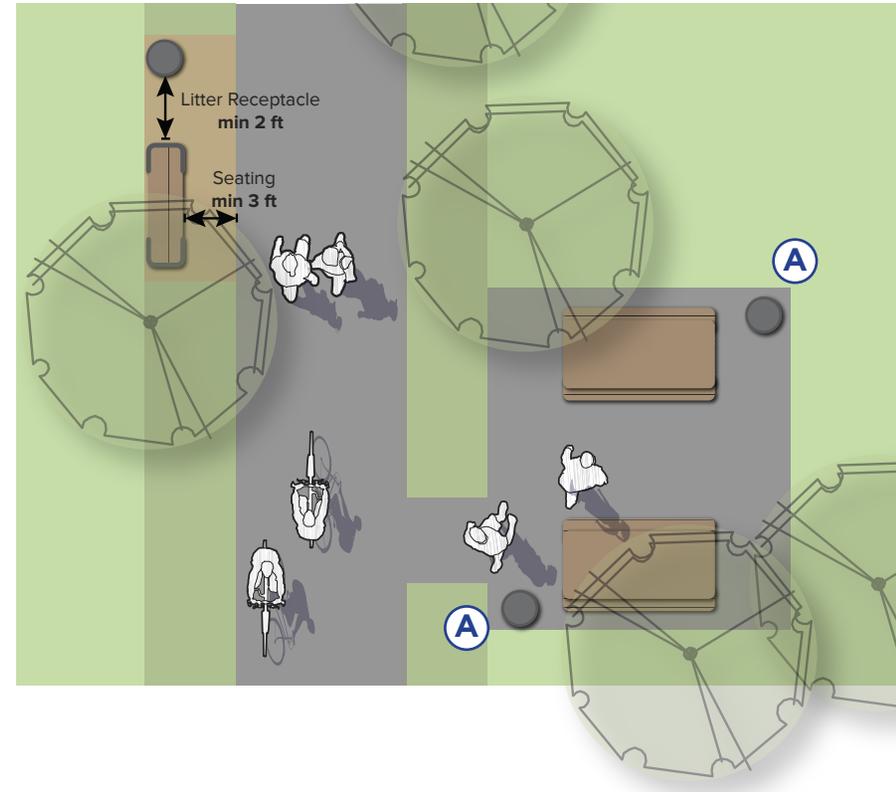
Trash and recycle receptacles provide for proper maintenance and appearance of the trail system.

TYPICAL APPLICATION

Trash and recycle receptacles should be placed at rest stops or comfort stations, concession facilities, or areas where users might stop to drink and eat.

DESIGN FEATURES

- Ⓐ Locate receptacles at each trailhead and each seating area (1 per every 1 picnic table, 1 per every 2 benches).
 - Placement of other receptacles will depend upon the location of concessions, facilities and areas of group activities.
 - Receptacles should be selected using the following criteria:
 - » Expected trash amount
 - » Maintenance program requirements
 - » Types of trail users
 - » Durability



FURTHER CONSIDERATIONS

Wildlife, such as opossums, skunks, and raccoons, are drawn to trash and recycling receptacles. In rural areas or areas with high concentration of wildlife, animal-proof receptacles should be considered.

MAINTENANCE

Receptacles need to be accessible to maintenance personnel and trail users.

ARCHITECTURAL ELEMENTS

Whether it be protection from the rain or a place to rest during a sunny day, shade structures and shelters create comfort and protection for all trail users.

TYPICAL APPLICATION

Architectural elements should be sensitive to context and designed to integrate with intended function of the site and trail user needs.

DESIGN FEATURES

- The orientation of structures should be considered to provide maximum protection from the elements.
- Can be placed in any setting (grass, concrete, asphalt, etc) with considerations for ADA access to and into the structure.
- Plants may be incorporated into the design of the architectural elements especially where they can provide additional user benefits (vines or greenwall for cooling effect). Plants additionally should be context sensitive and mindful of the maintaining agency's capacity.
- Structures should not impede bicycle and/or pedestrian movement and shall be located adjacent to the trail (not within the travelway).
- Structures should not block viewsheds of historic, natural, or cultural elements.
- Architectural elements should incorporate other amenities, especially benches and picnic tables.



BICYCLE AMENITIES

BICYCLE PARKING

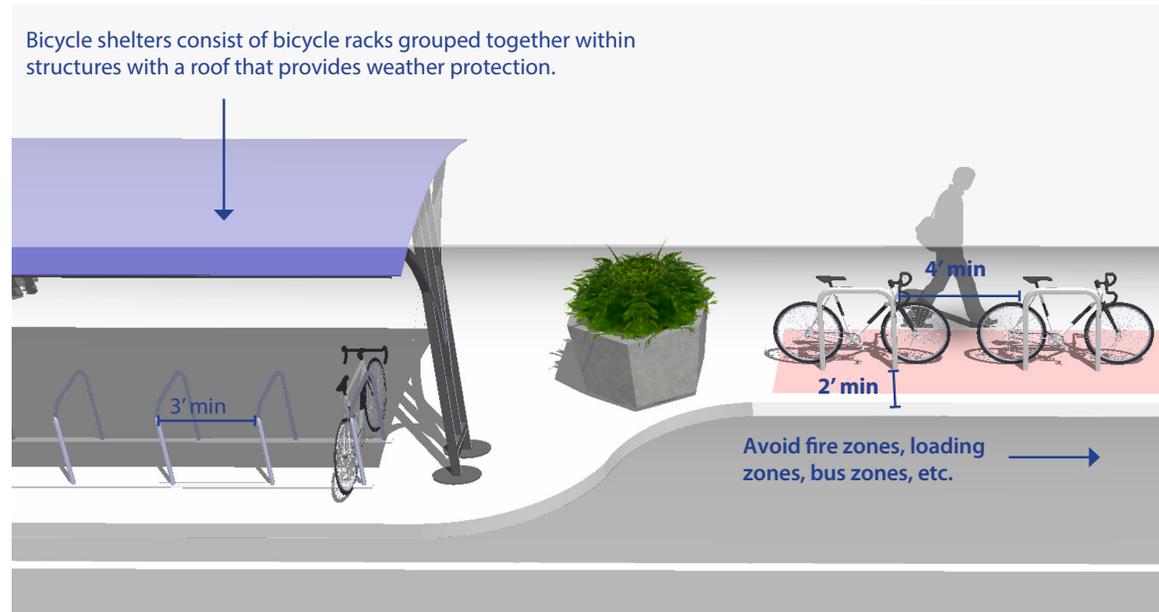
Short-term bicycle parking is meant to accommodate users departing in two hours or less. Racks should be placed adjacent to comfort stations, visitor centers, seating areas, and be weather protected where possible. The Association for Pedestrian and Bicycle Professionals (APBP) provides standards for bike rack design, spacing, and placement. Local, state, and federal codes should be consulted for additional count requirements and installation regulations.

TYPICAL APPLICATION

Bicycle parking should be placed at trailheads, near town centers, and where there are multiple amenities.

DESIGN FEATURES

- In urban settings: 2 ft minimum from the curb face to avoid 'dooring.'
- Close to destinations; 50ft maximum distance from main building entrance.
- Minimum clear distance of 6ft should be provided between the bicycle rack and a property line.
- Should be highly visible from adjacent bicycle routes and pedestrian traffic.
- Locate racks in areas that cyclists are most likely to travel.



FURTHER CONSIDERATIONS

- All bicycle parking spaces shall permit the locking of the bicycle frame and one (1) wheel with a U-type lock, support the bicycle in a stable horizontal position without damage to wheels, frame, or components, and provide two (2) points of contact with the bicycle's frame.
- Bicycle parking facilities shall be securely anchored so they cannot be easily removed and shall be of sufficient strength and design to resist vandalism and theft.

ON-STREET BICYCLE CORRAL

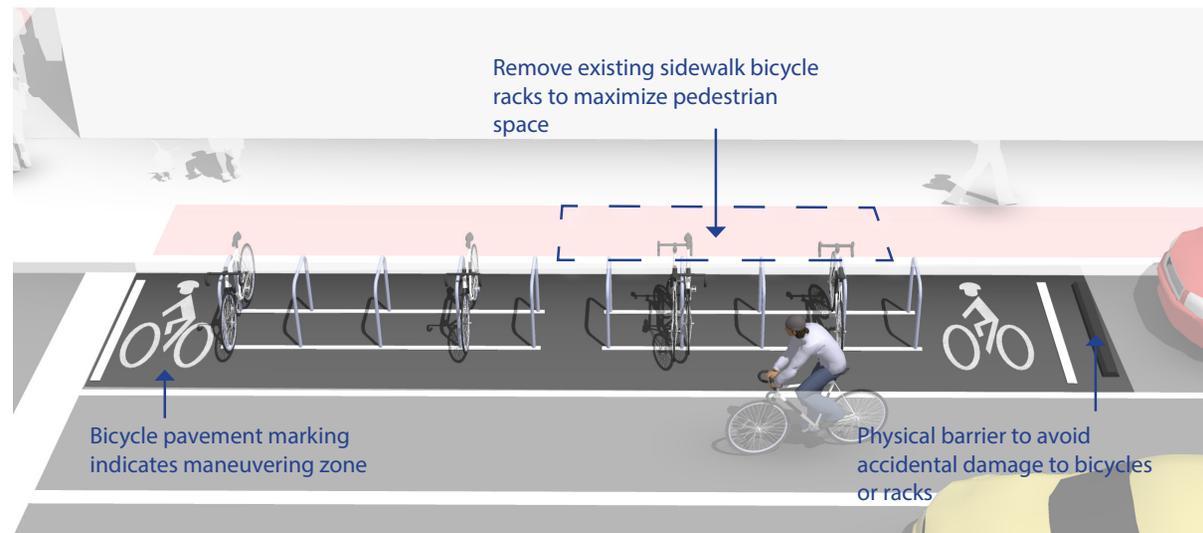
Bicycle corrals (also known as on-street bicycle parking) consist of bicycle racks grouped together in a common area within the street traditionally used for automobile parking. Bicycle corrals are reserved exclusively for bicycle parking and provide a relatively inexpensive solution to providing high-volume bicycle parking. Bicycle corrals move bicycles off the sidewalks, leaving more space for pedestrians, sidewalk café tables, etc. Because bicycle parking does not block sightlines (as large motor vehicles would do), it may be possible to locate bicycle parking in 'no-parking' zones near intersections and crosswalks.

TYPICAL APPLICATION

Bicycle corrals can be implemented by converting one or two on-street motor vehicle parking spaces into on-street bicycle parking. Each motor vehicle parking space can be replaced with approximately 6-10 bicycle parking spaces.

DESIGN FEATURES

- Bicyclists should have an entrance width from the roadway of 5-6 ft.
- Can be used with parallel or angled parking.
- Parking stalls adjacent to curb extensions are good candidates for bicycle corrals since the concrete extension serves as delimitation on one side.



FURTHER CONSIDERATIONS

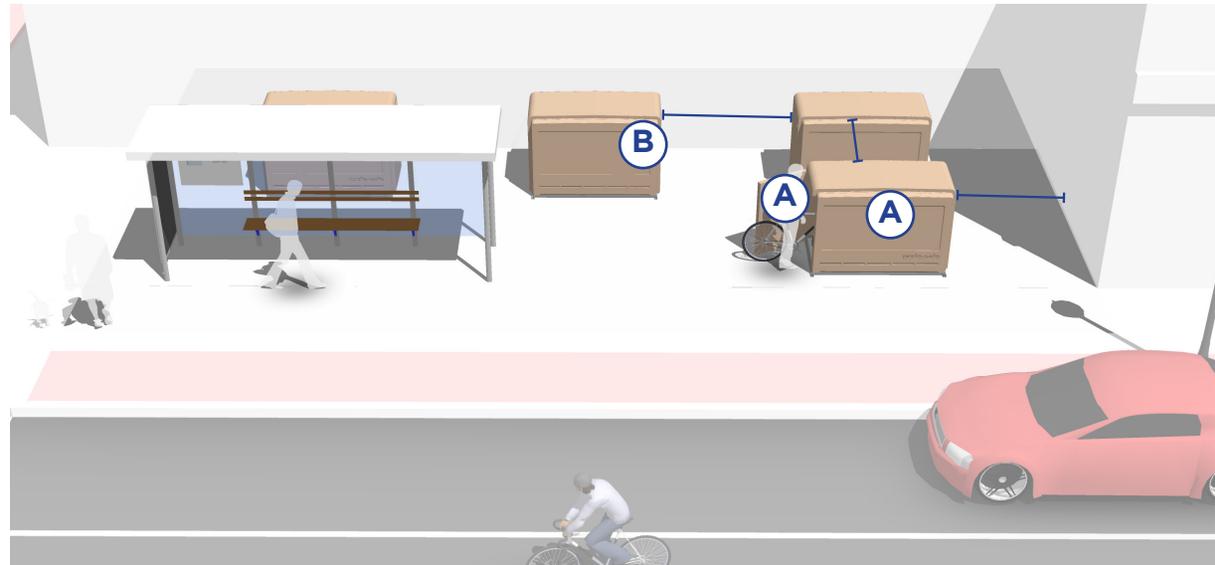
- In many communities, the installation of bicycle corrals is driven by requests from adjacent businesses, and is not a city-driven initiative. In such cases, the city does not remove motor vehicle parking unless it is explicitly requested. In other areas, the city provides the facility and business associations take responsibility for the maintenance of the facility. Communities can establish maintenance agreements with the requesting business.
- Bicycle corrals can be especially effective in areas with high bicycle parking demand or along street frontages with narrow sidewalks where parked bicycles would be detrimental to the pedestrian environment.

BICYCLE LOCKERS

Bicycle lockers are intended to provide long-term bicycle storage for employees, students, residents, commuters, and others expected to park more than two hours. Long-term facilities protect the entire bicycle, its components and accessories against theft and against inclement weather, including snow and wind-driven rain.

DESIGN FEATURES

- A** Minimum dimensions: width (opening) 2.5 ft; height 4 ft; depth 6 ft.
- B** 4 ft side clearance and 6 ft end clearance.
 - 7 ft minimum distance between facing lockers.
 - Locker designs that allow visibility and inspection of contents are recommended for increased security.
 - Access is controlled by a key or access code.



FURTHER CONSIDERATIONS

- Long-term parking facilities are more expensive to provide than short-term facilities, but are also significantly more secure. Although many bicycle commuters would be willing to pay a nominal fee to guarantee the safety of their bicycle, long-term bicycle parking should be free wherever automobile parking is free.
- Potential locations for long-term bicycle parking include transit stations, large employers, and institutions where people use their bikes for commuting and not consistently throughout the day.

SECURE PARKING AREAS (SPA)

A Secure Parking Area for bicycles, also known as a BikeSPA or Bike & Ride (when located at transit stations), is a semi-enclosed space that offers a higher level of security than ordinary bike racks. Accessible via key-card, combination locks, or keys, BikeSPAs provide high-capacity parking for 10 to 100 or more bicycles. Increased security measures create an additional transportation option for those whose biggest concern is theft and vulnerability.

TYPICAL APPLICATION

Long-term parking facilities are more expensive to provide than short-term facilities, but are also significantly more secure. Although many bicycle commuters would be willing to pay a nominal fee to guarantee the safety of their bicycle, long-term bicycle parking should be free wherever automobile parking is free. BikeSPAs are ideal for transit centers, airports, train stations, or wherever large numbers of people might arrive by bicycle and need a secure place to park while away.

DESIGN FEATURES

- Closed-circuit television monitoring.
- Double high racks and cargo bike spaces.
- Bike repair station with bench.
- Bike tube and maintenance item vending machine.
- Bike lock “hitching post” – allows people to leave bike locks.
- Secure access for users.



BICYCLE REPAIR STATIONS

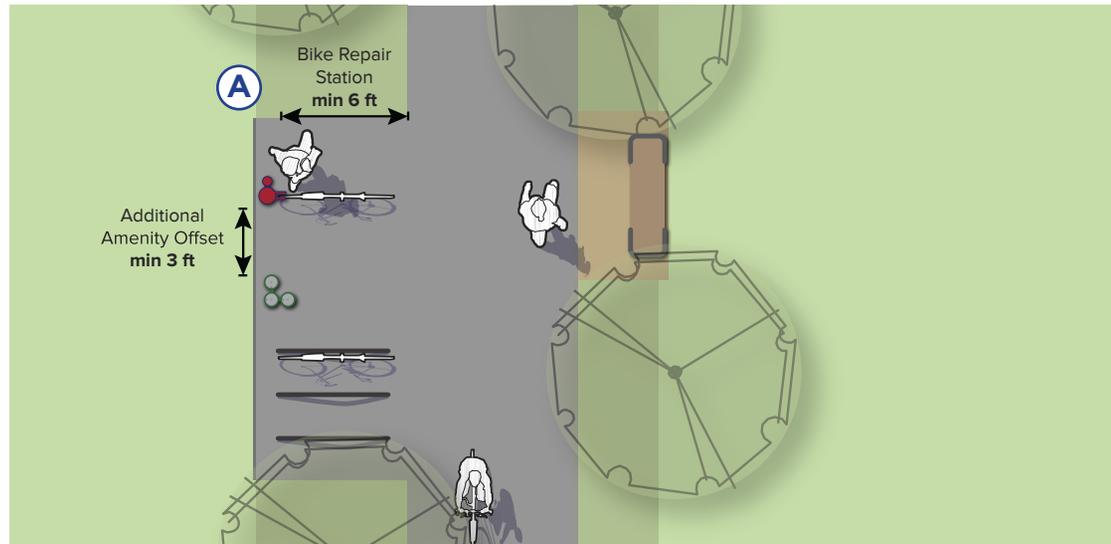
Bicycle repair stations are self-serve kiosks designed to offer a complete set of tools necessary for routine bicycle maintenance. Popular locations include Gateways, Trailheads, plazas, farmers markets, and any public center of activity that is well monitored and easily accessible by foot or bicycle.

TYPICAL APPLICATION

Bicycle repair stations can be grouped with other amenities. Typical locations for repair stations are Trailheads, parking lots, the intersection of two trails, and public gathering spaces.

DESIGN FEATURES

- A** Bicycle repair stations should be at least 6 ft from trail edge to allow room to repair bicycles.
 - Stations should be secured to a durable pad, such as concrete.
 - Bicycle repair station tools are secured by high security cables, but will still be an attractive target.
 - The proper placement of kiosks in areas of high activity is one key strategy to reduce potential vandalism.



MAINTENANCE

- Use of proper anchors will prevent vandalism and theft.
- Racks, lockers, and anchors should be regularly inspected for damage.
- Physical barriers may obstruct drainage.
- Educate snow removal crews to avoid burying racks during winter months.
- For bicycle lockers and SPAs, change keys and access codes periodically to prevent access to unapproved users.

REFERENCES

- AASHTO. *Guide for the Development of Bicycle Facilities*. 2012.
- APBP. *Bicycle Parking Guide* 2nd Edition. 2010.

PLANTINGS

Native vegetation along trails provides visual interest as well as habitat for animals and insects that may use the corridor for migration or habitat. Planting plans should consider local guidance for canopy goals, habitat creation, stormwater best practices, screening, disease resistance, avoidance of invasive species, and maintenance requirements.

TYPICAL APPLICATION

Planting should be used to provide a buffer between off-road sections of the trail and adjacent uses. Shade trees should be strategically placed near comfort stations to provide shade to seating areas and other amenities. Soil and drainage conditions should be considered prior to final plant palette selection.

MAINTENANCE

Depending on variety of vegetation, regular maintenance will be necessary. Trails should be cleared of all intruding plant material. Paths and shoulders should be kept clear of vegetation. Crime Prevention Through Environmental Design principles should be followed to ensure plant material does not become a hazard for trail users.

FURTHER CONSIDERATIONS

Plants should also be chosen for seasonal color and cultural significance to the area. When selecting planting material, the site microclimate and the USDA Plant Hardiness Zone Map should be considered. Use native species if possible and avoid invasive species.



WAYFINDING

On-street bike lanes designate an exclusive space for bicyclists through the use of pavement markings and signs. Bike lanes are located directly adjacent to motor vehicle travel lanes and travel in the same direction as motor vehicle traffic.

Signs are typically placed at decision points along bicycle routes – typically at the intersection of two or more bikeways and at other key locations leading to and along bicycle routes.

SIGN DESIGN FEATURES

A bicycle wayfinding system consists of comprehensive signing and/or pavement markings to guide bicyclists to their destinations along preferred bicycle routes. There are three general types of wayfinding signs:

(A) CONFIRMATION SIGNS

- Indicate to bicyclists that they are on a designated bikeway. Make motorists aware of the bicycle route.
- Can include destinations and distance/time. Do not include arrows.
- Every ¼ to ½ mile on off-street facilities and every 2 to 3 blocks along on-street bicycle facilities, unless another type of sign is used (e.g., within 150 ft of a turn or decision sign). Should be placed soon after turns to confirm destination(s). Pavement markings can also act as confirmation that a bicyclist is on a preferred route.

(B) TURN SIGNS

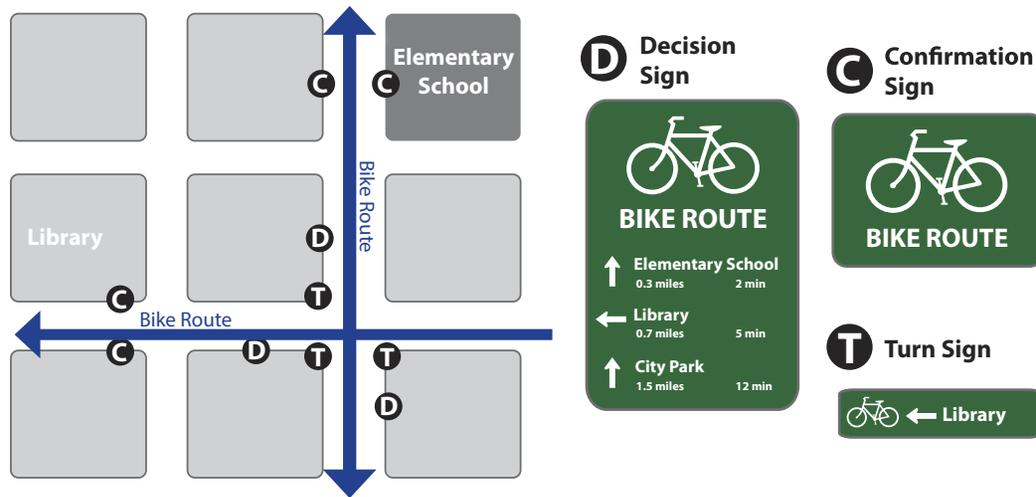
- Indicate where a bikeway turns from one street onto another street. Can be used with pavement markings.
- Include destinations and arrows.



- Near-side of intersections where bike routes turn (e.g., where the street ceases to be a bicycle route or does not go through). Pavement markings can also indicate the need to turn to the bicyclist.

(C) DECISION SIGNS

- Mark the junction of two or more bikeways.
- Inform bicyclists of the designated bike route to access key destinations. Includes destinations and arrows and distances.
- Travel times are optional but recommended.
- Near-side of intersections in advance of a junction with another bicycle route.
- Along a route to indicate a nearby destination.



Placement Diagram

FURTHER CONSIDERATIONS

- There is no standard color for bicycle wayfinding signage. Section 1A.12 of the *MUTCD* establishes the general meaning for signage colors. Green is the color used for directional guidance and is the most common color of bicycle wayfinding signage in the US, including those in the *MUTCD*.
- It can be useful to classify a list of destinations for inclusion on the signs based on their relative importance to users throughout the area. A particular destinations ranking in the hierarchy can be used to determine the physical distance from which the locations are signed. For example, primary destinations (such as the downtown area) may be included on signage up to 5 miles away. Secondary destinations (such as a transit station) may be included on signage up to two miles away. Tertiary destinations (such as a park) may be included on signage up to one mile away.

MAINTENANCE

Maintenance needs for bicycle wayfinding signs are similar to other signs and will need periodic replacement due to wear.

REFERENCES

AASHTO. *Guide for the Development of Bicycle Facilities*. 2012.
 FHWA. *Manual on Uniform Traffic Control Devices*. 2009.
 NACTO. *Urban Bikeway Design Guide*. 2012.





TRAIL CROSSING TREATMENTS

MARKED + SIGNED CROSSWALK

Where a shared use path crosses a roadway at a mid block location, markings must be used to establish a legal crosswalk. Well-designed mid-block crossings can provide many benefits for path user safety and comfort.

The most simple marked crossing type uses high visibility crosswalk markings with crossing warning signs.

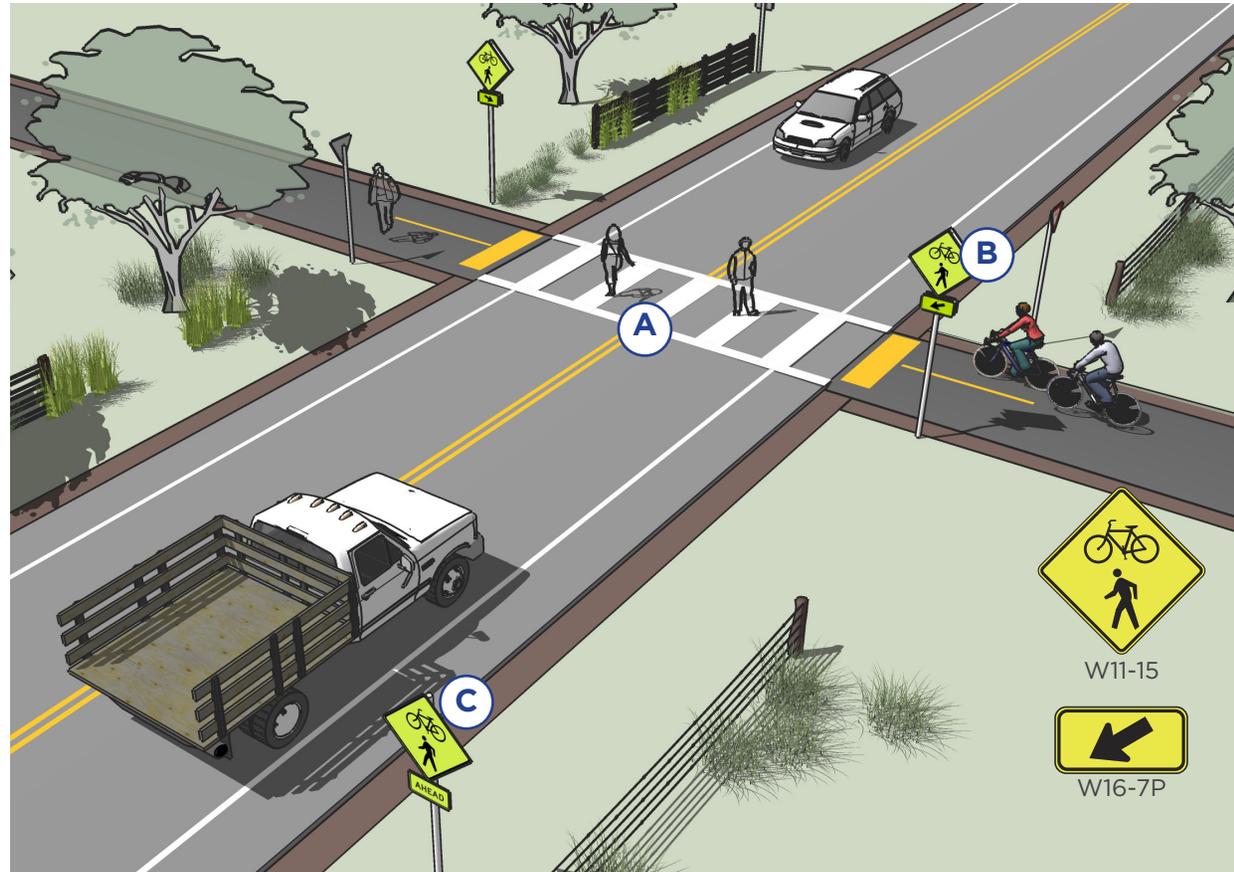
TYPICAL APPLICATION

Where shared use paths intersect with collector or minor arterial streets.

Mid-block path crossings should not be provided within 300 ft of an existing signalized intersection. On low-speed two lane roadways in urban contexts, mid-block crossings may be used within 200 ft of an existing signalized intersection. When an existing intersection is in close proximity, route the path directly to the signal.

DESIGN FEATURES

- A** High-visibility “ladder” style crosswalk markings
- B** A Bicycle/Pedestrian Warning sign (W11-15) with downward arrow plaque (W16-7P) at the crossing, on both sides. Bicycle and pedestrian figures on the sign should always face toward the crosswalk.
- C** A Bicycle/Pedestrian Warning sign (W11-15) with “ahead” plaque (W16-9) at the crossing.





This path crossing includes many enhancements to slow traffic and promote yielding.



Along pathways with high volumes of users and at path crossings in highly developed areas with crosswalks, path crossings should provide adequate room for path users to wait outside of the path of crossing sidewalks.

FURTHER CONSIDERATIONS

- Installation of high visibility crosswalks at previously unmarked crosswalk locations must meet accessibility guidelines.
- On roadways with high speed and high volumes of motor vehicles, crosswalk markings alone are often not a viable safety measure. This should not discourage the implementation of crosswalks but should rather support the creation of more robust crossing solutions (Zeeger 2005).
- On main streets and neighborhood collectors, “Yield to Pedestrian” signs may be mounted in the roadway centerline.

MAINTENANCE

Because the effectiveness of marked crossings depends entirely on their visibility, maintaining marked crossings should be a high priority. Thermoplastic or epoxy markings offer increased durability over conventional paint.

REFERENCES

Zeeger, C., J. Stewart, and H. Huang. “Safety Effects of Marked Versus Unmarked Crosswalks at Uncontrolled Locations.” 2005. PennDOT *Pub 13 Ch.19*

MARKED CROSSWALK WITH YIELD LINES

Where additional awareness and regulatory instruction is desired at marked path crossing, advanced yield lines and yield signs remind people to yield to crossing path users.

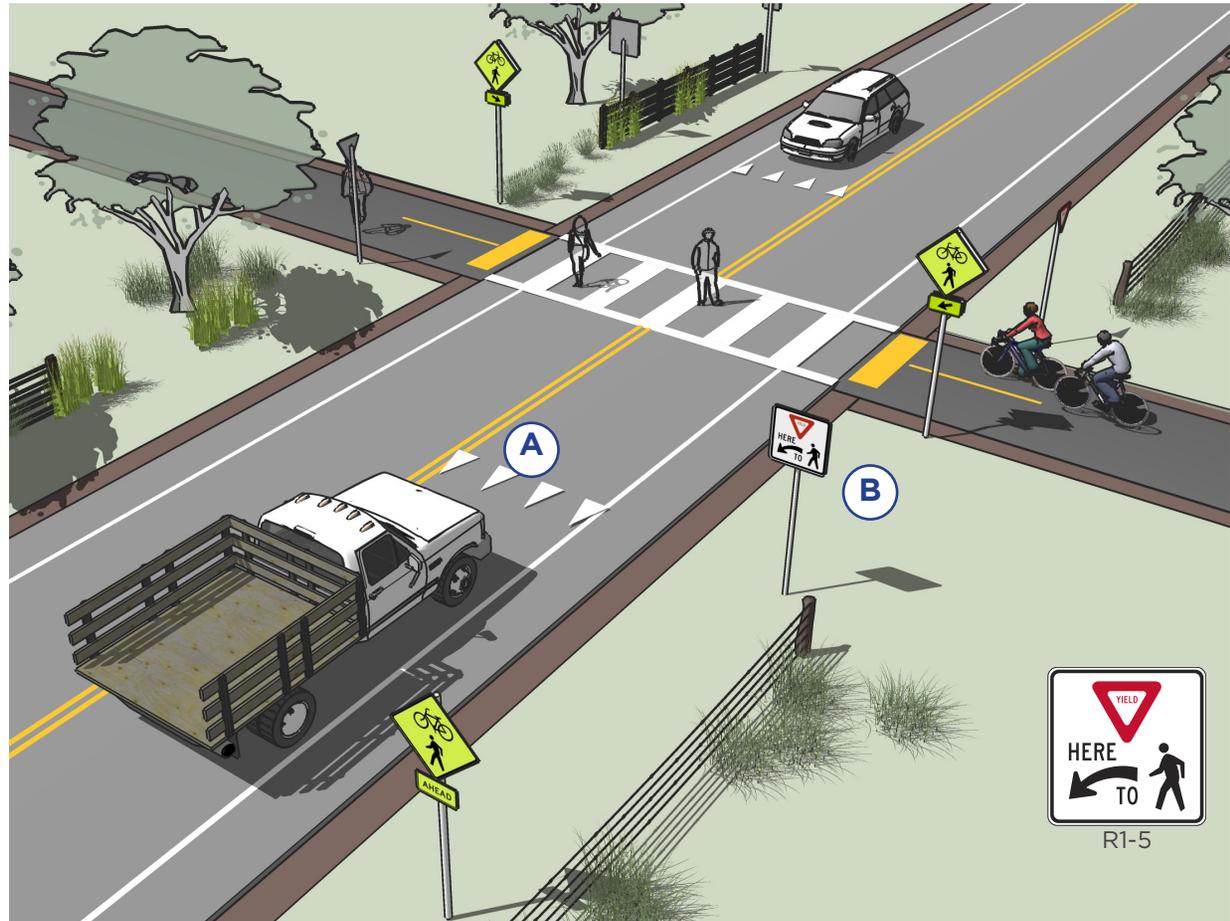
TYPICAL APPLICATION

Where a shared use path crosses a road with higher volumes, higher speeds, or more lanes than is desirable for a marked crosswalk only installation.

DESIGN FEATURES

In addition to a high visibility crosswalk and crossing sign assemblies described in the **Marked and Signed Crosswalk** treatment package, enhancements include:

- A** Advance yield line (sharks teeth)
- B** Yield Here to Pedestrian sign (R1-5)
 - Parking should be restricted between the yield line and the crosswalk.





Yield line with a "Yield Here to Pedestrians" sign clearly indicates expected behavior at this mid block crossing.



"Yield Here to Pedestrians" sign (R1-5)

FURTHER CONSIDERATIONS

- Application of an advance yield line with a Yield (R1-2) or "Yield Here To Pedestrians" (R1-5) sign gives yield priority to path users over crossing motor vehicle traffic. This requirement for motorists to yield is not explicitly extended to bicyclists, and the rights and responsibilities for bicyclists within crosswalks is ambiguous.
- Design solutions should resolve this ambiguity where possible by using geometric design features to give people on bicycles priority within the crossing. This may include **Raised Crosswalks** and **Median Refuge Island Crossings**.

MAINTENANCE

Because the effectiveness of marked crossings depends entirely on their visibility, maintaining marked crossings should be a high priority. Thermoplastic or epoxy markings offer increased durability over conventional paint.

REFERENCES

FHWA. *Manual on Uniform Traffic Control Devices*. 2009.

MEDIAN REFUGE ISLAND CROSSING

Median refuge islands are located at the mid-point of a marked crossing and help improve path user safety by allowing pedestrians to cross one direction of traffic at a time. Refuge islands minimize pedestrian exposure by shortening crossing distance and increasing the number of available gaps for crossing.

TYPICAL APPLICATION

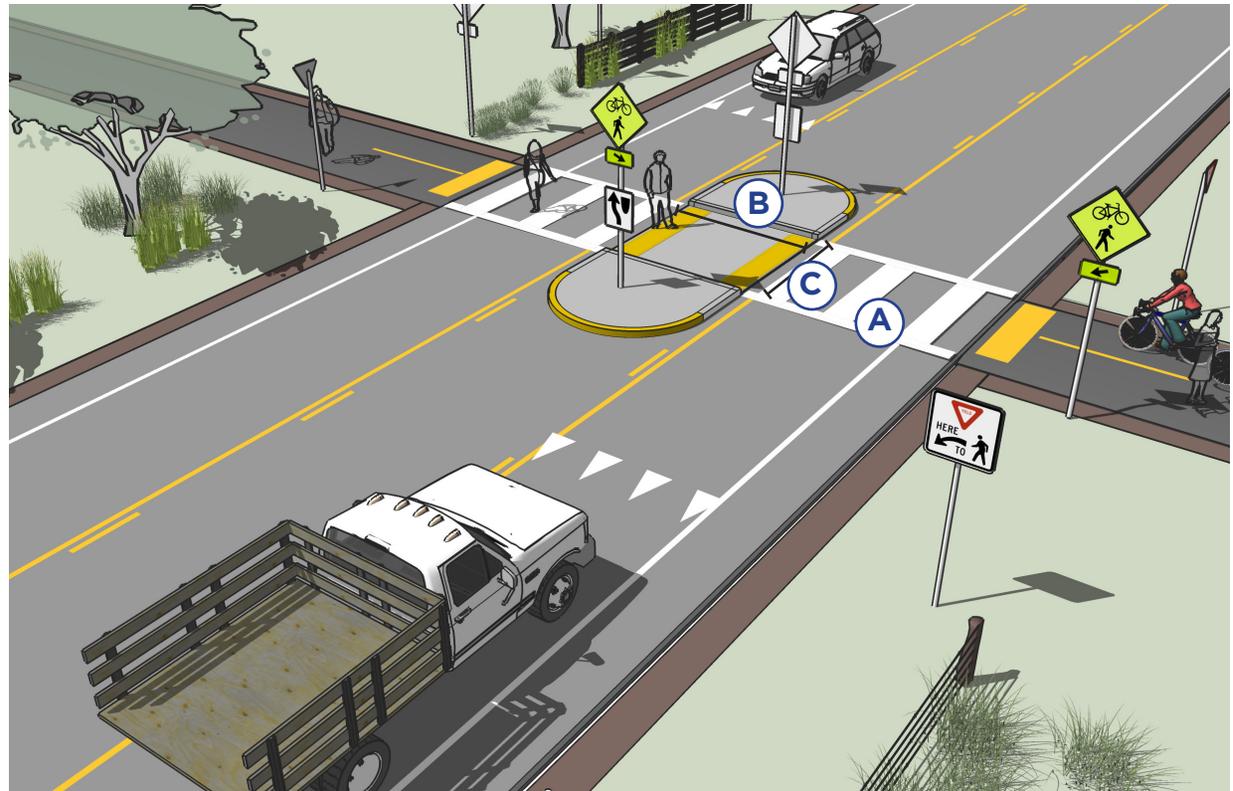
Can be applied on any roadway with a left turn center lane or median that is at least 8 ft wide, or where wide traffic lanes and/or shoulders can be narrowed to provide at least 8 ft of space for the island.

DESIGN FEATURES

- A** Median islands should be paired with a **Marked Crosswalk and Advanced Yield Line** crossing treatment package.

 - Configure the island with an at-grade passage through the island rather than ramps and landings. Detectable warning surfaces must be full-width and 2 ft deep to provide indication for people with vision disabilities.
- B** To accommodate bicyclists, the standard refuge area depth is 10 ft, 8 ft minimum (AASHTO *Bike Guide* 2012).
- C** PennDOT requires all pedestrian refuge island more than 6 ft have detectable warning surface on the edge of the refuge, with a min 2 ft length with a DWS within the refuge.

 - The path through the median should be the same width as the crosswalk and approaching shared use path.





This midblock median refuge island and raised crosswalk allows pedestrians to cross the street in two stages.



Median refuge islands can have angled passages to orient path users to face oncoming traffic.

FURTHER CONSIDERATIONS

- Any refuge landscaping should not compromise the visibility of pedestrians crossing in the crosswalk. Shrubs and ground plantings should be no higher than 1 ft 6 inches.
- On multi-lane roadways, consider pairing as a Rectangular Rapid Flashing Beacon Crossing for improved yielding compliance.
- Installation of a median safety island must meet accessibility guidelines.

MAINTENANCE

Refuge islands may collect road debris and may require somewhat frequent maintenance. Trees and plantings must be maintained so as not to impair visibility. Refuge islands should be visible to snow plow crews and should be kept free of snow berms that block access.

REFERENCES

AASHTO. *Guide for the Development of Bicycle Facilities*. 2012. PennDOT Pub 13 Ch.6



RAISED CROSSWALK

Raised crosswalks combine a marked crosswalk with raised speed-table geometry to increase yielding rates and clarify road user priority with geometric design.

TYPICAL APPLICATION

Pennsylvania's *Traffic Calming Handbook* states that raised crosswalks may be used at "local and minor collectors at intersections with volumes less than 10,000 vehicles per day." All midblock crossing should follow *MUTCD* guidelines.

DESIGN FEATURES

A Raised crosswalks should be paired with a Marked Crosswalk and Advanced Yield Line crossing treatment package.

- Raised crossing creates vertical deflection that may slow motorists and encourage yielding to path users, while high-visibility crosswalk markings establish a legal crosswalk away from intersections. Refer to *Standard Sheets* 608-07 for specific guidance on the design of raised crosswalks.
- Where parking lanes exist, curb extensions should be used to shorten crossing distance and position users in a visible location. Parking should be prohibited between the yield line and marked crosswalk.





This trail crossing combines a median safety island with raised crosswalk.



Raised crossings help to prioritize pedestrian movements across roadways.

FURTHER CONSIDERATIONS

- The approach to designing path crossings of streets depends on an evaluation of vehicular traffic, line of sight, pathway traffic, use patterns, vehicle speed, road type, road width, and other safety issues such as proximity to major attractions.
- Installation of a raised crosswalk must meet accessibility guidelines.
- For a curbed roadway, introduction of raised crossings may require adjustments to drainage catch basins.
- The path through the median should be the same width as the crosswalk and approaching shared use path.

MAINTENANCE

The speed table should use a sinusoidal profile to facilitate snow plow operation.

REFERENCES

Pennsylvania's Traffic Calming Handbook

RECTANGULAR RAPID FLASHING BEACON CROSSING

Rectangular Rapid Flashing Beacons (RRFBs) are user-actuated warning beacons to supplement pedestrian warning signs at unsignalized intersections or mid-block marked pedestrian crosswalks.

RRFBs have been shown to increase motor vehicle yielding compliance at crossings of multi lane or high volume roadways.

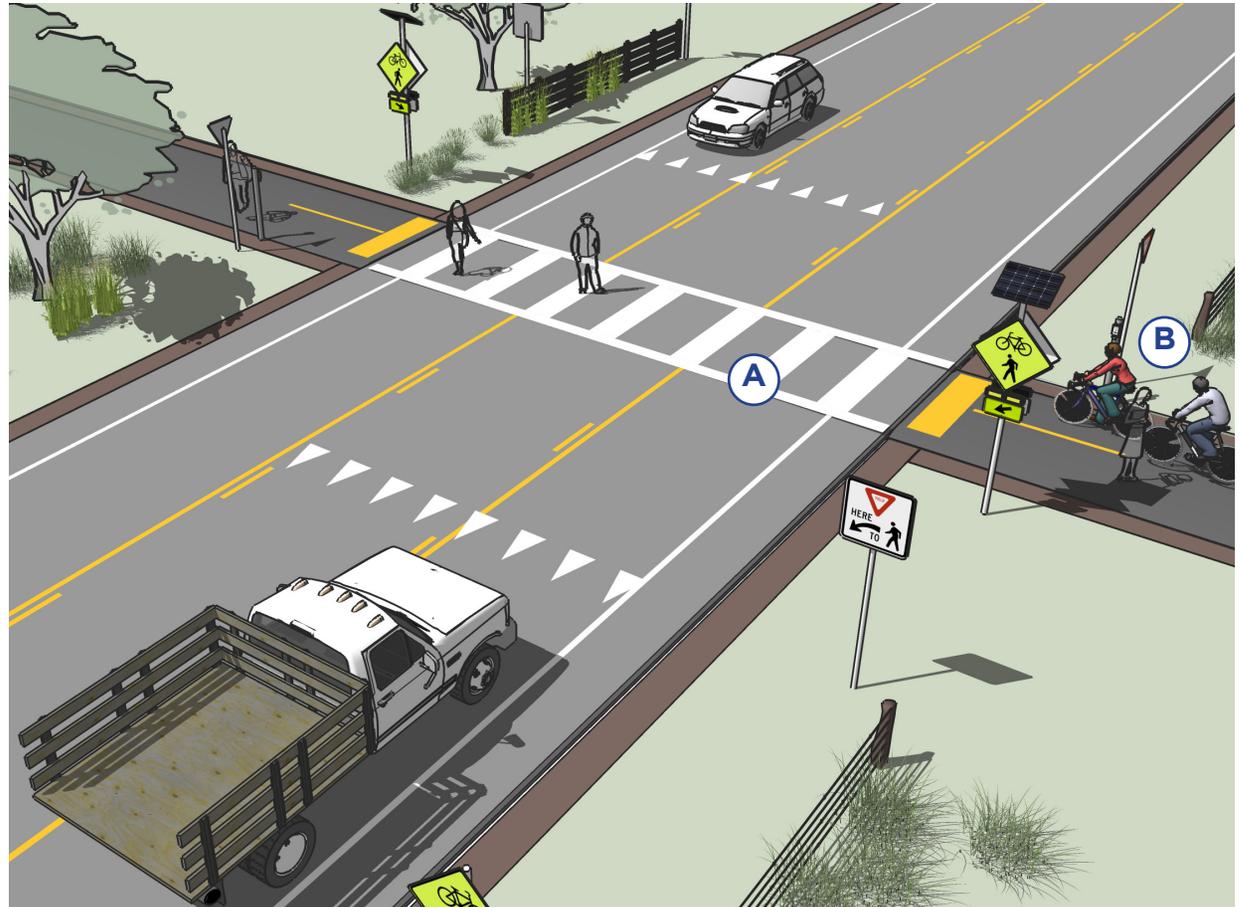
TYPICAL APPLICATION

Use RRFBs at high-volume pedestrian crossings or at priority bicycle route crossings, including shared-use paths.

The use of RRFBs may not be appropriate at locations where there is a combination of both high traffic volumes and high pedestrian volumes.

DESIGN FEATURES

- A** Rectangular Rapid Flashing Beacon Crossings should be paired with a **Marked Crosswalk** and **Advanced Yield Line** crossing treatment package.
- B** Push buttons should be easy to identify and located on the right-hand side of the path.
 - Where possible, RRFBs work well as multi-beacon installations on mast arms, or **Median Refuge Island Crossings** to improve driver yielding behavior.





RRFB bikeway crossing with separate pushbuttons for pedestrians and bicyclists.



On multilane streets, multiple beacon installations are critical for awareness by motorists in all approach lanes.

FURTHER CONSIDERATIONS

- Installation of a RRFB controlled crosswalk must meet accessibility guidelines.

MAINTENANCE

Depending on power supply, site conditions, the equipment used, and other variables, maintenance can be minimal. If solar power is used, active warning beacons can run for years without issue.

REFERENCES

FHWA. *Interim Approval for Optional Use of Rectangular Rapid Flashing Beacons (IA-11)*. 2008.

FULL TRAFFIC SIGNAL CROSSING

A full traffic signal installation treats the path crossing as a conventional four-way intersection and provides standard red-yellow-green traffic signal heads for all legs of the intersection.

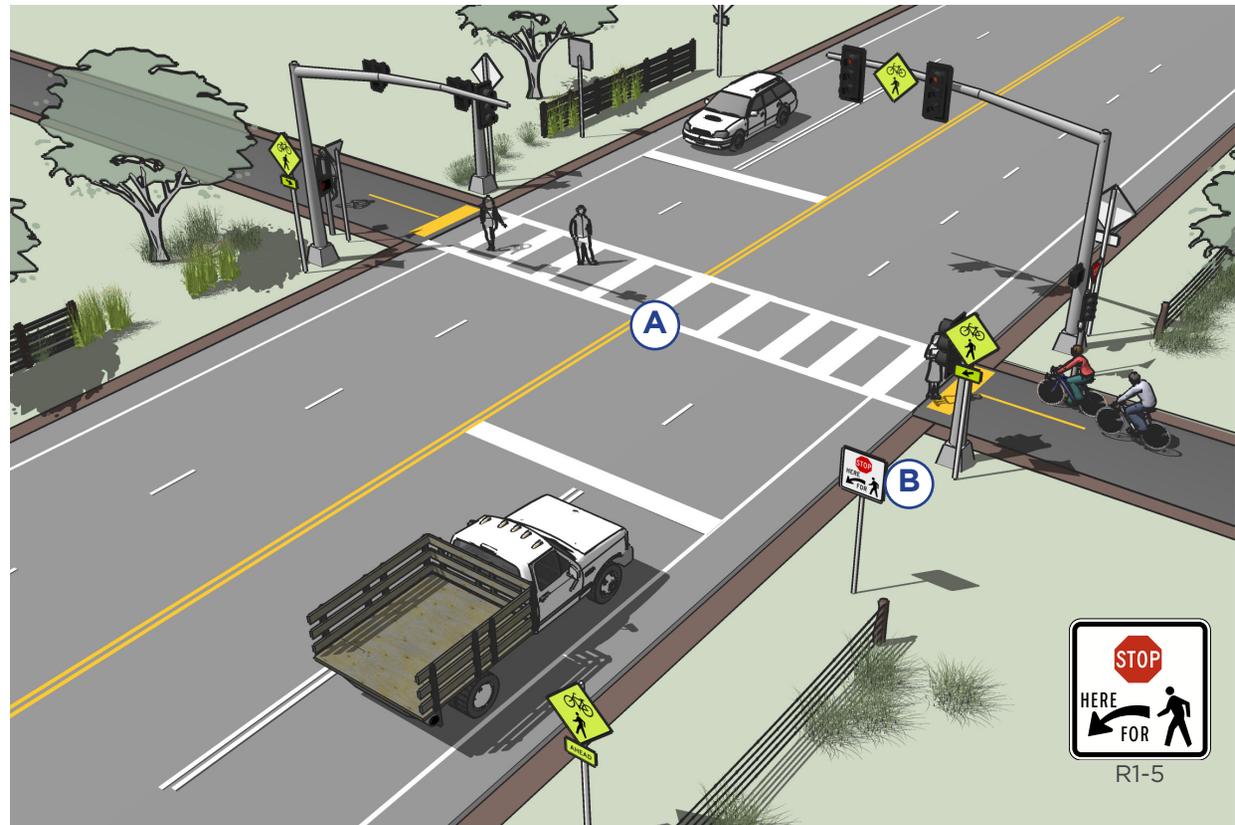
Signalized crossings provide the most protection for crossing path users through the use of a red-signal indication to stop conflicting motor vehicle traffic.

TYPICAL APPLICATION

Full traffic signal installations must meet *MUTCD* warrants.

DESIGN FEATURES

- A** Full Traffic Signal should be paired with a Marked Crosswalk.
- B** A stop line and Stop Here for Pedestrian sign (R1-5b) should be used.
 - Push buttons should be easy to identify and located on the right-hand side of the path. They should be positioned so that bicyclists do not have to dismount to activate.
 - Parking and other sight obstructions should be prohibited for at least 100 ft in advance of and at least 20 ft beyond the marked crosswalk to provide adequate sight distance.





Full traffic signals include signals facing trail users to indicate when it is or is not safe for path users to cross the roadway.



Traffic signals may be used in conjunction with other treatments, such as median islands. In these cases, additional push-buttons may be required, depending on signal phasing, crossing distance, and anticipated bike and pedestrian crossing times.

FURTHER CONSIDERATIONS

- Installation of full signal controlled crosswalk must meet ADA guidelines.
- Each crossing, regardless of traffic speed or volume, requires additional review by a registered engineer to identify sight lines, potential impacts on traffic progression, timing with adjacent signals, capacity and safety.
- Shared use path signals are normally activated by push buttons but may also be triggered by embedded loop, infrared, microwave or video detectors. The maximum delay for activation of the signal should be two minutes, with minimum crossing times determined by the width of the street.

MAINTENANCE

Traffic control signals should be regularly maintained to ensure that all lights and detection hardware are functional.

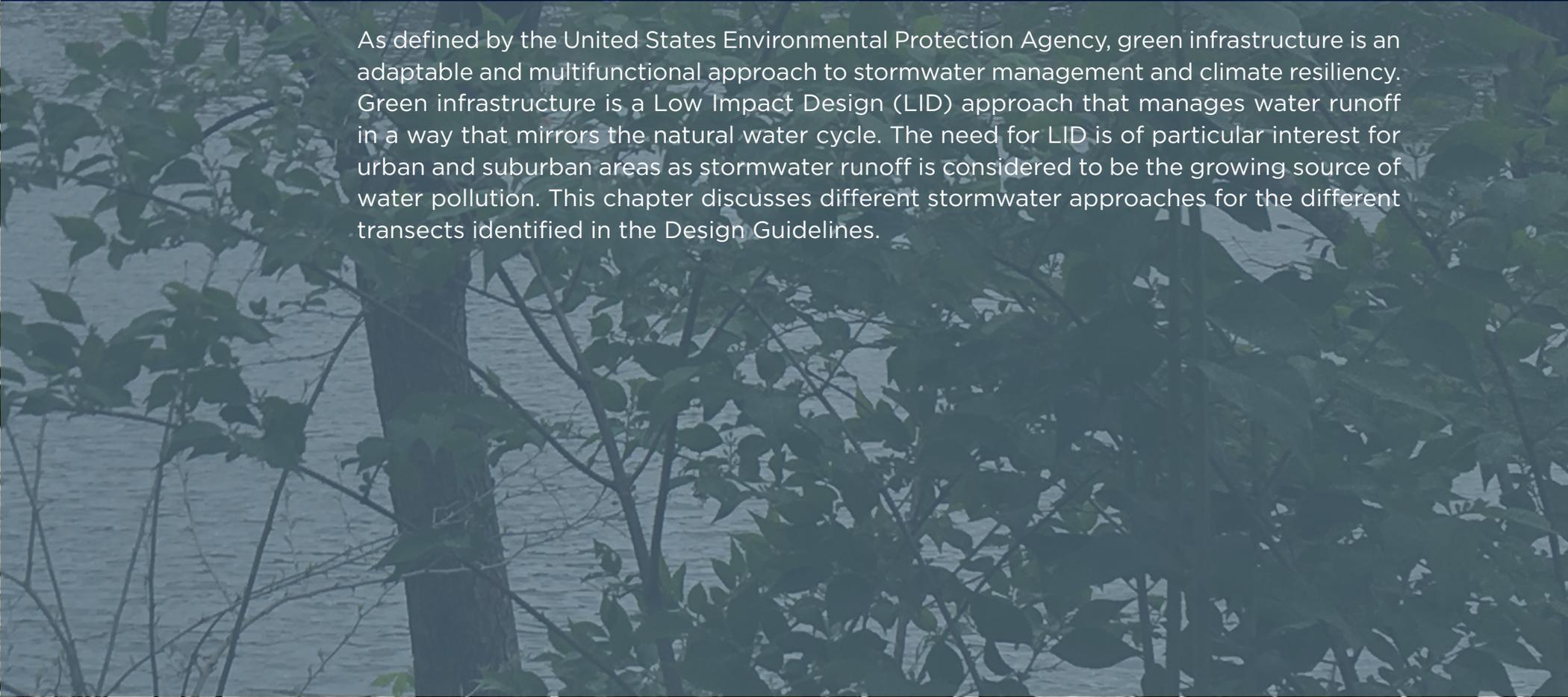
REFERENCES

FHWA. *Manual on Uniform Traffic Control Devices*. 2009.
PennDOT *Signal Design Handbook* (Pub.149)





GREEN INFRASTRUCTURE



As defined by the United States Environmental Protection Agency, green infrastructure is an adaptable and multifunctional approach to stormwater management and climate resiliency. Green infrastructure is a Low Impact Design (LID) approach that manages water runoff in a way that mirrors the natural water cycle. The need for LID is of particular interest for urban and suburban areas as stormwater runoff is considered to be the growing source of water pollution. This chapter discusses different stormwater approaches for the different transects identified in the Design Guidelines.

STORMWATER PLANTERS

Stormwater planters are structures installed in sidewalk areas, designed to capture, treat, and release stormwater runoff. They allow the runoff to seep into existing soils so long as soils have proper infiltration rate.

TYPICAL APPLICATION

Typically used in urban areas along sidewalks and are not used for the collection of stormwater from larger impervious surfaces. Stormwater Planters should not be installed on steep slopes.

DESIGN FEATURES

STORMWATER PLANTERS (INFILTRATION)

- Structured Wall
- Inlet
- Overflow Drain
- Bioretention Soil
- Gravel

STORMWATER PLANTERS (FILTRATION)

- Waterproofed Structured Box
- Inlet
- Cleanout
- Perforated Overflow Drain
- Bioretention Soil
- Gravel





FURTHER CONSIDERATIONS

Use native plantings that can handle frequent inundation. Before construction make sure subsoil is not contaminated and has appropriate infiltration rate.

MAINTENANCE

- Dewatering - Facilities should drain within 48 hours of rainfall.
- Mulch Layer - Check for adequate cover and sediment accumulation. Replace and/or remove mulch with excess sediments.
- Vegetative Surfaces - Check plant composition for proper health. Check for invasive species, weeds and dying vegetation and remove and replace accordingly.
- Erosion - Check for erosion , runoff, channelizing and bare spots. Reseed or plant accordingly.
- Debris and Trash Clean Out - Clear the facility of debris and trash on a monthly basis. Be sure to check inlets, outlets and contributing areas.
- Structural Components - Check for structural deterioration, spalling and cracking on an annual basis.
- Outlets - Check for erosion, rills or gulying seasonally and after major storms. Stabilize all eroded areas and grade accordingly.
- Gravel Diaphragm - Check for sediment accumulation in all gravel layers.

REFERENCES

National Association of City Transportation Officials



STORMWATER CURB EXTENSIONS (BUMP OUTS)

A vegetated area that extends the curb into the roadway at a midblock or intersection location. The extension has an inlet that allows water runoff to flow into the vegetated area where the filtration occurs. Treated runoff will either be allowed to infiltrate through the subgrade or be carried off to a dedicated location or drainage system via underdrain.

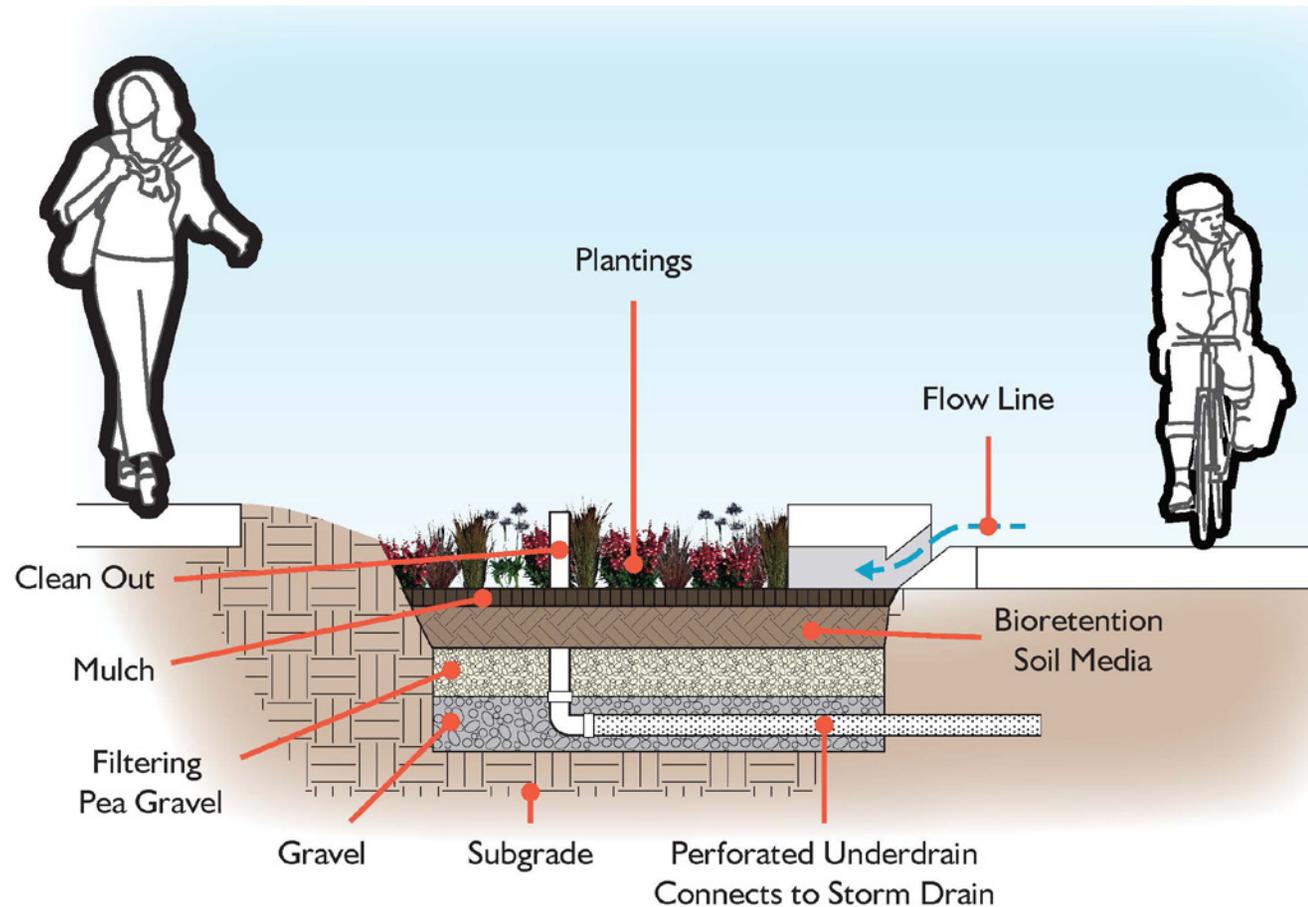
TYPICAL APPLICATION

Applied in either end of block or midblock locations.

DESIGN FEATURES

Stormwater Curb Extensions (Infiltration)

- Inlet/Curb Cut
- Plantings
- Mulch
- Cleanout (if applicable)
- Perforated Underdrain (if applicable)
- Bioretention Soil
- Pea Gravel
- Gravel
- Subgrade
- Outlet/Riser





FURTHER CONSIDERATIONS

Vegetation should be native and receive appropriate irrigation in establishment phase. Before construction make sure subsoil is not contaminated and has appropriate infiltration rate.

MAINTENANCE

- Dewatering - Facilities should drain within 48 hours of rainfall.
- Mulch Layer - Check for adequate cover and sediment accumulation. Replace and/or remove mulch with excess sediments.
- Vegetative Surfaces - Check plant composition for proper health. Check for invasive species, weeds and dying vegetation and remove and replace accordingly.
- Erosion - Check for erosion, runoff, channelizing and bare spots. Reseed or plant accordingly.
- Debris and Trash Clean Out - Clear the facility of debris and trash on a monthly basis. Be sure to check inlets, outlets and contributing areas.
- Structural Components - Check for structural deterioration, spalling and cracking on an annual basis.
- Outlets - Check for erosion, rills or gulying seasonally and after major storms. Stabilize all eroded areas and grade accordingly.
- Gravel Diaphragm - Check for sediment accumulation in all gravel layers.

REFERENCES

National Association of City Transportation Officials

PERMEABLE PAVEMENT

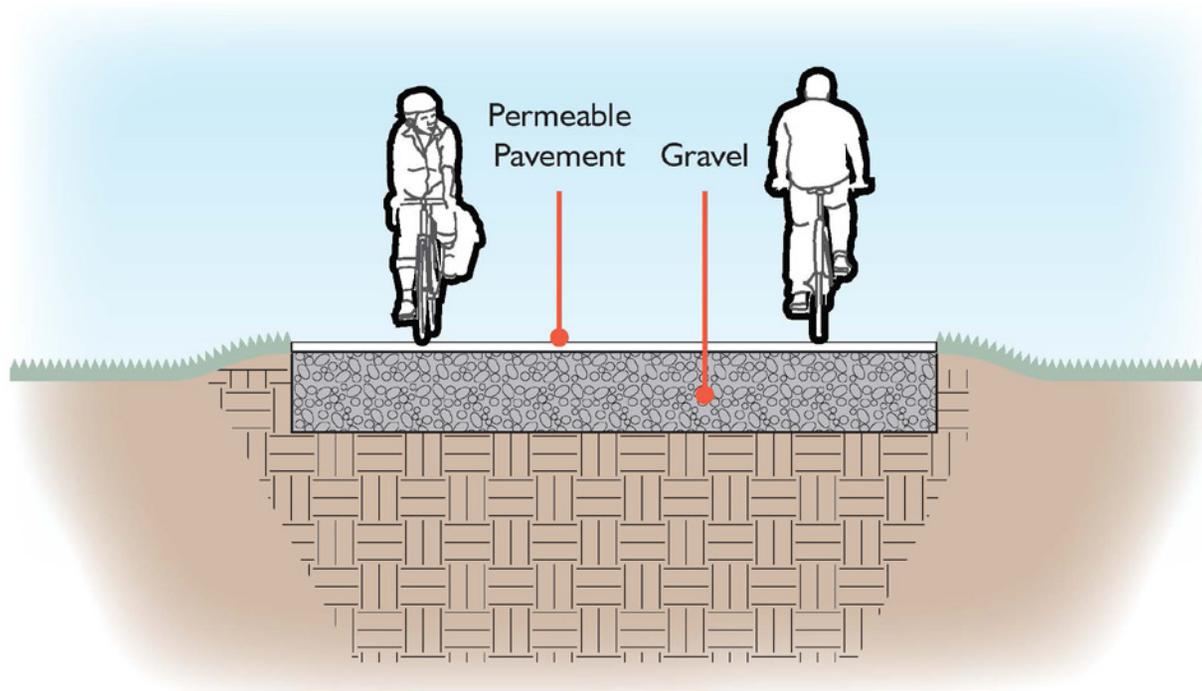
Permeable pavement is a porous structural surface which allows surface runoff to pass through to a stone reservoir, storing it until it slowly infiltrates into the soil below. Permeable pavements may be concrete, asphalt, or pavers.

TYPICAL APPLICATION

Permeable pavements have multiple applications including sidewalks, paths and roadways.

FURTHER CONSIDERATIONS

Permeable pavements must be be designed for native subsoil to address infiltration rate. Before construction make sure subsoil is not contaminated and has appropriate infiltration rate.

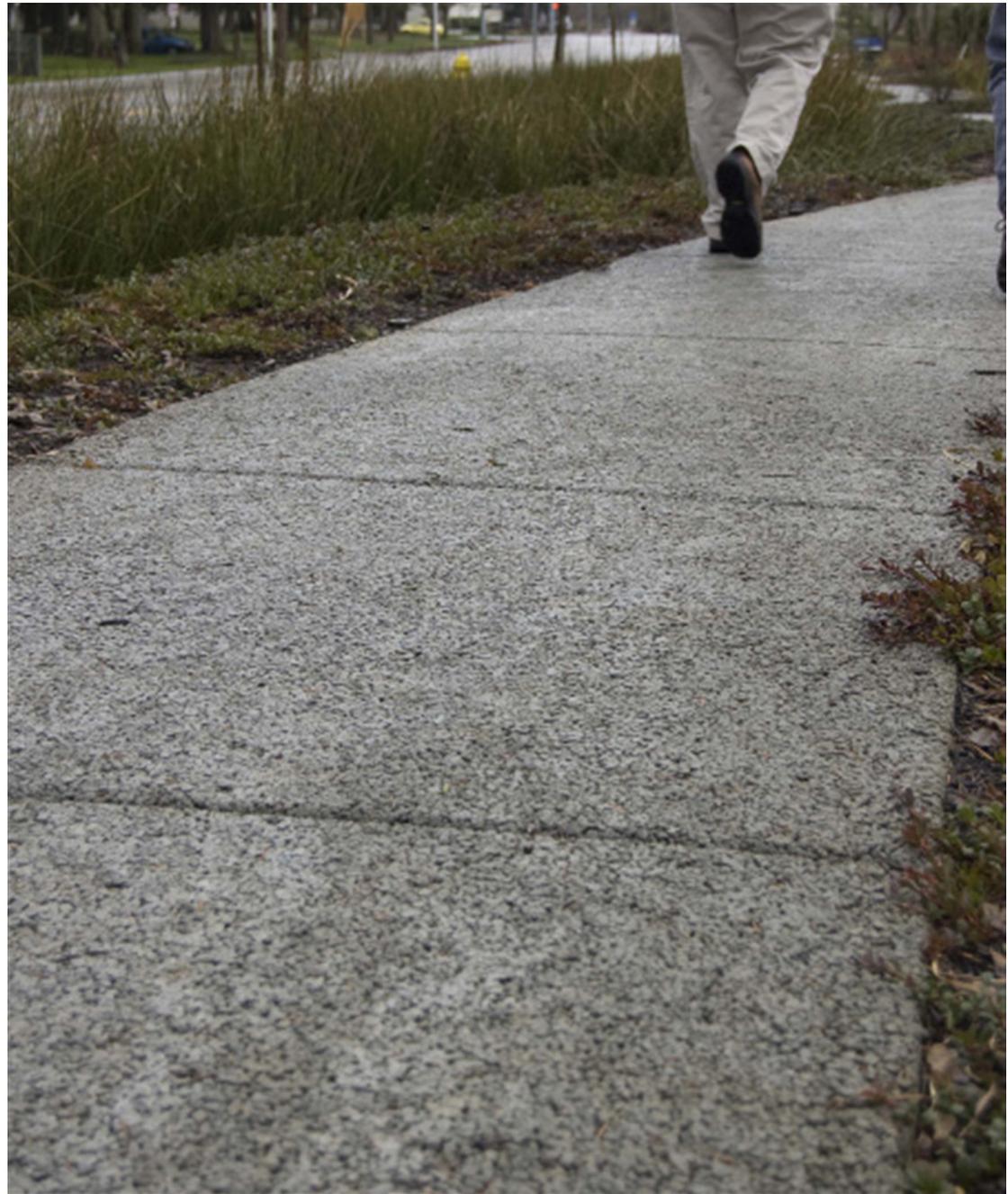


MAINTENANCE

- Dewatering - Facilities should drain within 48 hours of rainfall.
- Debris and Trash Clean Out - Clear the facility of debris and trash on a monthly basis. Be sure to check inlets, outlets and contributing areas.
- Structural Components - Check for structural deterioration, spalling and cracking on an annual basis.

REFERENCES

National Association of City Transportation Officials



RAIN GARDEN

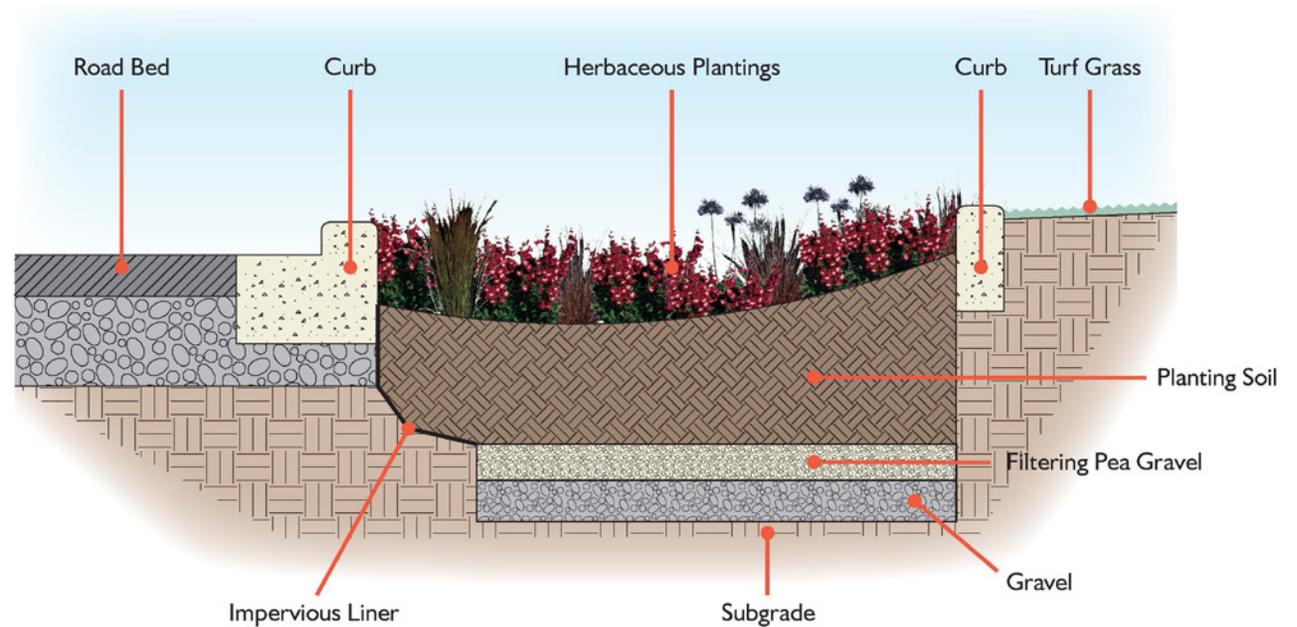
A rain garden is a depressed area in the landscape that collects rainwater from roofs, driveways, streets, etc. and allows it to soak into the ground.

TYPICAL APPLICATION

Applied in yards, parks, and other vegetated areas.

DESIGN FEATURES

- Plantings
- Mulch
- Bioretention Soil
- Pea Gravel
- Gravel
- Subgrade





FURTHER CONSIDERATIONS

Before construction make sure subsoil is not contaminated and has appropriate infiltration rate.

MAINTENANCE

- Dewatering - Facilities should drain within 48 hours of rainfall.
- Mulch Layer - Check for adequate cover and sediment accumulation. Replace and or remove mulch with excess sediments.
- Vegetative Surfaces - Check plant composition for proper health. Check for invasive species, weeds and dying vegetation and remove and replace accordingly.
- Erosion - Check for erosion , runoff, channelizing and bare spots. Reseed or plant accordingly.
- Debris and Trash Clean Out - Clear the facility of debris and trash on a monthly basis. Be sure to check inlets, outlets and contributing areas.
- Structural Components - Check for structural deterioration, spalling and cracking on an annual basis.
- Outlets - Check for erosion, rills or gulying seasonally and after major storms. Stabilize all eroded areas and grade accordingly.

REFERENCES

National Association of City Transportation Officials
Texas Coastal Watershed Program

BIOSWALES

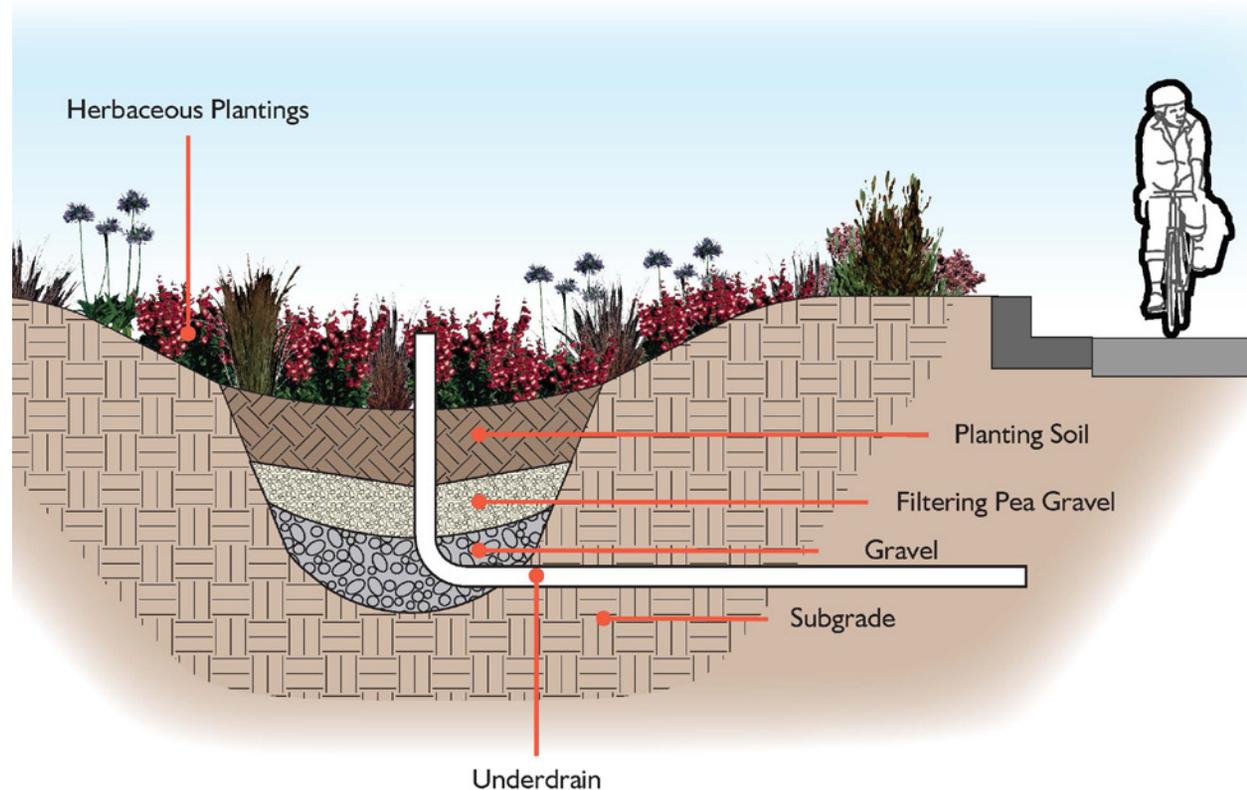
Vegetated shallow swales or channels that capture, treat and infiltrate stormwater runoff.

TYPICAL APPLICATION

The linear design of bioswales allows for placement along roads, trails and parking lots. Bioswales can be placed in areas with minimal slopes.

DESIGN FEATURES

- Plantings
- Clean out
- Perforated Underdrain
- Bioretention Soil
- Gravel
- Subgrade



FURTHER CONSIDERATIONS

Should be constructed in areas with slopes between 1%-4%. Before construction, make sure subsoil is not contaminated.

MAINTENANCE

- Dewatering - Facilities should drain within 48 hours of rainfall.
- Mulch Layer - Check for adequate cover and sediment accumulation. Replace and or remove mulch with excess sediments.
- Vegetative Surfaces - Check plant composition for proper health. Check for invasive species, weeds and dying vegetation and remove and replace accordingly.
- Erosion - Check for erosion, runoff, channelizing and bare spots. Reseed or plant accordingly.
- Debris and Trash Clean Out - Clear the facility of debris and trash on a monthly basis. Be sure to check inlets, outlets and contributing areas.
- Structural Components - Check for structural deterioration, spalling and cracking on an annual basis.
- Outlets - Check for erosion, rills or gullying seasonally and after major storms. Stabilize all eroded areas and grade accordingly.



REFERENCES

National Association of City Transportation Officials
Environmental Protection Agency





ON-ROAD FACILITIES

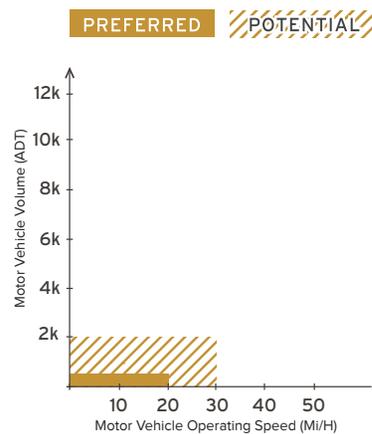


YIELD ROADWAY

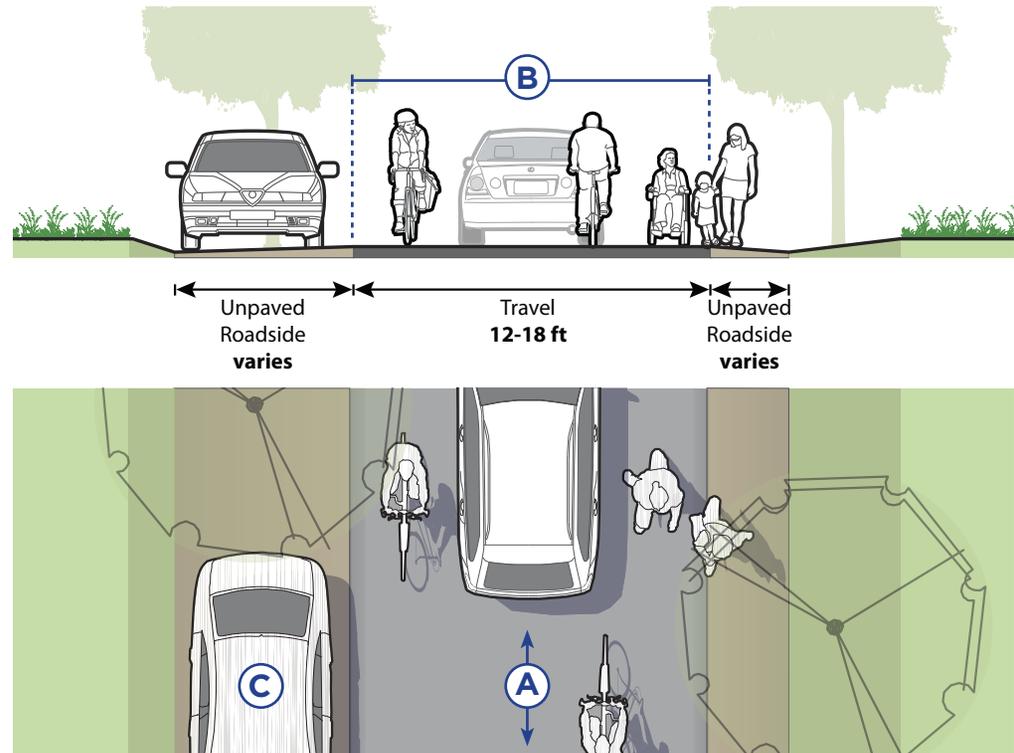
A yield roadway is a local roadway designed to serve pedestrians, bicyclists, and motor vehicle traffic all within the paved travel area. These roads are used by such low volumes of traffic that crashes are rare, as vehicles hardly encounter other vehicles.

The facility can effectively serve local traffic volumes, maintain aesthetic preferences, and should be considered the typical form for rural local roads.

TYPICAL APPLICATION



AASHTO *Guide for the Development of Bicycle Facilities* (Green Book) defines a “very low volume” road as a local road with 400 or fewer motor vehicles per day (p. 5-34).

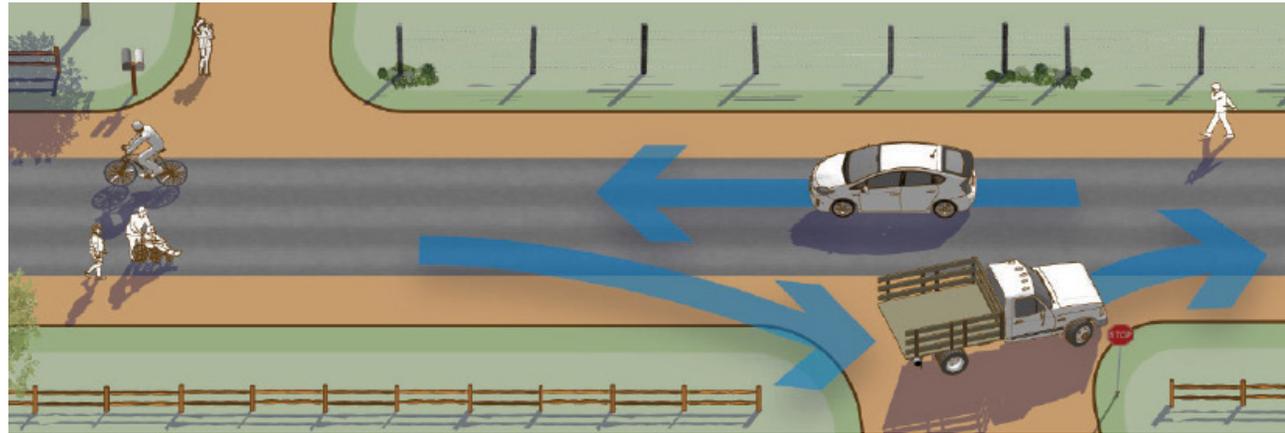


DESIGN FEATURES

- (A)** Due to low volumes and narrow roadway widths, no center lane should be marked (*MUTCD* 2009, p.349).
- (B)** A travel area width of 12 to 18 ft is appropriate for low volumes of two-way traffic and will require queuing or slowing during motor vehicle meeting events. The AASHTO *Green Book* notes, “The level of user inconvenience occasioned by the lack of two moving lanes is remarkably low” (p. 5-13).
- (C)** When widths are less than or equal to 14 ft, provide regular pull-out areas to allow for infrequent meeting and passing events between motor vehicles. Pull-out areas may be established in driveways, the parking lane, or roadside area.



W11-2 with ON ROADWAY plaque may clarify pedestrian operations.



Vehicles approaching from opposite directions must slow and may need to yield to negotiate the roadway space. Source: FHWA Small Town and Rural Multimodal Networks, 2016.

FURTHER CONSIDERATIONS

- When possible, the parking lane should be constructed with a contrasting material to differentiate the lane from the travel area. Bituminous, crushed stone, gravel, and turf shoulders can be used as contrasting materials to the traveled way (AASHTO *Green Book* 2011, p. 4-13).
- When operating at very low volumes, pedestrians may be comfortable walking within the travel area of the roadway. As volumes increase, consider providing an exclusive pedestrian facility such as a sidewalk or pedestrian lane. When yield roadways are intended for use by pedestrians, they must meet accessibility guidelines for grade, cross slope, and surface stability.
- Trees should be planted within the unpaved roadside area at regular intervals to visually and physically narrow the corridor, add to the aesthetic, and encourage slow speeds.
- Access for fire trucks and emergency vehicles should be provided. This requires adequate width along the road for an emergency response vehicle, and frequent opportunity to park and access equipment from the vehicle. There is no single fire code standard for local roads, however an acceptable range of clear roadway for parking/deploying fire department apparatus is between 16 and 20 ft (ODOT 2000).

MAINTENANCE

Yield roadways should be cleared of snow through routine snow removal operations.

REFERENCES

AASHTO. *A Policy on Geometric Design of Highways and Streets*. 2011.

AASHTO. *Guide for the Development of Bicycle Facilities*. 2012.

FHWA. *Manual on Uniform Traffic Control Devices*. 2009.

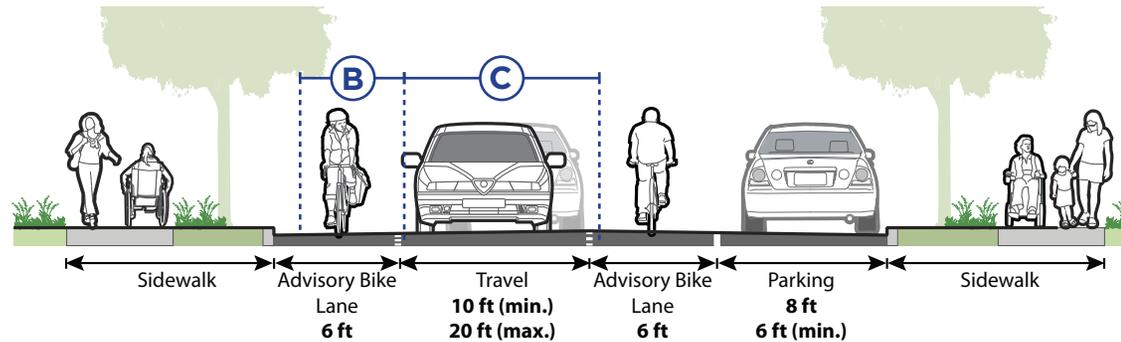
Oregon Department of Transportation (ODOT). *Neighborhood Street Design Guidelines: An Oregon Guide for Reducing Street Widths*. 2000.



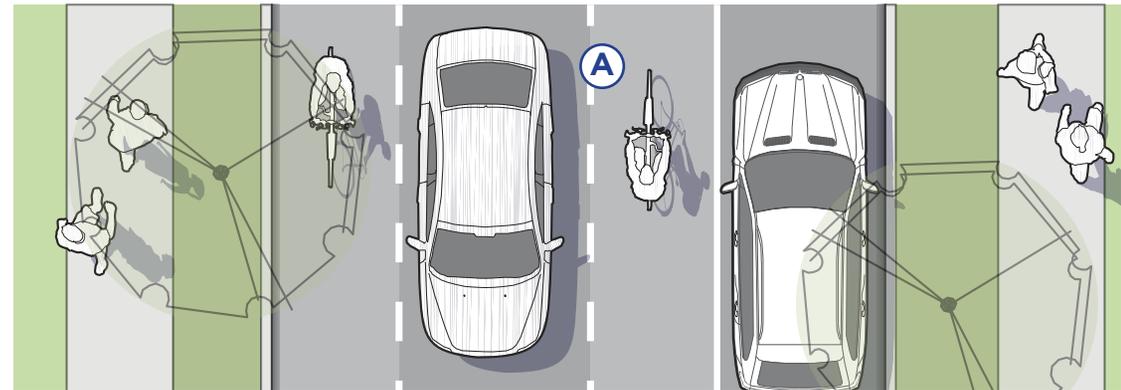
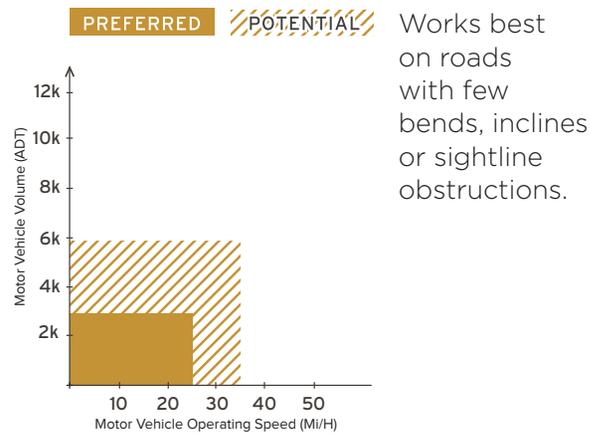
ADVISORY SHOULDERS

Roads with advisory shoulders accommodate low to moderate volumes of two-way motor vehicle traffic and provide a prioritized space for bicyclists and pedestrians with little or no widening of the paved roadway surface.

Advisory shoulders clarify operating positions for bicyclists and motorists to minimize conflicts and increase comfort. Similar in appearance to bike lanes, advisory shoulders are distinct in that they are temporarily shared with motor vehicles during turning, approaching, and passing.



TYPICAL APPLICATION



DESIGN FEATURES

- (A)** A broken white line indicates permissive operation.
- (B)** Standard advisory shoulder width is 6 ft, with an absolute minimum of 4 ft with no existing curbs or gutters (FHWA *Rural Guide* 2016, pg 2-17).
- (C)** Minimum two-way motor vehicle travel lane width of 10 ft .Maximum lane width is 20 ft (FHWA *Rural Guide* 2016).
 - No centerline should be marked on roadway.
 - Shared lane markings should be used within the advisory shoulders to increase the conspicuity and intent of the treatment. This treatment and use of shared lane markings is experimental, and does not conform to the *MUTCD* or *TSMI 13-07*.



Where no sidewalk is present, pedestrians may walk within advisory shoulders and should walk facing oncoming traffic.



Advisory shoulders are located within the travel area, outside of any on-street parking lanes. Additional width should be allocated to the advisory shoulder area when configured adjacent to parking.

FURTHER CONSIDERATIONS

- Pedestrian use of advisory shoulders is governed by state vehicle code section 1156. Pedestrians may walk in the roadway, generally facing oncoming traffic and as far to the edge as practicable. When advisory shoulders are intended for use by pedestrians, they must meet accessibility guidelines for grade, cross slope, and surface stability. This may be challenging to achieve on existing roadway edges.
- Advisory shoulders are not appropriate on streets with underutilized on-street parking lanes. In these conditions, the parking lane space should be allocated for dedicated bike lanes.
- Advisory shoulders are considered experimental by FHWA, and implementation requires participation in the Request to Experiment process as described in section 1A.10 of the *MUTCD*. FHWA is accepting experiments under the name “Dashed Bicycle Lanes.”
- Supplementary signs with Advisory Shoulders may include, NO CENTER LINE (W8-12), NO PARKING ON PAVEMENT (R8-1), and/or two-way road sign (W6-3, FHWA *Rural Guide* 2016, pg. 2-21).

MAINTENANCE

The full travel area width, including advisory shoulders, should be cleared of snow through routine snow removal operations.

REFERENCES

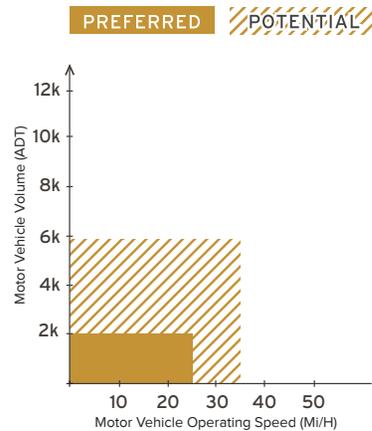
- FHWA. *Manual on Uniform Traffic Control Devices*. 2009.
 FHWA. *Bicycle Facilities and the MUTCD: Dashed Bicycle Lanes*. 2017.
 FHWA. *Small Town and Rural Multimodal Networks*. 2016.

PEDESTRIAN LANE

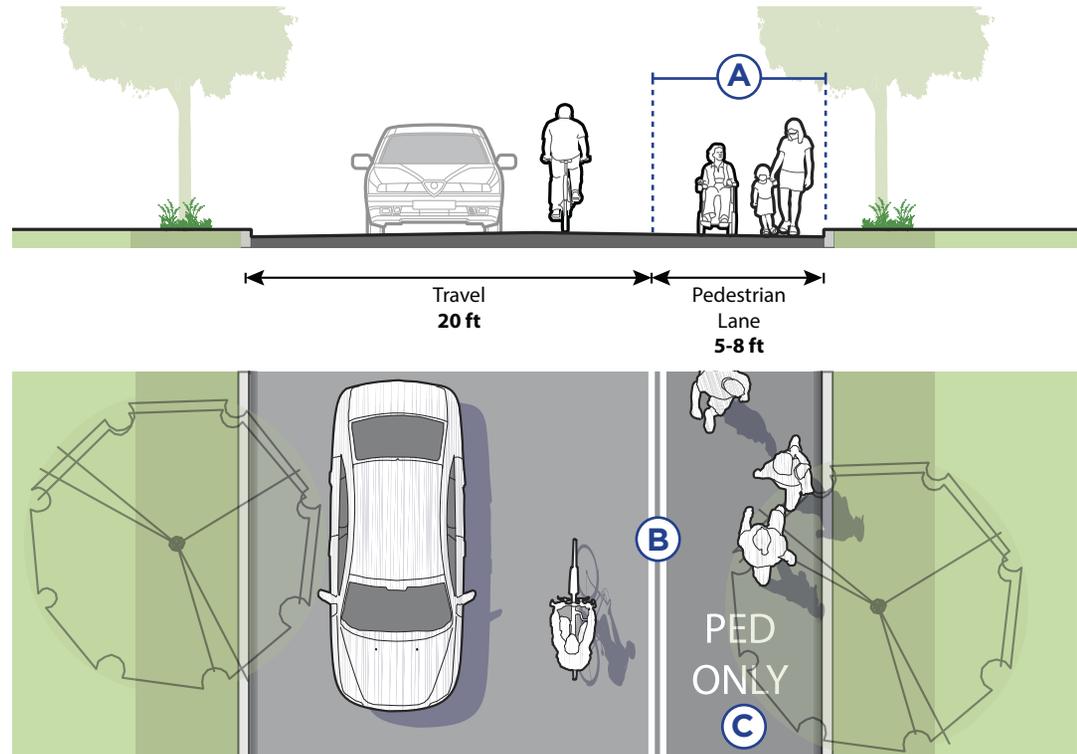
A pedestrian lane is an interim or temporary facility that may be appropriate on roads with low to moderate speeds and volumes. The lane provides a space for pedestrians to walk, separated from motor vehicle traffic by roadway striping.

These lanes are appropriate on roadways that operate at low motor vehicle volumes and speeds and where bicyclists are expected to travel in the roadway travel lane.

TYPICAL APPLICATION



PennDOT states that “Roadway shoulders... are not constructed to be pedestrian facilities... although pedestrians are permitted to use them.”, (*PUB 13 CH 6. p. 18*).

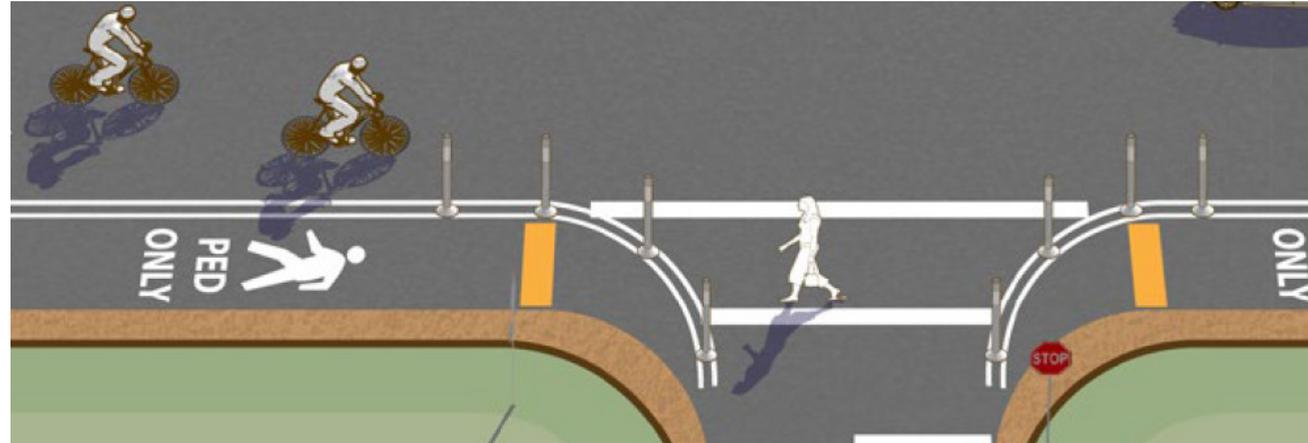


DESIGN FEATURES

- (A)** Standard pedestrian lane width is 8 ft to allow for comfortable two-way walking. Minimum width is 5 ft.
- (B)** A pedestrian lane must be separated from the adjacent travel lanes with some form of lane delineation, such as a double white line. A marked buffer may also be used to provide additional separation.
- (C)** “PED ONLY” markings must be white and be positioned laterally in the center of the lane (*MUTCD 2009, p. 415*).
 - Pedestrian Warning Sign (*W11-2*) paired with an “ON ROADWAY” legend sub plaque may be used to indicate to drivers to expect pedestrians within the paved road surface.



A W11-2 warning sign and “ON ROADWAY” legend plaque informs road users.



To preserve the integrity and accessibility of crossings, detectable warnings should be used at street crossings, along with clearly marked crosswalks. Flexible delineators may be used to discourage motor vehicle encroachment at corners. Source: FHWA *Small Town and Rural Multimodal Networks*, 2016.

FURTHER CONSIDERATIONS

- Because pedestrian lanes are intended for use by pedestrians, they must meet accessibility guidelines for grade, cross slope, and surface stability. This may be challenging to achieve on existing roadway edges.
- Pedestrian lanes provide interim or temporary pedestrian accommodation on roadways lacking sidewalks. They are not intended to be an alternative to sidewalks and often will fill short gaps between other higher-quality facilities.
- As part of the planning process, agencies should explore issues and the potential challenges a pedestrian lane may face, including: detectability by people with vision disabilities; undesired use by bicyclists; accessible cross-slope requirements; and maintenance strategies, such as sweeping and snow removal.
- Detectable Warning Strips are not required in shoulders at crosswalks (PennDOT *PUB 13* Chapter 6).
- Implementation of pedestrian lanes may share some strategies with the implementation of bicycle lanes. In some instances, sufficient space to provide a pedestrian lane may already exist or may be created through configuration changes including removing or consolidating on-street parking, or narrowing of travel lanes.

MAINTENANCE

Pedestrian lanes should be cleared of snow and debris through routine maintenance operations.

REFERENCES

- FHWA. *Manual on Uniform Traffic Control Devices*. 2009.
 FHWA. *Small Town and Rural Multimodal Networks*. 2016.
 United States Access Board. *Proposed Guidelines for Pedestrian Facilities in the Public Right-of-Way*. 2011.
 PennDOT. *PUB 13* - Chapter 6. 2012

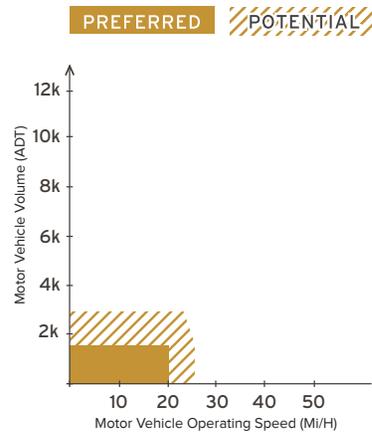
MARKED SHARED ROADWAYS

Marked shared roadways use shared lane markings, also known as “sharrows,” to designate a shared travel lane. Shared lane markings are used to encourage bicycle travel and remind motorists of the potential presence of bicyclists within a narrow travel lane.

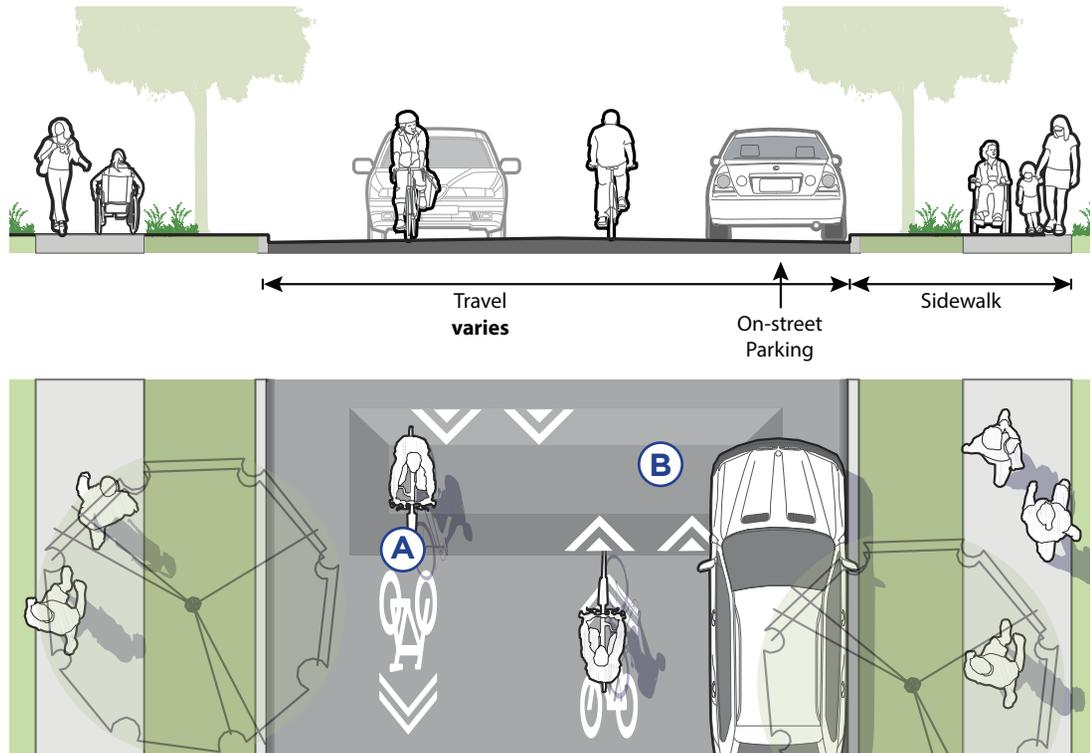
When combined with speed reduction and access management, these facilities are referred to as “Bicycle Boulevards.”

As described in TSMI 13-07, these markings may be paired with a W11-1 sign and IN LANE plaque.

TYPICAL APPLICATION



Most useful on roadways with a speed limit of 30 mph or less (NACTO 2012). Shared lane markings may be used on streets up to 35 mph.

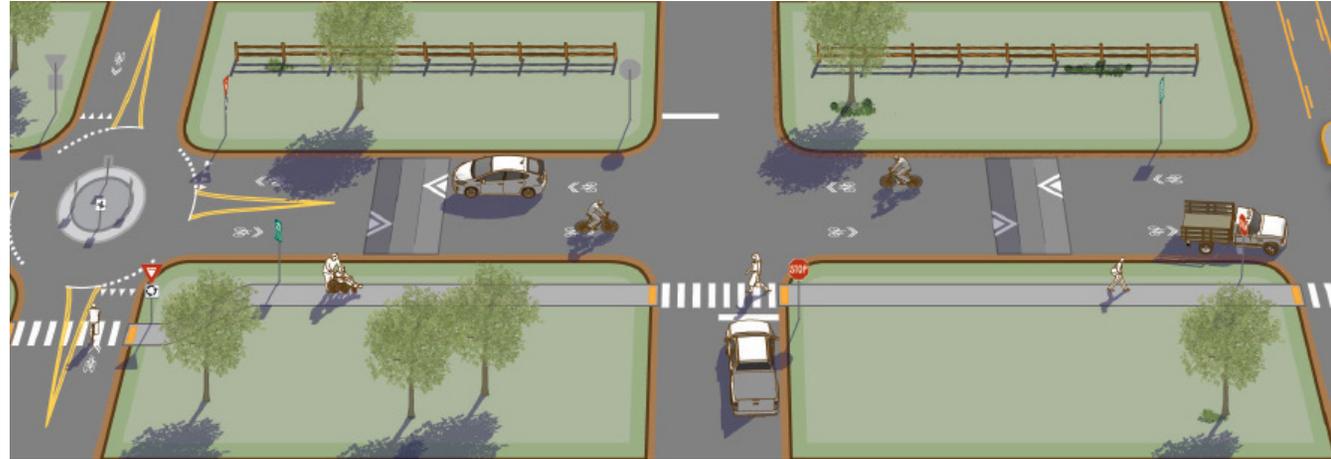


DESIGN FEATURES

- (A)** Place shared lane markings in the center of the effective travel lane to reduce marking wear and encourage cyclists to occupy the lane outside of the door zone of parked cars.
- (B)** Speed reduction measures and access management may also be necessary to achieve recommended speeds and volumes for shared roadways.
 - Shared lane markings should be placed immediately after an intersection (*MUTCD* 2009, 9C.07.06) and up to every 250 ft on low traffic bicycle routes (*NACTO Bike Guide* 2012). Shared Lane Marking Detail can be found in PennDOT *PUB 111*.



W11-1 with "IN LANE" plaque can inform users shared roadway conditions.



To create a prioritized experience for bicyclists, traffic calming and crossing enhancements should be used to create low motor vehicle volumes, bicycle compatible travel speeds, and safe comfortable crossings of major streets. Image source: FHWA *Small Town and Rural Multimodal Networks*, 2016.

FURTHER CONSIDERATIONS

- Guidance on traffic calming can be found in Pennsylvania's *Traffic Calming Handbook*.
- Signs should be used to support the marked shared roadway facility. Appropriate signs may include Bike Route (D11-1) or BIKES MAY USE FULL LANE sign (R4-11, *MUTCD* 2009).
- Because of higher motor vehicle speeds and volumes than Yield Roadways or Advisory Shoulders, sidewalks are the preferred pedestrian facility on marked shared roadways. Marked shared roadways are designed to prioritize use by bicyclists and are generally not intended for use by pedestrians. On these roads, the appropriate pedestrian facility is generally a sidewalk. If the marked shared roadway is intended to facilitate pedestrian travel within the roadway it must meet accessibility guidelines.

MAINTENANCE

Placement of shared lane markings in the center of the effective travel lane (TSMI 13-07) helps prevent wear and reduce maintenance needs. Marked Shared Roadways should be cleared of snow through routine snow removal operations.

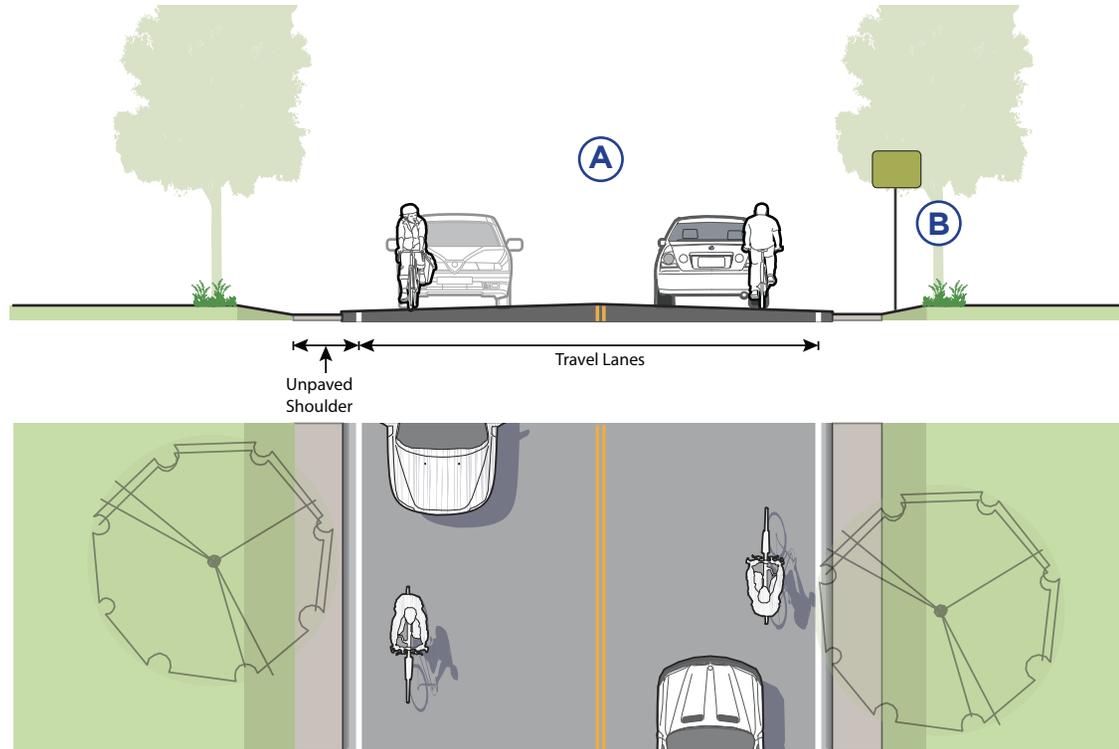
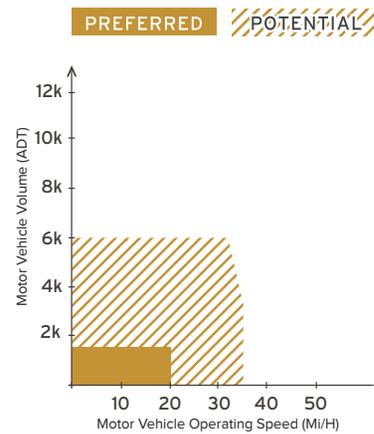
REFERENCES

AASHTO. *Guide for the Development of Bicycle Facilities*. 2012.
 FHWA. *Manual on Uniform Traffic Control Devices*. 2009.
 NACTO. *Urban Bikeway Design Guide*. 2012.
 PennDOT. *Pennsylvania's Traffic Calming Handbook (PUB 383)*. 2012
 PennDOT. *PUB 111*. 2013

SIGNED SHARED ROADWAYS

Signed shared roadways are roadways with travel lanes shared by bicyclists and motorists, and designated as a bike route with a unique route designation or PA *MUTCD* Bike Route signs. They work best on roads with low speeds and traffic volumes, however can be used on higher volume roads with wide outside lanes or shoulders. A motor vehicle driver will usually have to cross over into the adjacent travel lane to pass a bicyclist, unless a wide outside lane or shoulder is provided.

TYPICAL APPLICATION



DESIGN FEATURES

- A** Lane width varies depending on roadway configuration. The AASHTO *Bike Guide* recommends wide curb lanes with widths between 12 ft and 13.5 ft. Beyond this width, Bike Lanes may be provided.
- B** Signage should be applied at intervals frequent enough to keep users informed of changes in route direction and to remind motorists of the presence of bicyclists and pedestrians.



D11-1c



D1-1



D11-1/D1-3a

The MUTCD includes a series of bicycle guide signs appropriate for use on bicycle routes.

Confirmation signs (D11-1 series) indicate to bicyclists that they are on a designated bikeway, make motorists aware of the bicycle route, and can include destinations and distance/time but do not include arrows.

Turn signs (D1-1) indicate where a bikeway turns from one street onto another street. These can be used with pavement markings and include destinations and arrows.

Decisions signs (Combination D11-1/D1-3) indicate the junction of two or more bikeways and inform bicyclists of the designated bike route to access key destinations. These include destinations, arrows, and distances.

FURTHER CONSIDERATIONS

- Signed Shared Roadways serve either to provide continuity with other bicycle facilities or to designate preferred routes through high-demand corridors. However, these facilities tend to operate with higher motor vehicle speed and volume than is usually comfortable for shared roadway operation. Consider opportunities to calm the roadway to limit undesirable conditions, or widen the roadway to provide a bike lane or separated facility.
- This configuration differs from a Marked Shared Roadway due to a lack of traffic calming, pavement markings, and other enhancements designed to provide a higher level of comfort for a broad spectrum of users.

MAINTENANCE

Maintenance needs for bicycle guide signs are similar to other signs, and will need periodic replacement due to wear.

REFERENCES

AASHTO. *Guide for the Development of Bicycle Facilities*. 2012.
FHWA. *Manual on Uniform Traffic Control Devices*. 2009.

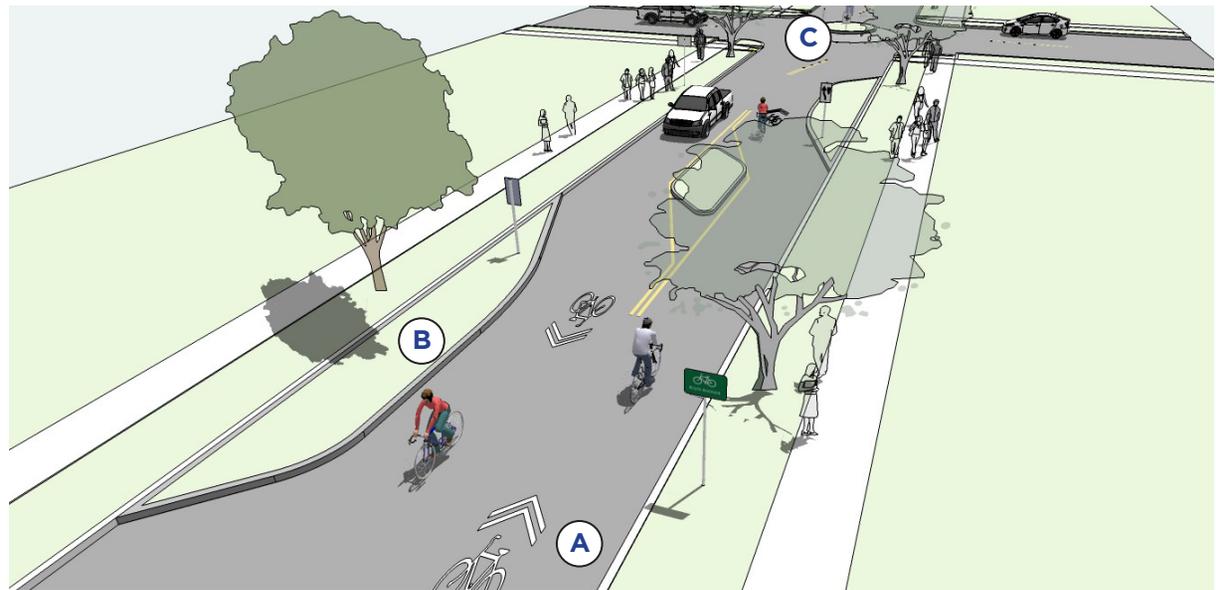


BICYCLE BOULEVARDS

Bicycle boulevards are low-volume and low-speed streets improved for bicycle travel through treatments such as traffic calming, signage and pavement markings, and intersection crossing treatments. These treatments allow safer, more comfortable through movements for pedestrians and bicyclists while discouraging nonlocal motor vehicle traffic from using these streets to avoid heavier traveled through streets. Access to properties along the route is maintained for motor vehicles.

TYPICAL APPLICATION

- Alignments along local streets that avoid excessive zigzag or circuitous routing.
- Streets with travel speeds of 25 mph or less and with traffic volumes of fewer than 3,000 vehicles per day.
- Local streets that residents have expressed a desire for traffic reduction
- Low-volume local streets that connect key destinations



DESIGN FEATURES

- Ⓐ Signs and pavement markings are the minimum treatments necessary to designate a street as a bicycle boulevard. Additional treatments such as signals, beacons and traffic calming increase safety and comfort.
- Ⓑ Physical traffic calming; chicanes and curb extensions for speed and volume control.
- Ⓒ Maintain vehicular access for residents, businesses, and emergency and maintenance vehicles.
 - Pavement markings, art and furnishings contribute to placemaking.
 - Intersection crossings that enhance safety and minimize delay for bicyclists; mini roundabouts as an alternative to stop signs.

BICYCLE BOULEVARDS



Bicycle boulevards are established on streets that improve connectivity to key destinations and provide a direct, low-stress route for bicyclists, with low motorized traffic volumes and speeds, designated and designed to give bicycle travel priority over other modes.

TRAFFIC CALMING



Streets along classified neighborhood bikeways may require additional traffic calming measures to discourage through trips by motor vehicles.

FURTHER CONSIDERATIONS

- Costs increase with type of facilities such as speed tables, curb extensions, roundabouts and other traffic calming and placemaking treatments.
- Nearby residents and adjacent property owners should be invited to provide input on the design.
- Bicycle boulevard retrofits to local streets are typically located on streets without existing signalized accommodation at crossings of collector and arterial roadways. Without treatments for bicyclists, these intersections can become major barriers along the bicycle boulevard and compromise safety.
- Traffic calming can deter motorists from driving on a street. Anticipate and monitor vehicle volumes on adjacent streets to determine whether traffic calming results in inappropriate volumes. Traffic calming can be implemented on a trial basis

MAINTENANCE

Bicycle Boulevards should be cleared of snow through routine snow removal operations. Thermoplastic or epoxy markings offer increased durability over conventional paint.

REFERENCES

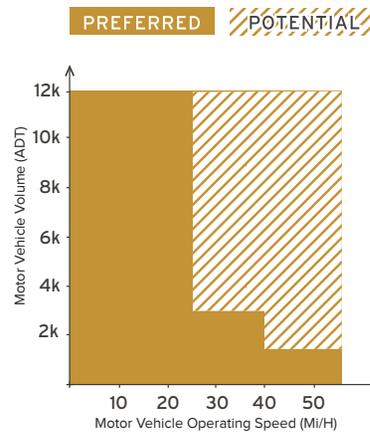
AASHTO. *Guide for the Development of Bicycle Facilities*. 2012.

SHOULDER BIKEWAYS

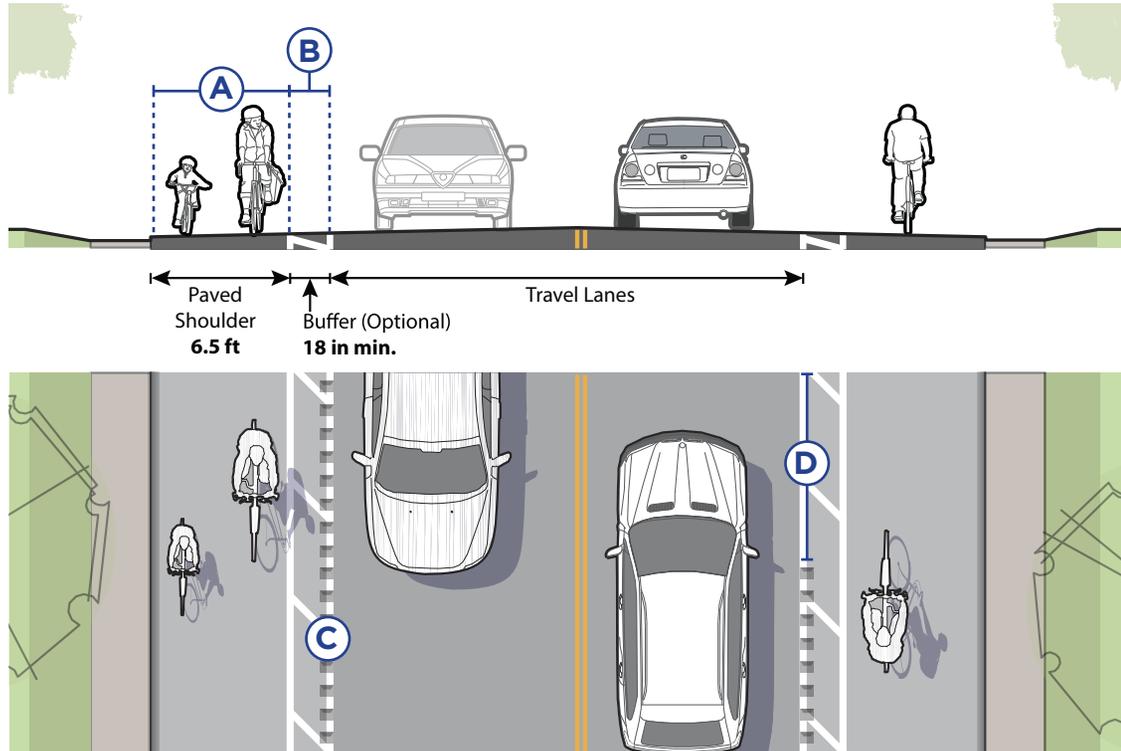
Typically found in less-dense areas, shoulder bikeways are paved, striped shoulders wide enough for bicycle travel.

To offer enhanced comfort and usability, shoulder bikeways should be wide enough for side-by-side travel, configured with a buffer area and use bicycle-tolerable rumble strip designs

TYPICAL APPLICATION



While shoulder bikeways may function on roads with high vehicle speeds and volumes, consider the use of a separated bike lane or sidepath for increased comfort.

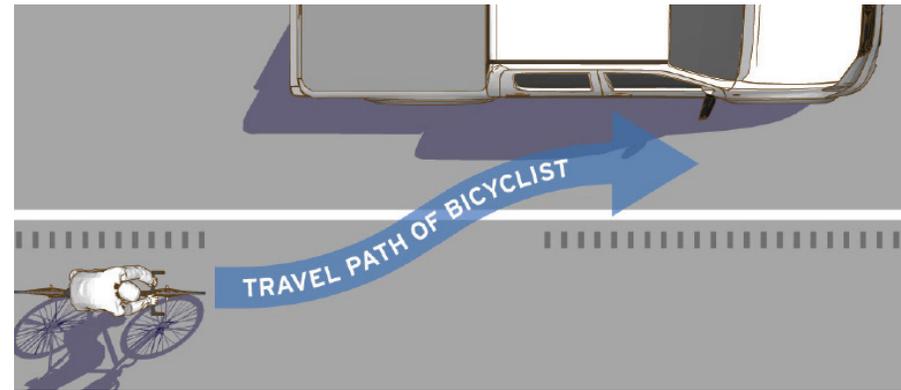


DESIGN FEATURES

- (A)** Standard shoulder bikeway width is 7 ft to allow for side-by-side riding. A minimum of 4 ft of rideable surface should be available for bicycle travel (AASHTO *Bike Guide* 2012). A minimum shoulder width of 5 ft is recommended where a curb and gutter, guardrail, or other roadside obstacle exists.
- (B)** An optional buffer space may be used to provide additional horizontal distance between moving vehicles and bicyclists.
- (C)** To minimize negative impact to bicyclists, rumble strips should be located as close as possible to the travel lane edge line, while maintaining a 4 ft clear width.
- (D)** Rumble strips should include a “bicycle gap” pattern of 12 ft gaps every 60 ft to allow access as needed (NCHRP *Synthesis 490*, 2016).



A wide paved surface, paired with a buffer area and rumble strips provides more comfortable experience for bicyclists traveling on this shoulder.



Provide a bicycle gap pattern to allow access into and out of the shoulder area by bicyclists. Image Source: FHWA *Small Town and Rural Multimodal Networks*, 2016.

FURTHER CONSIDERATIONS

- When shoulder bikeways are intended for use by pedestrians, they must meet accessibility guidelines for grade, cross slope, and surface stability. This may be challenging to achieve on existing roadway edges.
- Rumble strips are an FHWA Proven Safety Countermeasure for reducing roadway departure crashes. Research has shown that installing rumble strips can reduce severe crashes but may negatively impact bicycle travel if they are poorly constructed.
- PennDOT recommended shoulder widths and bicycle friendly rumble strip design on projects designed specifically to accommodate bicycling in the *PUB 13* - Chapter 16 and PUB 638.
- Shoulders are not substitutes for a well-designed pedestrian facility. However, there may occasionally be a need to design shoulders as walkways where roadside space is constrained.
- Contrasting or colored pavement materials may be used to differentiate the shoulder from the adjacent travel lanes (AASHTO *Green Book* 2011, p. 4-13).

MAINTENANCE

Shoulder bikeways should be cleared of snow and debris through routine maintenance operations.

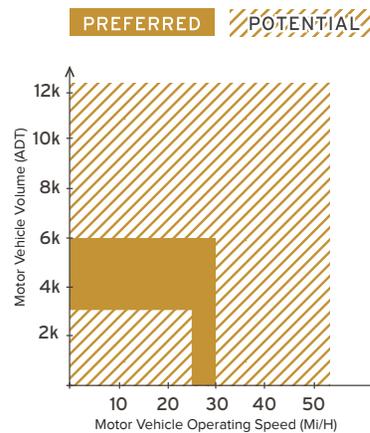
REFERENCES

- AASHTO. *A Policy on Geometric Design of Highways and Streets*. 2011.
- FHWA. *Manual on Uniform Traffic Control Devices*. 2009.
- FHWA. *Guidance Memorandum on Promoting the Implementation of Proven Safety Countermeasures*. 2012.
- National Cooperative Highway Research Program (NCHRP). *Synthesis 490 Practice of Rumble Strips and Rumble Stripes*. 2016.
- PennDOT *PUB 13* - Chapter 16. 2012
- PennDOT *PUB 638*. 2014

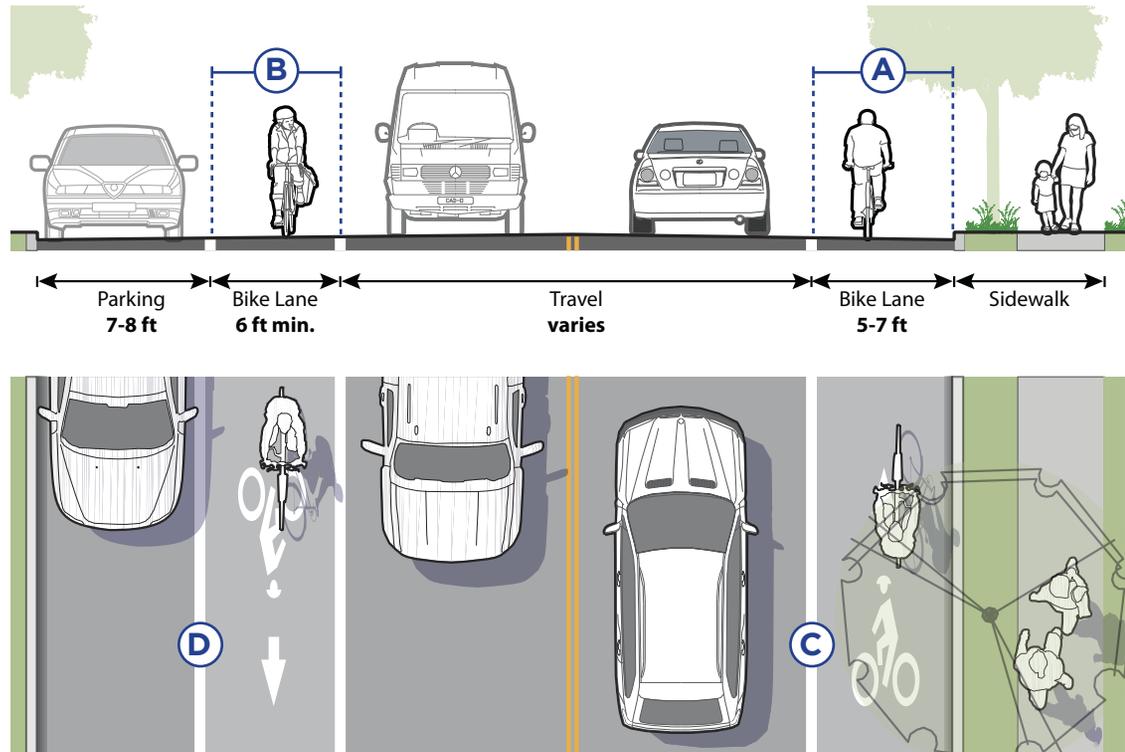
BIKE LANE

On-street bike lanes designate an exclusive space for bicyclists through the use of pavement markings and signs. Bike lanes are located directly adjacent to motor vehicle travel lanes and travel in the same direction as motor vehicle traffic.

TYPICAL APPLICATION



On streets with multiple travel lanes in any one direction, consider buffered or separated bike lanes for increased comfort.

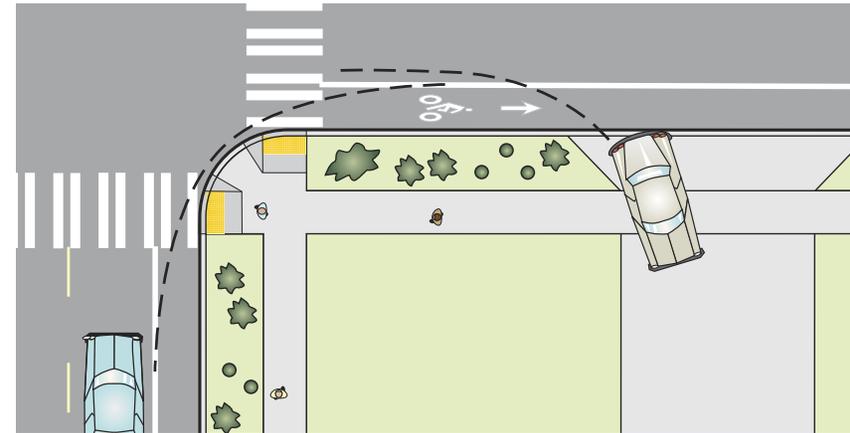


DESIGN FEATURES

- (A) Standard bike lane width is 7 ft to allow for side-by-side riding or passing.
- (B) In constrained conditions, minimum width is 6 ft adjacent to on-street parking, 5 ft adjacent to curb faces, and 4 ft adjacent to road edge (AASHTO *Bike Guide* 2012).
- (C) Mark travel side line with 4-6 in stripe (*MUTCD* 2009, 9C.04, see section 3A.06 for longitudinal striping details).
- (D) If on-street parking is present, mark parking lane line or “T” markings to define the parking lane, with a preferred width of a parking lane at 8 ft.
 - Bicycle lane markings and symbols details can be found in PennDOT *PUB 111*. (sheet 8 of 13). Typical bicycle lane cross sections can be found in Figure 16.1 in Chapter 16 in *PUB 13M*.



Supplemental bike lane signs, such as R3-17 (bike lane), R3-17aP (ahead), and R3-17bP (end) may be used to indicate bike lane provision.



Bike lane word, symbol, and arrow markings (MUTCD Figure 9C-3) shall be placed outside of the motor vehicle tread path in order to minimize wear from the motor vehicle path.

FURTHER CONSIDERATIONS

- Where added comfort is desired, and roadway width is sufficient, configure as a buffered bicycle lane.
- On high speed streets (greater than 45 mph) or multi-lane streets, a physically separated bike lane or sidepath is preferred over a bike lane for user comfort.
- There are many strategies available to implement bicycle lanes into roadway resurfacing projects, including road widening, lane narrowing, travel lane reconfiguration and parking lane reconfiguration (FHWA *Resurfacing Guide*, 2016).
- Narrow parking lane widths only increase operating space for bicyclists if additional operating space is provided as part of the bike lane. Reduced width parking lanes should be combined with increased width bicycle lanes (including 6 and 7 ft bike lanes) (Furth, 2010).
- PennDOT requires facilities to be properly signed and marked in accordance with *MUTCD*.

MAINTENANCE

Paint can wear more quickly in high traffic areas or in winter climates. Bicycle lanes should be cleared of snow and debris through routine maintenance operations.

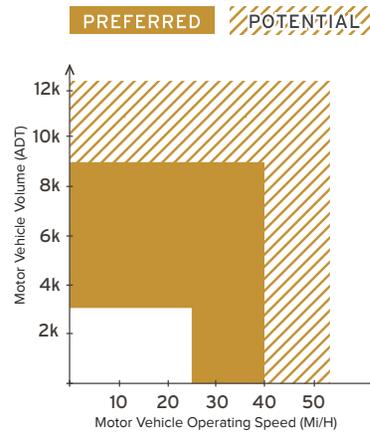
REFERENCES

- AASHTO. *Guide for the Development of Bicycle Facilities*. 2012.
 FHWA. *Manual on Uniform Traffic Control Devices*. 2009.
 FHWA, *Incorporating On-road Bicycle Networks into Resurfacing Projects*, 2015.
 Furth et al. "Parking Lane Width and Bicycle Operating Space," 2010.
 PennDOT *PUB 13* - Chapter 16. 2012
 PennDOT. *PUB 111*. 2013

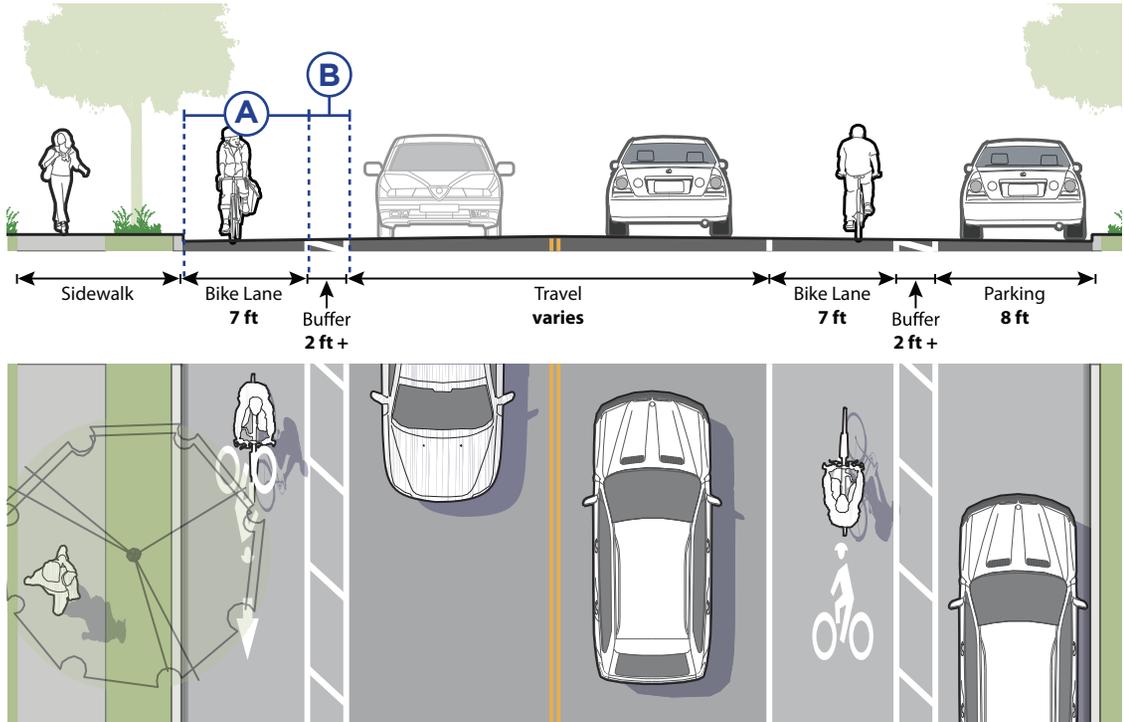
BUFFERED BIKE LANE

Buffered bike lanes are conventional bicycle lanes paired with a designated buffer space, separating the bicycle lane from the adjacent motor vehicle travel lane and/or parking lane.

TYPICAL APPLICATION



On streets with high speeds and high volumes or high truck volumes (NCHRP 776, 2016).



DESIGN FEATURES

- A** Standard bicycle travel area width (not including buffer) is 7 ft to allow for side-by-side riding or passing.
 - In constrained conditions, minimum width is 6 ft adjacent to on-street parking, 5 ft adjacent to curb faces, and 4 ft adjacent to road edge. (AASHTO *Bike Guide*. 2012)
- B** Buffers should be at least 2 ft wide. If buffer area is 4 ft or wider, white chevron or diagonal markings should be used. (MUTCD 2009, 3D.02)
 - Mark the inside buffer line as a dotted line across driveways or minor street crossings for user clarity.
 - Parking Side Buffer: For use adjacent to on-street parking in commercial districts with high parking turnover. (NACTO *Bike Guide*. 2012)



The use of bold, clear pavement markings delineates space for cyclists to ride in a comfortable facility.



A 2 ft buffer between the bike lane and the parking lane decreases the likelihood that bicyclists will be impeded by open car doors of parked vehicles.

FURTHER CONSIDERATIONS

- A study of buffered bicycle lanes found that, in order to make the facilities successful, there needs to also be driver education, appropriate signs and proper pavement markings (Dill, 2011).
- On high-speed streets (greater than 45 mph) or multi-lane streets, a physically separated bike lane or sidepath is preferred over a bike lane for user comfort.
- Where on-street parking is permitted and space is limited, NCHRP *Report 766* recommends installing a buffer space between the parking lane and bicycle lane rather than between the bicycle lane and vehicle travel lane.
- PennDOT requires all facilities should be properly signed and marked in accordance with *MUTCD*.

MAINTENANCE

Paint can wear more quickly in high traffic areas or in winter climates. Bicycle lanes should be cleared of snow and debris through routine maintenance operations.

REFERENCES

FHWA. *Manual on Uniform Traffic Control Devices*. 2009.
 Dill, J., Monsere, C.; and McNeil, N.; "Evaluation of Innovative Bicycle Facilities: SW Broadway Cycle Track and SW Stark/Oak Street Buffered Bike Lanes." 2011.
 NACTO *Urban Bikeway Design Guide*. 2012.
 NCHRP *Report 766: Recommended Bicycle Lane Widths for Various Roadway Characteristics*. 2016.
 PennDOT *PUB 13 - Chapter 16*. 2012
 PennDOT. *PUB 111*. 2013

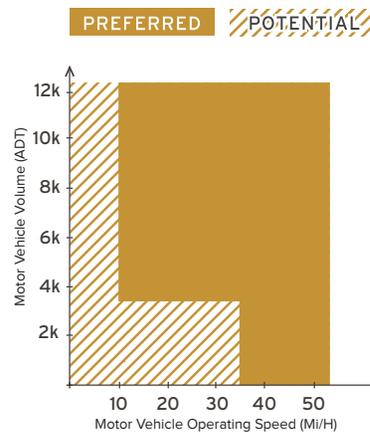
SEPARATED BIKE LANE (DIRECTIONAL)

One-way protected bicycle lanes are on-street bikeway facilities that are separated from vehicle traffic by a vertical element.

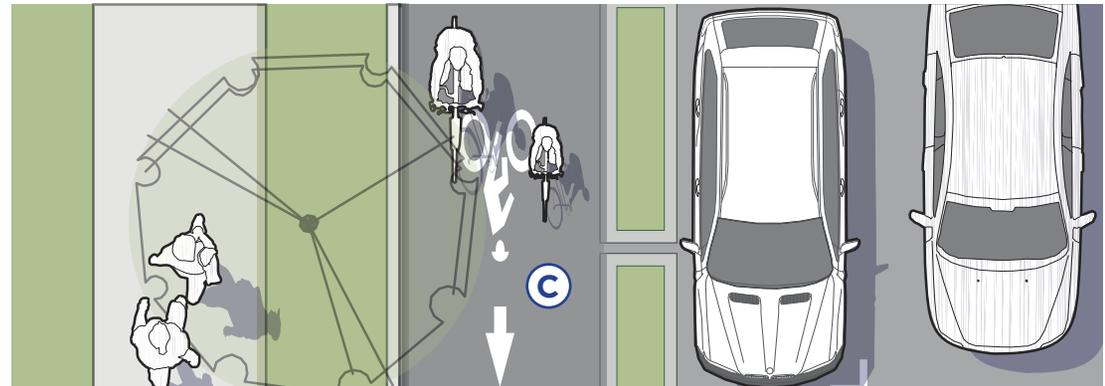
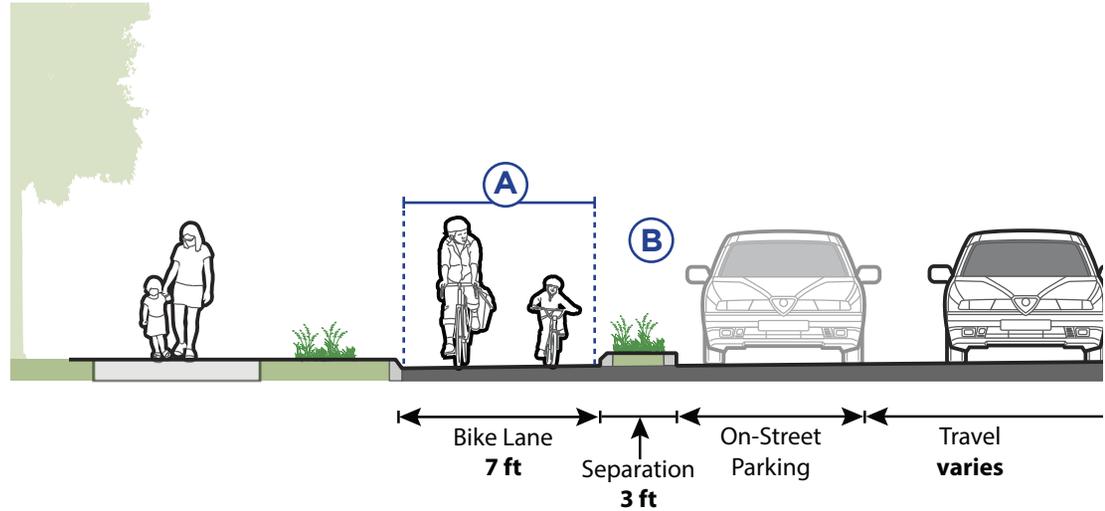
The separating element can include flexible delineators, extruded curbs, on-street parking, or other barriers.

Separated bike lanes using these barrier elements typically share the same elevation as adjacent travel lanes, but the bike lane may also be raised above street level.

TYPICAL APPLICATION

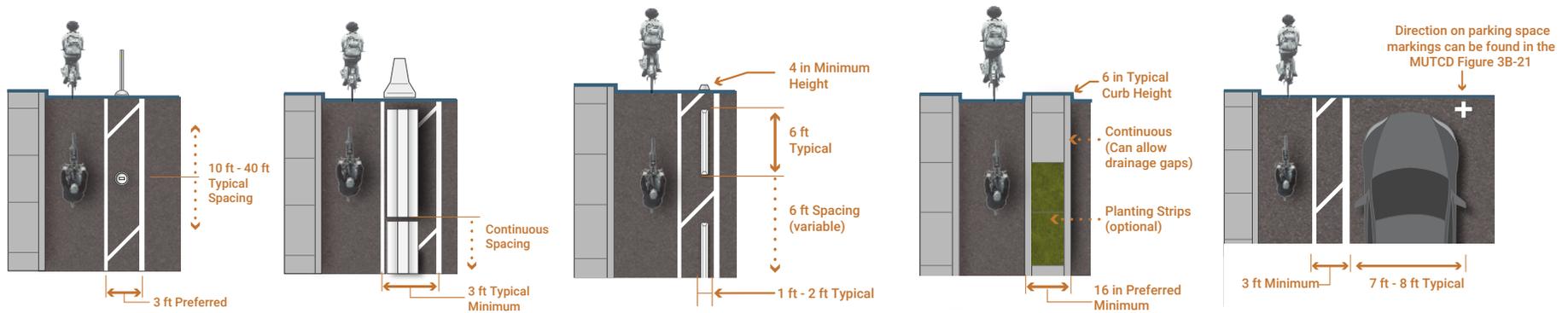


Where conventional bicycle lanes would cause many bicyclists to feel stress because of factors such as multiple lanes, high motor traffic volumes and speeds.



DESIGN FEATURES

- A** Standard directional separated bike lane width is 7 ft as a preferred minimum to allow for side by side riding and to facilitate safe passing behavior. Minimum width is 5 ft, FHWA *Separated Bike Lane Guide*. 2015).
- B** Separation width depends on physical separation method. Minimum separation width next to parking is 3 ft to accommodate opening doors (NACTO *Bike Guide*. 2012).
- C** Pavement markings, symbols, and/or arrow markings must be placed at the beginning of the separated bike lane and at intervals along the facility based on engineering judgment to define the bike direction.



Separated bike lanes can use a variety of separation methods, depending on cost, durability and aesthetics. Low-cost separation methods are often used for interim implementation to provide a functional facility prior to full capital construction with curbs and planted medians. Image Source: FHWA Separated Bike Lane Planning And Design Guide.

FURTHER CONSIDERATIONS

- Federal recognition and guidance on separated bike lanes can be found in the FHWA *Separated Bike Lane Planning and Design Guide*, 2015.
- Separated bike lane buffers and barriers are covered in the *MUTCD* as preferential lane markings (section 3D.01) and channelizing devices (section 3H.01). If buffer area is 4 ft or wider, white chevron or diagonal markings should be used (section 9C.04). Curbs may be used as a channeling device (section 3I.01).
- Where possible, physical barriers should be oriented towards the inside edge of the buffer to provide as much extra width as possible for bicycle use.
- Refer to the FHWA *Separated Bike Lane Guide* 2015 for information on the appropriate treatment for transit stops (p.92), accessible parking (p.97), and loading zones (p.99).

MAINTENANCE

The design of separated bike lanes and separation methods can impact the ease and cost of routine maintenance.

Bicycle facilities should be cleared of snow and debris through routine maintenance operations.

REFERENCES

- FHWA. *Manual on Uniform Traffic Control Devices*. 2009.
 FHWA. *Separated Bike Lane Planning and Design Guide*. 2015.
 NACTO *Urban Bikeway Design Guide*. 2012.

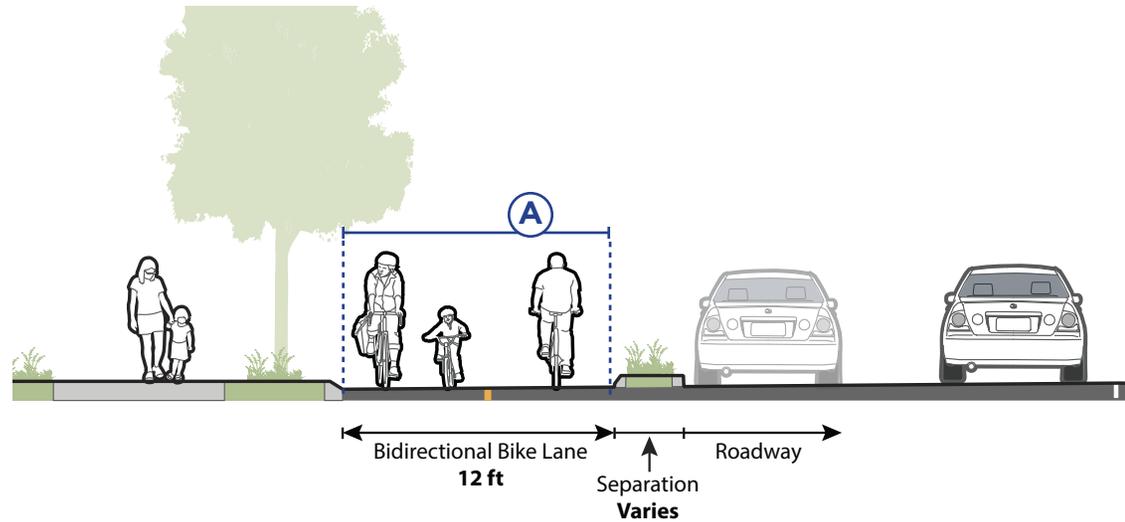
SEPARATED BIKE LANE (BIDIRECTIONAL)

Bidirectional separated bike lanes are bicycle facilities that allow bicycle movement in both directions on one side of a road. Two-way separated bikeways share some of the same design characteristics as one-way separated bicycle lanes but may require additional considerations at driveway and side street crossings.

To simplify operational concerns, bidirectional separated bike lanes function best on the left-side of one-way streets.

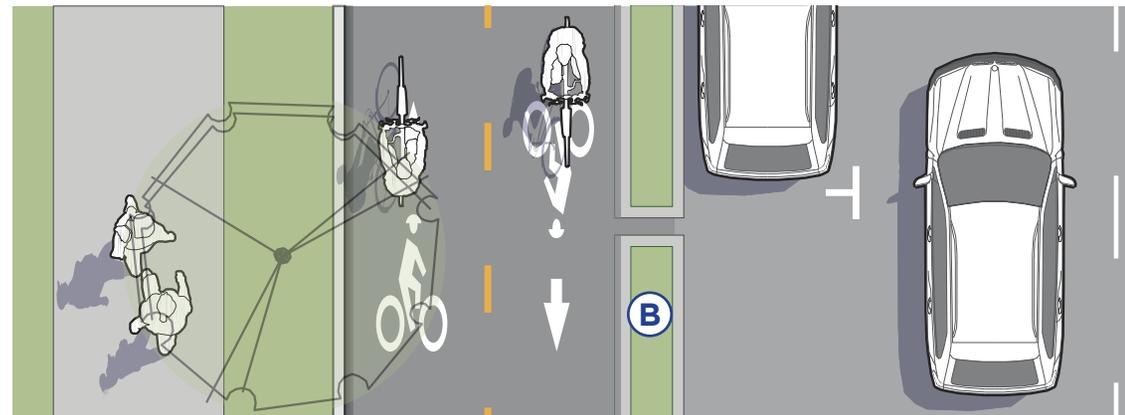
TYPICAL APPLICATION

- Generally follows speed and volume ranges for directional separated bike lanes.
- Functions well to fill gaps in shared use path corridors.
- Functions well on streets with few conflicts such as driveways or cross-streets on one side of the street



DESIGN FEATURES

- A Standard bidirectional separated bike lane width is 12 ft (FHWA *Separated Bike Lane Guide* 2015). Reduced width is 10 ft (NACTO *Bike Guide*. 2012).
 - In constrained conditions for short segments, separation minimum width is 8 ft (AASHTO *Bike Guide*. 2012).
- B Separation width depends on physical separation method. Minimum separation width next to parking is 3 ft to accommodate opening doors (NACTO *Bike Guide*. 2012).





The bidirectional separated bike lane is distinct from the sidewalk, and separated from the roadway.

FURTHER CONSIDERATIONS

- Federal recognition and guidance on separated bike lanes can be found in the FHWA *Separated Bike Lane Planning and Design Guide*, 2015.
- Separated bike lane buffers and barriers are covered in the *MUTCD* as preferential lane markings (section 3D.01) and channelizing devices (section 3H.01). If buffer area is 4 ft or wider, white chevron or diagonal markings should be used (section 9C.04). Curbs may be used as a channeling device (section 3I.01).
- Two-way bikeways introduce additional complexities at intersections and driveways. Protected signalization, modified geometric design, or other markings and signs may be necessary to mitigate conflicts.
- A two-way separated bike lane on one way street should be located on the left side where possible.
- Refer to the FHWA *Separated Bike Lane Guide* 2015 for information on the appropriate treatment for transit stops (p.92), accessible parking (p.97), and loading zones (p.99).

MAINTENANCE

Bidirectional separated bike lanes tend to be easier to maintain than directional separated bike lanes due to increased bikeway width.

Bicycle facilities should be cleared of snow and debris through routine maintenance operations.

REFERENCES

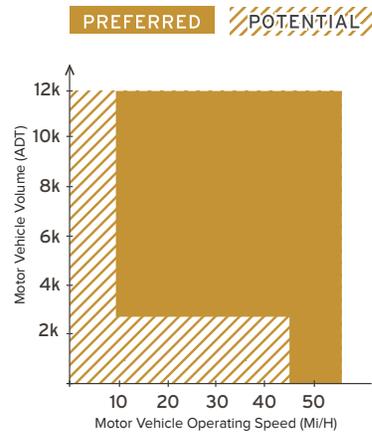
AASHTO. *Guide for the Development of Bicycle Facilities*. 2012.
 FHWA. *Manual on Uniform Traffic Control Devices*. 2009.
 FHWA. *Separated Bike Lane Planning and Design Guide*. 2015.
 NACTO. *Urban Bikeway Design Guide*. 2012.

SIDEPATH

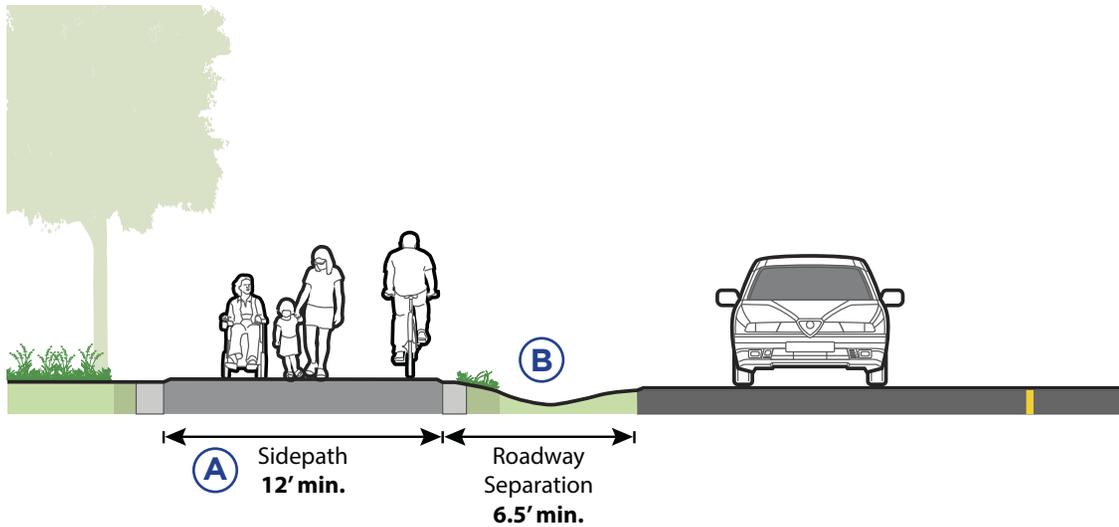
A sidepath is a bidirectional shared-use path located immediately adjacent and parallel to a roadway. Sidepaths can offer a high-quality experience for users of all ages and abilities as compared to on-roadway facilities in heavy traffic environments, allow for reduced roadway crossing distances and maintain community character.

Due to operational concerns, the ideal locations for sidepaths are roadways with few intersections or driveways.

TYPICAL APPLICATION



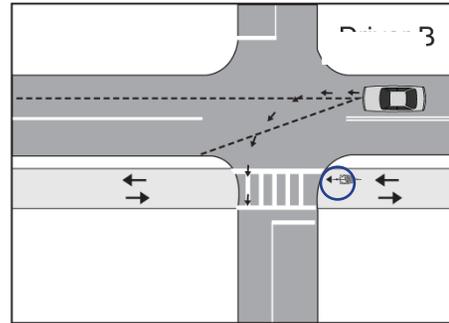
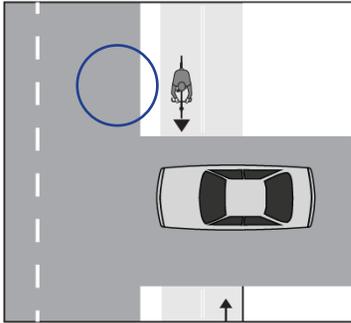
To fill gaps in the network of low-stress local routes such as shared use paths and bicycle boulevards.



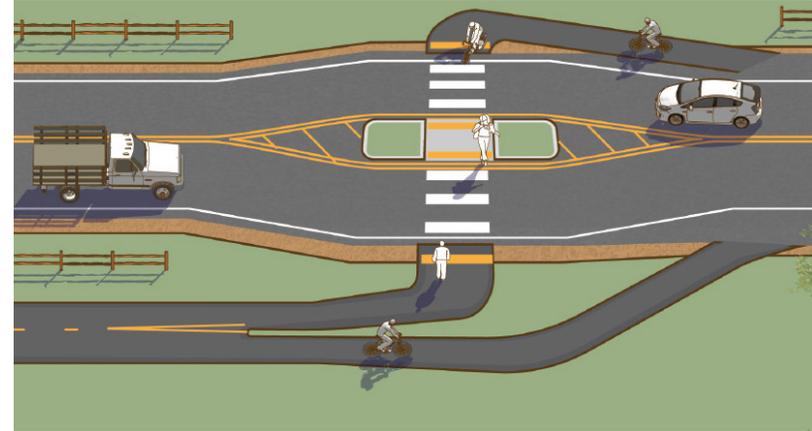
DESIGN FEATURES

- (A)** Standard sidepath width at locations with the potential for mixed pedestrian and bicyclist activity is 12 ft.
 - Minimum width of a sidepath is 10 ft.
- (B)** The preferred minimum roadway separation width is 6.5 ft (Schepers, 2011), with an absolute minimum separation width of 5 ft (AASHTO *Bike Guide* 2012, p. 5-11).
 - A horizontal clearance of 3 ft should be provided on each side of the pathway from signs, poles, trees, or other fixed objects.





Sidepaths running along streets with many driveways or street crossings can create operational issues. Drivers may block the sidepath (left) or fail to look for bicyclists traveling in both directions (right). (Image source: AASHTO *Bike Guide* Figure 5-4)



When a sidepath ends, users must transition to directional facilities on each side of the roadway. Image source: FHWA *Small Town and Rural Multimodal Networks*, 2016.

FURTHER CONSIDERATIONS

- The AASHTO *Bike Guide* lists 14 “potential conflicts” with bidirectional sidepath facilities in 3 categories:
 - » Design-related concerns, including issues of sight distance and motorist encroachment.
 - » Motorist lack of awareness of path users, particularly “wrong way” traveling bicyclists.
 - » End point concerns, where the sidepath must transition to directional facilities.
- Special attention should be paid to the geometric design and sight lines at the crossings of driveways, minor streets, and intersections.
- In highly constrained conditions where a 5 ft minimum separation distance cannot be provided, a physical barrier should be used. On high speed roadways, the barrier should be crashworthy (AASHTO *Bike Guide* 2012, p. 5-11).

MAINTENANCE

Obstructions can interfere with convenient winter maintenance.

REFERENCES

AASHTO. *Guide for the Development of Bicycle Facilities*. 2012.
 FHWA. *Manual on Uniform Traffic Control Devices*. 2009.
 FHWA *Small Town and Rural Multimodal Networks*, 2016.
 Schepers et al. “Road factors and Bicycle-Motor vehicle crashes at unsignalized priority intersections.” 2011



A photograph of a residential street intersection. In the foreground, a traffic light pole stands on the right side of the road, featuring a bicycle symbol sign and a traffic light. The road has a concrete sidewalk with a red brick tactile strip. In the background, there are houses, a white SUV, and a dark car. The scene is captured in bright daylight.

ON-ROAD CROSSING + INTERSECTION TREATMENTS

SHARED ROADWAY MAJOR STREET CROSSINGS

Shared Roadway facilities prioritize bicyclists along a roadway and should also prioritize bicyclist and pedestrian crossings of major streets.

Crossing enhancements at major streets can use a variety of engineering tools to address user comfort, provide additional gap acceptance opportunities, and increase yield-to-pedestrian rates.

TYPICAL APPLICATION

- Crossing treatments should be selected in response to motor vehicle volumes, speeds, sight lines, and number of lanes to cross.

DESIGN FEATURES

- Median Refuge Islands decrease crossing distances and traffic exposure, allowing bicyclists and pedestrians to cross a roadway in two stages.
- Rectangular Rapid Flash Beacons (RRFBs) may be used to enhance awareness of the crossing, and are effective at increasing motor vehicle yield-to-pedestrian rates. In some cases, bicyclists may benefit from motorist yielding behavior.
- A Pedestrian Hybrid Beacon (PHB), also called a HAWK Beacon, function similarly to a full traffic signal, and offer the highest degree of motorist stopping through the use of a red signal indication.

TABLE A.1 - SHARED ROADWAY CROSSING TREATMENT SELECTION QUICK REFERENCE

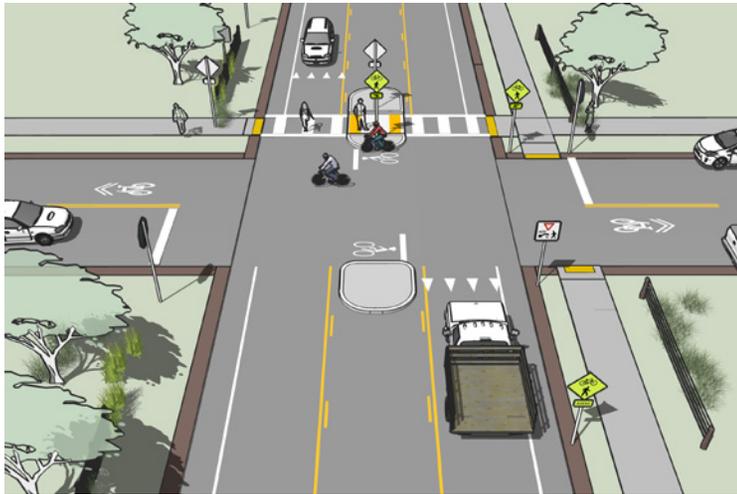
	CROSS STREET CHARACTERISTICS				
	LOCAL	2 LANES		4 OR MORE LANES	
		WITH MEDIAN	NO MEDIAN	WITH MEDIAN	NO MEDIAN
MARKED AND SIGNED CROSSWALKS	☑	☑	☑	X	X
RECTANGULAR RAPID FLASHING BEACON	X	☑	☑	EJ	X
PEDESTRIAN HYBRID BEACON / TRAFFIC SIGNAL	X	EJ	EJ	☑	☑

Legend

- ☑ = Most Desirable
- EJ = Engineering Judgment
- X = Not Recommended

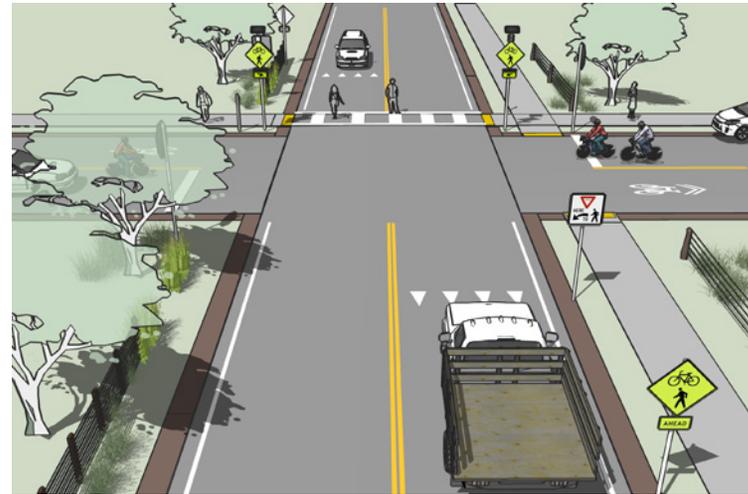
Treatment selection guidelines presented here are high-level recommendations only. Shared roadway crossings should follow similar crossing recommendations as shared use paths.

MEDIAN ISLAND AND MARKED CROSSWALKS



Median islands can provide refuge for both bicyclists and pedestrians, while still allowing motor vehicle access.

RECTANGULAR RAPID FLASHING BEACONS



RRFBs can increase yielding compliance over marked and signed crossings.

FURTHER CONSIDERATIONS

- NCHRP 562 provides guidance and methodology for identifying appropriate crossing enhancement tools for low speed shared roadway facilities.
- Median refuge islands may be designed to require horizontal deflection of the motor vehicle path. This should be used to slow motor vehicle speeds, which increases safety, improves sight lines, and increases yielding rates.

MAINTENANCE

Median Islands may collect debris and need additional cleaning maintenance. Median islands should be visible to snow plow crews, cleared of snow, and kept free of snow berms that block access. Beacons should be regularly maintained to ensure that all lights and detection hardware are functional.

REFERENCES

NCHRP *Report 562*. 2006.

SHOULDER BIKEWAY/BIKE LANE CROSSINGS

Key strategies for shoulder bikeways and bicycle lanes at intersections are to provide adequate lines of sight, minimize exposure to conflicts, reduce speeds at conflict points, communicate right-of-way priority, and maximize comfort for bicyclists.

TYPICAL APPLICATION

- Under most conditions, through-traveling bicyclists have priority over turning traffic. Traffic control markings and signs should support this priority and remind motorists of the obligation to yield.
- A variety of design treatments exist depending on the roadway configuration, available curb-to-curb width, traffic volumes, and desire to provide a dedicated turn lane.

DESIGN FEATURES

Intersection treatments for Bicycle Lanes and Shoulder Bikeways at intersections include:

- Intersection crossing markings
- Combined bike lane/turn lanes
- Through bicycle lane at an added right turn lane

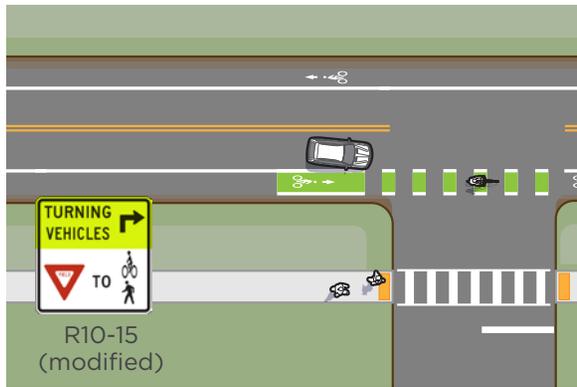
TABLE A.2 - SHOULDER BIKEWAY/BIKE LANE CROSSING TREATMENT SELECTION QUICK REFERENCE

	≤ 35 MPH			≥ 40 MPH
	PEAK HOUR RIGHT TURN LANE VOLUME			
	< 50 VEH/ HR	50-150 VEH/HR	> 150 VEH/HR	ALL
INTERSECTION CROSSING MARKINGS	☑	☑	EJ	EJ
COMBINED BIKE LANE / TURN LANE	X	☑	X	X
ADDED RIGHT TURN LANE	X	EJ	EJ	EJ
PROTECTED BICYCLE SIGNAL PHASE	X	EJ	☑	☑

Legend

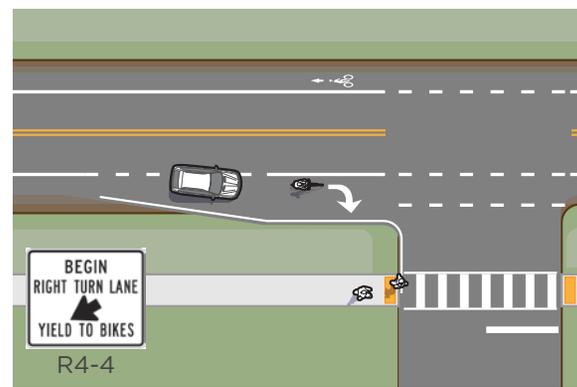
- ☑ = Most Desirable
- EJ = Engineering Judgment
- X = Not Recommended

INTERSECTION CROSSING MARKINGS



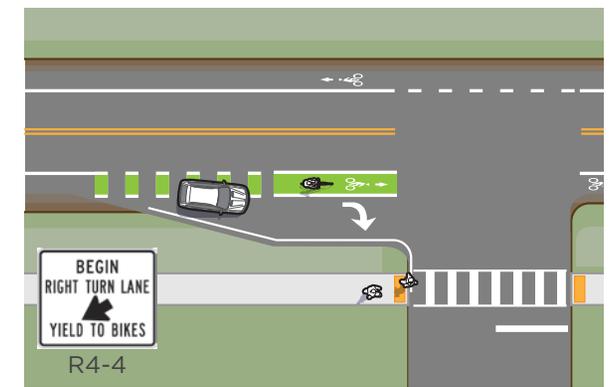
The *MUTCD* allows the use of a dotted line to define the path of bicyclists through intersections and can guide bicyclists and alert motorists to the bike lane path (p. 371, 806).

COMBINED BIKE LANE / TURN LANE



Where a right turn lane is desired, but there is not room to provide both a through bike lane and right turn only lane, a combined bike lane/turn lane creates a shared-lane condition in advance of the intersection.

ADDED RIGHT TURN LANE



Where right turn lanes are desired, the *MUTCD* recommends providing a bike lane to the left of an added right turn lane (p. 806-808).

FURTHER CONSIDERATIONS

- Dropped lanes, where a through lane transitions to the right turn lane, can be particularly challenging for bicyclists. The AASHTO *Bike Guide* suggests, “This scenario is the least preferred option and should be avoided where practicable” (p. 4-25).
- Where special emphasis is desired, green pavement color may be used within bike lanes where motor vehicles may cross bike lanes. Refer to FHWA *Interim Approval 14* for more information on the use of green colored pavement within bike lanes. Refer to the NACTO *Bike Guide* 2012 for information on colored pavement materials, installation, durability and cost (p. 125).

MAINTENANCE

Bicycle lanes should be cleared of snow through routine snow removal operations.

REFERENCES

AASHTO. *Guide for the Development of Bicycle Facilities*. 2012.
 FHWA. *Manual on Uniform Traffic Control Devices*. 2009.
 FHWA. *Interim Approval for Optional Use of Green Colored Pavement for Bike Lanes (1A-14)*. 2011.
 NACTO. *Urban Bikeway Design Guide*. 2012.

SHOULDER BIKEWAY/BIKE LANES AT ENTRANCE + EXIT RAMP

Arterial streets may contain high-speed ramp-style designs, such as merge lanes, that can create difficulties for bicyclists. Ramp-style entrance and exit lanes typically have intrinsic visibility problems because of low approach angles and feature high speed differentials between bicyclists and motor vehicles.

TYPICAL APPLICATION

- Streets with shoulders, bike lanes, buffered bike lanes, or separated bike lanes.
- Streets with ramp-style exit or entry lanes.

DESIGN FEATURES

- Bicycle priority designs maintain a dotted bike lane extension to identify the weave area. Green color should be used in the dotted bike lane area.
- Bicycle yield designs route the bike lane to create improved sightlines but require bicyclists to yield to motor vehicles.
 - » On exit ramps, use a jughandle turn to bring bicyclists to a location visible to exiting traffic.
 - » On entrance ramps, angle the bike lane to increase the approach angle with entering or exiting traffic and position the crossing before a driversft attention is focused on the upcoming merge.

TABLE A.3 - CROSSING TREATMENT SELECTION AT HIGH SPEED RAMP QUICK REFERENCE

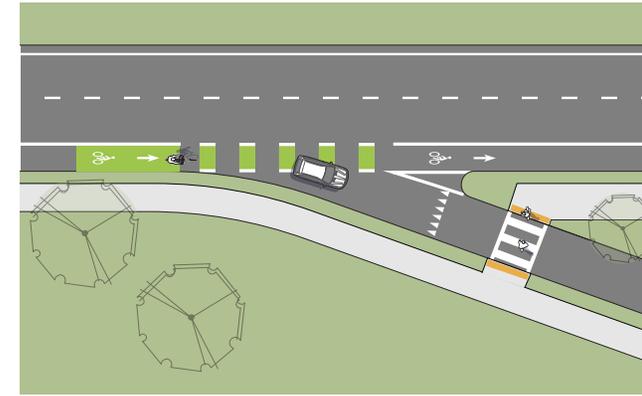
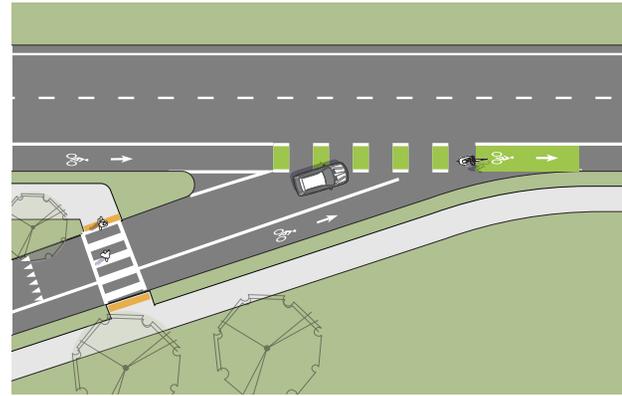
	RAMP CHARACTERISTICS			
	≤ 30 MPH	≥ 30 MPH	RAMP TO / FROM AUXILIARY LANE	MULTIPLE LANE RAMP
BICYCLE PRIORITY DESIGN	☑	☑	EJ	EJ
BICYCLE YIELD DESIGN	X	☑	X	X
GRADE SEPARATED	X	EJ	EJ	EJ

Legend

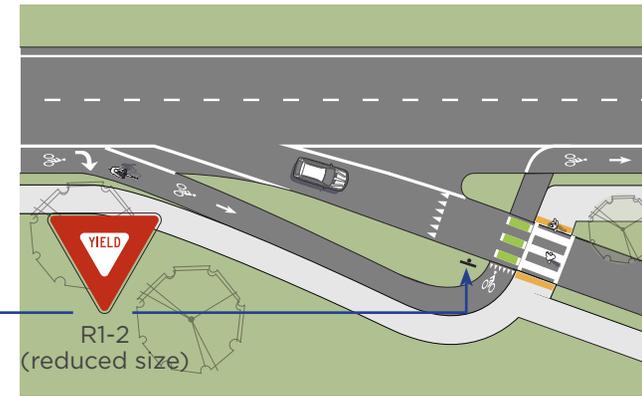
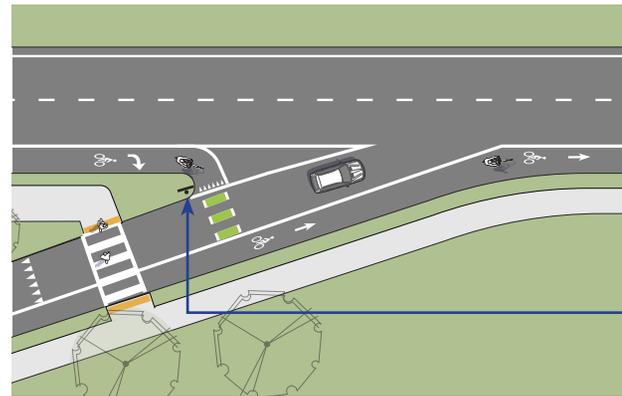
- ☑ = Most Desirable
- EJ = Engineering Judgment
- X = Not Recommended

Grade-separated crossings are preferred over at-grade crossings to offer low-stress crossings of high-speed interchange ramps. Grade separation designs utilizing a bicycle path should be considered if the approach ramp elevations are appropriate and if both bicyclist and motorist traffic volumes are high.

Bicycle priority designs require motorists to yield to bicyclists when merging across the bicycle lane. Use green colored pavement to highlight this weaving area.



A lower-stress design prioritizes bicyclist comfort over bicyclist delay. Bicyclists must yield to entering or exiting motorists and proceed when clear. These designs may allow confident bicyclists to opt-out of the jughandle maneuver if desired.



FURTHER CONSIDERATIONS

- High-speed ramp style lanes are challenging for bicyclists. The AASHTO *Bike Guide* notes that designs that encourage high-speed and/or free-flowing traffic movements are the most difficult for bicyclists to negotiate (p. 4-57). At ramp lanes where merge distance is long “it may be appropriate to provide a design that guides bicyclists in a manner that provides a short distance across the ramp at close to a right angle, and a crossing in an area where sight lines are good and drivers’ attention is not entirely focused on merging with traffic,” (p. 4-60).

MAINTENANCE

Bicycle lanes, including separated jughandle alignments, should be cleared of snow through routine snow removal operations.

REFERENCES

AASHTO. *Guide for the Development of Bicycle Facilities*. 2012.

DIRECTIONAL SEPARATED BIKE LANE CROSSINGS

The FHWA *Separated Bike Lane Guide* offers a range of intersection designs for creating safe interactions at intersections with separated bike lanes.

Like bike lanes, the primary design objectives of separated bike lanes at intersections are to provide adequate lines of sight, minimize exposure to conflicts, reduce speeds at conflict points, communicate right-of-way priority, and maximize comfort for bicyclists.

TYPICAL APPLICATION

- A variety of design treatments exist depending on the configuration of the separated bike facility, available right-of-way, right turn volume, and presence of a signal.
- Beyond 150 turning vehicles per hour, consider offering a protected bicycle signal phase (FHWA *Multimodal Networks* 2016, p. 97).

TABLE A.4 - DIRECTIONAL SEPARATED BIKE LANE CROSSING TREATMENT SELECTION QUICK REFERENCE

	PEAK HOUR RIGHT TURN VOLUME		
	< 50 VEH/HR	50-150 VEH/HR	> 150 VEH/HR
MIXING ZONE	☑	☑	X
ADJACENT CROSSING	☑	☑	EJ
SEPARATED CROSSING	☑	☑	EJ
PROTECTED BICYCLE SIGNAL PHASE	X	EJ	☑

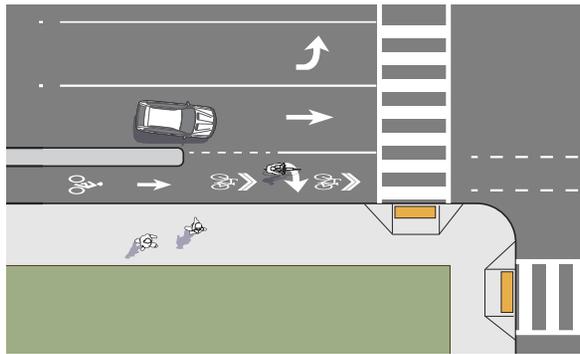
Legend

- ☑ = Most Desirable
- EJ = Engineering Judgment
- X = Not Recommended

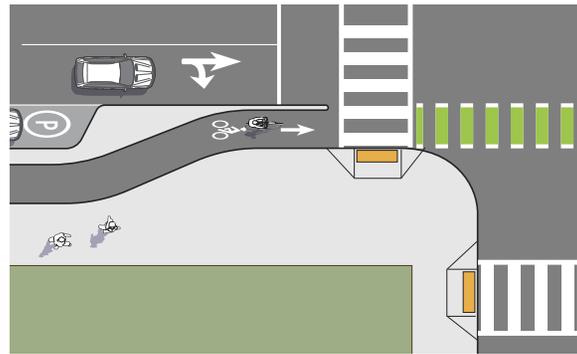
DESIGN FEATURES

Potential bicycle lane intersection treatments include:

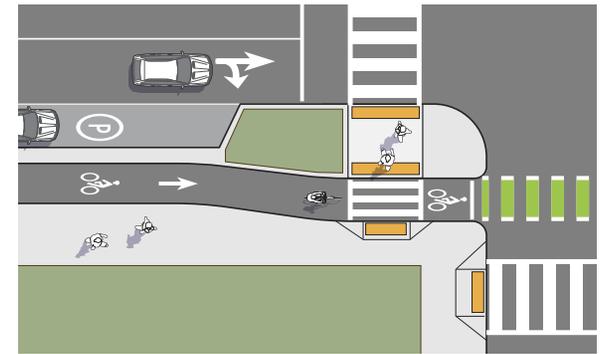
- Mixing zones (Combined bike lane/turn lane) in advance of the intersection.
- An adjacent crossing, immediately adjacent to the nearest travel lane to promote visibility prior to the turn.
- A separated crossing, where additional separation from the nearest travel lane provides motorists with space to yield to crossing bicyclists.
- Protected bicycle signal phasing, where all conflicting movements are prohibited with a red signal indication.



A mixing zone creates a shared travel lane where turning motor vehicles yield to through traveling bicyclists. All users negotiate potential conflict upstream of the intersection.



To increase the visibility of bicyclists by turning motorists prior to the turn, an adjacent crossing (also called “bend-in”) laterally shifts the separated bikeway adjacent to the turning lane.



A separated crossing (also called a “bend-out”) maintains or increases physical separation of the bike lane far into the intersection and provides a space for motor vehicles to yield to bicyclists and pedestrians.



R4-4 and R3-7R should be used in conjunction with Mixing Zone treatments.



R10-15 (modified) and R10-11 are to be used in conjunction with both Adjacent and Separated Crossing treatments.

FURTHER CONSIDERATIONS

- On separated bikeways, bicyclists are often unable to merge into traffic to turn left due to physical separation, a two-stage turn box can formalize a “pedestrian style” left turn. Refer to the FHWA *Separated Bike Lane Guide* for guidance on Two-Stage Turn Boxes (p. 125).
- At signalized intersections with very high right turn volumes or multiple right-turn-only lanes, a bicycle signal face and protected bicycle signal phase should be used to remove conflicts entirely. Refer to FHWA *Interim Approval 16* for more information on bicycle signal faces.

MAINTENANCE

Separated bike lanes should be cleared of snow and other debris across the entire width of the facility.

REFERENCES

FHWA. *Achieving Multimodal Networks*. 2016.
 FHWA. *Separated Bike Lane Planning and Design Guide*. 2015.
 FHWA MUTCD. *Interim Approval for Optional Use of a Bicycle Signal Face (IA-16)*. 2013.



BIDIRECTIONAL SEPARATED BIKE LANE CROSSINGS

Bidirectional separated bike lanes feature complex interactions at intersections and driveways.

Most of the treatments featured in the FHWA *Separated Bike Lane Guide* apply to bidirectional separated bike lanes.

TYPICAL APPLICATION

- Because of the added complexity of bidirectional facilities, the recommended turning volume criteria for considering protected signalization is 100 right turning vehicles per hour.

DESIGN FEATURES

Potential bicycle lane intersection treatments include:

- An adjacent crossing, immediately adjacent to the nearest travel lane to promote visibility prior to the turn
- A separated crossing, where additional separation from the nearest travel lane provides motorists with space to yield to crossing bicyclists

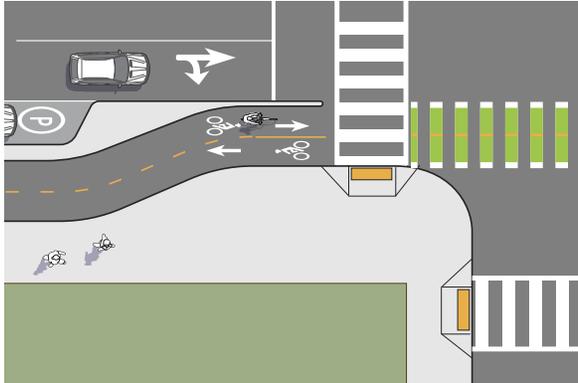
TABLE A.5 - BIDIRECTIONAL SEPARATED BIKE LANE CROSSING TREATMENT SELECTION QUICK REFERENCE

	PEAK HOUR RIGHT TURN VOLUME		
	< 50 VEH/HR	50-100 VEH/HR	> 100 VEH/HR
ADJACENT CROSSING	☑	☑	EJ
SEPARATED CROSSING	☑	☑	EJ
PROTECTED BICYCLE SIGNAL PHASE	X	EJ	☑

Legend
 ☑ = Most Desirable
 EJ = Engineering Judgment
 X = Not Recommended

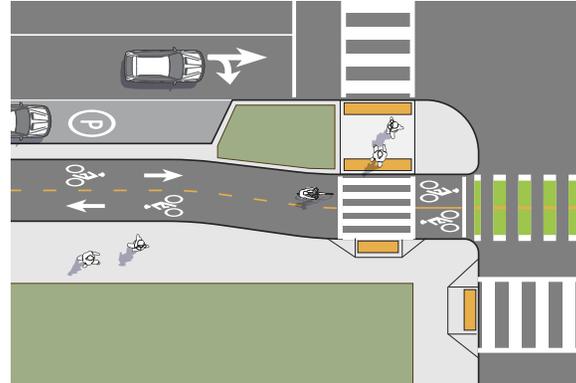
At uncontrolled crossings, bidirectional separated bike lanes face similar operational issues as Sidepaths. Refer to the section on Sidepath Crossings in this guide for more information on design strategies at those locations.

ADJACENT CROSSING



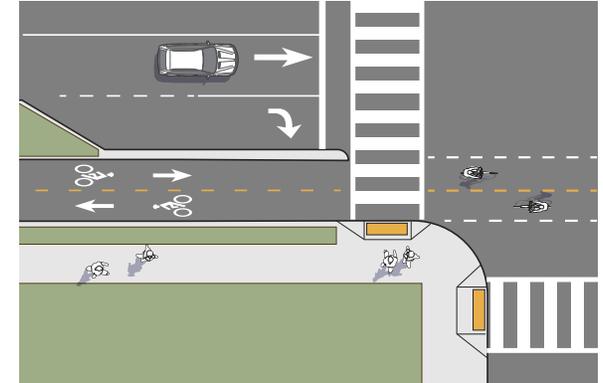
To increase the visibility of bicyclists by turning motorists prior to the turn, an adjacent crossing (also called “bend-in”) laterally shifts the separated bikeway immediately adjacent to the turning lane.

SEPARATED CROSSING



A separated crossing (also called a “bend-out”) maintains or increases physical separation of the bike lane far into the intersection and provides a space for motor vehicles to yield to bicyclists and pedestrians.

PROTECTED SIGNAL PHASE



At signalized intersections with high right turn volumes (over 100 veh/hr), a dedicated right turn lane and protected right turn signal phase should be provided.

FURTHER CONSIDERATIONS

- At signalized intersections, left turns across bidirectional separated bike lanes should be provided a protected signal phase.
- On separated bikeways, bicyclists are often unable to merge into traffic to turn left due to physical separation, a two-stage turn box can formalize a “pedestrian style” left turn. Refer to the FHWA *Separated Bike Lane Guide* for guidance on Two-Stage Turn Boxes (p. 125).
- At signalized intersections with very high right turn volumes or multiple right-turn-only lanes, a bicycle signal face and protected bicycle signal phase should be used to remove conflicts entirely. Refer to FHWA *Interim Approval 16* for more information on bicycle signal faces.

MAINTENANCE

Separated Bike Lanes, both at-grade with the adjacent roadway, or grade separated, should be cleared of snow and other debris across the entire width of the facility.

REFERENCES

FHWA. *Separated Bike Lane Planning and Design Guide*. 2015.
 FHWA MUTCD. *Interim Approval for Optional Use of a Bicycle Signal Face (IA-16)*. 2013.

SIDEPATH CROSSINGS

Sidepaths can provide a high degree of comfort on long uninterrupted roadway segments but have operational and safety concerns at driveways and intersections with cross streets.

Crossings should be designed to promote awareness, lower speeds, and facilitate proper yielding of motorists to bicyclists and pedestrians.

TYPICAL APPLICATION

- At controlled and uncontrolled sidepath crossings of driveways or minor streets.
- To increase the predictability of sidepath and road user behavior through clear, unambiguous right-of-way priority.

TABLE A.6 - SIDEPATH CROSSING TREATMENT SELECTION QUICK REFERENCE

Legend

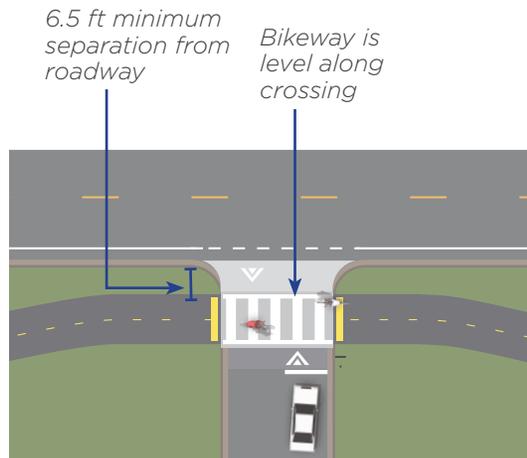
- = Most Desirable
- EJ = Engineering Judgment
- X = Not Recommended

	≤ 35		≥ 40 MPH
	CONSTRAINED ROW OR LIMITED SIGHTLINES	WIDE ROW	
SEPARATED CROSSING (16.5 FT)	EJ	<input checked="" type="checkbox"/>	EJ
DECELERATED LANE WITH ADJACENT CROSSING (6.5 FT)	X	EJ	<input checked="" type="checkbox"/>

DESIGN FEATURES

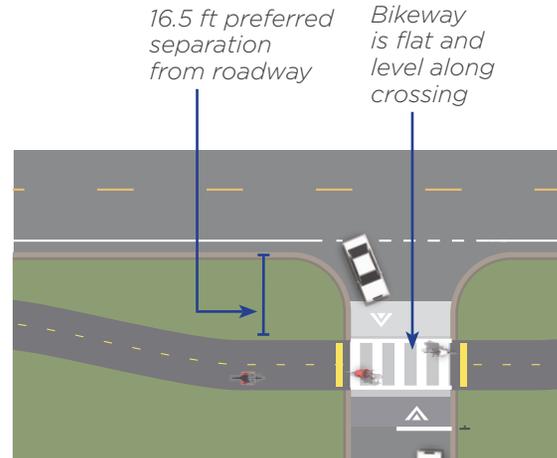
- The sidepath should be given the same priority as the parallel roadway at all uncontrolled crossings. Geometric design should support this priority by providing clear sight triangles for all approaches of the crossing.
- Maintain physical separation to the crossing of 16.5 ft, 6.5 ft min. (Schepers 2011). As speeds on the parallel roadway increase, so does the preference for wider separation distance.
- Maintain a level surface for the sidepath through the crossing, potentially as a type of raised crosswalk.
- A high-visibility crosswalk marking is recommended to indicate the through area of the crosswalk.
- Turning Vehicles Yield to Pedestrians sign (R10-15) is recommended in advance of turns across sidepath crossings to remind motorists to yield to path users.

ADJACENT SIDEPATH CROSSING



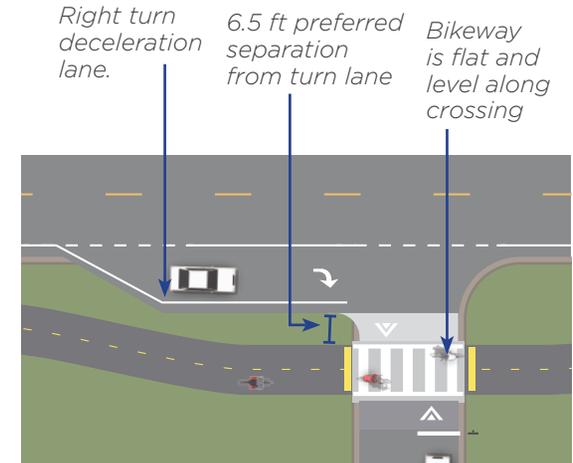
Where space is constrained or sight distance is limited, an adjacent crossing can promote visibility of path users.

SEPARATED SIDEPATH CROSSING



Where space is available, a separated crossing provides room for most motorists to yield to path users outside of the flow of through traffic.

WITH DECELERATION LANE



On high-speed roadways, a deceleration lane is recommended to allow motorists to slow down as needed to yield to path users.

FURTHER CONSIDERATIONS

- At regular driveways, sidepaths should remain level, similar to a raised crosswalk, but no tactile warnings should be used. Crosswalk markings and crossing signs are not required unless considered necessary.

MAINTENANCE

Sidepaths should be cleared of snow through routine snow removal operations.

REFERENCES

Schepers, J.P., Kroeze, P.A., Sweers, W., Wust, J.C., 2011. "Road factors and bicycle-motor vehicle crashes at unsignalized priority intersections." *Accident Analysis and Prevention*, 43(3), 853-861.

BIKE BOX

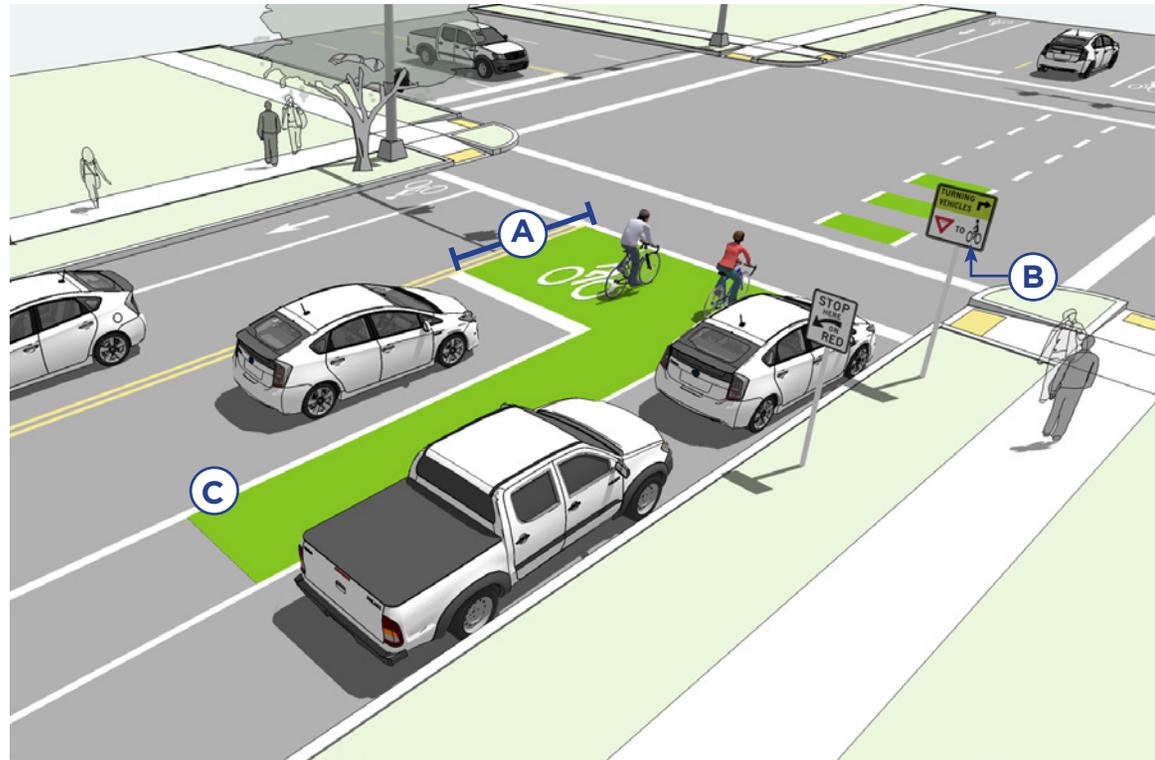
A bike box is an experimental treatment, designed to provide bicyclists with a safe and visible space to get in front of queuing traffic during the red signal phase. Motor vehicles must queue behind the white stop line at the rear of the bike box. On a green signal, all bicyclists can quickly clear the intersection.

TYPICAL APPLICATION

- Bike boxes should be used at signalized intersections with high bicycle volumes and high vehicle volumes.

DESIGN FEATURES

- A** 14 ft minimum depth from back of crosswalk to motor vehicle stop bar. (*NACTO*, 2012)
- B** A “No Turn on Red” (*MUTCD R10-11*) or “No Right Turn on Red” (*MUTCD R13A*) sign shall be installed overhead to prevent vehicles from entering the Bike Box (refer to *CVC 22101* for the signage). A “Stop Here on Red” (*MUTCD R10-6*) sign should be post mounted at the stop line to reinforce observance of the stop line.
- C** A 50 ft ingress lane should be used to provide access to the box.
 - Use of green colored pavement is optional.





A bike box allows for cyclists to wait in front of queuing traffic, providing high visibility and a head start over motor vehicle traffic.

FURTHER CONSIDERATIONS

- This treatment positions bicycles together and on a green signal, all bicyclists can quickly clear the intersection, minimizing conflict and delay to transit or other traffic.
- Pedestrians also benefit from bike boxes, as they experience reduced vehicle encroachment into the crosswalk.
- There are potential areas of conflict between bicyclists and turning vehicles, such as right or left turn locations.

REFERENCES

Monsere, C. & Dill, J. "Evaluation of Bike Boxes at Signalized Intersections. Final Draft." Oregon Transportation Research and Education Consortium. 2010.

TWO-STAGE TURN BOXES

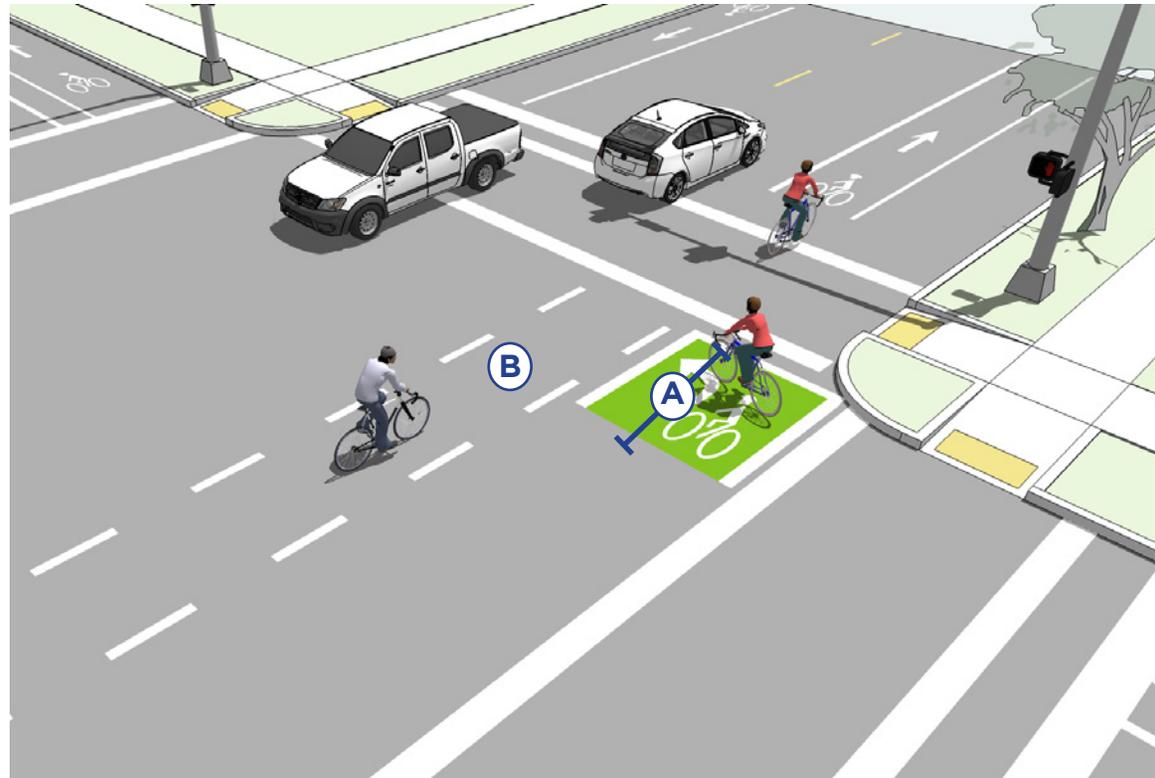
Two-stage turn boxes offer bicyclists a safe way to make turns at multi-lane signalized intersections from a physically separated or conventional bike lane. On physically separated bike lanes, bicyclists are often unable to merge into traffic to turn due to physical separation, making the provision of two-stage turn boxes critical.

TYPICAL APPLICATION

- At the intersections of streets with multi-lane roads with high vehicle speeds and/or traffic volumes and a signalized intersections.
- At signalized intersections with a high number of bicyclists making a left turn from a right side facility.

DESIGN FEATURES

- Ⓐ The two-stage turn box shall be placed in a protected area. Typically, this is within the shadow of an on-street parking lane or protected bike lane buffer area and should be placed in front of the crosswalk to avoid conflict with pedestrians.
- Ⓑ 8 ft by 6 ft preferred depth of bicycle storage area (6 ft by 3 ft minimum).
 - Bicycle stencil and turn arrow pavement markings shall be used to indicate proper bicycle direction and positioning (*NACTO*, 2012).



JUGHANDLE TURN BOX



This MUTCD compliant design carves a jughandle out of the sidewalk to provide space for waiting bicyclists.

SEPARATED BIKE LANE TURN BOX



On separated bike lanes, the two-stage turn box can be located in the protected buffer/parking area.

FURTHER CONSIDERATIONS

- Consider providing a “No Turn on Red” (*MUTCD R10-11*) on the cross street to prevent motor vehicles from entering the turn box.
- This design formalizes a maneuver called a “box turn” or “pedestrian style turn.”
- Some two-stage turn box designs are considered experimental by FHWA.
- Design guidance for two-stage turns apply to both bike lanes and separated bike lanes.
- Two-stage turn boxes reduce conflicts in multiple ways: from keeping bicyclists from queuing in a bike lane or crosswalk and by separating turning bicyclists from through bicyclists.
- Bicyclist capacity of a two-stage turn box is influenced by physical dimension (how many bicyclists it can contain) and signal phasing (how frequently the box clears).

REFERENCES

Monsere, C. & Dill, J. “Evaluation of Bike Boxes at Signalized Intersections. Final Draft.” Oregon Transportation Research and Education Consortium. 2010.



This roundabout with a separated bikeway and sidewalk help reduce conflicts between motorists and bicycle riders.

FURTHER CONSIDERATIONS

- The publication Roundabouts: Informational Guide states, “it is important not to select a multilane roundabout over a single-lane roundabout in the short term, even when long-term...traffic predictions” (*NCHRP* 2010, p 6-71).
- Other circulatory intersection designs exist, but they function differently than the modern roundabout. These include:
 - » Traffic circles (also known as rotaries) are old-style circular intersections used in some cities in the US where traffic signals or stop signs are used to control one or more entry.
 - » Neighborhood Traffic Circles are small-sized circular intersections of local streets with high pedestrian usage and less than 3,500 ADT. They may be uncontrolled or stop controlled and do not channelize entry. (See PennDOT *Pub. 414* for additional guidance.)

REFERENCES

Monsere, C. & Dill, J. (2010). “Evaluation of Bike Boxes at Signalized Intersections. Final Draft.” Oregon Transportation Research and Education Consortium. 2010.
 PennDOT. *Pennsylvania’s Traffic Calming Handbook (PUB 383)*. 2012

PROTECTED INTERSECTION

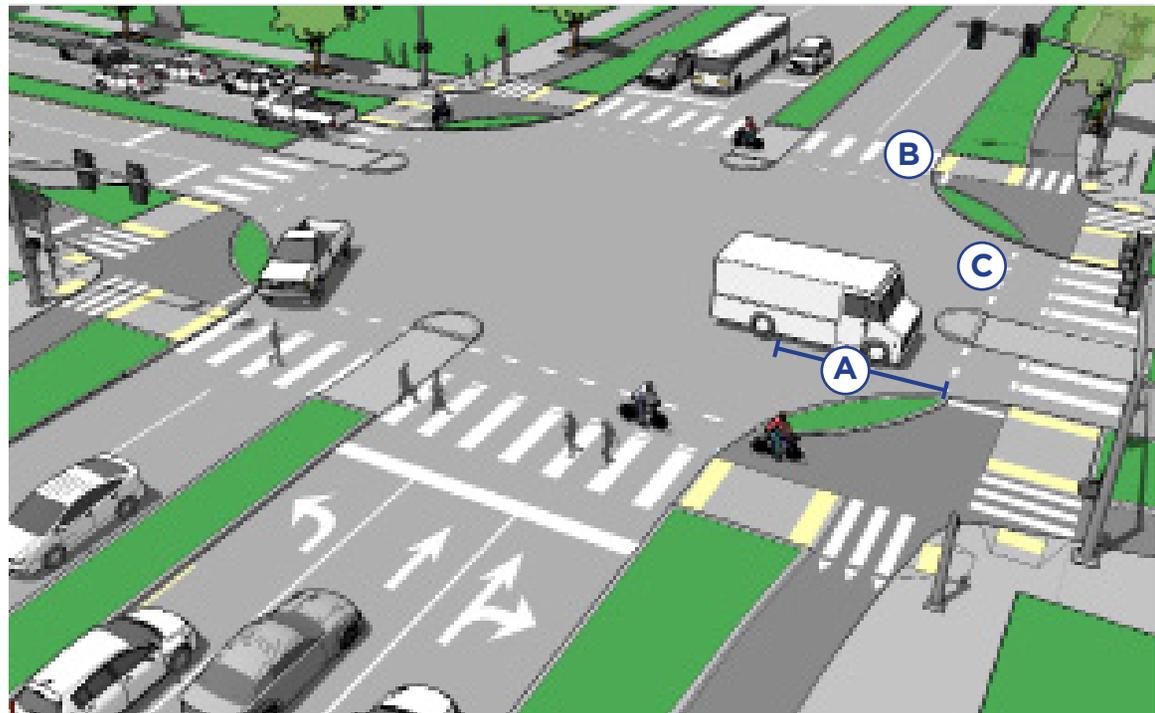
A protected intersection uses a collection of intersection design elements to maximize user comfort within the intersection and promote a high rate of motorists yielding to people bicycling. The design maintains a physical separation within the intersection to define the turning paths of motor vehicles, slow vehicle turning speed, and offer a comfortable place for people bicycling to wait at a red signal.

TYPICAL APPLICATION

- Streets where two separated bicycle lanes intersect and are protected by wide buffer or on-street parking.
- Helps reduce conflicts between right-turning motorists and bicycle riders by reducing turning speeds and providing a forward stop bar for bicycles and may reduce pedestrian crossing distance.

DESIGN FEATURES

- A** Setback bicycle crossing of 16.5 ft allows for one passenger car to queue while yielding. Smaller setback distance is possible in slow-speed, space constrained conditions.
- B** Corner safety island with a 15 to 20 ft corner radius slows motor vehicle speeds. Larger radius designs may be possible when paired with a deeper setback or a protected signal phase, or small mountable aprons. Two-stage turning boxes are provided for queuing bicyclists adjacent to corner islands.
- C** Use intersection crossing markings.





Protected intersections feature a corner safety island and intersection crossing markings.



Protected intersections incorporate queuing areas for two-stage left turns.

FURTHER CONSIDERATIONS

- Pedestrian crosswalks may need to be further set back from intersections in order to make room for two-stage turning queue boxes.
- Wayfinding and directional signage should be provided to help bicycle riders navigate through the intersection.
- Colored pavement may be used within the corner refuge area to clarify use by people bicycling and discourage use by people walking or driving.
- Intersection approaches with high volumes of right turning vehicles should provide a dedicated right turn only lane paired with a protected signal phase. Protected signal phasing may allow different design dimensions than are described here.

REFERENCES

Schepers, et al. "Road Factors and Bicycle-Motor Vehicle Crashes at Unsignalized Priority Intersections." *Accident Analysis & Prevention*. 2011.

GRADE SEPARATED CROSSINGS

Overcrossings and undercrossings provide critical non-motorized system links by joining areas separated by barriers, such as deep canyons, waterways, or major transportation corridors. In most cases, these structures are built in response to user demand for safe crossings where they previously did not exist.

TYPICAL APPLICATION

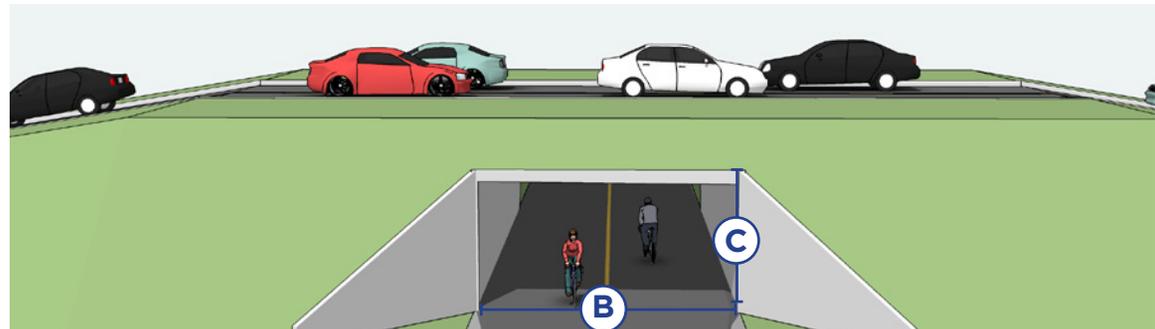
- The AASHTO *Bike Guide* recommends the use of grade separated crossings to provide continuity of a shared use path where a barrier exists.
- There are no minimum roadway characteristics for considering grade separation. Depending on the type of facility or the desired user group grade separation may be considered in many types of projects.



Typical Overcrossing

DESIGN FEATURES

- Ⓐ Clear width should allow 2 ft of clearance on each side of the pathway. Under constrained conditions, a bridge may taper to the pathway width (AASHTO 2012).
 - 10 ft headroom on overcrossings; clearance below will vary depending on feature being crossed: Roadway: 17 ft, Freeway: 18.5 ft, Heavy Rail Line: 23 ft.
- Ⓑ For undercrossings, 14 ft minimum width, greater widths preferred for lengths over 60 ft in constrained conditions.
- Ⓒ For undercrossings, there is a 10 ft minimum height, and a balanced proportion of 1.5:1 width to height is desired.



Typical Undercrossing



This overpass helps children cross a busy street at a midblock location.



A well-proportioned undercrossing feels open and safe.

FURTHER CONSIDERATIONS

- If overcrossings have any scenic vistas, additional width should be provided to allow for stopping.
- Overpasses require a minimum of 17 ft of vertical clearance to the roadway below versus a minimum elevation differential of around 12 ft for an underpass. This results in potentially greater elevation differences and much longer ramps for bicycles and pedestrians to negotiate.
- Overpasses for bicycles and pedestrians typically fall under the Americans with Disabilities Act (ADA), which strictly limits ramp slopes to 5% (1:20) with landings at 400 ft intervals, or 8.33% (1:12) with landings every 30 ft (*PROWAG*).
- Safety is a major concern with underpasses. Shared use path users may be temporarily out of sight from public view and may experience poor visibility themselves. To mitigate safety concerns, an underpass should be designed to be spacious, well-lit, equipped with emergency cell phones at each end and completely visible for its entire length from end to end (*AASHTO 2012*).

MAINTENANCE

Poorly maintained undercrossings can create unsafe feeling conditions, discouraging use. Grade separated crossings should be cleared of snow and other debris across the entire width of the facility.

REFERENCES

AASHTO. *Guide for the Development of Bicycle Facilities*. 2012.
 US Access Board. *Proposed Guidelines for Pedestrian Facilities in the Public Right-of-Way*. 2011.

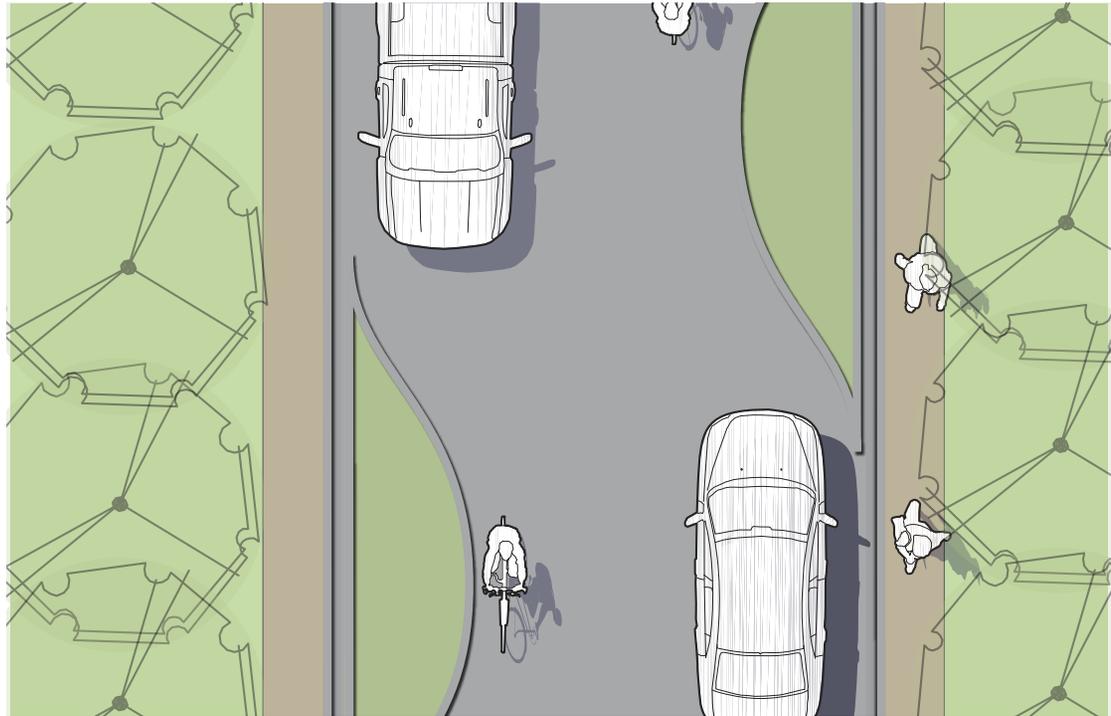
HORIZONTAL TRAFFIC CALMING

Horizontal traffic calming devices cause drivers to slow down by constricting the roadway space or by requiring careful maneuvering.

Such measures may reduce the design speed of a street and can be used in conjunction with reduced speed limits to reinforce the expectation of lowered speeds.

TYPICAL APPLICATION

- Raised Intersections are typically used in city centers and high commercial areas with high pedestrian activity, at the intersection of local and/or collector streets with less than 10,000 ADT.
- Bulb-outs can be used at intersections or mid block crossings.
- Chicanes are best used on local streets with less than 3,500 ADT for they significantly reduce speed and volume.



DESIGN FEATURES

- For all features, maintain a minimum clear width of 20 ft for two lanes of travel (or 28 ft with parking on both sides), with a constricted length of at least 20 ft in the direction of travel.
- Raised Intersections are intersections and crosswalks raised 3-6 in above street level with gently sloped ramps to the street.
- Bulb-outs reduce the crossing distance for pedestrians and protect parked cars.
- Chicanes are a series of raised or delineated curb extensions, edge islands, or parking bays on alternating sides of a street, forming an “S”-shaped curb, which reduce vehicle speeds by requiring motorists to shift laterally through narrowed travel lanes.
- Pinchpoints are curb extensions placed on both sides of the street, narrowing the travel lane and encouraging all road users to slow down. When placed at intersections, pinchpoints are known as chokers or neckdowns. They reduce curb radii and further lower motor vehicle speeds.

CHICANES



BULB-OUTS



RAISED INTERSECTIONS



(Credit: NACTO)

FURTHER CONSIDERATIONS

- All treatments should take into account average daily traffic (ADT) counts.

MAINTENANCE

Debris and snow should be removed from treatments.

REFERENCES

PennDOT. *Pennsylvania's Traffic Calming Handbook* (PUB 383). 2012.

THIS PAGE IS INTENTIONALLY LEFT BLANK

EXISTING PLAN REVIEW

APPENDIX



WHAT WOULD M...
EXPERIENCE ON...

WALKING INFRASTRUCTURE

EXISTING PLAN REVIEW

To understand the existing planning efforts in Lancaster County and provide a basis for new recommendations, 22 plans were reviewed. Many of the plans contained detailed descriptions or graphics of existing conditions or recommendations. The existing conditions discovered during the plan review were key areas of tourism and historical importance, while the recommendations were primarily facility related.

TABLE B.1 - PLANS REVIEWED

<i>Plans Reviewed</i>	<i>Year Adopted</i>	<i>Page</i>
Lancaster County and LIMC		
places2040	2018	B-26
Lancaster County Comprehensive Plan		
Balance: the Growth Management Element	2006	B-3
Choices: the Housing Element	2006	B-4
Tourism: the Strategic Tourism Element	2005	B-5
Connections 2040: The Transportation Element	2016	B-6
Heritage: the Cultural Heritage Element	2006	B-8
Blueprints: the Water Resources Element	2012	B-8
Greenscapes: the Green Infrastructure Element	2009	B-9
Lincoln Highway Streetscape Plan Phase 2	2015	B-24
Lancaster County: MOVING SMARTER: Harrisburg Pike Transportation and Land Use Study	2008	B-18
Lancaster County: Gateways Revitalization Strategy	2007	B-23
Growing Together: A Comprehensive Plan for Central Lancaster County	2006	B-12
Lancaster County Bicycle and Pedestrian Transportation Plan	2004	B-10
City of Lancaster		
Lancaster, PA Downtown Walkability Analysis	2015	B-13
City of Lancaster Green Infrastructure Plan	2011	B-20
Urban Parks, Recreation and Open Space Plan	2009	B-19
PennDOT		
Feasibility Study for Harrisburg Pike: Pedestrian Accommodations & Multi-Use Trail (Final Report)	2012	B-17

LANCASTER COUNTY BALANCE: THE GROWTH MANAGEMENT ELEMENT (EXECUTIVE SUMMARY & FULL REPORT 2006)

VISION

- Preserve treasured natural, cultural, historic, and architectural resources.
- Promote reinvestment in Lancaster City, the Boroughs, and developed areas in Townships' Urban Growth Areas.
- Expand housing choices and affordability in Growth Areas.
- Enhance character and form of development.
- Support conditions for a sustainable economy and agricultural industry.

GOALS

GOAL 1: An Enhanced Urban Growth Area Strategy, including a redevelopment strategy for Lancaster City, the Boroughs, and urbanized areas of Townships.

GOAL 2: A Rural Strategy to reduce sprawl; maintain and enhance agriculture; and protect natural, cultural, historic, and architectural resources.

GOAL 3: An Implementation Strategy designed to provide the County and municipalities with tools to implement the Urban Growth Area and Rural Strategies.

GOAL 4: Create targets for achieving Implementation.

RECOMMENDATIONS - INFRASTRUCTURE

Key approaches for Urban Growth Area Strategy:

- Focus transportation resources first on the Concentrated Building Areas and Core Reinvestment Areas.

- Establish or reestablish a grid network of streets, alleys, service roads, sidewalks and paths that provide safe, convenient transportation options within Urban Growth Areas.
- Municipalities should plan for future transit use, integrating it within the existing transportation system.
- Develop or retrofit non-motorized networks with a specific focus on providing opportunities for residents to access recreational amenities and other destinations within Urban Growth Areas.
- Update zoning and subdivision and land development ordinances so that the transportation component of future development is integrated with the existing community's transportation network.

Key approaches for Rural Transportation Strategy:

- Provide adequate shoulders for rural roads wherever feasible to decrease the potential for conflict between motorized vehicles and non-motorized vehicles, farm equipment, and bicyclists.
- Ensure that rural roads and bridges do not pose barriers to the movement of farm equipment and farm products.
- Modify locations on rural roads where hills, curves, and other obstructions make it difficult to see potential conflicts in the roadway ahead.

Key approaches for Designated Rural Centers:

- A grid network of streets, alleys, service roads, sidewalks and paths should be established that provide safe, convenient transportation options.
- Municipalities should plan for future transit use, integrating it within the existing transportation system and linking rural areas with urban areas.



RECOMMENDATIONS - POLICY

County Action Program to facilitate collaboration with municipalities, communities, and nonprofit groups for implementation of Balance:

- Cross-acceptance process with local officials for implementing land use designations.
- Converting the Smart Growth Toolbox into a web-based resource.
- Education, outreach, and technical assistance programs.
- New Economic Development Element of the Lancaster County Comprehensive Plan.
- Consistency Review of county and local plans, ordinances, and projects.

Smart Growth Funding Program for implementation, including:

- A new Lancaster County Smart Growth Grant Program.
- Targeting of all county funding to support Balance and other elements of the County's Comprehensive Plan.

Monitoring Program to measure implementation that includes:

- Upgrades to LCPC's Growth Tracking System to monitor progress towards achieving Balance's objectives and the availability of land in Urban Growth Areas.
- Growth Management Indicators to measure progress on key objectives and to determine future changes needed to the growth management program.

LANCASTER COUNTY CHOICES: THE HOUSING ELEMENT (EXECUTIVE SUMMARY & FULL REPORT 2006)

RECOMMENDATIONS - POLICY

- Promote development patterns that reduce the need for automobile travel, enhance neighborhood connectivity, and ensure low traffic in residential areas.
- Encourage non-vehicular transportation by requiring developments to provide walkways and bikeways and by providing incentives for locating development along bus and train routes.
- Support funding for mass transit and transportation-related enhancements to make communities safer, to reduce congestion, and to reduce motorized vehicular conflicts with pedestrians, bikes, and buggies.
- Support transit-oriented development and ride-share programs to more efficiently connect employees to jobs, while reducing traffic congestion, air pollution, and other transportation-related costs.
- Coordinate changes in development patterns with transportation investments.
- Changes in development patterns should be supported by investments in transportation including funding for mass transit. The County should ensure that transportation investments are consistent with and support changes in development patterns.

THE STRATEGIC TOURISM DEVELOPMENT ELEMENT (EXECUTIVE SUMMARY & FULL REPORT 2005)

GOALS

GOAL 1: Enhance visitor mobility and access through transportation improvements.

GOAL 2: Increase the quality of the visitor experience.

GOAL 3: Focus on overnight visitors for the greatest economic impact.

RECOMMENDATIONS - INFRASTRUCTURE

Enhance visitor mobility and access through transportation improvement actions:

- Create a seamless system of motorized and non-motorized linkage routes between designated Tourism Development Areas within Lancaster County.
- Create and enhance transportation linkages and facilities.
- Encourage non-fixed route transportation services.
- Improve conditions for non-motorized travel in designated Tourism Development Areas and Rural Resource-Based Tourism Areas.
- Expand parking facilities in designated Tourism Development Areas.
- Support the completion of the Paradise Station and improvements/ renovations to the Lancaster, Elizabethtown, and Mount Joy train stations.
- Publish a Facilities and Services Guide for bus drivers.

Increase the quality of the visitor experience:

- Develop pedestrian wayfinding programs in Designated Tourism Development Areas.

- Complete wayfinding program within the Lancaster-York Heritage Region and prioritize wayfinding signage in designated Tourism Development Areas and linkages.
- Establish and publicize a Countywide Scenic Byways program.
- Utilize “Context Sensitive Design” elements to plan transportation facilities in designated Tourism Development Areas and Rural Resource-Based Tourism Areas in the County.

Enhance existing and create new collaborative marketing initiatives and partnerships:

- Develop marketing partnerships between the City and the County, between the City and towns/villages, three state museums, and Discover Lancaster members to create new packages.
- Create more and new tourism packages that include the City.
- Take the lead in regional marketing to maximize the Discover Lancaster brand.
- Pursue cooperative marketing with transportation providers including Amtrak and bus operators.
- Market already-developed Heritage theme-based regional initiatives, such as the Quest for Freedom product.
- Support collaboration with higher education institutions to increase student and visitor spending within Lancaster County.

Focus on overnight visitors for the greatest economic impact.

- Promote Lancaster-York Heritage Region/Pennsylvania Dutch Country as a multi-day getaway.
- Create regional multi-day packaging opportunities.
- Create, develop and market multi-day thematic and geographic tours.
- Create hub-and-spoke itineraries of towns and villages for overnight stays/daily excursions.
- Engage personnel and technical resources to ensure the appropriate mechanisms are in place to “close the sale” on packages.



CONNECTIONS 2040: THE TRANSPORTATION ELEMENT (EXECUTIVE SUMMARY & FULL REPORT 2012)

VISION

- People— “Users first” philosophy
- Technology— Increases efficiency fairly and effectively
- System— Whole-system transportation thinking
- Modes— Real options available
- Energy and Environment— Used wisely
- Quality of Life— Communities and businesses thrive

GOALS

GOAL 1: Target transportation investments to support the Envision Lancaster County Vision, Goals and Strategies and the County’s Smart Growth Program.

GOAL 2: Maintain and improve the county’s multimodal infrastructure and services to provide an acceptable level of service.

GOAL 3: Improve safety and security for all users of the transportation system.

GOAL 4: Manage and operate the transportation system to reduce congestion.

GOAL 5: Ensure that transportation investments address protection of the county’s agricultural, natural, historic and cultural resources and environmental quality.

RECOMMENDATIONS - INFRASTRUCTURE

- Develop a transportation investment prioritization process to support County and municipal land use goals.
- Target transportation investments to support appropriate growth and development of Urban Growth Areas and support growth that is planned.
- Ensure that transportation programs in Rural Areas support rural land uses and their mobility and safety needs.
- Encourage transit-oriented development that includes high capacity transit stops/stations.
- Continue to implement PennDOT’s Smart Transportation Principles by coordinating and connecting land use and transportation.
- Continue to implement a Lancaster County Smart Growth Transportation Program to support economic development and promote alternatives to solo-driving in the county’s designated growth areas.
- Develop a Complete Streets Policy for the county that requires streets to be designed to safely and comfortably accommodate all users.
- Maintain highways on a recurring maintenance cycle.
- Continue to address the County’s growing backlog of substandard bridges.
- Plan for strategic capacity improvements that support economic development and improve system connectivity and accessibility.
- Improve public transit services through the development and implementation of SCTA’s transportation plan.
- Encourage local funding support of public transportation services to improve the extent and delivery of services.

- Improve intermodal connections between highway, transit, air, and rail modes to better serve residents and visitors.
- Support ongoing improvements to the County’s passenger rail system.
- Support ongoing improvements to the County’s rail freight system.
- Preserve, upgrade, and maintain pavement and navigational-related equipment at the county airport.
- Reduce the number of crashes and fatalities.
- Improve and maintain shoulders on the County’s roadway network (specifically on the County’s non-motorized priority network) in a context-sensitive manner.
- Upgrade or eliminate existing at-grade railroad crossings.
- Ensure compatible zoning for airport safety zones.
- Support safety education for all transportation modes.
- Work with PennDOT and emergency responders on emergency preparedness, as relates to the operation of vital transportation services and facilities.
- Develop safe and convenient bicycle and pedestrian accommodations for every type of trip and for all levels of ability.
- Implement the Regional Operations Plan (ROP) and deploy Intelligent Transportation Systems (ITS) equipment to better manage incidents and inform motorists.
- Improve the operation of highway intersections through the addition of turning lanes and improvement of traffic signals through signal timing, equipment upgrades, and signal coordination along key corridors.
- Improve the promotion of available public transportation and shared ride services and options.
- Promote alternatives to single occupant vehicle (SOV) use, such as transit, ridesharing, trolleys, and park-and-ride lots.
- Apply transportation design standards that consider community and environmental impacts through incorporation of context-sensitive solutions into projects.
- Meet federal air quality conformity standards with updated TIPs and LRTPs.
- Further integrate the planning and NEPA processes for early awareness and understanding of potential project issues among resource agencies through the use of the state’s new Linking Planning and NEPA process forms.
- Coordinate transportation planning and investment with the preservation, conservation, and promotion of heritage resources highlighted in the Lancaster County Comprehensive Plan.
- Use transportation to better manage stormwater and include “green streets” concepts in the development of a Complete Streets Policy for the county.



LANCASTER COUNTY: THE CULTURAL HERITAGE ELEMENTS (EXECUTIVE SUMMARY & FULL REPORT 2006)

GOALS

GOAL 1: Identify, conserve, and preserve the county's heritage resources as a basis for retaining and enhancing strong community character.

GOAL 2: Integrate the conservation and preservation of heritage resources in the economic development and revitalization of the county's towns, villages, and rural working landscapes.

GOAL 3: Ensure that new development respects and complements the patterns, character, and scale of the county's traditional communities and rural landscapes.

GOAL 4: Promote strong leadership, collaboration, awareness, and responsibility in the conservation of the county's heritage resources among the public, private, and nonprofit sectors.

GOAL 5: Celebrate and promote the county's heritage resources.

GOAL 6: Ensure that adequate financial resources and incentives are available to carry out the implementation of the county's heritage preservation goals.

BLUEPRINTS: THE WATER RESOURCES ELEMENT (EXECUTIVE SUMMARY & FULL REPORT 2012)

OBJECTIVES

Provide water, sewer, and stormwater infrastructure to accommodate 85% of future growth in Urban Growth Areas.

1. Deliver essential infrastructure services to both urban and rural settlements in a cost effective manner.
2. Reduce the number of miles of impaired streams.
3. Institutionalize Integrated Water Resources Management in Lancaster County.
4. Increase the use of green infrastructure in water resources management.

STRATEGIES:

1. Collaborate.
2. Accelerate Implementation of Existing Plans.
3. Improve Planning and Design.

OTHER TOOLS AND POLICIES

Blueprints includes several tools to assist municipalities with amending and adopting ordinances, including: A Model Stormwater Management Ordinance developed in accordance with the procedures outlined in PA Act 167; A Model Conservation Zoning District; and Natural Resource Protection Standards.

Amend Capital Projects and Maintenance Programs to make the best use of available resources, opportunities to incorporate watershed protection and restoration into capital projects and maintenance activities must be considered.

GREENSCAPES: THE GREEN INFRASTRUCTURE ELEMENT (EXECUTIVE SUMMARY & FULL REPORT 2009)

GOALS

GOAL 1: Preserve Lancaster County's exceptional natural resources.

GOAL 2: Conserve natural resources and services throughout Lancaster County's urban, suburban, and rural landscapes.

GOAL 3: Restore ecological connections and natural resource systems throughout Lancaster County's urban, suburban, and rural areas.

GOAL 4: Enhance the quality of life of residents through the provision of a diversity of easily accessible outdoor recreation opportunities and experiences.

RECOMMENDATIONS - INFRASTRUCTURE

- Central Susquehanna Forested Greenway/Upper Susquehanna Forested Greenway: Expand the upland natural habitat along the length of the Susquehanna River between the Conewago Creek and the Conestoga River. The expanded greenway would also provide outdoor recreational opportunities and connect municipalities along the river.
- Chiques Creek Greenway: Restore habitat to provide suitable habitat for plants and animals, to improve the water quality of Chiques Creek, and to provide a natural connection between

the Furnace Hills and the Susquehanna River through a predominantly agricultural and urban landscape.

- Cocalico Creek Greenway: This Conservation Greenway could incorporate undeveloped and underutilized land in and around Ephrata Borough and surrounding suburban areas, including the Cocalico Creek floodplain.
- Conestoga River Greenway: Preserve the remaining fragments with restoration of additional floodplain, wetland, and upland forest areas along the river and its tributaries. Habitat restoration could also provide an opportunity to expand recreational opportunities associated with the existing trail. The Conestoga Greenways River Corridor Conservation Plan, published by the Lancaster Inter-Municipal Committee (LIMC) in 1999, provides strategies to develop greenways along sections of the Conestoga River, Little Conestoga Creek, and the West Branch of the Little Conestoga Creek in central Lancaster County.
- Conewago Creek Greenway: The Conewago Creek Greenway is a proposed Ecological Greenway located between the Pennsylvania Turnpike and the Susquehanna River.
- Lititz Run Greenway: The Lititz Run Greenway is a proposed conservation Greenway that follows the stream corridor and incorporates its tributaries to the northeast.
- Mill Creek Greenway: Mill Creek is a proposed Conservation Greenway connecting the Welsh Mountain Hub with the Conestoga River Greenway and the Susquehanna River.
- Mine Ridge Greenway: The Mine Ridge Greenway is a proposed Ecological Greenway that follows a ridgeline of undulating hills that runs east-west across the southern part of Lancaster County and supports a significant series of upland forested habitats.



LANCASTER COUNTY BICYCLE AND PEDESTRIAN TRANSPORTATION PLAN (2004)

VISION

Lancaster County will be a place where people can safely and conveniently walk or bicycle everywhere.

GOALS

GOAL 1: Transportation improvements.

GOAL 2: Education.

GOAL 3: Multimodal access.

GOAL 4: Communications.

RECOMMENDATIONS - INFRASTRUCTURE

Improve the system of bicycle and pedestrian accommodations that extend throughout Lancaster County. The Lancaster County Bicycle and Pedestrian System is divided into these goals:

- Incorporate pedestrian and bicycle facilities as standard features in all transportation improvement projects.
- Implement the Pilot Projects listed in this Plan.
- Establish an ongoing program to eliminate critical gaps in the network through independent retrofit projects.
- Improve pedestrian conditions through the active involvement of boroughs, townships, and neighborhoods throughout the County.
- Employ new design strategies to improve pedestrian and bicycle access throughout the County.

- Augment the on-road network with high quality off-road paths that offer novice cyclists an opportunity to become more confident, and provide pedestrians with a car-free alternative.

Maintain bicycle and pedestrian facilities and multimodal access.

- Implement safety improvements (sidewalks, crosswalks, etc.) for pedestrians and bicyclists near transit stops in the County.
- Establish minimum standards for bicycle and sidewalk facilities near transit stops and stations.
- Conduct a field study of bicycle and pedestrian access to all transit stops and stations.

Provide facilities for the security and comfort of bicyclists and pedestrians at transit stops and stations.

- Provide secure bike parking at transit stops and stations.
- Provide comfortable facilities for people waiting at transit hubs.

Promote land use decisions that make it more convenient to bicycle and walk to transit and other destinations.

- Adopt zoning policies and subdivision regulations that make it easier to bicycle and walk in Lancaster County.
- Ensure a bicycle- and pedestrian-oriented focus in Lancaster County's Urban and Village Growth Areas.

Incorporate bicycle and pedestrian accommodations into county and municipal policies and development procedures.

- Lancaster County Municipalities should adopt the PennDOT Bicycle and Pedestrian Checklist.

- Update County and municipal roadway and subdivision and land development ordinances to include better accommodations for bicyclists and pedestrians.
- Establish minimum Bicycle Level of Service standards for Lancaster County roadways.
- Establish sidewalk requirements for Lancaster County roadways.

RECOMMENDATIONS - POLICY

Implement a pedestrian and bicycle safety education program for elementary school students.

- Develop a Pedestrian and Bicycle Safety Education Program in Lancaster County and offer the program as a pilot.
- Seek highway safety funds for bicycle and pedestrian safety programs.

Conduct a Bicycle and Pedestrian Safety Awareness Campaign.

- Encourage all driver education and traffic school classes to devote more time to teaching safe operating behavior around bicycles and pedestrians.
- Distribute brochures and make public safety announcements about safe operating behavior near bicyclists and pedestrians.
- Develop educational messages for bicyclists and pedestrians, and communicate them throughout the County.
- Increase police enforcement of safe driver behavior around pedestrians and bicyclists and safe vehicle operation by bicyclists. LCPC should work with municipal police departments.

- Seek support from local governments for the Lancaster County Bicycle and Pedestrian System.
- Increase community involvement in bicycling and walking issues, and expand BPAC's ability to communicate its message about improving Lancaster County for pedestrians and bicyclists.
- Establish programs to increase the awareness of bicycling and walking in the school community, and encourage more kids to bicycle and walk regularly.
- Promote bicycling and walking to Lancaster County organizations.
- Distribute the Lancaster County Bike Map throughout the County.
- Promote Lancaster County as a place where people can tour historic sites on foot and as a premier destination for bicycle vacations.



GROWING TOGETHER: A COMPREHENSIVE PLAN FOR CENTRAL LANCASTER COUNTY (2006)

GOALS

GOAL 1: Public Transportation (PT) An easily accessible, efficient, and affordable public transportation system will be available to improve access to homes, jobs, shopping, attractions, and recreation.

GOAL 2: Alternative Transportation (AT) A planned, interconnected, and safe network of alternative transportation options will be developed to move people and goods.

RECOMMENDATIONS - INFRASTRUCTURE

- Summary of public transportation system: Work with local and federal systems and funding resources to create an efficient system. Communicate the system through maps, public awareness and media to promote the system. Prompt the system through construction of park-and-rides, and through zoning ordinances to allow room for future systems.
- Summary of alternative transportation working with PennDOT and LCPC:
 - » Improve and upgrade existing bike and pedestrian system, including crosswalks.
 - » Promote an alternative transportation system within developments.
 - » Connect important nodes with the alternative transportation system.
 - » Educate the public about safety and available systems.

LANCASTER, PA DOWNTOWN WALKABILITY ANALYSIS (2015)

RECOMMENDATIONS - INFRASTRUCTURE

- Narrow DT Lancaster travel lanes (from 12–15' to 10') shared and consolidate lanes.
 - » Narrow lane width along Mulberry, Charlotte, Prince, Queen, S. Duke, Church, N. Broad, James, Lemon, Walnut, Chestnut, Orange, King, and Chesapeake Streets, Hershey Ave., and Harrisburg Pk.
- One way to two-way.
 - » Mulberry and Charlotte Streets to be converted to two-way.
 - » Other suggested pairs: Walnut and Chestnut, Queen and Prince, King and Orange Streets.
- Limited use and length of turn lanes; avoid swooping geometries
 - » Reconfigure King and Orange Streets to have two-lanes of traffic and eliminate all extra turn lanes.
 - » Shorten turn lanes at Prince & King, King & Queen, Orange & Queen, Duke & Vine, Prince & Orange Streets.
- Include bike lanes
- Continuous on-street parking
- Continuous street trees
- Replace unwarranted signals with all-way stop signs
- Proper crosswalks, signals, and lighting
 - » Particularly along Prince, Queen, Duke, Orange, and King Streets

DETAILED RECOMMENDATIONS - INFRASTRUCTURE

MULBERRY ST (PHASED):

After rebuild, 10-foot two-way, bike lane 6 feet wide, parking lane adjacent to the bike lane 8 feet wide. Once Charlotte receives its southbound bike lane, the sharrow decals on Mulberry should be allowed to disappear. Eliminate the left-hand turn lane south of the Harrisburg Pike. This change allows perhaps 8 additional parking spaces to be placed on the west curb.

CHARLOTTE ST:

Rebuild or restripe Charlotte Street with 10-foot driving lanes (combining both if possible into a single 20-foot facility), a 6-foot bike lane, and two striped parking lanes. Make the parking lanes 7 feet minimum. As carpath widens beyond 40 feet, add extra width to the parking lane adjacent to the bike lane. Beyond 41 feet, expand the opposite parking lane. Beyond 42 feet, expand both equally

WATER ST:

Consistently at its intersections with King, Orange, Chestnut, and Walnut Streets, restripe the crosswalks across Water street with bold in-pavement markings. Add a yellow Ped Xing sign in each of these locations.

PRINCE ST:

North of Chestnut Street, restripe to reinstate both sides of parking wherever the carpath exceeds 34 feet, with parking lanes striped. Restripe and then rebuild the Prince/Walnut intersection to eliminate the extra turn lane. Limit the turn lanes at Orange and King to a shorter length—approx. 40 feet of storage and 40 feet of taper—reinstating parking wherever possible. Stripe all parking spaces.



QUEEN ST:

North of Vine, restripe Queen to include standard-width driving lanes and a left flank of parking. Close the eastern access to the Intelligencer lot if possible. Limit the turn lanes at Orange, King, and Chestnut to a shorter length—approx. 40 feet of storage and 40 feet of taper— resulting in a large increase in the supply of curb parking on both flanks. Stripe all parking spaces.

CHRISTIAN ST:

Repave the entire length of Christian Street, inserting prominent sharrow markings north and south of each intersection, and a northbound contraflow lane between James and Frederick Streets. Build speed tables at all major intersections, prominently signed, including mid-street pylon signage on all multi-lane streets. Provide all major intersections with HAWK beacons if possible.

DUKE ST:

Investigate the daytime civilian parking ban alongside the County Courthouse, and perhaps remove. Investigate the need for a continuous bus stop from Grant to King Street, and perhaps shorten the bus zone to provide curb parking. Add back the two missing parking spaces north and south of Chestnut Street. Limit the turn lanes at Vine Street to a shorter length — approx. 40 feet of storage and 40 feet of taper — resulting in a greater supply of curb parking. Restripe and eventually rebuild the southeast corner of the Duke/Vine intersection to a 15-foot curb return radius. South of Church Street, stripe 6-foot bike lanes into the roadway. When the right-hand turn lane is introduced south of church, place it on the right flank of the bike lane, and reduce each driving lane to 9 feet in width. (The effective width is greater, due to the bike lane.) South of the median, place the bike lanes 9 feet from the curb so that the driving lanes are not too wide. Restripe the left-hand turn lanes approaching Chesapeake Street to include about 50 feet of car storage beyond an approx. 40-foot taper zone, with no striped “swoop” area before the taper. This change allows for many more curb parking spaces. Expand the effort to make Duke Street two-way to include Queen Street as its partner.

LIME ST:

No change

CHURCH ST:

Eliminate the left driving lane of Church Street and pull the left lane of parallel parking off the curb. Insert two 5-foot cycle lanes and a 5-foot car-door buffer between the curb and the moved parking lane. Stripe the parking lane on the east flank.

CHESAPEAKE AND SOUTH BROAD STS:

Remove the center lane and restripe this segment of Chesapeake/ South Broad Street to contain two driving lanes flanked by two 8-foot bike lanes, each consisting of a 5-foot lane and a 3-foot traffic-side striped buffer.

NORTH BROAD ST:

Make North Broad Street a continuous two-lane facility by inserting 6-foot bike lanes 9 feet from each curb. In the unlikely event that traffic congestion mandates a left-hand turn lane, any such facility should be provided by narrowing one parking lane to 8 feet and removing the other, resulting in a configuration of 8 park - 6 bike - 10 drive - 10 turn - 10 drive - 6 bike. This facility should be very short, approx. 60 feet total including taper zone.

HARRISBURG PK:

Restripe Harrisburg Pike from Prince Street to Race Avenue with 10-foot driving lanes, dedicating the space gained to parallel parking. Convert right-hand turn lanes to parallel parking as well. Placing parking on the south side of the street, as is recommended near the YMCA, will require the infill of the parking bay in front of Cox and Evans Architects.

JAMES ST:

Eliminate right-hand turn lanes at Queen and Lime. Shorten left-hand turn lanes at Prince and Queen, such that curb parking can be reinstated to within 60 feet of the crosswalk. Insert westbound bike lane. Restripe the driving lanes to 10 feet, combining both if possible into a single 20-foot facility. Dimensions of the additional street components vary as a function of the carpath width. At its narrowest dimension, the street includes a 7-foot parking lane, and an 8-foot parking lane along a 5-foot bike lane. As the street widens, the bike lane first widens to 6 feet. Beyond that, the 7-foot parking lane widens to 8 feet. Any subsequent increase in width occurs in the bike-side parking lane. At the left-hand turn lanes, the remaining parking lane may have to narrow to 7 feet. If space is still tight, the bike lane can narrow to 5 feet.

LEMON ST:

Shorten left-hand turn lanes at Prince and Queen, such that curb parking can be reinstated to within 60 feet of the crosswalk. Insert eastbound bike lane. Restripe the driving lanes to 10 feet, combining both if possible into a single 20-foot facility. Dimensions of the additional street components vary as a function of the carpath width. At its narrowest dimension, the street includes a 7-foot parking lane (always striped), and an 8-foot parking lane along a 6-foot bike lane. As the street widens, the 7-foot parking lane widens to 8 feet. Any subsequent increase in width occurs in the bike-side parking lane. At the left-hand turn lanes, the remaining parking lane may have to narrow to 7 feet. If space is still tight, the bike lane can narrow to 5 feet.

WALNUT ST:

Revert to two-way travel. Include short left-hand turn lanes (approx 60-foot total facility, including taper) at Lime, Duke, Queen and Prince. Insert westbound bike lane. Stripe the driving lanes to 10 feet, combining both if possible into a single 20-foot facility. Dimensions of the additional street components vary as a function of the carpath width. At its narrowest dimension, the street includes a 7-foot parking lane, and an 8-foot parking lane

(always striped) along a 6-foot bike lane. As the street widens, the 7-foot parking lane widens to 8 feet. Any subsequent increase in width occurs in the bike-side parking lane. At the left-hand turn lanes, the remaining parking lane may have to narrow to 7 feet. If space is still tight, the bike lane can narrow to 5 feet.

CHESTNUT ST:

Eliminate the left driving lane of Chestnut Street and pull the left lane of parallel parking off the curb. Insert two cycle lanes and a 3-foot car-door buffer between the curb and the moved parking lane. Stripe the parking lane on the south flank, investigating whether there is room for any spaces in the taxi stand/bus stop segment between Market and Queen. For the one segment between Prince and Market, where curb extensions surround parking spaces on the north curb, make the curb extensions continuous, and provide a similar cycle track facility by eliminating the parking on the south curb. If the effort to create a cycle track fails, revert the street to two-way as a partner to Walnut Street, with an eastbound bike lane. In this condition, if the carpath narrows below 42 feet in a left-hand turn lane location, the bike lane must briefly become a well-marked sharrow within the adjacent driving lane.

ORANGE ST:

East of Queen Street, apply the strategy, limiting the turn lane to a shorter length — approx. 40 feet of storage and 40 feet of taper — reinstating parallel parking on the north flank as a result. From Queen to Market streets, reduce north driving lane to 10 feet in width, and stripe parking back on the north curb. East of Prince Street, apply the strategy, limiting the turn lane to a shorter length — approx. 40 feet of storage and 40 feet of taper — reinstating parallel parking on both flanks as a result. West of Prince Street, stripe one parallel parking spot in front of the Sunoco, and another in front of the Firestone parking lot. West of Arch Street, as elsewhere, use market-based pricing to determine a proper cost for the parking meters, so that these parking spaces are used.



KING ST:

Add parking back to the south curb east of Mulberry Street, leading to an approx. 80-foot turn lane facility (approx. 40 feet of storage and 40 feet of taper) approaching Prince Street. Shorten the turn lane approaching Queen Street to the same length, regaining parallel parking on both flanks as a result. Add back 3 parking spaces to the south curb in the vicinity of the East King Street Garage.

CHESAPEAKE ST WEST OF DUKE ST:

Restripe this segment of Chesapeake Street to contain two 10-foot driving lanes flanked by two 9-foot bike lanes, each consisting of a 5-foot lane and a 4-foot traffic-side striped buffer. If a left-hand turn lane is desired at Duke Street, such a facility should be provided by briefly narrowing the driving lanes to 9 feet and the bike lanes to 5 feet, resulting in a configuration of 5 bike - 9 drive - 10 turn - 9 drive - 5 bike. This facility should be very short, approx. 60 feet total including taper zone.

HERSHEY AVE:

Restripe Hershey Avenue to contain two bike lanes alongside curb parking. The width of the parking and bike lanes varies based upon the width of the street, as follows:

45 feet: 7.5 park - 5 bike - 10 drive - 10 drive - 5 bike - 7.5 park.

47 feet: 7.5 park - 6 bike - 10 drive - 10 drive - 6 bike - 7.5 park.

50 feet: 9 park - 6 bike - 10 drive - 10 drive - 6 bike - 9 park.

This moderate-volume street should not contain any left-hand turn lanes.

MANOR ST:

Reduce sight triangle

WEST LIBERTY ST:

Two feet should be removed from each driving lane and added to each sidewalk.

WABANK ST TO HAZEL ST TO BEAVER ST:

Alternative bike route from Millersville University to downtown. The most promising corridor seems to be Wabank Street (peak-hour car count: 460), which connects via Hazel Street and Beaver Street to downtown.

PENN SQ:

Create roundabout

MCGOVERN AND PRINCE:

Improve crossing

QUEEN, CHURCH, AND CONESTOGA:

Improve crossing

TRANSIT:

Improve downtown times and bus attractiveness

WAYFINDING:

Pedestrian wayfinding

DEVELOPMENT:

Increase density through planning on high anchor development block.

FEASIBILITY STUDY FOR HARRISBURG PIKE: PEDESTRIAN ACCOMMODATIONS & MULTI-USE TRAIL (2012 FINAL REPORT)

RECOMMENDATIONS - INFRASTRUCTURE

Segment 1: Race Avenue to Dillerville Road/North President Avenue intersection.

- Primary: Reconstruct or retrofit curb ramps and crosswalk locations at Harrisburg Pike and Race Avenue, eliminate diagonal ramps where possible. Construct north side sidewalk along Wendy's restaurant frontage through the Dillerville Road intersection east/west approach.
- Secondary: Construct sidewalks and crosswalks on the south side of Harrisburg Pike, including the State Street intersection and connection along the northeast corner (Wendy's) of Dillerville Road.

Segment 2: Dillerville Road/President Avenue to Shreiner Avenue.

- Primary: Construct sidewalk on the north side of Harrisburg Pike, connecting Dillerville Road with the Lancaster County Solid Waste Management Authority (LCSWMA) existing sidewalks.
- Secondary: Construct sidewalks and crosswalks on the south side of Harrisburg Pike between Dillerville Road southwest corner and Shreiner Avenue, including crosswalks at Landis Avenue and Shreiner Avenue. Construct sidewalks along the western side of President Avenue, south of Dillerville Road and southwest corner of intersection to connect to existing sidewalks along President Avenue.

Segment 3: Shreiner Avenue to Vermont Avenue/Intersection of LCSWMA entrance.

- Primary: Install new accessible curb ramp on the south side of Harrisburg Pike, at the southeast corner of the LCSWMA entrance/Harrisburg Pike intersection. Construct sidewalks

from the new accessible curb ramp location at the LCSWMA entrance westward to Vermont Avenue/Harrisburg Pike intersection.

- Secondary: Construct sidewalks along the frontage of Franklin & Marshall College's Baker Campus athletic fields from the new curb ramp at the LCSWMA entrance to Shreiner Avenue.

Segment 4: West of Vermont Avenue to Norfolk Southern Railroad Bridge

- Primary: Construct sidewalk on the south side of Harrisburg Pike between Vermont Avenue and the existing sidewalk at the Zephyr Thomas Home Improvement Company.
- Secondary: None. Due to structure constraints, sidewalks on the north side of Harrisburg Pike are not feasible to construct. If the planned roadway improvements to Harrisburg Pike were modified related to the Crossings at Conestoga Creek to allow for sidewalks on both sides of the roadway, future planning and development should include the installation of sidewalks on the north side to complete the system along the corridor on both sides.

Segment 5: West of Norfolk Southern Bridge underpass to Long's Park

- Primary: Construct sidewalks on the south side of Harrisburg Pike for a complete route between Norfolk Southern Bridge underpass to Long's Park entrance at Bluebird Drive.
- Secondary (Long Term and future connectivity to Route 30 Interchange): Construct sidewalks west of Bluebird Drive and The Crossings at Conestoga Creek planned site driveway on both the north and south side of Harrisburg Pike to the Toys-R-Us Drive. Also, construct sidewalks on the south side of the roadway between the Toy-R-Us Drive/Farmingdale Road and the Route 30 East interchange ramps to provide the continuous sidewalk connection for the corridor heading towards Park City mall and points west.



MOVING SMARTER - HARRISBURG PIKE TRANSPORTATION AND LAND USE STUDY (2008)

VISION

Harrisburg pike will represent the standard for a Lancaster county mixed-use transportation network by inviting opportunities for all forms of travel, aligning the flow of the pike to the extraordinary concentration of major businesses and county-wide community assets, and encouraging environmentally-friendly movement of people, goods, and services.

GOALS

GOAL 1: Improve the overall carrying capacity of the Harrisburg Pike Corridor and enhance the safety for all users.

GOAL 2: Incorporate alternative modes of transportation in new development and redevelopment along the Harrisburg Pike Corridor.

GOAL 3: Preserve the unique qualities of the urban and suburban land patterns and the community values and environmental resources of the project area.

RECOMMENDATIONS - INFRASTRUCTURE

Location-Description:

- Dillerville Road - west to Long's Park - Complete sidewalk system
- City to Long's Park - Provide Bicycle Route/connectivity
- Long's Park to PA 741 - Add a sidewalk and/or multi use trail or circulation system
- James Street Improvement District - Include sidewalk along with Mulberry and Liberty Street extensions
- Park City Center - Park-and-ride facility
- Lancaster General Hospital - Park-and-ride facility
- PA 741/PA 283 Interchange - Park-and-ride facility
- Entire Corridor - Increase frequency of bus service
- Entire Corridor - Extend bus routes
- Entire Corridor - Local road connectivity
- Entire Corridor - Mass transit amenities including bus shelters, bicycle racks, benches, etc.
- Entire Corridor - Implement Capital Red Rose Corridor Regional Rail Service
- PA 741 to State Road - Add a sidewalk/multiuse trail system
- Plaza Boulevard - Add sidewalk system from Harrisburg Pike to shopping areas
- Dillerville Road - Connect sidewalk from Harrisburg Pike to Manheim Pike
- PA 741 to Dillerville Road - Complete planned Conestoga Greenway trail system
- State Road/PA 283 Interchange - Park-and-ride facility
- Southeast Quadrant of the US 30/Harrisburg Pike Interchange - Park-and-ride facility
- Entire Corridor - Guaranteed ride home and similar programs
- Near PA 741- Add sidewalks along Good Drive, Spring Valley Road, and PA 741
- State Road/Harrisburg Pike Intersection - Park-and-ride
- Entire Corridor - Add pedestrian lighting along existing and future pedestrian paths

URBAN PARKS, RECREATION AND OPEN SPACE PLAN (2009)

GOALS

GOAL 1: Respond to public input

GOAL 2: Develop and improve open space connections

GOAL 3: Enhance existing park facilities

GOAL 4: Promote environmental stewardship and education

RECOMMENDATIONS - INFRASTRUCTURE

- Regional Park Analysis – Infrastructure for Lancaster’s Central Park
- Community Park Analysis
 - » Conestoga Pines Park
 - » Long’s Park
- Neighborhood Park Analysis & Estimates of Probable Cost
 - » Brandon Park
 - » Buchanan Park
 - » Conestoga Creek Park
 - » Conlin Field/Farnum Park (now Culliton Park)
 - » Crystal Park
 - » Musser Park
 - » Northwest Corridor Linear Park (now Mayor Janice P. Stork Corridor Park)
 - » Reservoir Park
 - » Roberto Clemente Park
 - » Rodney Park
 - » Sixth Ward Memorial Park
- Mini Park Analysis
 - » Binns Park/Lancaster Square
 - » Case Commons
 - » Ewell-Gantz Playground
 - » Joe Jackson Tot Lot
 - » Market Street Kid’s Park
 - » Milburn Playground
 - » Penn Square
 - » Rotary Park
 - » South End Park
 - » Triangle Park
- Other Open Spaces
 - » Cabbage Hill Veterans Memorial
 - » Camba Park
 - » Holly Pointe Park
 - » Intersection of W. King and W. Orange Streets
 - » South Duke Street Mall
 - » Walnut Street Fishing Area
- Proposed:
 - » 7-mile Outer Corridor loop
 - » Several Radial Corridors
 - » 1.7-mile Inner loop



CITY OF LANCASTER GREEN INFRASTRUCTURE (2011)

VISION

To provide more livable, sustainable neighborhoods for City residents and reduce combined sewer overflows

GOALS

GOAL 1: Strengthen the City's economy and improve the health and quality of life for its residents by linking clean water solutions to community improvements (e.g. green streets).

GOAL 2: Create green programs that respond comprehensively to the multiple water quality drivers (e.g. TMDL, CSO and stormwater regulations) to maximize the value of City investments.

GOAL 3: Use GI to reduce pollution and erosive flows from urban stormwater and combined sewer overflows to support the attainment of the Watershed Implementation Plan for the Chesapeake Bay and to improve water quality in the Conestoga River.

GOAL 4: Achieve lower cost and higher benefit from the City's investments.

GOAL 5: Establish Lancaster City as a national and statewide model in green infrastructure implementation.

RECOMMENDATIONS - INFRASTRUCTURE

Green Park 1:

- 6th Ward Park-E Ross St & Hamilton St - Porous basketball; vegetated curb ext; rain garden behind sign; rain garden at Frederick St.
- Reservoir Park-E King St & N Franklin St - Porous pavement parking lot; playcourt; cisterns; subsurface infiltration bed.
- Brandon Park-Wabank St & Hazel St - Bioretention, porous pavement parking stalls; porous play court, vegetated swales.
- Crystal Park-1st St & Reiker Ave - Porous pavement basketball court captures upland pkg lot/roof runoff; convert alleys on E to park extension/greenpath.
- Rodney Park-W 4th St & N Rodney St - Bioretention, porous pavement parking Lane; porous playcourt.
- Conlin Field/Farnum Park (now Cuilliton Park)-South Water St and E Filbert St - Porous pavement parking lot; existing rain garden proposed, vegetated curb extension with tree replacement at hydrant near basketball court; capture road runoff at gateway inlet and direct into parking lot bed.
- Northwest Corridor Linear Park (now Mayor Janice P. Stork Corridor Park) - W. Lemon St & Harrisburg Ave - Rain gardens, green trail, green parking lot with pedestrian enhancements, landscape restoration, Infiltration trench.
- Northeast Greenway Corridor-McCaskey HS to E Walnut St - Green trailway.
- Triangle Park-New Holland Ave at E Walnut St-Infiltration bed beneath parking lot; tree trench to intercept adjacent residential rooftop runoff.
- Carter & MacRae Elementary School-201 S Prince St - Cisterns (3) on south roof; porous playcourt and tree plantings;
- Public Parking Lot: S Plum St - 600 block South Plum Street - Porous pavement/green alley.
- Public Parking Lot: Dauphin St - 200 block Dauphin Street - Bioretention; infiltration bed beneath alleyway.

- Public Parking Lot: Penn Ave. - 500 block Penn Ave. - Porous pavement parking lot.
- Public Parking Lot: E. Mifflin St - 400 block E. Mifflin Street - Bioretention.
- Hand Middle School - 431 South Ann Street - Green rooftop, infiltration trench adjacent to parking lot and roadway.
- Green Street at Prince Street - 500–700 blocks N Prince St - Pavement reduction; replacement with tree trench for urban canopy enhancement.
- Lancaster County Library - 125 N Duke St - Green roof, bioretention; cistern; tree trench.
- Strawberry St. Separation - E. Strawberry & Chesapeake Sts - Bioretention.
- Commercial Green Street at Walnut & Plum - 302 N. Plum St. - Curb extension/planter with tree trench at Lancaster Brewery; tree trench along Walnut and Plum Streets.
- Private Parking Lot - Water Street - Infiltration bed; tree trench and bioretention.

RECOMMENDATIONS - POLICY

1. Implement a comprehensive demonstration program to allow the details of each project type and technology to be worked through and adapted for the specific requirements of the City's unique land use types and
 - a. Establish a prioritized capital program for green infrastructure implementation within Department of Public Works;
 - b. Apply a screening process to review existing City capital programs for possible green project opportunities (e.g. roofing, pavement restoration and other projects that restore or reconstruct impervious surfaces); and
 - c. Create a Green Grant Fund to incentivize action by funding the marginal cost of the green portion of improvements on private property.
2. Implement the recommended actions:
 - a. Institute a GI advisory committee comprised of City leaders to discuss and remove implementation barriers and endorse selected implementation programs. Create working subcommittees at the local neighborhood level to suggest projects to the advisory committee;
 - b. Convene a review process to evaluate City Codes to include Green Options;
 - c. Revise City Standard Design Guidelines and Details;
 - d. Evaluate and revise the First Flush Ordinance to manage all impervious area in the full area of disturbance for redevelopment;
 - e. Implement an impervious cover-based stormwater rate to equitably apportion the cost of wet weather controls; and
 - f. Develop a program to utilize vacant land (publicly and privately owned) for management of stormwater runoff.
3. Implement partnering and outreach including:
 - a. Develop and manage a list of key partners and volunteers to help deliver outreach messages, host workshops, and provide support for grant funding pursuits;
 - b. Develop partnerships and volunteer efforts to implement the results of the Urban Tree Canopy Project being conducted by PA DCNR and evaluate additional models for expanding street tree programs;
 - c. Coordinate with County efforts to implement the state and federal pollution reduction requirements;
 - d. Coordinate with County efforts to implement the Greenscapes Plan;
 - e. Develop a GI Portal on the City website to disseminate information to the public about GI technologies, program updates, and what homeowners can do to help;
 - f. Develop a homeowner's guide to GI;



- g. Provide GI Fact Sheets and education materials on the Portal and brochures for selected audiences;
 - h. Develop a public outreach plan, presentation materials and schedule for outreach to key neighborhood groups, business leaders, the Mayor, City Council, and other stakeholders through public meetings; and
 - i. Leverage learning through local and state key stakeholders to inform the adoption and implementation of green infrastructure in other urban centers.
4. Implement other studies & technical tools including:
- a. Conduct a Green Streets workshop to support the selection and development of projects and approaches to demonstrate green streets in various types of road and alley reconstruction practices;
 - b. Update the City Hydrologic and Hydraulic Models to simulate green improvements in relation to other grey alternatives;
 - c. Update the CSO LTCP to include GI Plan;
 - d. Expand the GI Plan to evaluate the required implementation levels of the Chesapeake Bay TMDL and the nutrient reductions required for Lancaster in the PA Watershed Implementation Plan (WIP) and develop an integrated strategy for meeting CSO reduction and nutrient reduction objectives at the least cost and highest benefit to the City;
 - e. Partner with PA DEP in the development of the revised WIP for meeting the Chesapeake Bay TMDL requirements;
 - f. Develop a project tracking system to document GI Implementation projects including the first flush projects and the area that they control;
 - g. Identify direct stream inflow sources for potential removal from the combined sewer system;
 - h. Prepare a comprehensive Tree Management Plan by analyzing and developing a more specific tree planting goal based on the results of the Urban Tree Canopy Project and street tree inventory; and
 - i. Address GIS data needs and update parcel-based land use data, impervious area data, and parcel ownership information.

GATEWAYS REVITALIZATION STRATEGY (2007)

VISION

The community envisions a future of the Gateways Area that:

- Preserves its urban form and acknowledges its rich heritage;
- Reuses vacant or underutilized properties;
- Offers a range of transportation choices, including an efficient network of sidewalks, trails and paths;
- Includes a variety of business enterprises that provide jobs for residents and contribute to a stable tax base;
- Provides a broad range of housing opportunities;
- Is known as a place where innovation is encouraged and supported; and,
- Continues to benefit from cooperative efforts to create and sustain the Gateways Area as a thriving and vibrant place.

GOALS

GOAL 1: Reconnect various areas of the community through a coherent and cohesive vision and land use plan;

GOAL 2: Revitalize the economic base by recycling industrial land with job producing opportunities tied to clean growth industries;

GOAL 3: Improve and/or build on public/private partnerships that will help attract a variety of uses needed to support residents, prospective employers and visitors;

GOAL 4: Strengthen housing opportunities to retain current residents and attract new infill housing development and create a sense of community;

GOAL 5: Serve as a foundation for improving the regulatory climate for smart growth redevelopment; and

GOAL 6: Serve as a model for others pursuing revitalization in their communities.

RECOMMENDATIONS - INFRASTRUCTURE

The proposed plan envisions the conversion of the Norfolk Southern railroad holdings, within the Liberty Street and Stadium districts into a greenway. The Gateways Plan also provides for future connections to the Northwest Corridor Linear Park (now Mayor Janice P. Stork Corridor Park), Long's Park, Park City Mall, Red Rose Commons and the Conestoga Greenway via the Grandview Heights neighborhood. Increase pedestrian and bicycle facilities along proposed greenway.



LINCOLN HIGHWAY STREETScape PLAN PHASE 2 (2015)

VISION

Make Lincoln Highway an economically vibrant corridor that is safe, efficient, and beautiful for local residents and visitors.

PLANNING PRINCIPLES FOR THE CORRIDOR

1. **Slow Traffic to the Speed Limit**
Traffic on Lincoln Highway is not only moving people and goods along the corridor; it is providing customers for the businesses located there. The conceptual design reduces lane widths slightly in order to slow traffic to the speed limit. This change will increase safety, but will not reduce roadway capacity, create new congestion, or reduce customer access to corridor businesses.
2. **Provide Multi-Modal Access Along the Entire Corridor**
Multimodal facilities play an important role in providing transportation choices for people using the corridor. Working within multiple constraints, the conceptual design provides for multi-modal access along the entire corridor through the development of a multi-use path along the south side of Lincoln Highway. Additional improvements include improved sidewalks on the north side of the street, enhanced transit stops, and a network of on-and off-road trails approaching the corridor.
3. **Buffer Sidewalks from Traffic**
In order to create a safer pedestrian experience, it is important to create some space between the sidewalk and traffic. Forty percent of the corridor has sidewalks without any buffer between the walkway and the travel lanes, forcing pedestrians to walk immediately adjacent to trucks and other traffic. The conceptual design sets minimum setbacks between sidewalks and travel lanes. Landscaping standards are designed to further protect pedestrians from adjacent traffic.
4. **Reallocate Underutilized Right-of-Way for Multi-Modal Access**
The corridor currently has a continuous center turn lane, even in places where no left turn is needed. The conceptual design eliminates the center turn lane where it is not required and replaces it with a mountable raised median. Where possible, the resulting “excess” right-of-way has been shifted to sidewalk and trail elements.
5. **Maintain Consistent Through Lanes**
In order to address safety issues caused by merging traffic and general user confusion, the conceptual design eliminates lane shifts to maintain through lanes wherever possible.
6. **Reduce Conflicts**
As part of corridor safety improvements, the conceptual design proposes consolidating driveways at locations with high accident rates. Removing driveways from the corridor also reduces the need for a continuous left turn lane.
7. **Increase Safety with Protected Left Turn Lanes**
Many high accident locations on the corridor are missing protected left turn lanes. The conceptual design includes protected, signalized left-turn lanes at high-accident

intersections and areas with a large number of left turning movements.

8. Integrate Signage And Wayfinding at all Scales

Signage and wayfinding will be scaled and located at appropriate locations for cars, bicycles, buses, and pedestrians to provide information to visitors and create a cohesive sense of place.

9. Create Attractive, Functional Landscaping Incorporating Stormwater Management Facilities

Landscape guidelines will help create a cohesive and aesthetically pleasing look for the corridor and contribute to stormwater management. Guidelines allow individual property owners to contribute to a larger coordinated landscape for the corridor.

10. Enable Interconnectivity

The conceptual design identifies new street alignments that would connect the corridor to hard-to-reach parcels, and create new navigation options for drivers, transit users, pedestrians, and cyclists. Increasing choices will improve circulation, reduce congestion, and offer calmer and more scenic routes for those traveling throughout the corridor.



PLACES2040: THINKING BEYOND BOUNDARIES (2018)

BIG IDEAS AND POLICIES

- Creating great places
 - » Make our downtowns more vibrant, safe, and attractive
 - » Design communities that put people first
 - » Create a mix of uses in our communities and corridors
 - » Provide a greater supply and diversity of housing types to rent and own
 - » Find new and innovative ways to reduce congestion
- Connecting people, place, and opportunity
 - » Make our downtowns into regional hubs
 - » Create more places to hike, bike, play and enjoy nature
 - » Make it easier for residents and visitors to get around without a car
 - » Connect housing, jobs, schools, transportation, and other destinations
 - » Intentionally cultivate, retain, and expand industry
- Taking care of what we have
 - » Preserve large, contiguous areas of agricultural and natural land
 - » Preserve the farmer as well as the farm
 - » Improve water quality and work together on stormwater management
 - » Use existing buildings and maintain public infrastructure
 - » Promote entrepreneurship and help local businesses grow
- Growing responsibly
 - » Grow where we're already growing
 - » Prioritize redevelopment and infill in Urban Growth Areas
 - » Manage the use of large tracts of vacant land in Urban Growth Areas
 - » Limit large-lot suburban development in rural areas

- Thinking beyond boundaries
 - » Integrate place-based thinking into all future planning initiatives
 - » Break down the traditional silos that limit our effectiveness
 - » Make planning and regulation more efficient, consistent, and regional
 - » Keep ourselves accountable for the goals we've set

CATALYTIC TOOLS AND STRATEGIES

- Practice place-based planning and analysis
- Simplify zoning
- Utilize official maps
- Implement complete streets
- Invest in sufficient infrastructure and public services
- Collaborate to implement places2040
- Align community resources with these policies

COMMUNITY OUTREACH

APPENDIX



WHAT RESIDENTS AND VISITORS ARE SAYING

More Trails Transit Shelters **Wide Sidewalks**
Changes In Behavior **Connections To Schools**
Safe Bicycling Routes
Bicycle Parking **Family-Friendly Transportation**



VISIONING + TECHNICAL ADVISORY COMMITTEE

Two steering committees - Visioning and Technical Advisory - were formed to develop the vision statement and goals that would guide the planning process. Representatives from local advocacy groups, key decision makers, health professionals, business representatives, municipal staff, and interested citizens gathered throughout the planning journey to formulate five plans in one. These five plans are linked together by the common thread of the community to provide a united framework that fosters cooperation and builds momentum for implementation.

While the Visioning Committee established high level guidance, the Technical Committee dug into the details of policy, network, and design guidance. Together, their efforts established a legacy of communication, collaboration, and activism that will continue beyond the adoption of this plan.



Visioning and Technical Advisory Committee Meeting, October 13, 2016

WHAT WE HEARD...

PUBLIC KICK OFF EVENT MARCH 2, 2017

FORMAT:

Open house with organizations from across the county, education boards, presentations, maps, and survey

EDUCATION OBJECTIVES:

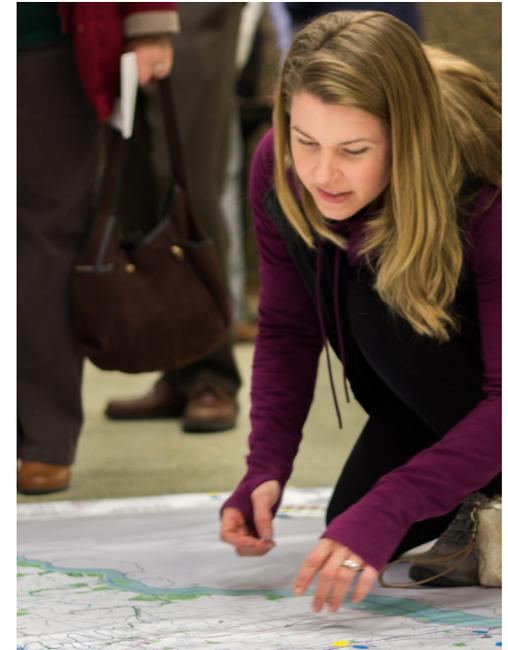
- Learn about what active transportation means for communities across the county
- Learn about the planning process of five plans with one common theme of creating great places
- Learn about bicycle facility types
- Learn about the benefits and impacts of greenways
- Learn and be inspired by keynote speaker Jeff Olson's stories from across the country
- Learn about PennDOT's initiatives to connect the state with better facilities and policies that support active transportation



PUBLIC KICK OFF EVENT MARCH 2, 2017

LISTENING OUTCOMES:

- Most attendees were already bicyclists and in support of active transportation - perfect for network input and identifies a need to reach out to those who may not already bike, walk, or use transit throughout the planning process and into the future
- Facilities need to serve both confident active transportation users and those who are interested but have concerns
- The city bicycle network should connect residential areas with the core of downtown and the many cultural destinations throughout the city
- The county network should be a combination of touring and commuter routes with a series of greenways that provide recreation and transportation benefits
- The Engleside greenway needs to safely connect into the city and respond to the context of the park
- The Northeast greenway alignment should be trail, and when on-road, be as separated as possible to serve users of all ages and abilities
- The Greater Lancaster Heritage Pathway should connect with parks on the west side of the city
- The Greater Lancaster Heritage goat path should be an experience that is more than just a path; preserve views and vistas



CHARRETTE WEEK APRIL 24 - 27, 2017

FORMAT: 2 committee meetings, 3 days of open studio, 3 open houses, 4 focus groups

OBJECTIVES: COMMITTEES ELECTED OFFICIALS RESIDENTS PLAIN SECT

- Craft prioritization criteria to guide short-, mid-, and long-term implementation
- Present the proposed Lancaster city bicycle network and revise based on committee, staff, and public input
- Identify 5 priority, catalyst, or immediate need projects with staff and the community to be included in the final plan
- Present a network of county greenways, touring routes, and commuter routes and refine based on resident experience
- Identify a corridor to test the application of design guidelines developed to apply to the county transect
- Identify and craft an active transportation mini plan based on high demand areas identified in the first round of public input
- Understand whether the goat path would be used by the plain sect population and what their facility and connectivity needs are
- Refine greenway alignments based on community feedback and further field exploration
- Conclude the week with solid recommendations that will be used to craft a final plan

LANCASTER CITY BICYCLE NETWORK · LANCASTER COUNTY-WIDE ACTIVE TRANSPORTATION PLAN
NE LANCASTER GREENWAY · GREATER LANCASTER HERITAGE PATHWAY · ENGLISIDE GREENWAY

Join us for the
Lancaster Active Transportation Plan
Trail and Greenway Open House



Drop in to learn more and discuss trails and greenways including the NE Greenway Trail and the Greater Lancaster Heritage Pathway. There will be information about the process and initial greenway concepts.

Tue April 25
5-7 pm

City Council Chambers
100 N Duke Street,
Lancaster, PA 17603

- Enter on Marion Street
- Parking available at the Duke Street Garage

 If you cannot join us, find out more at LancasterATP.com





HIGHLIGHTS FROM CHARRETTE WEEK

Experienced cyclists and concerned residents came together to give their unique perspective on network development, policy, programs, and design guidelines. The feedback ranged from interest in developing more commuter routes to boosting the local economy through bicycle tourism. Key discoveries include:

- There is a growing enthusiasm about cycling around Lancaster. There has been growth in the industry including new bike shops and partnerships with hotels for visitors to rent bikes.
- Tourism was a focus for many of the participants. Routes that would connect existing trails such as the Northeast River Trail and the Enola Low Grade Trail, were strongly encouraged. It was clear that new routes with a focus on tourism would also need to include destinations such as local restaurants and shops.
- While the network for active transportation grows with the demand, it feels disjointed. Residents want to see a cohesive branding effort for cycling and tourism, similar to the Susquehanna River Trail's brand.
- As these networks are created, residents want to be sure there is a way to track the success of the new routes and improvements. If these new routes are successful, this could mean more safety measures and facility upgrades throughout the Lancaster area.



BICYCLE COMMUTERS FOCUS GROUP

SUMMARY APRIL 27, 2017

ABOUT THE FOCUS GROUP. The focus group was comprised primarily of vehicular cyclists – experienced cyclists who ride at high speeds and typically in traffic - from urban and suburban parts of Lancaster County.

- **DIVERSE BICYCLING CULTURE.** The group acknowledged that bicycling comes in many different forms in Lancaster County. This includes recreational cyclists who ride for pleasure and those who commute; cyclists who commute by choice and others by necessity; experienced vehicular cyclists and novices; trail cyclists and road cyclists; urban and Mennonite cyclists; those who follow the rules and those who don't even know them. The plan should focus on the needs of those who must or want to bicycle but don't feel safe doing so.
- **CULTURE SHIFT.** Cyclists describe a growing bicycle movement despite challenging conditions. The group would like to see a shift towards greater acceptance of bicycling, more respect between cyclists and motorists, enforcement of speed limits and traffic infractions, education about traffic laws, and policies that provide infrastructure and empower people to bicycle.
- **ROADWAY HAZARDS AND OTHER BARRIERS TO BICYCLING.** The group named roadway hazards such as long or wide turning lanes which drivers use to turn with excessive speed or to cut cyclists off; vehicles parking in bike lanes; sunken utility access points; long light cycles; no-turn-on-red; major intersections that do not consider the need of bicyclists; and lack of shoulders. A variety of other barriers exist, including: lack of showers and end-of-trip facilities for commuters; lack of secure, user-friendly bicycle parking; low-density development patterns that spread buildings far apart and make it difficult to walk or bike places, especially to schools; policies that make it impossible for children to bike to school; lack of education and knowledge of bicycling laws; lack of traffic law enforcement; lack of investment in bicycle infrastructure; and lack of knowledge of how to properly ride a bike or fit a bike or helmet.
- **INFRASTRUCTURE.** Many in the focus group felt that most of the population is not comfortable cycling under current conditions, and that designated bicycle infrastructure would help to encourage others to bicycle. One cyclist opposed bicycle infrastructure, describing infrastructure as something that makes people feel safe without actually making them safe. Others argued that most people will never bicycle unless they feel safe, and that infrastructure was essential to achieve that goal.
- **BICYCLE LAWS: EDUCATION AND AWARENESS.** Most of the cyclists indicated that they follow the rules of the road, though acknowledged that many cyclists do not. The group felt that following the rules makes cyclists more predictable, which may help to improve the relationship between cyclists and motorists. However, following the rules can sometimes put cyclists at risk. As one cyclist put it, “the first rule of safety is ‘put yourself in a safe position.’ The car will be fine.” The group agreed that everyone – including cyclists, drivers, students and adults – could use more education about traffic laws. Motorists in particular could be more aware and purposeful about looking for cyclists.
- **ENFORCEMENT.** Participants believe that enforcement of traffic laws is insufficient. As a result, many motorists speed and disobey traffic laws in a way that may put cyclists and pedestrians at risk. The group felt that more enforcement could help improve safety on the roads.
- **DEVELOPMENT PATTERNS.** To promote bicycling, the group felt bicycle infrastructure should be required in new development; existing roads should be reconstructed to include bicycle infrastructure; and development should be denser so more destinations are within a walkable/bikeable distance.



TOURISM FOCUS GROUP

SUMMARY APRIL 27, 2017

ABOUT THE FOCUS GROUP. This group was comprised of bicycle tourism experts and business owners, Lancaster County tourism professionals, and representatives of the hotel/motel industry.

- **EXISTING CONDITIONS.** Lancaster County is a great place to ride bicycles and already has an international reputation for excellence in bicycle tourism. However, hotels and other tourism industry professionals may not know about the services available related to walking, hiking, biking, or exploring nature. Bicycle resources can be difficult to find, as no comprehensive list or map of trails and bike routes exists.
- **EXISTING BICYCLE TOURISM SERVICES.** Intercourse Bikeworks provides bike rentals and on-road tours at their Intercourse location, as well as bike concierge (dropping and picking up bikes for guest use to hotels). They also offer a bike share designed by Clair Brothers along the Warwick to Ephrata Rail Trail (WERT). Zagster operates a bike share in Lancaster City. Chiques Rock Outfitters rents kayaks and bicycles along the Susquehanna River.
- **OPPORTUNITIES AND AREAS FOR IMPROVEMENT.**
 - **STAFFING AND INFORMATION SHARING.** There's currently no single website or map that shows all information about biking, hiking, and trails in Lancaster County. An effort like this would benefit locals and the tourism industry alike, but would probably require the attention of full-time staff to keep up with frequent changes and updates. Staff would also be able help inform people face-to-face about available resources.
 - **EXPANDING OFFERINGS FOR DEMOGRAPHIC GROUPS.** Providing more offerings for certain groups, including equestrians, young families with children under age 12, and novice bicycle riders – particularly off-road facilities or protected on-road facilities.
 - **OWNERSHIP AND MANAGEMENT.** In the long term, it would be helpful to have a single entity managing trails. This could help ensure consistent surfaces, maintenance, and signage.
 - **PROVIDING CONSISTENT, FREQUENT SIGNAGE.** Signage or “wayfinding” is essential to making sure that people can find their way along designated routes. The high number of municipalities, organizations, and entities that own our roads and trail systems can make it difficult to apply consistent signage in a way that is easy for users to find and follow.
 - **COUNTYWIDE BIKE SHARE.** There are now at least two different bike share programs in Lancaster County. Creating a single, countywide system would improve the ability of cyclists to move around the county – rather than isolating them to smaller areas.
 - **IMPROVING TECHNOLOGY FOR GUIDED TOURS.** Bicycle tourism is often guided through paper cut sheets currently. Moving forward, apps would read directions aloud to riders, as well as providing narrative about important cultural or scenic attractions.

WIKI MAPPING COMMENT

SUMMARY 2017

• MAJOR BARRIERS TO BICYCLING

- No shoulder
- Speeds too fast/dangerous drivers
- Intersection issues – difficulty turning left, signals not registering bikes, poor design
- Lack of signage and bicycle facilities (lanes, sharrows, etc.)
- Uneven pavement

• MAJOR BARRIERS TO WALKING

- No sidewalks
- Intersections and crosswalks: missing/unclear or poorly designed crosswalk, lack of crosswalk signal or signage, dangerous/unsafe to cross street, motorists do not slow/yield to pedestrians
- Roadway characteristics: lack of lighting, steep slopes, turn lanes enable fast turns and motorists don't look for pedestrians
- Motorist behaviors: speeding, failing to look for or yield to pedestrians
- Geographic barriers: streams, bridges, highways/interchanges

• COMMON ISSUES AND SUGGESTIONS

- **Crossing Major Highways.** Many communities are divided by limited access highways. The public proposed numerous routes involving new bridges or underpasses over/under highways or improved bicycle/pedestrian access across existing bridges/underpasses. Routes 283, 222, and 30 were most frequently cited. Examples:
 - New underpass under Route 30 between Route 272 and Route 222 (Butler Ave to Eden Road)

- Connection across Route 283 connecting two segments of W Roseville Road
- Colebrook Rd to Sylvan Rd connection over/under 283 - East Hempfield Township
- Lack of adequate bike/ped facilities on Route 30 overpasses and underpasses, ex: at Lititz Pike, Oregon Pike, Fruitville Pike

- **Connections to Parks and Trails – Particularly Via Natural Areas.** Many of the proposed routes either connected multiple parks together or connect residential areas to parks or existing trails. Many routes involved crossing rivers or creeks, or meandering along them. Examples:

- Enola Low Grade/NW River Trail – connecting these two trails, connecting the Enola Low Grade to Lancaster City along the Conestoga
- Lititz Run Greenway – connecting Lititz Springs Park down Lititz Run to the Conestoga
- Little Conestoga Multi-Park Connection – connecting Maple Grove Park to Wheatland Hills Park to Farmingdale Trails to Long's Park along the Little Conestoga

- **Connections that Enable Children to Walk/Bike to School.** Some members of the public requested certain connections specifically to facilitate children walking or biking to school. Examples:

- E Walnut Street/Route 23 near McCaskey
- From Dairy Lane to the Bear Creek School, over/under Route 283
- Hill Street and Druid Hill Drive over Route 30

- **Filling in the Gaps.** The public pointed out some places where a direct route could significantly reduce the amount of time required to travel from one spot to another. Examples:



- Connect Lititz Pike to Oregon Pike & Valley Road at Delp – extending Delp Road towards East Delp.
- Connect Wheatland Ave to Good Drive
- Connect Lefever Road to Park Avenue in Mount Joy (at Willow Creek Drive)
- **Radial Route Improvements.**
 - **Where:** Most of the major roads leading out of the city and towards each of the boroughs were highlighted by the public as routes that needed improvement – including Old Philadelphia Pike, New Holland Pike, Oregon Pike, Lititz Pike, Fruitville Pike, Harrisburg Pike, Marietta Pike, and Columbia Pike. In terms of priorities, Harrisburg Pike and routes between the City and Route 30 in Manheim Township were among the more frequently cited by the public.
 - **How:** Bike lanes, shoulders, and sidewalks were commonly cited as needed improvements. In addition, improvements are also needed to help pedestrians and cyclists cross these routes – intersections and lack of crosswalks were among the more commonly cited barriers to walking and biking. Finally, enforcement of speed limits would help to improve safety on the roads.
- **New Regional Route Suggestions**
 - **Loop Route.** To get around the suburbs outside of the city by car, you simply use Route 30. To do so as a bicyclist or pedestrian is more challenging. One new route suggestion runs from Grandview Heights, to Belmont, to Long’s Park. This route requires crossing Oregon Pike, Lititz Pike, Fruitville Pike, Manheim Pike, and a set of railroad tracks. The specific path is not laid out, but the general flow demonstrates the lack of E-W options in the northern suburbs and N-S options in the western suburbs. Additional new route suggestions then connect Longs Park to The Crossings at Conestoga Creek, and The Crossings at Conestoga Creek to a proposed greenway along the Little Conestoga – connecting Manheim Township to East Hempfield & Manor townships.
 - **Goat Path/Route 23 Corridor/Greater Lancaster Heritage Pathway.** (The plan explores this route in depth.)

ACTIVE TRANSPORTATION PLAN ONLINE SURVEY

RESULTS 2017

WHAT ARE THE OBSTACLES OR CONCERNS THAT CURRENTLY PREVENT YOU FROM WALKING/RUNNING? (CHECK ALL THAT APPLY)

<i>Obstacles to Walking</i>	<i>Percent</i>
Lack of interest in walking	5%
The distance to my destination is too far	50%
The sidewalks/trails do not feel safe	31%
I don't know the best routes for walking	10%
The transit system is inconvenient	26%
The sidewalks are in poor condition	32%
The sidewalks/trails don't go where I need to travel (e.g. home/work/school)	30%
I have too much to carry	24%
Street crossings feel unsafe	29%
I get too sweaty	8%
Drivers are too aggressive	40%
I can't walk for other reasons	4%
Transit doesn't go to where I need to go	17%
TOTAL RESPONSES	851

Respondents could select more than one response, thus percentage totals equal more than 100.



WHAT IS THE LIKELIHOOD THAT THE FOLLOWING TYPES OF WALKING FACILITIES WOULD INFLUENCE YOU TO WALK MORE OFTEN?

<i>Walking Facilities</i>	<i>Percent*</i>
Directional and Wayfinding Signage	44%
Sidewalks	88%
Intersection Improvements at Non-Signalized Intersections (curb ramps, crosswalks)	70%
Intersection Improvements at Signalized Intersections (pedestrian signal, curb, ramps, crosswalks)	72%
Off-Street Paths/Trails	86%
More Amenities Along Sidewalks/Trails (lights, trash cans, benches)	71%
Better Pedestrian Access to Transit	57%
TOTAL RESPONSES	832

** Respondents indicating “likely” or “very likely”*

Respondents could select more than one response, thus percentage totals equal more than 100.

WHAT ARE THE OBSTACLES OR CONCERNS THAT CURRENTLY PREVENT YOU FROM BIKING? (CHECK ALL THAT APPLY)

<i>Obstacles to Bicycling</i>	<i>Percent</i>
Lack of interest in biking	11%
The distance to my destination is too far	21%
The streets/trails do not feel safe	64%
There isn't enough bicycle parking/storage at my destinations	35%
I don't know the best routes for biking	21%
The transit system is inconvenient	9%
The bike trails don't go where I need to travel (e.g. home/work/school)	42%
There are no bike lanes on the route to my destination	65%
I have too much to carry	21%
Street crossings feel unsafe	29%
I get too sweaty	10%
Drivers are too aggressive	54%
I don't know how to bike/I can't bike for other reasons	5%
TOTAL RESPONSES	701

Respondents could select more than one response, thus percentage totals equal more than 100.



WHAT IS THE LIKELIHOOD THAT THE FOLLOWING TYPES OF WALKING FACILITIES WOULD INFLUENCE YOU TO BIKE MORE OFTEN?

<i>Biking Facilities</i>	<i>Percent*</i>
Directional and wayfinding signage for bicyclists	43%
Bicycle Boulevard (shared, low-speed streets)	71%
Striped bike lanes	77%
Buffered bike lanes	83%
Protected bike lanes (physically separated by curb or parking)	83%
Intersection improvements for bicyclists	76%
Off-street paths	85%
Better bicycle access to transit	40%
More bike parking	61%
TOTAL RESPONSES	793

** Respondents indicating “likely” or “very likely”
 Respondents could select more than one response, thus percentage totals equal more than 100*

IN YOUR OPINION, WHAT ARE THE TOP THREE STREETS IN NEED OF BICYCLE AND/OR PEDESTRIAN IMPROVEMENTS IN LANCASTER CITY/LANCASTER COUNTY?

#	City Street	Responses
1	Queen	249
2	Prince	246
3	King	200
4	Chestnut	142
5	Walnut	125
6	Duke	122
7	Orange	108
8	Harrisburg Pike	101
9	Lemon	39
9	Lime	39
10	College	26
11	Water	23
12	James	21
13	Columbia	20
14	Manor	15
15	Fruitville	14
16	Park	11
17	Marietta	10
17	Plum	10
18	Charlotte	9
18	New Holland	9
19	Liberty	7
19	Ross	7
20	Christian	6
20	Race	6
20	West End	6

#	County Street	Responses
1	Lititz Pike/501	158
2	Harrisburg Pike	123
3	Fruitville Pike	122
4	Columbia Pike/462	75
5	Manheim Pike/72	66
6	Oregon Pike/272	60
7	Marietta Pike/23 west	55
8	Lincoln Highway/King/30	54
9	New Holland Pike/23 east	39
10	Rohrerstown/Millersville Rd/741	30
11	Millersville Pike/Manor/999	25
12	Willow Street Pike/222/272	23
12	Centerville Road	23
13	Route 23 (unspecified)	18
14	Old Philadelphia Pike/340	18
15	Route 222 (unspecified)	10
16	Route 322	9
17	Route 462 (unspecified)	8
18	Strasburg Pike	7
19	Stony Battery Road	6
19	Rothsville Road/772/Main Street (Lititz)	6
20	River Road/441	5



IN YOUR OPINION, WHAT ARE THE TOP THREE INTERSECTIONS IN NEED OF BICYCLE AND/OR PEDESTRIAN IMPROVEMENTS IN LANCASTER CITY/LANCASTER COUNTY?

#	City Intersection	Responses
1	Queen & King	96
2	Prince & James/Harrisburg	48
3	Queen & Orange	44
4	Prince & Walnut	41
5	Prince & Orange	32
6	Prince & King	25
7	College & Chestnut/Marietta	19
8	Queen & Chestnut	18
9	Manheim & Dillerville	17
10	Prince & Lemon	16
10	Prince & McGovern	16
11	Duke & Liberty	15
12	College & Columbia	13
12	College & Harrisburg Pike	13
12	Manor/Charlotte & King	13
12	Prince & Chestnut	13
12	Water & Lemon	13
13	Duke & Church	12
13	Water & Orange	12
13	West End & Columbia	12
14	Water & Chestnut	11
15	Broad & King	10
15	Mary & Lemon	10

#	County Intersection	Responses
1	Golden Triangle - Lititz (501) & 222 & Oregon (272) & Pleasure	43
2	Harrisburg Pike & Dillerville Road/President	34
3	30 & Harrisburg Pike	21
3	Bridgeport - Lincoln Hwy (462)/Old Philadelphia (340)/Pitney/King	21
4	Columbia (462) & Rohrerstown (741)	18
5	Manheim Pike (72) & Fruitville	17
6	30 & Lititz Pike (501)	14
6	Marietta (23) & Rohrerstown (741)	14
7	Marietta (23) & Centerville	13
8	30 & Fruitville Pike	10
8	222 & Keller/Marshall	10
8	222 & New Danville Pike (324) & Fairview & Hershey	10
9	Fruitville Pike & Dillerville Road	9
10	Columbia (462) & Centerville	7
10	Millersville Road (741) & Millersville Pike (999)	7
11	30 & New Holland (23)	6
11	Fruitville Pike & Granite Run Drive	6
11	Lititz (501) & Valley/Petersburg (722)	6
12	Lititz (501) & Roseville	5
12	Oregon Pike (272) & Creek	5
12	Oregon Pike (272) & Oregon Road (722)	5
12	Manheim Pike (72) & Plaza Boulevard	5

IMPLEMENTATION REFERENCE APPENDIX



APPENDIX D: IMPLEMENTATION REFERENCE

This appendix serves as a supplement to Chapter 7: Implementation, providing additional details and resources on certain plan recommendations.

A1

(right) Colored pavement within a bicycle lane on Prince Street increases visibility, identifies potential areas of conflict, and reinforces priority to bicyclists in this area.

(far right) High-visibility crosswalk markings are easier for drivers to see; “look” text reminds pedestrians to look up before crossing.



IMPLEMENTATION REFERENCE

A. CONNECT THE TRANSPORTATION NETWORK.

(A1) STUDY PRIORITY ROAD CORRIDORS AND IMPLEMENT BICYCLE/PEDESTRIAN IMPROVEMENTS.

The priority corridors for bicycle and pedestrian improvements have been identified in this plan, but in order to make improvements, these places will need to be studied to determine scope and feasibility. Corridor planning enables us to look beyond traditional boundaries to address multiple problems within one project. Though the focus of this plan is on the bicycle, pedestrian, and transit-related elements of road corridors - corridor planning should also look at land use, character, safety, economic development opportunities, congestion, stormwater management, and other factors that influence the well-being of our communities. Corridor planning efforts should include a wide variety of stakeholders who bring unique perspectives to bear.

A downtown mobility study should also be undertaken to analyze the existing traffic flow throughout downtown and determine the potential impact of converting one-way streets to two-way traffic. Additional analysis would include lane reduction or “right-sizing” projects along key corridors as they leave the City limits. This study should be multimodal in scope and consider the potential impacts to bicycle and pedestrian safety, bike share efficiency and transit connections.

Transportation considerations for corridor plans might include planning for more frequent and high-visibility crosswalks; closing sidewalk gaps; adding bike/buggy lanes or shoulders; narrowing lanes; adding bulb-outs or medians; using access management techniques; creating a grid or connecting streets; and adding bicycle amenities such as parking or storage. The specific features used will depend on roadway characteristics and width, community character, cost, and a variety of other factors.

Places2040, the Lancaster County Comprehensive Plan, emphasizes corridor planning as a means to implement improvements that reduce congestion; implement complete streets that accommodate all users (young, old, people of all abilities) and all modes (automobile, transit, bicycle, pedestrian); and encourage compact, mixed-use development.

Sample Programs and Resources:

Lincoln Highway Streetscape Plan, Phase 2. East Lampeter Township. 2015. <https://www.pennidot.gov/ProjectAndPrograms/Planning/Documents/PennDOTConnects/2015%20Lancaster%20County%20-%20East%20Lampeter%20Twp.%20US-30%20Streetscape%20Plan.pdf>

Building Healthy Corridors: Transforming Urban and Suburban Arterials into Thriving Places. Urban Land Institute. 2016. <http://uli.org/wp-content/uploads/ULI-Documents/Building-Healthy-Corridors-ULI.pdf>

[National Complete Streets Coalition](#)

[Lancaster County Complete Streets Guidebook](#)



(A2) IMPLEMENT MOBILITY HUBS TO IMPROVE INTERMODAL CONNECTIONS.

This recommendation focuses on the need to improve connections between various modes of transportation, and in turn connect these hub locations to the broader community. Mobility hubs should contain more amenities, infrastructure, and transportation choices than a typical transit stop, with the goal of improving community connections and enhancing the user experience.

The location of proposed mobility hubs is outlined in Chapter 4. Primary mobility hubs are located where existing Amtrak or SCTA transit stops are, as well as at the proposed locations of new bus transfer stations. The location of these hubs is thus more definite than those of other mobility hubs. The exact location of secondary

and tertiary mobility hubs may be somewhat flexible. For example, a community that has regional trail access, bus service, and a downtown – but no single intersection of these three important destinations – may need to select the best location for the mobility hub based on usage or the availability of space to add amenities. Bicycle and pedestrian connections between the mobility hub and these other important destinations could then be prioritized.

Amenities will vary between mobility hubs, with the greatest level of investment and amenities generally recommended for primary mobility hubs. The chart below provides general guidance on the types of amenities that might be appropriate at different levels of mobility hubs. Cost-sharing and alternative funding strategies for the installation of these amenities should be explored, including sources such as grants, capital improvement

MOBILITY HUB AMENITIES

<i>AMENITIES</i>	<i>PRIMARY</i>	<i>SECONDARY</i>	<i>TERTIARY</i>
Station / Indoor Waiting Area	x		
Restrooms	x		
Secure Bicycle Parking/Storage	x	x	
Real Time Transit Arrival Signage	x	x	
Vehicle Share	x	x	
Commuter Parking	x	x	x
Lighting / Signage / Visibility	x	x	x
Sidewalks / Crosswalks	x	x	x
Bicycle Lanes, Sharrows, or Shoulders	x	x	x
Bike Repair Stations	x	x	x
Bike Racks	x	x	x
Bike Share	x	x	x
Seating	x	x	x
Bus Shelter	x	x	x
Bus Pull-Off Area	x	x	x

planning, parks and recreational plans and budgets, transit budgets, land owners or developers, businesses and employers, institutions, and civic organizations.

In addition to the cost of installation, these improvements will also have on-going maintenance requirements. Maintenance needs will vary depending on the amenities at the mobility hub. Common maintenance needs may include trash removal, cleaning/power washing, light bulb replacement, broken glass replacement, maintenance/repairs, and vandalism monitoring and remediation. Primary hubs will have addition costs such as building maintenance; restroom cleaning and associated products; utility costs for electric, heat, water/sewer; landscaping; and monitoring of connecting infrastructure such as bike racks, crosswalks, and sidewalks. On-going maintenance costs should be considered at the time of design and factored in to the cost of implementation.

Unfortunately, many of these costs are not covered by recurring, dedicated funding sources. Thus, implementing and maintaining improvements will require communities and transit providers to work together to prioritize essential improvements; develop maintenance partnerships with each other, land owners, employers/businesses, or civic or volunteer organizations; and cultivate revenue streams for on-going maintenance.

Planning for mobility hubs and improvements should also be incorporated into municipal planning, budgeting, and regulatory processes, such as comprehensive planning or official map development (in coordination with transit service providers).

Additional policy guidance on mobility hub implementation and maintenance should be developed in partnership with SCTA and other stakeholders to address issues such as: best practices and design guidance; cost estimates; maintenance strategies, costs, and partnerships; and implementation strategies.

Sample Programs and Resources

South Central Transit Authority Transit Development Plan Update - Final Report, July 2018. Nelson Nygaard / South Central Transit Authority. <https://www.sctapa.com/wp-content/uploads/2018/09/SCTA-Final-Report.pdf>



(A5) ADOPT OFFICIAL MAPS.

The official map is a tool municipalities can use to implement elements of the comprehensive plan and signal intent to use land for public purposes (as enabled in Article IV of the PA Municipalities Planning Code). Official maps have two components: an adopted ordinance (often called a regulating plan) and a corresponding map that illustrates improvements a community wants to see in the future. These improvements usually relate to transportation, community facilities, and environmentally critical areas such as floodplains, habitats, and groundwater recharge areas. Transportation needs can focus on cars, buses, rail, pedestrians, and bicyclists – and may include improvements like bike lanes, crosswalk improvements, transit stops, trail or roadway connections. Community facilities are things like parks, utilities, and stormwater management facilities.

In addition to identifying improvements that the community wants to see, official maps may express a local government’s interest in acquiring land for public purposes and letting developers and property owners know of this interest. Since the features highlighted on an official map often extend into adjacent municipalities, every effort should be made to develop and adopt official maps at the regional level.

Official maps should be public documents shared with the community, neighboring municipalities, land owners, developers, and PennDOT. Whenever land developments or subdivisions are proposed, they should incorporate official map features. If municipal land acquisition is indicated, the municipality has up to a year to confirm its interest and negotiate for acquisition once the property. When roadway improvements are planned or proposed,

the official map should be consulted to ensure that official map features are implemented. Official maps should always be consulted as part of the PennDOT Connects process, for example.

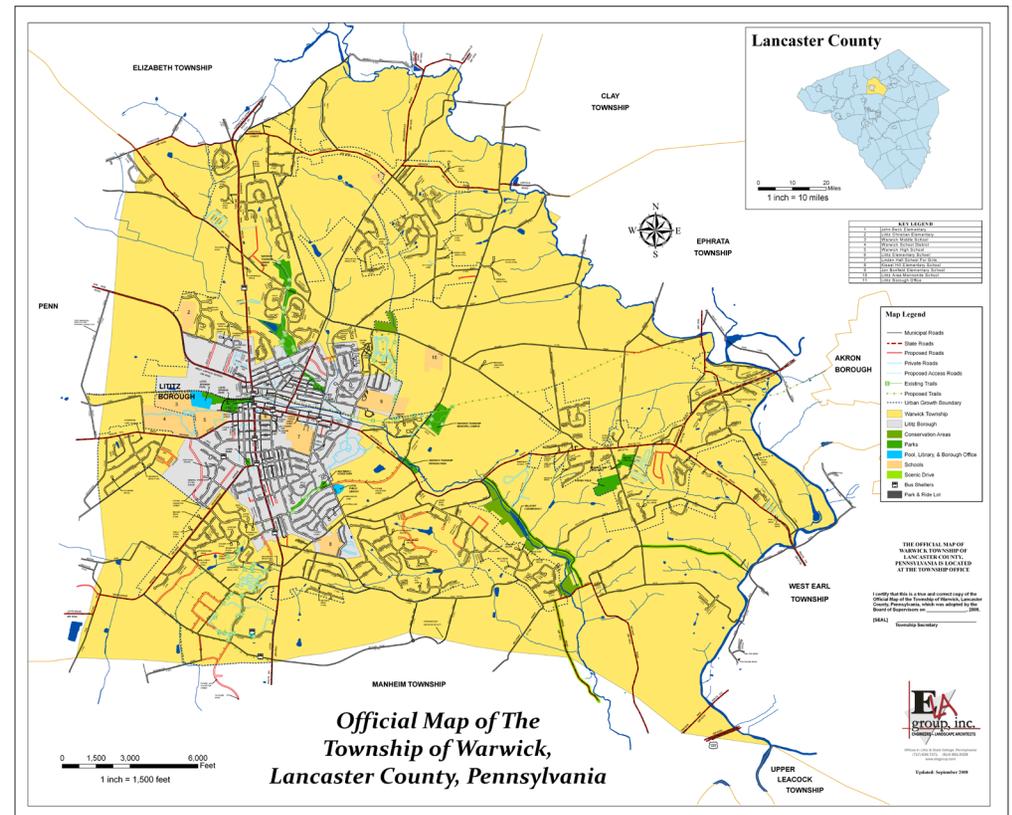
Sample Programs and Resources:

Warwick Township Official Map - <http://www.warwicktownship.org/planning-zoning/pages/official-map>

The Official Map: A Handbook for Preserving and Providing Public Lands and Facilities. PA DOT, Brandywine Conservancy, et al. <https://www.dot.state.pa.us/public/PubsForms/Publications/PUB%20703.pdf>



The Warwick Township official map plans new trails and streets.



(A6) CONNECT THE STREET NETWORK.

The goal of connecting the road network is to provide more direct routes, which reduces the distance users must travel between various origins and destinations. More connections also may offer a greater number of alternative routes. Reducing the distances which users must travel on roads and distributing users over multiple routes may help to alleviate traffic congestion.

Connecting the road network can also help to encourage people to bike or walk. Bicyclists and pedestrians have practical restrictions on the distances they can travel, so having direct routes increases the number of destinations that can be reached on foot or by bicycle. Having a variety of routes available means that bicyclists and pedestrians may be able to choose a route that feels more safe and comfortable.

Highways, bridges, and underpasses are examples of features that can serve as barriers to connectivity. Special attention should be given to designing these features to include comfortable facilities for bicyclists and pedestrians. Highways, in particular, tend to have high speeds and traffic volumes, so it may be necessary to provide separated facilities in order to improve the comfort of vulnerable road users.

Connectivity may be regulated through a variety of ordinances, including subdivision and land development ordinances, zoning, and official maps. These ordinances may connect the street grid through a variety of regulations, including but not limited to: requiring new developments to connect to existing developments; requiring multiple access points to new developments; prohibiting or restricting new cul-de-sacs; connecting streets at existing intersections whenever possible; reducing permitted block lengths; and encouraging street grid completion. PennDOT even suggests specific connectivity provisions which use a connectivity index to ensure that new developments are adequately connecting to their surroundings.

Sample Programs and Resources:

Improving Connectivity and System Function through Local Planning. PA Department of Transportation. <https://www.dot.state.pa.us/public/pubsforms/Publications/PUB%20731.pdf>

Networks of Complete Streets. National Complete Streets Coalition. <https://www.smartgrowthamerica.org/app/legacy/documents/cs/factsheets/cs-networks.pdf>



(A7) CONNECT AND IMPROVE TRANSIT STOPS

This recommendation focuses on the need to better connect transit stops to the communities they serve, as well as to improve the conditions of these stops.

In order to create an interconnected transportation network, transit stops should be connected to their surroundings through an array of infrastructure. “Last-Mile Improvements” refers to the need to make the most efficient use of our transit network by increasing the number of locations passengers can reach from transit stops. Passengers should be able to safely walk, bike, or roll from transit stops to their final destinations. Improvements that can help to better connect transit stops to the communities they serve might include: ADA-accessible

sidewalks and curb ramps, safe crossings, platforms, or bicycle lanes and racks.

There are a variety of other amenities that can improve the transit user experience and encourage people to use transit. Shelters, benches, trash receptacles, lighting, landscaping, and fencing can help to create a more comfortable wait for transit users. Route maps, wayfinding or other signage can help to orient transit users to both the transit system and nearby destinations.

The benefits of these improvements are clear, but there are also costs associated with the construction and ongoing maintenance of these improvements. The installation of a single shelter might cost \$10,000, while a bench might be around \$1,000. More extensive improvements including sidewalks, lighting, fencing, landscaping, shelter, seating, and trash receptacles could cost over \$100,000 for a single transit stop. This level of investment is not necessary at all transit stops, but may be appropriate the highest-volume stops.

In addition to installation costs, improved transit stops will also require regular maintenance. Costs will vary depending on the level of infrastructure provided, but basic maintenance services might include: trash removal, cleaning/power washing, light bulb replacement, broken glass replacement, maintenance/repairs, and vandalism monitoring and remediation.

Unfortunately, many of these costs are not covered by recurring, dedicated funding sources. Thus, implementing and maintaining improvements will require communities

A7

*Columbia Borough Transit Stop at
329 Locust Street*



and transit providers to work together to prioritize essential improvements; develop maintenance partnerships with each other, land owners, employers/businesses, or civic or volunteer organizations; and cultivate revenue streams for on-going maintenance.

Prioritization is an integral part of this process, as limited resources should be targeted to areas that will have the greatest impact rather than being distributed evenly throughout the county. For example, improvements at designated mobility hub locations and at the highest volume transit stops should generally be prioritized over those at other transit stops.

Planning for transit stops and improvements should also be incorporated into municipal planning, budgeting, and regulatory processes, such as comprehensive planning or official map development (in coordination with transit service providers).

Additional policy guidance on this issue should be pursued in coordination with SCTA through the development of design guides, cost estimates, prioritization criteria, and maintenance strategies and partnerships for transit stops.

Sample Programs and Resources:

Columbia Borough Transit Stop at 329 Locust Street

Elizabethtown Amtrak Station, Bicycle Parking & Repair Station

South Central Transit Authority Transit Development Plan Update – Final Report, July 2018. Nelson Nygaard / South Central Transit Authority. <https://www.sctapa.com/wp-content/uploads/2018/09/SCTA-Final-Report.pdf>

A7 *Elizabethtown Amtrak Station, bicycle parking.*



Photo Credit: Matthew Wiegosz

B. IMPLEMENT COMPLETE STREETS: CONSIDER ALL ROADWAY USERS IN INFRASTRUCTURE DESIGN.

(B4) USE BEST PRACTICES TO IMPROVE SAFETY AND REDUCE CONFLICT ON ROADWAYS: TRAFFIC CALMING.

Traffic calming is used to mitigate the effects of speeding and cut-through traffic in residential neighborhoods. Traffic calming measures improve safety for pedestrians, cyclists, and residents who travel along neighborhood streets. A common traffic calming strategy is to reduce posted speed limits. Lowering speed limits on streets can dramatically reduce injuries and fatalities that result from pedestrian and cyclist collisions. According to the ITE Transportation Planning Council, the risk of fatality decreases from 45% to 5% when the speed limit is reduced from 30-35 mph to 20-25 mph. This reduction is consistent with the goal to establish a Vision Zero program aimed at achieving zero traffic deaths on Lancaster's streets.

In addition, Lancaster should consider traffic calming techniques that slow traffic, reduce lane width and make drivers more aware of their surroundings. Roadway width reduction and the slowing of traffic can be accomplished by several techniques. Curb extensions or bulb-outs are areas of expanded curbing that extend across a parking lane and otherwise narrow a travel lane. Curb-extensions are often vegetated and are used for green stormwater infrastructure. Chicanes are one or more small bulb-outs, staggered at mid-block locations on one or alternating sides of the street. Lower cost alternatives include painted pavement markings, flexible, reflective delineators, and on-street parking.

Raised median islands are narrow islands, at mid-block or intersections, between travel lanes, and often include a pedestrian refuge. Traffic circles or mini-roundabouts are raised islands in the center of an intersection that require vehicles to travel counterclockwise around the circle. Landscaping and public art can be incorporated into these areas to assist further traffic calming and make drivers

B4 *Bold striping and a median island in Bird-in-Hand creates a safer street crossing for pedestrians.*



more aware of whom the streets are meant for. Gateway treatments can use physical traffic calming techniques as well as landscaping and architectural enhancements to provide identity to an area and therefore increase driver awareness.

Other infrastructure improvements to increase safety for pedestrians and bicyclists include striping, signage and beacons, and realigning or replacing stormwater grates.

Striping is a cost-effective and flexible traffic calming technique. It is also less disruptive to emergency service vehicles since no vertical or horizontal displacement occurs within the roadway. Striping can be implemented quickly through conventional construction techniques and it doesn't affect drainage. Types of traffic calming striping include but are not limited to parking lanes, centerlines, and edge lines; striped medians, chokers or chicanes; striped speed humps without raised speed humps; and bike lanes.

A wide variety of standardized signage is in current use as directed by the *Manual of Uniform Traffic Control Devices (MUTCD)*. In addition, several flashing beacons can be used in conjunction with striping, signage and other traffic calming techniques.

Stormwater grates should be realigned so that the grates are perpendicular to bicycle travel. If realigning grates is not practical, bicycle-safe grates should be installed, especially within bike lanes, shoulder areas and on all bicycle boulevards.

Target Audience:

All roadway users; road crews and public works departments.

Sample Programs and Resources:

[Manual of Uniform Traffic Control Devices](#)

[Pennsylvania's Traffic Calming Handbook](#)

B4

Heads Up campaign, here in Eureka, CA, encourages pedestrians to look up to see oncoming vehicles and be seen by bikes and drivers before entering a crosswalk.



Photo Credit: ALTA Planning



(B4) USE BEST PRACTICES TO IMPROVE SAFETY AND REDUCE CONFLICT ON ROADWAYS: TRANSPORTATION DEMAND MANAGEMENT/ACCESS MANAGEMENT.

According to FHWA, Transportation Demand Management (TDM) “is about providing travelers, regardless of whether they drive alone, with travel choices, such as work location, route, time of travel and mode. In the broadest sense, demand management is defined as providing travelers with effective choices to improve travel reliability.” TDM should be integrated into transportation planning activities carried out by PennDOT, Lancaster County Metropolitan Planning Organizations, and local municipalities and agencies.

Access Management (AM) is the management of vehicular access from roadways to adjacent land parcels that minimizes the number of conflict points that exist along a corridor. Implementing access management can increase roadway capacity, reduce crashes, and shorten travel time. FHWA states that “Access Management provides an important means of maintaining mobility. It calls for effective ingress and egress to a facility, efficient spacing and design to preserve the functional integrity, and overall operational viability of street and road systems.” Local municipalities should use access management to encourage safe and efficient use of the transportation network that achieves balance between property access and functional integrity of the road system.

Although TDM focuses on motor vehicle traffic, it is a necessary component to creating a safe and convenient environment for pedestrian and bicycle travel along many county roadways.

Target Audience:

Municipal government, transportation planners and engineers, design professionals.

Sample Programs and Resources:

FHWA Office of Operations - [Travel Demand Management](#) and [Access Management](#)

(B5) IMPROVE AND MAINTAIN PEDESTRIAN INFRASTRUCTURE.

Pedestrian infrastructure is critical to the healthy functioning of urban areas and represents a major public investment; and yet, maintenance of this infrastructure is often deferred or neglected – which can impair mobility and create liability issues. In some cases, lack of maintenance may be due to a lack of clarity about who is responsible for sidewalk maintenance. Thus, it is critical for communities to adopt policies outlining standards, roles, and responsibilities for sidewalk inspection, maintenance, and replacement. Regular maintenance can help extend the life of existing infrastructure and reduce the need for complete replacement. Municipalities should also address the need for safe detours around construction zones while work is underway.

When designing pedestrian infrastructure, consider other features that may help to improve user feelings of safety and comfort – such as human-scale lighting or locating trees and vegetation between pedestrians and roadways. Some of these considerations are outlined in Appendix A, Design Guidelines.

Target Audience:

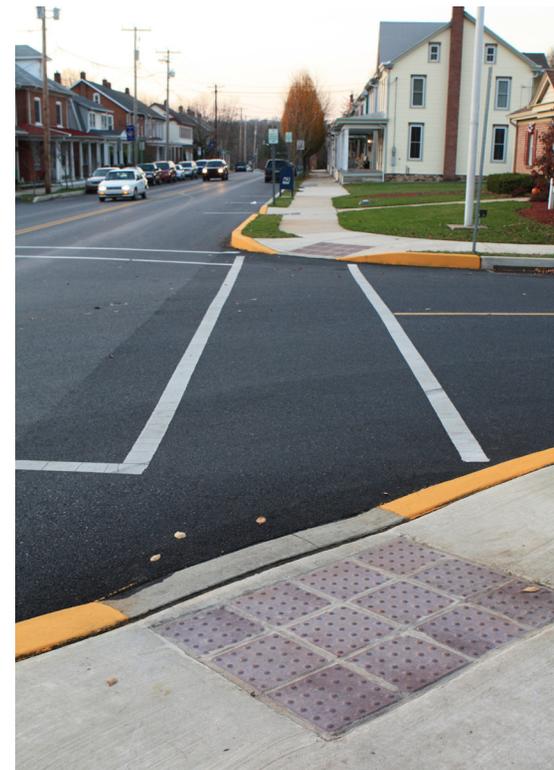
Municipalities and Planners/Landscape Architects/Engineers.

Sample Programs and Resources:

[A Guide for Maintaining Pedestrian Facilities for Enhanced Safety](#). Federal Highway Administration.

B5

Communities should provide ADA-compliant ramps, sidewalks, and crosswalks like this curb ramp in Denver Borough.



(B6) IMPROVE AND MAINTAIN BICYCLE INFRASTRUCTURE AND PARKING: BICYCLE PARKING.

Whether on-street or in parking lots or garages, bicycle parking is an important element of a robust bicycle network. Secure parking should encourage more people to choose bicycling as a transportation option for short trips and errands. The intent of on-street bike racks is for short-term parking like cars parked at parking meters. Studies show that bike parking spaces generate more revenue in a business district than car parking spaces. Bicycles take up less space, so more customers can park in front of a business. These customers are often more motivated to buy locally and have more disposable income.

Bicycle parking consists of a variety of posts, racks, corrals, and lockers. Regardless of style and materials, all bicycle parking structures should allow a bicycle frame and front wheel to be conveniently and securely locked to the rack using a standard U-shaped shackle lock. Each bicycle rack shall be securely anchored to the sidewalk, street or building and each bicycle parking space should be easily accessible without moving another bicycle for access and maneuvering. In addition, the bicycle rack design must adhere to all Americans with Disabilities Act (ADA) standards for protrusions in the right-of-way including the ability to detect the rack with a white cane.

The City of Lancaster started a bike rack program with initial funding through a grant from the Lancaster Bicycle Club. The City recognizes that the installation of bicycle parking racks, especially racks with innovative and aesthetic designs improves the City’s transportation infrastructure and enhances Lancaster’s image as an exciting, livable city. Through the program, a sponsor pays for the cost of the bike rack and the City installs the rack at an appropriate location within the public right-of-way. Businesses and institutions with employees commuting via bicycle are encouraged to provide safe and convenient bicycle parking on-site.

Municipalities should review and develop policies for placement and design of bicycle parking based on land use.

Codes related to parking should be evaluated to consider expanding the types of uses required to install bike parking and considering thresholds for building construction or expansion that trigger parking requirements. In high-volume destination areas, like downtowns and shopping centers, bicycle parking structures could be placed in underused pavement and single parking spaces. NACTO guidelines should be consulted for ideal bike parking density in areas with high bike volumes.

Target Audience:

Business community, current cyclists, potential cyclists and visitors.

Sample Programs and Resources:

[Association of Pedestrian and Bicycle Professionals](#)

B6

*right top: City bike corral.
below: City of Lancaster artistic bike post design.
right bottom: Columbia River Park’s amusing Mayfly bike rack.*



(B6) IMPROVE AND MAINTAIN BICYCLE INFRASTRUCTURE AND PARKING: MAINTAIN BICYCLE INFRASTRUCTURE.

As with all types of infrastructure, bicycle infrastructure requires regular maintenance in order to remain safe and usable. Maintenance includes traditional practices such as cleaning debris or repainting lines, but may also include enforcement remedies to keep bicycle infrastructure clear of double-parked cars or other barriers. Bicycle infrastructure includes formally designated facilities such as bike lanes and sharrows, as well as informal infrastructure such as road shoulders and commonly-used bicycle routes.

Communities should factor the cost of maintenance into improvement projects from the outset. These costs should be included in regular maintenance budgets, capital improvement plans, or parks and recreational plans and budgets. Other sources of funding should also be explored, such as grants, partnerships with local civic or advocacy organizations, or agreements with PennDOT. Cost estimates should be inclusive of special equipment needs, materials, labor, and staff training. Roles and responsibilities for this maintenance should also be explicitly defined, particularly when multiple municipalities or PennDOT are involved in the project.

Some design guides, like NACTO, provide basic information on common maintenance concerns for different types of bicycle infrastructure. Appendix A: Design Guidelines in this document also outlines high-level maintenance considerations. Common maintenance practices for bicycle infrastructure might include, but are not limited to, the following:

B6

Worker installing thermoplastic bike lane markings.



- Repainting or reapplication of line markings, stencils, and painted areas
- Street cleaning to clear stones, trash, and other debris from bicycle infrastructure
- Inventories and replacement of posts, bollards, or other features used to protect bicycle infrastructure
- Winter maintenance and snow plowing
- Inspections to ensure that bicycle infrastructure surfaces remain smooth and even, particularly following roadway maintenance, utility work, or other full or partial repaving

Regarding enforcement, issues such as double parking in bicycle lanes, motorized vehicles using bicycle lanes, or shoveling of snow into bike lanes render this infrastructure dangerous or unusable. Public works staff, law enforcement, and the public should all be aware of the rules of bicycle infrastructure. Enforcement of rules from the outset can help to establish a positive culture around bicycle infrastructure.

Because many local communities have not dealt with this type of infrastructure or maintenance in the past, there may be a learning curve as best practices are established that will work for Lancaster County. Additional research, information sharing, and training should be pursued to help communities estimate and prepare for the time and cost associated with bicycle infrastructure maintenance and enforcement.

Sample Programs and Resources:

Winter Bike Lane Maintenance. Alta Planning & Design. <https://altaplanning.com/wp-content/uploads/winter-bike-riding-white-paper-alta.pdf>

How Communities are Paying to Maintain Trails, Bike Lanes, and Sidewalks. Alliance for Biking & Walking and the League of American Bicyclists. https://bikeleague.org/sites/default/files/AA_MaintenanceReport.pdf

C. IMPROVE SAFETY THROUGH EDUCATION, AWARENESS, AND ENFORCEMENT.

(C1) EXPAND THE REACH OF SAFETY AND EDUCATION PROGRAMS FOR ALL ROADWAY USERS: BEGINNING DRIVER EDUCATION.

Improving awareness of pedestrian, bicycle, and buggy traffic and increasing the knowledge of the rules of the road, shared responsibilities, and common behaviors help to make a safer road environment for all users. These courses can also increase public acceptance of enforcement actions. Lancaster can help support the safety of all road users by supporting efforts to require pedestrian and bicycle-related training within local, private, and statewide driver education courses.

Target Audience:

All roadway users; may be more specific for targeted campaigns throughout the county.

Sample Programs and Resources:

[Illinois' Driver Education Video](#) and Curriculum; Wisconsin's [Share & Be Aware Driver Ed.](#)

C1 *Road Respect is a statewide program in Utah that promotes cooperation and respect between all road users (Photo: UDOT)*



Photo Credit: ALTA Planning

(C1) EXPAND THE REACH OF SAFETY AND EDUCATION PROGRAMS FOR ALL ROADWAY USERS: CLASSROOM AND ON-BIKE TRAINING.

Bicycle safety and skills education in elementary and middle schools can be an effective way to teach youth about bicycling safety and how to ride in a predictable, safe manner. These programs educate younger students about bicycling and other non-motorized transportation options, and may go a long way in affecting their decision to choose bicycling for transportation and recreation later in life.

For the past several years, Lancaster Bikes! Coalition and its partners have assisted with or taught safe riding skills at local schools and other events around the community including Lafayette Elementary School in April 2018, and AAA Bike Rodeos at Clipper Stadium in May 2017 and McCaskey High School in December 2017.

The School District of Lancaster conducted a bicycle educational program through its regular physical education classes for several grades with PE teachers doing instruction. Lancaster Bikes! Coalition members performed service on the bikes to prepare them for safe use. Other partners provided free helmets for participants.

A bike rodeo is an opportunity for kids to learn how to safely ride their bikes. At recent events, professional mechanics from local bike shops inspected each child's bike for safety and fixed small problems on the spot. The kids had their helmets checked for proper fit, and then

learned how to use hand signals while riding through a series of stations in the parking lot - learning how to stop and start safely, scan for cars, and dodge small obstacles in the road. Local bike shops donated bikes and helmets for kids without them.

Target Audience:

Elementary and middle/junior high school students.

Sample Programs and Resources:

[Lancaster Bikes! Coalition](#); [Bike Rodeo Station Guide](#); [Bike Rodeo Program](#) (Salt Lake City, UT).



The Salt Lake City Utah Police Department hosts several bicycle rodeos during school fairs or community events.



Photo Credit: ALTA Planning

(C2) ORGANIZE MEDIA & PUBLIC AWARENESS CAMPAIGNS.

Lancaster County should partner with the city, boroughs, and townships to develop regional campaigns that address unsafe and illegal behaviors of motorists, pedestrians, bicyclists, and buggy drivers. These campaigns will encourage mutual respect among all roadway users and foster active transportation. Establish a communication campaign to celebrate successes as progress is made. A key first task is to establish a page on the county's website dedicated to active transportation education and project updates. Materials should be distributed to all communities within Lancaster County.

Target Audience:

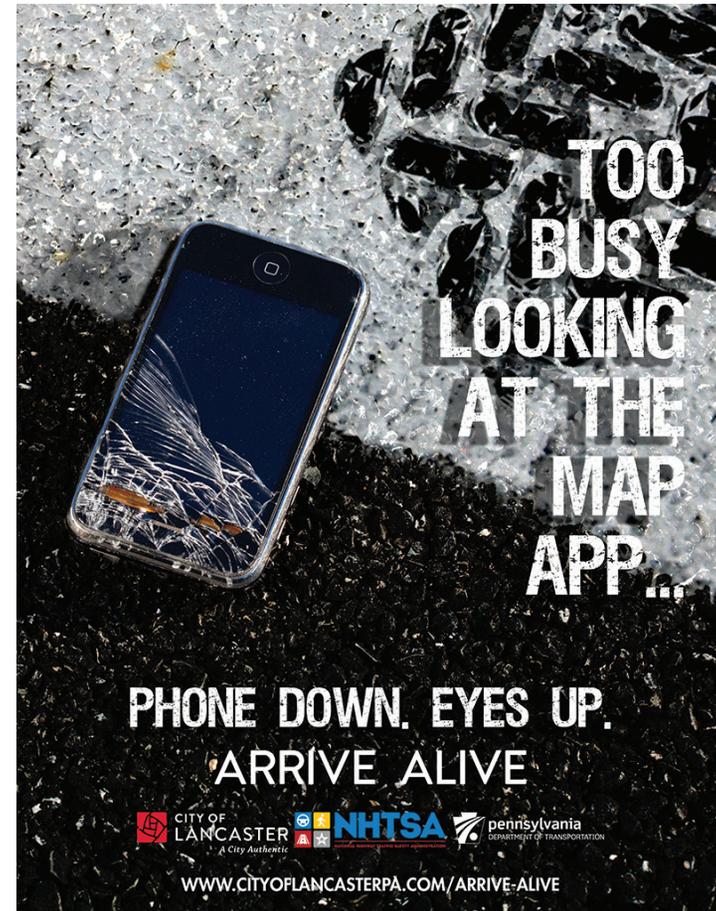
All roadway users; may be more specific for targeted campaigns throughout the county.

Sample Programs and Resources:

[Bikes Belong Safety Campaign Best Practices](#); [Road Respect](#) (Utah); [How We Roll](#) (Columbus, OH);

[Heads Up Boulder: Mind the Crosswalk](#) (Boulder, CO)

C2 Lancaster City "Arrive Alive" campaign. www.cityoflanasterpa.com/arrive-alive



(C3) COORDINATE POLICE ENFORCEMENT OPERATIONS.

Regardless of your preferred mode of transportation, sometime during the day, you are a pedestrian. Sometime during the day, everyone is a pedestrian. Unfortunately, according to the National Highway Traffic Safety Administration, pedestrians were one of the few groups of road users to experience an increase in fatalities in the United States in 2016, totaling 5,987 deaths. On average, one pedestrian is killed in a traffic crash every 1½ hours.

Motorists who routinely fail to yield the right-of-way to pedestrians, as required by law, are unlikely to change their behavior if they perceive that there are no consequences for their actions. Hundreds of communities around the U.S. implement targeted crosswalk enforcement. Though enforcement and education for all users should be a part of these campaigns, efforts should emphasize protection of the most vulnerable road users. While targeted crosswalk enforcement often results in citations, the greater impact comes through media publicity of the event to reinforce the importance of obeying pedestrian crossing laws.

In 2018, the City of Lancaster partnered with a wide range of organizations to pilot an educational and media campaign, and high visibility enforcement by the Lancaster City Bureau of Police. The campaign targeted residents, visitors, and employees within the City of Lancaster who drive or walk. Print and digital materials were developed

and distributed in both English and Spanish and the City of Lancaster encouraged all project partners to fully utilize their websites and social media outlets to repeatedly feature pedestrian safety information.

Target Audience:

Drivers and bicyclists.

Sample Programs and Resources:

[National Highway Traffic Safety Administration](#), [City of Lancaster PA](#), [New York State Pedestrian Safety Action Plan](#), [Ocean City, MD](#)

C3

Costumed deputy brings awareness of rights of pedestrians and school crosswalk safety to motorists in Moreno Valley, Riverside County, CA.



Photo Credit: ALTA Planning, LA1st.com

(C4) EMPHASIZE POLICE TRAINING ON BICYCLE AND PEDESTRIAN ISSUES.

Strengthening the walking and biking information in police education courses and training will help officers improve public safety and enforce existing laws more effectively. Police training will enhance many other education and enforcement programs currently offered in Lancaster County. Targeted bicycle and pedestrian safety enforcement training for local and state law enforcement officers will ensure state laws are equitably enforced.

Target Audience:

All enforcement officers, including any private enforcement officers such as campus police.

Sample Programs and Resources:

Traffic Enforcement or Bicyclist Safety Training Video (Chicago, IL); [Watch for Me, NC](#) (Raleigh, NC)

C4

Chicago police officers are required to take a bicycle and pedestrian safety course as part of their annual professional development program.



Photo Credit: ALTA Planning

(C5) WORK TO REDUCE TRAFFIC FATALITIES: CRASH ANALYSIS & REDUCTION.

By developing a routine analysis for pedestrian and bicycle-related crashes, other cities have been able to implement safety-driven, multi-modal enforcement programs along with strategic infrastructure changes to reduce traffic fatalities.

Pennsylvania Department of Transportation (PennDOT) has incorporated Working Toward Zero Deaths (TZD), a national movement involving numerous state and federal departments of transportation into its Strategic Highway Safety Plan (SHSP). The SHSP lays the foundation for achieving a TZD Vision by incorporating cost-effective, data-driven, science-based and proven strategies into interdisciplinary approaches to highway safety.

Coordinated enforcement efforts with local Police Departments or State Police where there is no local

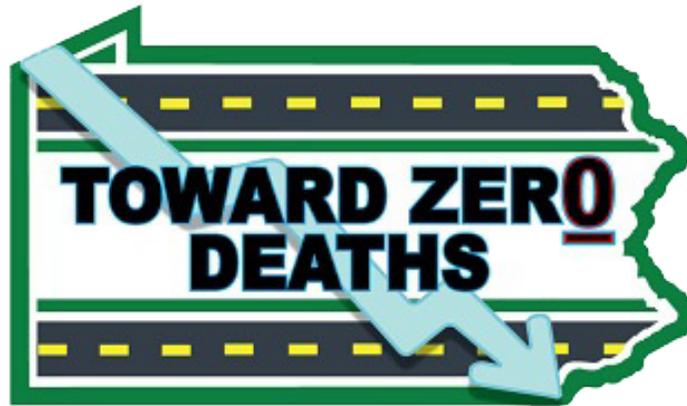
coverage, to conduct targeted enforcement operations will help to increase safety for all active transportation modes and raise awareness of active transportation in Lancaster County.

Target Audience:

All roadway users; may be more specific for targeted campaigns throughout the county.

Sample Programs and Resources:

[NYC's Vision Zero](#) (New York City, NY); Targeted Multi-Modal Enforcement (Tucson, AZ); Denver's Vision Zero Program (Denver, CO). [Pennsylvania's Strategic Highway Safety Plan](#)



C5 *Pennsylvania's Strategic Highway Safety Plan*

D. ENCOURAGE EVERYONE TO WALK AND BIKE.

(D1) UPDATE THE LANCASTER COUNTY BICYCLE MAP.

Lancaster County's beautiful Amish countryside provides a unique and sought-after backdrop for breathtaking bike touring. There are several organizations, such as Lancaster Bicycle Club, Discover Lancaster, and Intercourse Bike Works, that have designed specific routes for all skill levels. Lancaster County produced *A Guide to Bicycling, Walking & Transit following the Lancaster County Bicycle and Pedestrian Plan Phase II* in 2004. The bike map was designed to help residents and visitors plan their biking trips. The updated map should show countywide routes and trails, and highlight key cultural, historic, and tourism destinations. In addition to developing a new County-wide bike map, Lancaster County Planning Commission should consider developing a brand package for County-wide bike wayfinding for commuter routes and touring routes.

The City of Lancaster currently provides guided and self-guided tours for green stormwater infrastructure, public art, and historic architecture. Additional opportunities for bicycle and walking tours exist in the City and along the Greater Lancaster Heritage Pathway where numerous recreational, historical and cultural sites are located including Wheatland and LancasterHistory.org, the Conestoga House, and Downtown Lancaster City. Lancaster City and the municipalities comprising the Lancaster Intermunicipal Committee Cultural Hike and Bike Map should collaborate with local visitor and cultural organizations to develop a map depicting cultural resources and destinations throughout the city and region paired with manageable walking and biking routes for all levels of tourists.

Furthermore, these resources need to be shared and coordinated to increase bicycle tourism in the county.

Quarterly stakeholder meetings to discuss existing resources, new opportunities, and potential partnerships should be organized to improve communication.

Target Audience:

Current cyclists, potential cyclists and visitors.

Sample Programs and Resources:

[Intercourse Bike Works](#); Florida Destination Cycling Tours ([Bike Florida](#)); Philadelphia, PA (several private operators)

D1

Visit Philadelphia promotes a series of bike tours through Center City, from the Delaware River to the Schuylkill River. By partnering with local business, the tours include lunch and admission to attractions.



Photo Credit: ALTA Planning



(D2) EXPAND ACCESS TO BIKES AND SHARED MOBILITY: BIKE SHARE, SHARED MOBILITY AND PERSONAL MOBILITY DEVICES.

As interest in living, working and recreating in urban centers has grown in the past two decades, so has the need for transportation alternatives. Shared mobility lets users access transportation services such as bicycles or automobiles on an on-demand basis. The recent shared mobility phenomenon is often viewed as more efficient and sustainable and has been made possible by the rapid advances made in computer and wireless technologies.

The most common type of non-motorized shared mobility is bike sharing. A bike share program is a service which makes bicycles available for shared use to individuals on a very short-term basis. Bike share systems allow people to borrow a bike from point “A” and return it at point “B”.

Like bike share, electric scooters have become more common in recent years. As a form of shared mobility, also known as micro-mobility, scooters are a type of personal mobility devices (PMD). A PMD is defined as a vehicle that is designed to be used by one person and is propelled by human power, an attached electric motor or both. PMD include, but are not limited to, unicycles, bicycles and tricycles; wheelchairs and similar devices; rollerblades, roller skates, and skateboards; scooters and skate-scooters; and Segways.

Given the growing trend of shared personal mobility devices, municipalities need to establish ways to manage the use of these vehicles as well as the facilities (sidewalks, bike lanes, paths, and trails) on which they will be used. Policies and regulations should consider the diverse range of activities and modes and potential conflicts among uses, for minimizing problems.

As this plan is implemented and more bicycle infrastructure is added across the county, other townships and boroughs should consider exploring the feasibility of launching their own mobility sharing programs or joining existing programs, if feasible. The county should provide regional coordination support to ensure bike share and other sharing programs are consistent with best practices and current state legislation.



D2 *Bike It! Lancaster stations can be seen throughout the downtown area.*



In 2017, the City of Lancaster launched a bike share system supported by a group of community sponsors. Bike It! Lancaster consists of 6 fixed station locations and 30 comfortable multi-speed bicycles. Affordable annual or hourly membership plans are available to anyone with a credit card and access to a mobile device.

To ensure success and access, the City should monitor usage by station and purpose. As the program matures, underperforming stations may need to be relocated, and the coverage area expanded while also increasing station density within existing service areas.

Target Audience:

Current cyclists, potential cyclists and visitors.

Sample Programs and Resources:

[Planning for Shared Mobility](#) (American Planning Association PAS Report); [Bike It! Lancaster](#) Zagster Bike Share; [Lititz Rail Trail Bike Share](#); Philadelphia's bike share program, [Indego](#)

(D3) COORDINATE SIGNAGE AND WAYFINDING: PEDESTRIAN AND BICYCLE WAYFINDING.

Well-designed pedestrian and bicycle wayfinding is one of the most fundamental elements of a welcoming and pleasant walking or biking environment. Wayfinding schemes should include destinations, sign types, travel time, and/or distance where possible, and a plan for implementation. A cohesive and conspicuous wayfinding network will help pedestrians and bicyclists identify the best routes to key destinations. Efforts across the county should mimic and expand the wayfinding network in Lancaster City while also creating a unique brand and style for each individual community.

Target Audience:

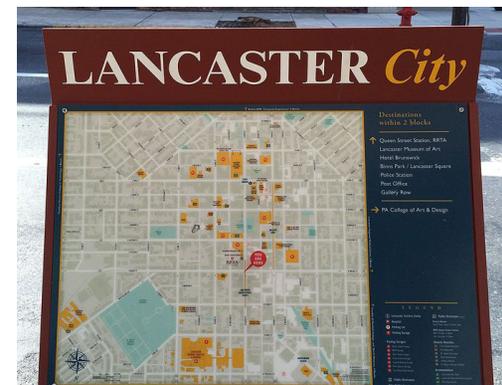
Residents and visitors.

Sample Programs and Resources:

Philadelphia, PA; Corolla, NC

D3

Wayfinding signs in downtown Lancaster include maps that promote and identify key destinations within a walkable, two-mile radius.



(D4) SEEK BICYCLE-FRIENDLY DESIGNATIONS.

The League of American Bicyclists created a Bicycle FriendlySM America program to assist and recognize states, communities, universities, and businesses in being bicycle friendly. The program is designed to make bicycling a real transportation and recreation option for people of all ages and abilities.

The Bicycle FriendlySM Community (BFC) program is designed to give communities the tools needed to improve their bicycling environment and facilities. BFC designation lets bicyclists know the community is trying to make bicycling safe and convenient for commuting and recreation.

Bicycle Friendly Business programs raise the profile of and show support for bicycling in a community, while also promoting local businesses and building a sense of community. The League of American Bicyclists recognizes businesses across the country that promote and encourage bicycling as an attractive and convenient form of transportation. Communities throughout the county should be encouraged to apply or continue to improve their existing standing. There are currently several businesses and one university in Lancaster County that have been designated as such:

- Lancaster Chamber of Commerce and Industry (Bronze)
- Weber Advertising and Marketing (Bronze)
- The Common Wheel (Gold)
- Dream Ride Projects (Gold)
- .Recumbent Cycles (Silver)
- Borough of Elizabethtown (Silver)
- Cargas Systems (Bronze)
- Lancaster City (Bronze)

- Lancaster General Health (Bronze)
- Lemon Street Market (Bronze)
- Franklin and Marshall College (Bronze)

Organizations such as Lancaster Bikes! Coalition and Lancaster Bicycle Club should be encouraged to assist local businesses, colleges and municipalities to seek the appropriate “Bicycle FriendlySM” designation. The development and implementation of this plan is an essential first step toward becoming designated as a bicycle friendly Community. Municipalities should embrace bicycling as a benefit for the community and for its residents and provide safe and convenient bicycle facilities. In 2013 and 2015, the City of Lancaster applied for ‘Bicycle FriendlySM’ Community designation and received an Honorable Mention both times. With progress on program, policy, and infrastructure recommendations and implementation, the City should be able to reapply for and receive recognition by 2020. Other municipalities that have been installing bicycle facilities, like Elizabethtown, should also seek designation.

Target Audience:

Businesses, colleges and municipalities.

Sample Programs and Resources:

[League of American Bicyclists; Bicycle Friendly Business Program](#) (Long Beach, CA)

(D5) MAKE SCHOOLS BICYCLE- AND PEDESTRIAN-FRIENDLY.

The rate of children walking and biking to school is at an all-time low and parents have become wary of allowing children to walk or bike alone, often due to traffic concerns. Safe Routes to School (SRTS) is a national program that uses a variety of education, engineering, and enforcement strategies to create safer, more convenient, and healthier routes for children to walk and bicycle to school. Common barriers to students walking to school may include school policies or absence of infrastructure or instructive programming.

School districts should identify and remedy policies that discourage or prohibit school children from engaging in active transportation. Policy changes should be accompanied by a review of existing infrastructure on school grounds and along frequently-used walking and biking routes to school. Examples of necessary improvements might include adding sheltered bicycle racks or indoor bicycle parking; improving signage or pavement markings at key intersections; or adding crossing guards.

Educational programming, such as walking school buses or bike trains can encourage students and parents to walk and bike to school. Walking school buses and bike trains are two ways for parents and community members to be actively involved in children's trips to school. Walking school buses help alleviate fear and time constraints that may be associated with children walking to school. Parents can take turns leading the "bus", which follows the same route every time and picks up children from their homes or designated stops at specific times. The program can be as informal as a few parents alternating to walk with their children but is often led by the PTA or a local agency or organization.

Other programming, such as bike rodeos or in-school education, can give students the skills they need to bicycle safely.

Target Audience:

School Districts, Students and Parents/PTAs.

Sample Programs and Resources:

[Maine Walking School Bus Program](#), [Safe Routes To School Walking School Bus & Bicycle Train](#), [Pennsylvania Safe Routes to School](#), [Safe Routes to School Bicycle Train](#)

D5 Kids and parents often feel more comfortable walking to school as a group.



Photo Credit: ALTA Planning



(D6) SUPPORT LOCAL AND REGIONAL PROGRAMMING THAT ENCOURAGES ACTIVE TRANSPORTATION: OPEN STREETS EVENTS.

The City of Lancaster has been hosting Open Streets events since 2014 to engage people in walking, biking, and physical activity. The event temporarily closes City streets to automobile traffic reserving them exclusively for walking, biking, and other forms of active transportation. Open Streets events provide sports and recreational activities for children and adults as well as music, food, games, and other attractions. These efforts should be expanded to other communities throughout the county and continued on a regular basis.

Target Audience:

Persons of all ages and abilities; may be more specific for targeted campaigns throughout the county.

Sample Programs and Resources:

[Open Streets Project/Open Streets Guide](#); [Cyclovia](#) (Tucson, AZ).

D6 Lancaster City Open Streets event on Water Street.



Photo Credit: Lancaster Rec. / Michelle Johnsen

(D6) SUPPORT LOCAL AND REGIONAL PROGRAMMING THAT ENCOURAGES ACTIVE TRANSPORTATION: SMARTTRIPS.

This neighborhood-based program encourages public and active transportation through free bike/walk/transit kits, coupons to local businesses, educational newsletters, and collaborative community events. The program seeks to educate interested people on how to find a safe route to where they live, work, play and learn. Other communities that have launched a SmartTrips program have successfully reduced the number of Single Occupancy Vehicles (SOVs).

Target Audience:

Residents of targeted communities and neighborhoods.

Sample Programs and Resources:

[SmartTrips Program](#) (St. Paul, MN); [GoSMART](#) (Triangle Area, NC).

D6 SmartTrip coordinators in Salt Lake City routinely ride the S-Line streetcar to encourage more active transportation options.



Photo Credit: ALTA Planning

(D6) SUPPORT LOCAL AND REGIONAL PROGRAMMING THAT ENCOURAGES ACTIVE TRANSPORTATION: PARK(ING) DAY.

Park(ing) Day is an annual event that takes place around the world where neighborhood residents, artists, business owners, cities, counties, and others collaborate to temporarily transform parking spaces into small parklets as temporary public places for the day. Parklets are a form of tactical urbanism and can be a great way to showcase how public spaces can be transformed for different uses that foster active transportation. Lancaster City and other communities throughout the county should implement and encourage parklet and tactical urbanism activities.

The City of Lancaster and municipalities should consider working with advocacy organizations like the Lancaster County Coalition for Smart Growth to implement a tactical urbanism approach as a low-cost alternative to implementing small scale temporary pedestrian and bicycle improvements that can be used to measure acceptance and efficacy.

Target Audience:

Neighborhood residents, business owners, and visitors.

Sample Programs and Resources:

[Official Park\(ing\) Day](#); [Park\(ing\) Day Philadelphia](#)

D6

The Smart Growth Coalition's Pop-Up Park in a parking space along Gallery Row, North Prince Street, Lancaster.



(D6) SUPPORT LOCAL AND REGIONAL PROGRAMMING THAT ENCOURAGES ACTIVE TRANSPORTATION: BIKE REGISTRATION.

The purpose of a bicycle registration program is to document an owner's bicycle information to help them protect their property. An assigned serial number can assist law enforcement agencies should an owner lose their bike or become a victim of theft.

Currently, three county municipalities have bicycle registration requirements or programs. The City of Lancaster has a bicycle registration program whereby, the Lancaster Police Department or the Lancaster City Alliance will register any bicycle for a \$1 fee. Manheim Township offers free bike registration through the Township Police Department. Communities across the county are encouraged to implement similar programs and adopt requirements for bicycle registration. Cost for bicycle registration should remain low or be offered free of charge to provide equitable access. Programs should be easily accessible and promoted through multiple online and hard copy forms.

Target Audience:

Current cyclists.

Sample Programs and Resources:

[Lancaster City Alliance](#)

D6

Lancaster's \$1 registration fee covers the cost of a serial number sticker to be placed on the bike.



E. ALIGN RESOURCES AND WORK COLLABORATIVELY TO IMPLEMENT ACTIVE TRANSPORTATION PRIORITIES.

(E4) INCORPORATE OTHER COMMUNITY NEEDS INTO TRANSPORTATION IMPROVEMENTS.

When scoping road improvements, incorporate the recommendations of all community plans. For state projects, the PennDOT Connects process can be used to engage stakeholders and implement the planning that communities have undertaken.

In the City of Lancaster, street reconstruction and reconfiguration projects have been used as opportunities to incorporate green infrastructure. Green infrastructure has many benefits, including reducing stormwater runoff and associated pollutants, minimizing combined sewer overflows, and urban greening to improve air quality and mitigate urban heat island effect. The Mulberry Street two-way conversion project is an example of this type of coordination. This project used porous pavers in parking areas, incorporated 13 bioretention areas in vegetated curb extensions, and protected or replaced over 100 street trees. In addition to the notable environmental benefits, the project also provides aesthetic benefits that may boost property values and improve quality of life.

It is also critical to incorporate utility improvements with transportation improvements. Municipalities should share plans for projects such as road reconstruction or repaving with utility companies as early as possible to allow for necessary utility work to be completed prior to construction. In the absence of this coordination, newly-repaved roads may need to be disturbed and patched, which reduces the integrity of the roadway surface. Poor road surface conditions can reduce the efficiency of both bicycles and cars, and may even pose safety risks to these users. To encourage contractors to adhere to improvement schedules, the City of Lancaster requires contractors to

mill and repave roads to a high standard if more than 25% of the roadway surface has been disturbed.

Target Audience:

Municipalities, Utility Companies.

Example:

[Mulberry Street Two-Way Conversion Project, City of Lancaster](#)



E4

Vegetated curb extensions along Walnut Street in Lancaster City.

(E5) COLLECT AND USE BICYCLE AND PEDESTRIAN DATA IN DECISION MAKING.

Bicycle and pedestrian user counts provide important information that can be used to approximate use and demand for facilities and programs. Currently, minimal data is available to measure bicycle and pedestrian usage; this data is often limited, costly, and may contain implicit biases (due to sourcing from cell-phones and apps). The National Bicycle and Pedestrian Documentation Project (NBPDP), a nationwide effort to provide a consistent model of data collection and ongoing data, states that “without accurate and consistent demand and usage figures, it is difficult to measure the positive benefits of investments in [bicycling], especially when compared to other transportation options such as the private automobile.”

There are some existing efforts to quantify bicycling and walking in Lancaster County. Since 2015, the Lancaster County Planning Commission, supported by Lancaster City Department of Public Works and volunteers, has conducted periodic manual bicycle user counts in the City with the help of volunteers. The counts have been conducted during one week in September most recently on streets with existing or proposed bicycle facilities. The primary purpose of the counts is to estimate existing bicycle activity and change over time. This type of data collection is very time and labor intensive, and provides limited results. The Northwest River Trail and Enola Low Grade Trail both have stationary counters which collect data year-round, though these counters can only be used for non-motorized recreational trails.

Implementation of automated data collection methods, particularly on-road, would allow for volume and trend analysis which may support investment in the active transportation network across the county. Modern automatic counters are highly accurate and can provide continuous pedestrian and bicyclist counts. Cities around the country utilize counters to analyze trends and measure traffic volumes before and after infrastructure installation. In addition, automatic counters collect data

continuously and in all weather conditions. The county should investigate options for purchasing equipment, either by itself or in partnership with other counties, that would allow for regular on-road bicycle counts. This data could potentially be used to inform MPO decision-making and other planning processes.

Target Audience:

County and city staff (planners and analysts).

Sample Programs and Resources:

[National Bicycle and Pedestrian Documentation Project](#); [Bike It! Lancaster](#).

Innovation in Bicycle and Pedestrian Counts. Alta Planning + Design. <https://altaplanning.com/wp-content/uploads/Innovative-Ped-and-Bike-Counts-White-Paper-Alta.pdf>

The image shows a 'STANDARD BICYCLE INTERSECTION COUNT FORM'. At the top, it asks for Name, Location, Date, Start Time, End Time, and Weather. Below this, it provides instructions: 'Please fill in your name, count location, date, time period, and weather conditions (fat, rainy, very cold). Count all bicyclists crossing through the intersection under the appropriate categories.' It lists four categories: 'Count for two hours in 15-minute increments.', 'Count bicyclists who ride on the sidewalk.', 'Count the number of people on the bicycle, not the number of bicycles.', and 'Use one intersection graphic per 15-minute interval.' The form contains four identical intersection diagrams, each for a 15-minute interval: 0:00-0:15, 0:15-0:30, 0:30-0:45, and 0:45-1:00. Each diagram shows a four-way intersection with a north arrow. The north-south road is labeled A3, A2, A1 from top to bottom. The east-west road is labeled D1, D2, D3 from left to right. The southeast quadrant is labeled B3, B2, B1 from top to bottom. The southwest quadrant is labeled C1, C2, C3 from top to bottom. Each diagram has a grid for recording counts.

E5

National Bicycle and Pedestrian Documentation Project Standard Intersection count form.



FUNDING SOURCES FOR ACTIVE TRANSPORTATION PLAN IMPLEMENTATION

FEDERAL OR STATE FUNDING ALLOCATED TO THE MPO

The MPO, in collaboration with SCTA and PennDOT, funds projects through the Metropolitan Transportation Plan (MTP) and the Transportation Improvement Plan (TIP). The following are funding categories that may be used for active transportation projects in Lancaster County.

TRANSPORTATION ALTERNATIVES (TA)

- **Eligible Projects:** SRTS programs; on-road and off-road trails, sidewalks, bikeways, pedestrian and bike signals, traffic calming, lighting, and other safety-related infrastructure; rail-trails; recreational trails program; construction, planning, and design of infrastructure-related projects that will provide safe routes for non-drivers including children and seniors.

HIGHWAY SAFETY IMPROVEMENT PROGRAM (HSIP).

- **Eligible Projects:** Safety projects that are consistent with the State's Strategic Highway Safety Plan; bike and pedestrian safety improvements, traffic calming projects, and crossing treatments such as pedestrian hybrid beacons, medians, and pedestrian crossing islands.

CONGESTION MITIGATION/AIR QUALITY PROGRAM (CMAQ).

- **Eligible Projects:** Bicycle, pedestrian, and transit facilities that reduce travel by automobile. Purely recreational facilities are not eligible.

FEDERAL TRANSIT ADMINISTRATION (FTA) CAPITAL FUNDS

- **Eligible Projects:** All pedestrian improvements located within one-half mile and all bicycle improvements located within three miles of a public transportation stop or station.

COMPETITIVE FUNDING SOURCES AND GRANTS

At the federal, state, and local levels, competitive funding sources and grants are available to fund active transportation projects. Special funding for regional transportation projects should be coordinated through the MPO.

FEDERAL

BETTER UTILIZING INVESTMENTS TO LEVERAGE DEVELOPMENT (BUILD) DISCRETIONARY GRANTS

- **Distributed by:** US DOT

BUILD Transportation grants are for investments in surface transportation infrastructure and are to be awarded on a competitive basis for projects that will have significant local or regional impact. BUILD funding can support roads, bridges, transit, rail, ports or intermodal transportation.

<https://www.transportation.gov/BUILDgrants>

STATE

TRANSPORTATION ALTERNATIVES (TA) SET-ASIDE

- **Distributed by:** Pennsylvania DOT
- **Eligible Projects:** On- and off-road pedestrian and bicycle facilities, infrastructure projects for improving non-driver access to public transportation and enhanced mobility, community improvement activities, environmental mitigation, recreational trail projects, and safe routes to school projects.
<https://sportal.dot.pa.gov/Planning/AppReg/TAP/Pages/default.aspx>

MULTIMODAL TRANSPORTATION FUND (MTF) – PENNDOT

- **Distributed by:** Pennsylvania DOT
- **Eligible Projects:** Projects which coordinate local land use with transportation assets to enhance existing communities; projects related to streetscapes, lighting, sidewalk enhancement and pedestrian safety; projects improving connectivity or utilization of existing transportation assets; projects related to transit-oriented development.
<https://www.penndot.gov/ProjectAndPrograms/MultimodalProgram/Documents/Multimodal%20Transportation%20Fund%20FAQs%2001.30.2018.pdf>

MULTIMODAL TRANSPORTATION FUND (MTF) – DCED

- **Distributed by:** Pennsylvania DCED
- **Eligible Projects:** Development, rehabilitation, and enhancement of transportation assets in existing communities, streetscape, lighting, sidewalk enhancement, pedestrian safety, connectivity of transportation assets and transit-oriented development.
<https://dced.pa.gov/programs/multimodal-transportation-fund/>

COMMUNITY RECREATION AND CONSERVATION PLANNING FUNDING

- **Distributed by:** PA DCNR
- **Eligible Projects:** Planning projects that lay the groundwork for future acquisition, development, and/or management of parks, recreational facilities, critical habitat, open space, natural areas, greenways, and river/watershed corridors. This includes efforts such as master site development plans; feasibility studies; comprehensive recreation, park, and open space and greenway plans; river conservation plans; land conservation and stewardship plans; etc.
<https://www.dcnr.pa.gov/Communities/Grants/Pages/default.aspx>

PARK REHABILITATION AND DEVELOPMENT GRANTS

- **Distributed by:** PA DCNR
- **Eligible Projects:** Park rehabilitation and development or small community development.
<https://www.dcnr.pa.gov/Communities/Grants/Pages/default.aspx>

NON-MOTORIZED TRAILS GRANTS

- **Distributed by:** PA DCNR
- **Eligible Projects:** Acquisition; planning; development, rehabilitation, or maintenance; purchase of equipment; education programs.
<https://www.dcnr.pa.gov/Communities/Grants/Pages/default.aspx>



GREENWAYS, TRAILS, AND RECREATION PROGRAM (GTRP)

- **Distributed by:** PA DCED
- **Eligible Projects:** Projects involving development, rehabilitation and improvements to public parks, recreation areas, greenways, trails, and river conservation.

<https://dced.pa.gov/programs/greenways-trails-and-recreation-program-gtrp/>

LAND ACQUISITION AND CONSERVATION GRANT

- **Distributed by:** PA DCNR
- **Eligible Projects:** The acquisition of lands that are added to state parks, forests, and gamelands; assistance for acquisition of trail corridors, recreation areas, greenways, critical habitat, and other open space by local government or nonprofit organizations; assistance for the purchase of conservation easements; assistance for large, landscape-scale planning efforts.

<https://www.dcnr.pa.gov/Communities/Grants/LandAcquisitionGrants/Pages/default.aspx>

RECREATION TRAILS PROGRAM (RTP)

- **Distributed by:** PA DCNR
- **Eligible Projects:** Maintenance and restoration of existing recreational trails; development and rehabilitation of trailside and trailhead facilities and trail linkages for recreational trails; purchase and lease of recreational trail construction and maintenance equipment; construction of new recreational trails; assessment of trail conditions for accessibility and maintenance; development and dissemination of publications and operation of educational programs to promote safety and environmental protection; payment of costs to the state incurred in administering the program.

http://www.docs.dcnr.pa.gov/cs/groups/public/documents/document/d_001241.pdf

HERITAGE PARKS PROGRAM – SUSQUEHANNA RIVERLANDS CONSERVATION LANDSCAPE GRANT PROGRAM

- **Distributed by:** Lancaster County Conservancy
- **Eligible Projects:** Land conservation and preservation, stream and habitat restoration, passive recreation development, locally driven planning, and community economic revitalization efforts (located within the designated Susquehanna Riverlands area).

<https://www.lancasterconservancy.org/susquehanna-riverlands-program/susquehanna-riverlands-mini-grant-announcement/>

REGIONAL/LOCAL

SMART GROWTH TRANSPORTATION (SGT) PROGRAM

- **Distributed by:** Lancaster County Transportation Coordinating Committee (LCTCC)
- **Eligible Projects:** Preparation and implementation of master transportation and land use plans for priority corridors within designated growth areas; non-motorized facilities that may also provide a recreational benefit, including trails, bike networks, and sidewalk installation; investments that make transit service more viable and convenient by providing safe connections to access transit, including sidewalks and interconnected streets; urban streetscape projects and traffic calming; projects that provide non-motorized connections between neighborhoods and nearby commercial and retail districts, regional parks, transit centers, libraries, or schools; improved roadway connections that provide a more interconnected transportation network; redevelopment of existing streets into neighborhood streets utilizing traffic calming and other techniques; curb extensions; retiming and coordination of traffic signals; turning lanes that provide

crosswalks and median strips; studies that would result in any of the project types listed above.

<https://lancastercountyp Planning.org/147/Funding-Programs>

LANCASTER BIKE CLUB GRANT PROGRAM

- **Distributed by:** Lancaster Bike Club
- **Eligible Projects:** Bicycle racks, bicycle lane markings, signs promoting bicycle rights/safety on roadways, repair and maintenance of facilities that are part of the Lancaster County bicycling experience – such as covered bridges, advocacy efforts for bicyclist rights and safety, bicycling promotion and awareness, etc.

<https://lancasterbikeclub.net/grant-program/>

COMMUNITY DEVELOPMENT BLOCK GRANT (CDBG)

- **Distributed by:** Lancaster County Redevelopment Authority
- **Eligible Projects:** Project must be located in an eligible area (areas where at least 46.74% of the population is low- or moderate-income). Eligible project types include but may not be limited to: new sanitary sewer systems, sanitary sewer system extensions, public water system distribution and extensions, neighborhood improvement projects (including curb and sidewalk replacement, stormwater management improvements, street reconstruction, or water and sewer main replacement), parks and recreational facilities, and public facility improvements (such as energy efficiency improvements or handicap accessibility improvements).

<http://www.lchra.com/facility-and-infrastructure-improvements/>

OTHER POTENTIAL SOURCES OF FUNDING

Existing sources of transportation funding may not be adequate to fully fund the implementation of the active transportation network or larger projects. New and creative funding sources and partnerships should be sought to supplement existing resources.

PUBLIC SOURCES:

- Business Improvement District (BID) funds
- General obligation bonds
- Tax increment financing (TIF)
- Transit agency funding

PRIVATE SOURCES:

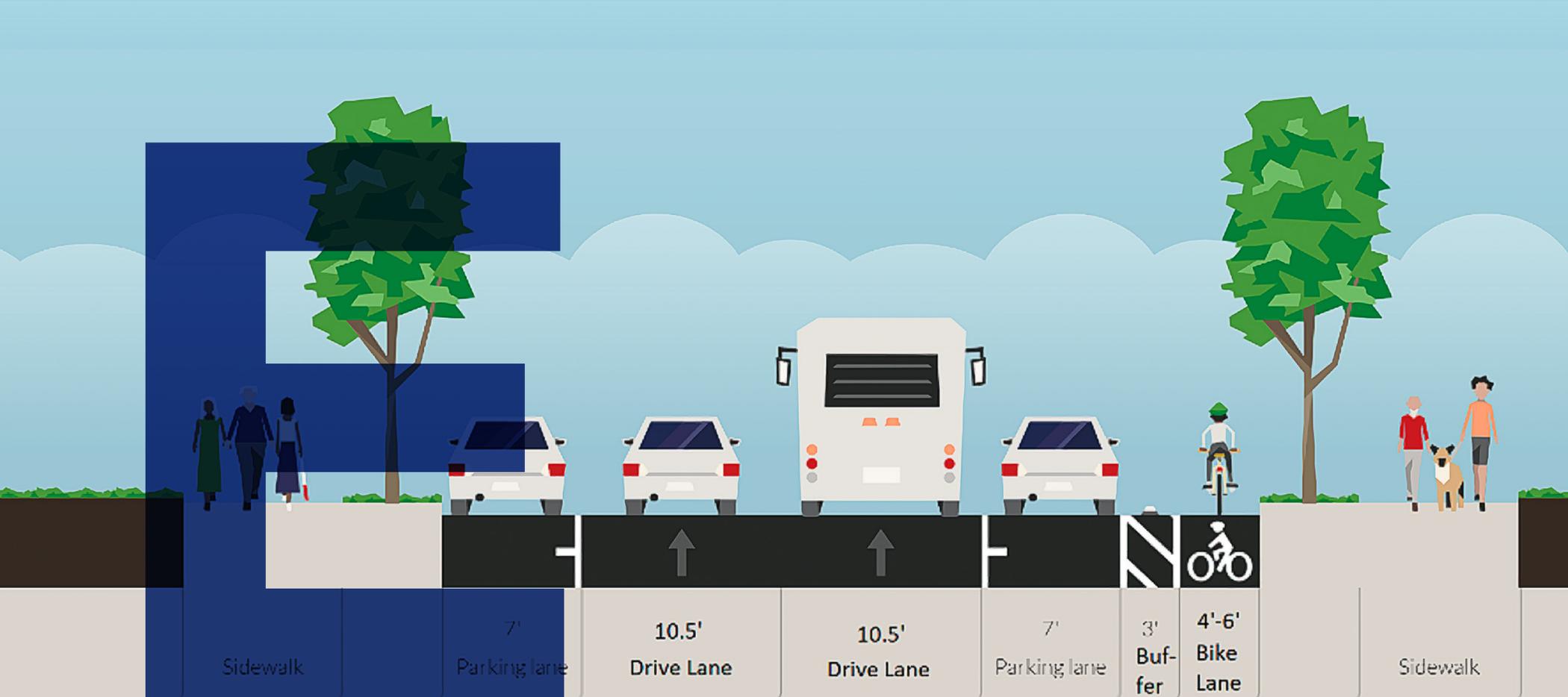
- Developers
- Hospitals
- Philanthropic Foundations
- Universities
- Businesses and Employers



THIS PAGE IS INTENTIONALLY LEFT BLANK

MEMORANDUM: CITY OF LANCASTER - CHESTNUT AND WALNUT STREETS BICYCLE FACILITY RECOMMENDATIONS

APPENDIX





111 E Chapel Hill St
 Suite 100
 Durham, NC 27701
 984.329.5043

MEMORANDUM

To: Cindy McCormick, PE Deputy Director - City Engineer, City of Lancaster

From: Chris Allen, PE, Alta Planning and Design

Date: 10/10/2018

Re: City of Lancaster Bike Plan - Chestnut Street and Walnut Street Bicycle Facility Recommendations

This memo evaluates the feasibility and recommendation for retrofitting bicycle facilities on Chestnut Street and Walnut Street, from College Avenue to Ranck Avenue through downtown Lancaster, Pennsylvania.

EXISTING ROADWAYS AND USAGE

Chestnut Street and Walnut Street are two-lane, one-way roads forming a segment of Pennsylvania Route 23 through downtown Lancaster. While they are part of the Arterial Highway classification, the roads are in a highly urban context, with three story residences and businesses frontage, street parking on each side of the roadway, blocks as short as 300 ft, and a high degree of pedestrian and other non-motorized activity. Buses from the Red Rose Transit Authority run down both of these corridors. There are currently no bicycle facilities.

Existing Road Data		
	Chestnut Street	Walnut Street
Average Daily Traffic (2018)	5,500 - 8,520 ADT ¹	5,700 - 10,400 ADT ¹
Posted Speed	25 mph	25 mph
Actual Speed	28 - 33 mph ¹	23 - 33 mph ¹
Federal Functional Class		
College Ave to Prince St	Minor Arterial²	Minor Arterial²
Prince St to Ranck Ave	Principal Arterial²	Principal Arterial²
PennDOT <i>Smart Transportation Guide</i> Classification	Community Arterial - Urban Core 25-30 mph desired operating speed 5,000 - 25,000 ADT Includes Federal "Minor Arterial" and "Principal Arterial" 300' - 1,100' signal spacing	
<i>Lancaster County Complete Street Guide</i> Classification	Community Arterial	
Width (Curb to Curb)	Variable 36' - 42' (No Gutter)	Variable 39' - 44' (No Gutter)
Lanes	2 Travel Lanes 2 Parking Lanes	2 Travel Lanes 2 Parking Lanes

1 Lancaster County GIS

2 Pennsylvania Department of Transportation, Federal Functional Class Lancaster County



111 E Chapel Hill St
 Suite 100
 Durham, NC 27701
 984.329.5043

MEMORANDUM

DESIGN CRITERIA

In accordance with the NACTO *Designing for All Ages and Abilities Guide* (2017), protected bicycle lanes are desired on Chestnut and Walnut to achieve a “high-comfort” facility, warranted by high curbside activity, a 25 mph target speed, and a greater than 6,000 ADT. Proposing a parking protected bike lane (with the bicycle lane between the parked cars and curb), is thus desirable to provide a high level of bicycle protection while maintaining vehicular parking on both sides of the street.

Installed Example: A parking protected bicycle lane was recently installed on Market Street and John F. Kennedy Boulevard in Philadelphia, PA in 2018. Video of the bike lane in use can be viewed on the Philadelphia Magazine website (<https://www.phillymag.com/news/2018/06/14/protected-bike-lanes-jfk-market/>)

While not considered a “high-comfort” bicycle facility type, conventional bicycle lanes without will be necessary where there is not enough space for parking protected bike lanes. In the downtown setting, conventional bicycle lanes will still attract and encourage bicycle use for users of all ages and abilities.

Parking Protected Bike Lane Design

The NACTO *Urban Bikeway Design Guide* (2011) and the FHWA *Separated Bike Lane Planning and Design Guide* (2015), and the AASHTO *Guide for the Development of Bicycle Facilities* (2012) recommend a preferred 5’ minimum width bike lane when against a curb. With grate inlets intruding 2 ft into the bike space, it is particularly preferable to maintain 5’ minimum width from the curb as to keep the center path of the bike lane away from the grates (inlets should also be installed with “bicycle safe” grates). An absolute minimum 4’ bike lane may be used, but should be limited to constrained segments of the corridors, as allowed by AASHTO after narrowing all other travel lanes to their minimum widths. On segments with extra road width, up to a 7’ maximum bike lane width is recommended to allow for passing space, which is particularly useful in the confined space of the parking protected bike lane.

A 3’ buffer between the parked cars and bike lane is also required for opening car doors, as per the NACTO and FHWA guides.

Parking Protected Bike Lane and Buffer		
Bike Lane Width		
Absolute Minimum	4’	When constrained, after all other travel and parking lanes minimized.
Preferred Minimum	5’	Standard
Maximum	7’	When extra roadway width is available.
Buffer Width Minimum	3’	-

Visibility between turning traffic and cyclists can be an issue for parking protected bike lanes, therefore it is important that car parking be restricted 30’ from intersections (NACTO), and 20’ from minor driveways (FHWA)*. Since these corridors have limited driveway entrances between each intersection, dropping parking at these conflicts should be feasible.





111 E Chapel Hill St
 Suite 100
 Durham, NC 27701
 984.329.5043

MEMORANDUM

Parallel Parking

The *Lancaster Complete Streets Guide* (2015) recommends a 7'-8' parallel parking stall width, with 8' recommended for streets with heavy traffic volumes. Since these arterial roads have a steady flow of traffic, 8' width is recommended, but may be narrowed to 7' minimum where constrained. These dimensions are also consistent with the PennDOT *Smart Transportation Guide*, therefore should be an acceptable part of State Route 23.

Parallel Parking Width		
Minimum	7'	Constrained
Preferred	8'	Standard

Conventional Bicycle Lanes

There are segments on the corridor that cannot feasibly fit a parking protected bike lane with buffer, but can fit a conventional bike lane between the street parking and vehicle lane. The NACTO and AASHTO guides recommend a minimum 6' wide bike lane adjacent to parking, but will allow a minimum as low as 5' wide. The primary concern is "dooring" from parked vehicles, with the risk also dependent on the width of the parking stall. NACTO further clarifies a desired 14.5' combined width of parallel parking and bike lane, with 12' being the absolute minimum.

Conventional Bicycle Lane Adjacent to Parallel Parking			
	Parking + Bike Lane Width	Parking Width	Bike Lane Width
Absolute Minimum	12'	7'	5'
Preferred Minimum	14.5'	8'	6.5'

Vehicle Travel Lanes

Per the direction of the City of Lancaster, the two existing westbound travel lanes on Walnut Street will be maintained, while the two existing eastbound travel lanes on the narrower Chestnut Street will be reduced to one lane for most of the corridor. Traffic studies should be completed to verify the impact of lane reduction on the overall road network. Changes to traffic signals will require coordination with PennDOT.

According to the *Lancaster County Complete Streets Guide* and the *PennDOT Smart Transportation Guidebook*, 10'-12' lanes are appropriate for a Community Arterial. The PennDOT guide further recommends 10'-11' lanes for urban roads in a posted speed less than 35 mph, therefore 11' should be considered the maximum to discourage speeding. Since Chestnut Street and Walnut Street accommodate bus traffic, 10.5' minimum vehicle lanes are preferred by the City of Lancaster, although an absolute minimum of 10' may be allowable in shorter length, constrained sections with permission from the City.

Where the road reduces to a single lane between two parked car lanes, extra road width (when available) should be given to the travel lane to ease parallel parking and large vehicle maneuvering (ie. fire trucks¹). Widening beyond 11' is not an issue for speeding in the single lane case, as traffic will encounter sufficient traffic calming "friction" from the two adjacent parked car lanes.

¹ The Fire Department should be consulted on roads being reduced to a single lane. Minimum clear width between parked cars may become an issue for preferred fire truck access. Since the streets are within a connected grid, alternative fire access routes can be identified in case of lane blockage.



111 E Chapel Hill St
 Suite 100
 Durham, NC 27701
 984.329.5043

MEMORANDUM

Vehicle Travel Lanes		
Bike Lane Width		
Absolute Minimum	10'	Shorter length, constrained sections
Preferred Minimum	10.5'	-
Preferred Maximum (2-lane)	11'	To avoid excessive speed.
Preferred Maximum (1-lane)	16'	Allows extra maneuvering between parked vehicles.

LANE BALANCE RECOMMENDATIONS

Due to the variation in curb to curb width, Walnut Street will need to alternate between a parking protected bike lane, a conventional bike lane, and a shared lane to maintain the two vehicle lanes and parking on both sides. Segments 42' or greater in width will accommodate the parking protected bike lane, with all narrower segments requiring a transition to the conventional bike lane.

Walnut Street Lane Schedule				
From	To	Width (Curb to Curb)	Section	Lanes(Left to Right)
McCaskey Ave	N Marshall St	41'	Section 2: Conventional Bike Lane	7' Parking 2x 10.5' Travel Lanes 6' Bike Lane 7' Parking
N Marshall St	N Plum St	42'	Section 1: Parking Protected Bike lane	7' Parking 2x 10.5' Travel Lanes 7' Parking / 3' Buffer 4' Bike Lane
N Plum St	N Lime St	41'	Section 2: Conventional Bike Lane	7' Parking 2x 10.5' Travel Lanes 6' Bike Lane 7' Parking
N Lime St	N Cherry St	39'		7' Parking 2 x 10' Travel Lanes 5' Bike Lane 7' Parking
N Cherry St	N Christian St	40'		7' Parking 2x 10.5' Travel Lanes 5' Bike Lane 7' Parking

(continued next page)





111 E Chapel Hill St
 Suite 100
 Durham, NC 27701
 984.329.5043

MEMORANDUM

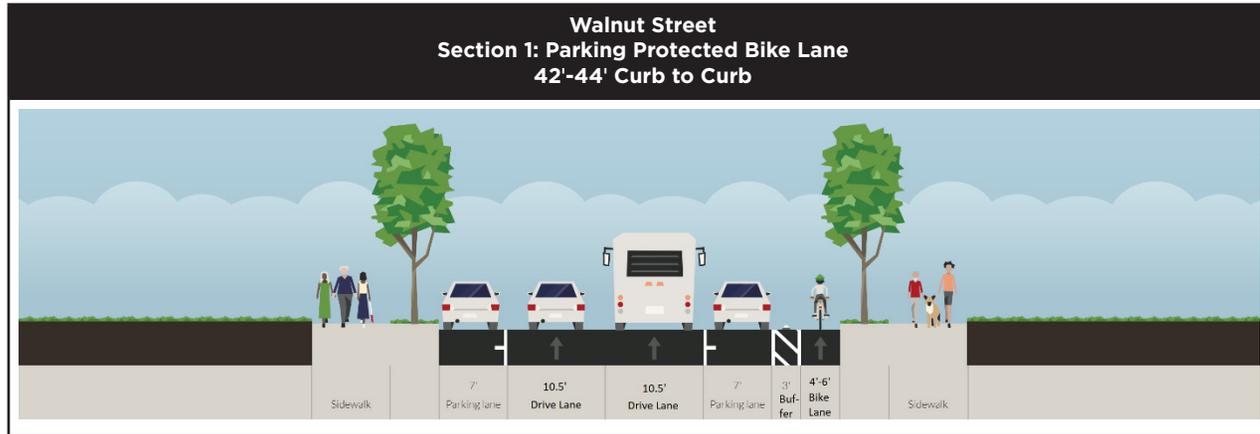
(continued from previous page)

Walnut Street Lane Schedule				
From	To	Width (Curb to Curb)	Section	Lanes(Left to Right)
N Christian St	N Queen St	42'	Section 1: Parking Protected Bike lane	7' Parking 2x 10.5' Travel Lanes 7' Parking / 3' Buffer 4' Bike Lane
N Queen St	N Charlotte St	43'		7' Parking 2x 10.5' Travel Lanes 7' Parking / 3' Buffer 5' Bike Lane
N Charlotte St	N Mary St	44'		7' Parking 2x 10.5' Travel Lanes 7' Parking / 3' Buffer 6' Bike Lane
N Mary St	N Pine St	43'		7' Parking 2x 10.5' Travel Lanes 7' Parking / 3' Buffer 5' Bike Lane
N Pine St	College Ave	42'		7' Parking 2x 10.5' Travel Lanes 7' Parking / 3' Buffer 4' Bike Lane

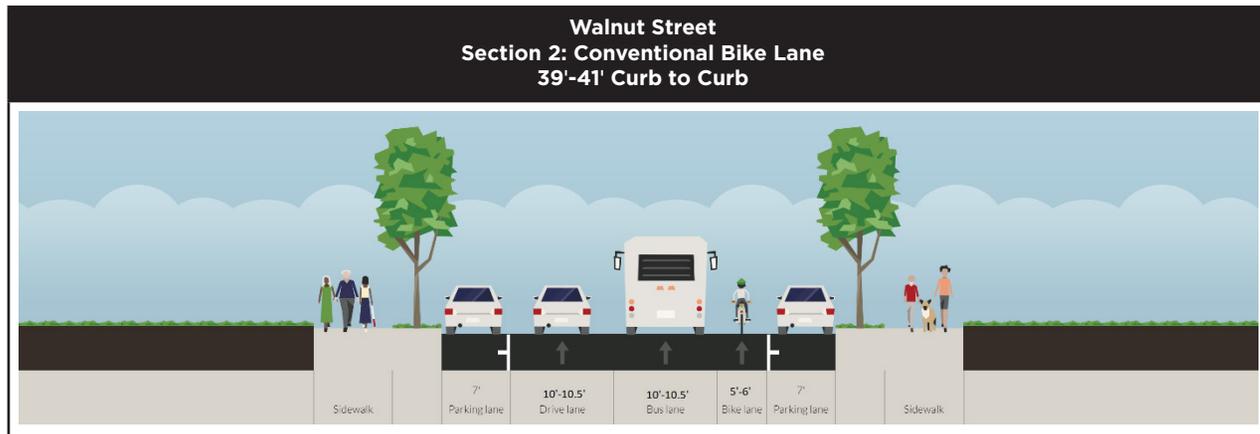


111 E Chapel Hill St
 Suite 100
 Durham, NC 27701
 984.329.5043

MEMORANDUM



Vehicle lanes and parking lanes must be reduced to their minimum accepted widths (10.5' and 7' respectively) to provide enough space for the minimum parking protected bike lane. Additional width shall be given to the bike lane where available.



Segments of Walnut Street less than 42' will not be wide enough to accommodate the 3' buffer required for the parking protected bike lane, therefore shall have conventional bike lanes. Vehicle lanes and parking lanes should be reduced to their minimum accepted widths (10'-10.5' and 7' respectively) to fit the 5'-6' bike lane recommended along parallel parking.





111 E Chapel Hill St
 Suite 100
 Durham, NC 27701
 984.329.5043

MEMORANDUM

Chestnut Street varies in vehicle lane requirement (1-2 lanes), has select segments with bus drop off zones, and varies in curb to curb width. Segments of Chestnut Street will therefore need to alternate between a parking protected lane, buffered bike lane, shared bus/bike lane, and shared lane markings.

Chestnut Street Lane Schedule				
From	To	Width (Curb to Curb)	Section	Lanes (Left to Right)
College Ave	N Mary St	40'	Section A: 1 Vehicle Lane Parking Protected Bike Lane	8' Parking 14' Travel Lane 8' Parking / 3' Buffer 7' Bike lane
N Mary St	N Charlotte St	42'		8' Parking 16' Travel Lane 8' Parking / 3' Buffer 7' Bike lane
N Charlotte St	N Concord St	41'		8' Parking 15' Travel Lane 8' Parking / 3' Buffer 7' Bike lane
N Concord St	N Mulberry St	39'		8' Parking 13' Travel Lane 8' Parking / 3' Buffer 7' Bike lane
N Mulberry St	N Water St	38'		8' Parking 12' Travel Lane 8' Parking / 3' Buffer 7' Bike lane
N Water St	N Prince St	38'	Section B: 2 Vehicle Lanes Shared Lane	8' Parking 2x 11' lanes (Shared Lane Marking) 8' Parking
N Prince St	N Market St	36'		7.5' Parking 2x 10.5' lanes (Shared Lane Marking) 7.5' Parking
N Market St	N Queen St	38'	Section C: 2 Vehicle Lanes Shared Bus / Bike Lane	7' Parking 2x10.5' Travel Lanes 10' Bus Loading - Bike Lane
N Queen St	N Christian St	40'		8' Parking 2x10.5' Travel Lanes 11' Bus Loading - Bike Lane

(continued next page)



111 E Chapel Hill St
 Suite 100
 Durham, NC 27701
 984.329.5043

MEMORANDUM

(continued from previous page)

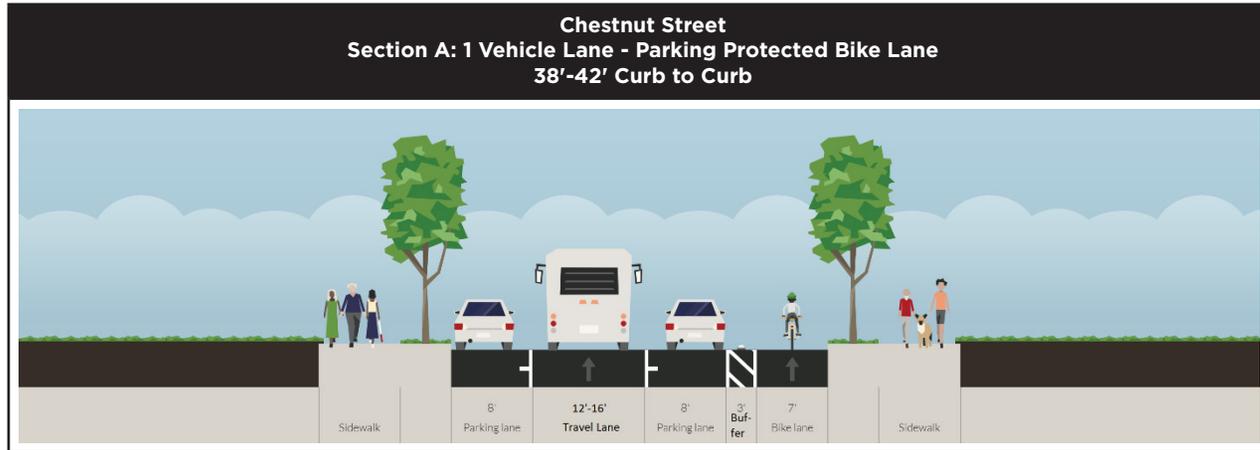
Chestnut Street Lane Schedule				
From	To	Width (Curb to Curb)	Section	Lanes (Left to Right)
N Christian St	N Duke St	40'	Section D: 2 Vehicle Lanes Buffered Bike Lane	8' Parking 2x11' Travel Lanes 3' Buffer 7' Bike Lane
N Duke St	N Lime St	40'	Section E: 2 Vehicle Lanes Conventional Bike Lane	7' Parking 2x 10.5 lanes 5' Bike Lane 7' Parking
Lime St	N Plum St	39'	Section A: 1 Vehicle Lane Parking Protected Bike Lane	8' Parking 13' Travel Lane 8' Parking / 3' Buffer 7' Bike lane
N Plum St	N Sherman St	41'		8' Parking 15' Travel Lane 8' Parking / 3' Buffer 7' Bike lane
N Sherman St	N Broad St	40'		8' Parking 14' Travel Lane 8' Parking / 3' Buffer 7' Bike lane



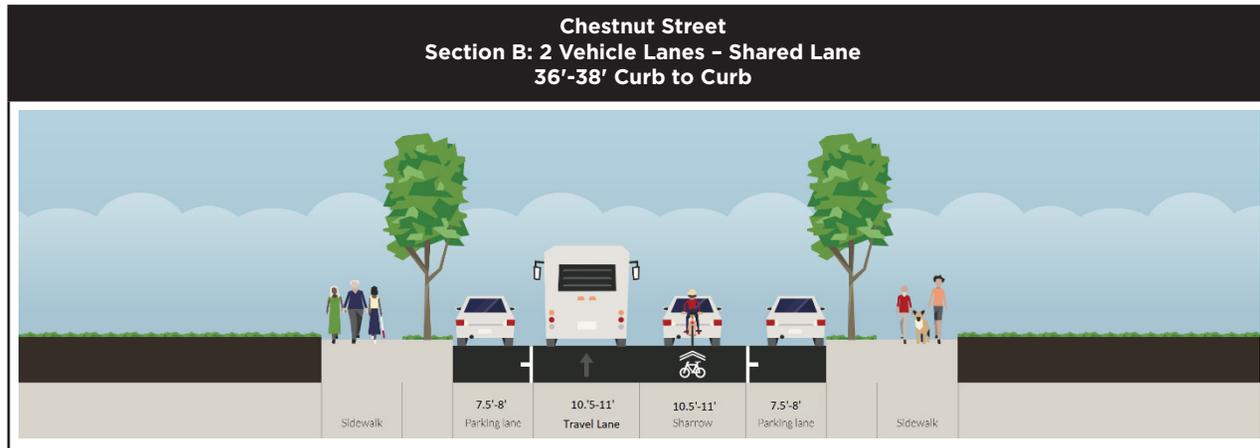


111 E Chapel Hill St
 Suite 100
 Durham, NC 27701
 984.329.5043

MEMORANDUM



Reduction from two to one vehicle lane allows maximizing the parking protect bike lane to a 7' bike lane with 3' buffer. The preferred 8' parking can be provided with the remaining width given to a wider single travel lane.

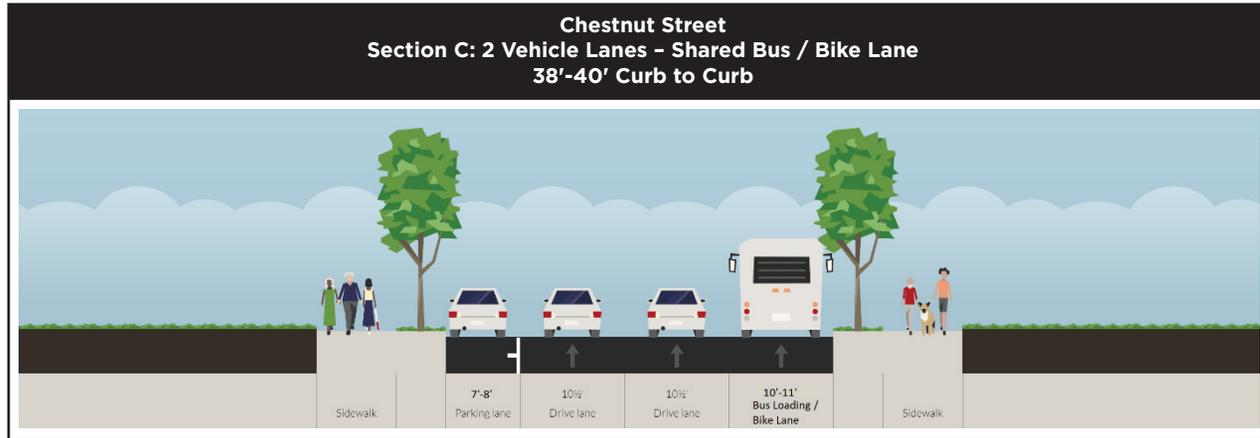


Segments less than 40' cannot accommodate bicycle lanes with the desired 2 vehicle lanes and parking on both sides. Shared lane markings shall be used to connect the bike lane facilities.

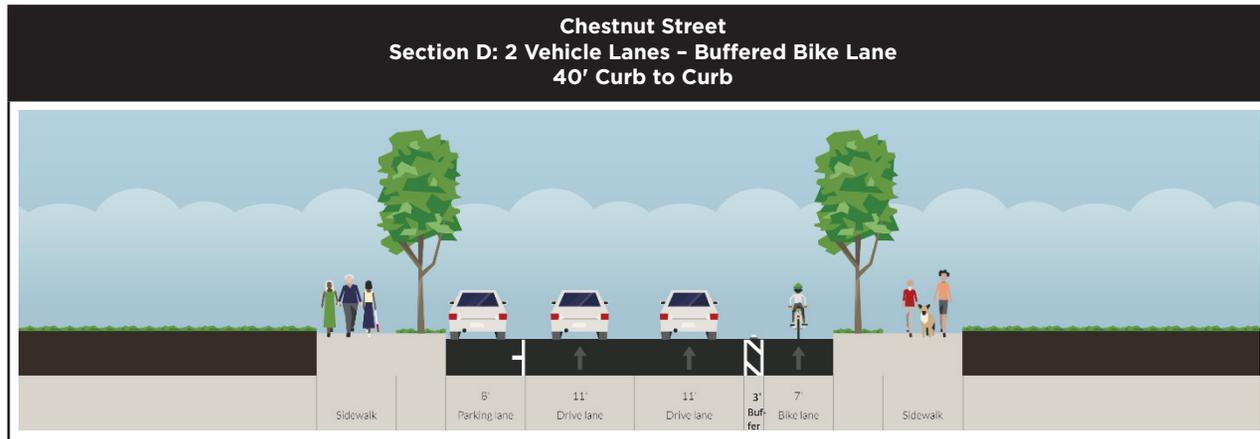


111 E Chapel Hill St
 Suite 100
 Durham, NC 27701
 984.329.5043

MEMORANDUM



Segments of Chestnut Street requiring 2 travel lanes and a bus loading areas require dropping of a parking lane and sharing the bicycle and bus loading space.



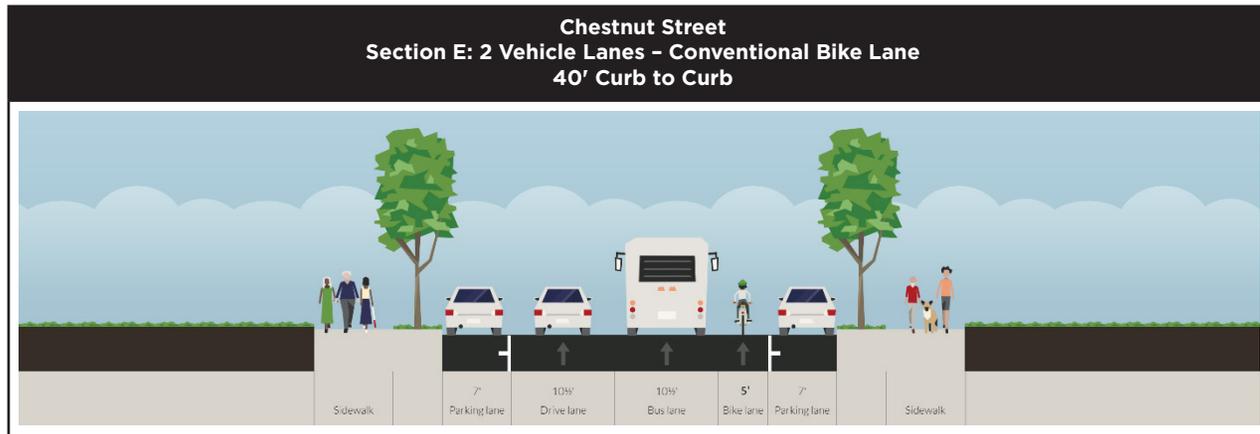
Where only one side of parking is required and no bus loading lane is needed, a wide buffered bike lane can be accommodated. The two vehicle lanes should be maximized to no more than 11' to avoid speeding. The remainder of the street allows for the preferred 8' parking lane and the maximum 7' bike lane with a 3' buffer.





111 E Chapel Hill St
Suite 100
Durham, NC 27701
984.329.5043

MEMORANDUM



Segments of Chestnut with 40' width allow the minimum dimensions for two travel lanes, two parking lanes, and a conventional bike lane adjacent to parking.

SUMMARY

Installation of parking protected bicycle lanes will be geometrically feasible on portions of Walnut Street and Chestnut Street corridors through downtown Lancaster, with conventional bike lanes and shared lane marking needed on the constrained segments. Where lanes are reduced from two to one, a traffic analysis will need to be completed to understand the impact to the traffic network. The Lancaster Fire Department should be consulted in regard to the narrowed clear width of the single one-way travel lane and evaluated for impact to fire response.

Notes:

1. All existing curb to curb dimensions taken from City of Lancaster staff field measurements, as e-mailed by Cindy McCormick to Jennifer Baldwin at Alta Planning + Design on September 16, 2018.
2. No traffic analysis was completed by Alta Planning and Design. Travel lane count used as provided from City of Lancaster concepts.

THIS PAGE IS INTENTIONALLY LEFT BLANK



Lancaster County Planning Commission
150 North Queen Street • Suite 320 • Lancaster, PA 17603
717-299-8333 • F 717-295-3659

www.lancastercountypanning.org

APRIL 2019