REGIONAL Bicycle Connections Study

CITY OF HARRISBURG • HUMMELSTOWN BOROUGH • SOUTH LONDONDERRY TOWNSHIP • NORTH LONDONDERRY TOWNSHIP

DERRY TOWNSHIP • PALMYRA BOROUGH • SWATARA TOWNSHIP • PAXTANG BOROUGH

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alta PLANNING + DESIGN

Sabra, Wang & Associates, Inc.

REGIONAL Bicycle Connections Study

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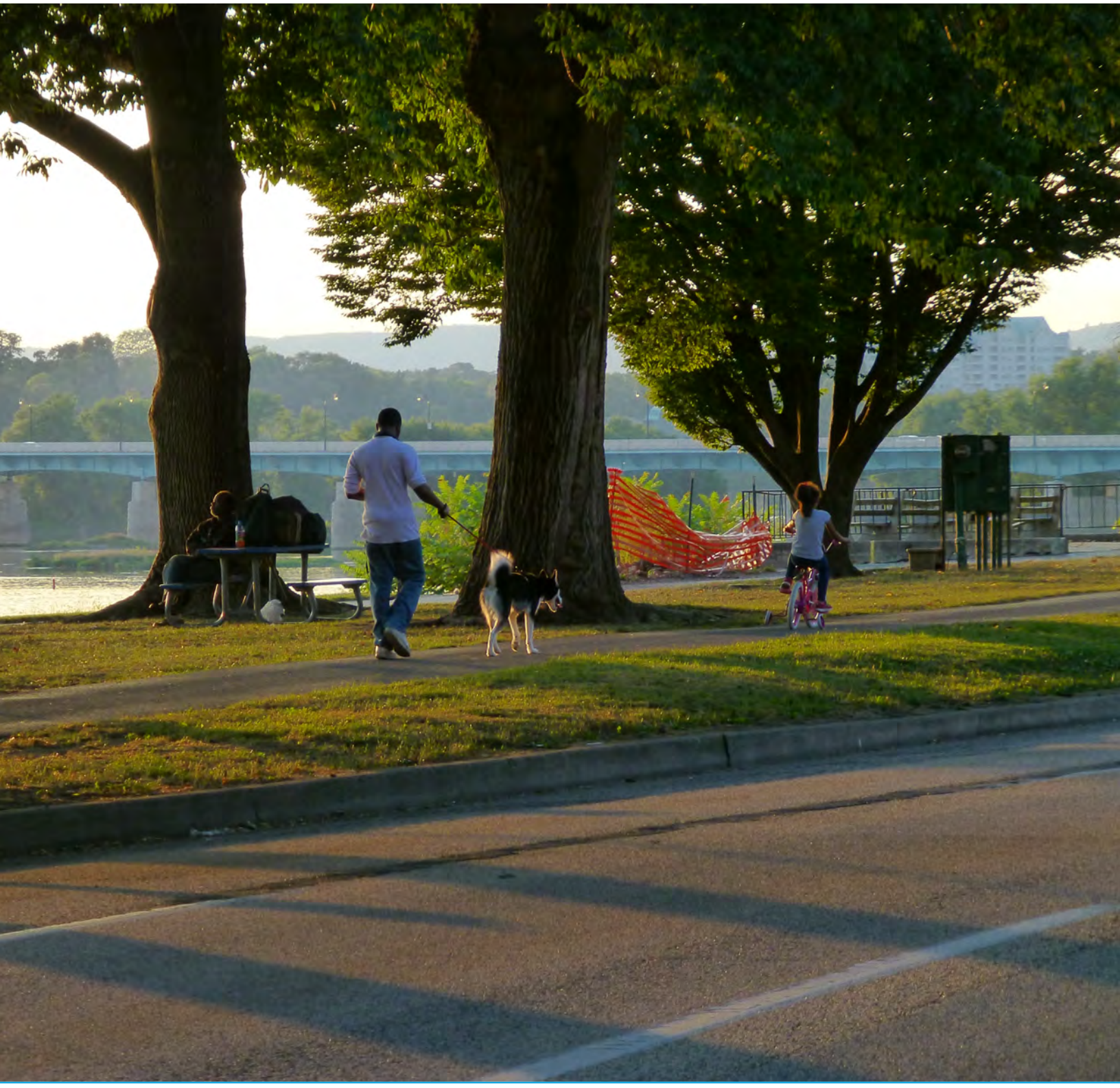


Chapter One: Project Overview + Purpose

Purpose and Background

The Region and the Plan

The Regional Bicycle Connections Study is a joint planning effort by the City of Harrisburg, Hummelstown Borough, Palmyra Borough, Paxtang Borough, Derry Township, North Londonderry Township, South Londonderry Township, and Swatara Township. Together these municipalities have crafted a vision to improve the bicycling environment and culture of the region.

The area currently offers a variety of bicycle routes and facilities, such as on-road regional bicycle routes and roadways with paved shoulders, as well as off-road facilities such as the Derry Township Jonathan Eshenour Memorial Trail, Conewago Recreation Trail, and Lebanon Valley Rail Trail. However, even with these facilities many gaps exist both locally and regionally that make bicycling an uncomfortable transportation and recreation option.

This Plan identifies these gaps, the bicycle infrastructure needed to fill them, and bicycle-supportive policies and programs to improve opportunities for two-wheeled travel.

Role of the Regional Bicycle Connections Study

The purpose of the *Regional Bicycle Connections Study* is to bring together municipalities, two counties, regional and state agencies, and stakeholders to develop a vision for the future of bicycling in the region.

Multi-jurisdictional cooperation is critical to the success of this Plan both in facility implementation and seeking funding sources. Also imperative to creating a regional network are the programming elements of education, enforcement, and evaluation. A shift in culture is occurring across the nation and many communities are evaluating how to create safer spaces for multiple modes. Infrastructure and design of the built environment will communicate behavioral expectations and, coupled with programming, will foster the development of a better educated community with citizens who respect the rights and obey the laws of a multimodal society.

This Plan communicates a clear vision, goals, recommendations, and action steps to better connect the region through a network of bicycle facilities and supporting policies and programs. Funded through the Regional Connections Program of the Tri-County Regional Planning Commission, the Plan advances the region's values of safety, connectivity, livability, awareness, and health and wellness.

The recommendations of this Plan build upon previous local and regional plans and are intended to be incorporated into future transportation and land use planning documents and decision-making.

Plan Overview

While bicycle plans benefit many types of bicyclists, recommendations at this scale should be focused on connecting people to places where they live, work, play, and learn and addressing the needs of those "types." While many regional bicyclists are experienced riders and regular bicycle commuters, there are groups who may not have access to vehicles, require access to public transportation stops beyond walking distance of their homes or places of employment, and desire or need safe facilities to access daily needs. There are also the "60% Interested But Concerned" (see pages 4-5) who need designated spaces and separation to overcome uncertainties and bicycle in the area.

To begin to form a network of facilities and recommendations for these communities, the steering committee formed a vision with five thematic goals:

Vision

The *Regional Bicycle Connection Study* will enhance the human-powered component of the regional transportation system by creating consistent design standards, a diverse network of interconnected routes, support facilities, and programs to make bicycling for transportation and recreation more practical and desirable for bicyclists of all ages and abilities.

This vision is intended to guide the development of the regional bicycle system through the year 2030.

Goals

Safety Improve safety for bicycle riders of all ages and abilities through careful planning, design, implementation, and programming.

Connectivity Create a bicycle network that connects to places that people want to go and provides a time-efficient travel option.

Livability Build vibrant and healthy communities by creating a welcoming environment for bicycle riding.

Awareness Increase community support for bicycling as an acceptable and viable means of transportation and educate everyone how to appropriately interact with all modes.

Health & Wellness Increase the use of bicycles for transportation and recreation.

Plan Components

This Plan is designed to guide the bicycle planning efforts and decision-making of participating municipalities and the region by providing a clear purpose (Chapter 1), an assessment of where things stand today (Chapter 2), a multi-faceted public involvement process (Chapter 3), detailed recommendations for bicycle facilities and programs (Chapter 4), and implementation strategies for bicycle-related policies, programs, and infrastructure (Chapter 5).

Also included in this Plan are appendices that are designed to be used as implementation resources. They cover topics such as design guidelines, facility development resources, potential funding sources, and an analysis of bicycling demand in the region.

Benefits of a Bicycle-Friendly Community

The benefits of bikeable communities are well-documented and serve to inform the importance of implementing this Plan. People and businesses are choosing to live and relocate in communities that offer high quality of life amenities, including bikeways and greenways. Changes to the built environment, supported by policy changes and influential programs, can contribute to a region that is supportive of bicycling and provides important regional connections and amenities.

The sections below outline the many benefits of a bicycle-friendly community, including health and physical activity benefits, economic benefits, environmental benefits, transportation benefits, and quality of life benefits. These benefits align with the vision and goals crafted for this Plan.

Health & Physical Activity Benefits

A growing number of studies show that the design of our communities—including neighborhoods, towns, transportation systems, parks, trails, and other public recreational facilities—affects our level of physical activity. Regular physical activity is recognized as an important contributor to good health and only a few lifestyle choices have a large as an impact on your health as physical activity; the Centers for Disease Control and Prevention (CDC) recommend 30 minutes of moderate physical activity each day for adults and 60 minutes each day for children.[1]

Unfortunately, many people do not meet these recommendations because they lack environments where they can be physically active. The CDC reports that "physical inactivity causes numerous physical and mental health problems, is responsible for an estimated 200,000 deaths per year, and contributes to the obesity epidemic."[2]

Having accessible bicycle facilities available, such as bike lanes and paths, can help people more easily incorporate physical activity into their daily lives. Regular physical activity as part of their daily life, such as bicycling, is shown to have numerous health benefits:[3]

- Reduces the risk and severity of heart disease and diabetes
- Reduces the risk of some types of cancer
- Improves mood
- Controls weight
- Reduces the risk of premature death

1 Centers for Disease Control and Prevention. http://www.cdc.gov/physicalactivity/everyone/guidelines/index.html.

2 U.S. Department of Health and Human Services. Centers for Disease Control and Prevention. (1996). Physical Activity and Health: A Report of the Surgeon General.

3 National Prevention Council. (2011). National Prevention Strategy: America's plan for better health and wellness. Retrieved from http://www.healthcare.gov/prevention/nphpphc/strategy/report.pdf.

Hidden Health Costs of Transportation

The National Health Costs of…	$$ (Billions)	Estimate Includes	Source
Obesity and overweight	$142	• Healthcare costs • Lost wages due to illness & disability • Future earnings lost by premature death	National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Diseases. Statistics Related to Overweight and Obesity: The Economic Costs. Available at: http://win.niddk.nih.gov/statistics/index.htm
Air pollution from traffic	$50-80	• Health care costs • Premature death	Federal Highway Administration. 2000. Addendum to the 1997 Federal Highway Cost Allocation Study Final Report, May 2000. Available at: www.fhwa.dot.gov/policy/hcas/addendum.htm
Traffic crashes	$180	• Healthcare costs • Lost wages • Property damage • Travel delay • Legal/administrative costs • Pain & suffering • Lost quality of life	AAA. Crashes vs. Congestion? What's the Cost to Society? Cambridge, MD: Cambridge Systematics, Inc.; 2008. Available at: www.aaanewsroom.net/assets/files/20083591910.crashesVscongestionfullreport2.28.08.pdf

All cost estimates adjusted to 2008 dollars.

Source: The American Public Health Association, 2010, The Hidden Health Costs of Transportation.

The American Public Health Association also recognizes the health benefits of walk- and bike-friendly communities. According to its 2010 report, "Investments in transit, walking and bicycling facilities support transit use, walking and bicycling directly; they also support the formation of compact, walkable, transit-oriented neighborhoods that in turn support more walking, bicycling and transit and less driving."[4] These built environments have repeatedly been associated with the following[4]:

- More walking, bicycling and transit use,
- increased overall physical activity and lower body weights;
- lower rates of traffic injuries and fatalities, particularly for pedestrians;
- Lower rates of air pollution and greenhouse gas emissions;
- and better mobility for non-driving populations.

The CDC determined that creating and improving places to be active could result in a 25 percent increase in the number of people who exercise at least three times a week.[5] A modest increase of 25 percent is significant considering that for people who are inactive, even small increases in physical activity can bring measurable health benefits. The establishment of a safe and reliable network of bikeways and trails can have a positive impact on the health of nearby residents. The Rails-to-Trails Conservancy puts it

4 American Public Health Association. (2010) The Hidden Costs if Transportation

5 U.S. Department of Health and Human Services, Centers for Disease Control and Prevention. (2002). Guide to Community Preventive Services.

simply: "Individuals must choose to exercise, but communities can make that choice easier."[6]

An increasingly growing concern of community leaders and planners alike is how healthy our communities will be in the future. Education, infrastructure, health, and public safety needs are critical challenges at the local level. Transportation and mobility are also key elements of the livability index. Open space and recreational opportunities are other important elements. Promoting bicycle facilities is consistently recognized as an effective strategy to create healthier communities, improve safety, and better the quality of life in localities that have embraced them.

Suburban settings strike a balance between utilitarian (transportation) and recreational bicycling. It is often in these settings, through recreational opportunities, that we teach our children the "rules of the road" and bicycle safety.

Economic Benefits

Transportation Savings

When it comes to transportation costs, **bicycling is one of the most affordable forms of transportation available, second only to walking**. According to the American Automobile Association, the cost of owning and operating a medium-sized sedan for one year, assuming one drives 10,000 miles per year, is approximately $7,804.[7] Owning and operating a bicycle costs just $120 per year, according to the League of American Bicyclists.[8]

6 Rails-to-Trails Conservancy. (2006) Health and Wellness Benefits.

7 American Automobile Association. (2013). Your Driving Costs: How Much are You Really Paying to Drive? 2013 Edition.

8 The League of American Bicyclists. www.bikeleague.org.

The Pedestrian and Bicycle Information Center explains how these lower costs help individuals and communities as a whole:

"When safe facilities are provided for pedestrians and bicyclists, more people are able to be productive, active members of society. Car ownership is expensive and consumes a major portion of many Americans' income."

Bicycling becomes even more attractive from an economic standpoint when the unstable price of gasoline is factored into the equation. Oil prices more than quadrupled between 2000 and

Annual Cost Per Mile

costs		yearly totals
operating costs		
gas per mile		
total miles driven	×	
total gas	=	
maintenance	+	
tires	+	
total operating costs	+ =	
ownership costs		
depreciation		
insurance	+	
taxes	+	
license and registration	+	
finance charges	+	
total ownership costs	+ =	
other costs (washing, accessories, etc.)	+	
total driving costs	=	
total miles driven	÷	
cost per mile	=	

Driving Costs Worksheet. American Automobile Association, Your Driving Costs Report: 2013 Edition.

2008, when gasoline prices topped $4 a gallon.[9] The unreliable cost of fuel reinforces the idea that local communities should be built to accommodate people-powered transportation, such as walking and biking.

Some areas of the region already have traditional mixed-use and generally compact land development patterns; when combined with new strategies for improving bicycle transportation, many of these communities could foster local reductions in auto- and oil-dependency.

Property Values

Bicycle facilities such as bike lanes, paths, and greenway trails are popular community amenities that add value to properties nearby. According to a 2002 survey by the National Association of Realtors and the National Association of Homebuilders, **homebuyers rank trails as the second-most important community amenity out of 18 choices**, above golf courses, ball fields, parks, security, and others.[10] A study of home values along the Little Miami Scenic Trail in Ohio found that single-family home values increased by $7.05 for every foot closer a home was to the trail.[11] These higher prices reflect how trails and greenways add to the desirability of a community, attracting homebuyers and visitors alike.

Environmental Benefits

Air Quality

Providing the option of bicycling as an alternative to driving can reduce the volume of gasoline consumed and resulting car-related emissions, which in turn improves air quality. Cleaner air reduces the risk and complications of asthma, particularly for children, the elderly, and people with heart conditions or respiratory illnesses.[12] Lower automobile traffic volumes also help to reduce neighborhood noise levels and improve local water quality by reducing automobile-related discharges that are washed into local rivers, streams, and lakes. Furthermore, every car trip replaced with a bicycle trip reduces U.S. dependency on fossil fuels, which is a national goal. According to a survey by the National Association of Realtors and Transportation for America, 89 percent of Americans agree that transportation investments should support the goal of reducing energy use.[13]

Environmental Services of Greenways

Greenways and trails are a key component of any bicycle network and carry environmental benefits as well. Greenways protect and link fragmented habitat and provide opportunities for protecting plant and animal species. By conserving plant cover, greenways also preserve the natural air filtration processes provided by plants, filtering out harmful pollutants, such as ozone, sulfur

9 King, Neil. The Wall Street Journal: Another Peek at the Plateau. (2/27/08).

10 National Association of Homebuilders. (2008). www.nahb.com.

11 Rails to Trails Conservancy. (2005). Economic Benefits of Trails and Greenways.

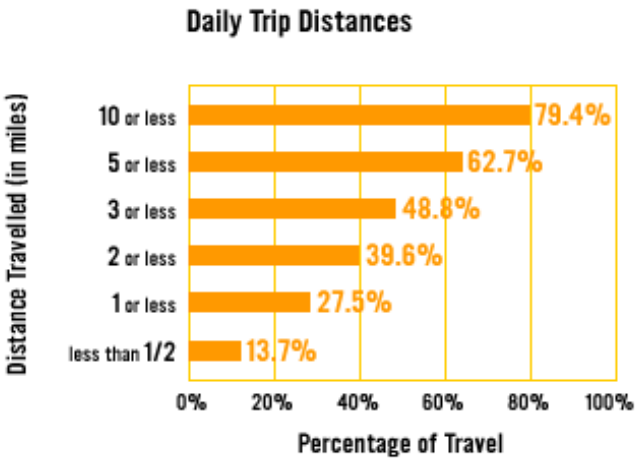
12 Health Effects Institute. (2010). Traffic-Related Air Pollution: A Critical Review of the Literature on Emissions, Exposure, and Health Effects. Special Report 17.

13 National Association of Realtors and Transportation for America. (2009). 2009 Growth and Transportation Survey. www.t4america.org/docs/011609_pr_nart4poll.pdf.

dioxide, carbon monoxide, and airborne heavy metal particles. Finally, greenways improve water quality by creating a natural buffer zone that protects waterways. This natural buffer helps mitigate soil erosion and filters pollution cause by agriculture and road runoff before it enters the water. Greenways also act as a line of defense against natural hazards, such as flooding - a problem that is of special concern to this region after sustaining damage from flooding in 2011.

Transportation Benefits

Providing a well-connected bicycle network provides a safe transportation option for those who are unable or unwilling to drive or who do not have access to an automobile. According to the 2001 National Household Travel Survey, 12 percent of persons age 15 or older do not drive, and 8 percent of U.S. households do not own an automobile. Bicycle improvements can increase access to important destinations for the young, the elderly, low-income families, and others who may be unable to drive or do not have a motor vehicle. They can also free up time for those who may otherwise have to provide rides to other household members.



Almost 50 percent of all trips in the U.S. are 3 miles or less, or less than a 15-minute bike ride. Source: Pedestrian and Bicycle Information Center, www.pedbikeinfo.org

Investing in bicycle facilities can also help to reduce congestion and the pollution, gas costs, wasted time, and stress that comes with it. **Each person who makes a trip by bicycle is one less car on the road or in the parking lot**. A network of wide shoulders, bike lanes, and paths gives people the option of making a trip by bike, which helps to alleviate congestion for everyone. Bicycle facilities can also help to substantially reduce transportation costs by providing a way of getting around without a car for the region's shorter trips. About half of all trips taken by car are three miles or less, equivalent to a 15-minute bike ride.[14] With a safe, convenient bicycle network, some of these shorter trips could be comfortably made by bike, saving money on gas, parking costs, and vehicle wear and tear over time.

Quality of Life

Many factors go into determining quality of life for community residents: the local education system, prevalence of quality employment opportunities, and affordability of housing are all items that are commonly cited. Increasingly though, citizens are demanding a cleaner, safer, more enjoyable community that provides amenities for adults and children alike. Communities with quality bike lanes, trails, and bicycle routes attract new residents as well as new businesses and industries. Getting outdoors and being physically active also

14 U.S. Department of Transportation and Federal Highway Administration. (2009). National Household Travel Survey.

helps to relieve stress, improve mood, and foster social connections between residents.

Transportation and recreation options will be especially important for older Americans in the coming years. According to the Brookings Institution, the number of older Americans is expected to double between 2000 and 2025.[15] Seniors who find themselves unable to drive will find that their mobility is severely limited if other transportation options are not available. While many seniors are capable of driving and riding with traffic. Trails, paths, and separated bicycle facilities will provide seniors with a more comfortable ride for users with mobility impairments or those wanting to take a more leisurely route to nearby shops and services. Off-street paths and trails are also valuable transportation connections because they accommodate motorized wheelchairs, which can provide many seniors with the independent mobility that they would not have otherwise.

Children under 18 are another important subset of our society and equally merit access to safe mobility options and a higher quality of life. In recent years, increased traffic and a lack of pedestrian and bicycle facilities have made it less safe for children to travel to school or to a friend's house. **In 1969, 48 percent of students walked or biked to school, but by 2001, less than 16 percent of students walked or biked to or from school.**

In a 2005 Centers for Disease Control and Prevention survey, 1,588 adults answered questions about barriers to walking to school for their children aged 5 to 18 years.[16] The main reasons cited by parents included distance to school, at 62 percent, and traffic-related danger, at 30 percent.

Strategic additions to the bicycle and pedestrian network could shorten the distance from homes to schools, and overall pedestrian and bicycle improvements can increase the safety of our roadways so that children could once again safely bike in their communities. According to the National Center for Safe Routes to School,

"Walking or biking to school gives children time for physical activity and a sense of responsibility and independence; allows them to enjoy being outside; and provides them with time to socialize with their parents and friends and to get to know their neighborhoods."[17]

Ensuring that children have safe connections to their schools and throughout their neighborhoods can encourage them to spend time outdoors, get the physical activity they need for good health, and enjoy a higher quality of life. Additionally, safe connections can provide young adults a means of transportation to after school jobs or activities.

The Planning Process and Public Involvement

Project Steering Committee

The development of this Plan was guided by the project's Steering Committee, a group of over 20

15 Brookings Institution. 2003. The Mobility Needs of Older Americans: Implications for Transportation Reauthorization.

16 Centers for Disease Control and Prevention. The Importance of Regular Physical Activity for Children. Accessed in 2005 from www.cdc.gov/nccdphp/dnpao/index.html.

17 National Center for Safe Routes to School. (2006). National Center for Safe Routes to School Talking Points.

individuals representing the bicycling interests of the member municipalities and the region. Steering committee members also represented a number of agencies and backgrounds, including the Tri-County Regional Planning Commission, participating municipalities, PennDOT, Capital Area Transit, and local advocacy groups. The Project Steering Committee met with project consultants throughout the process, focusing on project vision and goals (April 2014), existing conditions (August 2014), the draft Plan (January 2015), and the final Plan (March 2015).

Data Collection and Analysis

After collecting baseline information about the study area, the consultants, Alta Planning + Design and Sabra, Wang, & Associates, began assessing existing conditions of the region (Chapter 2). Consultants used aerial photography and geographic information systems (GIS) data to identify opportunities and constraints for bicycle facility development.

These preliminary findings were then tested for applicability and appropriateness through on-the-ground fieldwork. The existing conditions and the preliminary findings were presented to the Steering Committee in August 2014 and to the public in August 2014 at the Hershey Farmers' Market.

Public Involvement

Public involvement efforts for the *Regional Bicycle Connections Study* were carried out throughout the planning process. The consultant team gathered input and feedback both in person and online through public meetings, workshops, and the Plan's website. The website served as a clearinghouse of information with details on the Plan and planning process, informational display boards for events, public input cards, an interactive online WikiMap, and results of bicycling demand and supply analysis. For more information on the public involvement process, please see Chapter 3.

How to Use This Plan

This Plan is the first regional planning effort of its type for the study area. As the first step in developing a more bicycle-friendly region, it is likely the implementation strategies and steps will change as the culture and landscape evolve.

A study may be funded in the short term that may include a long-term implementation step of this Plan. However, many of these recommendations may simply be accomplished as part of any already-scheduled resurfacing or other road or bridge improvements. It is vital that municipalities use these upcoming road improvements as windows of opportunity to improve transportation options by incorporating bicycle and pedestrian improvements when possible. It is acceptable to implement that strategy sooner to create economies of scale in planning and implementation efforts throughout the region.

Action items should be reevaluated each year to revisit priorities for the upcoming year and note accomplishments. Eventually, this study should be conducted again to update the recommendations based on the progress of statewide, regional, and local engineering and programming efforts.

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Chapter Two: Existing Conditions

Overview

This chapter describes the existing bicycling environment within the *Regional Bicycle Connections Study* area, bicycle network strengths and weaknesses, challenges that need to be addressed to improve the bicycling environment, and current bicycling demand. Later sections of the chapter identify current bicycle-related programs and review the existing plans and policies that have shaped the present-day bicycling environment. Relevant data collected for this Plan is also presented throughout the chapter to provide further insight into existing bicycle conditions in the region.

Current Conditions

GIS Base Maps

Geographic Information Systems (GIS) data was obtained from participating municipalities, PennDOT, and counties within the study area. The map on page 2-5 presents the existing conditions within the study area and serves as the foundation for analyzing the current bicycling environment. Analysis conducted for this study included evaluating the roadway network, identifying popular destinations and existing bicycling routes, documenting existing bicycle facilities, and examining various demographic patterns that may be useful in assessing need for future facilities.

Bicycling can be a necessity or a choice. For both, several types of cyclists exist; those from the most confident to beginners and children. Currently, only some roadways are capable of supporting ridership by the more concerned bicyclists. The efforts of the region to complete the recommendations within this Plan will expand the possibilities for all who need or choose to bicycle.

Trip Attractors & Current Movement within the Region

People currently drive, walk, or bike to a variety of destinations across the region for various purposes. These potential destinations and points of origin for bicyclists are referred to in this document as 'trip attractors'. Regional and local trip attractors include the following:

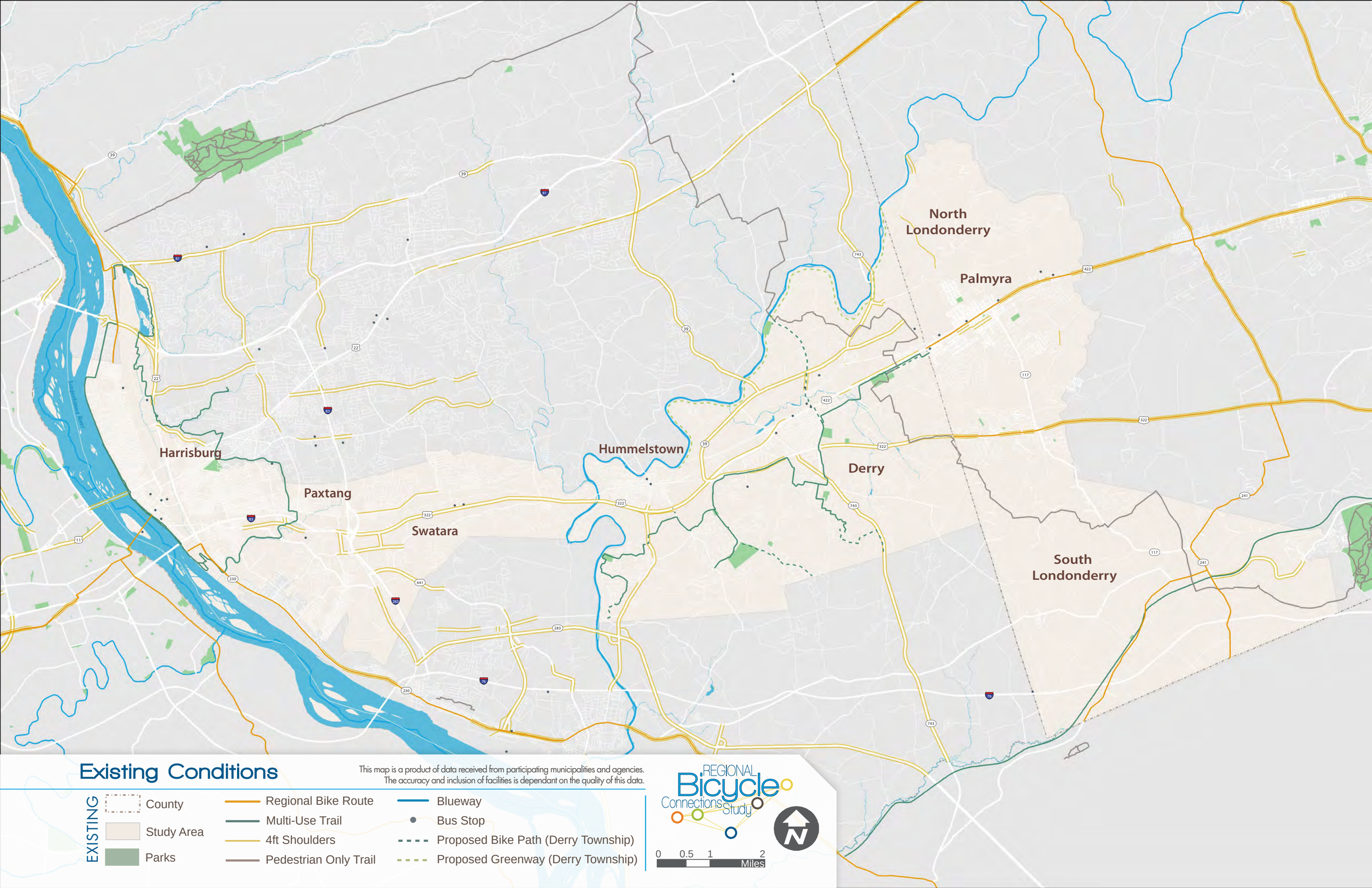
- Downtown districts or "Main Streets"
- Jonathan Eshenour Memorial Trail, Conewago Recreation Trail, Lebanon Valley Rail Trail, Capital Area Greenbelt Trail, and other trails
- Parks: Hodges Heights Park, Italian Park, Shank Park, and other parks in the region

The Pennsylvania State Capital in Harrisburg
(Image courtesy of Commonwealth Media Services)

- Large employers: Commonwealth of Pennsylvania, United States Federal Government, Giant Food Stores, Penn State Hershey Medical Center, Hershey Entertainment and Resorts Company, The Hershey Company, UPS, and other major employers
- Transit facilities: Capital Area Transit and Lebanon Transit
- Restaurants
- Shopping locations: Downtown districts, Harrisburg Mall, Colonial Park Mall, Tanger Outlets, and other shopping
- Higher density/Multi-family residential areas
- Public destinations: Libraries, schools, post offices, seats of government
- Harrisburg University, HACC, Penn State Harrisburg and Penn State College of Medicine
- Attractions: Pennsylvania State Capitol, Hershey Lodge & Convention Center, National Civil War Museum, State Museum of Pennsylvania, Riverfront Park, Hersheypark, Capital Area Greenbelt, Whitaker Center for Science and the Arts, other cultural sites, historic sites, Broadstreet Market and other points of interest geared toward residents and visitors

The above categories of bicycle trip attractors were considered when determining locations for facility improvements. They represent important starting and ending points for bicyclist travel and provide a good basis for planning ideal routes.

Much of the current bicycle movement in the region is recreational, with people using trails and some on-road routes to bicycle for exercise, social rides, family rides, and sightseeing. People who use bicycles for transportation are restricted by the choice of routes that feel safe and the lack of bicycle connectivity between destinations; these deficits limit bicycling for transportation mainly to the most confident riders or riders without other means of transportation.


North Londonderry
Palmyra
Hummelstown
Harrisburg
Paxtang
Swatara
Derry
South Londonderry
Susquehanna River
39
22
83
743
422
117
322
441
283
230
241
76
Existing Conditions
This map is a product of data received from participating municipalities and agencies.
The accuracy and inclusion of facilities is dependant on the quality of this data.
EXISTING
County
Study Area
Parks
Regional Bike Route
Multi-Use Trail
4ft Shoulders
Pedestrian Only Trail
Blueway
Bus Stop
Proposed Bike Path (Derry Township)
Proposed Greenway (Derry Township)
REGIONAL Bicycle Connections Study
N
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Miles

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Field Inventory & Observations

Bicycling in the study area is quite challenging due to the lack of on-road bicycle facilities, the presence of narrow and high-traffic volume roadways, a sprawling roadway network, and complex, high-volume intersections. The variation in density and development patterns across the study area present unique opportunities and constraints when developing a bicycle network. The bustling downtown core of Harrisburg has a favorable grid environment but higher traffic volumes, and the lower volume roadways throughout the smaller municipalities create a favorable environment for bicycling but are disjointed and intersect major barriers for bicyclists.

The narrative on the following pages will discuss the opportunities and constraints of the bicycling network and provide a photo inventory of key circumstances throughout the study area.

Currently in the region, there are many examples of both opportunities and constraints for bicycle friendly communities. Opportunities serve as potential to improve the future bikability of the region. Identifying the gaps can lead to opportunities for improvement and/or redirection.

Existing Bicycle System Opportunities

While the study area currently lacks a variety of on-road bicycle facilities, there are numerous assets and opportunities throughout the study area that provide a strong base for facilitating a safe, accessible, and cost-efficient regional network.

Transportation in Harrisburg is facilitated via a compact grid network with corridors that promote relatively low speed with varying volumes of traffic. This creates a favorable environment for short bicycle commutes, cross-town trips, and easy access to important connecting routes to regional destinations. The downtown core of Harrisburg has a strong concentration of attractions and amenities, promoting short bicycle trips for nearby residents and, if well connected, becoming destinations for the region. The Capital Area Greenbelt is another strong attraction that facilitates recreation and transportation around the city.

Large portions of the study area also contain a favorable grid roadway pattern, particularly the historic downtowns of Hummelstown, Hershey, and Palmyra. This grid pattern creates a predictable, option-rich environment where bicyclists can easily navigate and select routes that best suite their travel purpose or level of safety.

Additionally, there exists a high number of low-volume local streets that are presently functioning as bicycle boulevards or neighborhood greenways. These low-stress streets encourage bicycling trips and have enormous potential to be developed into strong components of the regional network.

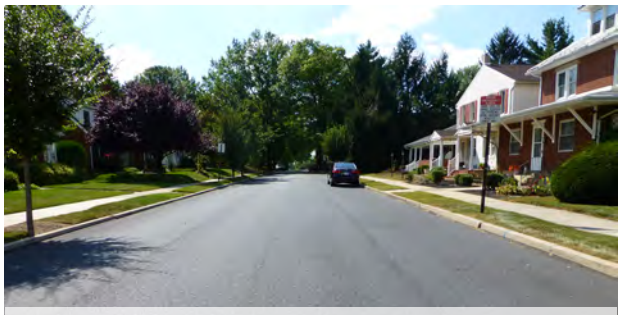
These assets and attractions are substantial strengths and act as a strong foundation to improving the region's bikeability.

Key Opportunities of the existing bicycle system and roadway network:

- Approximately 65 miles of multi-use trails that function as recreation and transportation opportunities;
- Favorable, low-volume streets offer calm travel options;
- Historic, compact towns with grid roadway networks that are connected and easily navigated;
- Many roadways throughout the study area have more capacity than their traffic volumes warrant. This creates an opportunity to reutilize the space, such as a road diet to add space for on-street parking, landscaping, and bicycle facilities;
- Some of the roadways with extra capacity are scheduled for resurfacing in the near future - incorporating bicycle accommodations during routine maintenance is an opportunity to save costs, time, and resources;
- Many primary schools are located in bikeable areas. Relatively minor infrastructure improvements can greatly improve facilities and increase the safety and number of students bicycling to school;
- The Capital Area Transit and Lebanon Transit systems feature bike racks on the front of buses.
- State BicyclePA Route J runs through Harrisburg and several bike routes have been identified in the Lebanon County Bike Transportation Map (improved and more frequent signage will raise awareness of the bicycling facility and indicate to motorists that bicyclists belong on the road);

The Capital Area Greenbelt is a popular destination for both on-road and recreational bicyclists. Improving bicycle connectivity to trailheads, such as this one on S Paxtang Ave, would improve safety and access for local riders and tourists.

Several roadways have excessive capacity, such as Cherry Street in Palmyra (10 ft travel lanes & 14 ft on-street parking) where there is ample room to accommodate a bicycle lane and maintain parking. Additionally, there is a concrete barrier dissecting the street that was likely installed to mitigate through-traffic. Installing a bike-ped cut-through will improve access to the street for bicyclists while still prohibiting vehicles.



With minor improvements, low-volume neighborhood streets such as Areba Avenue in Derry Township can offer an ideal environment for bicycling and serve as an alternative route for bicyclists wishing to avoid travelling on Route 422.

N 2nd Street is a popular commercial destination in Harrisburg. A road diet could be implemented to add space for pedestrian amenities, landscaping, bike facilities, and pedestrian crossing improvements.

Hummelstown and many of the historic downtowns in the study area are compact and feature a grid roadway network, resulting in a close proximity of key destinations and improved accessibility.

Similar to Northside Elementary School in Palmyra, many schools in the study area are positioned in bikeable areas. Minor improvements such as sharrows, signage, and traffic calming can raise awareness and improve the safety and attractiveness of bicycling to school.

Existing Constraints to Bicycling Mobility

The study area is a collection of various levels of land use densities and roadway types, with multi-lane regional highways intersecting important corridors in each municipality. The high traffic volumes and speeds of these regional highways make traveling by bicycle difficult, creating significant barriers to a bicycle network.

Additionally, many local roadways are narrow, lack paved shoulders, and are generally designed for automobile use only. Many of the roads and intersections were designed some time ago and primarily accommodate motor vehicles. Theses roads and intersections need to be redesigned or re-striped to consider the needs of all transportation modes. Regional attractions often require crossing these high-traffic roadways with complex and intimidating traffic patterns. Navigating these barriers are difficult and act as major detractors to promoting bicycling in the region.

Key Constraints of the existing bicycle system and roadway network:

- Other than the portion of the Capital Area Greenbelt and the Jonathan Eshenour Memorial Trail that run parallel to a roadway, the study area has no on-road bicycle facilities linking destinations (other than shoulders);
- The current trail system lacks a regional connection between the Capital Area Greenbelt, the Jonathan Eshenour Memorial Trail, and the Lebanon Valley Rail Trail;
- The roadway network is not well-connected; developments with curvilinear streets and a single-point entry to major arterials is more common than a grid network in many municipalities;
- Existing right-of-way limitations pose significant challenges to the implementation of bicycle facilities that would require widening during future roadway construction;
- Accommodating bicyclists on the study area's main arterial thoroughfares (specifically, Route 422, Route 322, Paxton Street, and Derry Street) that carry high traffic volumes, numerous driveway entrances, and underpasses will require future feasibility studies to assess conflict zones between bicyclists and motorists;
- Bicycle connectivity into Harrisburg across the railroad tracks is limited due to a lack of separated bicycle facilities across the bridges;
- End-of-trip facilities, such as short and long-term bicycle parking, is limited throughout the study area;
- Bicycle connectivity to transit and secure bicycle parking at transit stations is limited.

Stormwater grates are a hazard for people on bicycles. Many are placed in spaces where bicyclists are expected to ride, forcing riders to maneuver into the travel lane to avoid them. Many grates in the study are placed incorrectly for bicyclists, causing bicycle tires to get caught and injuring riders.

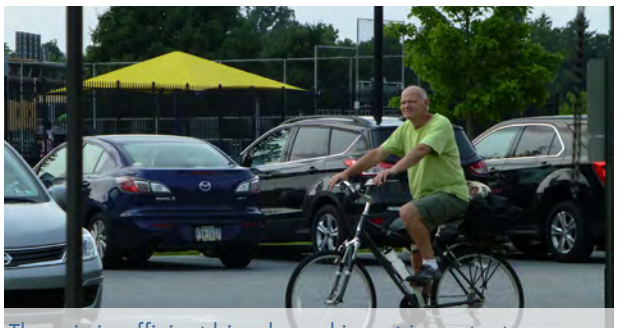
Route 241 has been identified as a Regional Bike Route by Lebanon County and is an example of a narrow roadway corridor that is constrained by utility lines. This can result in insufficient width for drivers to safely pass bicyclists.

Many of the study area's busiest retail, employment, and recreation centers are difficult to access by bike due to them being along high-traffic, high-speed roadways. Corridors such as Route 422 have tremendous potential to generate bicycle traffic, but there are currently too many barriers to encourage bicycle usage.

Northside Drive in South Londonderry Township is an example of a curvilinear street that is common throughout the study area. The design of the road fosters high speed traffic. The width can become an opportunity to add bicycle facilities while maintaining vehicular efficiency.

Many intersections in the study area are complex and intimidating to navigate via a bicycle. Intersection treatments such as lane striping, bicycle loop detectors, and bicycle boxes will be cost-effective solutions to improving the awareness and safety of bicyclists at intersections.

Sections of Derry Street have numerous driveway entrances that cause conflict zones between bicyclists and motorists. Future feasibility studies and driveway access management techniques will be required to improve the multi-modal uses of the roadway.



There is insufficient bicycle parking at important destinations. Increasing the availability of end-of-trip facilities such as parking will encourage residents to take more bicycle trips and mitigate bicycles being secured to public property such as sign posts or trees.

Bicycle Suitability Index Analysis

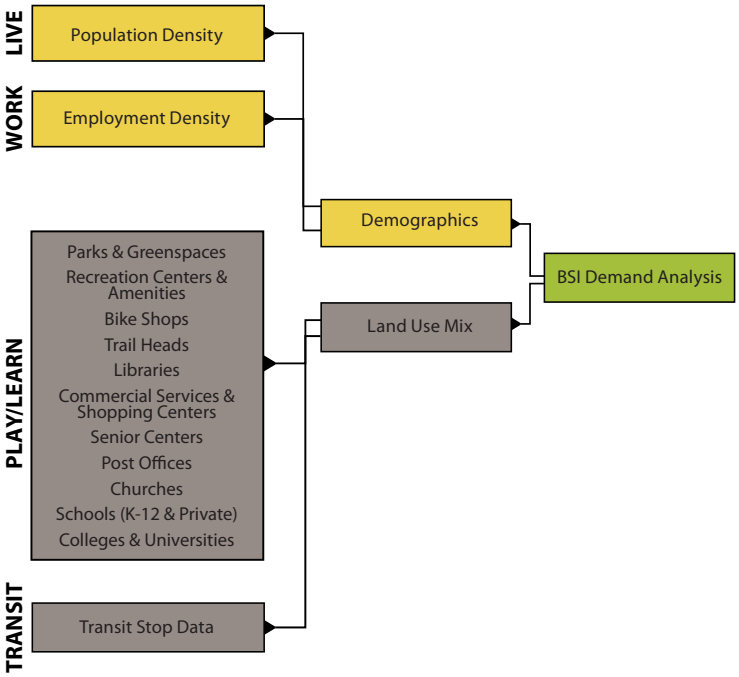
The Bicycle Suitability Index (BSI) provides a general understanding of expected activity in the bicycling environment by combining categories representative of where people live, work, play, access public transit and go to school into a composite sketch of regional demand. Area specific land use and transportation factors, such as Capital Area Transit (CAT) and Lebanon Transit (LT) service, local cultural destinations, schools, and trails are considered, as well as demographic factors.

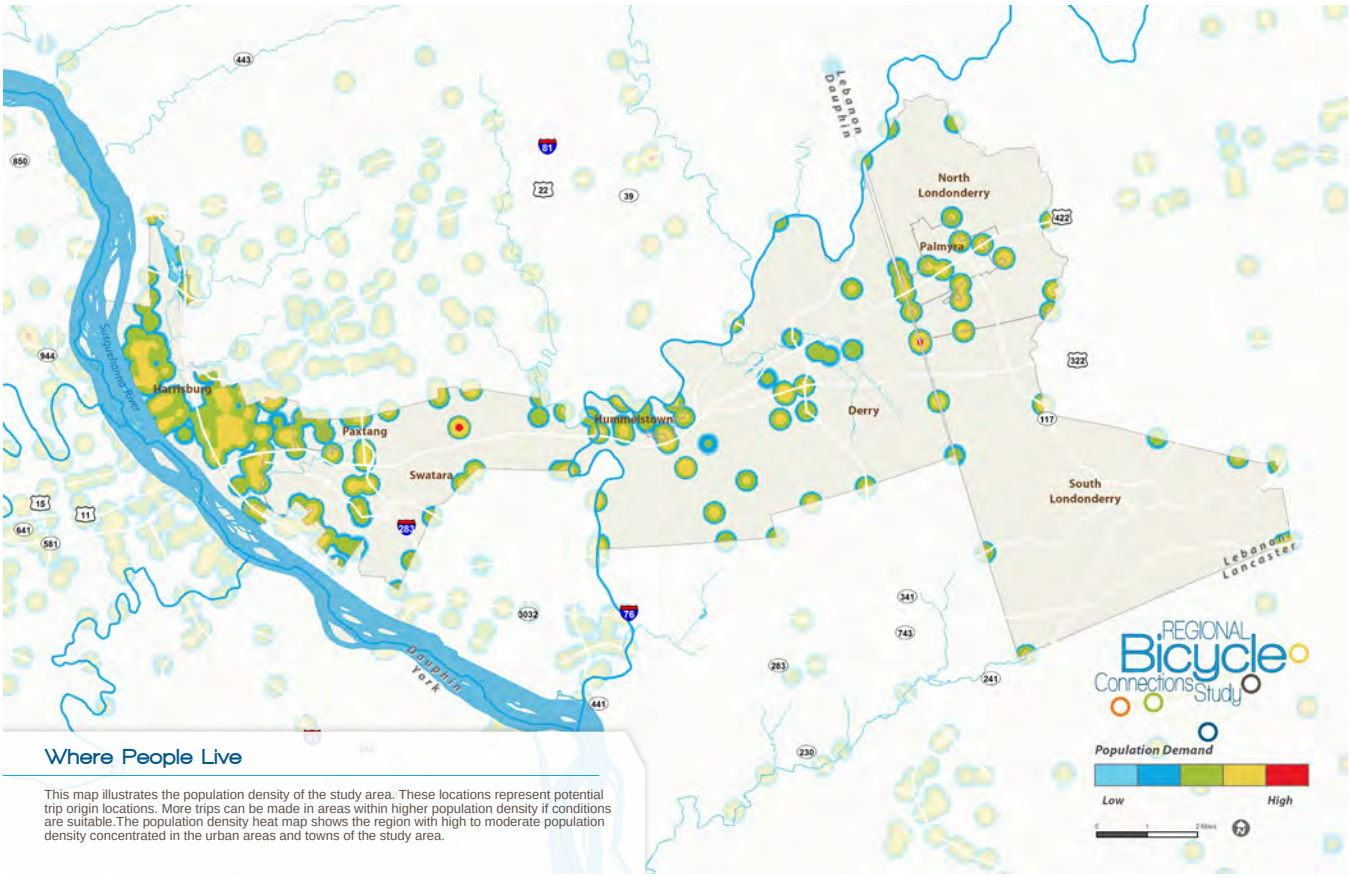
This demand component of the analysis displays concentrations of trip generators and attractors. Areas of high demand are indicated by dark red "heat" spots. These areas of high heat identify places within the study areas where bicyclists are likely to travel to and from; therefore indicating a demand for a bicycle facility to connect each hot spot.

Suitability is used to identify levels of comfort of roadways and specify those that may be suitable for bicycle facilities. Scores in BSI supply analysis are based on roadway characteristics that are known or perceived to have an impact on bicycle safety, comfort, and ease of movement. The purpose of the supply analysis is to determine if infrastructure improvements are warranted given the existing conditions.

Using available data for the entire region, roadways were assigned a score based on the level of stress a bicyclists is likely to experience when traveling along the roadway. In addition, the roadways scored points based on proximity to existing bicycle facilities such as those identified in the Lebanon County Bicycle Transportation Map. Red lines indicated the least suitable roadways for bicyclists due to the existing design. This translates into a route to avoid, or a route requiring significant changes to create a safe and comfortable bicycle route.

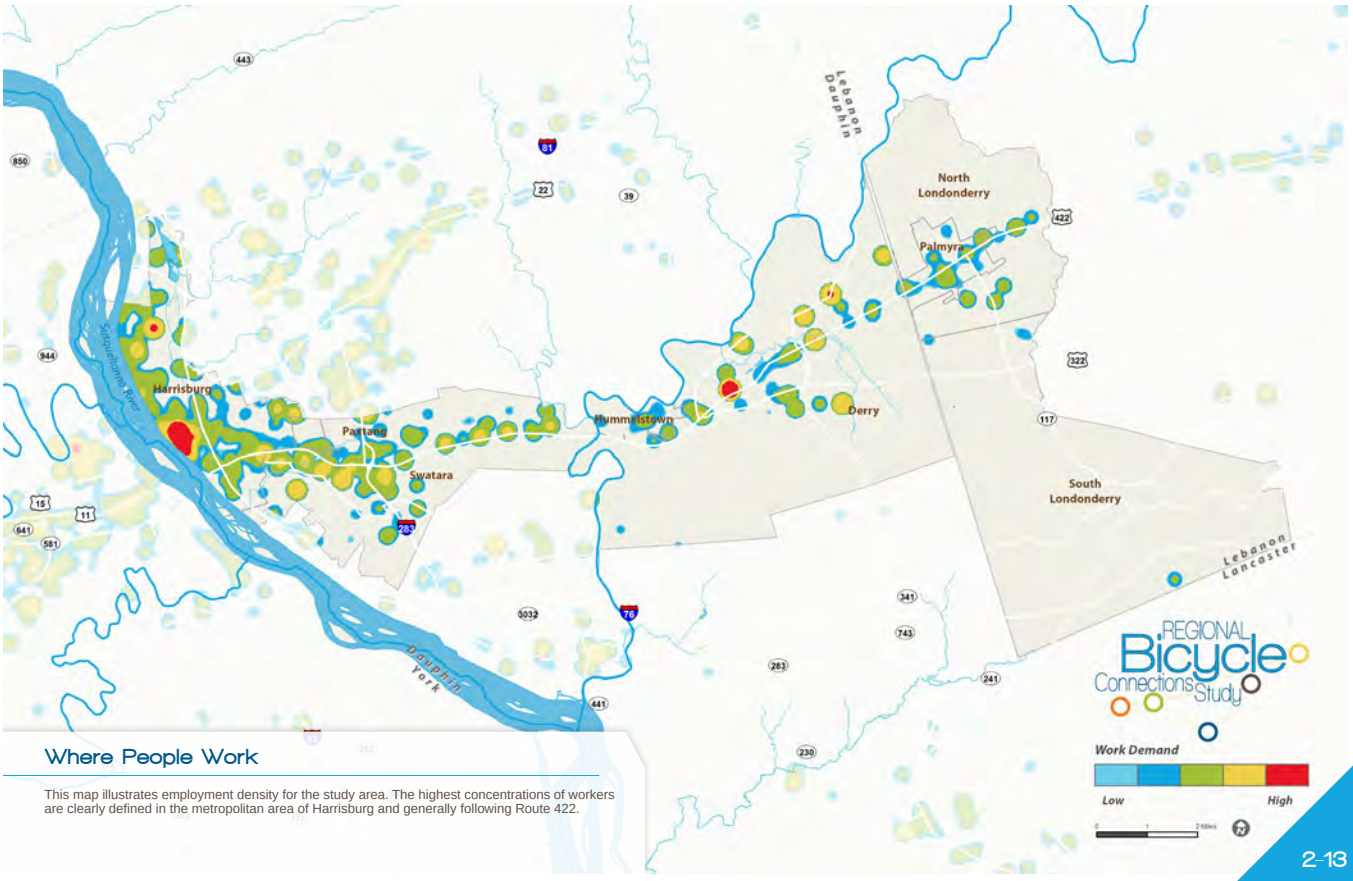
Figure 1 - BSI Regional Demand Flowchart





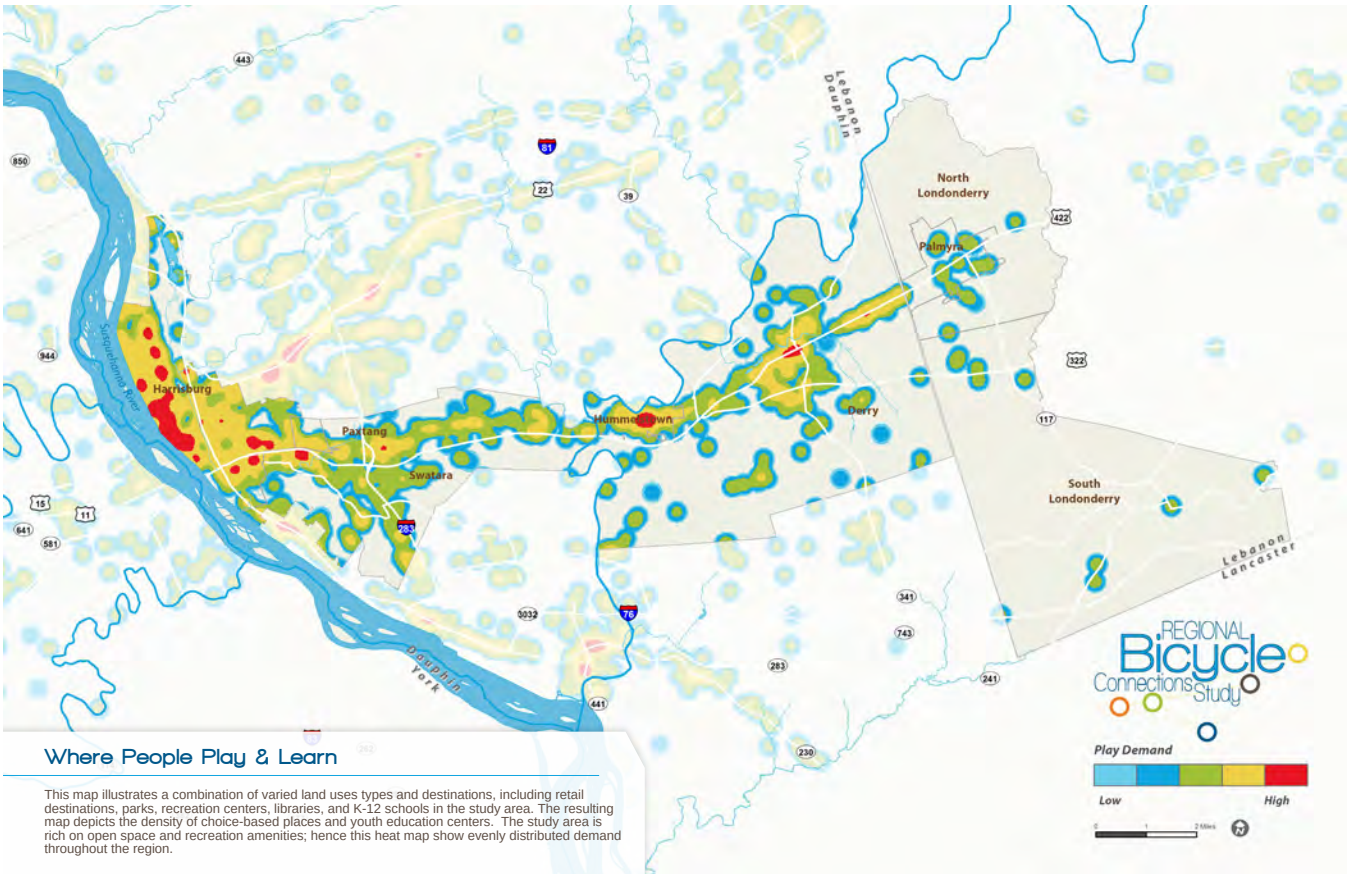
Where People Live

This map illustrates the population density of the study area. These locations represent potential trip origin locations. More trips can be made in areas within higher population density if conditions are suitable.The population density heat map shows the region with high to moderate population density concentrated in the urban areas and towns of the study area.



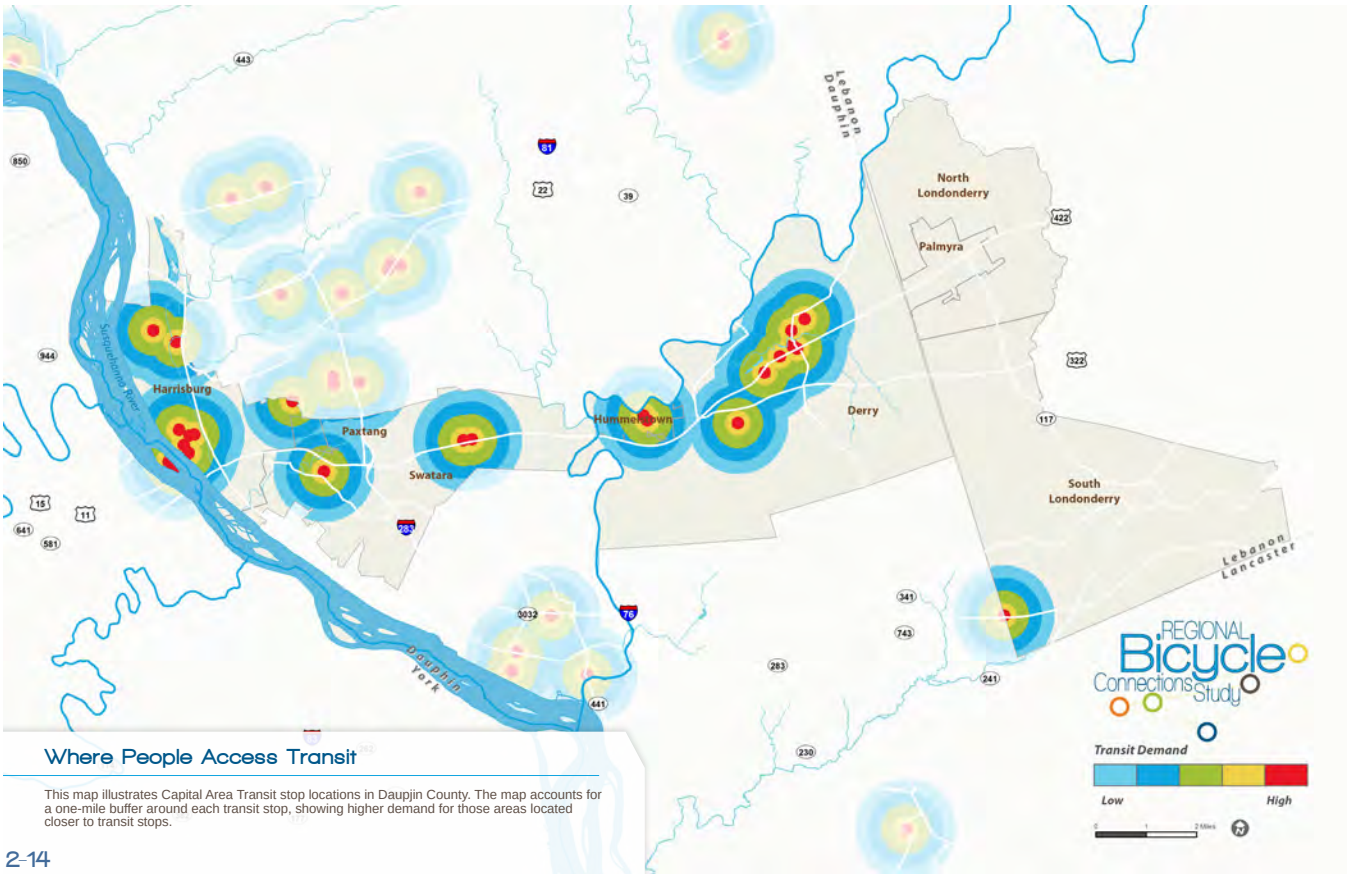
Where People Work

This map illustrates employment density for the study area. The highest concentrations of workers are clearly defined in the metropolitan area of Harrisburg and generally following Route 422.



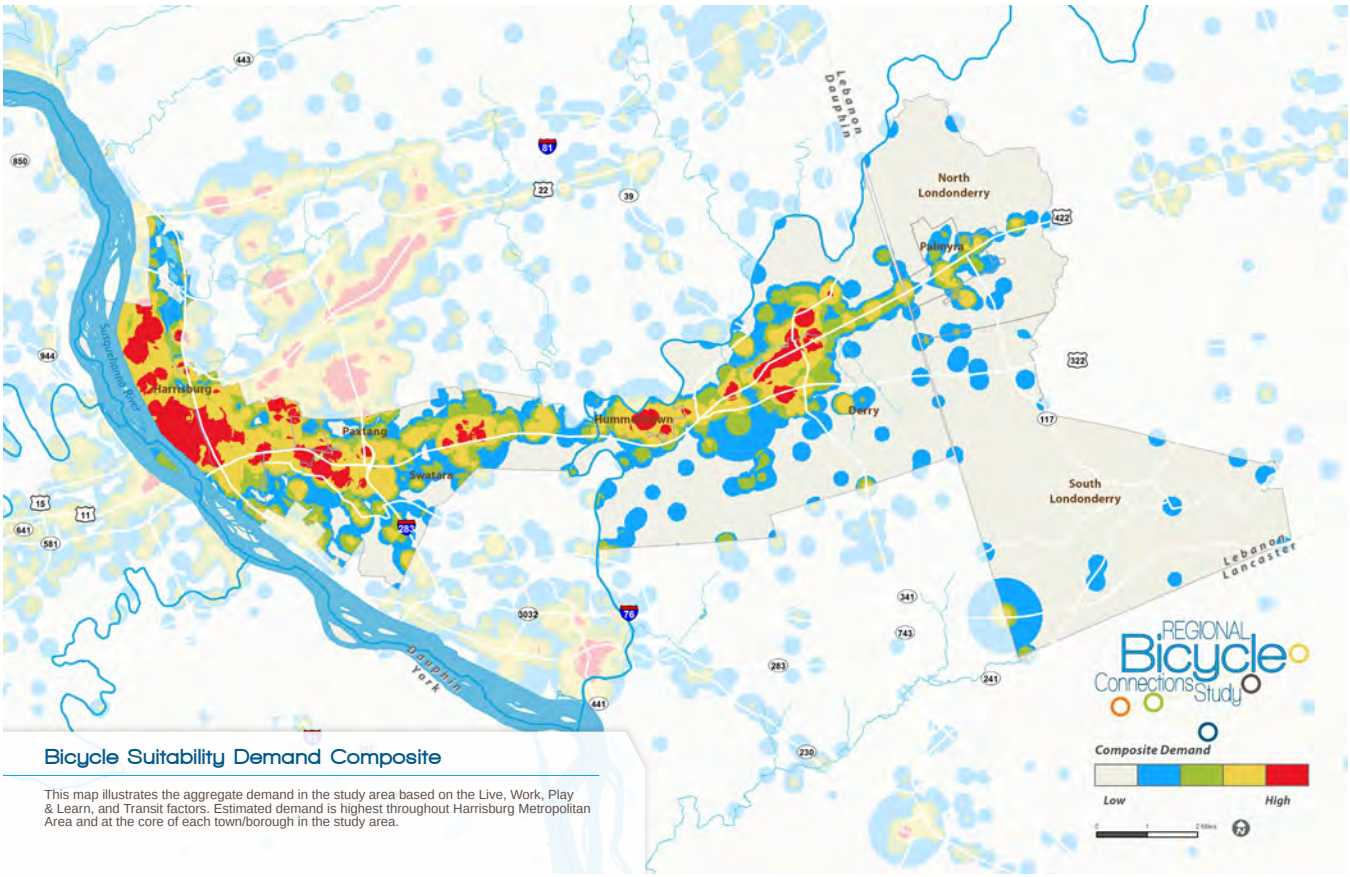
Where People Play & Learn

This map illustrates a combination of varied land uses types and destinations, including retail destinations, parks, recreation centers, libraries, and K-12 schools in the study area. The resulting map depicts the density of choice-based places and youth education centers. The study area is rich on open space and recreation amenities; hence this heat map show evenly distributed demand throughout the region.



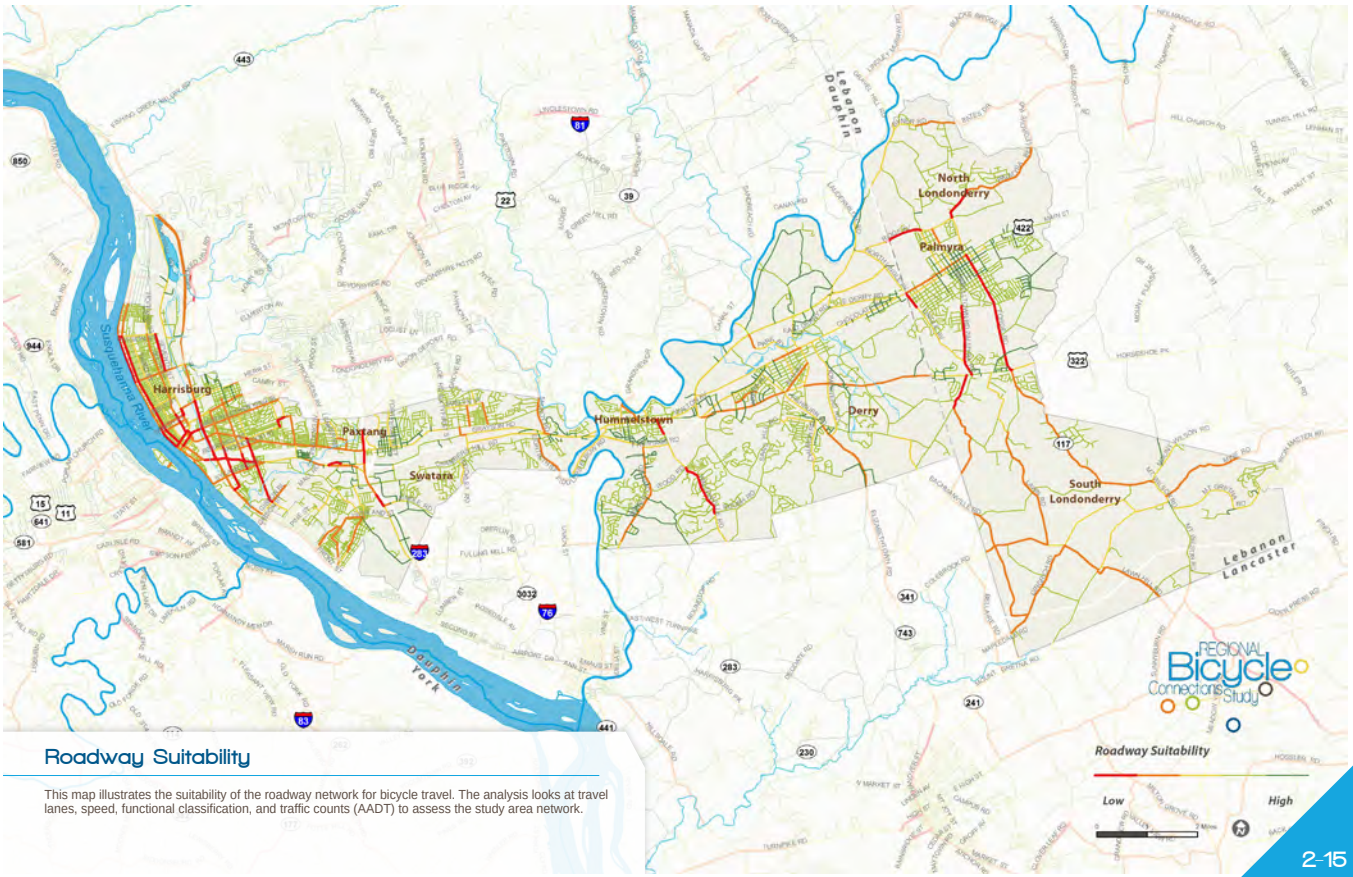
Where People Access Transit

This map illustrates Capital Area Transit stop locations in Daupjin County. The map accounts for a one-mile buffer around each transit stop, showing higher demand for those areas located closer to transit stops.



Bicycle Suitability Demand Composite

This map illustrates the aggregate demand in the study area based on the Live, Work, Play & Learn, and Transit factors. Estimated demand is highest throughout Harrisburg Metropolitan Area and at the core of each town/borough in the study area.



Roadway Suitability

This map illustrates the suitability of the roadway network for bicycle travel. The analysis looks at travel lanes, speed, functional classification, and traffic counts (AADT) to assess the study area network.

BSI Analysis Conclusions

The BSI composite activity model is an important tool for assessing potential bicycle improvements and to guide fieldwork. The model reveals that the estimated demand is highest throughout the Harrisburg Metropolitan Area and at the core of each town/borough in the study area. These downtown areas are also largely composed of lower-speed, grid pattern streets that have a moderate roadway suitability ranking. As a result, these downtown areas should be targeted as priority investment areas to invest in infrastructure to meet latent demand.

Palmyra, North Londonderry, and South Londonderry indicate moderate demand for bicycle accommodations. These areas are likely best served with infrastructure investments coupled with bicycle education and encouragement programs to induce demand. Education and encouragement programs could include increasing bicycle parking, bicycling maps, cycling events, and education programs that teach cycling skills to youths and adults.

Important corridors for priority investments include, but are not limited to:

- N 2nd Street between Paxton Street and Maclay Street
- N 3rd Street between Walnut Street and Maclay Street
- Derry Street from Mulberry Street to N 72nd Street
- Harrisburg Street (Route 441) from Paxton Street to Chambers Street
- Route 322
- Route 422

Existing Policies and Programs Related to Bicycling

The following section provides an overview of existing policies and programs that influence the outcomes of this Plan and should be recognized as tools for enhancing the safety and facility options within the study area.

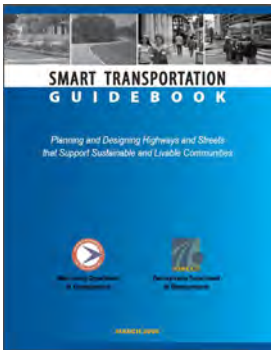
2007 PennDOT Access and Mobility Policy

In 2007, PennDOT Department policy was revised to require the evaluation of access and mobility needs for bicyclists and pedestrians in all highway and bridge projects. This policy made the PennDOT Bicycle and Pedestrian Checklist a formal part of all project planning, programming, scoping, and design to ensure that bicycle and pedestrian needs are considered throughout a project.

PennDOT Bicycle and Pedestrian Checklist

The Bicycle and Pedestrian Checklist provides a standardized way for DOT staff to evaluate the access and mobility needs of pedestrians and bicyclists and ensure that these needs are addressed in project development. The checklist considers a variety of criteria to evaluate bicycle and pedestrian access and mobility, including consistency with current bicycle and pedestrian planning documents, safety needs, land use patterns, and availability of transit. Based on existing conditions, the checklist identifies bicycle and pedestrian accommodations that should be implemented based on the evaluation of current access and mobility. This checklist is used as part of all PennDOT highway and bridge projects. The checklist can be found here: ftp://ftp.dot.state.pa.us/public/PubsForms/Forms/D-310.pdf.

2008 PennDOT Smart Transportation Guide



This guide, a joint effort of PennDOT and the New Jersey DOT, is used to guide the development of non-limited access roads to address the needs of all road users, including bicyclists and pedestrians. The purpose of the guide is to create a transportation system that works well for all users, is affordable, and supports smart growth community planning goals.

Bike to School Day

Some schools in the region, including Derry Township, have participated in Bike to School Day in the past. Bike to School Day is held in May during National Bike Month and provides education and encouragement opportunities for children to bike to school.

Safe Routes to School and Capacity Building for Increasing Physical Activity Mini-Grants

Penn State Hershey PRO Wellness Center Mini-Grant Program

While funding for the mini-grants ended in 2013, the program serves as a local best practice for following the national Safe Routes to School mission. The program was initiated by the Penn State Hershey PRO Wellness Center who administersed mini-grants to help schools and their

communities increase Safe Routes to School efforts and physical activity programs. The funding was granted by the Pennsylvania Department of Health through the Preventive Health and Health Services Block Grant from the Centers for Disease Control and Prevention.

Bicycling Resources, Rides, and Events

The Harrisburg Bicycle Club (HBC) and the Lebanon Valley Bicycle Coalition (LVBC) both provide websites with a wealth of information on bicycle education, riding tips, suggested ride routes, and bicycle planning in the region and state. The HBC provides regular group rides for a variety of skill levels and interests, special rides, social events, bicycling directions for individual rides, and a calendar of other rides and events. The club also offers and advertises classes on bicycle law, bicycle maintenance, and health topics such as injury prevention and stroke awareness.

The Lebanon Valley Bicycle Coalition was started in the 1980s with an emphasis on recreational bicycling and offered annual fundraising rides, the Tour de Lebanon Valley and No Baloney Century. After several years of inactivity, in 2008, LVBC was reorganized to focus on bicycle advocacy. In addition, there are bicycling activities which are being expanded to include not only rides but mentoring and basic maintenance.

LVBC's Bylaws explain the Coalition's purpose:

- Protect and defend bicyclists' rights.
- Advocate for positive attitudes and public policies that will improve and promote the safety, convenience and acceptance of bicyclists in the Lebanon Valley.
- Advocate for recognition of the bicycle as a vehicle that is used for many purposes including economical transportation, recreation, personal fitness and competition.
- Work with municipal, county and state governments to establish and implement policies and practices that accommodate the needs of bicyclists.
- Advocate for local, state and federal legislation related to improving and promoting the safety and accommodation of bicyclists.
- Join forces with bicyclists, bike clubs and other relevant groups in Lebanon County, the region and the Commonwealth to help assure that bicyclists have a greater voice in making cycling accepted, safe and accommodated.
- Educate bicyclists and motorists on road safety.
- Develop partnerships and other ties amongst community organizations and businesses in order to achieve mutual goals.
- Provide mentoring for new bicyclists and/or new commuters.
- Develop scenic bicycling routes in the Lebanon Valley that can be enjoyed by local bicyclists and touring bicyclists.
- Provide bicycling opportunities for LVBC members who want to participate in Club rides.
- Provide opportunities for bicyclists to network with other bicyclists.

Bicycle Maintenance Clinics

The Harrisburg Bicycle Club (HBC) offers a series of Bicycle Maintenance Clinics to teach riders how to perform basic maintenance tasks on their bikes. Classes have been offered on fixing flats, safety checks, bicycle fit and adjustments, helmet review and fit check, chain review and cleaning, and other bicycle maintenance issues. The clinics are open to both HBC members and non-members, with a requested donation to cover class expenses.

Additionally, Recycle Bicycle fixes abandoned or donated bikes and either returns them to the community or sends them to Pedals to Progress for use elsewhere. The non-profit organization also offers maintenance services and a mobilized bike repair station for kids in the summer.

Existing Plan Review

In order to understand the existing planning environment and provide a basis for new recommendations, this Plan includes a review of previous recommendations created by other planning studies, feasibility studies, and related documents. The plan review uncovered 16 documents that address topics related to regional recreation links, alternative transportation choices, and multimodal connections. They all represent important efforts, provide valuable insight and background, and have influenced the development of this Plan.

The following plans were evaluated to understand recommendations within the study area and those within the context of the study area that support bicycling culture in Pennsylvania. For more detailed information, please consult the document in its entirety.

Capital Area Transit (CAT) Service Study (2010)

The Service Study highlights proposed expansions to route and systems within the Capital Area Transit service area, one of which falls within the Regional Bicycle Connections Study area.

Dauphin County Parks, Recreation, Open Space, & Greenways Study (2009)

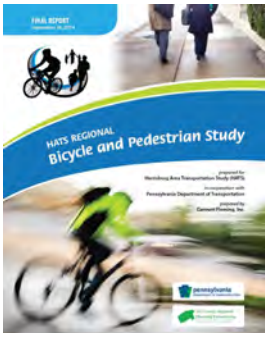
This Dauphin County plan discusses on-road and off-road bicycle connections to provide local and regional connectivity.

Dauphin County Comprehensive Plan (2008)

This plan lists existing bicycle trails within the study area, including Stony Creek Trail, Derry Township Jonathan Eshenour Memorial Trail, and the Capital Area Greenbelt. The Capital Area Greenbelt and the Derry Township Pathway received transportation enhancement funds for construction in fiscal years 2005 to 2008. No bicycle facility recommendations are included in this plan.

Harrisburg Area Transportation Study (HATS) Regional Bicycle and Pedestrian Study (2014)

The *HATS Regional Bicycle and Pedestrian Study* outlines several goals and strategic actions to improve the bicycling environment in the Harrisburg area, including education, encouragement, enforcement, and evaluation and planning initiatives.



Harrisburg Area Transportation Study (HATS) 2035 Regional Transportation Plan (2011)

The *HATS 2035 Regional Transportation Plan (RTP)* sets goals to improve the bicycling environment and identifies some bicycle infrastructure, planning, and coordination needs within the study area.

Lebanon County MPO Transportation Improvement Program (TIP) Project Prioritization and Selection Process (2011)

While 'bicycling' was not specifically stated as a criterion for selecting and prioritizing projects in Lebanon's LRTP and TIP, the criterion that directly addresses transportation and is related to bicycling states: Provide transportation choices for residents, businesses, and visitors. No bicycle facility recommendations are included in this plan.

Lebanon County MPO Long Range Transportation Plan (LRTP) (2013)

The Lebanon County MPO LRTP identifies several corridors within the Regional Bicycle Connections Study area for bicycle improvements and other safety improvements that affect bicycling.

Lebanon County MPO Congestion Management Process (CMP) (2014)

This document primarily discusses congestion management from a motorized traffic perspective, but does include some bicycle improvements within the study area.

Palmyra Borough Main Street (US 422) Corridor Study (2010)

This study proposes a phase implementation of bicycle improvements to the Main Street/Route 422 corridor.

Pennsylvania Department of Transportation (PennDOT) Bicycle and Pedestrian Master Plan (2007)

This plan identifies two statewide bike routes that pass through the Regional Bicycle Connections Study area. Route J is the only state bicycle route to pass through Harrisburg and uses a combination of on-road routing and off-road rail-trail. The route is 220 miles in length. Route S, extending 435 miles across the state, is the longest Bicycle PA route. The route is aligned on-road through the Regional Bicycle Connections Study area.

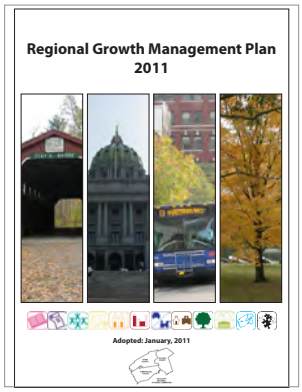
Regional Transit Coordination Study (2011)

This study outlines guidelines for establishing policies regarding regional transit. One guideline states that when a corridor is submitted as a candidate for state funding to support a transit system, a series of evaluation factors should be used for consideration of support, two of which are related to bicycling: 1) development of regulations that include transit, bicycle, and pedestrian, amenities and 2) bicycle and pedestrian amenities such as bike racks, sidewalks, and pedestrian signal activation.

Swatara Creek Greenway River Conservation Plan (1997)

This plan proposes some off-road bicycle trails to be implemented as part of the conservation plan.

Tri-County Regional Planning Commission Regional Growth Management Plan (2011)



This plan covers the tri-county area. Specific bicycling facilities or policies were not outlined in the plan. General transportation principles outlined and related to bicycling facilities included the following: 1) Provide more transportation choices, 2) Improve economic competitiveness through reliable and timely access to employment centers, and 3) Value communities and neighborhoods by investing in health, safety, and walkable neighborhoods.

Tri-County Regional Planning Commission Cross Rivers Connections Study

The Tri-County study identifies several bicycle improvements to roadway corridors, trails, and intersections.

The Tri-County Regional Planning Commission Transportation Improvement Program (TIP) for 2015-2018

Several infrastructure projects scheduled to begin within the study area during the 2015-2018 years will affect bicycling in the area including a project that involves installation and updating the crossing of local bike trail at various locations within the Harrisburg Area. The scope includes, pavement marking, signage, and flashing warning signs.

Lebanon County Bicycle Transportation Map

The Lebanon County Bicycle Transportation Map was created to inform PennDOT, the Lebanon County Metropolitan Planning Organization, municipalities, contracted planners, and engineers which roads are most frequently used by bicyclists to reach their varied destinations. The map can be found by visiting http://www.lebcounty.org/Planning/Documents/MPO%20documents/BicycleTransportationPriorities%20Map4-25-14.pdf.


Bicycle Facility Types
Bike Lanes/Buffered Bike Lanes
Bike Boulevards: Sharrows
Paved Shoulders/Wide Outside Lanes
Shared-Use Paths/Boardwalks
Regional Bicycle Connections Study

Chapter Three: Public Participation

Overview

Developing a well-informed plan requires the participation of citizens throughout the region who represent a variety of backgrounds and bicycle-related interests. To ensure that members of the public had several opportunities and means of participation, the *Regional Bicycle Connections Study* included a multifaceted public engagement process, using a variety of meetings, events, and project resources to reach individuals for plan input and feedback. This chapter discusses the public participation process, project resources used to raise awareness of the Plan and gather input, and a summary of feedback received through this process.

Public Participation Process

A variety of events and resources were developed so that citizens of the region had the opportunity to participate. A combination of in-person events, hard copy resources, and electronic resources were used to address the different communication needs and preferences of the public. The public participation process included the following:

- Steering Committee Meetings
- Public Outreach Events
- Project Information Resources
  - Project website with link to interactive input map
  - Online interactive input map (WikiMap)
  - Public input cards
  - Informational display boards
  - Hard copy maps

Steering Committee Meetings

The development of this plan was guided by the project's Steering Committee, a group of over 20 individuals representing the bicycling interests of the member municipalities and the region. Steering committee members also represented a number of agencies and backgrounds, including the Tri-County Regional Planning Commission, participating municipalities, PennDOT, and local advocacy groups. The Project Steering Committee met with project consultants throughout the process, focusing on project vision and goals (April 2014), existing conditions (August 2014), the draft plan (January 2015), and the final Plan (March 2015).

Public Outreach Events

Two rounds of public input were planned. The first consisted of a information gathering process to determine the needs and desires of the community. The purpose of the second round was to vet the draft network and Plan.

Round One

Gathering feedback from the community about the existing conditions of biking in the region set the tone for the types of recommendations that are critical in the area. By reviewing existing plans, programs, and infrastructure, the project team gained a better understanding of the implementation process, critical infrastructure gaps, and programming efforts focused on education, enforcement and evaluation.

Participants discussing safety and facilities at the Hershey Farmers Market.

The project website supported the effort to spread awareness of the project. The WikiMap, Steering Committee meetings, and piggy-back event at the farmers market in Hershey provided the project team with the perspective of those who ride, citizens who wish to ride but are intimidated, motorists who interact with bicyclists, enthusiastic advocates, and key decision makers.

Information boards were created to educate participants. By sharing the demand and supply modes with the public, citizens were able to compare their on-the-road experiences with GIS mapping models. For those who were not familiar with the wide variety of bicycle facility types, a pictorial display was used to feature photographs of several different potential treatments - both on- and off-road. Maps were also available for comment. Participants used stickers to indicate where they live, would like to travel on bike, and challenging areas. Route characteristics were also discussed to convey those roads that feel safe today and those that would provide useful connections but are currently uncomfortable for riders.

Round Two

The second round of public input involved the review of the network, a prioritization discussion, and a discussion of key action steps. In addition to a public meeting, a special breakfast was arranged by the Lebanon Valley Bicycle Coalition. This meeting enabled PennDOT, municipal and county leaders, and key stakeholders to vet the network and discuss how each party can become an integral supportive force in creating a more bicycle friendly region. Input was vetted for inclusion in the final Plan by modifying the network, creating additional cost effective solutions, and refining prioritization.

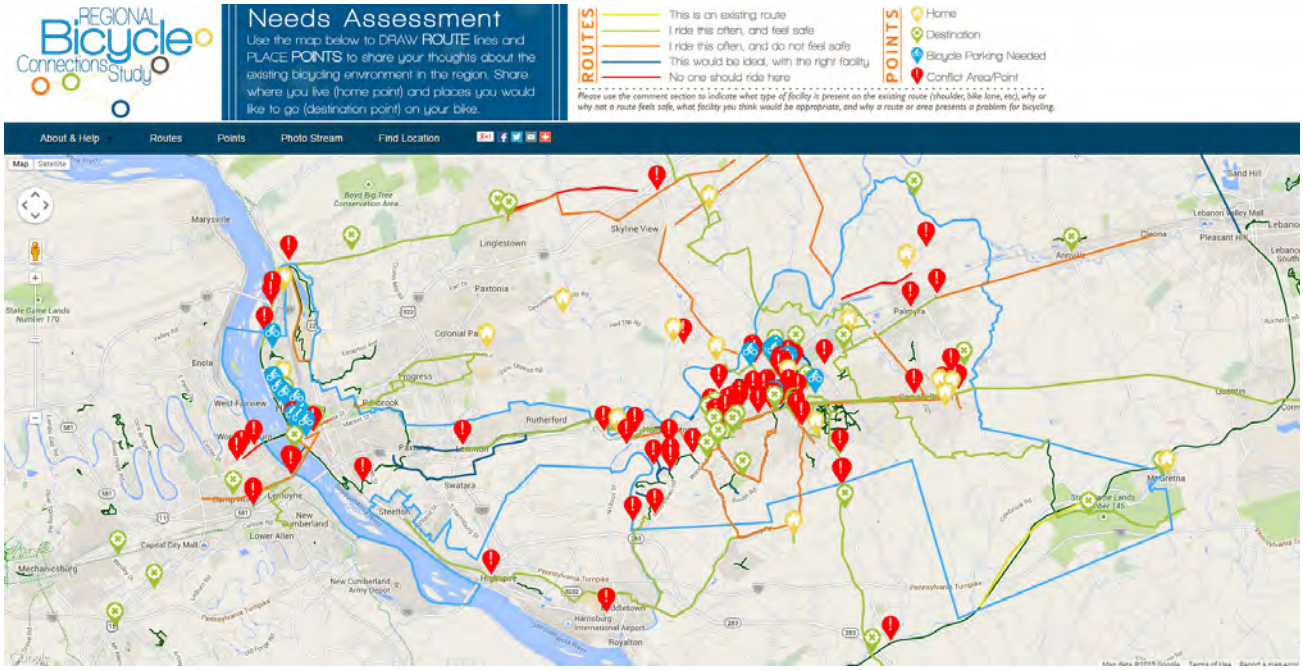
Project Resources

Project Website

A project website was developed to provide project information, maps, upcoming event information, contact information, and additional resources to the public. The website also featured a link to the online interactive input map, offering an additional medium for residents of the region to become engaged and participate in the planning process.

Round Two participants worked in groups to refine the recommended network.

The project website featured details of the study as it progressed, including access to the WikiMap.



Over 250 unique users provided input on which routes may be suitable for new facilities and where they would like to be able to ride on their bicycles.

Online Interactive Input Map (WikiMap)

A WikiMap of the study area was created online as part of this public participation process. Citizens were invited to electronically draw route lines and place points on the map to share thoughts about the existing bicycling environment in the region. The map allowed participants to draw lines of existing bicycle routes, roadways that feel safe, roadways that do not feel safe, routes that would be ideal with the right facility, and routes that should be avoided. Participants could place points for where they live, bicycling destinations, places where bicycle parking is needed, and identify conflict areas. A comment section allowed citizens to indicate what type of facility is present on existing routes, why a route does or does not feel safe, suggested facility types for proposed routes, and why a route or area presents a problem for bicycling. Over 250 unique users provided comments and information that was formative in the network development.

Public Input Cards

The information card shown here was designed to spread awareness of the project as well as to direct interested citizens to the website and to provide

Information boards help participants and Steering Committee members understand the planning process and analysis tools.

contacts for further information. By providing the general public with access to different avenues of public input, these public engagement components provided a variety of opportunities for the voices of the region to be heard.

Informational Display Boards

A series of project information boards were created to showcase the planning process and garner feedback and support for the Plan's development. These boards presented existing bicycle conditions and bicycling demand in the region, bicycle facility types, vision and goals, and project recommendations. The boards were displayed at Steering Committee meetings and at public outreach events. Feedback received on the boards was incorporated into the final Plan.

Hard Copy Maps

Hard copy maps of each municipality in the study area were developed to gather input on bicycle facility opportunities, constraints, and priorities in

the region. The maps displayed existing bicycle facilities, including bike routes, roadways with four-foot paved shoulders, and multi-use trails. Steering Committee members and the public were invited to mark up the maps at meetings and events to inform the plan's report of existing conditions and recommendations.

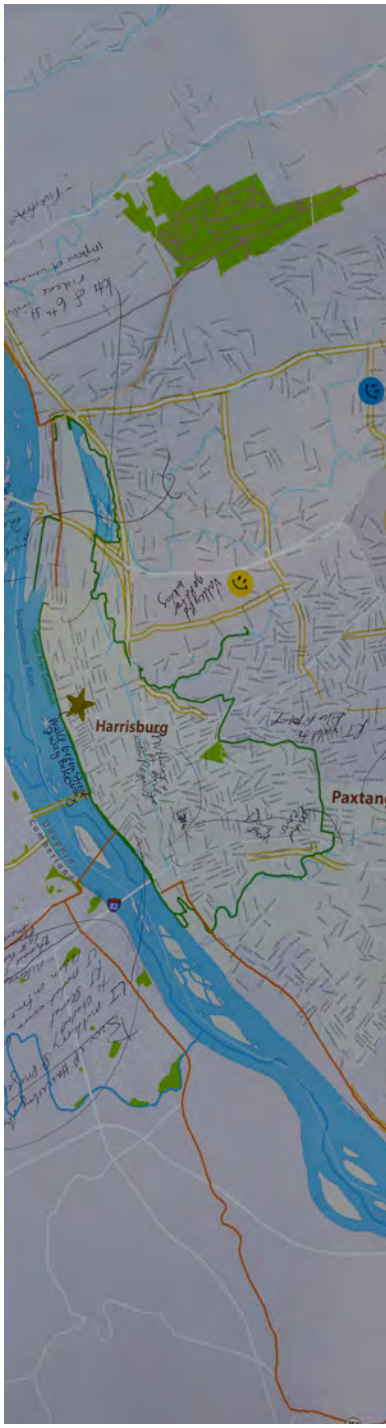
Public Participation Takeaways

Overall, while there are some great recreational resources in the region, there is a significant lack of on-road facilities that would serve as encouragement to the "Interested but Concerned" and the bicycle commuting community. Several people we encountered while conducting field work commented how integral the existing trails are to their quality of life. Critical improvements are needed for roadway crossings and intersections to improve both pedestrian and bicyclist safety.

Other than paved shoulders and BicylePA Route J in Harrisburg, the growing bicycling community feels they are not well served by the street network. Improvements were requested to add bike lanes, protected bike lanes (cycletracks), and indications to motorists that would communicate bicyclists are permitted to use the road.

Many motorists and bicyclists admitted they were not aware of all the rules and regulations in place that dictate how to appropriately behave in a multimodal environment. While infrastructure and cultural support seem to exist in Philadelphia and Pittsburgh, citizens felt the state could do more to support and enable smaller communities to become more bicycle friendly.

The map shows that there is significant potential for bicycling, including existing routes that feel safe, routes that could be ideal with a bicycle facility upgrade, and bicycling destinations throughout the region, some of which are already served by routes where bicyclists report feeling safe. However, the map also indicates some major challenges to bicycling. These include a large number of conflict areas, routes with heavy traffic and high speeds that do not feel safe, areas where bicycle parking is needed, destinations that are not currently accessible by a bicycling route that feels safe, and a disconnected network of comfortable routes.



Public input is integral to the planning process. User feedback and desires of the community help formulate network recommendations.

REGIONAL Bicycle Connections Study

Chapter Four: Recommendations

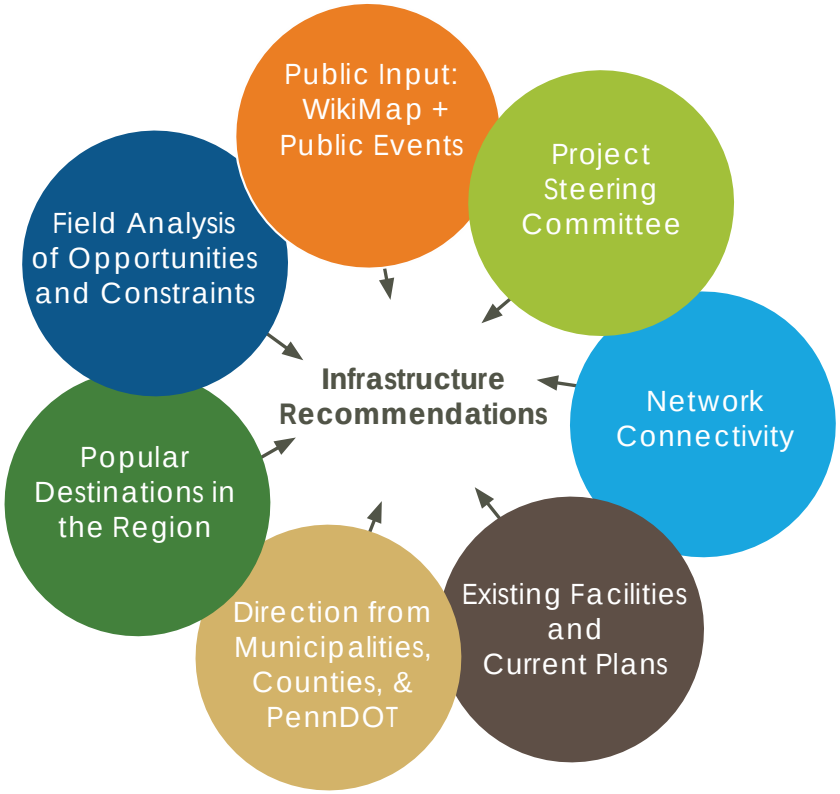
Overview

This Plan recommends a network of bicycle facilities that will link communities, neighborhoods, schools, and businesses across the region. The network consists of existing and proposed facilities such as bicycle lanes, paved shoulders, bicycle boulevards, and signed routes. This chapter includes sections on bicyclist types, bicycle facility types, bicycle network recommendations including bike network maps, the project prioritization process, and program recommendations.

The recommendations presented in this chapter are based on the 5 "E's": Engineering, Education, Encouragement, Enforcement, and Evaluation. Recommendations for the first "E", Engineering, are covered in the first half of this chapter and in the Bicycle Network Recommendations section. Recommendations for the final four "E's" are addressed in the Program Recommendations section.

Methodology

The recommended bicycle network was developed based on information from several sources: input from the municipalities and Steering Committee, public input obtained online and through in-person events, previous plans and studies, review of existing bicycle facilities, noted bicycle trip attractors, and field analysis. Fieldwork examined the opportunities and needs for bicycle facilities along key roadway corridors that make connections between communities and key destinations in the region. Input sources for the Plan are summarized by the diagram below.



This diagram illustrates the inputs used to develop this Plan's recommendations.

Building A Network

Network recommendations are crafted after first developing a baseline of information about the community. This baseline is detailed in the Existing Conditions chapter and includes a review of previously adopted plans, GIS demand and supply modeling, fieldwork, and public needs analysis. The results and outputs of existing conditions tactics are then layered to reveal a framework for:

WHO should be served by the network?

WHERE do they live?

WHERE do they want to go?

WHICH facility types are appropriate?

The WHO

For this region, **the vision and goals of the Plan emphasize safety for all ages and abilities.** Therefore, this network should serve recreation and transportation users of varying skill across a spectrum of income levels. This requires a "hubs and spokes" method for developing a network that connects people from their homes to key destinations and daily services. Essentially, the hubs are high demand areas (downtown, residential neighborhoods, shopping centers) which need to be served by spokes (protected bike lanes or cycle tracks, bike lanes, bike/walk streets, etc.). Serving multiple ages, abilities, and purposes also dictates a level of comfort and safety acceptable for children riding bikes to school, physically challenged individuals recreating and commuting, households without access to a private vehicle commuting to work, and visitors exploring the city.

The 'hubs and spokes' model conceptually illustrates how destinations in the region will be linked through various types of bicycle facilities.

The WHERE

The Live, Work, Play, analysis tells us where people live and key destinations across the community. The supply analysis reveals which roads may be suitable for bicycle facilities. Public input also helps refine these areas of high demand as well as which routes may be ideal for facilities and which to avoid. Input from local staff, public comments, and the demand and supply analysis are layered to narrow potential routes to review in field analysis.

The WHICH

Knowing the WHO and WHERE fuels a more focused field exploration of WHICH routes may become alignments for different types of facilities. With a goal of elevating the protection and comfort as high as possible, the facility selection becomes a delicate balance of what can fit within the existing right-of-way or roadway (curb-to-curb), and where it is critical that the municipalities invest in larger capital projects to implement facilities with protection and organization that enable all levels of cyclists to circulate. Both qualitative and quantitative factors guide the facility selection process.

The WHO: Types of Bicyclists

Bicyclists, or people on bikes, can be categorized into four distinct groups based on comfort level and riding skills. Bicyclists' skill levels greatly influence expected speeds and behavior, both in separated bikeways and on shared roadways. Each of these groups has different bicycle facility needs, so it is important to consider how a bicycle network will accommodate each type of cyclist when creating a non-motorized plan or project. The bicycle infrastructure should accommodate as many user types as possible, with decisions for separate or parallel facilities based on providing a comfortable experience for the greatest number of people. Since this Plan focuses on many user types, it is critical to consider WHO you are connecting to, WHERE, and WHAT facility type may be key to their comfort and safety. In the US population, people are generally categorized into one of four cyclist types. The characteristics, attitudes, and infrastructure preferences of each type are described below.

Strong and Fearless (Approximately 4%)

This cyclist type is characterized by the bicyclists that will typically ride anywhere regardless of roadway conditions or weather. These bicyclists can ride faster than other user types, prefer direct routes, and will typically choose roadway connections even if shared with vehicles over separate bicycle facilities such as multi-use paths.

Enthused and Confident (Approximately 9%)

This user group includes bicyclists who are fairly comfortable riding on all types of bikeways but usually choose low traffic streets or multi-use paths when available. These bicyclists may deviate from a more direct route in favor of a preferred facility type. This group includes all kinds of bicyclists such as commuters, recreational riders, racers, and utilitarian bicyclists.

Interested but Concerned (Approximately 56%)

This user type comprises the bulk of the cycling population and represents bicyclists who typically only ride a bicycle on low traffic streets or multi-use trails under favorable weather conditions. These bicyclists perceive significant barriers to their increased use of cycling, specifically traffic and other safety issues. These people may become "Enthused & Confident" with encouragement, education, and experience.

No Way, No How (Approximately 31% of population)

Persons in this category are not bicyclists and perceive severe safety issues with riding in traffic. Some people in this group may eventually become more regular cyclists with time and education. A significant portion of these people will never ride a bicycle other than on rare occasions or under special circumstances (e.g., in a park or with a child).

"Strong and Fearless"

"Enthused and Confident"

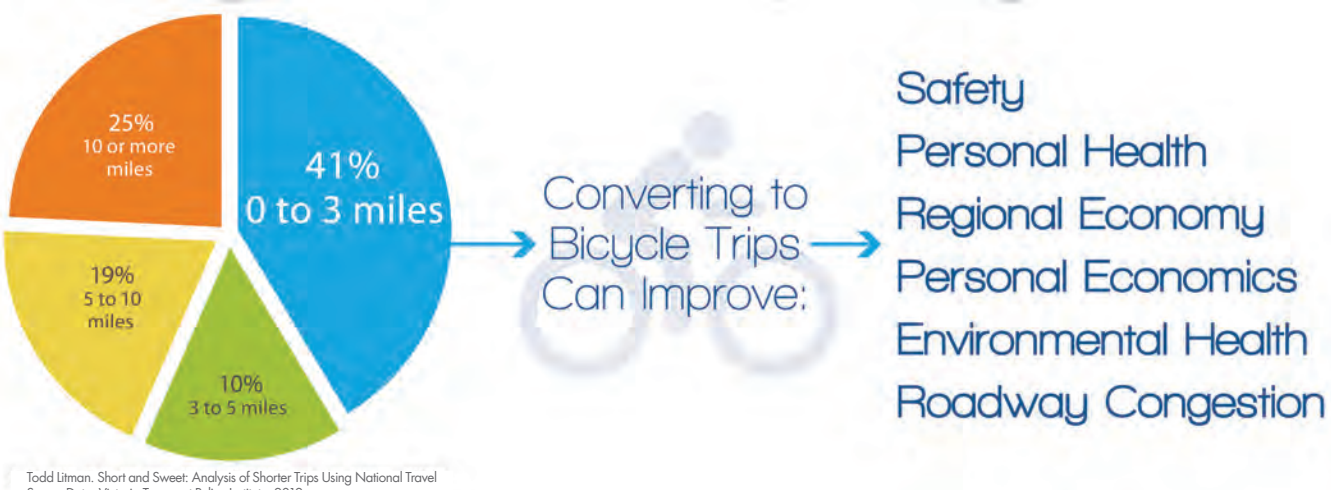
"Interested but Concerned"

Who We Plan For in Bicycle Master Plans

Source: Adapted from J Dill., N Mcneil. Four Types of Cyclists. 2012.

It is important to plan for the 56% Interested but Concerned. As more of this group choose to bike, benefits like alleviating congestion and increasing travel efficiency for all modes become a reality.

Trip Distances: Benefits of Converting the Short Trips



Todd Litman. Short and Sweet: Analysis of Shorter Trips Using National Travel Survey Data. Victoria Transport Policy Institute. 2012.

The 56% Interested but Concerned are likely to begin venturing out for small trips. Since these comprise 41% of all trips, this can have a huge impact for all modes.

THE WHERE: DEMAND AND SUPPLY

The "hubs" of the network were derived from the demand model, online input map, and public survey. Top priorities for bicycle network connections are the cores and "main streets" of each municipality, schools, dense residential areas, employments centers, and centers of commerce. With the hubs and spokes method, each hot spot in the demand model shows major cores which will need connective "spokes" reaching out to other hot spots throughout the region to connect people with key destinations.

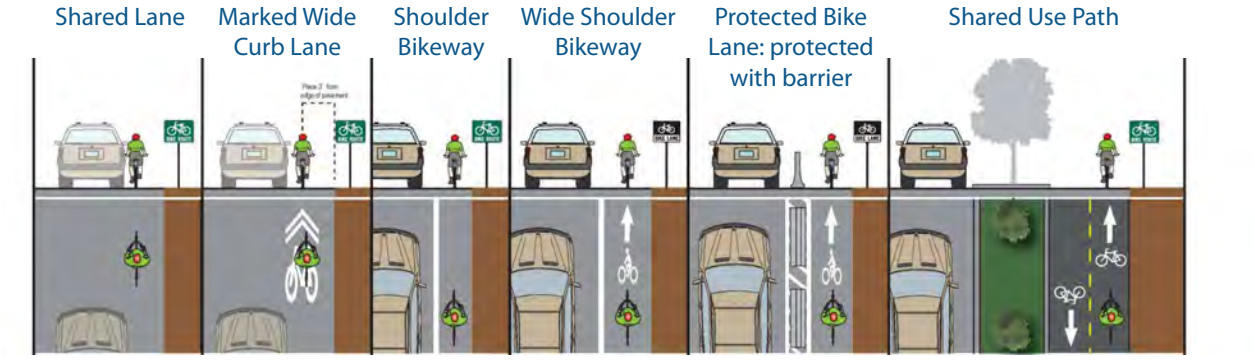
After layering the Bicycle Suitability Index (BSI) (full size map and methodology found in Appendix C: Regional Bicycle Demand) with the demand analysis, there are several roadways that need to be considered for bicycle improvements but currently are not "comfortable" as indicated by the BSI analysis. In these cases, fieldwork is imperative to understanding the current geometry of the roadway and determining if changes can be made to reconfigure the environment to support multiple modes in a safe, organized manner.

The WHICH: Bicycle Facility Types

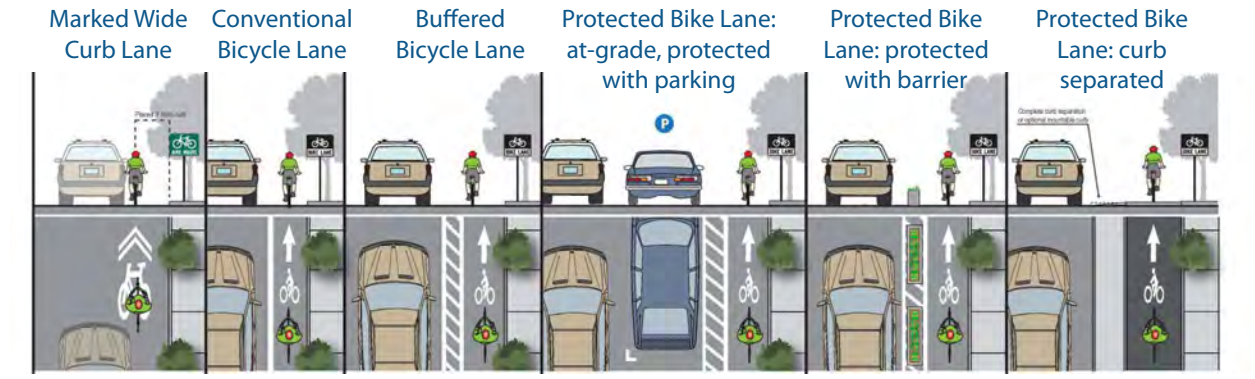
When choosing facility types to generate a well-connected network for the region, it is essential to understand the different types of facilities and in what conditions they should be implemented. The below continuum summarizes multiple bicycle facilities by level of protection. Appendix A provides details for each of the below facilities and how they should be implemented according to national and local standards.

Least Protected → Most Protected

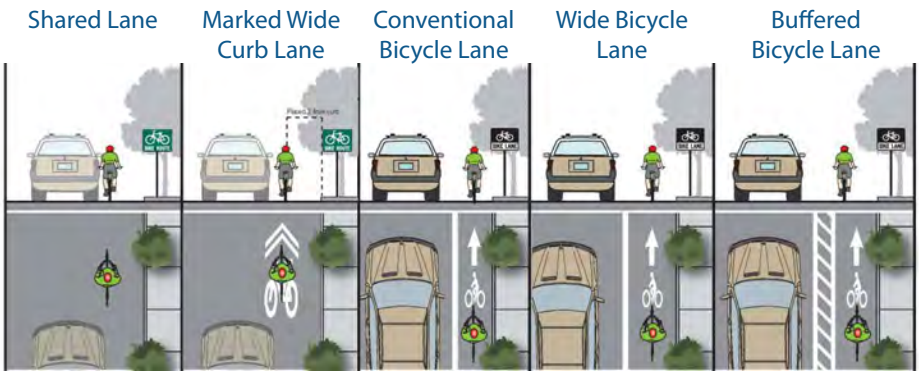
Arterial/Highway Bikeway Continuum (without curb and gutter)



Arterial/Highway Bikeway Continuum (with curb and gutter)



Collector Bikeway Continuum



Signed Shared Roadway (Bike Route/Signed Route)

Signed routes use bicycle signage and markings to increase driver awareness on the roadway. Signed routes may also include traffic calming devices and intersection treatments to improve the safety for bicyclists and all other transportation modes. A signed shared roadway is recommended where calm roadways linking neighborhoods, schools, and parks serve as alternate routes to unsafe bicycling corridors. Sharrows may be used in areas with higher traffic volumes and vehicle conflicts.

Shared Lane Markings (Sharrows)

Shared lane markings are pavement markings used to indicate shared space for bicyclists and motorists. Sharrows are used on roads where dedicated bicycle lanes are desirable but not possible due to constraints (roadway width, on-street parking, etc). Placed every 100 to 250 feet along a corridor, sharrows make motorists aware of the potential presence of cyclists, direct cyclists to ride in a specific direction, and guide cyclists to ride further from parked cars to avoid 'dooring' collisions.

Paved Shoulder

A paved shoulder is the part of a roadway that is continuous to the travel lane, separated by a pavement marking stripe. A minimum of four feet is preferred where possible, although there is no minimum width for paved shoulders. Ideally, paved shoulders should be included in the construction of new roadways or the upgrade of existing facilities, especially where there is a need to accommodate bicycles. Paved shoulders are common on rural roads with low traffic volumes.

Bicycle Lane

Bike lanes designate an exclusive space for bicyclists through the use of pavement markings and signage. The bike lane is located adjacent to a motor vehicle travel lane and is generally used in the same direction as motor vehicle traffic. The bike lane is typically located on the right side of the street, and should be wide enough for a bicyclists to ride comfortably between the adjacent travel lane and either the curb, road edge, or parking lane. The typical width for a bike lane is between four and six feet, depending on the roadway configuration.

Buffered Bike Lane

Similar to a conventional bicycle lane, a buffered bicycle lane has an additional marked buffer component separating the bicyclists from the motor vehicle lane. The purpose of the buffered bicycle lane is to increase separation between motor vehicle traffic and bicyclists on high volume and/or high speed roads, especially those with a high frequency of large vehicle traffic. The added separation increases bicyclists' safety and comfort.

Bicycle Boulevard

Bicycle boulevards are streets with low motorized traffic volumes and speeds, designated and designed to give bicycle travel priority. Bicycle boulevards use signs, pavement markings, and speed and volume management measures to discourage through trips by motor vehicles and create safe, convenient crossing of busy arterials. Many of the design treatments of bicycle boulevards, such as chicanes, bulb-outs, speed humps, etc., not only benefit bicyclists, but they also help create "quiet" streets that benefit residents and improve safety for all road users.

Protected Bicycle Lane / Cycle Track

A protected bike lane, also called a cycle track, is an exclusive bike facility that combines the user experience of a separated path with the on-street infrastructure of a conventional bike lane. A protected bike lane is physically separated from motor traffic and distinct from the sidewalk. Protected bike lanes have different forms but all share common elements – they provide space that is intended to be exclusively or primarily used by bicycles, and are separated from motor vehicle travel lanes, parking lanes, and sidewalks.

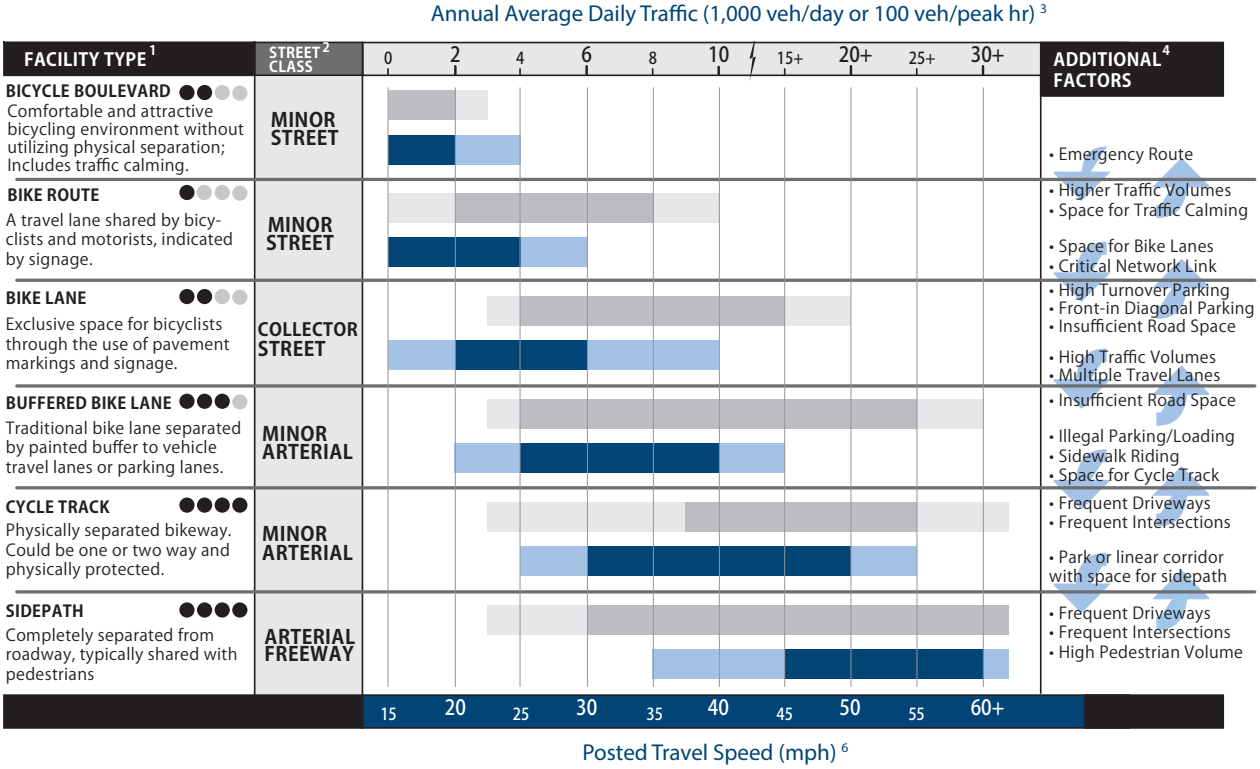
Protected bike lanes may be one-way or two-way, and may be at street level, sidewalk level, or at an intermediate level between the street and sidewalk height. A combination of curbs, medians, bollards, on-street parking, and different pavement/color is used to protect and differentiate the protected bike lane from motor traffic and the sidewalk.

Shared-Use Path

A shared-use path is physically separated from motorized traffic and accommodates pedestrians and two-way bicycle traffic. A shared-use path is often used for recreation and users of all skill levels preferring separation from vehicle traffic. Paths within the roadway corridor right-of-way, or adjacent to a road, are called 'side paths.' Paths within or adjacent to railroad right-of-way are called 'rail-trails' and paths within a greenspace corridor, utility corridor, or public use easement are often referred to as 'greenway trails.'

Layering The Potential

To summarize best practices and regulations from various sources, the chart below accounts for multiple factors that influence comfort and safety. There is a significant impact on cycling comfort when the speed differential between bicyclists and motor vehicle traffic is high and motor vehicle traffic volumes are high. As a starting point to identify appropriate facilities, the chart below can be used as a guide. To use this chart, identify the appropriate daily traffic volume and travel speed on an existing roadway and locate the facility types indicated as appropriate given those key variables.



LEGEND

SEPARATION [5]

- Minimal Separation
- Moderate Separation
- Good Separation
- High Separation

min	VOLUME	max
min	SPEED	max
Acceptable	Desired	Acceptable

Notes:

1. Refers to specific bicycle facilities described in the design guidelines. Many local roads function just fine as they are due to their low traffic volume and speed.

2. The use of functional classes provides some general context for the cases in which bicycle facilities are most likely to be implemented. Land use and additional factors (see 4) should always take precedence in determining which facility type to select.

3. Urban peak hour factors typically range from 8 to 12 percent of AADT. For the purposes of this chart, the peak hour is assumed to be 10 percent of AADT.

4. Noted additional factors include a selection of considerations that may influence the selection of bicycle facility type where roadway speed/volume values overlap over multiple facilities. Many of the factors that suggest increasing separation are common across multiple facility types like bike lanes, buffered bike lanes and cycle tracks.

5. Increased separation of bicycle facilities from motor vehicle traffic typically results in higher levels of user comfort and appeals to wider skill levels of bicyclists.

6. This chart considers posted speed limit only. The 85th percentile speed may vary, and may change with implementation of a bikeway.

Other factors beyond speed and volume that affect facility selection include traffic mix of automobiles and heavy vehicles, the presence of on-street parking, intersection density, surrounding land use, and roadway sight distance. See the right column of the chart for other key issues to consider when selecting an appropriate facility type.

The chart on the previous page (which is derived from guidance provided by American Association of State Highway and Transportation Officials [AASHTO], National Association of City Transportation Officials [NACTO], Federal Highway Administration [FHWA], and other sources) can serve as a useful tool to assist in decision making for the placement and type of bicycle facility, but contextually sensitive considerations and cause and effect scenarios for implementing bicycle facilities (parking removal or lane reductions) do not fall into one simple chart. This stresses the importance of the human element in facility design, including input from users, non-users, staff (including maintenance departments), engineers, planners, and designers.

Additional Considerations

To address the network as a whole and how it functions together as a hubs and spokes model, a wider lens must be used to consider the holistic impact of the system. Stepping away from the minutia of facility options within particular roadway segments, the network must function as a whole. **A hierarchy should emerge with clear defined spaces for bicyclists, connecting major destinations and providing protection, separation, and organization for multiple modes.** Reaching out from these routes can be facilities with less protection due to factors such as lower traffic volumes. The last branches, or spokes, should be those reaching the last mile into demand areas such as residences.

The network recommendations in this Plan compose the backbone of the bicycle system and some of the facilities reaching out into neighborhoods. Additional study of each municipality can help close the last mile or half mile gaps and organize appropriate routes that should become bicycle boulevards. Future additions to the system will help strengthen the backbone and build out the rest of the hierarchy as needed. It is important to consider the following factors as future routes and facilities are planned and constructed.

Accessibility

Readily accessible connections need to be considered a key component of any bicycle network. Accessibility is measured by the distance a bike facility is located from a specified attraction, the ease by which this distance can be traveled by bicycle, and the extent to which all likely origins and destinations are served. For example, some communities in other states have adopted a criterion of having a bicycle facility within one mile of every residence.

Directness

Both bicyclists and motorists desire a direct and quick route to destination points. **Studies have shown that most bicyclists will not even use the best bicycle facility if it greatly increases the travel distance or trip time over that provided by less desirable alternatives.** Generally speaking, experienced and fearless bicyclists prefer directness, while confident and concerned bicyclists prefer comfort and perceived safety as the key characteristics of the bicycle facility.

CONTINUITY

A proposed bicycle network should be viewed as a transportation system and provide continuous, direct connections to numerous attractions throughout the community. If gaps exist in the network, measures should be taken to provide safe and efficient short-term alternatives and long-term permanent solutions.

CONSISTENCY

Providing consistent bicycle facility types should be a goal when planning and designing bicycle networks. To the fullest extent possible, bicycle facilities should provide bicyclists with a relatively consistent facility type (i.e. shared use path, bicycle lane, or shoulder improvement) within key corridors. Switching between facility types can create conflict points, be confusing, and leave bicyclists with a sense of abandonment within the overall network.

ROUTE ATTRACTIVENESS

Bicycle networks or portions of the network should encompass factors as separation from motor traffic, proximity to visual aesthetics, connections to employment centers, major passive and active recreation areas, and the real or perceived threat to personal safety along the facility. These factors tend to encourage novice and recreational bicyclists to view the bicycle as a mode of transportation and enhance the overall bicycle network.

LOW CONFLICT

Bicycle networks should consist of routes that minimize conflicts between bicyclists and motorists and between bicyclists and pedestrians. In addition, areas of high crash incidents should be avoided or addressed directly through intersection improvements and/or other safety improvement measures.

In addition to implementing low conflict bikeways, it's also important to educate riders when they're travelling against traffic or in a manner that creates direct conflict with motorists. Installing Ride With Traffic and Wrong Way MUTCD signage on corridors such as Forge Road and Lingle Avenue will help mitigate high conflict contraflow riding and encourage the use of appropriate facilities.

The perceived safety of a side path (as seen here on Waltonville Road) can make a huge impact for children and more timid bicyclists.

Obtaining buy-in for this Plan from private developers and companies will provide an opportunity for collaboration and gap closures. For example, in the spirit of the vision and goals, it would be an asset for more timid bicyclists to be able to use the path on Old West Chocolate Avenue. Currently, at five feet, the path is too narrow to support pedestrians and bicyclists, especially two-way travel. Expanding this path to ten or twelve feet would close a large gap in the system.

EASE OF IMPLEMENTATION/COSTS

Right-of-way, environmental, historical, and funding constraints, as well as the political climate, must all be considered during the planning process to ensure that implementation of the Plan is actually feasible. For example, land acquisition costs and historical and environmental impacts need to be carefully considered to determine the feasibility of a project.

MULTIMODAL COORDINATION

The integration of bicycling with other modes of transportation, particularly public transit, benefits the entire transportation network. It has been well demonstrated in many American, European, and Asian communities that with the proper facilities and policies, bicycles can have a significant complementary effect on transit systems, resulting in increased ridership. Bicycles provide the on-demand, door stop service that most bus and rail systems are unable to provide. Buses and trains will usually travel faster and farther than most bicyclists. The combination has a synergistic effect amplifying the market area and effectiveness of each. Bicycle facilities also complement park and ride facilities by providing bicyclists and motorists with mode transfer opportunities. Finally, multimodal connections help reduce traffic congestion by providing alternatives to the single occupant vehicle (SOV).

MULTI-JURISDICTIONAL COORDINATION

Providing and anticipating connections across jurisdictional boundaries are necessary in developing a comprehensive plan. Communities need to look outside their borders to ensure there is a level of regional connectivity associated with the local plan. The Tri-County Regional Planning Commission can provide insight and assistance during this process.

SAFETY AND SECURITY OF BICYCLISTS

The design of bicycle facilities needs to be treated as any other transportation project, with personal and traffic safety as key design elements. Safety is an important part of any plan and includes education, enforcement, encouragement, and design of facilities. The concepts of safety, such as safe intersection treatments, must guide the development of all bicycle facilities.

In addition, people on bicycles needs to be educated about safe bicycling practices. Finally, personal security issues need to be addressed, especially when dealing with shared use paths. Appropriate landscaping, lighting, safety call boxes, and frequent patrols are common measures to improve bicycling safety and security.

Project Prioritization Process

The recommendations in this Plan include dozens of individual projects that together make up the overall proposed regional bicycle network. These projects will be developed incrementally over the coming years. Some will be developed based on locally determined priorities, while others will be built as opportunities arise (such as when funding or right-of-way becomes available or when new development facilitates construction). While the partners of this Plan should certainly take advantage of implementation opportunities as they arise, there also needs to be a plan in place for proactively developing the network in a logical and strategic manner. This section outlines a set of prioritized projects for that purpose. These should be pursued for development as part of a coordinated effort among the regional stakeholders.

Prioritization Criteria

The criteria described below were used to guide the prioritization process and can help determine future priority projects as needed.

- Public Support: The proposed network was developed primarily from a combination of stakeholder input, public input, and existing plans. Projects that are already supported by existing plans should take priority.
- Functional Segment: Each priority bicycle project should have an "anchor" or destination on each end, such as a park, neighborhood, school, shopping area, or existing on-road bicycle facility or trail.
- Project Cost: Lower cost projects, particularly those anticipated to provide a high impact through other criteria, are ideal "low-hanging fruit" to pursue in the short- to medium-term.
- Geographic Distribution: Projects should be implemented over time with a relatively even distribution throughout the region.
- Feasibility: Any known major obstacles that would likely prohibit the near-term development of a project were taken into consideration when determining priorities.
- Available Funding: A lack of an identified funding source alone should not prevent a project from being considered a priority. However, if a project already has funding in place, or a likely source has been identified, that project should be considered a strong candidate for priority development.
- Overall Connectivity: The priority projects should provide a logical, connected foundation from which the larger regional bicycle network may expand over time. For example, priority east-west connections should be balanced with priority north-south connections, and they should connect to one another to the fullest extent possible.

Network Prioritization and Cost Estimates

The following charts illustrate the projects in order of priority. Each project contains a "to" and "from" location to define the overall project. Projects that span multiple jurisdictions are identified in a separate table at the end to illustrate the importance of multi-jurisdictional coordination.

It is important to note that the following recommendations are considered "planning level," and the cost estimate, type, and extent of each facility may change as the project progresses through design and construction phases. A buffered bicycle lane may need to be downgraded to a bike lane due to roadway constraints or flexible delineators could be added to a buffered bicycle lane to increase vertical separation.

Derry

Route Name	To	From	Facility Type	Miles	Cost Estimate	Priority
E Areba Avenue	Spring Creek Church	Cocoa Avenue	Bicycle Boulevard	0.85	$121,553.52	Short
W Areba Avenue	Cocoa Avenue	Route 322	Bike Lane	1.45	$53,931.34	Short
Sand Hill Road	Bullfrog Valley Road	Route 322	Bike Route	2.08	$1,315.32	Short
Bullfrog Valley Road	Sand Hill Road	Route 322	Bike Route	2.11	$1,338.60	Short
Chocolate Avenue	Lingle Avenue	University Drive	Buffered Bike Lane	4.00	$254,562.48	Short
Cocoa Avenue	Elm Avenue	Route 422	Shared Lane Marking	0.34	$1,916.48	Short
E Derry Road	Route 422	Olde Course Road	Shared Lane Marking	0.91	$5,110.26	Short
Sipe Avenue	Route 422	Mae Street	Shared Lane Marking	0.32	$1,779.74	Short
Elm Avenue	Cocoa Avenue	Route 322	Protected Bike Lane	0.68	$225,691.74	Short
Route 322	Elm Avenue	Cherry Drive	Multi-Use Path	0.33	$157,615.02	Short
Briarcrest Drive	W Areba Avenue	University Drive	Bicycle Boulevard	0.49	$70,356.00	Mid
South Lane (alley south of E Chocolate Ave)	E Connection to Jonathan Eshenour Memorial Trail	W Connection to Jonathan Eshenour Memorial Trail	Bicycle Boulevard	0.37	$52,739.94	Mid
Centerview Lane	Route 322	Briarcrest Drive	Bike Lane	0.18	$6,678.76	Mid
Cocoa Avenue	Route 322	Elm Avenue	Buffered Bike Lane	0.48	$30,475.62	Mid
Mae Street	Lucy Avenue	Hershey Park Drive	Buffered Bike Lane	0.31	$19,850.76	Mid
Jonathan Eshenour Memorial Trail Ext.	Jonathan Eshenour Memorial Trail at Jacobs Creek Dr	Nye Road	Multi-Use Path	1.26	$901,120.32	Mid
University Drive	Briarcrest Drive	Route 322	Multi-Use Path	0.35	$248,915.58	Mid
Route 422	University Drive	Sipe Ave	Multi-Use Path	0.35	$251,211.60	Mid
Valley Road	Cocoa Avenue	Route 422	Bicycle Boulevard	0.70	$100,203.18	Long
Cherry Drive	W Governor Road	W Areba Street	Bicycle Boulevard	0.35	$50,439.84	Long
E Derry Road	Olde Course Road	Park Avenue	Bike Lane	1.36	$50,690.80	Long
Middletown Road	Route 322	Schoolhouse Road	Buffered Bike Lane	2.34	$148,748.04	Long
Homestead Road	Areba Avenue	Route 322	Multi-Use Path	0.77	$672,439.43	Long
Route 322	Homestead Road	Cocoa Avenue	Multi-Use Path	0.45	$392,984.08	Long

Harrisburg

Route Name	To	From	Facility Type	Miles	Cost Estimate	Priority
2nd Street	Vine Street	Division Street	Bike Lane	3.02	$112,557.58	Short
Front Street	Vine STreet	Division Street	Bike Lane	2.95	$109,917.14	Short
Forster Street	Seventh Street	N Front Street	Bike Lane	0.40	$14,946.02	Short
13th Street	Walnut Street	State Street	Shared Lane Marking	0.11	$633.88	Short
17th Street	Sumner Road	Walnut Street	Shared Lane Marking	1.37	$7,640.48	Short
3rd Street	Forster Street	Maclay Street	Shared Lane Marking	1.0	$5,591.15	Short
4th Street/ Mulberry Street	Walnut Street	Derry Street	Shared Lane Marking	0.70	$3,936.84	Short
Commonwealth Avenue	Walnut Street	Forster Street	Shared Lane Marking	0.35	$1,936.62	Short
Sycamore Street	Paxton Street	S Front Street	Shared Lane Marking	1.09	$6,125.74	Short
Vine Street	Capital Area Greenbelt	2nd Street	Shared Lane Marking	0.10	$554.38	Short
Walnut Street	N Front Street	N 3rd Street	Shared Lane Marking	0.20	$1,093.92	Short
Maclay Street	N Cameron Street	N 6th Street	Shared Lane Marking	0.53	$2,949.98	Short
Walnut Street/N 7th Street	State Street	N 3rd Street	Protected Bike Lane	0.36	$119,120.34	Mid
Dauphin Street	2nd Street	6th Street	Bicycle Boulevard	0.42	$60,641.46	Mid
Walnut Street	13th Street	Parkway Drive	Bicycle Boulevard	0.71	$101,420.88	Mid
19th Street	Derry Street	Capital Area Greenbelt	Bike Lane	0.89	$33,252.60	Mid
Division Street	N Front Street	Sixth Street	Bike Lane	0.57	$21,201.18	Mid
N 6th Street	Forster Street	Division Street	Bike Lane	1.8	$66,561.68	Mid
Reily Street	Seventh Street	N Front Street	Bike Lane	0.46	$17,014.60	Mid
Woodbine Street	Sixth Street	N Front Street	Buffered Bike Lane	0.52	$33,357.96	Mid
Emerald Street	Sixth Street	N Front Street	Buffered Bike Lane	0.52	$32,947.92	Mid
3rd Street	Walnut Street	Forster Street	Bike Lane	0.40	$14,847.18	Mid
4th Street	Reily Street	Graham Street	Bicycle Boulevard	1.54	$220,078.98	Long
N 6th Street/ Hoffman Street	Division Street	Linglestown Road/ PA 39	Bike Lane	2.36	$88,108.80	Long
Paxton Street	Sycamore Street	N Front Street	Buffered Bike Lane	1.37	$87,507.36	Long
State Street (Bridge)	N 7th Street	13th Street	Protected Bike Lane	0.47	$158,028.36	Long

Hummelstown

Route Name	To	From	Facility Type	Miles	Cost Estimate	Priority
Kokomo Avenue	End of Street	Circle Drive	Bike Route	0.27	$171.60	Short
Kokomo Avenue	Campground	End of Street	Multi-Use Path	0.08	$56,320.02	Short
Hanover Street	Hwy 322	S Hoernerstown Road	Shared Lane Marking	0.82	$4,584.50	Short
Main Street	Old Farm Road	E North Alley Street	Shared Lane Marking	1.16	$6,512.64	Short
Quarry Road	Main Street	Poplar Avenue	Shared Lane Marking	0.19	$1,048.34	Short
Kokomo Avenue	Circle Drive	Hanover Street	Shared Lane Marking	0.36	$1,991.74	Short
High Street	W Main Street	East end of High Street	Bicycle Boulevard	1.14	$163,280.04	Mid
Division Street/ Parkside Avenue	Waltonville Road/Quarry Road	S Hanover Street	Bicycle Boulevard	0.35	$49,790.40	Long
Water Street	Division Street	E Main Street	Bicycle Boulevard	0.29	$41,888.88	Long

North Londonderry

Route Name	To	From	Facility Type	Miles	Cost Estimate	Priority
Palmyra Road/ Campbelltown Road	Railroad Street	Cottonwood Court	Bike Route	0.46	$289.20	Short
Leon Avenue	Grubb Road	S Forge Street	Shared Lane Marking	0.27	$1,535.94	Short
Gravel Hill Road	Syner Road	Ridge Road	Bike Route	2.35	$1,487.77	Short
S Railroad Street	S Forge Road	E Elm Street	Bike Lane	0.72	$26,940.96	Mid
E Elm Street	S King Street	S Railroad Street	Bicycle Boulevard	0.53	$75,389.16	Mid

South Londonderry

Route Name	To	From	Facility Type	Miles	Cost Estimate	Priority
Mount Gretna Road	Princeton Avenue	Mount Wilson Road	Bike Route	2.83	$1,794.96	Short
Mount Wilson Road	Spring Lane	Horseshoe Trail	Bike Route	1.78	$1,129.32	Short
Northside Drive	S Lingle Avenue	Forge Road	Buffered Bike Lane	1.04	$66,474.72	Short
Lawn Rd/Hinkle Rd	S Forge Road	Elizabethtown Road	Bike Route	5.6	$3,549.84	Short
Airport Road/ Taxiway Road	Taxiway Road	Forge Road	Bike Lane	0.36	$13,272.80	Mid
Elizabethtown Road	T326	Mount Gretna Road	Wide Shoulder	3.94	$2,496.60	Long
S Forge Road	Hwy 322	Mount Gretna Road	Wide Shoulder	4.06	$2,574.60	Long
Route 322	S Thistledown Dr	S Forge Road	Buffered Bike Lane	1.32	441,230.82	Long

Swatara

Route Name	To	From	Facility Type	Miles	Cost Estimate	Priority
Derry Street/ Pleasant View Road	Bridge Road	Milroy Road	Shared Lane Marking	1.37	$7,666.98	Short
Derry Street	N 40th Street	Wilhelm Road	Bike Lane	0.56	$20,975.26	Short
Derry Street	S 43rd Street	N 40th Street	Shared Lane Marking	0.41	$2,311.86	Short
Chamber Street	Harrisburg Street	Front Street	Shared Lane Marking	1.17	$6,539.14	Short
Derry Street	Milroy Street	50th Street	Bike Lane	2.85	$106,189.46	Mid
Harrisburg Street	Capital Area Greenbelt	Chambers Street/ Ball Field	Bike Lane	1.73	$64,408.38	Mid
Derry Street	N 50th Street	43rd Street	Buffered Bike Lane	0.49	$30,958.02	Mid
Chambers Hill Road	S 40th Street	N Harrisbyrg Street	Bike Lane	0.53	$19,619.74	Long
Chambers Hill Road	Penhar Street	S 40th Street	Buffered Bike Lane	0.74	$46,901.34	Long
Paxton Street	Sycamore Street	32nd Street/ Capital Area Greenbelt	Buffered Bike Lane	0.82	$52,292.16	Long

Palmyra

Route Name	To	From	Facility Type	Miles	Cost Estimate	Priority
Cherry Street	S Horstick Avenue	Hwy 422	Bike Lane	1.50	$55,759.88	Short
N Railroad Street	Ridge Road	Hwy 422	Shared Lane Marking	0.91	$5,114.50	Short
Railroad Street	Hwy 422	E Elm Street	Shared Lane Marking	0.53	$2,956.34	Short
N Forge Street	E High Street	E Ridge Road	Shared Lane Marking	0.61	$3,147.42	Short
E Spruce Street	Railroad Street	Forge Road	Bicycle Boulevard	0.64	$91,219.26	Mid
Forge Road	E Cherry Street	E High Street	Bike Lane	0.33	$12,305.58	Mid
Grant Street	Ridge Road	E Spruce Street	Bike Lane	0.32	$11,910.22	Long
Grant Street	E Cherry Street	E Spruce Street	Bike Lane	0.56	$20,763.46	Long

Multi-Jurisdictional Projects

The following table displays the project recommendations that span multiple jurisdictions. These projects will require resource, funding, and information sharing coordination between municipalities to implement the recommended bikeway.

Route Name	To	From	Facility Type	Miles	Cost Estimate	Priority
S Duke Street / Grubb Road	**Leon Avenue**	**Cherry Street**	**Shared Lane Marking**	**1.20**	**$6,690.72**	**Short**
S King St/Hemlock St/Grubb Rd *(North Londonderry)*	Leon Avenue	E Elm Street	Shared Lane Marking	0.77	$4,324.80	Short
S Duke Street *(Palmyra)*	E Elm Street	Cherry Street	Shared Lane Marking	0.42	$2,365.92	Short
Derry Street	**Mulberry Street**	**Wilhelm Road**	**Shared Lane Marking**	**2.25**	**$12,583.26**	**Short**
Derry Street *(Paxtang)*	S 29th Street	Wilhelm Road	Shared Lane Marking	0.66	$3,714.24	Short
Derry Street *(Harrisburg)*	Mulberry Street	29th Street	Shared Lane Marking	1.58	$8,869.02	Short
Lingle Avenue	**Laudermilch Road**	**Oatfield Lane**	**Bike Route**	**3.22**	**$2,037.84**	**Short**
Lingle Avenue *(South Londonderry)*	Palmyra Road	Oatfield Lane (S. Londonderry border)	Bike Route	0.69	$435.24	Short
Lingle Avenue *(North Londonderry)*	Oatfield Lane (S. Londonderry border)	Crest Lane (N. Londonderry border)	Bike Route	0.79	$498.84	Short
Lingle Avenue *(Derry)*	Route 422	Laudermilch Road	Bike Route	1.38	$875.76	Short
Lingle Avenue *(Palmyra)*	Crest Lane (N. Londonderry border)	Route 422	Bike Route	0.36	$228.00	Short
Ridge Road/Palmyra Bellegrove Road	**Syner Road**	**Lingle Avenue**	**Bike Route**	**4.30**	**$2,729.28**	**Short**
Ridge Road/Palmyra Bellegrove Road *(North Londonderry)*	N Railroad Street	Syner Road	Bike Route	3.80	$2,408.52	Short
Ridge Road/Palmyra Bellegrove Road *(Derry)*	Lingle Avenue	N Railroad Street	Bike Route	0.50	$320.76	Short
S Forge Road	**E Cherry Street**	**Route 322**	**Bike Route**	**2.38**	**$1,509.48**	**Short**
S Forge Road *(South Londonderry)*	North Londonderry/ South Londonderry Border	Route 322	Bike Route	0.99	$627.36	Short
S Forge Road *(North Londonderry)*	E Cyress Street	North Londonderry/ South Londonderry Border	Bike Route	1.03	$655.68	Short
S Forge Road *(Palmyra)*	E Cherry Street	E Cyress Street	Bike Route	0.36	$266.44	Short

Multi-Jurisdictional Projects Continued

Route Name	To	From	Facility Type	Miles	Cost Estimate	Priority
Palmyra Road	**Cottonwood Court**	**Route 322**	**Wide Shoulder**	**1.40**	**$889.44**	**Short**
Palmyra Road *(South Londonderry)*	Cottonwood Court	Sweetwater Drive (S. Londonderry border)	Wide Shoulder	0.87	$549.00	Short
Palmyra Road *(North Londonderry)*	Sweetwater Drive (S. Londonderry border)	Route 322	Wide Shoulder	0.54	$340.44	Short
Waltonville Road/ Quarry Road	**Poplar Avenue**	**Jonathan Eshenour Memorial Trail**	**Buffered Bike Lane**	**0.51**	**$32,634.36**	**Mid**
Waltonville Road *(Derry)*	Route 322	Jonathan Eshenour Memorial Trail	Buffered Bike Lane	0.19	$12,144.42	Mid
Quarry Road *(Hummelstown)*	Poplar Avenue	Route 322	Buffered Bike Lane	0.32	$20,489.94	Mid
E Main Street/ Walton Avenue	**Route 39**	**E Main Street**	**Bike Lane**	**0.66**	**$24,745.30**	**Mid**
E Main Street *(Hummelstown)*	Alison Drive	E Main Street	Bike Lane	0.38	$14,197.66	Mid
Walton Avenue *(Derry)*	Route 39	Alison Drive	Bike Lane	0.28	$10,547.64	Mid
Forge Road	**Northside Drive**	**Leon Avenue**	**Multi-Use Path**	**0.90**	**$643,155.72**	**Mid**
Forge Road *(South Londonderry)*	Northside Drive	N. Londonderry/S. Londonderry border	Multi-Use Path	0.55	$395,185.56	Mid
Forge Road *(North Londonderry)*	N. Londonderry/S. Londonderry border	Leon Ave	Multi-Use Path	0.35	$247,970.16	Mid
Caracas Avenue	**Washington Ave.**	**S Horstick Avenue**	**Bicycle Boulevard**	**1.32**	**$188,364.66**	**Mid**
Caracas Avenue *(Derry)*	Washington Ave.	S Lingle Avenue	Bicycle Boulevard	0.89	$126,721.98	Mid
W Cherry Street *(Palmyra)*	S Lingle Avenue	S Horstick Avenue	Bicycle Boulevard	0.43	$61,642.68	Mid
W Main Street	**Old Farm Road**	**Route 322**	**Bike Lane**	**0.43**	**$16,146.22**	**Long**
W Main Street *(Swatara)*	Village Road	Route 322	Bike Lane	0.22	$8,302.56	Long
W Main Street *(Hummelstown)*	Old Farm Road	Village Road	Bike Lane	0.21	$7,843.66	Long
Swatara Creek Water Trail	**Hershey Campground**	**Fulling Mill Road**	**Multi-Use Path**	**7.55**	**$5,381,600.76**	**Long**
Swatara Creek Water Trail *(Hummelstown)*	Campground	Route 322	Multi-Use Path	4.65	$3,316,668.42	Long
Swatara Creek Water Trail *(Derry)*	Route 322	Fulling Mill Road	Multi-Use Path	2.90	$2,064,932.34	Long
Route 322	**S Thistledown Drive**	**Homestead Road**	**Multi-Use Path**	**2.35**	**$1,675,284.24**	**Long**
Route 322 *(Derry)*	Homestead Road	Derry / South Londonderry Border	Multi-Use Path	2.07	$1,480,257.60	Long
Route 322 *(South Londonderry)*	Derry / South Londonderry Border	S Thistledown Road	Multi-Use Path	0.27	$195,026.64	Long

Regional Bicycle Network Facility Type Totals

Derry

Facility Type	Mileage	Total Cost Estimate
Bike Lane	3.26	$121,522.37
Buffered Bike Lane	7.31	$465,477.41
Protected Bike Lane	0.67	$223,081.06
Bicycle Boulevard	3.65	$521,500.32
Wide Shoulder	N/A	N/A
Multi-Use Path	10.24	$7,302,316.03
Bike Route	6.07	$3,845.95
Shared Lane Marking	1.57	$

Harrisburg

Facility Type	Mileage	Total Cost Estimate
Bike Lane	12.83	$478,261.34
Buffered Bike Lane	2.41	$89,837.09
Protected Bike Lane	0.83	$30,939.74
Bicycle Boulevard	2.87	$410,056.42
Wide Shoulder	N/A	N/A
Multi-Use Path	N/A	N/A
Bike Route	N/A	N/A
Shared Lane Marking	7.03	$39,681.31

North Londonderry

Facility Type	Mileage	Total Cost Estimate
Bike Lane	0.72	$26,839.30
Buffered Bike Lane	N/A	N/A
Protected Bike Lane	N/A	N/A
Bicycle Boulevard	0.53	$75,724.70
Wide Shoulder	0.54	$342.14
Multi-Use Path	0.35	$249,590.88
Bike Route	8.42	$5,334.91
Shared Lane Marking	1.04	$5,820.67

Hummelstown

Facility Type	Mileage	Total Cost Estimate
Bike Lane	0.59	$33,176.35
Buffered Bike Lane	0.32	$11,928.58
Protected Bike Lane	N/A	N/A
Bicycle Boulevard	1.78	$254,320.70
Wide Shoulder	N/A	N/A
Multi-Use Path	2.98	$2,125,088.06
Bike Route	0.27	$171.07
Shared Lane Marking	2.53	$14,159.90

Palmyra

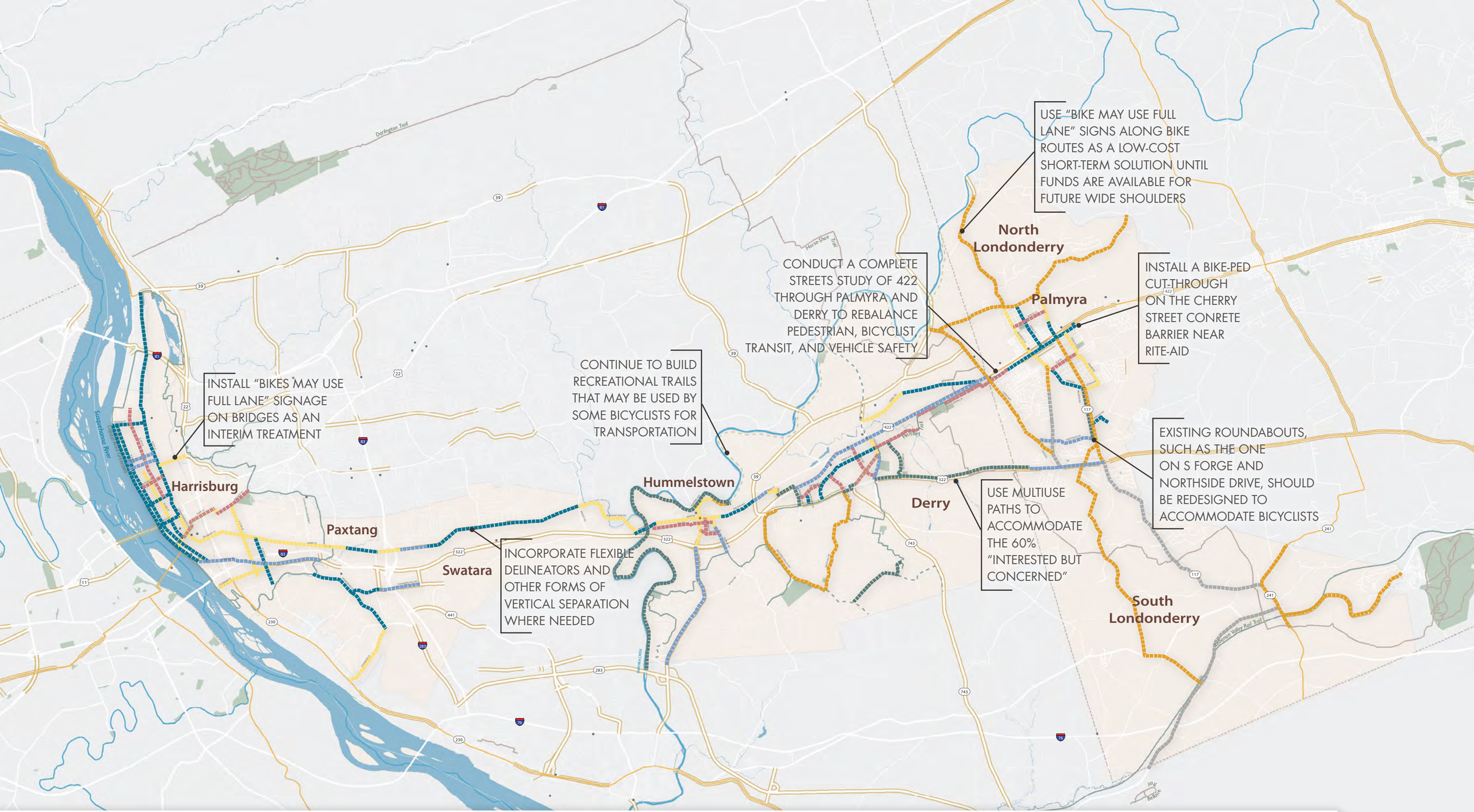
Facility Type	Mileage	Total Cost Estimate
Bike Lane	2.70	$100,647.36
Buffered Bike Lane	N/A	N/A
Protected Bike Lane	N/A	N/A
Bicycle Boulevard	1.07	$152,878.18
Wide Shoulder	N/A	N/A
Multi-Use Path	N/A	N/A
Bike Route	0.71	$449.86
Shared Lane Marking	2.47	$13,824.10

South Londonderry

Facility Type	Mileage	Total Cost Estimate
Bike Lane	0.36	$14,537.95
Buffered Bike Lane	1.37	$51,069.22
Protected Bike Lane	N/A	N/A
Bicycle Boulevard	N/A	N/A
Wide Shoulder	8.87	$5,620.03
Multi-Use Path	0.82	$584,755.78
Bike Route	11.89	$7,533.50
Shared Lane Marking	N/A	N/A

Swatara

Facility Type	Mileage	Total Cost Estimate
Bike Lane	5.89	$219,560.35
Buffered Bike Lane	2.04	$76,044.67
Protected Bike Lane	N/A	N/A
Bicycle Boulevard	N/A	N/A
Wide Shoulder	N/A	N/A
Multi-Use Path	N/A	N/A
Bike Route	N/A	N/A
Shared Lane Marking	2.95	$16,510.56



Recommended Regional Network

This map is a product of data received from participating municipalities and agencies. The accuracy and inclusion of facilities is dependant on the quality of this data.

EXISTING

- County
- Study Area
- Parks
- Regional Bike Route
- Multi-Use Trail
- 4ft Shoulders
- Pedestrian Only Trail
- Blueway
- Bus Stop
- Proposed Bike Path (Derry Township)
- Proposed Greenway (Derry Township)

RECOMMENDATIONS OF THIS PLAN

- Multi-Use Path
- Protected Bike Lane
- Buffered Bike Lane
- Bike Lane
- Wide Shoulder
- Bicycle Boulevard
- Sharrow
- Bike Route

REGIONAL Bicycle Connections Study

0 0.5 1 2 Miles

Harrisburg Area Recommended Network

REGIONAL Bicycle Connections Study

This map is a product of data received from participating municipalities and agencies. The accuracy and inclusion of facilities is dependant on the quality of this data.

0 0.25 0.5 1 Miles

EXISTING

- County
- Study Area
- Parks
- Regional Bike Route
- Multi-Use Trail
- 4ft Shoulders
- Pedestrian Only Trail
- Blueway
- Bus Stop
- Proposed Bike Path (Derry Township)
- Proposed Greenway (Derry Township)

RECOMMENDATIONS OF THIS PLAN

- Multi-Use Path
- Protected Bike Lane
- Buffered Bike Lane
- Bike Lane
- Wide Shoulder
- Bicycle Boulevard
- Sharrow
- Bike Route

Harrisburg / Paxtang / Swatara Area Recommended Network

This map is a product of data received from participating municipalities and agencies.
The accuracy and inclusion of facilities is dependant on the quality of this data.

REGIONAL Bicycle Connections Study

EXISTING

- County
- Study Area
- Parks
- Regional Bike Route
- Multi-Use Trail
- 4ft Shoulders
- Pedestrian Only Trail
- Blueway
- Bus Stop
- Proposed Bike Path (Derry Township)
- Proposed Greenway (Derry Township)

RECOMMENDATIONS OF THIS PLAN

- Multi-Use Path
- Protected Bike Lane
- Buffered Bike Lane
- Bike Lane
- Wide Shoulder
- Bicycle Boulevard
- Sharrow
- Bike Route

0 0.25 0.5 1 Miles

LINGLE IS A CRITICAL ROUTE FOR LOCAL BICYCLISTS. THIS IS A SHORT-TERM LOW COST SOLUTION. FUTURE STUDIES ARE RECOMMENDED TO ASCERTAIN THE FEASIBILITY OF ADDING PROTECTED BIKE LANES TO LINGLE.

REGIONAL Bicycle Connections Study

This map is a product of data received from participating municipalities and agencies. The accuracy and inclusion of facilities is dependant on the quality of this data.

0 0.5 1 Miles

Hummelstown / Derry / Palmyra Area Recommended Network

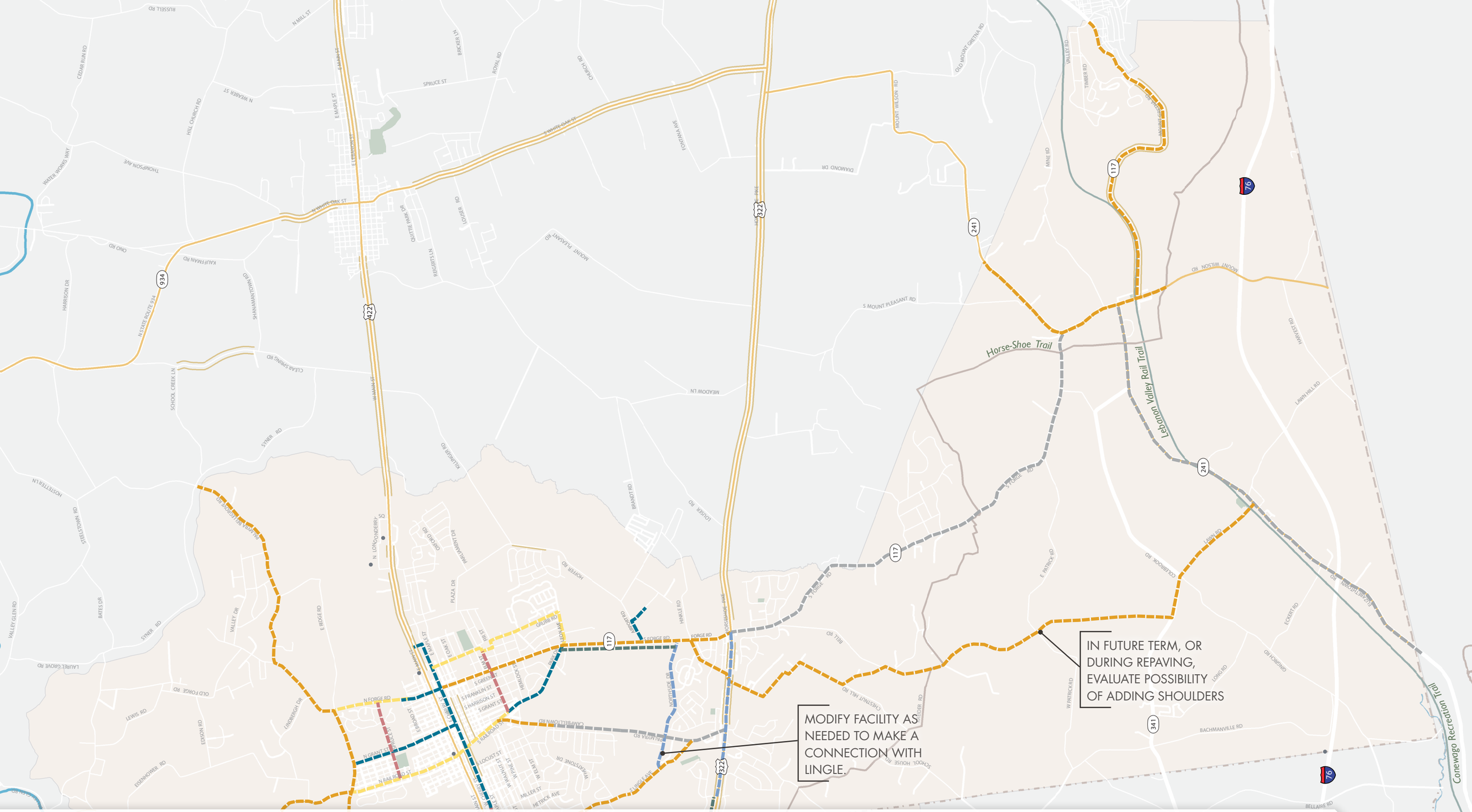
EXISTING

- County
- Study Area
- Parks
- Regional Bike Route
- Multi-Use Trail
- 4ft Shoulders
- Pedestrian Only Trail
- Blueway
- Bus Stop
- Proposed Bike Path (Derry Township)
- Proposed Greenway (Derry Township)

RECOMMENDATIONS OF THIS PLAN

- Multi-Use Path
- Protected Bike Lane
- Buffered Bike Lane
- Bike Lane
- Wide Shoulder
- Bicycle Boulevard
- Sharrow
- Bike Route

North Londonderry / Palmyra / South Londonderry Area Recommended Network



EXISTING

- County
- Study Area
- Parks
- Regional Bike Route
- Multi-Use Trail
- 4ft Shoulders
- Pedestrian Only Trail
- Blueway
- Bus Stop
- Proposed Bike Path (Derry Township)
- Proposed Greenway (Derry Township)

RECOMMENDATIONS OF THIS PLAN

- Multi-Use Path
- Protected Bike Lane
- Buffered Bike Lane
- Bike Lane
- Wide Shoulder
- Bicycle Boulevard
- Sharrow
- Bike Route

REGIONAL Bicycle Connections Study

0 0.5 1 Miles

This map is a product of data received from participating municipalities and agencies. The accuracy and inclusion of facilities is dependant on the quality of this data.

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Program Recommendations

While improving bicycle infrastructure is critical to increasing bicycling rates and safety, program efforts play an equally important role in developing a more bike-friendly culture. These programs can ensure that more residents learn traffic and bicycle safety, are provided opportunities to bicycle within their communities regardless of age or skill level, and receive guidance on why and how to incorporate bicycling into their daily lives. In essence, these efforts market active transportation to the general public and ensure the maximum "return on investment" in the form of more residents bicycling and a higher degree of safety and awareness.

The following sections contain information on program ideas to pursue and potential program partners, with a description of the basic approach and links to model programs and resources. Programs are categorized using the "5 E's" approach (Education, Encouragement, Enforcement, and Evaluation, with the fifth "E", Engineering, covered by the infrastructure recommendations earlier in this chapter). Recommendations were informed by the public and stakeholders and are based on national best practices.

Program Partners

Participating Municipalities & Counties

Participating municipalities should work with the HATS and Lebanon County MPO Bicycle and Pedestrian Task Force to lead and assist in the coordination of projects and programs recommended in this Plan. Public Works, Engineering, Planning, Parks and Recreation, and other staff will be important contributors to the implementation of this Plan.

Tri-County Regional Planning Commission and Region MPOs

These regional planning bodies can help to coordinate Plan implementation, progress evaluation, and future bicycle planning across participating municipalities in the region. The cooperation of region MPOs will also be important to incorporate the recommendations of this Plan into Long Range Transportation Plans and prioritize bicycle infrastructure projects for funding within the Transportation Improvement Program (TIP).

- TCRPC website: http://www.tcrpc-pa.org/Pages/default.aspx
- HATS MPO website: http://www.tcrpc-pa.org/HATS/Pages/default.aspx
- Lebanon County MPO website: http://www.lebcounty.org/Planning/Pages/MPO.aspx

Regional Healthcare Organizations

Healthcare organizations often sponsor programs that aim to increase physical activity and promote active living. In 2012, Holy Spirit Health Care System, Penn State Milton S. Hershey Medical Center, and Pinnacle Health System collaborated on a Community Health Needs Assessment for the Five South Central Pennsylvania Counties. The resulting #1 priority identified in this assessment was the "Promotion of Healthy Lifestyles." Good Samaritan Health System conducted a *Community Health Needs Assessment* which listed transportation and access as an existing deficiency and future priority for the County.

PennDOT

PennDOT will necessarily be involved in any project on state-owned facilities and can be a strong partner for trainings related to active transportation.

- Website: http://www.dot.state.pa.us/Internet/Bureaus/pdBikePed.nsf/BikePedHomepage

Local Schools

Public and private schools in the region are natural partners for Safe Routes to School (SRTS) efforts as well as enforcement actions related to student safety. Working with school administration, faculty, and staff will be important for implementing valuable education and encouragement programs that teach children traffic safety and promote bicycling.

Local Police Departments

Municipal police departments will continue to lead the investigation of traffic safety problems and execution of enforcement campaigns. The enforcement recommendations in this chapter will only be successful if implemented with the partnership and support of the local police departments.

Parks and Recreation Departments

Municipal and County Parks and Recreation departments are natural partners for public events and classes. Coordinating with Parks and Recreation staff will be especially important for any greenway trail initiatives and education and encouragement programs.

Local Bike Clubs & Advocacy Groups

Local bike clubs and advocacy groups, such as the Harrisburg Bicycle Club (HBC) and the Lebanon Valley Bicycle Coalition (LVBC), are natural partners for education and encouragement programs and events. HBC provides recreational riding and encouragement opportunities while the LVBC acts as an advocate for better, safer roads in the region and provides bicycling education classes for all age groups. The regional bicycle advocacy group, Bicycle South Central Pennsylvania, and the statewide bicycle and pedestrian advocacy group, Pennsylvania Walks and Bikes, are also excellent resources and potential partners for program and policy guidance and ideas. The groups post information on bicycle and pedestrian workshops, courses, policies, legislation, and regional activities that could be coordinated with the implementation of this Plan.

- Harrisburg Bicycle Club website: http://www.harrisburgbicycleclub.org/
- Lebanon Valley Bicycle Coalition website: http://www.bikelebanon.org/
- Bicycle South Central PA website: http://bicyclesouthcentralpa.org/
- Pennsylvania Walks and Bikes website: http://www.pawalksandbikes.org/

Parent Teacher Organization (PTOs)

PTOs can be effective partners in implementing Safe Routes to School efforts and other school-oriented traffic safety initiatives.

Commuter Services of Pennsylvania

The program actively seeks to reduce traffic congestion by advocating alternative modes of transportation. The program will be an important partner for advocacy and encouragement initiatives.

Safe Routes to School (SRTS) Pennsylvania State Network

The state advocacy group, Pennsylvania Walks and Bikes, serves as the network organizer for the SRTS Pennsylvania State Network. The network brings together a coalition of organizations who are committed to implementing SRTS programs across the state. The group maintains an online library of resources, Pennsylvania SRTS success stories, a list of partner affiliates, and other information that will be useful to expand SRTS initiatives in the region.

- Website: http://saferoutespartnership.org/state/srts-in-your-state/pennsylvania

Education Programs

The following programs are suggested to strengthen the success of implementing facilities and help shift the culture in Pennsylvania to become more accepting of transportation-based bicycling. It takes multiple parties to create a successful program and support the education and evaluation measures. Each program should have a lead agency, responsible task leader, and written action plan. Each action plan should detail funding sources, key partners, roles, action steps, timelines, and an evaluation section for use after the program is complete. Each time a program is implemented these action plans will serve as a guide to improve and modify elements to increase impact.

Media Campaign to Educate Motorists, Bicyclists, and Pedestrians

Purpose: Educate all road users on traffic laws and safety tips to reduce crashes and make roadways more comfortable for all users.

Audience: General public

Partners: TCRPC/HATS, participating municipalities, local police departments, HATS and Lebanon County MPO Bicycle and Pedestrian Task Forces

Launch a comprehensive traffic safety campaign to reduce the number of bicyclists and pedestrians involved in crashes with motor vehicles. The campaign should consist of educational messaging directed individually toward drivers, bicyclists, and pedestrians in order to teach people traffic laws and safety tips unique to each mode. Public outreach could be conducted through bus advertisements and banners, brochures, bumper stickers, gas pump stickers, TV and radio advertisements, and a police enforcement effort. The Bicycle and Pedestrian Advisory Committee could help with outreach through local events, programs, and online.

Sample program: North Carolina: Watch for Me NC campaign, http://www.watchformenc.org/

Safe Routes to School (SRTS) Program

Purpose: Provide opportunities for children to safely bike and walk to school; improve traffic safety around schools through investments in bicycle and pedestrian infrastructure and programs.

Audience: School-aged children and their parents; school administrators, faculty, and staff

Partners: Local schools; Parent-Teacher Organizations (PTOs); Police departments; Municipal public works, planning, and engineering staff; Community volunteers

Safe Routes to School (SRTS) is a program that enables and encourages children to bike and walk to school. The program helps make bicycling and walking a safe and more appealing method of transportation for children. SRTS facilitates the planning, development, and implementation of projects and activities that will improve safety and reduce traffic, fuel consumption, and air pollution in the vicinity of schools. The Hershey ECC & Elementary School SRTS Infrastructure Plan is a great example of a local SRTS plan and walkability audit that has resulted in several improvement projects.

Some schools in the region, such as those in Derry Township, already have executed SRTS Programs. Participating municipalities should build upon existing programs and community momentum to implement SRTS programs in every elementary and middle school within the region.

An important first step for SRTS programs in the region would be to host a Safe Routes to School Community Workshop. Designed to help communities develop sound SRTS programs based on their unique local context, this is a one-day event that provides information on best practices, useful

strategies, and available resources. The National Center for Safe Routes to School and the Pedestrian and Bicycle Information Center developed a "Safe Routes to School National Course," that could be used as the framework for the workshop. Next steps would include identifying leaders and key contacts at each school, developing SRTS action plans, and prioritizing projects around each school.

The SRTS grant programs for infrastructure and non-infrastructure changed based on federal and local funding sources. If interested in organizing a program, saferoutespa.org is a great resource. The find out about funding, contacting the SRTS coordinator at the state level is advised.

SRTS Resources:

- National Center for Safe Routes to School: http://www.saferoutesinfo.org/
- Pennsylvania resources and success stories: http://www.saferoutesinfo.org/program-tools/find-state-contacts/pennsylvania and http://www.saferoutespa.org/

Professional Development Courses

Purpose: Educate and train planners, engineers, and other professional staff on best practices for bicycle and pedestrian facility planning, design, and implementation.

Audience: Professional staff in Planning, Public Works, Parks and Recreation, Engineering, and related departments and fields

Partners: Municipal departments; GIS staff; County staff; MPO staff; PennDOT staff

Professional development courses provide training to transportation and other professionals who may not have received extensive experience or training in pedestrian and bicycle facilities. These courses are helpful for educating staff on bicycle and pedestrian design standards, complete streets concepts, how to coordinate with other departments on bicycle and pedestrian projects, funding opportunities, and other topics related to bicycle and pedestrian planning, design, and implementation. Courses are available through the Pedestrian and Bicycle Information Center (PBIC), the Institute for Bicycle and Pedestrian Innovation, the Association of Pedestrian and Bicycle Professionals (APBP), and others.

Educating professional staff in these issues helps to ensure that bicycle and pedestrian improvements are appropriately included in future projects and development. It also helps staff understand why it is important to include bicycle and pedestrian accommodations, and the benefits that such improvements provide to the community.

Sample programs:

- Pedestrian and Bicycle Information Center: http://www.pedbikeinfo.org/training/webinars.cfm
- Institute for Bicycle and Pedestrian Innovation: http://www.ibpi.usp.pdx.edu/
- Association of Pedestrian and Bicycle Professionals: http://www.apbp.org/?page=Webinars

Traffic Ticket Diversion Class

Purpose: Educate first-time traffic offenders, including motorists, bicyclists, and pedestrians, on roadway safety and traffic laws.

Audience: General public, usually first-time offenders of particular traffic violations

Partners: Municipal police departments; County court system

A diversion class is offered to first-time offenders of certain community-related traffic violations, such as motorists speeding, pedestrians jaywalking, or bicyclists running a stoplight. In lieu of receiving a citation and/or fine, individuals can take a one-

time free or inexpensive class on traffic safety. In Marin County, California, interested citizens can take the class even if they did not receive a ticket. This program is a good way to educate all road users about their rights and responsibilities.

Sample program:

- Marin County, CA: http://www.marinbike.org/Campaigns/ShareTheRoad/Index.shtml#StreetSkills

Regional One Stop Bike Website

Purpose: Provide a comprehensive website of bicycle resources for residents, visitors, and businesses.

Audience: General public

Partners: Municipal planning and public works departments; HATS and Lebanon County MPO Bicycle and Pedestrian Task Forces; IT staff

Many current and potential bicyclists do not know where to turn to find out about bicycling laws, events, maps, safety tips, and groups. Partners should work together to develop a "one-stop" website that offers a variety of bicycling resources. A website is not usually difficult to create, but it will only be successful if the site is both easy to use and updated frequently. All website content should be reviewed regularly for accuracy. The bicycling community can assist in keeping the site up to date. Other recommended programs in this chapter could be housed on the website, such as Traffic Ticket Diversion Class information, bicycle maps and tours, and event information. This website could build upon the website used for this planning process.

Sample websites:

- Knoxville, TN Regional Bicycle Program: http://www.ibikeknx.com/
- Austin, TX: http://austintexas.gov/bicycle
- Portland, OR: http://www.portlandoregon.gov/transportation/60164

Bicycling Skills Training

Purpose: Educate children, teenagers, and adults on safe bicycling skills and encourage bicycling.

Audience: General public

Partners: Municipal and County Parks and Recreation departments; HATS and Lebanon County MPO Bicycle and Pedestrian Task Forces

Many bicyclists do not receive training on safe bicycling practices, the rules of the road, and bicycle handling. Skills courses can address this education gap. The most common program is the League of American Bicyclists' course series (including Traffic Skills 101, Traffic Skills 201, and Commuting), taught by League Certified Instructors.Course information can be found here: http://www.bikeleague.org/ridesmart.

Courses cover bicycle safety checks, fixing a flat, on-bike skills, crash avoidance techniques, and traffic negotiation. Offering at least one course per year in the region would be an excellent starting point.

Materials for the League of American Bicyclists courses must be purchased and courses often require a fee for participation in order to cover costs. However, participating municipalities and regional MPOs may choose to seek sponsorships to defer costs and offer courses at no expense to the student. Communities could also choose to offer scholarships to a select number of participants. This may reduce financial barriers to participation and increase the diversity of the audience.

Bicycle education courses can be supplemented with a media campaign featuring the rights and responsibilities of bicyclists. The Palmetto Cycling Coalition showcases a "Safe Streets Save Lives" campaign that offers free resources for communities seeking to educate residents about safe bicycling practices, including professionally developed Public Service Announcements.

Sample programs:

- CAN-bike, Canada: http://www.toronto.ca/cycling/canbike/canbike.htm
- League of American Bicyclists, USA: http://bikeleague.org/programs/education/courses.php
- Safe Streets Save Lives, South Carolina: www.safestreetssavelives.org

Encouragement Programs

Open Streets Events

Purpose: Raise awareness of local bicycling and walking opportunities; Encourage people to participate in bicycling and walking activities in a fun, traffic-free environment.

Audience: General public

Partners: Chambers of Commerce and Downtown development groups; Municipal and County Parks and Recreation departments

Open Streets Events are periodic street festivals (typically held on the weekend) that create a temporary park that is open to the public for walking, bicycling, dancing, hula hooping, roller skating, and other forms of human-powered activity. These programs are known by many names: Open Streets, Ciclovias, Sunday Parkways, Summer Streets, and Sunday Streets. They have been very successful internationally and are rapidly becoming popular in the United States. They promote health by creating a safe and attractive space for physical activity and social interaction and are cost-effective compared to the cost of building new parks for the same purpose. These events can be weekly events or one-time events and are generally very popular and well-attended. Activities at an Open Streets Events could include bicycle obstacle courses, a BMX show, jump roping, Zumba, a Kids' Bike Rally, and prize drawings.

These events lend themselves to innovative partnerships and public/private funding. Health care providers whose mission includes facilitating physical activity are often major sponsors. Businesses and downtown development groups may also help sponsor the event if it brings customers to their location. Participating municipalities could rotate responsibility for the event on a monthly or quarterly basis.

Open Streets resources:

- Pittsburgh Open Streets: http://bikepgh.org/openstreetspgh/
- Portland, OR Sunday Parkways Guide: http://www.portlandonline.com/transportation/index.cfm?c=51522&a=274625
- Alliance for Biking and Walking and Street Plans Open Streets Guide: http://nacto.org/docs/usdg/smaller_open_streets_guide_final_print_alliance_biking_walking.pdf

Celebrate Bike Month and Bike to School/Work Day

Purpose: To showcase the benefits of bicycling and to encourage current and potential bicyclists to incorporate bicycling into their daily lives.

Audience: General public, commuters

Partners: Cycling groups, Bicycle and Pedestrian Task Forces, Police Departments, Municipal and County Parks and Recreation departments; Local bike shops

Cities and towns across the country participate in Bike to Work Day, Bike to School Day, and National Bike Month annually during May. The League of American Bicyclists (LAB) hosts a website for event organizers. The website contains information on nationwide and local events, an organizing handbook, and promotional materials. Municipalities in the region

should host National Bike Month events and activities annually, with the support of local bicycling groups and shops. Events and activities for Bike Month may change from year to year and should evolve and grow as the bicycling community in the region grows.

Bike to Work Day could include Bike to Work Day Breakfast Stations with free coffee and breakfast for bicyclists, free bicycle tune-ups, helmet or light giveaways, drawings for gift certificates to local bike shops, and other fun activities that reward and incentivize biking to work. Other Bike Month events could include an Open Streets Event, a Bike Rodeo for children where police and volunteers teach children safe riding skills, a police-escorted ride or race around the city, a month-long mileage challenge, and other activities that appeal to a variety of bicyclist ages and experience levels.

Sample programs:

- League of American Bicyclists Bike Month page: http://www.bikeleague.org/content/national-bike-month
- Sacramento, CA: http://www.mayisbikemonth.com/
- Seattle, WA: http://www.cascade.org/bikemonth
- San Francisco, CA: https://www.sfbike.org/bike-month/

Bicycling Maps and Tours

Purpose: Encourage bicycling by providing easy-to-read maps of on-road bicycle facilities, trails, and routes for reaching destinations by bike; Promote bicycling tourism within the region.

Audience: General public

Partners: Downtown development groups, Chambers of Commerce, Travel and tourism agencies, Municipal planning departments

One of the most effective ways of encouraging people to bike is through the use of maps and guides. Participating municipalities should develop a regional bike map and distribute it to residents and visitors both in print and online; copies could be available for free or for a small charge at city and town halls, local bike shops, gyms and recreation centers, and at other businesses. The map should show where existing bike lanes, trails, and other facilities are located and help to guide people to enjoyable routes and destinations; safety tips and links to local resources are also valuable additions. The map should be updated on a regular basis to reflect the most current facilities in the region.

Participating municipalities should also collaborate to create one or more guided bicycling tour routes, such as tours of breweries, local farms, regional points of interest, and/or public art. Live tours should be hosted by knowledgeable tour guides (annually or more frequently as demand permits) and publicized widely. The tour routes should be preserved in a brochure and/or a self-guided (e.g., iPod-based) tour for those who cannot attend the live tour. The maps should be distributed widely, both in print and online, to maximize availability and use.

Sample maps and tours:

- Lebanon County, PA: http://www.bikelebanon.org/images/scenicrides/county-map_5-8-15.pdf
- Bedford, PA: http://www.visitbedfordcounty.com/walkingtours.html
- Philadelphia, PA: http://museumwithoutwallsaudio.org/wp-content/uploads/2012/03/PHL-Outdoor-Public-Art-Bike-Map.pdf
- Lancaster, PA Group Rides: http://www.meetup.com/Lancaster-Bicycle-Club/events/

Enforcement Programs

20's Plenty Campaign

Purpose: Reduce crashes and crash severity by reducing vehicle speeds on neighborhood streets to 20 MPH.

Audience: Motorists

Partners: Municipal public works departments; Municipal police departments; County court system

"20's Plenty" is a campaign that originated in the United Kingdom with the goal of minimizing pedestrian crash injuries and deaths. Lowering residential speeds to 20 MPH has enormous safety benefits for all users, especially pedestrians and cyclists, by reducing both the chance of a crash and its severity. This campaign could be implemented throughout the region in areas with high bicyclist and pedestrian traffic, such as in the downtown, on facilities recommended in this Plan and other neighborhood streets, and near schools, parks, and shopping centers.

A successful campaign will bring together several different strategies, including:

- Making residents aware of the benefits of 20 MPH roadways and engaging their partnership on raising awareness and buy-in from their neighbors.
- Identifying specific streets on which a 20 MPH speed limit is appropriate. Likely candidates include designated school walking or bicycling routes, roads identified in pedestrian or bicycle plans as important corridors, and residential streets whose residents request a 20 MPH program.
- Traffic engineering to ensure that the design speed of the street matches the posted speed.
- Partnership with law enforcement to issue warnings and moving violations on designated 20 MPH streets.
- Evaluation of vehicle speeds and reported crashes (number and severity) before and after the integrated campaign is implemented to the effort to measure results and correct course.
- Changing the legal guidelines around minimum speed and/or authority to set speed limits. For example, the State Legislature may consider passing a law that would permit towns, cities, burroughs, and townships to set speed limits on certain types of roadways, based on classification or designation in an adopted plan.

More about UK "Twenty's Plenty" campaign:

- http://www.20splentyforus.org.uk/
- http://www.streetfilms.org/no-need-for-speed-20s-plenty-for-us/

Speeding Enforcement & Speed Feedback Signs

Purpose: Reduce speeding throughout the region to lower the risk and severity of bicycle and pedestrian crashes.

Audience: Motorists

Partners: Municipal public works departments; Municipal police departments; County court system

Speeding vehicles endanger all road users, including pedestrians and bicyclists. High-speed driving results in more frequent crashes and crashes that are more likely to result in serious injury or death. Targeted speed enforcement activities are a proven way to improve road safety and make walking and bicycling more comfortable.

Law enforcement officials should enforce speed near schools and parks, in downtown, and at locations that are known to have speeding

problems (as identified by police officers and resident complaints). These campaigns are ideal for a Safe Routes to School Program; many towns hold an annual "Back to School Blitz" to enforce speed limits in school zones.

As part of ongoing enforcement against speeding, municpalities should also consider creating a speed feedback sign request program to deploy speed feedback signs at the request of neighborhood associations and schools. The signs serve as a traffic calming device when used temporarily at strategic roadway locations. Municipalities should also use speed feedback signs on streets with new pedestrian and bicycle facilities. The signs should be mounted temporarily (e.g., for two weeks) and then be moved to another location to keep motorists from becoming inured to the speed feedback sign effect.

Example speed feedback sign request program:

- Toronto, Canada: http://www.toronto.ca/transportation/walking/wysp/

Evaluation Programs

HATS Bicycle and Pedestrian Task Force & a Lebanon County MPO Bicycle and Pedestrian Task Force

Purpose: Represent bicycle and pedestrian interests within municipalities and the region; Assist with the promotion and operation of bicycle and pedestrian projects and programs.

Audience: City staff; City Council; General public

Partners: Municipal planning departments; Municipal police departments

At the conclusion of this planning process, a Bicycle and Pedestrian Task Force for the Lebanon County MPO should be created to represent the community's interests regarding bicycle and pedestrian issues. The Task Force should resemble the recently established HATS Bicycle and Pedestrian Task Force. The duties for both Task Force's should include reviewing development and improvement considerations that affect walking and bicycling conditions, making recommendations for street and sidewalk improvements, pursuing bicycle and pedestrian improvements recommended in this Plan, helping to track Plan progress through benchmarking and an annual report, and assisting with the development and implementation of programs.

Sample committees:

- Southwestern Pennsylvania Commission: http://www.spcregion.org/trans_pedbike.shtml
- Lancaster County, PA: http://www.lancastercountyplanning.org/151/Bicycle-Pedestrian-Planning

State of Bicycling Annual Report

Purpose: Share information about key bicycling metrics.

Audience: General public; Elected officials and decision makers; City staff

Partners: Municipal planning, engineering, and public works departments; Municipal and county parks and recreation departments, Bicycle and Pedestrian Task Forces

As the implementation of this Plan progresses, a useful strategy is to use performance benchmarks to measure implementation accomplishments. A comprehensive review of the Plan's progress should be published in an annual report that includes relevant performance metrics (new bicycle facility

miles, completed projects, new and ongoing programs, and bicyclist-involved crashes). The report may also include information on user satisfaction, public perception of safety, or other qualitative and quantitative data that has been collected related to bicycling. Tracking successes over time helps to build momentum and justify continued or increased funding for bicycle projects and programs.

Sample program:

- Memphis, TN: 2014 State of Bicycling Report, https://bikepedmemphis.files.wordpress.com/2012/03/state-of-bicycling-2014.pdf

Maintenance Hotlines

Purpose: Allow road users to report safety problems related to bicycling and walking facilities and request facilities.

Audience: Regional residents who bike and walk

Partners: Municipal public works departments; Bicycle and Pedestrian Task Forces

Municipalities can work together with residents to identify bicycling and walking safety issues by creating online forms, an app, and/or hotlines that residents can use to request maintenance or enhancements. The online form could be housed on the city's One-Stop Bike Website (recommended in this chapter). A maintenance hotline benefits the public by helping them route their concerns to the correct party. It also benefits municipalities by making sure they hear about potential safety and liability issues early so they can take action. Many jurisdictions also find that this approach is beneficial because their scheduled maintenance and complaint-based inspection approach cannot identify every legitimate issue, so hotlines and web forms can essentially distribute the job of inspecting facilities to all residents.

The highest priority should be creating a mechanism for residents to report bicycling and walking safety issues such as cracked pavement, blocked drains, malfunctioning crossing signals, encroaching vegetation, and debris in bike lanes or along sidewalks or trails. If desired, additional input may be invited such as allowing residents to request bicycling and walking maps by mail, allowing residents to request parking enforcement that impacts bicycling and walking (e.g., parked cars blocking bike lanes or ADA ramps), and/or allowing residents to request traffic safety enforcement.

Sample program:

- Durham, NC "Report a Problem" web page: www.bikewalkdurham.org/BPAC_report.html

Policy Recommendations

Policies across the study area and the Tri-County region should be examined to enable communities to implement engineering solutions and programming that will improve bicycling in the region. A few policies to address include:

- Continue to use the PennDOT D-310 Planning and Programming Checklist to accommodate bicyclists and pedestrians in each new roadway project and resurfacing project.
- Develop policies to encourage transit agencies and municipalities to work together to provide bicycle parking accommodations at hubs and examine improvements that will close gaps for the last mile from each hub to resident homes.
- Encourage businesses through tax breaks or other incentives to provide bicycle parking.
- Collaborate across the TCRPC region to establish consistent criteria for GIS data and create a process by which each planning study releases updated and new GIS data to TCRPC.

- Orient grates appropriately for bicycle safety. Use this Plan as a guide for routes where this is critical and establish a recording method (see Maintenance Hotlines page 4-38) for existing critical needs.
- Ensure maintenance schedules and checklists include trimming vegetation that would impede the use of a shoulder, bike lane, or trail.
- Reinforce the four-foot law by using the "Bikes May Use Full Lane" sign instead of the "Share The Road" sign. This is critical in places where four feet can not be safely created between bicyclists and passing vehicles.
- Follow FHWA, AASHTO, and the guidelines within this Plan for rumble strip placement.

Breakfast stations set up across the region for Bike To Work Day would be a great way to encourage new bicyclists, assemble commuter groups, and build relationships among advocates, local businesses, key decision makers, and the bicycling community.

REGIONAL Bicycle Connections Study

Chapter Five: Implementation Strategies

Overview

This Plan's infrastructure, program, and policy recommendations provide the framework for creating a connected bicycle network throughout the City of Harrisburg, Hummelstown Borough, Palmyra Borough, Paxtang Borough, Derry Township, North Londonderry Township, South Londonderry Township, and Swatara Township. This chapter defines a structure for managing the implementation of these recommendations. Successful implementation will require a consistent, coordinated effort by municipalities, counties, TCRPC, HATS and Lebanon County MPOs, PennDOT, private partners, stakeholders, and advocates in the region. Performance measures will be important for evaluating implementation progress over time, allowing the region to gauge its success in providing quality bicycle transportation and recreation choices. Measuring the performance of plan implementation will also provide a mechanism for making informed decisions and cost-effective investments in the future.

This chapter discusses key partners who can help lead or assist with the implementation of this Plan and priority action steps for the region. The action steps presented do not cover every individual infrastructure, policy, and program recommendation of this Plan. Rather, they call out priority items within each of these categories in order to provide guidance for moving forward on the most important items.

Key Partners in Implementation

Municipal and County Officials

Local councils and boards will be responsible for adopting this Plan. Through adoption, the municipalities' leadership is further recognizing the value of bicycling and is putting forth a well-thought-out set of recommendations for improving public safety and overall quality of life. By adopting this Plan, local officials are also signifying that they are prepared to support the efforts of other key partners in the Plan's implementation, including the work of municipal departments, regional agencies, and PennDOT. Local officials should be prepared to:

- Adopt a set-aside budget for expenditures of funding that supports the bicycle program. Municipal staff should be prepared to provide supporting materials for the budget process, including any bicycling reports, user estimates, and benchmarking statistics.
- Consider a bond referendum to fund projects from this Plan.
- Be informed of the health, economic, and quality-of-life benefits of a more walkable and bikeable community.

County and Municipal Planning Boards

A planning board serves as the advisory board to local officials on matters of planning and zoning. Each planning board in the region should be prepared to:

- Become familiar with the recommendations of this Plan and support implementation.
- Learn about bicycle-related policies in Pennsylvania.

Engineering and Public Works Departments

Engineering and public works staff collaborate to maintain transportation facilities. The staff should be prepared to:

- Become familiar with the standards set forth in Appendix A of this Plan, as well as state and national standards for bicycle and pedestrian facility design (including AASHTO and NACTO).
- Work with local, regional, and state partners to implement the infrastructure recommendations of this Plan using the Design Guidelines found in Appendix A.
- Communicate and coordinate with other town departments and the HATS and Lebanon County MPO Bicycle and Pedestrian Task Forces on priority bicycle projects.
- Design, construct, and maintain bicycle facilities.
- Communicate and coordinate with PennDOT on this Plan's recommendations for state-owned and maintained roadways. Provide comments and reminders about this Plan's recommendations no later than the design phase.
- Work with PennDOT to ensure that when state-owned and maintained roadways are resurfaced or reconstructed, this Plan's adopted recommendations for bicycle facilities are included on those streets. If a compromise to the original recommendation is needed, then contact PennDOT for guidance on appropriate alternatives.
- Ensure bicycle facilities are regularly maintained.

Parks and Recreation Departments

Municipal and County parks and recreation departments impact the bicycling environment through the provision of parks and open space, trails, and greenways. The staff should be prepared to:

- Serve as lead agency for implementation of off-road trail projects, working closely with municipalities and PennDOT.
- Coordinate among county and municipal planners to ensure trail network connectivity between jurisdiction borders.
- Ensure that the greenway trail design guidelines of this Plan are used in the design of greenway facilities and aim for uniform standards in greenway facilities, such as with signage and wayfinding.
- Lead greenway programmatic activities to encourage use.
- Conduct evaluation activities along greenway trails such as recording trail user counts.

Municipal Planning Departments

Planning and zoning staff will take primary responsibility for the contact with new development to implement the Plan. The staff should be prepared to:

- Communicate and coordinate with local developers on adopted recommendations for bicycle facilities, including paved multi-use trails.
- Assist public works and engineering staff in communicating with PennDOT and regional partners.
- Become experts on bicycle-related policies in Pennsylvania.
- Refine local policies and regulations based on recommendations from this Plan.

Police Departments

The commitment of local police departments to this Plan is an important step towards creating a bicycle-friendly region that is safer for all road users. Police officers and staff should be prepared to:

- Become experts on bicycle-related laws in Pennsylvania.
- Continue to enforce not only bicycle-related laws, but also motorist laws that affect bicyclist safety, such as speeding, running red lights, and aggressive driving.
- Participate in bicycle-related education programs.
- Review safety considerations with public works and engineering staff as projects are implemented.

PennDOT

PennDOT is responsible for the construction and maintenance of bicycle facilities on state-owned and maintained roadways. PennDOT staff should be prepared to:

- Become familiar with the bicycle facility recommendations for PennDOT roadways in this Plan; take initiative in incorporating this Plan's recommendations into the schedule of improvements whenever possible.
- Provide guidance and technical support for implementing on-street bikeway facilities, as well as related greenway trail facilities such as shared-use paths in roadway corridors, trail-roadway crossings, and improvements that increase safety for bicyclists crossing bridges on state roadways.
- Continue working with municipalities and MPOs on coordination of upcoming and future roadway projects that involve bikeway recommendations. Communication with municipalities and MPOs regarding scheduled road maintenance and road construction projects is crucial to network development.

Non-Profits and Advocacy Groups

Non-profit organizations and advocacy groups, such as the Lebanon Valley Bicycle Coalition and Bicycle South Central PA, can serve a variety of purposes and are already leading many programmatic-related activities across the region.

Roles related to this Plan include:

- Lead education, encouragement, and enforcement programmatic efforts.
- Participate in the activities of the Task Forces and, as needed, provide representation on the committee.
- Maintain open dialogue with the Task Forces and local municipalities to promote resource- and information-sharing and reduce duplications of effort.
- Advocate, promote, and encourage the development of the bicycle network throughout the community.
- Educate citizens on the benefits of bicycling.
- Play an active role in raising funds for network development in concert with the Bicycle and Pedestrian Task Forces
- When possible, fund programs or bicycling amenities such as bicycle racks.
- Help to organize volunteers to assist with implementation and management.
- Sponsor or co-sponsor bicycling events.

Bicycle and Pedestrian Task Force

The current HATS Bicycle and Pedestrian Task Force and the Lebanon County MPO Bicycle and Pedestrian Task Force (established due to this Plan), will play a major role in the implementation of Plan recommendations. Members of the two Task Forces should be prepared to:

- Advocate for implementing the bicycle network.
- Facilitate cooperation among government agencies and nonprofit partners for network development.

- Define and recommend sources of funding for network development.
- Meet quarterly with an agenda that includes: A) Implementation progress updates B) Confirmation of specific tasks to be completed by specific members before the next meeting, and C) Discussion of new opportunities and constraints and identification of ways to address them.
- Pursue funding including the solicitation of major donors and corporate sponsors.
- Be actively engaged with education, encouragement, and enforcement programs, providing promotional materials to the public.
- Keep local leaders informed about bicycle -related issues and developments through direct dialogue and personal e-mail; promote facility development among local leaders through creative approaches, such as organized tours of existing trails or proposed trail corridors.
- Rally public support for key public hearings and coordinate mass e-mail campaigns for special votes.
- Continue communication and build positive relationships with organizations such as utility companies, public and private schools, and others that can assist with issues related to potential bicycle facility right-of-way and trail development.

Key Action Steps

The following is a recommended organizational framework for managing implementation of the Regional Bicycle Connections Study. The structure is based on input from the project Steering Committee, the public, and evidence of successful implementation strategies from around the country.

Policy Action Steps

Adopt this Plan

The first step toward implementation is the adoption of this Plan. All participating municipalities, their counties, TCRPC, and HATS and Lebanon County MPOs should adopt this Plan as the guiding document for improving bicycle transportation and recreation in the region. Having an adopted plan is helpful in securing funding from federal, state, and private agencies.

Form a Lebanon County MPO Bicycle and Pedestrian Task Force to Complement the HATS Bicycle and Pedestrian Task Force

The formation of a Lebanon County MPO Bicycle and Pedestrian Task Force will complement the existing HATS Bicycle and Pedestrian Task Force and help guide and track the implementation of this Plan. The two Task Forces should be a citizen-oriented group, which could include members of the Derry Regional Bicycle Connections Study Steering Committee. The two Task Forces should have representation from commuting and recreational cyclists, as well as active pedestrians. The Bicycle and Pedestrian Task Forces should champion the recommendations of this Plan and continue to provide a communications link between the citizens of the community and local and regional governments. The groups should meet at least quarterly, and be tasked with assisting in community outreach, marketing, and program activities recommended in this Plan.

Incorporate Plan Recommendations into Other Planning Documents

The recommendations made in the Regional Bicycle Connections Study should be incorporated into the Long-Range Transportation Plan, local comprehensive plans, land use plans, and other regional and local plans that will affect transportation

planning decisions. TCRPC should lead this effort with support from municipal planners, county planners, the HATS and Lebanon County MPOs, and PennDOT. The recommendations of this Plan should serve as the starting point for the integration of bicycle facilities into future transportation and land use planning documents around the region.

Revise Local and Regional Policies

Changing the way that bicycles are considered within the transportation fabric will require revisions to municipal and county codes and ordinances. With assistance from TCRPC and the HATS and Lebanon County MPOs, municipal and county planners should revise ordinances to better accommodate bicycles and bicycle infrastructure.

Develop a Complete Streets Policy

Each municipality and county within the region should develop a Complete Streets Policy to provide a basis for developing roadways that accommodate all road users, including bicyclists and pedestrians. These policies will demonstrate the region's commitment to improving the bicycling environment and will provide official guidance for considering bicycle and pedestrian improvements as part of roadway repaving, reconstruction, and new roadway projects. Lancaster County adopted a Complete Streets policy in 2014 and should be used as a local best practice.

Develop Form-Based Codes

The bicycle-friendliness of an area is determined as much by land use decisions as by transportation decisions. Municipal planners should review existing zoning codes and replace use-based zoning codes with form-based zoning codes to support a mix of uses and human-scale streetscapes that encourage and enable bicycle transportation.

Program Action Steps

Designate Staff

Designate staff to oversee the implementation of this Plan and the proper maintenance of the facilities that are developed. It is recommended that a combination of existing planning staff and public works staff oversee the day-to-day implementation of this Plan within each municipality, with designated support staff at participating counties, TCRPC, and the HATS and Lebanon County MPOs. In many larger municipalities, this task is covered by a full-time bicycle and pedestrian coordinator, but in smaller municipalities, it may be sufficient to fold these responsibilities into current staff responsibilities. Additionally, a local planning and design firm can be contracted initially to help jumpstart the Plan recommendations.

One-Stop Website

Many current and potential bicyclists do not know where to turn to find out about bicycling laws, events, maps, tips, and groups. Developing a "Bike Central" website provides information to a wide audience and encourages people to bicycle. A one-stop bike website is not usually difficult to set up, but it will only be successful if the site is both easy to use and updated frequently. All website content should be reviewed regularly for accuracy. The bicycling community can assist in keeping the site up to date. The TCRPC may be an ideal host and partner in this effort and could help to post information and event updates to the website, with a link on each municpalities' website home page that directs users to the "Bike Central" website.

Establish a Monitoring Program

From the beginning, and continuously through the life of a bicycle facility project, the Bicycle and Pedestrian Task Forces should brainstorm specific benchmarks

to track through a monitoring program and honor the completion of projects with public events and media coverage. Monitoring should be supported by the evaluation tools described below as well as regular facility inspection and maintenance by public works staff. Benchmarks should be revisited and revised periodically as the bicycle facility network evolves.

Develop Evaluation Tools for the Region

Generate a model smart growth scorecard and bicycle needs checklist for use around the region. A smart growth scorecard helps to evaluate how local and regional policies are affecting development patterns, and whether those policies support the vision for growth and development within the municipality or the region. A bicycle needs checklist is a similar evaluation tool that evaluates existing policies, programs, and infrastructure that affect the bicycling environment to determine how well bicycling is supported. These tools could be developed by the Bicycle and Pedestrian Task Forces using models from other communities, with support from the TCRPC, HATS and Lebanon County MPOs, municipal planners, and county planners. Develop these tools based on best practices and market them to local staff for use in development review.

Begin Annual Meeting with Key Project Partners

Coordination between key project partners will establish a system of checks and balances, provide a level of accountability, and ensure that recommendations are implemented. This meeting should be organized by the TCRPC and should include representatives from participating municipalities and counties, TCRPC, the HATS and Lebanon County MPOs and their Bicycle and Pedestrian Task Forces, and PennDOT. The purpose of the meeting should be to ensure that this Plan's recommendations are integrated with other transportation planning efforts in the region, as well as long-range and current land use planning, economic development planning, and environmental planning. Attendees should work together to identify and secure funding necessary to immediately begin the first year's work, and start working on a funding strategy that will allow the region to incrementally complete each of the recommended infrastructure improvements, policy changes, and programs by 2030. A brief progress benchmark report should be a product of these meetings, and goals for the year should be reconfirmed by participants. The meetings could also occasionally feature special training sessions on bicycle, pedestrian, and trail issues.

Educate Staff on Bicycle- and Pedestrian-Related Issues

Bicyclists remain one of the most vulnerable forms of traffic. In many cases, planning and engineering staff, police officers, and other staff are not fully aware of the effect that state and local laws, new facility designs and standards, and policies have on bicyclists. Organized training on these topics can be a valuable way to raise awareness of bicycle-related issues and ensure that staff and officers are trained in how to foster a safe and comfortable bicycling environment and culture. Staff trainings could be held using free online resources available from the National Highway Traffic Safety Administration (NHTSA) (see links at www.bicyclinginfo.org/enforcement/training.cfm) and through webinars available through the Association of Pedestrian and Bicycle Professionals (APBP). Training sessions for the 2012 AASHTO Guide for the Development of Bicycle Facilities have been provided in the region in the past.

Develop Bicycle Facility Designs and Specifications for Proposed Projects

Municipal staff could prepare these in-house to save resources, using the design guidelines of this Plan as starting points. The public should have an opportunity to comment on the design of new facilities.

Improve Existing Programs and Launch New Programs

Chapter 4: Recommendations provides a set of programmatic resources for education, encouragement, enforcement, and evaluation that will support the goals of this Plan. Participating municipalities should reference the recommendations to expand and improve upon existing programs, as well as to develop new programs that promote bicycling.

Through cooperation with other municipalities, the Bicycle and Pedestrian Task Forces, counties, and groups such as walking and bicycling clubs, strong education, encouragement, and enforcement campaigns could also occur as new facilities are built. When an improvement has been made, the roadway environment has changed and proper interaction between motorists and bicyclists is critical for the safety of all users. A campaign through local television, on-site enforcement, education and encouragement events, and other methods will bring attention to the new facility, and educate, encourage, and enforce proper use and behavior.

Apply for "Bicycle Friendly Community" Designation

A goal for participating municipalities should be to seek "Bicycle Friendly Community" (BFC) designation. The BFC campaign is an award program run by the League of American Bicyclists that recognizes municipalities that actively support bicycling activities and safety. A Bicycle Friendly Community provides safe accommodation for bicycling and encourages its residents to bicycle for transportation and recreation. Several Pennsylvania communities have become designated as Bicycle Friendly Communities or are seeking designations as such. The development and implementation of this Plan is an essential first step for participating municipalities to achieve designation as Bicycle Friendly Communities.

Infrastructure Action Steps

Estimate Costs

Cost estimates should be calculated for the priority projects included in this Plan, using local or regional engineering cost estimates. The cost estimate for a project should include costs for planning, design and engineering, and environmental considerations. A contingency buffer of 10 to 20 percent can help to provide a more conservative cost estimate in the case of unforeseen project delays or extra costs.

Identify Funding

Achieving the vision that is defined within this Plan requires, among other things, a stable and recurring source of funding. Communities across the country that have successfully engaged in bicycle development programs have relied on multiple funding sources to achieve their goals. No single source of funding will meet the recommendations identified in this Plan. Instead, stakeholders will need to work cooperatively a wide range of private sector, municipality, state, and federal partners to generate funds sufficient to implement the recommendations. A list of potential funding sources is listed in Appendix B: Funding.

Leverage Opportunities

In the course of seeking funding opportunities, consider partnerships with developers and non-traditional development partners. Implementing a regional bicycle network is an iterative process often well served by opportunistic chances. By involving the developer and other stakeholders early in the process, they have the opportunity to share in the discussions of the specific facility and its features, ultimately creating a transportation and recreation corridor that directly contributes to the economic potential of the developed property.

Complete Priority Bicycle Projects

By moving forward quickly on priority projects, the planning partners and stakeholders will demonstrate their commitment to carrying out the Plan and will better sustain enthusiasm generated during the outreach stages of the planning process. Chapter 4 identifies priority bicycle projects.

Design, Construct, and Maintain Network Facilities

Once a network segment is selected for implementation, facility design typically follows. For this Plan, some facilities, such as bicycle routes or shared-lane markings, will require signage and limited construction activities. Others may require more intensive restriping, road reallocation, and reconstruction. Preliminary design plans should be reviewed by multiple stakeholders, including emergency service personnel and the local police department, so they can offer suggestions and have their voices heard from the very beginning.

Annual operations and maintenance costs vary, depending upon the facility to be maintained, level of use, location, and standard of maintenance. Operations and maintenance budgets should take into account routine and remedial maintenance over the life cycle of the improvements and on-going administrative costs for the operations and maintenance program.

On-road bicycle facilities can be implemented in a variety of ways. These are described briefly below:

- Striping - Some roadways can be simply striped with bicycle lanes because of adequate, wide widths of the roadway's outside lanes. This is an inexpensive implementation method.
- Pavement Marking - Sharrows, as described in Chapter 4, are simple pavement markings added to the roadway. In these cases, additional pavement width is not needed. Therefore, this is an inexpensive implementation method.
- Roadway Retrofit (Lane Narrowing) - In some cases, existing roadway travel lanes can be narrowed to allow for a roadway restriped with bicycle lanes. The typical minimum travel lane is 10'. This is still inexpensive but requires removal of old striping. It is ideal to restripe during a scheduled resurfacing.
- Roadway Retrofit (Road Diet) - In some cases, a reduction in travel lanes can be implemented to include bicycle lanes or other facilities. A full traffic analysis is required before implementing a road diet. A typical road diet occurs when converting a four-lane road to a three-lane with bicycle lanes.
- Roadway Retrofit (Bicycle Boulevard) - The addition of pavement markings, signage, and traffic calming measures can be added at varying costs on an existing residential roadway.
- New Construction - When a new roadway is constructed or existing roadway reconstructed, bicycle lanes, paved shoulders, sidepaths, or other facilities may be included in the project.

Performance Measures

The performance measures in this Plan are important for assessing whether the Plan is meeting its goals over time. While they are focused on assessing progress over the long-term, data on these measures should be collected on a regular basis to help track interim progress being made. This information will allow for course adjustments to be made to help ensure achievement of Plan goals.

The Plan performance measures are generated from the goals of the Plan (see Chapter 1). The performance measures for the Plan were selected in part based on the ability of local municipalities, the region, and the state to collect relevant data, both now and in the future. This data can help inform project selection and design, the development and success of education and encouragement programs, measures to improve safety, and other issues. Data and performance measures outlined in the following table represent the way that local municipalities and the region will track achievement of the Plan's goals over time.

Goal Categories	Performance Measure	Baseline Measurement	Performance Target / Desired Trend
Safety, Livability, Awareness, Health & Wellness	Number of bicycle programs	2014 Number	Increase
Safety, Connectivity, Livability	Percentage of bicycle network completed	2014 Percentage	Increase
Safety	Bicycle/Pedestrian Collision Rates; Number of serious injuries and fatalities	PennDOT Highway Safety & Traffic Operations Division; Municipal police departments	Reduce collision rates; Zero fatalities
Connectivity, Awareness	Funding set aside for bicycle improvements	2014 Number	Increase
Safety, Connectivity, Livability, Awareness, Health & Wellness	Areas lacking bicycle facilities	2014 Number	Zero areas lacking bicycle facilities
Livability, Awareness, Health & Wellness	Commute mode share	2012 Census Data	Increase

Financing

A combination of funding from federal, state, local, and private sources will be necessary to fully implement this Plan. The MPO's and municipalities participating in the Plan should cooperate and coordinate to seek funds appropriate for regional implementation as well as single community projects. Detailed information on specific funding options and their applicability to projects and geographies are provided in Appendix B: Funding Sources.

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REGIONAL Bicycle Connections Study

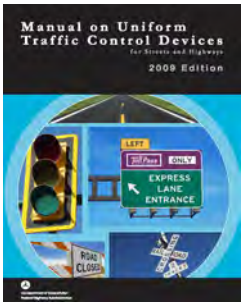
APPENDIX A: DESIGN GUIDELINES

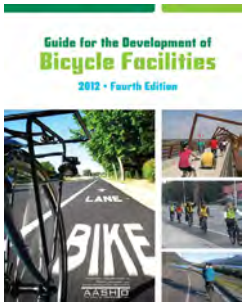
Contents

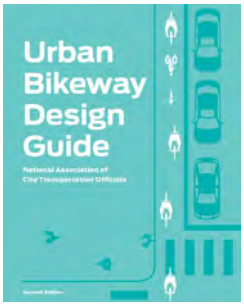
Introduction

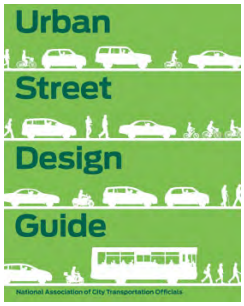
This technical handbook is intended to assist the City of Harrisburg, Hummelstown Borough, South Londonderry Township, North Londonderry Township, Derry Township, Palmyra Borough, Swatara Township, and Paxtang Borough in the selection and design of bicycle facilities as it relates to the *Regional Bicycle Connections Study*. The following sections assemble best practices by facility type from public agencies and municipalities nationwide. Within the this appendix, treatments are covered within a single sheet tabular format relaying important design information and discussion, example photos, schematics (if applicable), and existing summary guidance from current or upcoming draft standards. These treatments and design guidelines are important because they represent the tools for creating a bicycle-friendly, safe, and accessible community. The guidelines are not, however, a substitute for a more thorough evaluation by a landscape architect or engineer upon implementation of facility improvements. Some improvements may also require cooperation with PennDOT for specific design solutions. Existing standards are referenced throughout and should be the first source of information when seeking to implement any of the treatments featured here.

National Standards









The Federal Highway Administration's *Manual on Uniform Traffic Control Devices* (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 traffic. The MUTCD is the primary source for guidance on lane striping requirements, signal warrants, and recommended signage and pavement markings.

To further clarify the MUTCD, the FHWA created a table of contemporary bicycle facilities that lists various bicycle-related signs, markings, signals, and other treatments and identifies their official status (e.g., can be implemented, currently experimental). See *Bicycle Facilities and the Manual on Uniform Traffic Control Devices*.[1]

Bikeway treatments not explicitly covered by the MUTCD are often subject to experiments, interpretations and official rulings by the FHWA. The *MUTCD Official Rulings* is a resource that allows website visitors to obtain information about these supplementary materials. Copies of various documents (such as incoming request letters, response letters from the FHWA, progress reports, and final reports) are available on this website.[2]

American Association of State Highway and Transportation Officials (AASHTO) *Guide for the Development of Bicycle Facilities*, updated in June 2012 provides guidance on dimensions, use, and layout of specific bicycle facilities. The standards and guidelines presented by AASHTO provide basic information, such as minimum sidewalk widths, bicycle lane dimensions, detailed striping requirements and recommended signage and pavement markings.

The National Association of City Transportation Officials' (NACTO) 2012 *Urban Bikeway Design Guide*[3] is the newest publication of nationally recognized bicycle-specific design guidelines, and offers guidance on the current state of the practice designs. The NACTO Urban Bikeway Design Guide is based on current practices in the best cycling cities in the world. The intent of the guide is to offer substantive guidance for cities seeking to improve bicycle transportation in places where competing demands for the use of the right of way present unique challenges. All of the NACTO Urban Bikeway Design Guide treatments are in use internationally and in many cities around the US.

Offering similar guidance for pedestrian design, the 2004 AASHTO *Guide for the Planning, Design and Operation of Pedestrian Facilities* provides comprehensive guidance on planning and designing for people on foot.

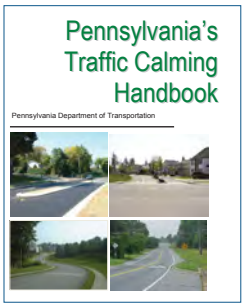
Some of these treatments are not directly referenced in the current versions of the AASHTO Guide or the MUTCD, although many of the elements of these treatments are found within these documents. In all cases, engineering judgment is recommended to ensure that the application makes sense for the context of each treatment, given the many complexities of urban streets.

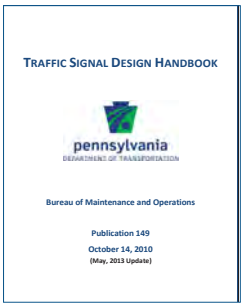
1 *Bicycle Facilities and the Manual on Uniform Traffic Control Devices. (2011). FHWA. http://www.fhwa.dot.gov/environment/bikeped/mutcd_bike.htm*

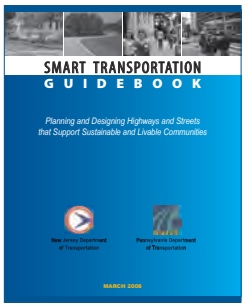
2 *MUTCD Official Rulings. FHWA. http://mutcd.fhwa.dot.gov/orsearch.asp*

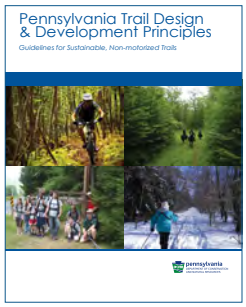
3 *http://nacto.org/cities-for-cycling/design-guide/*

Local Standards



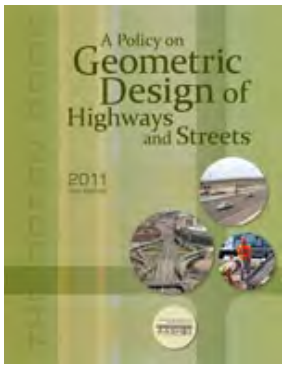






The Pennsylvania Department of Transportation (PennDOT) has published a variety of additional resources for designing bicycle facilities. These include *Pennsylvania's Traffic Calming Handbook*, the *Pavement Markings and Signing Standards* TC-8600 and TC-8700 Series, the *PennDOT Traffic Signal Design Handbook*, and the *PennDOT and New Jersey Department of Transportation Smart Transportation Guidebook*. The Pennsylvania Department of Conservation and Natural resources has also developed the *Pennsylvania Trail Design and Development Principles Guideline*.

Additional US Federal Guidelines



Meeting the requirements of the Americans with Disabilities Act (ADA) is an important part of any bicycle and pedestrian facility project. The United States Access Board's proposed *Public Rights-of-Way Accessibility Guidelines*[4] (PROWAG) and the *2010 ADA Standards for Accessible Design*[5] (2010 Standards) contain standards and guidance for the construction of accessible facilities. This includes requirements for sidewalk curb ramps, slope requirements, and pedestrian railings along stairs.

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

4 http://www.access-board.gov/prowac/
5 http://www.ada.gov/2010ADAstandards_index.htm

Design Needs of Bicyclists

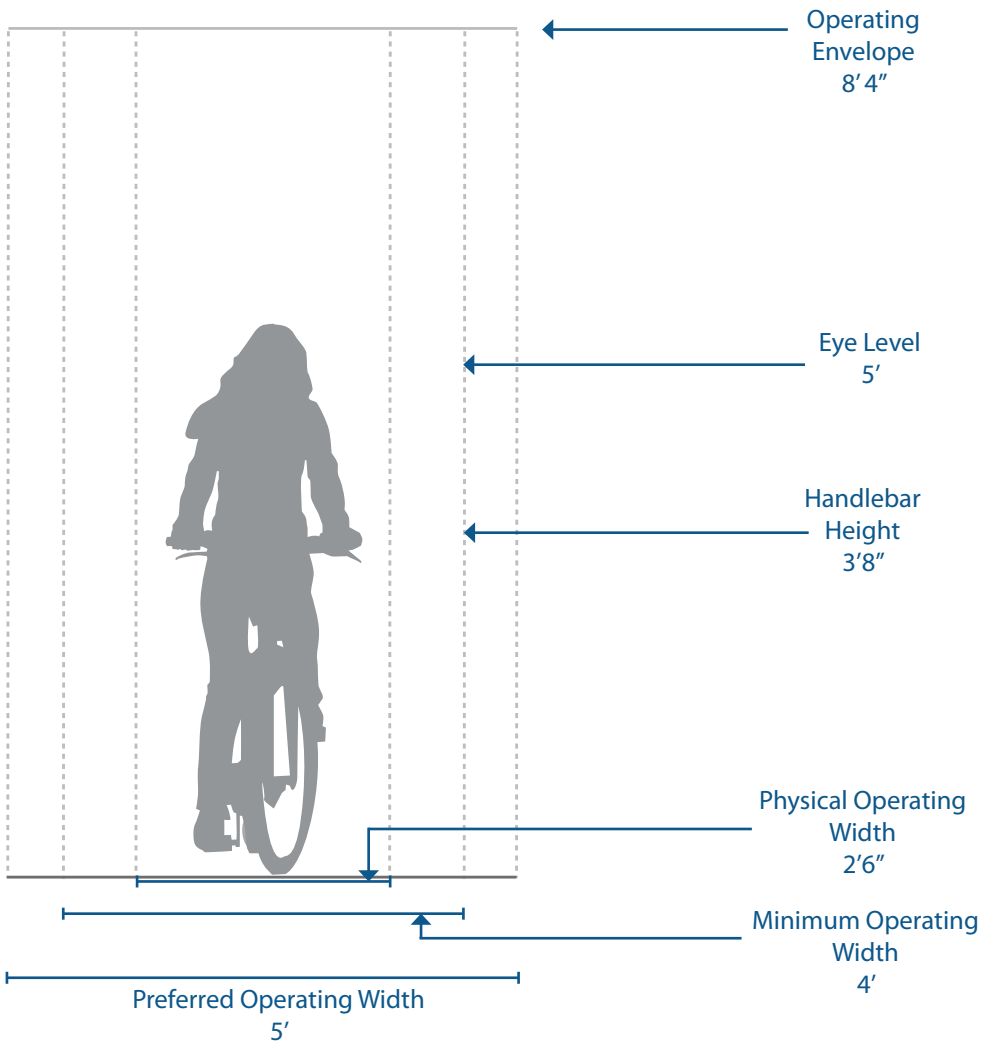
The purpose of this section is to provide the facility designer with an understanding of how bicyclists operate and how their bicycle influences that operation. Bicyclists, by nature, are much more affected by poor facility design, construction and maintenance practices than motor vehicle drivers. Bicyclists lack the protection from the elements and roadway hazards provided by an automobile's structure and safety features. By understanding the unique characteristics and needs of bicyclists, a facility designer can provide quality facilities and minimize user risk.

Bicycle as a Design Vehicle

Similar to motor vehicles, 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 bikeway should consider reasonably expected bicycle types on the facility and utilize the appropriate dimensions.

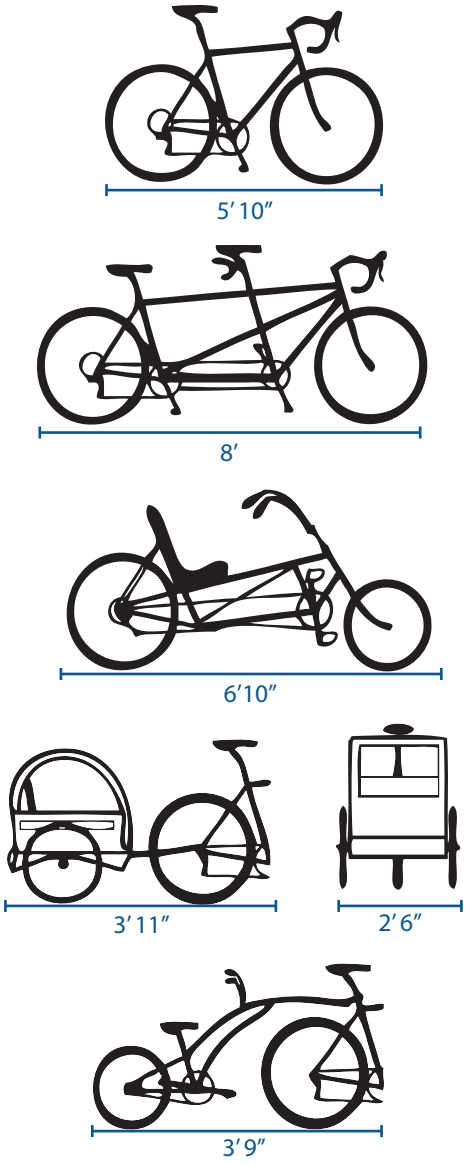
The figure below illustrates the operating space and physical dimensions of a typical adult bicyclist, which are the basis for typical facility design. Bicyclists require clear space to operate within a facility. This is why the minimum operating width is greater than the physical dimensions of the bicyclist. Bicyclists prefer five feet or more operating width, although four feet may be minimally acceptable.

Standard Bicycle Rider Dimensions



Source: AASHTO Guide for the Development of Bicycle Facilities, 4th Edition. 2012.

In addition to the design dimensions of a typical bicycle, there are many other commonly used pedal-driven cycles and accessories to consider when planning and designing bicycle facilities. The most common types include tandem bicycles, recumbent bicycles, and trailer accessories. The figure and table below summarize the typical dimensions for bicycle types.



Bicycle as Design Vehicle - Typical Dimensions

Source: AASHTO *Guide for the Development of Bicycle Facilities*, 4th Edition *AASHTO does not provide typical dimensions for tricycles.

Bicycle as Design Vehicle - Typical Dimensions

Bicycle Type	Feature	Typical Dimensions
Upright Adult Bicyclist	Physical width	2 ft 6 in
	Operating width (Minimum)	4 ft
	Operating width (Preferred)	5 ft
	Physical length	5 ft 10 in
	Physical height of handlebars	3 ft 8 in
	Operating height	8 ft 4 in
	Eye height	5 ft
	Vertical clearance to obstructions (tunnel height, lighting, etc)	10 ft
	Approximate center of gravity	2 ft 9 in - 3 ft 4 in
Recumbent Bicyclist	Physical length	8 ft
	Eye height	3 ft 10 in
Tandem Bicyclist	Physical length	8 ft
Bicyclist with child trailer	Physical length	10 ft
	Physical width	2 ft 6 in

Design Speed Expectations

The expected speed that different types of bicyclists can maintain under various conditions also influences the design of facilities such as shared use paths. The table to the right provides typical bicyclist speeds for a variety of conditions.

Bicycle as Design Vehicle - Design Speed Expectations

Bicycle Type	Feature	Typical Speed
Upright Adult Bicyclist	Paved level surfacing	15 mph
	Crossing Intersections	10 mph
	Downhill	30 mph
	Uphill	5 -12 mph
Recumbent Bicyclist	Paved level surfacing	18 mph

*Tandem bicycles and bicyclists with trailers have typical speeds equal to or less than upright adult bicyclists.

Types of Bicyclists

It is important to consider bicyclists of all skill levels when creating a non-motorized plan or project. Bicyclist skill level greatly influences expected speeds and behavior, both in separated bikeways and on shared roadways. Bicycle infrastructure should accommodate as many user types as possible, with decisions for separate or parallel facilities based on providing a comfortable experience for the greatest number of people.

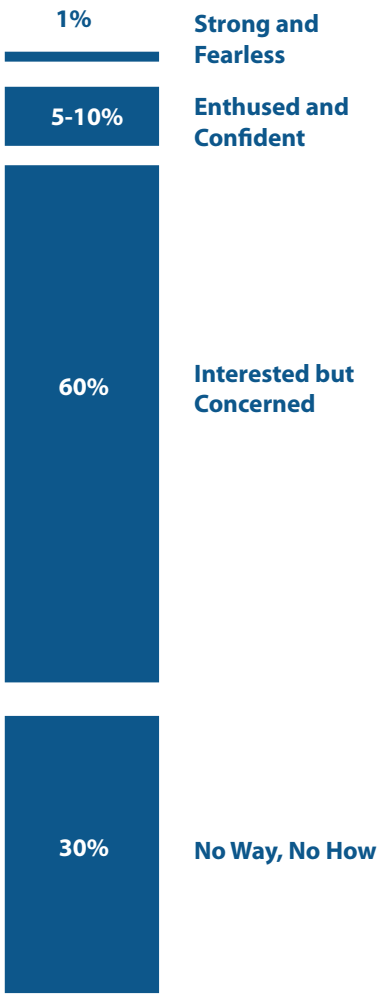
The bicycle planning and engineering professions currently use several systems to classify the population which can assist in understanding the characteristics and infrastructure preferences of different bicyclists. The current AASHTO Guide to the Development of Bicycle Facilities encourages designers to identify their rider type based on the trip purpose (Recreational vs Transportation) and on the level of comfort and skill of the rider (Causal vs Experienced). A more detailed framework for understanding of the US population's relationship to transportation focused bicycling is illustrated in the figure below. Developed by planners in Portland, OR[1] and supported by research[2], this classification provides the following alternative categories to address varying attitudes towards bicycling in the US:

- **Strong and Fearless** (approximately 1% of population) – Characterized by bicyclists that will typically ride anywhere regardless of roadway conditions or weather. These bicyclists can ride faster than other user types, prefer direct routes and will typically choose roadway connections -- even if shared with vehicles -- over separate bicycle facilities such as shared use paths.

- **Enthused and Confident** (5-10% of population) - This user group encompasses bicyclists who are fairly comfortable riding on all types of bikeways but usually choose low traffic streets or shared use paths when available. These bicyclists may deviate from a more direct route in favor of a preferred facility type. This group includes all kinds of bicyclists such as commuters, recreationalists, racers and utilitarian bicyclists.

- **Interested but Concerned** (approximately 60% of population) – This user type comprises the bulk of the cycling population and represents bicyclists who typically only ride a bicycle on low traffic streets or shared use paths under favorable weather conditions. These bicyclists perceive significant barriers to their increased use of cycling, specifically traffic and other safety issues. These people may become "Enthused & Confident" with encouragement, education and experience.

- **No Way, No How** (approximately 30% of population) – Persons in this category are not bicyclists, and perceive severe safety issues with riding in traffic. Some people in this group may eventually become more regular cyclists with time and education. A significant portion of these people will not ride a bicycle under any circumstances.



Typical Distribution of Bicyclist Types

1 *Roger Geller, City of Portland Bureau of Transportation. Four Types of Cyclists. http://www.portlandonline.com/transportation/index.cfm?&a=237507. 2009.*

2 Dill, J., McNeil, N. *Four Types of Cyclists? Testing a Typology to Better Understand Bicycling Behavior and Potential.* 2012.

Bicycle Facility Selection Guidelines

The specific bicycle facility type that should be provided depends on the surrounding environment (e.g. auto speed and volume, topography, and adjacent land use) and expected bicyclist needs (e.g. bicyclists commuting on a highway versus students riding to school on residential streets).

Facility Selection Guidelines

There are no 'hard and fast' rules for determining the most appropriate type of bicycle facility for a particular location – roadway speeds, volumes, right-of-way width, presence of parking, adjacent land uses, and expected bicycle user types are all critical elements of this decision. Studies find that the most significant factors influencing bicycle use are motor vehicle traffic volumes and speeds. Additionally, most bicyclists prefer facilities separated from motor vehicle traffic or located on local roads with low motor vehicle traffic speeds and volumes. Because off-street pathways are physically separated from the roadway, they are perceived as safe and attractive routes for bicyclists who prefer to avoid motor vehicle traffic. Consistent use of treatments and application of bikeway facilities allow users to anticipate whether they would feel comfortable riding on a particular facility, and plan their trips accordingly. This section provides guidance on various factors that affect the type of facilities that should be provided.


Facility Classification


Facility Continua


Bicycle Facility Contextual Guidance

Facility Classification

Description

Consistent with bicycle facility classifications throughout the nation, these Bicycle Facility Design Guidelines identify the following classes of facilities by degree of separation from motor vehicle traffic.

Shared roadways are bikeways where bicyclists and cars operate within the same travel lane, either side by side or in single file depending on roadway configuration. The most basic type of bikeway is a signed shared roadway. This facility provides continuity with other bicycle facilities (usually bike lanes), or designates preferred routes through high-demand corridors.

Shared roadways may also be designated by pavement markings, signage and other treatments including directional signage, traffic diverters, chicanes, chokers and /or other traffic calming devices to reduce vehicle speeds or volumes. Such treatments often are associated with Neighborhood Greenways.

Separated Bikeways, such as bike lanes, use signage and striping to delineate the right-of-way assigned to bicyclists and motorists. Bike lanes encourage predictable movements by both bicyclists and motorists.

Protected Bicycle Lanes are exclusive bike facilities that combine the user experience of a separated path with the on-street infrastructure of conventional bike lanes.

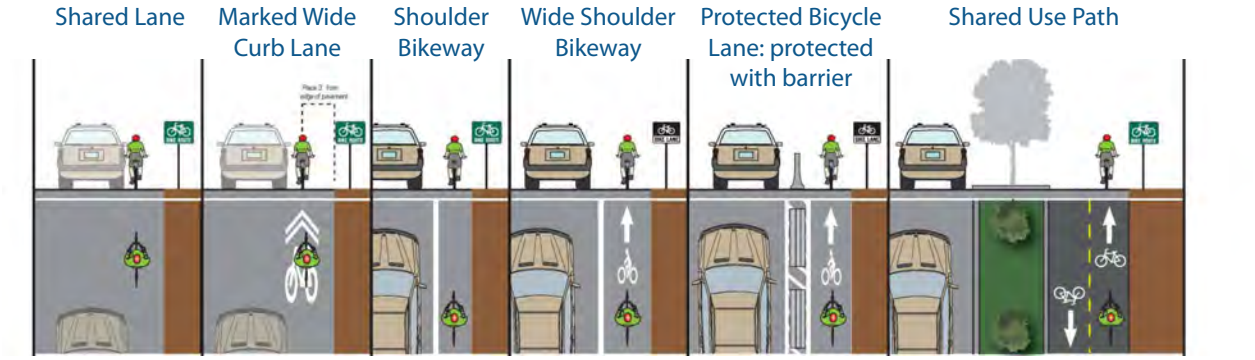
Shared Use Paths are facilities separated from roadways for use by bicyclists and pedestrians.

Facility Continua

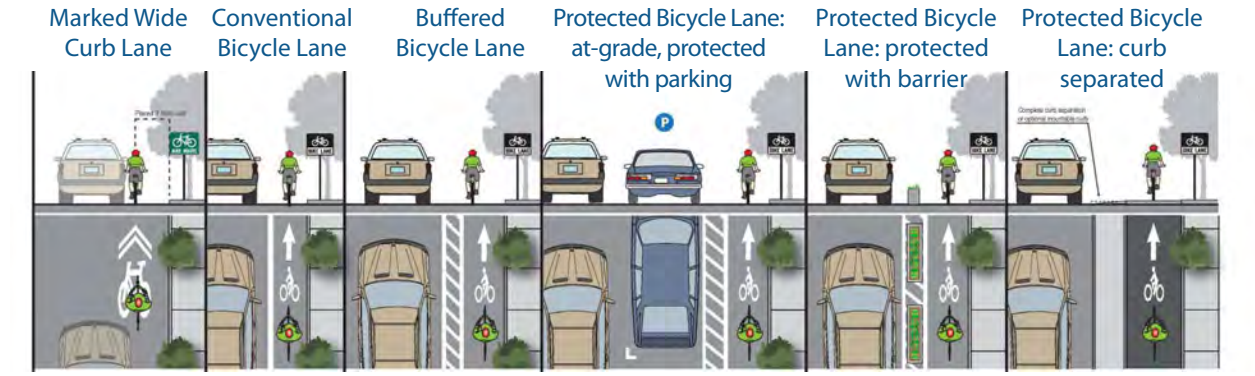
The following continua illustrate the range of bicycle facilities applicable to various roadway environments, based on the roadway type and desired degree of separation. Engineering judgment, traffic studies, previous municipal planning efforts, community input and local context should be used to refine criteria when developing bicycle facility recommendations for a particular street. In some corridors, it may be desirable to construct facilities to a higher level of treatment than those recommended in relevant planning documents in order to enhance user safety and comfort. In other cases, existing and/or future motor vehicle speeds and volumes may not justify the recommended level of separation, and a less intensive treatment may be acceptable.

Least Protected → Most Protected

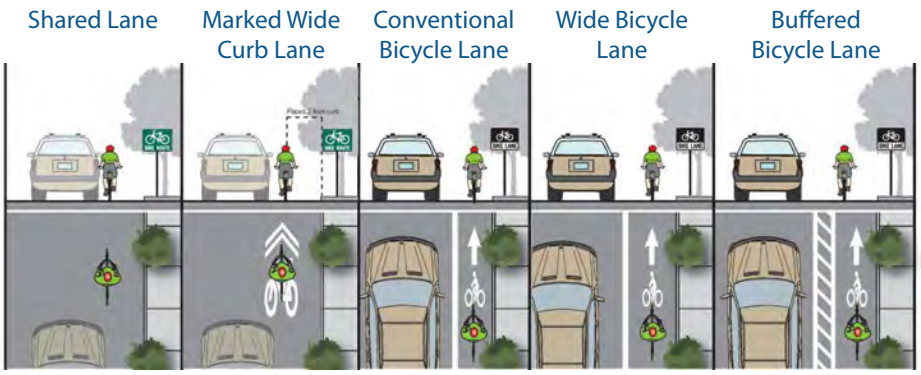
Arterial/Highway Bikeway Continuum (without curb and gutter)



Arterial/Highway Bikeway Continuum (with curb and gutter)



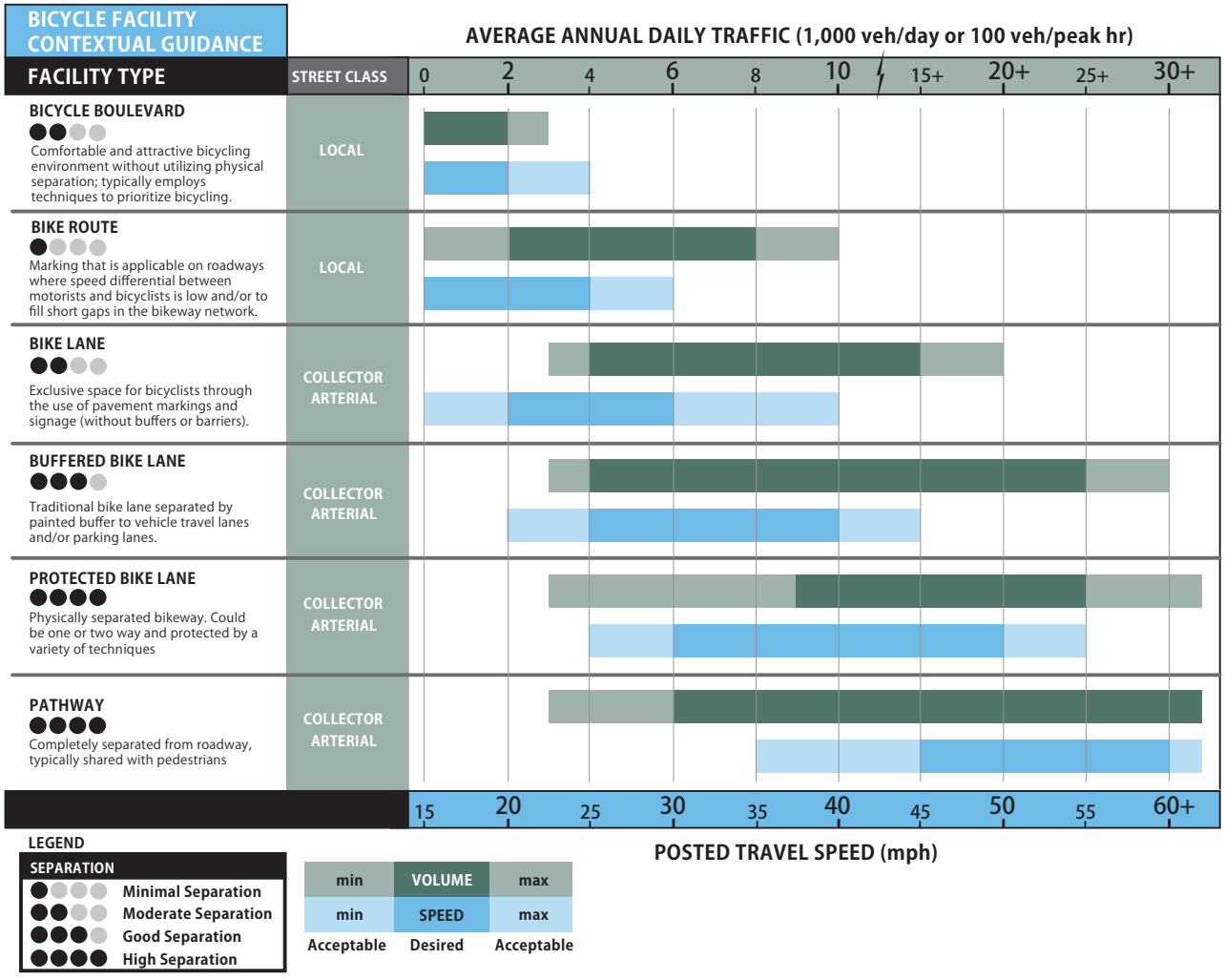
Collector Bikeway Continuum



Bicycle Facility Contextual Guidance

Selecting the best bikeway facility type for a given roadway can be challenging, due to the range of factors that influence bicycle users' comfort and safety. There is a significant impact on cycling comfort when the speed differential between bicyclists and motor vehicle traffic is high and motor vehicle traffic volumes are high. As a starting point to identify a preferred facility, the chart below can be used to determine the recommended type of bikeway to be provided in particular roadway speed and volume situations. To use this chart, identify the appropriate daily traffic volume and travel speed on or the existing or proposed roadway, and locate the facility types indicated by those key variables.

Other factors beyond speed and volume which affect facility selection include traffic mix of automobiles and heavy vehicles, the presence of on-street parking, intersection density, surrounding land use, and roadway sight distance. These factors are not included in the facility selection chart below, but should always be considered in the facility selection and design process.



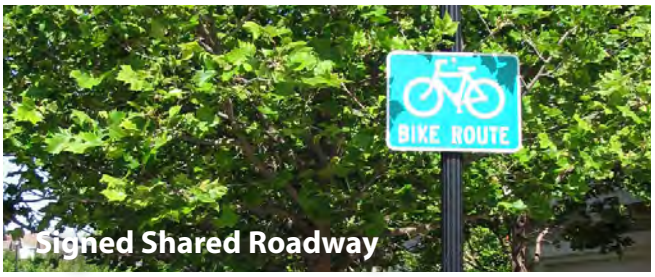
Shared Roadways

On shared roadways, bicyclists and motor vehicles use the same roadway space. These facilities are typically used on roads with low speeds and traffic volumes, however they 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.

Shared roadways employ a large variety of treatments from simple signage and shared lane markings to more complex treatments including directional signage, traffic diverters, chicanes, chokers, and/or other traffic calming devices to reduce vehicle speeds or volumes.

Neighborhood Greenways

Neighborhood greenways are a special class of shared roadways designed for a broad spectrum of bicyclists. They are low-volume local streets where motorists and bicyclists share the same travel lane. Treatments for neighborhood greenways are selected as necessary to create appropriate automobile volumes and speeds, and to provide safe crossing opportunities of busy streets.



Signed Shared Roadway


Marked Shared Roadway


Shared Roadways with Diagonal Parking


Neighborhood Greenways

Signed Shared Roadway

Description

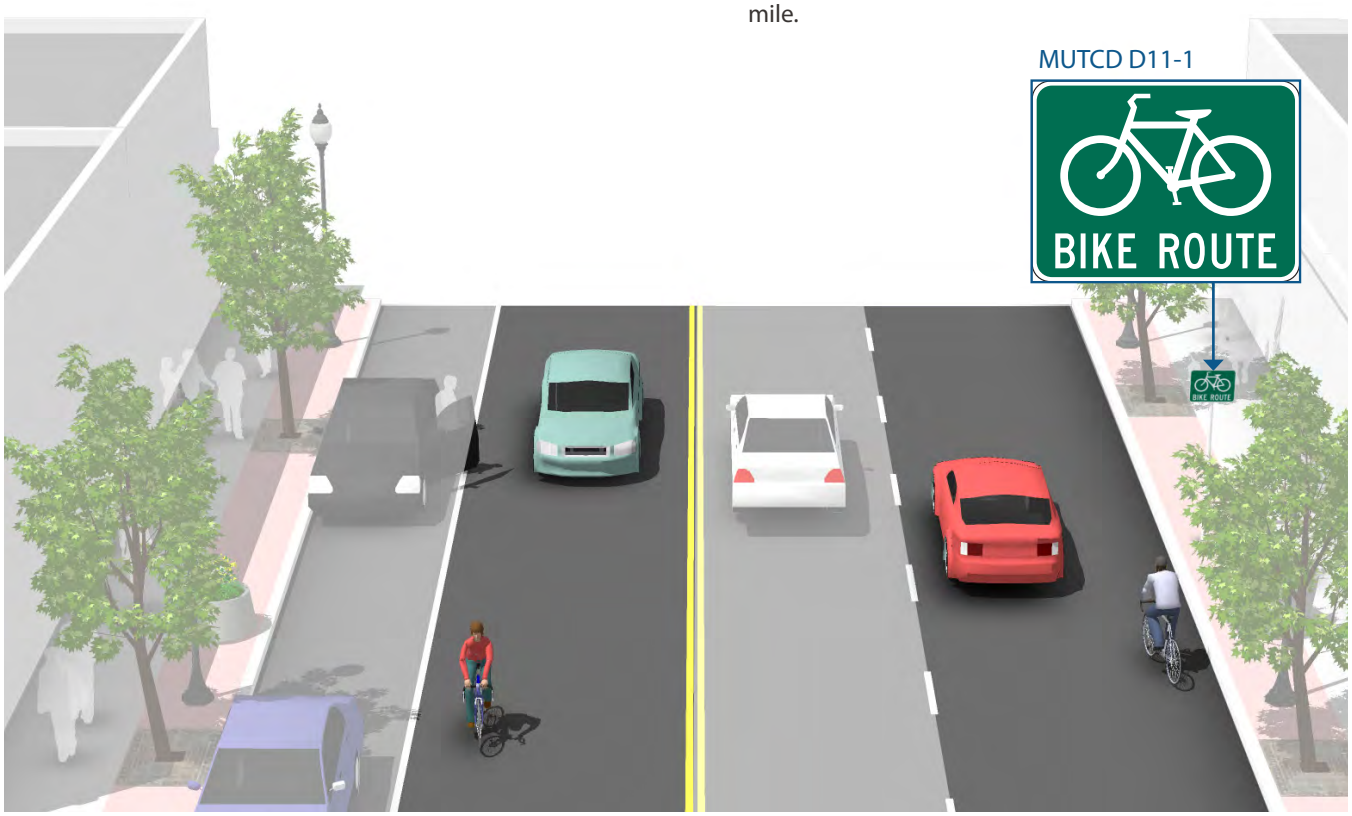
Signed shared roadways are facilities shared with motor vehicles. They are typically used on roads with low speeds and traffic volumes, however can be used on higher volume roads with wide outside lanes or shoulders. A motor vehicle driver will usually have to cross over into the adjacent travel lane to pass a bicyclist, unless a wide outside lane or shoulder is provided.

Guidance

Lane width varies depending on roadway configuration.

Bike route signage (D11-1) should be applied at intervals frequent enough to keep bicyclists informed of changes in route direction and to remind motorists of the presence of bicyclists. Commonly, this includes placement at:

- Beginning or end of Bicycle Route.
- At major changes in direction or at intersections with other bicycle routes.
- At intervals along bicycle routes not to exceed ½ mile.



Discussion

Signed Shared Roadways serve either to provide continuity with other bicycle facilities (usually bike lanes) or to designate preferred routes through high-demand corridors.

This configuration differs from a neighborhood greenway due to a lack of traffic calming, wayfinding, pavement markings and other enhancements designed to provide a higher level of comfort for a broad spectrum of users.

Additional References and Guidelines

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

Materials and Maintenance

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

Marked Shared Roadway

Description

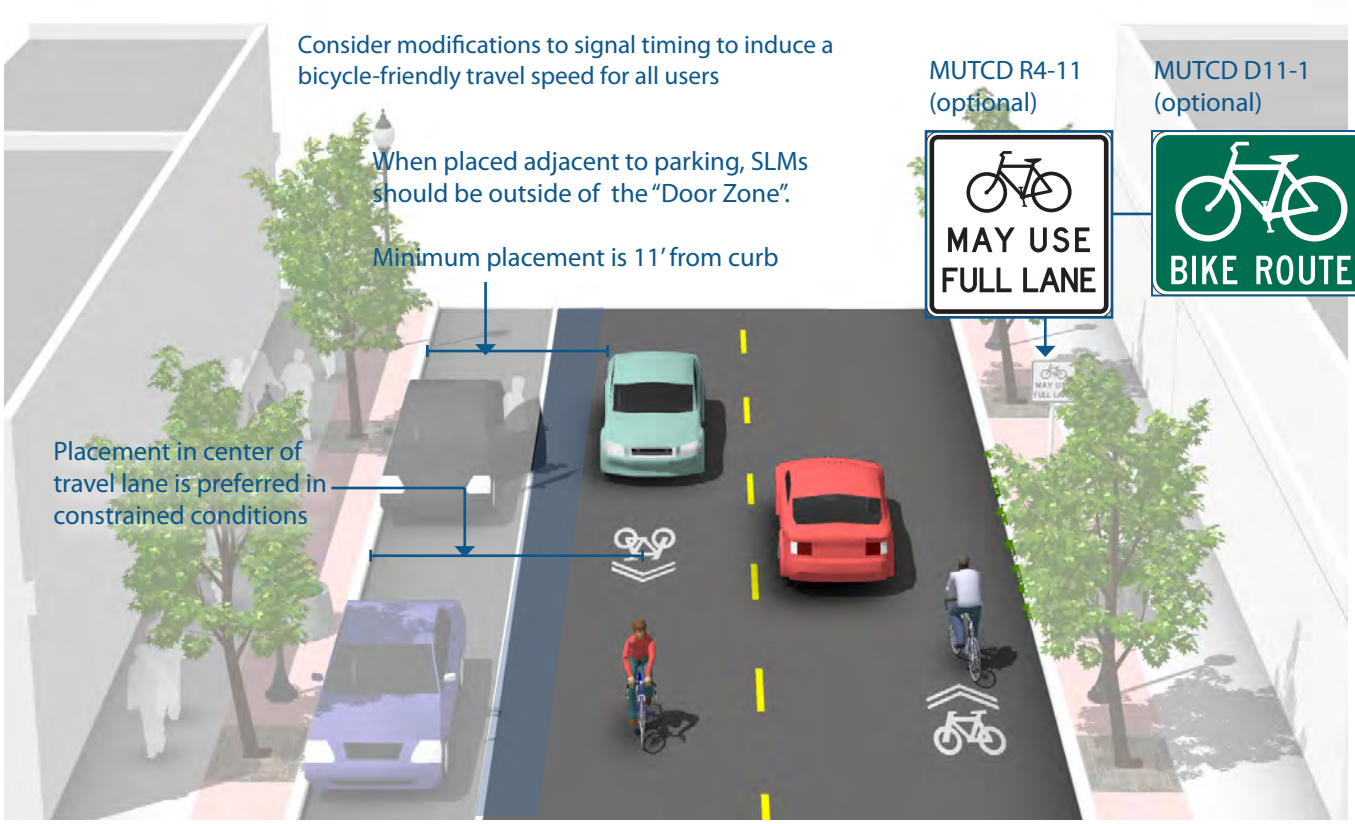
A marked shared roadway is a general purpose travel lane marked with shared lane markings (SLM) used to encourage bicycle travel and proper positioning within the lane.

In constrained conditions, the SLMs are placed in the middle of the lane. On a wide outside lane, the SLMs can be used to promote bicycle travel to the right of motor vehicles.

In all conditions, SLMs should be placed outside of the door zone of parked cars.

Guidance

- May be used on streets with a speed limit of 35 mph or under. Lower than 30 mph speed limit preferred.
- In constrained conditions, preferred placement is in the center of the travel lane to minimize wear and promote single file travel.
- Minimum placement of SLM marking centerline is 11 feet from edge of curb where on-street parking is present, 4 feet from edge of curb with no parking. If parking lane is wider than 7.5 feet, the SLM should be moved further out accordingly.



Discussion

If collector or arterial, this should not be a substitute for dedicated bicycle facilities if space is available.

Bike Lanes should be considered on roadways with outside travel lanes wider than 15 feet, or where other lane narrowing or removal strategies may provide adequate road space. SLMs shall not be used on shoulders, in designated bike lanes, or to designate bicycle detection at signalized intersections. (MUTCD 9C.07)

Additional References and Guidelines

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

Materials and Maintenance

Placing SLMs between vehicle tire tracks will increase the life of the markings and minimize the long-term cost of the treatment.

Shared Roadway Adjacent to Diagonal Parking

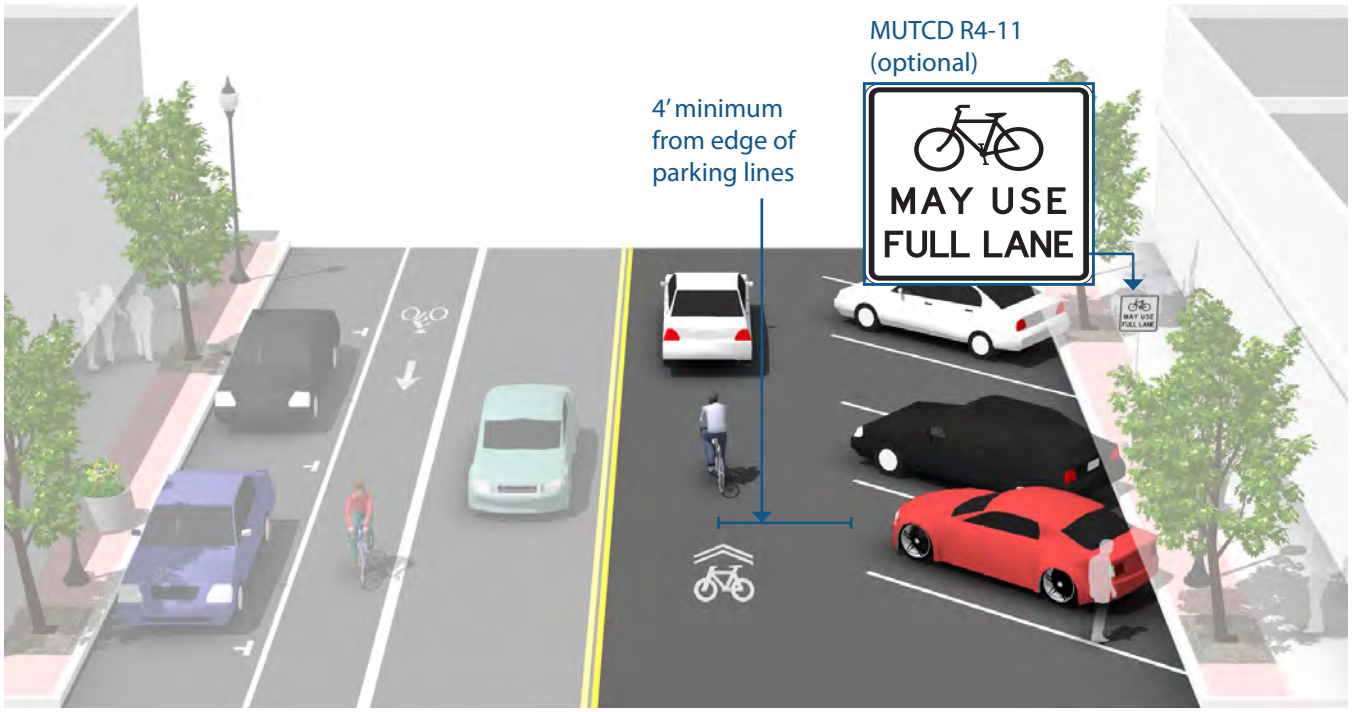
Description

In certain areas with high parking demand such as urban commercial areas, diagonal parking can be used to increase parking supply.

Back-in diagonal parking improves sight distance between drivers and bicyclists when compared to conventional head-in diagonal parking. Back-in diagonal parking provides additional benefits to vehicles including loading and unloading of the trunk at the curb rather than in the street, passengers (including children) are directed by open doors towards the curb; there is also no door conflict with bicyclists.

Guidance

- In constrained conditions, preferred placement is in the center of the travel lane to minimize wear and promote single file travel.
- Minimum placement of SLM marking centerline is 4 feet from the edge of parking lines.



Discussion

Conventional front-in diagonal parking is not compatible or recommended in conjunction with high levels of bicycle traffic as drivers backing out of conventional diagonal parking have poor visibility of approaching bicyclists.

While there may be a learning curve for some drivers, using back-in diagonal parking is typically an easier maneuver than conventional parallel parking.

Additional References and Guidelines

There is no currently adopted Federal or State guidance for this treatment.

Materials and Maintenance

Paint can wear more quickly in high traffic areas or in winter climates.

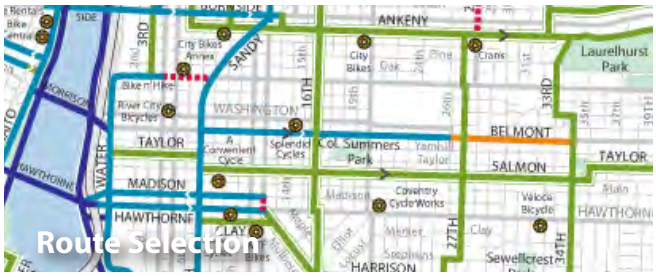
Bicycle Boulevard

Bicycle Boulevards (sometimes known as Neighborhood Greenways) are low-volume, low-speed streets modified to enhance bicyclist by using treatments such as signage, pavement markings, traffic calming and/or traffic reduction, and intersection modifications. These treatments allow through movements of bicyclists while discouraging similar through-trips by non-local motorized traffic.

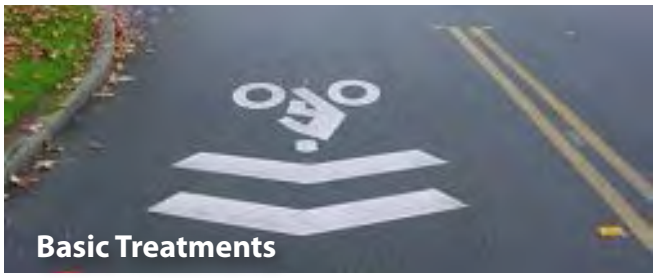
Jurisdictions throughout the country use a wide variety of strategies to determine where specific treatments are applied. While no federal guidelines exist, several best practices have emerged for the development of neighborhood greenways. At a minimum, neighborhood greenways should include distinctive pavement markings and wayfinding signs. They can also use combinations of traffic calming, traffic diversion, and intersection treatments to improve the bicycling environment. The appropriate level of treatment to apply is dependent on roadway conditions, particularly motor vehicle speeds and volumes.

Traffic conditions on neighborhood greenways should be monitored to provide guidance on when and where treatments should be implemented. When motor vehicle speeds and volumes or bicyclist delay exceed the preferred limits, additional treatments should be considered for the neighborhood greenway.


Bicycle Boulevard



Route Selection


Basic Treatments

Traffic Calming

Traffic Diversion


Intersection Treatments

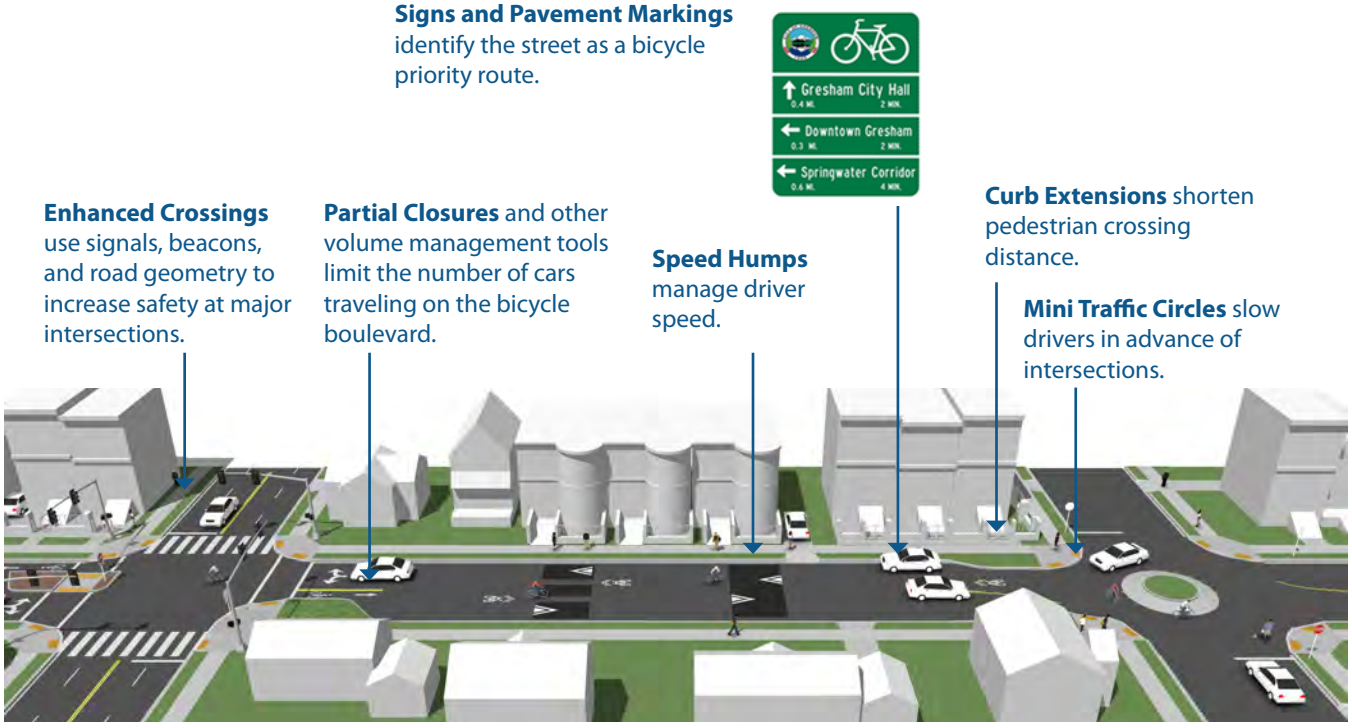
Bicycle Boulevard

Description

Bicycle boulevards are low-volume, low-speed streets modified to enhance bicyclist comfort by using treatments such as signage, pavement markings, traffic calming and/or traffic reduction, and intersection modifications. These treatments allow through movements of bicyclists while discouraging similar through-trips by non-local motorized traffic.

Guidance

- Signs and pavement markings are the minimum treatments necessary to designate a street as a bicycle boulevard.
- Bicycle boulevards should have a maximum posted speed of 25 mph. Use traffic calming to maintain an 85th percentile speed below 22 mph.
- Implement volume control treatments based on the context of the bicycle boulevard, using engineering judgment. Target motor vehicle volumes range from 1,000 to 3,000 vehicles per day.
- Intersection crossings should be designed to enhance safety and minimize delay for bicyclists.



Discussion

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.

Additional References and Guidelines

Alta Planning + Design and IBPI. *Bicycle Boulevard Planning and Design Handbook*. 2009.
BikeSafe. *Bicycle countermeasure selection system.*
Ewing, Reid. *Traffic Calming: State of the Practice.* 1999.
Ewing, Reid and Brown, Steven. *U.S. Traffic Calming Manual.* 2009.

Materials and Maintenance

Vegetation should be regularly trimmed to maintain visibility and attractiveness.

Route Selection

Description

Neighborhood greenways should be developed on streets that improve connectivity to key destinations and provide a direct route for bicyclists. Local streets with existing traffic calming, traffic diversions, or signalized crossings of major streets are good candidates, as they tend to be existing bicycle routes and have low motor vehicle speeds and volumes. Other streets where residents have expressed a desire for traffic calming are also good options.

Neighborhood greenways parallel to commercial streets improve access for "interested but concerned" bicyclists and complement bike lanes on major roadways.

Guidance

- Streets are signed at 25 mph or less to improve the bicycling environment and decrease the risk and severity of crashes.
- Traffic volumes are limited to 3,000 vehicles per day (ideally less than 1,500) to minimize passing events and potential conflicts with motor vehicles.
- Use of streets that parallel major streets can discourage non-local motor vehicle traffic without significantly impacting motorists.
- Use of streets where a relatively continuous route for bicyclists exists and/or where treatments can provide wayfinding and improve crossing opportunities at offset intersections.
- Use of streets where bicyclists have right-of-way at intersections or where right-of-way is possible to assign to bicyclists.

In Portland, OR, the bicycle network includes a high density of neighborhood greenways parallel to streets with bike lanes.

Discussion

Neighborhood greenways should form a continuous network of streets or off-street facilities that accommodate bicyclists who are less willing to ride on streets with motorized traffic. Most neighborhood greenways are located on residential streets, though they can also be on commercial or industrial streets. Due to the presence of trucks and commercial vehicles, as well as the need to maintain good traffic flow and retain motor vehicle parking, neighborhood greenways on commercial or industrial streets can tolderate higher automobile speeds and volumes than would be desired on neighborhood streets. Vertical traffic calming can minimize impacts to large vehicles and parking.

Additional References and Guidelines

Alta Planning + Design and IBPI. *Bicycle Boulevard Planning and Design Handbook.* 2009.
City of Berkeley. *Bicycle Boulevard Design Tools and Guidelines.* 2000.
City of Emeryville. *Bicycle Boulevard Treatments.* 2011.

Materials and Maintenance

Repaving, street sweeping and other maintenance should occur with higher frequency than on other local streets.

Basic Treatments

Description

Signs and pavement markings are the minimum treatments necessary to designate a street as a neighborhood greenway. Together, they visibly designate a roadway to both bicyclists and motorists. Signs, and in some cases pavement markings, provide wayfinding to help bicyclists remain on the designated route.

Guidance

Pavement Markings

Place symbols every 250-800 feet along a linear corridor, as well as after every intersection.

On narrow streets where a motor vehicle cannot pass a bicyclist within one lane of traffic, place stencils in the center of the travel lane.

See Marked Shared Roadway guidance for additional information on the use of shared lane markings.

A bicycle symbol can be placed on a standard road sign, along with distinctive coloration.

Signs

See Bikeway Signing for guidance on developing bicycle wayfinding signage. Some cities have developed unique logos or colors for wayfinding signs that help brand their neighborhood greenways.

Be consistent in content, design, and intent; colors reserved by the Manual on Uniform Traffic Devices (MUTCD) for regulatory and warning road signs are not recommended.

Signs can include information about intersecting bikeways and distance/time information to key destinations.

Discussion

Wayfinding signs displaying destinations, distances, and "riding time" can dispel common misperceptions about time and distance while increasing users' comfort and accessibility to the neighborhood greenway network. Neighborhood greenways frequently include offset intersections or 'jog' onto another street. Signs and pavement markings can help bicyclists remain on the route. In addition, fewer businesses or services are located along local streets, and signs inform bicyclists of the direction to key destinations, including commercial districts, transit hubs, schools and universities, and other bikeways.

Additional References and Guidelines

City of Milwaukie. *Milwaukie Bicycle Wayfinding Signage Plan.* 2009.
City of Oakland. *Design Guidelines for Bicycle Wayfinding Signage.* 2009.
NACTO. *Urban Bikeway Design Guide.* 2012.
PennDOT. *Pavement Markings and Signing Standards TC-8600 and TC-8700 Series*. 2013

Materials and Maintenance

Pavement markings should be repainted and signs replaced as needed. Wayfinding signs should be regularly updated with new major destinations and bikeways.

Vertical Traffic Calming

Description

Motor vehicle speeds affect the frequency at which automobiles pass bicyclists as well as the severity of crashes that can occur. Maintaining motor vehicle speeds closer to those of bicyclists' greatly improves bicyclists' comfort on a street. Slower vehicular speeds also improve motorists' ability to see and react to bicyclists and minimize conflicts at driveways and other turning locations.

Vertical speed control measures are composed of slight rises in the pavement, on which motorists and bicyclists must reduce speed to cross.

Speed Hump

Offset Speed Hump

Temporary Speed Cushion

Raised Crosswalk

Guidance

- Neighborhood greenways should have a maximum posted speed of 25 mph. Use traffic calming to maintain an 85th percentile speed below 22 mph.
- Speed humps are raised areas usually placed in a series across both travel lanes. A 14' long hump reduces impacts to emergency vehicles. Speed humps can be challenging for bicyclists, gaps can be provided in the center or by the curb for bicyclists and to improve drainage. Speed humps can also be offset to accommodate emergency vehicles.
- Speed lumps or cushions have gaps to accommodate the wheel tracks of emergency vehicles.
- Speed tables are longer than speed humps and flat-topped. Raised crosswalks are speed tables that are marked and signed for a pedestrian crossing.
- For all vertical traffic calming, slopes should not exceed 1:10 or be less steep than 1:25. Tapers should be no greater than 1:6 to reduce the risk of bicyclists losing their balance. The vertical lip should be no more than a 1/4" high.

Discussion

Emergency vehicle response times should be considered where vertical deflection is used. Because emergency vehicles have a wider wheel base than passenger cars, speed lumps/cushions allow them to pass unimpeded while slowing most other traffic. Alternatively, speed tables are recommended because they cannot be straddled by a truck, decreasing the risk of bottoming out. Traffic calming can also deter motorists from driving on a street. Monitor vehicle volumes on adjacent streets to determine whether traffic calming results in inappropriate volumes. Traffic calming can be implemented on a trial basis.

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.
Alta Planning+Design & IBPI. *Bicycle Boulevard Planning & Design Handbook.* 2009.
BikeSafe. *Bicycle countermeasure selection system.*
Ewing, Reid. *Traffic Calming: State of the Practice.* 1999.
Ewing, Reid and Brown, Steven. *U.S. Traffic Calming Manual.* 2009.
NACTO. *Urban Street Design Guide.* 2013.
PennDOT. *Pennsylvania's Traffic Calming Handbook.* 2012.

Materials and Maintenance

Traffic calming should be designed to minimize impacts to snowplows. Vegetation should be regularly trimmed to maintain visibility and attractiveness.

Horizontal Traffic Calming

Description

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.

Guidance

- Maintain a minimum clear width of 20 feet (or 28 feet with parking on both sides), with a constricted length of at least 20 feet in the direction of travel.
- 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.
- Pinchponts 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.
- Traffic circles are raised or delineated islands placed at intersections that reduce vehicle speeds by narrowing turning radii and the travel lane. Traffic circles can also include a paved apron to accommodate the turning radii of larger vehicles like fire trucks or school buses.

Temporary Curb Extension

Chicane

Choker or Neckdown

Pinchpoint with Bicycle Access

Discussion

Horizontal speed control measures should not infringe on bicycle space. Where possible, provide a bicycle route outside of the element so bicyclists can avoid having to merge into traffic at a narrow pinch point. This technique can also improve drainage flow and reduce construction and maintenance costs. Traffic calming can also deter motorists from driving on a street. Monitor vehicle volumes on adjacent streets to determine whether traffic calming results in inappropriate volumes. Traffic calming can be implemented on a trial basis.

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.
Alta Planning+Design & IBPI. *Bicycle Boulevard Planning & Design Handbook.* 2009.
BikeSafe. *Bicycle countermeasure selection system.*
Ewing, Reid. *Traffic Calming: State of the Practice.* 1999.
Ewing, Reid and Brown, Steven. *U.S. Traffic Calming Manual.* 2009.
NACTO. *Urban Street Design Guide.* 2013.
PennDOT. *Pennsylvania's Traffic Calming Handbook.* 2012.

Materials and Maintenance

Traffic calming should be designed to minimize impacts to snowplows. Vegetation should be regularly trimmed to maintain visibility and attractiveness.

Traffic Diversion

Description

Motor vehicle traffic volumes affect the operation of a neighborhood greenway. Higher vehicle volumes reduce bicyclists' comfort and can result in more conflicts.

Implement volume control treatments based on the context of the neighborhood greenway, using engineering judgment. Target motor vehicle volumes range from 1,000 to 3,000 vehicles per day, above which the route should be striped as a bike lane or considered a signed shared roadway.

Partial Closure

Diagonal Diverter


Median Diverter


Full Closure

Guidance

- Traffic diversion treatments reduce motor vehicle volumes by completely or partially restricting through traffic on a neighborhood greenway.
- Partial closures allow full bicycle passage while restricting vehicle access to one way traffic at that point.
- Diagonal diverters require all motor vehicle traffic to turn.

Median diverters (see Major Intersection Treatments) restrict through motor vehicle movements while providing a refuge for bicyclists to cross in two stages.

- Street closures create a "T" that blocks motor vehicles from continuing on a neighborhood greenway, while bicycle travel can continue unimpeded. Full closures can accommodate emergency vehicles with the use of mountable curbs (maximum of six inches high).

Discussion

Neighborhood greenways on streets with volumes higher than 3,000 vehicles per day are not recommended, although a segment of a neighborhood greenway may accommodate more traffic for a short distance if necessary to complete the corridor. Providing additional separation with a bike lane, protected bike lane, or other treatment is recommended where traffic calming or diversion cannot reduce volumes below this threshold.

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.
Alta Planning+Design & IBPI. *Bicycle Boulevard Planning & Design Handbook.* 2009.
Ewing, Reid. *Traffic Calming: State of the Practice.* 1999.
Ewing, Reid and Brown, Steven. *U.S. Traffic Calming Manual.* 2009.
Oregon Department of Transportation. *Right-In Right-Out Channelization*. 1998.
PennDOT. *Pennsylvania's Traffic Calming Handbook*. 2012.

Materials and Maintenance

Depending on the diverter type, these treatments can be challenging to keep clear of snow and debris. Vegetation should be regularly trimmed to maintain visibility and attractiveness.

Minor Intersection Treatments

Description

Treatments at minor roadway intersections are designed to improve the visibility of a neighborhood greenway, raise awareness of motorists on the cross-street that they are likely to encounter bicyclists, and enhance safety for all road users.

Guidance

- On the neighborhood greenway, the majority of intersections with minor roadways should stop-control cross traffic to minimize bicyclist delay. This will maximize bicycling efficiency.

Traffic circles are a type of horizontal traffic calming that can be used at minor street intersections. Traffic circles reduce conflict potential and severity while providing traffic calming to the corridor.

- If a stop sign is present on the neighborhood greenway, a second stop bar for bicyclists can be placed closer to the centerline of the cross street than the motorists' stop bar to increase the visibility of bicyclists waiting to cross the street.
- Curb extensions can be used to move bicyclists closer to the centerline to improve visibility and encourage motorists to let them cross.

Stop Signs on Cross-Street


Traffic Circles


Bicycle Forward Stop Bar


Curb Extension

Discussion

Stop signs increase bicycling time and energy expenditure, frequently leading to non-compliance by bicyclists and motorists, and/or use of other less desirable routes. Neighborhood greenways should have fewer stops or delays than other local streets. A typical bicycle trip of 30 minutes can increase to 40 minutes if there is a STOP sign at every block (*Berkeley Bicycle Boulevard Design Tools and Guidelines*). If several stop signs are turned along a corridor, speeds should be monitored and traffic-calming treatments used to reduce excessive vehicle speeds on the neighborhood greenway.

Additional References and Guidelines

City of Berkeley. *Bicycle Boulevard Design Tools and Guidelines.* 2000.
City of London Transport for London. *Advanced stop lines (ASLS) background and research studies.*
Transportation Research Board. *Improving Pedestrian Safety at Unsignalized Crossings.* NCHRP Report # 562. 2006.
PennDOT. *Pennsylvania's Traffic Calming Handbook.* 2012.

Materials and Maintenance

Vegetation in traffic circles and curb extensions should be regularly trimmed to maintain visibility and attractiveness. Repaint bicycle stop bars as needed.

Major Intersection Treatments

Description

The quality of treatments at major street crossings can significantly affect a bicyclist's choice to use a neighborhood greenway, as opposed to another road that provides a crossing treatment.

Guidance

- Bike boxes increase bicyclist visibility to motorists and reduce the danger of right "hooks" by providing a space for bicyclists to wait at signalized intersections.
- Median islands provided at uncontrolled intersections of neighborhood greenways and major streets allow bicyclists to cross one direction of traffic at a time as gaps in traffic occur.
- Hybrid beacons, active warning beacons and bicycle signals can facilitate bicyclists crossing a busy street on which cross-traffic does not stop.
- Select treatments based on engineering judgment; see National Cooperative Highway Research Program (NCHRP) Report # 562 *Improving Pedestrian Safety at Unsignalized Crossings* (2006) for guidance on appropriate use of crossing treatments. Treatments are designed to improve visibility and encourage motorists to stop for pedestrians; with engineering judgement many of the same treatments are appropriate for use along neighborhood greenways.

Bike Box

Median Island

Hybrid Beacon (HAWK)

Rectangular Rapid Flash Beacon (RRFB)

Discussion

Neighborhood greenway 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 neighborhood greenway and compromise safety.

Additional References and Guidelines

Transportation Research Board. *Improving Pedestrian Safety at Unsignalized Crossings.* NCHRP Report # 562. 2006.
Federal Highway Administration. *Safety Effects of Marked Versus Unmarked Crosswalks at Uncontrolled Locations.* FHWA-RD-04-100. 2004.
NACTO. *Urban Bikeway Design Guide.* 2012.

Materials and Maintenance

Maintain signs, markings, and other treatments and replace as needed. Monitor intersections for bicyclist delay to determine if additional treatments are warranted.

Offset Intersection Treatments

Description

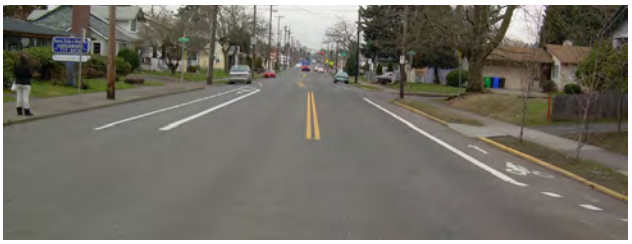
Offset intersections can be challenging for bicyclists who are required to briefly travel along the busier cross street in order to continue along the neighborhood greenway.

Guidance

- Appropriate treatments depend on volume of traffic including turning volumes, traffic speeds and the type of bicyclist using the crossing.
- Contraflow bike lanes allow bicyclists to travel against the flow of traffic on a one-way street and can improve neighborhood greenway connectivity.
- Bicycle left-turn lanes can be painted where a neighborhood greenway is offset to the right on a street that has sufficient traffic gaps. Bicyclists cross one direction of traffic and wait in a protected space for a gap in the other direction. The bike turn pockets should be at least 4 feet wide, with a total of 11 feet for both turn pockets and center striping.
- Short bike lanes on the cross street assist with accessing a neighborhood greenway that jogs to the left. Crossing treatments should be provided on both sides to minimize wrong-way riding.
- A protected bike lane can be provided on one side of a busy street. Bicyclists enter the protected bike lane from the neighborhood greenway to reach the connecting segment of the neighborhood greenway. This maneuver may be signalized on one side.

Contraflow Bike Lane

Left Turn Bike Lanes



Short Bike Lanes on the Cross Street

Protected Bike Lane Connection

Discussion

Because neighborhood greenways are located on local streets, the route is often discontinuous. Wayfinding and pavement markings assist bicyclists with remaining on the route.

Additional References and Guidelines

Hendrix, Michael. *Responding to the Challenges of Bicycle Crossings at Offset Intersections.* Third Urban Street Symposium. 2007.
NACTO. *Urban Bikeway Design Guide.* 2012.

Materials and Maintenance

Paint can wear more quickly in high traffic areas or in winter climates. Facilities should be cleared of snow through routine snow removal operations.

Separated Bikeways

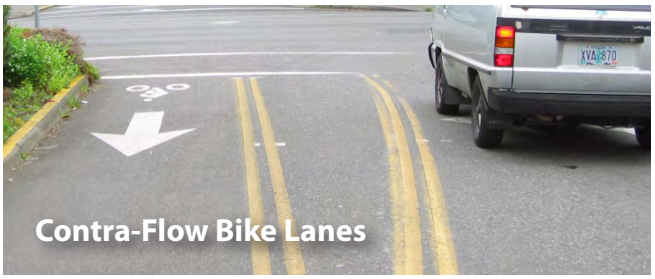
Designated exclusively for bicycle travel, separated bikeways are segregated from vehicle travel lanes by striping, and can include pavement stencils and other treatments. Separated bikeways are most appropriate on arterial and collector streets where higher traffic volumes and speeds warrant greater separation.

Separated bikeways can increase safety and promote proper riding by:

- Defining road space for bicyclists and motorists, reducing the possibility that motorists will stray into the bicyclists' path.
- Discouraging bicyclists from riding on the sidewalk.
- Reducing the incidence of wrong way riding.
- Reminding motorists that bicyclists have a right to the road.


Shoulder Bikeways


Conventional Bicycle Lanes


Contra-Flow Bike Lanes


Uphill Bike Lane Treatments


Buffered Bike Lanes


Advisory Bike Lanes

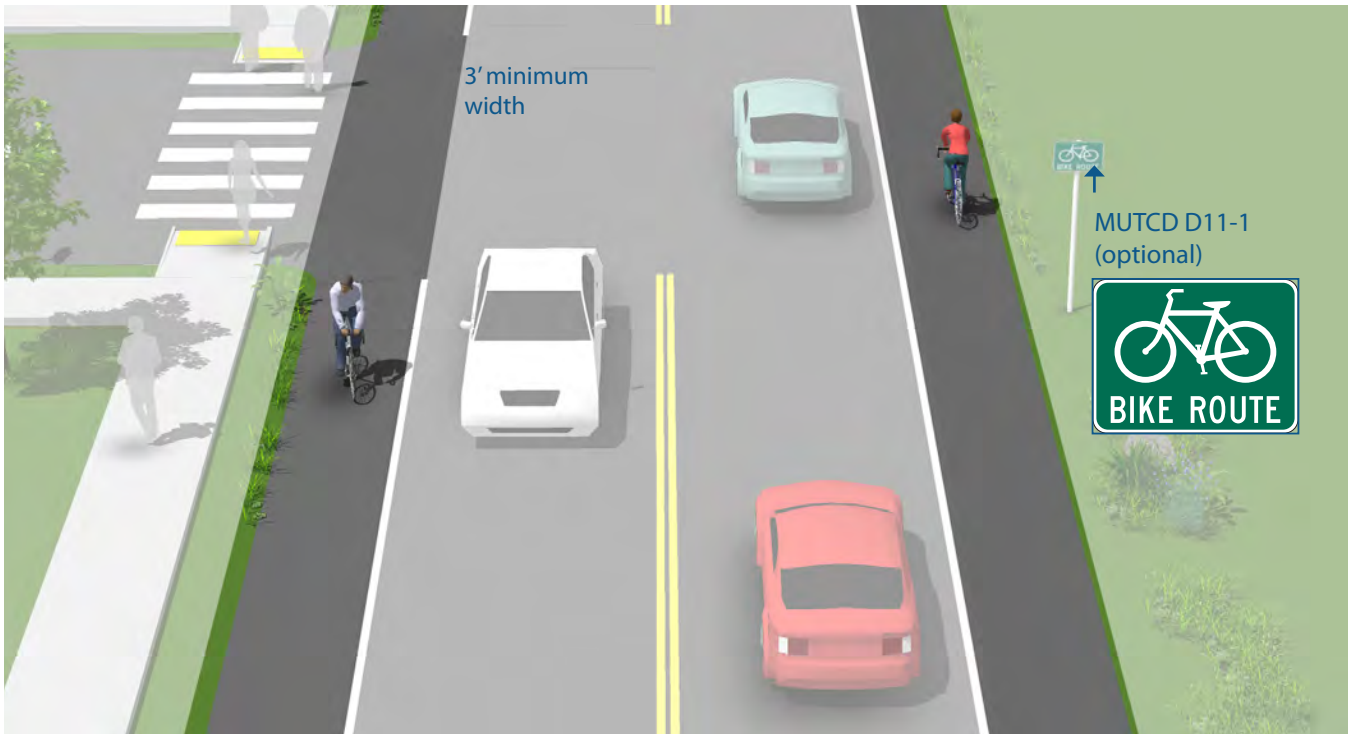
Shoulder Bikeways

Description

Typically found in less-dense areas, shoulder bikeways are paved roadways with striped shoulders (4'+) wide enough for bicycle travel. Shoulder bikeways often, but not always, include signage alerting motorists to expect bicycle travel along the roadway. Shoulder bikeways should be considered a temporary treatment, with full bike lanes planned for construction when the roadway is widened or completed with curb and gutter. This type of treatment is not typical in urban areas and should only be used where constraints exist.

Guidance

- If 4 feet or more is available for bicycle travel, the full bike lane treatment of signs, legends, and an 8" bike lane line would be provided.
- If it is not possible to meet minimum bicycle lane dimensions, a reduced width paved shoulder can still improve conditions for bicyclists on constrained roadways. In these situations, a minimum of 3 feet of operating space should be provided.
- Rumble strips are not recommended on shoulders used by bicyclists unless there is a minimum 4 foot clear path. 12 foot gaps every 40-60 feet should be provided to allow access as needed.



Discussion

A wide outside lane may be sufficient accommodation for bicyclists on streets with insufficient width for bike lanes but which do have space available to provide a wider (14'-16') outside travel lane. Consider configuring as a marked shared roadway in these locations.

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.
FHWA. *Manual on Uniform Traffic Control Devices.* 2009.
PennDOT & NJDOT. *Smart Transportation Guidebook.* 2008.

Materials and Maintenance

Paint can wear more quickly in high traffic areas or in winter climates. Shoulder bikeways should be cleared of snow through routine snow removal operations.

Bicycle Lane

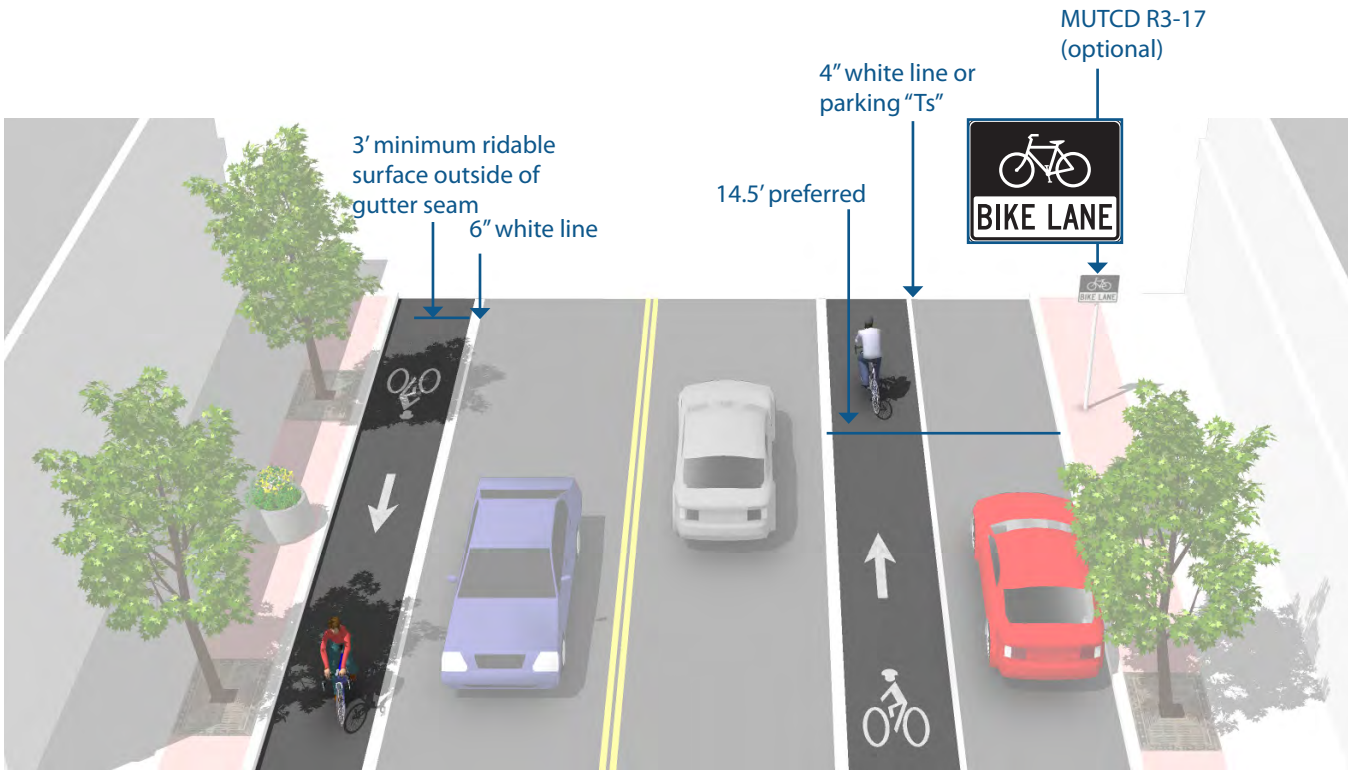
Description

Bike lanes designate an exclusive space for bicyclists through the use of pavement markings and signage. The bike lane is located adjacent to motor vehicle travel lanes and is used in the same direction as motor vehicle traffic. Bike lanes are typically on the right side of the street, between the adjacent travel lane and curb, road edge or parking lane.

Many bicyclists, particularly less experienced riders, are more comfortable riding on a busy street if it has a striped and signed bikeway than if they are expected to share a lane with vehicles.

Guidance

- 4 foot minimum when no curb and gutter is present.
- 5 foot minimum when adjacent to curb and gutter or 3 feet more than the gutter pan width if the gutter pan is wider than 2 feet.
- 14.5 foot preferred from curb face to edge of bike lane. (12 foot minimum).
- 7 foot maximum width for use adjacent to arterials with high travel speeds. Greater widths may encourage motor vehicle use of bike lane.



Discussion

Wider bicycle lanes are desirable in certain situations such as on higher speed arterials (45 mph+) where use of a wider bicycle lane would increase separation between passing vehicles and bicyclists. Appropriate signing and stenciling is important with wide bicycle lanes to ensure motorists do not mistake the lane for a vehicle lane or parking lane. Consider buffered bike lanes when further separation is desired.

Additional References and Guidelines

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

Materials and Maintenance

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

Bike Lane without On-Street Parking

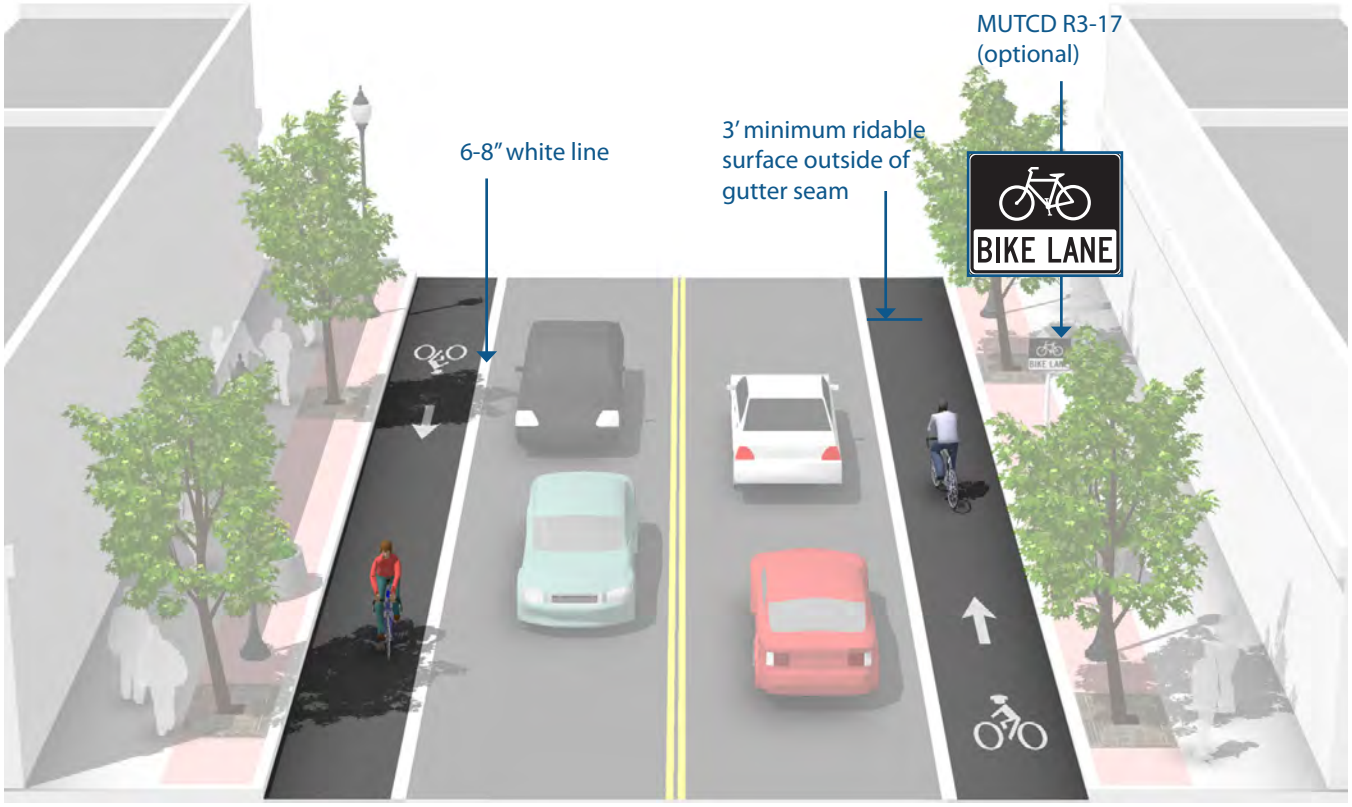
Description

Bike lanes designate an exclusive space for bicyclists through the use of pavement markings and signage. The bike lane is typically located on the right side of the street, between the adjacent travel lane and curb, and is used in the same direction as motor vehicle traffic.

A bike lane width of 7 feet makes it possible for bicyclists to ride side-by-side or pass each other without leaving the bike lane, thereby increasing the capacity of the lane.

Guidance

- 4 foot minimum when no curb and gutter is present.
- 5 foot minimum when adjacent to curb and gutter or 3 feet more than the gutter pan width if the gutter pan is wider than 2 feet.
- 7 foot maximum width for use adjacent to arterials with high travel speeds. Greater widths may encourage motor vehicle use of bike lane. Configure as buffered bicycle lanes when a wider facility is desired.



Discussion

Wider bicycle lanes are desirable in certain situations such as on higher speed arterials (45 mph+) where use of a wider bicycle lane would increase separation between passing vehicles and bicyclists. Appropriate signing and stenciling is important with wide bicycle lanes to ensure motorists do not mistake the lane for a vehicle lane or parking lane. Consider buffered bicycle lanes when further separation is desired.

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.
FHWA. *Manual on Uniform Traffic Control Devices.* 2009.
NACTO. *Urban Bikeway Design Guide.* 2012.
PennDOT & NJDOT. *Smart Transportation Guidebook.* 2008.

Materials and Maintenance

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

Bike Lane Adjacent to On-Street Parallel Parking

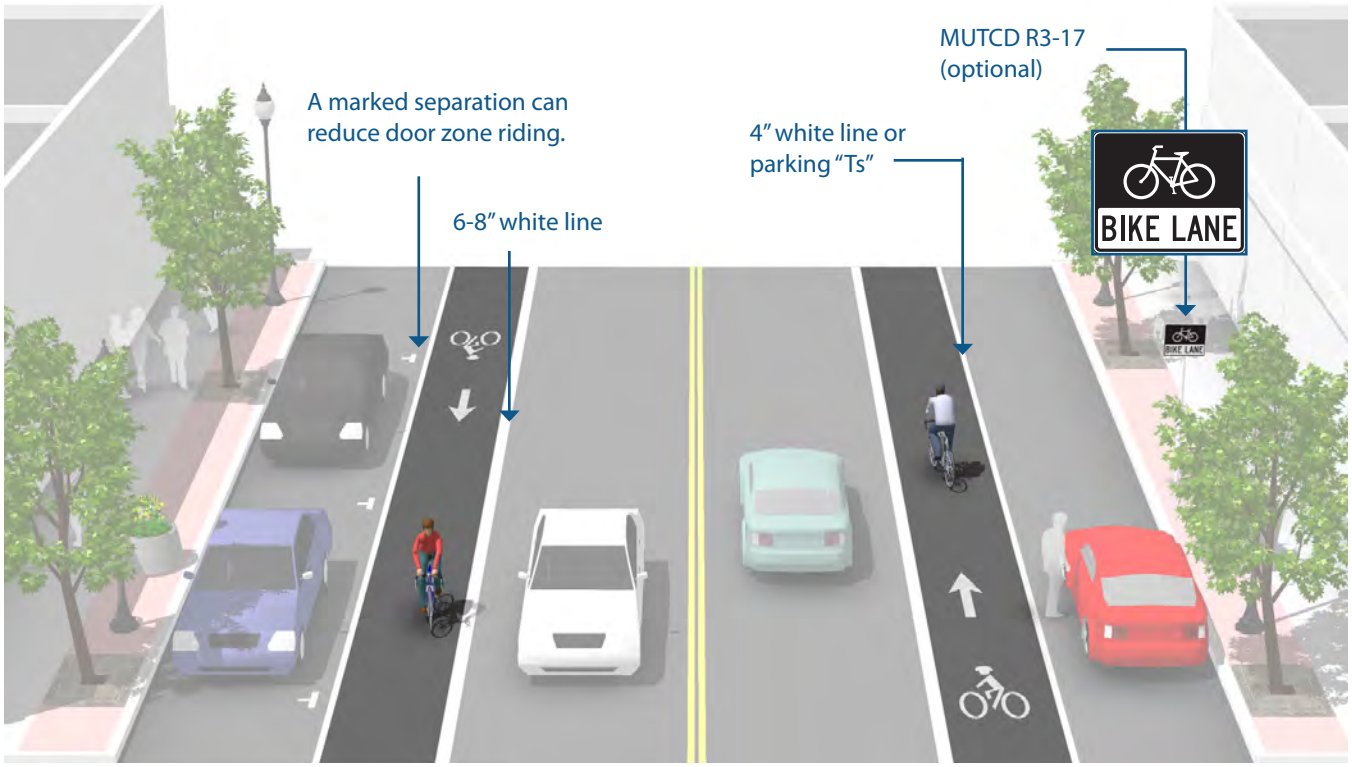
Description

Bike lanes designate an exclusive space for bicyclists through the use of pavement markings and signage. The bike lane is located adjacent to motor vehicle travel lanes and is used in the same direction as motor vehicle traffic. Bike lanes are typically on the right side of the street, between the adjacent travel lane and curb, road edge or parking lane.

Many bicyclists, particularly less experienced riders, are more comfortable riding on a busy street if it has a striped and signed bikeway than if they are expected to share a lane with vehicles.

Guidance

- 12 foot minimum from curb face to edge of bike lane.
- 14.5 foot preferred from curb face to edge of bike lane.
- 7 foot maximum for marked width of bike lane. Greater widths may encourage vehicle loading in bike lane. Configure as buffered bicycle lanes when a wider facility is desired.



Discussion

Bike lanes adjacent to on-street parallel parking require special treatment in order to avoid crashes caused by an open vehicle door. The bike lane should have sufficient width to allow bicyclists to stay out of the door zone while not encroaching into the adjacent vehicular lane. Parking stall markings, such as parking "Ts" and double white lines create a parking side buffer that encourages bicyclists to ride farther away from the door zone.

Additional References and Guidelines

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

Materials and Maintenance

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

Bike Lanes and Diagonal Parking

Description

In certain areas with high parking demand such as urban commercial areas, diagonal parking can be used to increase parking supply.

Back-in diagonal parking improves sight distances between drivers and bicyclists when compared to conventional head-in diagonal parking. Back-in parking is best paired with a dedicated bicycle lane.

Conventional front-in diagonal parking is not compatible or recommended with the provision of bike lanes, as drivers backing out of conventional diagonal parking have limited visibility of approaching bicyclists. Under these conditions, shared lane markings should be used to guide bicyclists away from reversing automobiles.

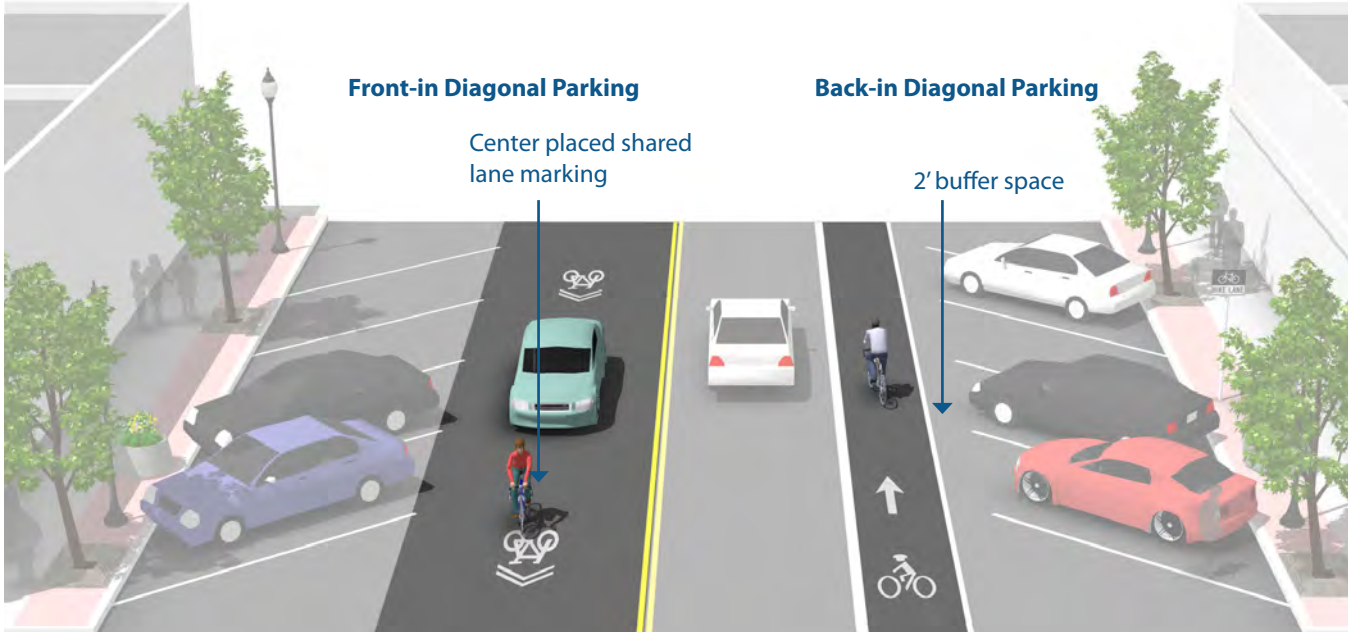
Guidance

Front-in Diagonal Parking

- Shared lane markings are the preferred facility with front-in diagonal parking

Back-in Diagonal Parking

- 5 foot minimum marked width of bike lane
- Parking bays are sufficiently long to accommodate most vehicles (so vehicles do not block bike lane)



Discussion

Additional References and Guidelines

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

Materials and Maintenance

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

Bike Lane Adjacent to On-Street Back-in Diagonal Parking

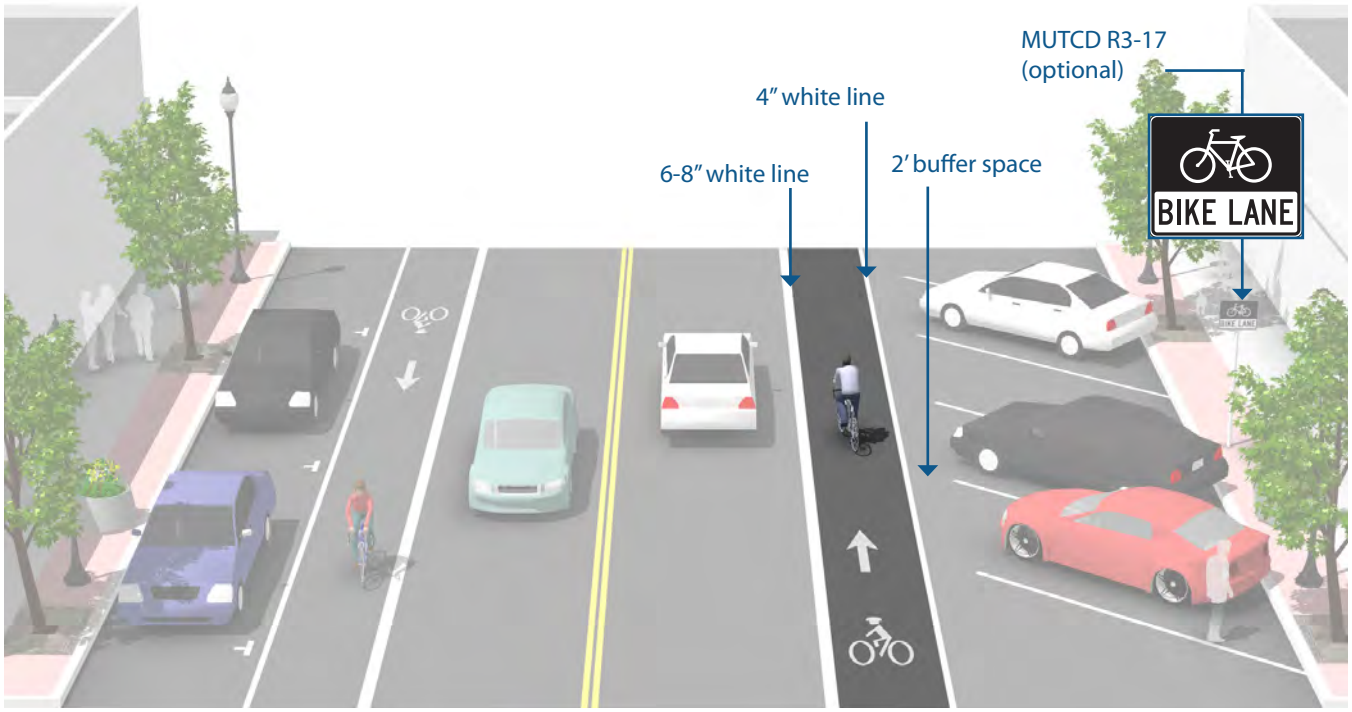
Description

In certain areas with high parking demand such as urban commercial areas, diagonal parking can be used to increase parking supply.

Back-in diagonal parking improves sight distances between drivers and bicyclists when compared to conventional head-in diagonal parking. Back-in diagonal parking provides other benefits including loading and unloading of the trunk at the curb rather than in the street, passengers (including children) are directed by open doors towards the curb and there is no door conflict with bicyclists. While there may be a learning curve for some drivers, back-in diagonal parking is typically an easier maneuver than conventional parallel parking.

Guidance

- 5 foot minimum marked width of bike lane.
- Parking bays are sufficiently long to accommodate most vehicles (so vehicles do not block bike lane).



Discussion

Conventional front-in diagonal parking is not compatible or recommended in conjunction with high levels of bicycle traffic or with the provision of bike lanes, as drivers backing out of conventional diagonal parking have limited visibility of approaching bicyclists.

Additional References and Guidelines

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

Materials and Maintenance

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

Colored Bike Lanes

Description

Colored pavement within a bicycle lane increases the visibility of the bicycle facility. Use of colored pavement is appropriate for use in areas with pressure for illegal parking, frequent encroachment of motor vehicles, clarify conflict areas, and along enhanced facilities such as contra-flow bicycle lanes and protected bike lanes.

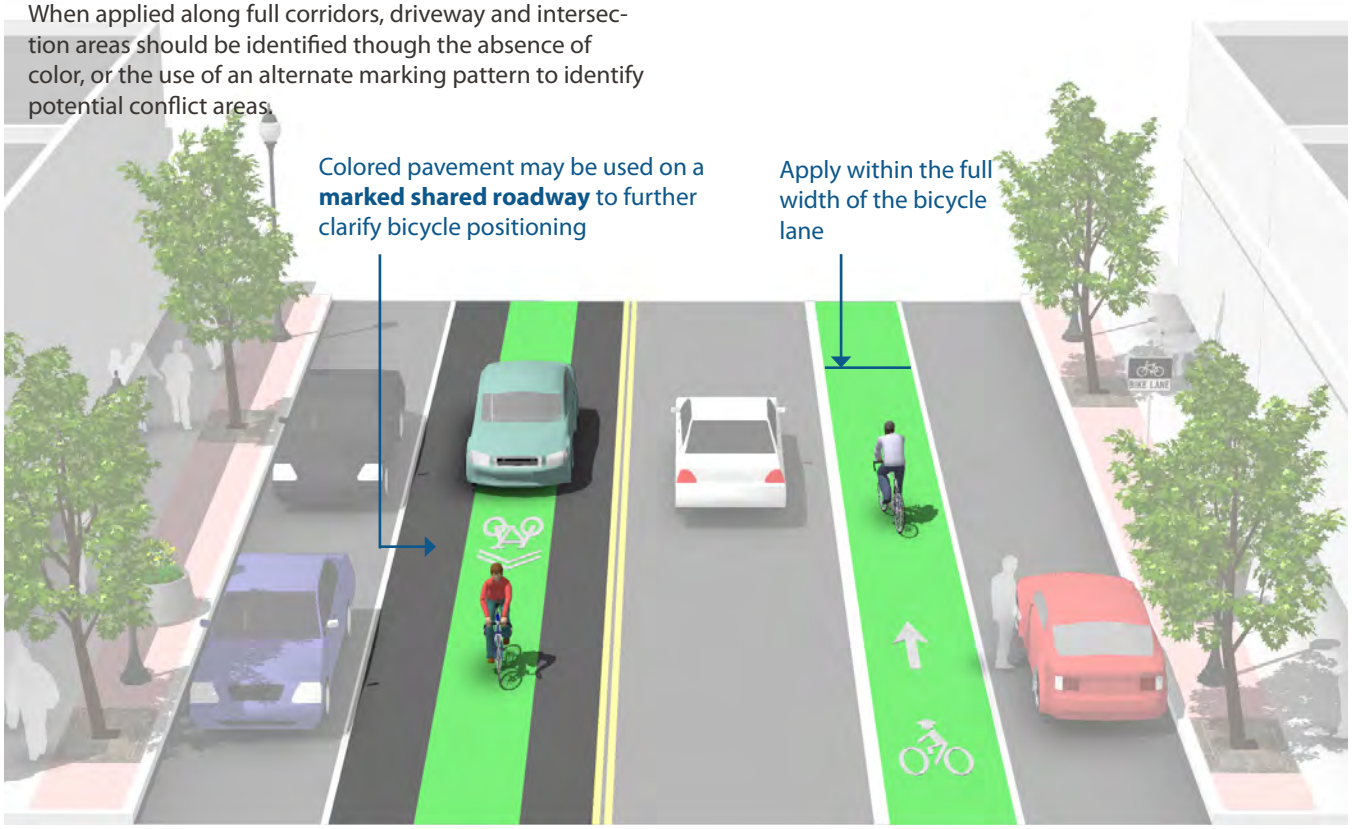
Colored pavement has also been used in conjunction with shared lane markings to create a "lane within a lane" to further clarify proper bicyclist positioning on shared roadway streets.

When applied along full corridors, driveway and intersection areas should be identified though the absence of color, or the use of an alternate marking pattern to identify potential conflict areas.

Guidance

The color green has been given interim approval by the Federal Highways Administration in March of 2011. See interim approval IA-14 for specific colored pavement standards.

The colored surface should be skid resistant and retro-reflective.



Discussion

Colored pavement is also used to identify potential areas of conflict, and reinforces priority to bicyclists in these conflict areas. See Colored Bike Lanes in Conflict Areas for more guidance.

Additional References and Guidelines

FHWA. Interim Approval (IA-14) has been granted. Requests to use green colored pavement need to comply with the provisions of Paragraphs 14 through 22 of Section 1A.10. 2011.
NACTO. *Urban Bikeway Design Guide.* 2012.

Materials and Maintenance

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

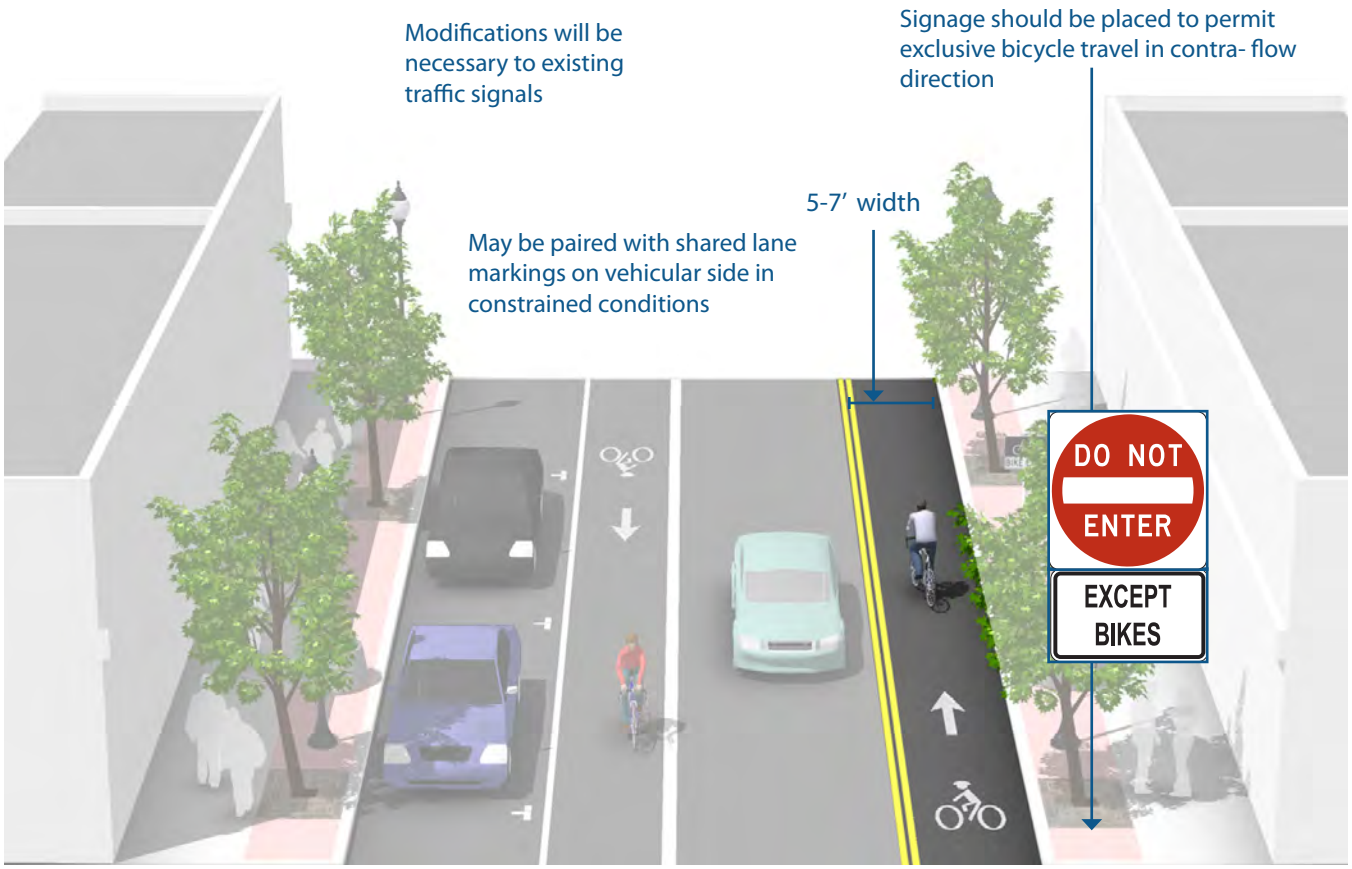
Contra-flow Bike Lane on One-way Street

Description

Contra-flow bike lanes provide bidirectional bicycle access on a roadway that is one-way for motor vehicle traffic. This treatment can provide direct access and connectivity for bicyclists and reducing travel distances. Contra-flow bike lanes can also be used to convert two-way motor vehicle traffic to one-way to reduce traffic volumes where desired.

Guidance

- The contra-flow bike lane should be 5-7 feet wide and marked with a solid double yellow line and appropriate signage. Bike lane markings should be clearly visible to ensure that the contra-flow lane is exclusively for bicycles. Coloration should be considered in the bike lane.
- Signage specifically allowing bicycles at the entrance of the contra flow lane is recommended.



Discussion

Because of the opposing direction of travel, contra-flow bike lanes increase the speed differential between bicyclists and motor vehicles in the adjacent travel lane. If space permits consider a buffered bike lane or protected bike lane configuration to provide additional separation.

Additional References and Guidelines

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

Materials and Maintenance

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

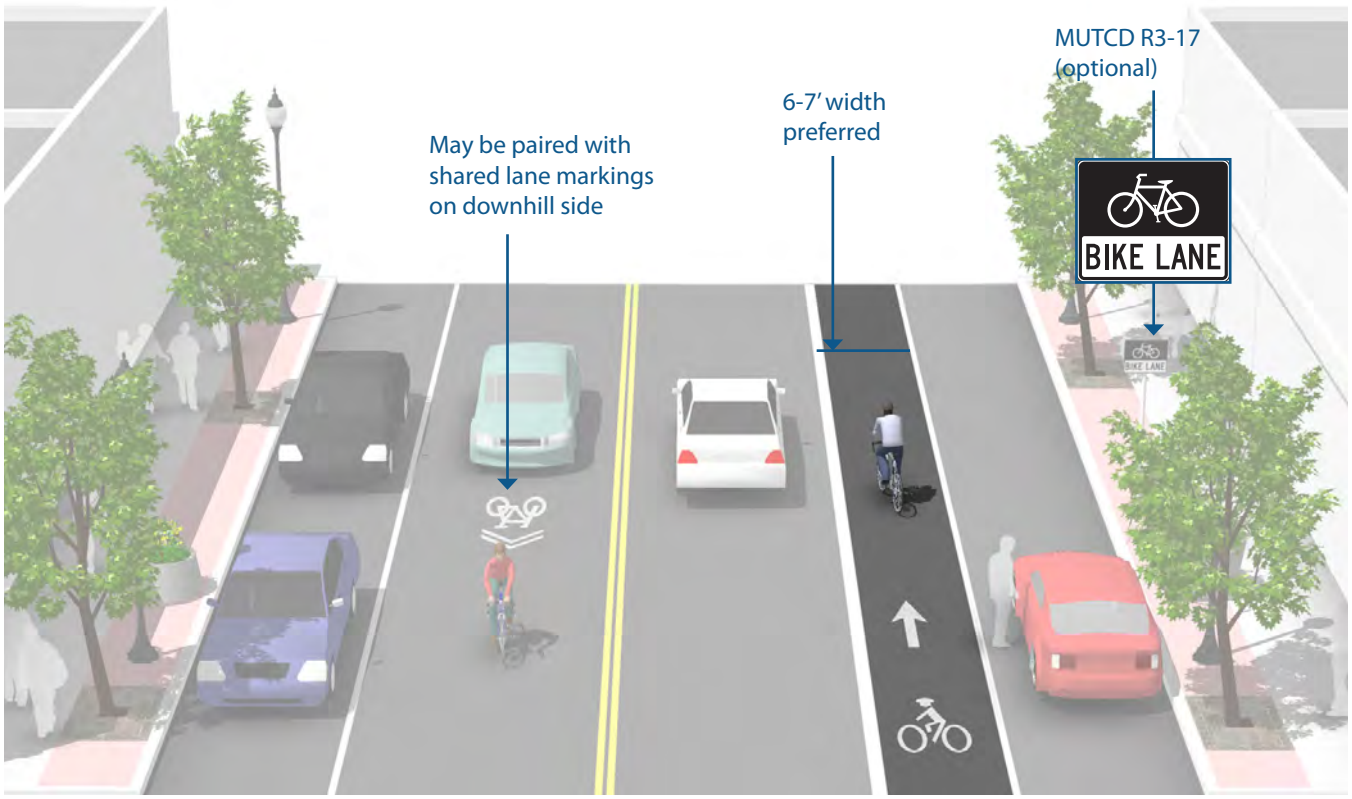
Uphill Bicycle Climbing Lane

Description

Uphill bike lanes (also known as "climbing lanes") enable motorists to safely pass slower-speed bicyclists, thereby improving conditions for both travel modes.

Guidance

- Uphill bike lanes should be 6-7 feet wide (wider lanes are preferred because extra maneuvering room on steep grades can benefit bicyclists).
- Can be combined with shared lane markings for downhill bicyclists who can more closely match prevailing traffic speeds.



Discussion

This treatment is typically found on retrofit projects as newly constructed roads should provide adequate space for bicycle lanes in both directions of travel. Accommodating an uphill bicycle lane often includes delineating on-street parking (if provided), narrowing travel lanes and/or shifting the centerline if necessary.

Additional References and Guidelines

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

Materials and Maintenance

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

Buffered Bike Lane

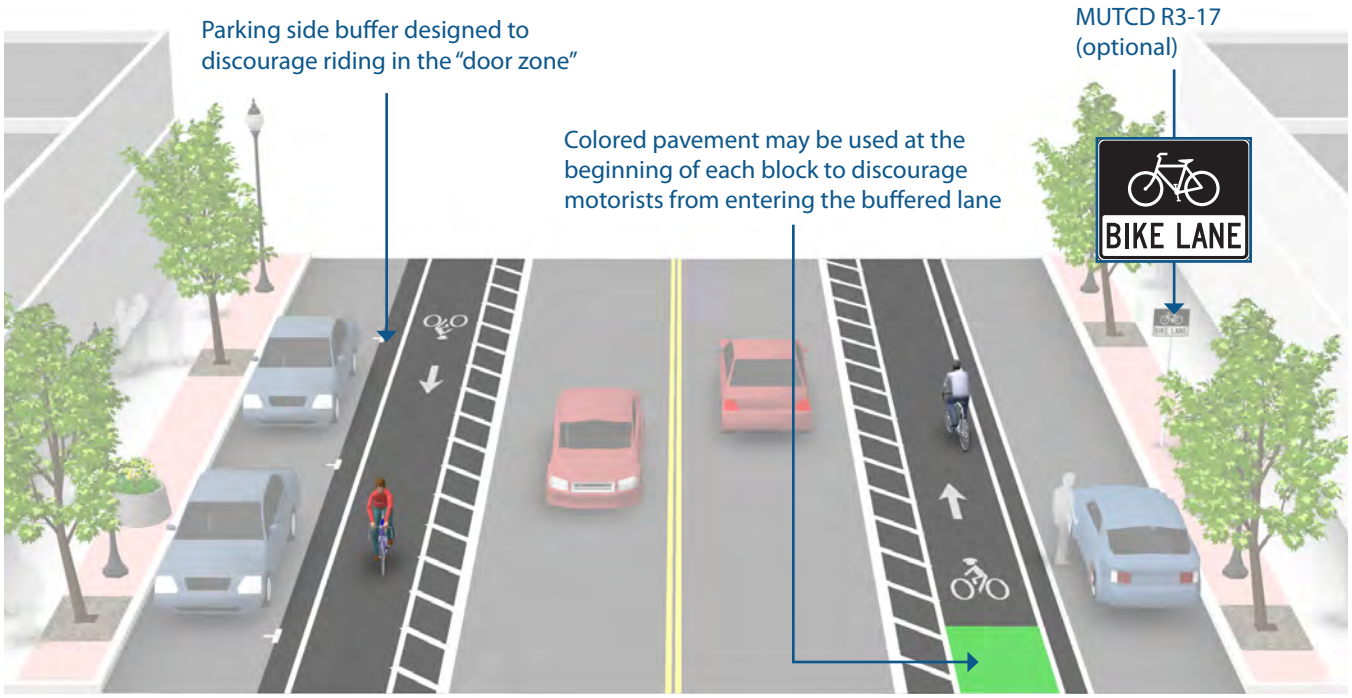
Description

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. Buffered bike lanes follow general guidance for buffered preferential vehicle lanes as per MUTCD guidelines (section 3D-01).

Buffered bike lanes are designed to increase the space between the bike lane and the travel lane and/or parked cars. This treatment is appropriate for bike lanes on roadways with high motor vehicle traffic volumes and speed, adjacent to parking lanes, or a high volume of truck or oversized vehicle traffic.

Guidance

- The minimum bicycle travel area (not including buffer) is 5 feet wide.
- Buffers should be at least 2 feet wide. If 3 feet or wider, mark with diagonal or chevron hatching. For clarity at driveways or minor street crossings, consider a dotted line for the inside buffer boundary where cars are expected to cross.
- Buffered bike lanes can buffer the travel lane only, or parking lane only depending on available space and the objectives of the design.



Discussion

Frequency of right turns by motor vehicles at major intersections should determine whether continuous or truncated buffer striping should be used approaching the intersection. Commonly configured as a buffer between the bicycle lane and motor vehicle travel lane, a parking side buffer may also be provided to help bicyclists avoid the 'door zone' of parked cars.

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.
FHWA. *Manual on Uniform Traffic Control Devices. (3D-01).* 2009.
NACTO. *Urban Bikeway Design Guide.* 2012.

Materials and Maintenance

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

Advisory Bike Lane

Description

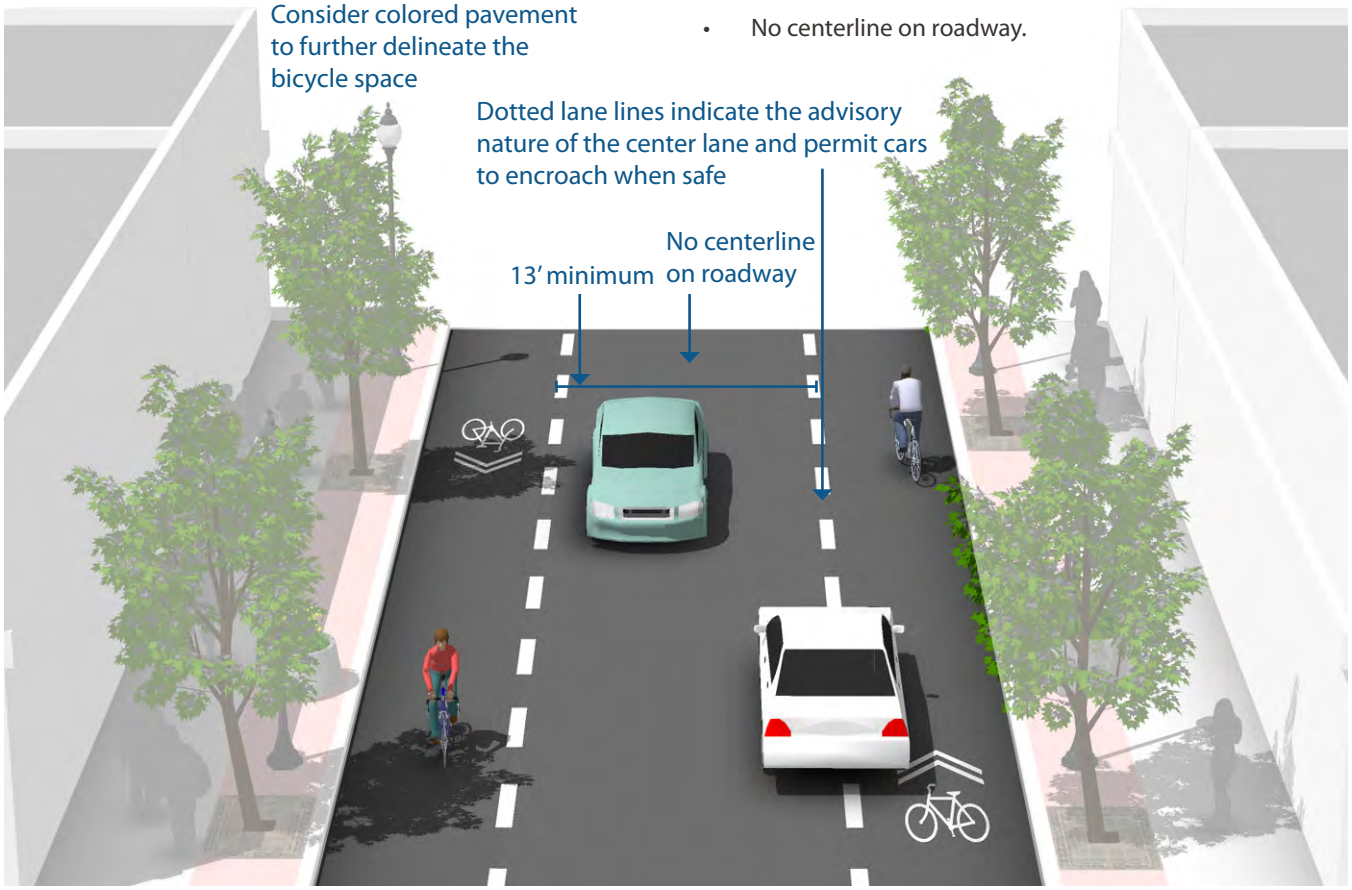
Advisory bike lanes are bicycle priority areas delineated by dotted white lines, separated from a narrow automobile travel area. The automobile zone should be configured narrowly enough so that two cars cannot pass each other in both directions without crossing the advisory lane line.

Motorists may only enter the bicycle zone when no bicycles are present. Motorists must overtake with caution due to potential oncoming traffic.

Guidance

Advisory bike lanes can be used on roadways where the following conditions exist:

- Motor vehicle traffic is <4000 motor vehicles per day (<2000 preferred).
- Advisory bike lane width of 5 to 7 ft.
- Minimum 2-way motor vehicle travel lane width of 13-18 feet.
- No centerline on roadway.



Discussion

Most appropriate when roadways are straight with few bends, inclines or sightline obstructions. Consider the use of colored pavement within the bicycle priority area to discourage unnecessary encroachment by motorists or parked vehicles.

Additional References and Guidelines

City of Minneapolis. Request To Experiment. July 2010.

Materials and Maintenance

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

Protected Bike Lane

A protected bike lane is an exclusive bike facility that combines the user experience of a separated path with the on-street infrastructure of a conventional bike lane. A protected bike lane is physically separated from motor traffic and distinct from the sidewalk. Protected bike lanes have different forms but all share common elements—they provide space that is intended to be exclusively or primarily used by bicycles, and are separated from motor vehicle travel lanes, parking lanes, and sidewalks. In situations where on-street parking is allowed, protected bike lanes are located to the curb-side of the parking (in contrast to bike lanes).

Protected bike lanes may be one-way or two-way, and may be at street level, sidewalk level or at an intermediate level. If at sidewalk level, a curb or median separates them from motor traffic, while different pavement color/texture separates the protected bike lane from the sidewalk. If at street level, they can be separated from motor traffic by raised medians, on-street parking or bollards.

A two-way protected bike lane is desirable when more destinations are on one side of a street (therefore preventing additional crossings), if the facility connects to a path or other bicycle facility on one side of the street, or if there is not enough room for a protected bike lane on both sides of the road.

By separating bicyclists from motor traffic, protected bike lanes can offer a higher level of comfort than bike lanes and are attractive to a wider spectrum of the public.

Intersections and approaches must be carefully designed to promote safety and facilitate left-turns from the right side of the street.


One-Way Protected Bike Lanes


Two-Way Protected Bike Lanes


Driveways and Minor Streets


Major Street Crossings

Protected Bike Lane Separation and Placement

Description

Protection is provided through physical barriers and can include bollards, parking, a planter strip, an extruded curb, or on-street parking. Protected bike lanes using these protection elements typically share the same elevation as adjacent travel lanes.

Raised protected bike lanes may be at the level of the adjacent sidewalk or set at an intermediate level between the roadway and sidewalk to separate the protected bike lane from the pedestrian area.

Guidance

- Protected bike lanes should ideally be placed along streets with long blocks and few driveways or mid-block access points for motor vehicles. Protected bike lanes located on one-way streets have fewer potential conflict areas than those on two-way streets.
- In situations where on-street parking is allowed, protected bike lanes shall be located between the parking lane and the sidewalk (in contrast to bike lanes).

Discussion

Sidewalks or other pedestrian facilities should not be narrowed to accommodate the protected bike lane as pedestrians will likely walk on the protected bike lane if sidewalk capacity is reduced. Visual and physical cues (e.g., pavement markings & signage) should be used to make it clear where bicyclists and pedestrians should be travelling. If possible, separate the protected bike lane and pedestrian zone with a furnishing zone.

Additional References and Guidelines

NACTO. *Urban Bikeway Design Guide*. 2012.

Materials and Maintenance

In cities with winter climates, barrier separated and raised protected bike lanes may require special equipment for snow removal.

One-Way Protected Bike Lanes

Description

One-way protected bike lanes are physically separated from motor traffic and distinct from the sidewalk. Protected bike lanes are either raised or at street level and use a variety of elements for physical protection from passing traffic.

Guidance

- 7 foot recommended minimum to allow passing.
- 5 foot minimum width in constrained locations.
- When placed adjacent to parking, the parking buffer should be three feet wide to allow for passenger loading and to prevent door collisions.
- When placed adjacent to a travel lane, one-way raised protected bike lanes may be configured with a mountable curb to allow entry and exit from the bicycle lane for passing other bicyclists or to access vehicular turn lanes.

Discussion

Special consideration should be given at transit stops to manage bicycle and pedestrian interactions. Driveways and minor street crossings are unique challenges to protected bike lane design. Parking should be prohibited within 30 feet of the intersection to improve visibility. Color, yield markings and "Yield to Bikes" signage should be used to identify the conflict area and make it clear that the protected bike lane has priority over entering and exiting traffic. If configured as a raised protected bike lane, the crossing should be raised so that the sidewalk and protected bike lane maintain their elevation through the crossing.

Additional References and Guidelines

NACTO. *Urban Bikeway Design Guide.* 2012.

Materials and Maintenance

In cities with winter climates, barrier separated and raised protected bike lanes may require special equipment for snow removal.

Two-Way Protected Bike Lanes

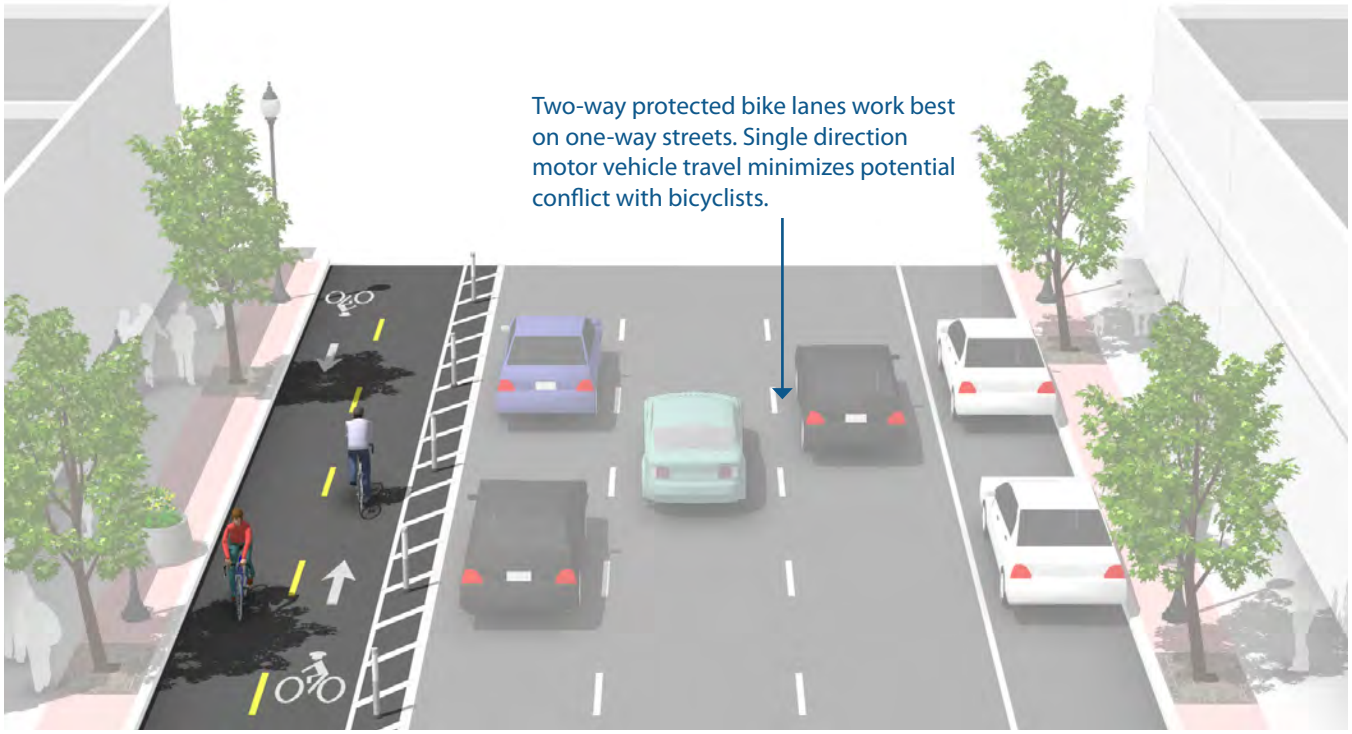
Description

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

A two-way protected bike lane may be configured as a protected bike lane at street level with a parking lane or other barrier between the protected bike lane and the motor vehicle travel lane and/or as a raised protected bike lane to provide vertical separation from the adjacent motor vehicle lane.

Guidance

- 12 foot recommended minimum for two-way facility
- 8 foot minimum in constrained locations
- When placed adjacent to parking, the parking buffer should be three feet wide to allow for passenger loading and to prevent door collisions.



Discussion

Two-way protected bike lanes require a higher level of control at intersections to allow for a variety of turning movements. These movements should be guided by separated signals for bicycles and motor vehicles. Transitions into and out of two-way protected bike lane should be simple and easy to use to deter bicyclists from continuing to ride against the flow of traffic.

At driveways and minor intersections, bicyclists riding against roadway traffic in two-way protected bike lanes may surprise pedestrians and drivers not expecting bidirectional travel. Appropriate signage is recommended.

Additional References and Guidelines

NACTO. *Urban Bikeway Design Guide*. 2012.

Materials and Maintenance

In cities with winter climates barrier, separated and raised protected bike lanes may require special equipment for snow removal.

Driveways and Minor Street Crossings

Description

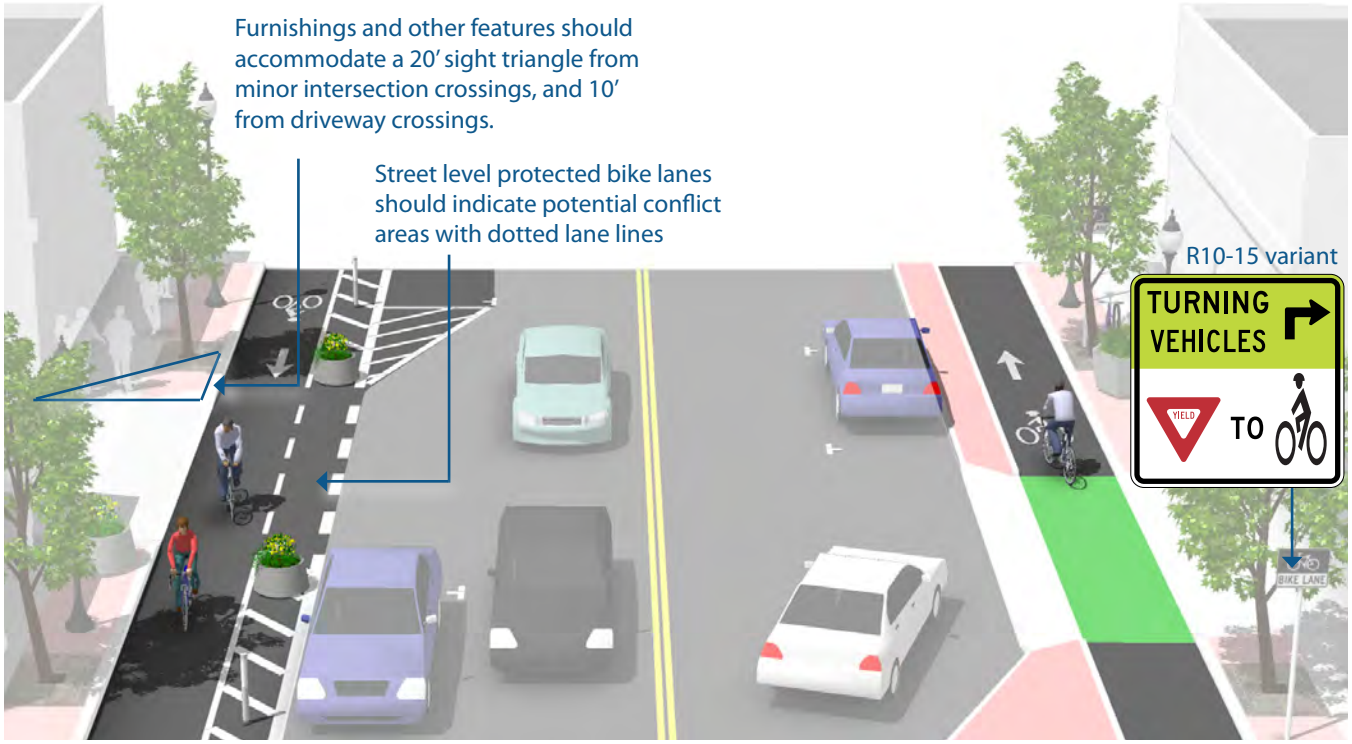
The added separation provided by protected bike lanes creates additional considerations at intersections that should be addressed.

At driveways and crossings of minor streets a smaller fraction of automobiles will cross the protected bike lane. Bicyclists should not be expected to stop at these minor intersections if the major street does not stop.

Guidance

- If raised, maintain the height of the protected bike lane through the crossing, requiring automobiles to cross over.
- Remove parking 30 feet prior the intersection.
- Use colored pavement markings and/or shared lane markings through the conflict area.
- Place warning signage to identify the crossing.

Openings in the barrier or curb are needed at intersections and driveways or other access points to allow vehicle crossing.



Discussion

At these locations, bicyclist visibility is important, as a buffer of parked cars or vegetation can reduce the visibility of a bicyclist traveling in the protected bike lane. Markings and signage should be present that make it easy to understand where bicyclists and pedestrians should be travelling. Access management should be used to reduce the number of crossings of driveways on a protected bike lane. Driveway consolidations and restrictions on motorized traffic movements reduce the potential for conflict.

Additional References and Guidelines

NACTO. *Urban Bikeway Design Guide*. 2012.

Materials and Maintenance

In cities with winter climates, barrier separated and raised protected bike lanes may require special equipment for snow removal.

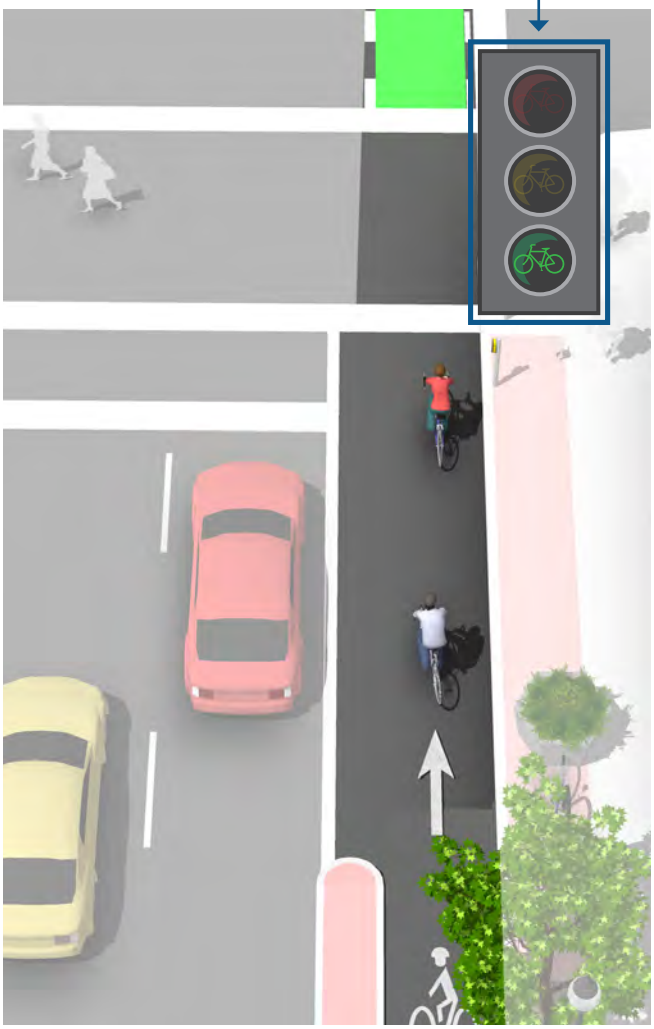
Major Street Crossings

Description

Protected bike lanes approaching major intersections must minimize and mitigate potential conflicts and provide connections to intersecting facility types.

Protected bike lanes crossings of signalized intersections can also be accomplished through the use of a bicycle signal phase which reduces conflicts with motor vehicles by separating bicycle movements from any conflicting motor vehicle movements.

Demand-only bicycle signals can be implemented to reduce vehicle delay and to prevent an empty signal phase from regularly occurring.



Guidance

- Drop protected bike lane buffer and transition to bike lane 16' in advance of the intersection.
- Remove parking 16'-50' in advance of the buffer termination.
- Use a bike box or advanced stop line treatment to place bicyclists in front of traffic.
- Use colored pavement markings through the conflict area.
- Provide for left-turning movements with two-stage turn boxes.
- Consider using a protected phase bicycle signal to isolate conflicts between bicyclists and motor vehicle traffic.
- In constrained conditions with right turn only lanes, consider transitioning to a shared bike lane/turn lane.

Discussion

Signalization utilizing a bicycle signal head can also be set to provide protected bike lane users a green phase in advance of vehicle phases. The length of the signal phase will depend on the width of the intersection.

The same conflicts exist at non-signalized intersections. Warning signs, special markings and the removal of on-street parking in advance of the intersection can raise visibility and awareness of bicyclists.

Additional References and Guidelines

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

Materials and Maintenance

In cities with winter climates, barrier separated and raised protected bike lanes may require special equipment for snow removal.

Separated Bikeways at Intersections

Intersections are junctions at which different modes of transportation meet and facilities overlap. An intersection facilitates the interchange between bicyclists, motorists, pedestrians and other modes in order to advance traffic flow in a safe and efficient manner. Designs for intersections with bicycle facilities should reduce conflict between bicyclists (and other vulnerable road users) and vehicles by heightening the level of visibility, denoting clear right-of-way and facilitating eye contact and awareness with other modes. Intersection treatments can improve both queuing and merging maneuvers for bicyclists, and are often coordinated with timed or specialized signals.

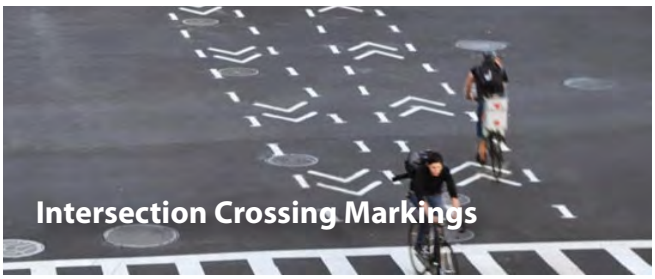
The configuration of a safe intersection for bicyclists may include elements such as color, signage, medians, signal detection and pavement markings. Intersection design should take into consideration existing and anticipated bicyclist, pedestrian and motorist movements. In all cases, the degree of mixing or separation between bicyclists and other modes is intended to reduce the risk of crashes and increase bicyclist comfort. The level of treatment required for bicyclists at an intersection will depend on the bicycle facility type used, whether bicycle facilities are intersecting, and the adjacent street function and land use.


Bike Boxes


Bike Lanes at Right Turn Only Lanes


Colored Bike Lanes in Conflict Areas

Combined Bicycle/Right Turn Lane


Intersection Crossing Markings


Two Stage Turn Boxes

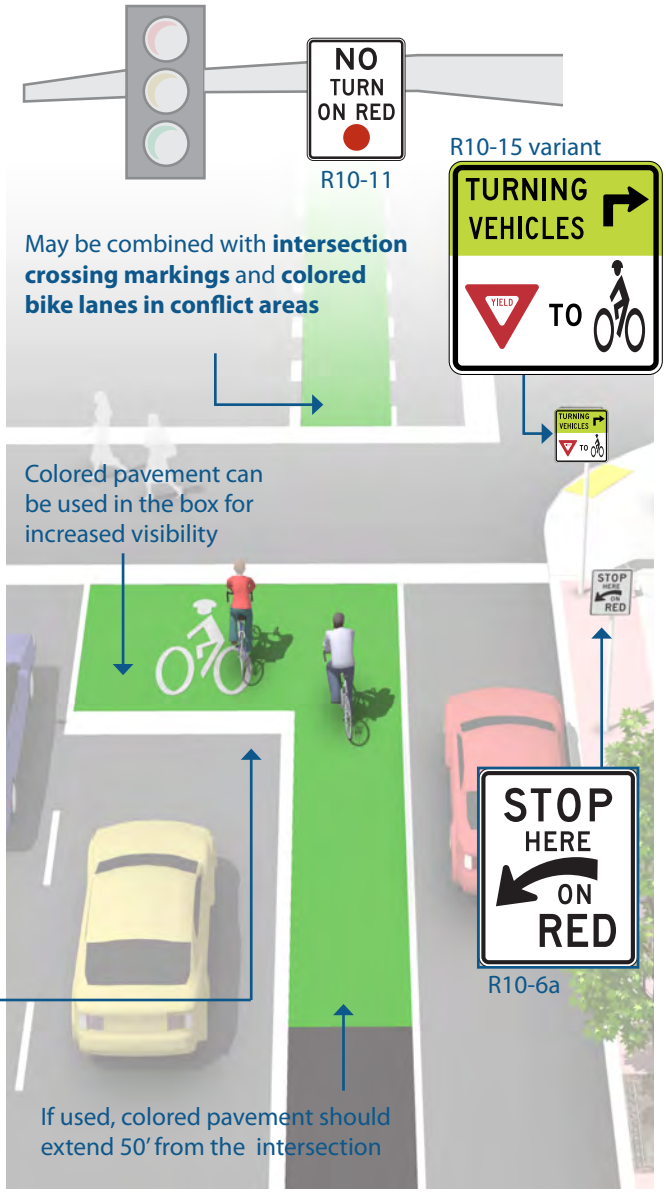
Bike Box

Description

A bike box is a designated area located at the head of a traffic lane at a signalized intersection that provides bicyclists with a safe and visible space to get in front of queuing motorized traffic during the red signal phase. Motor vehicles must queue behind the white stop line at the rear of the bike box.

Guidance

- 14' minimum depth
- A "No Turn on Red" (MUTCD R10-11) sign shall be installed overhead to prevent vehicles from entering the Bike Box.
- A "Stop Here on Red" sign should be post-mounted at the stop line to reinforce observance of the stop line.
- A "Yield to Bikes" sign should be post-mounted in advance of and in conjunction with an egress lane to reinforce that bicyclists have the right-of-way going through the intersection.
- An ingress lane should be used to provide access to the box.
- A supplemental "Wait Here" legend can be provided in advance of the stop bar to increase clarity to motorists.



Discussion

Bike boxes are considered experimental by the FHWA.
Bike boxes should be placed only at signalized intersections, and right turns on red shall be prohibited for motor vehicles. Bike boxes should be used in locations that have a large volume of bicyclists and are best utilized in central areas where traffic is usually moving more slowly. Prohibiting right turns on red improves safety for bicyclists yet does not significantly impede motor vehicle travel.

Additional References and Guidelines

NACTO. *Urban Bikeway Design Guide.* 2012.
FHWA. Interim Approval (IA-14) has been granted. Requests to use green colored pavement need to comply with the provisions of Paragraphs 14 through 22 of Section 1A.10. 2011.

Materials and Maintenance

Because the effectiveness of markings depends entirely on their visibility, maintaining markings should be a high priority.

Bike Lanes at Right Turn Only Lanes

Description

The appropriate treatment at right-turn lanes is to place the bike lane between the right-turn lane and the right-most through lane or, where right-of-way is insufficient, to use a shared bike lane/turn lane.

The design (right) illustrates a bike lane pocket, with signage indicating that motorists should yield to bicyclists through the conflict area.

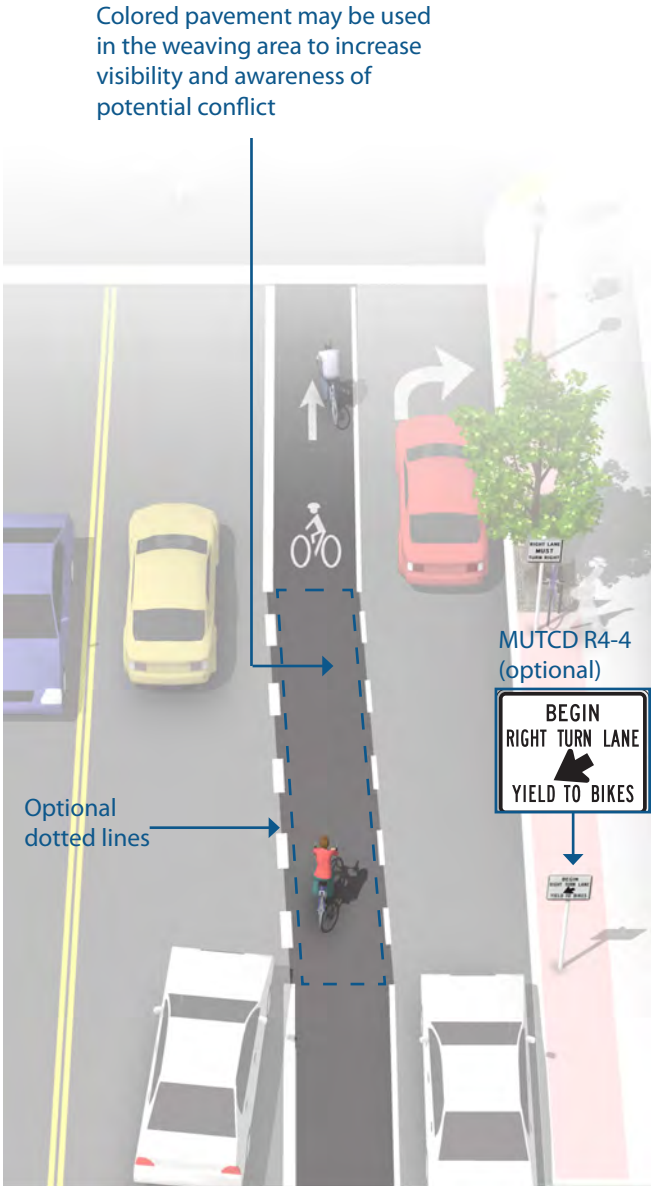
Guidance

At auxiliary right turn only lanes (add lane):

- Continue existing bike lane width; standard width of 5 to 6 feet or 4 feet in constrained locations.
- Use signage to indicate that motorists should yield to bicyclists through the conflict area.
- Consider using colored conflict areas to promote visibility of the mixing zone.

Where a through lane becomes a right turn only lane:

- Do not define a dotted line merging path for bicyclists.
- Drop the bicycle lane in advance of the merge area.
- Use shared lane markings to indicate shared use of the lane in the merging zone.



Discussion

For other potential approaches to providing accommodations for bicyclists at intersections with turn lanes, please see guidance on shared bike lane/turn lane, bicycle signals, and colored bike facilities.

Additional References and Guidelines

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

Materials and Maintenance

Because the effectiveness of markings depends entirely on their visibility, maintaining markings should be a high priority.

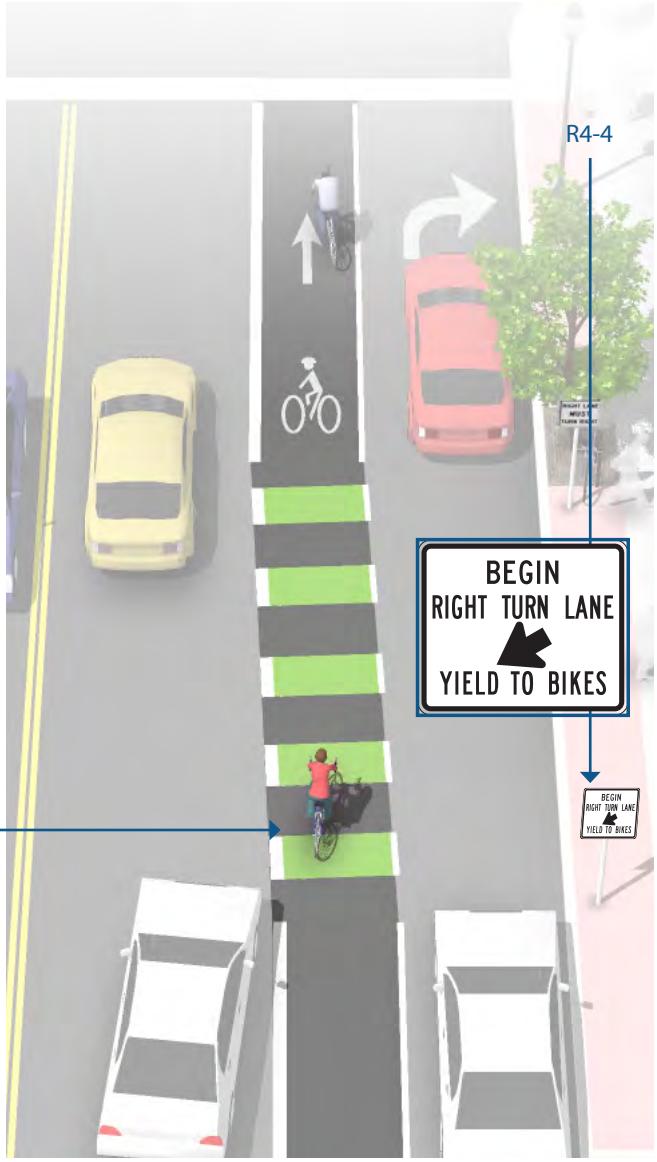
Colored Bike Lanes in Conflict Areas

Description

Colored pavement within a bicycle lane increases the visibility of the facility and reinforces priority of bicyclists in conflict areas.

Guidance

- Green colored pavement was given interim approval by the Federal Highways Administration in March 2011. See interim approval for specific colored pavement standards.
- The colored surface should be skid resistant and retro-reflective.
- A "Yield to Bikes" sign should be used at intersections or driveway crossings to reinforce that bicyclists have the right-of-way in colored bike lane areas.



Discussion

Evaluations performed in Portland, OR, St. Petersburg, FL and Austin, TX found that significantly more motorists yielded to bicyclists and slowed or stopped before entering the conflict area after the application of the colored pavement when compared with an uncolored treatment.

Additional References and Guidelines

FHWA. Interim Approval (IA-14) has been granted. Requests to use green colored pavement need to comply with the provisions of Paragraphs 14 through 22 of Section 1A.10. 2011.
NACTO. *Urban Bikeway Design Guide.* 2012.

Materials and Maintenance

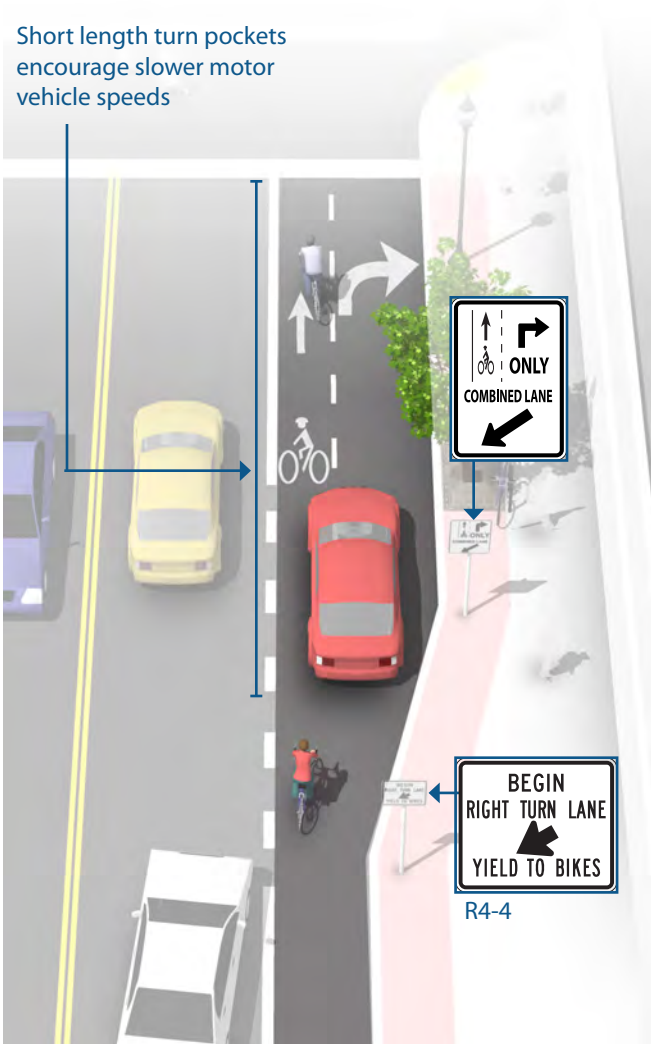
Because the effectiveness of markings depends entirely on their visibility, maintaining markings should be a high priority.

Combined Bike Lane / Turn Lane

Description

The combined bike lane/turn lane places a standard-width bike lane on the left side of a dedicated right turn lane. A dotted line delineates the space for bicyclists and motorists within the shared lane. This treatment includes signage advising motorists and bicyclists of proper positioning within the lane.

This treatment is recommended at intersections lacking sufficient space to accommodate both a standard through bike lane and right turn lane.



Guidance

- Maximum shared turn lane width is 13 feet; narrower is preferable.
- Bike Lane pocket should have a minimum width of 4 feet with 5 feet preferred.
- A dotted 4 inch line and bicycle lane marking should be used to clarify bicyclist positioning within the combined lane, without excluding cars from the suggested bicycle area.
- A "Right Turn Only" sign with an "Except Bicycles" plaque may be needed to make it legal for through bicyclists to use a right turn lane.

Discussion

Case studies cited by the Pedestrian and Bicycle Information Center indicate that this treatment works best on streets with lower posted speeds (30 MPH or less) and with lower traffic volumes (10,000 ADT or less). May not be appropriate for high-speed arterials or intersections with long right turn lanes. May not be appropriate for intersections with large percentages of right-turning heavy vehicles.

Additional References and Guidelines

NACTO. *Urban Bikeway Design Guide*. 2012.

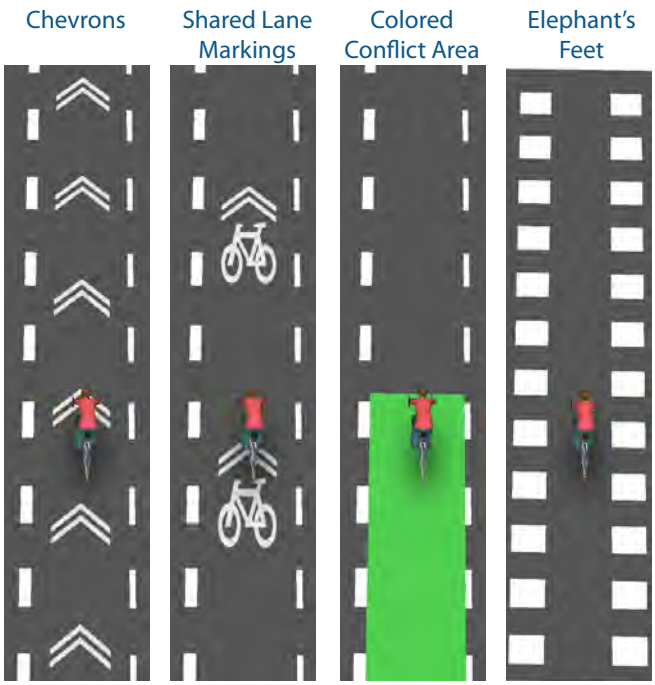
Materials and Maintenance

Locate markings out of tire tread to minimize wear. Because the effectiveness of markings depends on their visibility, maintaining markings should be a high priority.

Intersection Crossing Markings

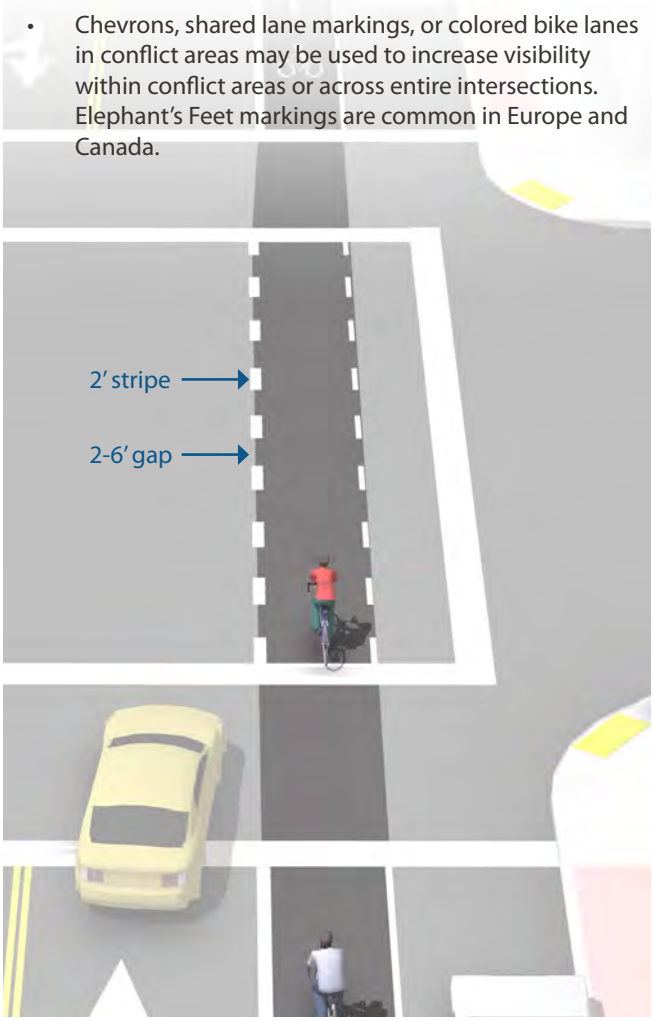
Description

Bicycle pavement markings through intersections indicate the intended path of bicyclists through an intersection or across a driveway or ramp. They guide bicyclists on a safe and direct path through the intersection and provide a clear boundary between the paths of through bicyclists and either through or crossing motor vehicles in the adjacent lane.



Guidance

- See MUTCD Section 3B.08: "dotted line extensions"
- Crossing striping shall be at least six inches wide when adjacent to motor vehicle travel lanes. Dotted lines should be two-foot lines spaced two to six feet apart.
- Chevrons, shared lane markings, or colored bike lanes in conflict areas may be used to increase visibility within conflict areas or across entire intersections. Elephant's Feet markings are common in Europe and Canada.



Discussion

Additional markings such as chevrons, shared lane markings, or colored bike lanes in conflict areas are strategies currently in use in the United States and Canada. Cities considering the implementation of markings through intersections should standardize future designs to avoid confusion.

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.
FHWA. *Manual on Uniform Traffic Control Devices. (3A.06).* 2009.
NACTO. *Urban Bikeway Design Guide.* 2012.

Materials and Maintenance

Because the effectiveness of marked crossings depends entirely on their visibility, maintaining marked crossings should be a high priority.

Two-Stage Turn Boxes

Description

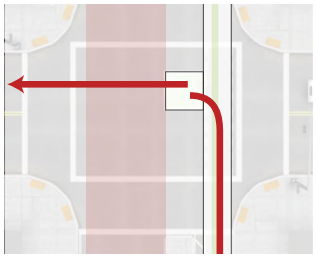
Two-stage turn queue boxes offer bicyclists a safe way to make left turns at multi-lane signalized intersections from a right side protected bike lane or bike lane.

On right side protected bike lanes, bicyclists are often unable to merge into traffic to turn left due to physical separation, making the provision of two-stage left turn boxes critical. Design guidance for two-stage turns apply to both bike lanes and protected bike lanes.

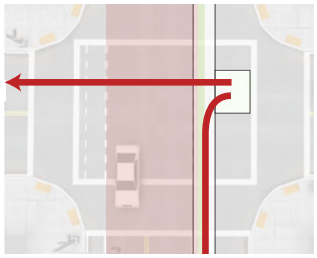
Guidance

- The queue box shall be placed in a protected area. Typically this is within an on-street parking lane or protected bike lane buffer area.
- 6' minimum depth of bicycle storage area
- Bicycle stencil and turn arrow pavement markings shall be used to indicate proper bicycle direction and positioning.
- A "No Turn on Red" (MUTCD R10-11) sign shall be installed on the cross street to prevent vehicles from entering the turn box.

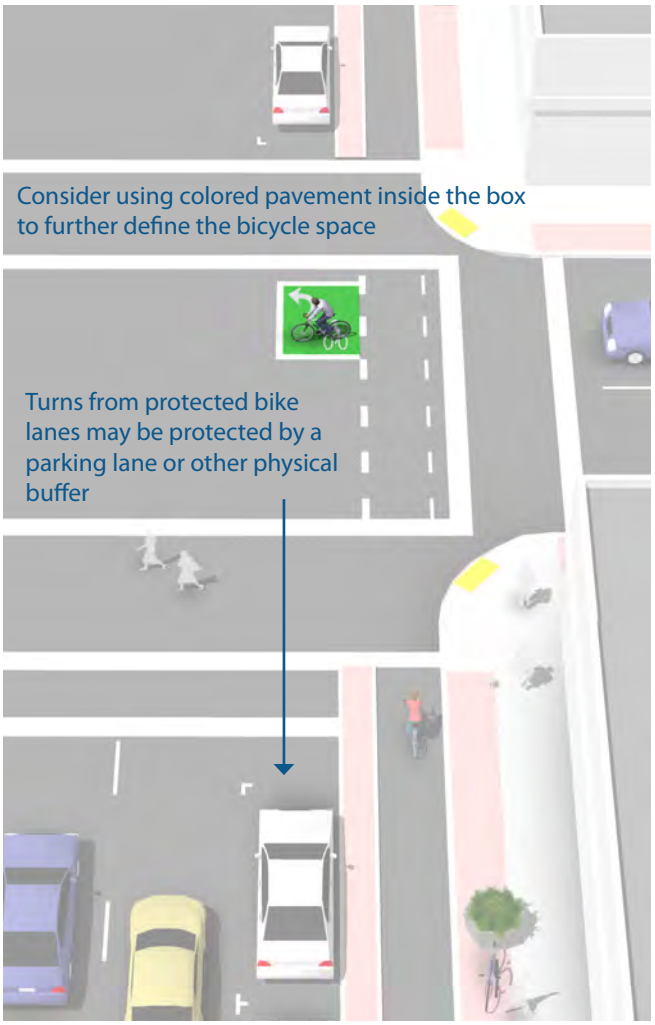
Protected bike lane turn box protected by physical buffer:



Bike lane turn box protected by parking lane:



Turns from a bicycle lane may be protected by an adjacent parking lane or crosswalk setback space



Discussion

Two-Stage Turn boxes are considered experimental by FHWA.

While two stage turns may increase bicyclist comfort in many locations, this configuration will typically result in higher average signal delay for bicyclists due to the need to receive two separate green signal indications (one for the through street, followed by one for the cross street) before proceeding.

Additional References and Guidelines

NACTO. *Urban Bikeway Design Guide*. 2012.

Materials and Maintenance

Paint can wear more quickly in high traffic areas or in winter climates.

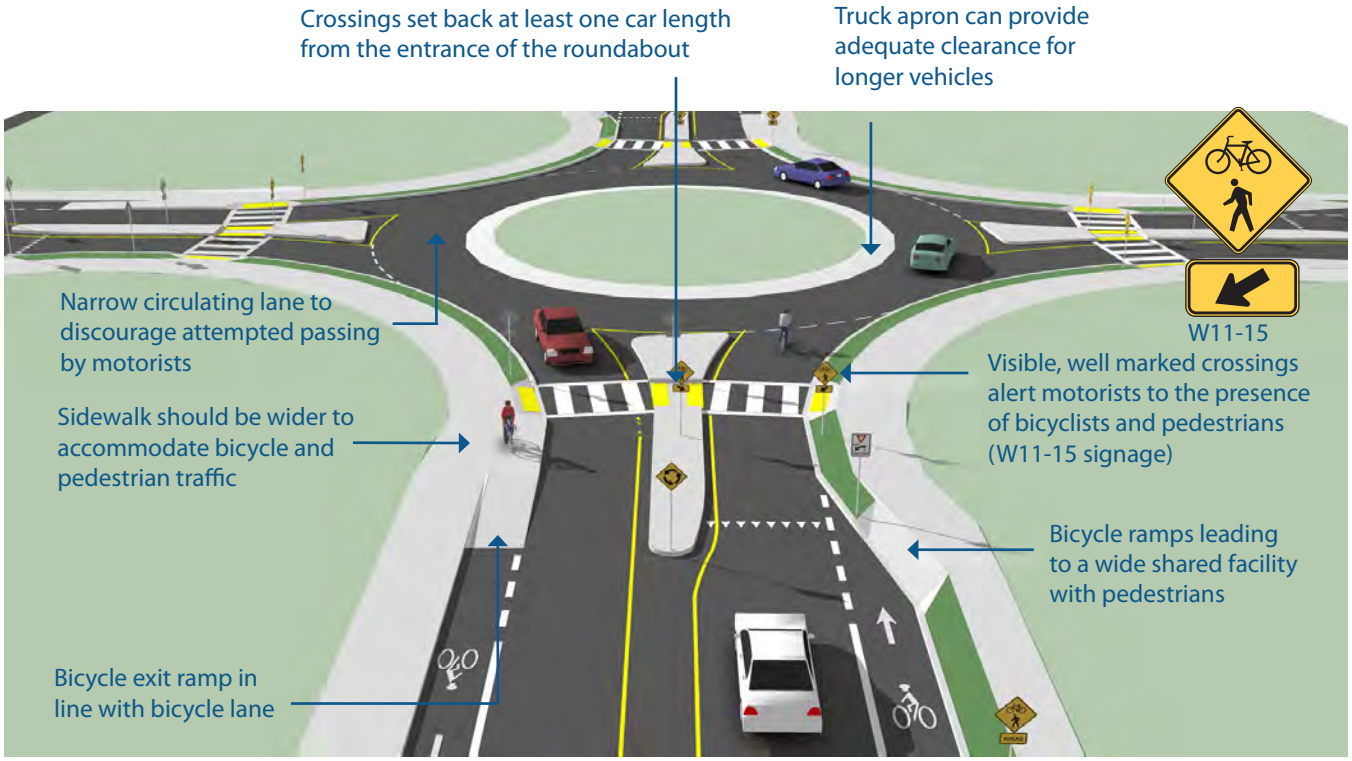
Bicyclists at Single Lane Roundabouts

Description

In single lane roundabouts it is important to indicate to motorists, bicyclists and pedestrians the right-of-way rules and correct way for them to circulate, using appropriately designed signage, pavement markings, and geometric design elements.

Guidelines

- 25 mph maximum circulating design speed.
- Design approaches/exits to the lowest speeds possible.
- Encourage bicyclists navigating the roundabout like motor vehicles to "take the lane." Use "Bike May Use Full Lane" sign on approach to the roundabout.
- Maximize yielding rate of motorists to pedestrians and bicyclists at crosswalks.
- Provide separated facilities for bicyclists who prefer not to navigate the roundabout on the roadway.



Discussion

Research indicates that while single-lane roundabouts may benefit bicyclists and pedestrians by slowing traffic, multi-lane roundabouts may present greater challenges and significantly increase safety problems for these users.

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.
FHWA. *Roundabouts: An Informational Guide.* 2000.
TRB. *Roundabouts: An Informational Guide, Second Edition.* NCHRP 672. 2010.
PennDOT & NJDOT. *Smart Transportation Guidebook.* 2008.

Materials and Maintenance

Signage and striping require routine maintenance.

Bike Lanes at Diverging Ramp Lanes

Description

Some arterials may contain high speed freeway-style designs such as merge lanes and exit ramps, which can create difficulties for bicyclists. The entrance and exit lanes typically have intrinsic visibility problems because of low approach angles and feature high speed differentials between bicyclists and motor vehicles.

Strategies to improve safety focus on increasing sight distances, creating formal crossings, and minimizing crossing distances.

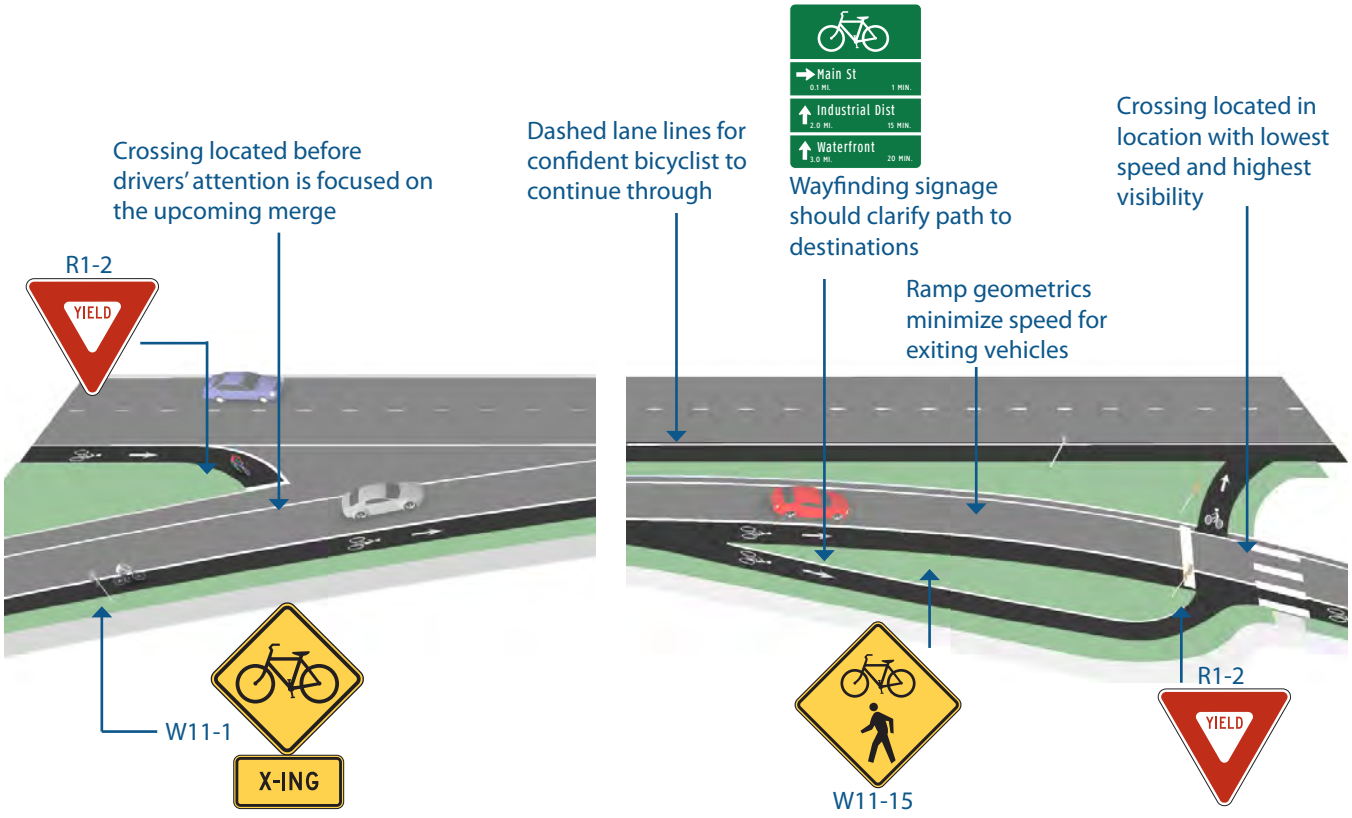
Guidance

Entrance Ramps:

Angle the bike lane to increase the approach angle with entering traffic. Position crossing before drivers' attention is focused on the upcoming merge.

Exit Ramps:

Use a jug handle turn to bring bicyclists to increase the approach angle with exiting traffic, and add yield striping and signage to the bicycle approach.



Discussion

While the jug-handle approach is the preferred configuration at exit ramps, provide the option for through bicyclists to perform a vehicular merge and proceed straight through under safe conditions.

Additional References and Guidelines

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

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

FHWA. *Bicycle and Pedestrian Transportation. Lesson 15: Bicycle Lanes*. 2006.

Materials and Maintenance

Locate crossing markings out of wheel tread when possible to minimize wear and maintenance costs.

Channelized Turn Lanes

Description

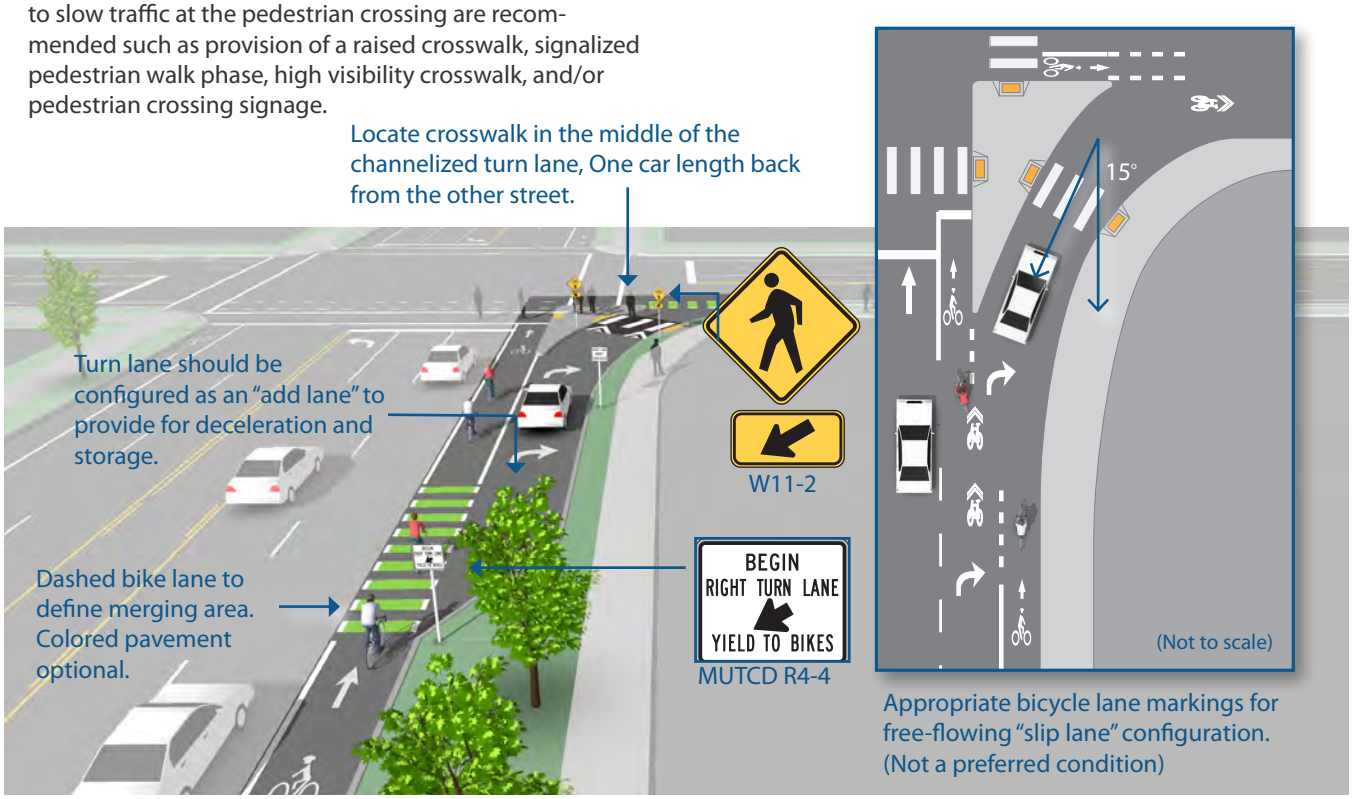
In some intersections of arterials streets, design vehicle requirements or intersection angles may result in wide turning radii at corners. Configuring the intersection as a channelized (or free-right) turn lane with a raised refuge island can improve conditions for pedestrians trying to cross the street.

Similar to a median refuge island, the raised refuge island can reduce crossing distances, allow staged crossing of the roadway, and improve visibility of pedestrians crossing the roadway.

To improve safety and comfort for pedestrians, measures to slow traffic at the pedestrian crossing are recommended such as provision of a raised crosswalk, signalized pedestrian walk phase, high visibility crosswalk, and/or pedestrian crossing signage.

Guidelines

- The preferred angle of intersection between the channelized turn lane and the roadway being joined is no more than 15 degrees to allow for simultaneous visibility of pedestrians and potential roadway gaps.
- Design with a maximum 30-35 foot turning radius.
- Signing: Pedestrian crossing sign assembly (W11-2) or Yield (R1-2) to encourage yielding. Yield to Bikes (R4-4) or similar if bike lanes are present.
- Raised crossings in the channelized turn lane may slow driver speed through the turning area.



Discussion

This design requires trucks to turn into multiple receiving lanes, and may not be appropriate on the approach to streets with one through lane.

Channelized turn lanes can be very challenging for blind pedestrians. NCHRP 674 identified the use of sound strips (a full lane rumble strip-like device) in conjunction with flashing beacons to increase yielding compliance.

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.
TRB. *NCHRP 674 Crossing Solutions at Roundabouts and Channelized Turn Lanes for Pedestrians with Vision Disabilities.* 2011.
ITE. *Designing Walkable Urban Thoroughfares.* 2010.

Materials and Maintenance

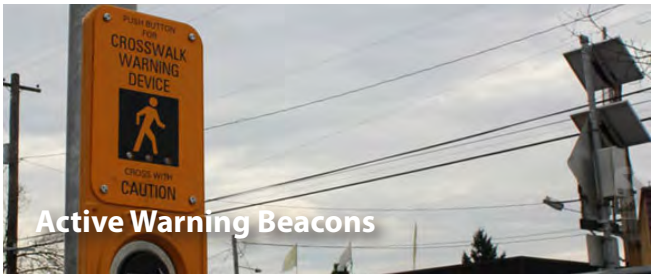
Signage and striping require routine maintenance.

Signalization

Bicycle signals and beacons facilitate bicyclist crossings of roadways. Bicycle signals make crossing intersections safer for bicyclists by clarifying when to enter an intersection and by restricting conflicting vehicle movements. Bicycle signals are traditional three lens signal heads with green, yellow and red bicycle stenciled lenses that can be employed at standard signalized intersections. Flashing amber warning beacons can be utilized at unsignalized intersection crossings. Push buttons, signage, and pavement markings may be used to supplement these facilities for both bicyclists and motorists.

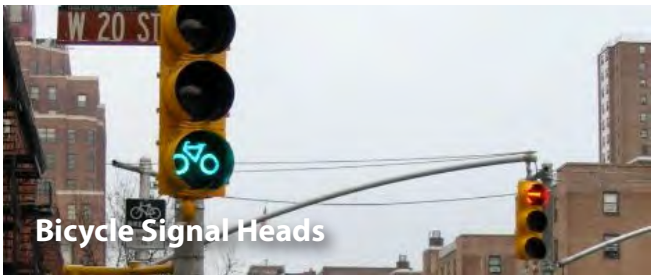
Determining which type of signal or beacon to use for a particular intersection depends on a variety of factors. These include speed limits, Average Daily Traffic (ADT), anticipated bicycle crossing traffic, and the configuration of planned or existing bicycle facilities. Signals may be necessary as part of the construction of a protected bicycle facility such as a protected bike lane with potential turning conflicts, or to decrease vehicle or pedestrian conflicts at major crossings. An intersection with bicycle signals may reduce stress and delays for a crossing bicyclist, and discourage illegal and unsafe crossing maneuvers.


Bicycle Detection and Actuation



Active Warning Beacons


Hybrid Beacons (HAWK)



Bicycle Signal Heads

Bicycle Detection and Actuation

Description

Push Button Actuation

User-activated button mounted on a pole facing the street.

Loop Detectors

Bicycle-activated loop detectors are installed within the roadway to allow the presence of a bicycle to trigger a change in the traffic signal. This allows the bicyclist to stay within the lane of travel without having to maneuver to the side of the road to trigger a push button.

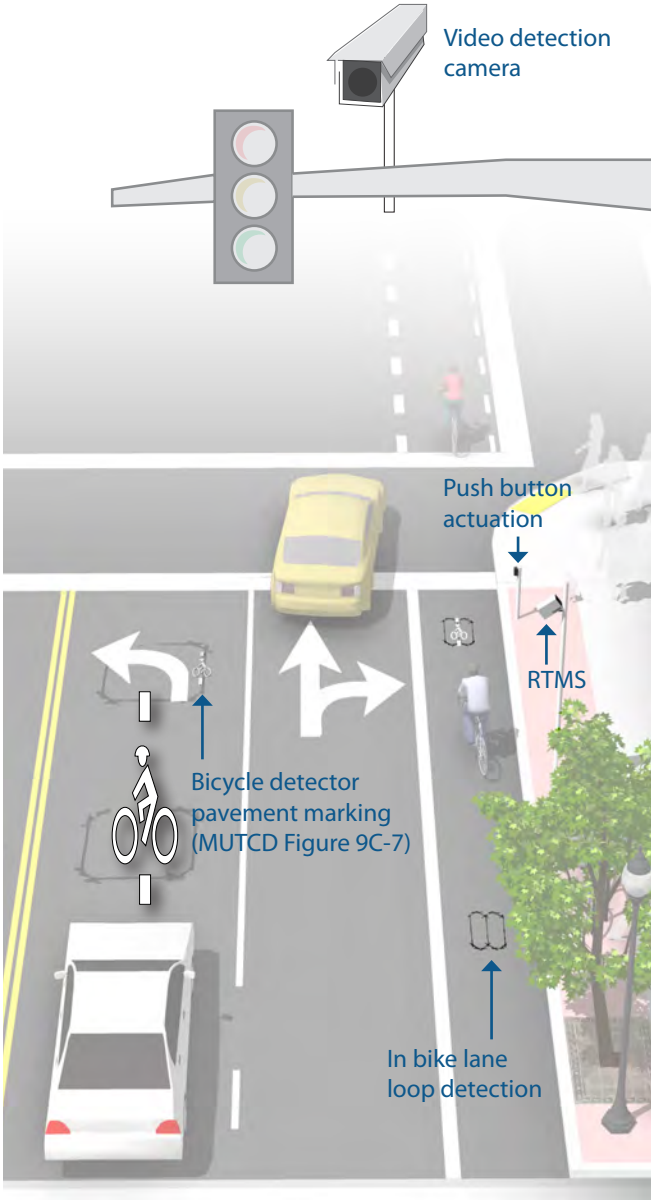
Loops that are sensitive enough to detect bicycles should be supplemented with pavement markings to instruct bicyclists how to trip them.

Video Detection Cameras

Video detection systems use digital image processing to detect a change in the image at a location. These systems can be calibrated to detect bicycles. Video camera system costs range from $20,000 to $25,000 per intersection.

Remote Traffic Microwave Sensor Detection (RTMS)

RTMS is a system which uses frequency modulated continuous wave radio signals to detect objects in the roadway. This method marks the detected object with a time code to determine its distance from the sensor. The RTMS system is unaffected by temperature and lighting, which can affect standard video detection.



Discussion

Proper bicycle detection should meet two primary criteria: 1) accurately detects bicyclists and 2) provides clear guidance to bicyclists on how to actuate detection (e.g., what button to push, where to stand).

Bicycle loops and other detection mechanisms can also provide bicyclists with an extended green time before the light turns yellow so that bicyclists of all abilities can reach the far side of the intersection.

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.
FHWA. *Manual on Uniform Traffic Control Devices.* 2009.
NACTO. *Urban Bikeway Design Guide.* 2012.
PennDOT. *Traffic Signal Design Handbook.* 2013

Materials and Maintenance

Signal detection and actuation for bicyclists should be maintained with other traffic signal detection and roadway pavement markings.

Active Warning Beacons

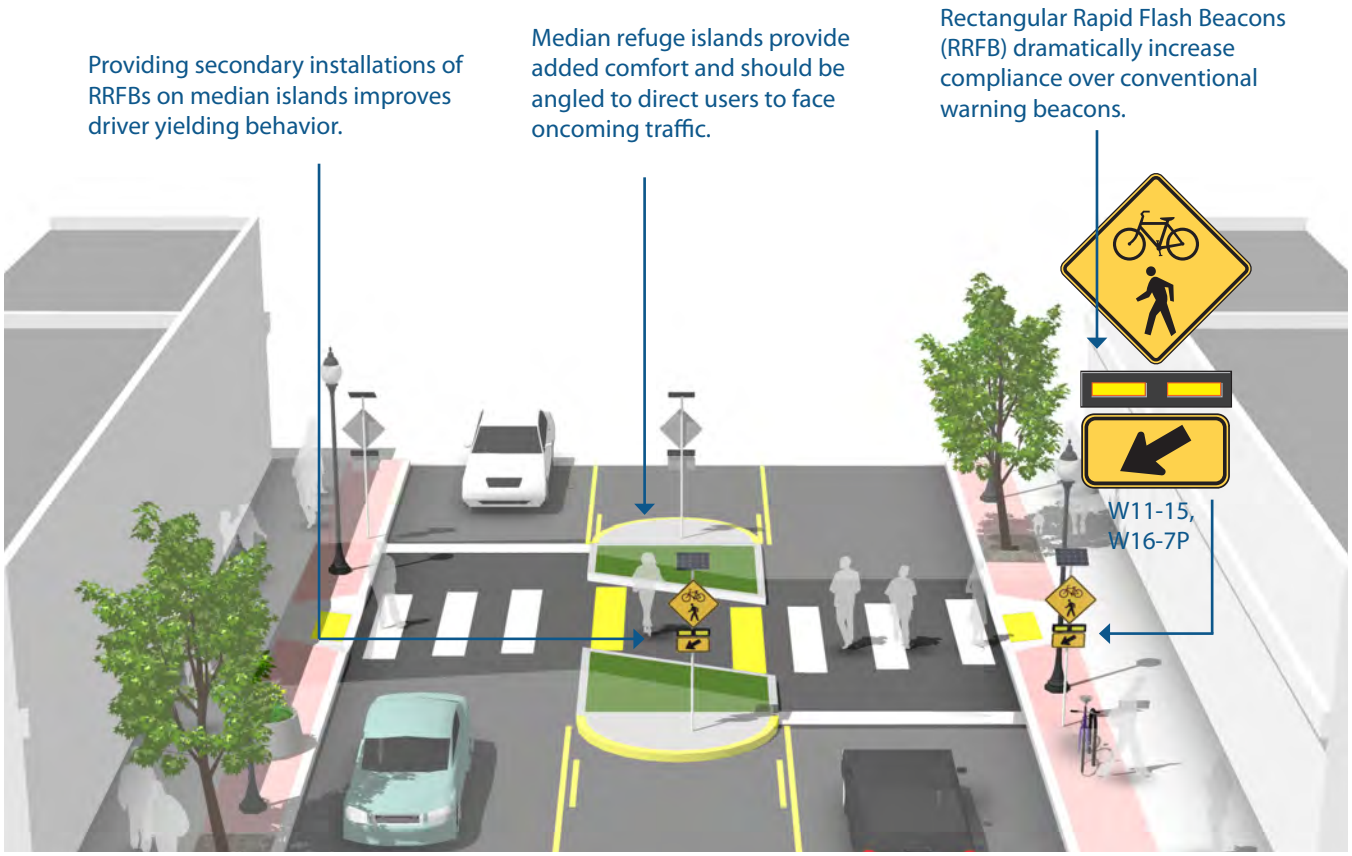
Description

Active warning beacons are user actuated illuminated devices designed to increase motor vehicle yielding compliance at crossings of multi lane or high volume roadways.

Types of active warning beacons include conventional circular yellow flashing beacons, in-roadway warning lights, or Rectangular Rapid Flash Beacons (RRFB).

Guidance

- Warning beacons shall not be used at crosswalks controlled by YIELD signs, STOP signs or traffic signals.
- Warning beacons shall initiate operation based on pedestrian or bicyclist actuation and shall cease operation at a predetermined time after actuation or, with passive detection, after the pedestrian or bicyclist clears the crosswalk.



Discussion

Rectangular rapid flash beacons have the highest compliance of all the warning beacon enhancement options.

A study of the effectiveness of going from a no-beacon arrangement to a two-beacon RRFB installation increased yielding from 18 percent to 81 percent. A four-beacon arrangement raised compliance to 88 percent. Additional studies over long term installations show little to no decrease in yielding behavior over time.

Additional References and Guidelines

NACTO. *Urban Bikeway Design Guide.* 2012.
FHWA. *Manual on Uniform Traffic Control Devices.* 2009.
FHWA. *MUTCD - Interim Approval for Optional Use of Rectangular Rapid Flashing Beacons (IA-11).* 2008.
PennDOT. *Traffic Signal Design Handbook.* 2013

Materials and Maintenance

Depending on power supply, maintenance can be minimal. If solar power is used, RRFBs can run for years without issue.

Hybrid Beacons

Description

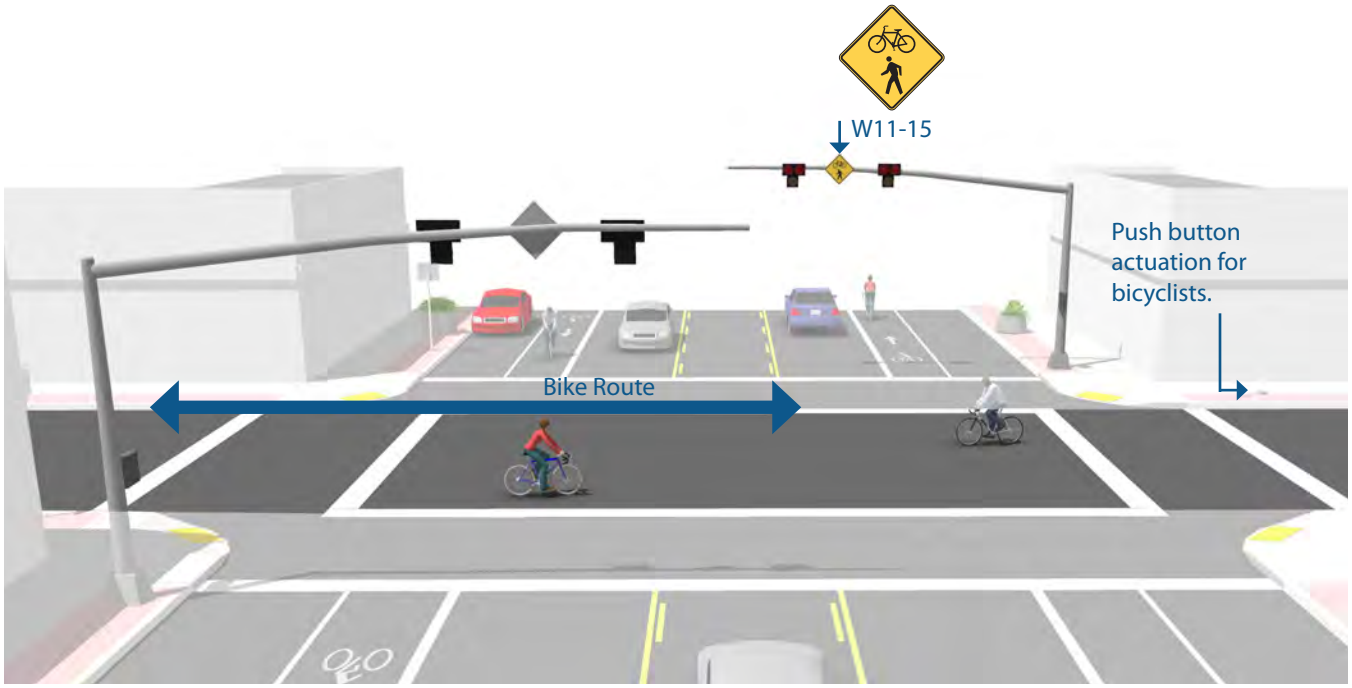
A hybrid beacon, formerly known as a High-intensity Activated CrosswalK (HAWK), consists of a signal-head with two red lenses over a single yellow lens on the major street, and pedestrian and/or bicycle signal heads for the minor street. There are no signal indications for motor vehicles on the minor street approaches.

Hybrid beacons are used to improve non-motorized crossings of major streets in locations where side-street volumes do not support installation of a conventional traffic signal or where there are concerns that a conventional signal will encourage additional motor vehicle traffic on the minor street. Hybrid beacons may also be used at mid-block crossing locations.

Guidance

Hybrid beacons may be installed without meeting traffic control signal warrants if roadway speed and volumes are excessive for comfortable user crossing.

- If installed within a signal system, signal engineers should evaluate the need for the hybrid signal to be coordinated with other signals.
- Parking and other sight obstructions should be prohibited for at least 100 feet in advance of and at least 20 feet beyond the marked crosswalk to provide adequate sight distance.



Discussion

The hybrid beacon can significantly improve the operation of a bicycle route, particularly along neighborhood greenway corridors. Because of the low traffic volumes on these facilities, intersections with major roadways are often unsignalized, creating difficult and potentially unsafe crossing conditions for bicyclists.

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.

Additional References and Guidelines

FHWA. *Pedestrian Hybrid Beacon Guide - Recommendations and Case Study.* 2014.
NACTO. *Urban Bikeway Design Guide.* 2012.
FHWA. *Manual on Uniform Traffic Control Devices.* 2009.

Materials and Maintenance

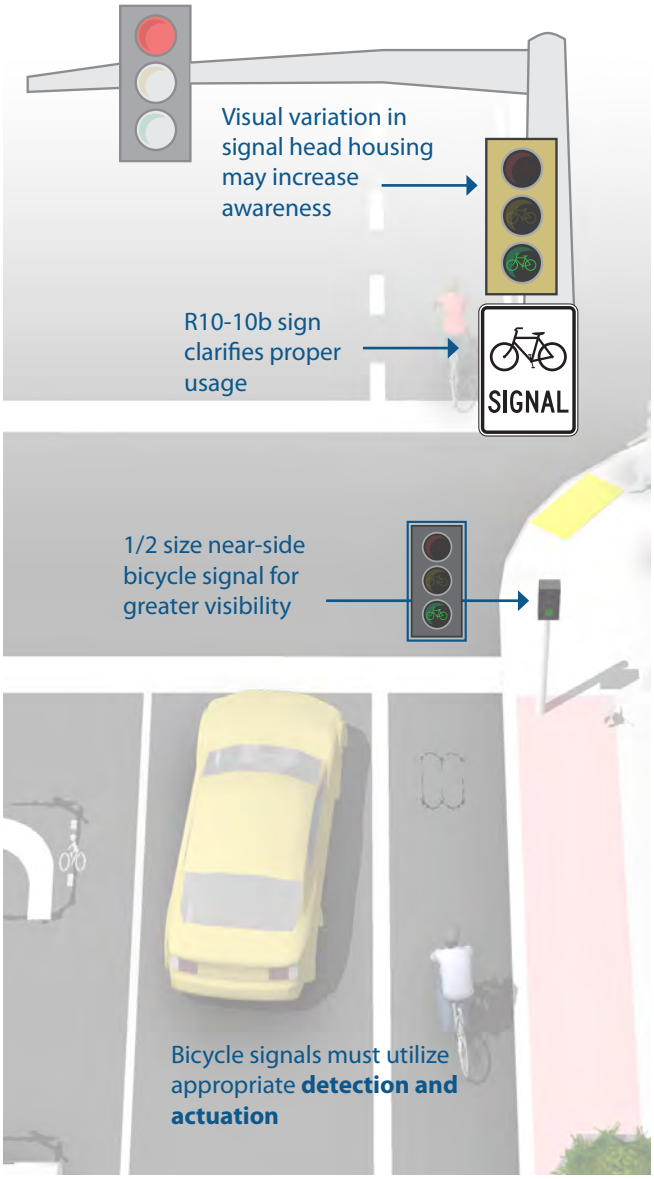
Hybrid beacons are subject to the same maintenance needs and requirements as standard traffic signals. Signing and striping need to be maintained to help users understand any unfamiliar traffic control.

Bicycle Signal Heads

Description

A bicycle signal is an electrically powered traffic control device that should only be used in combination with an existing traffic signal. Bicycle signals are typically used to improve identified safety or operational problems involving bicycle facilities. Bicycle signal heads may be installed at signalized intersections to indicate bicycle signal phases and other bicycle-specific timing strategies. Bicycle signals can be actuated with bicycle sensitive loop detectors, video detection, or push buttons.

Bicycle signals are typically used to provide guidance for bicyclists at intersections where they may have different needs from other road users (e.g., bicycle-only movements).



Guidance

Specific locations where bicycle signals have had a demonstrated positive effect include:

- Those with high volume of bicyclists at peak hours
- Those with high numbers of bicycle/motor vehicle crashes, especially those caused by turning vehicle movements
- At T-intersections with major bicycle movement along the top of the "T."
- At the confluence of an off-street bike path and a roadway intersection
- Where separated bike paths run parallel to arterial streets

Discussion

Local municipal code should be checked or modified to clarify that at intersections with bicycle signals, bicyclists should only obey the bicycle signal heads. For improved visibility, smaller (4 inch lens) near-sided bicycle signals should be considered to supplement far-side signals.

Additional References and Guidelines

FHWA. *MUTCD - Interim Approval for Optional Use of a Bicycle Signal Face (IA-16).* 2013.
NACTO. *Urban Bikeway Design Guide.* 2012.

Materials and Maintenance

Bicycle signal heads require the same maintenance as standard traffic signal heads, such as replacing bulbs and responding to power outages.

Bikeway Signing

The ability to navigate through a city is informed by landmarks, natural features and other visual cues. Signs throughout the city should indicate to bicyclists:

- Direction of travel
- Location of destinations
- Travel time/distance to those destinations

These signs will increase users' comfort and accessibility to the bicycle systems.

Signage can serve both wayfinding and safety purposes including:

- Helping to familiarize users with the bicycle network
- Helping users identify the best routes to destinations
- Helping to address misperceptions about time and distance
- Helping overcome a "barrier to entry" for people who are not frequent bicyclists (e.g., "interested but concerned" bicyclists)

A community-wide bicycle wayfinding signage plan would identify:

- Sign locations
- Sign type – what information should be included and design features
- Destinations to be highlighted on each sign – key destinations for bicyclists
- Approximate distance and travel time to each destination

Bicycle wayfinding signs also visually cue motorists that they are driving along a bicycle route and should use caution. Signs are typically placed at key locations leading to and along bicycle routes, including the intersection of multiple routes. Too many road signs tend to clutter the right-of-way, and it is recommended that these signs be posted at a level most visible to bicyclists rather than per vehicle signage standards.

Wayfinding Sign Types


Wayfinding Sign Placement

Wayfinding Sign Types

Description

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:

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.

Turn Signs

Indicate where a bikeway turns from one street onto another street. Can be used with pavement markings.

Include destinations and arrows.

Decisions 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.

Discussion

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.

Additional References and Guidelines

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

Materials and Maintenance

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

Wayfinding Sign Placement

Confirmation Signs

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.

Turn Signs

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.

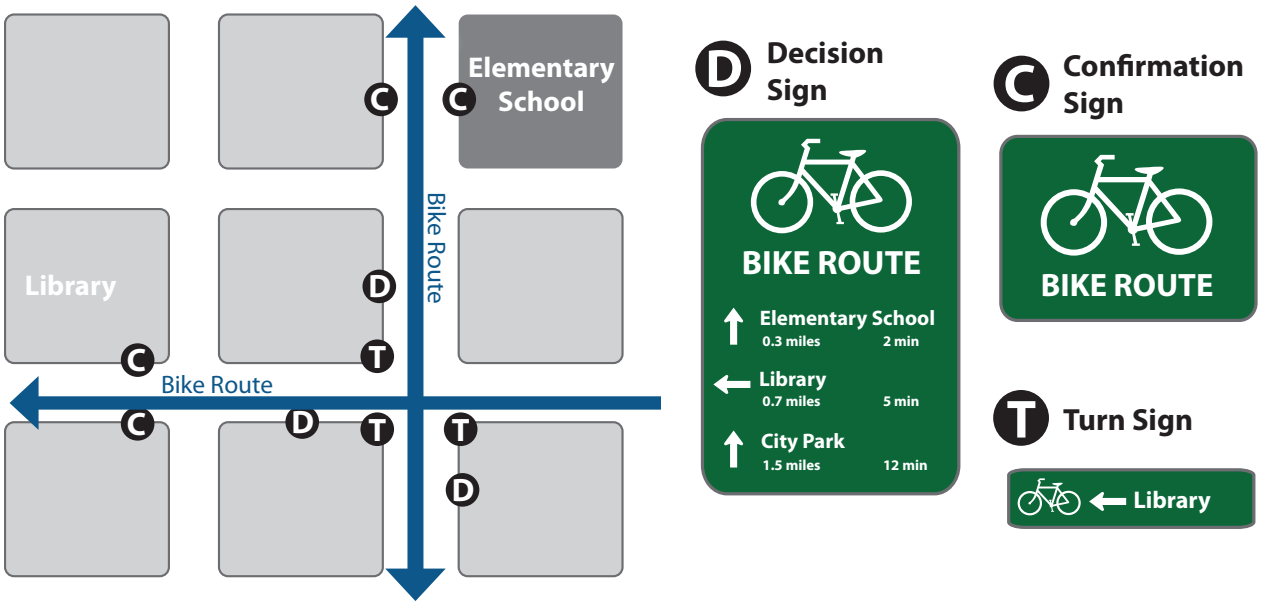
Guidance

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.

Decisions Signs

Near-side of intersections in advance of a junction with another bicycle route.

Along a route to indicate a nearby destination.



Discussion

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 destination's 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.

Additional References and Guidelines

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

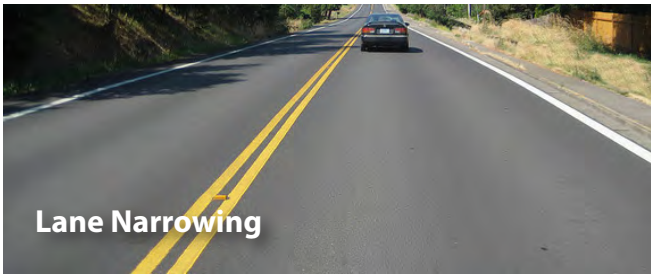
Materials and Maintenance

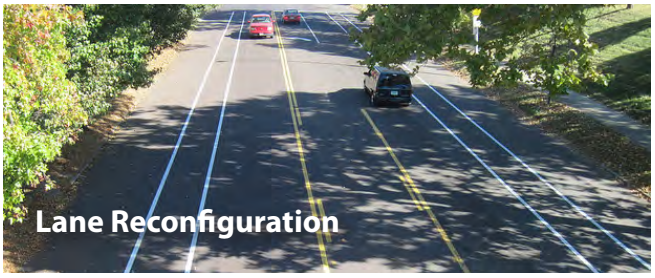
Maintenance needs for bicycle wayfinding signs are similar to other signs and will need periodic replacement due to wear.

Retrofitting Existing Streets to add Bikeways

Most major streets are characterized by conditions (e.g., high vehicle speeds and/or volumes) for which dedicated bike lanes are the most appropriate facility to accommodate safe and comfortable riding. Although opportunities to add bike lanes through roadway widening may exist in some locations, many major streets have physical and other constraints that would require street retrofit measures within existing curb-to-curb widths. As a result, much of the guidance provided in this section focuses on effectively reallocating existing street width through striping modifications to accommodate dedicated bike lanes.

Although largely intended for major streets, these measures may be appropriate for any roadway where bike lanes would be the best accommodation for bicyclists.





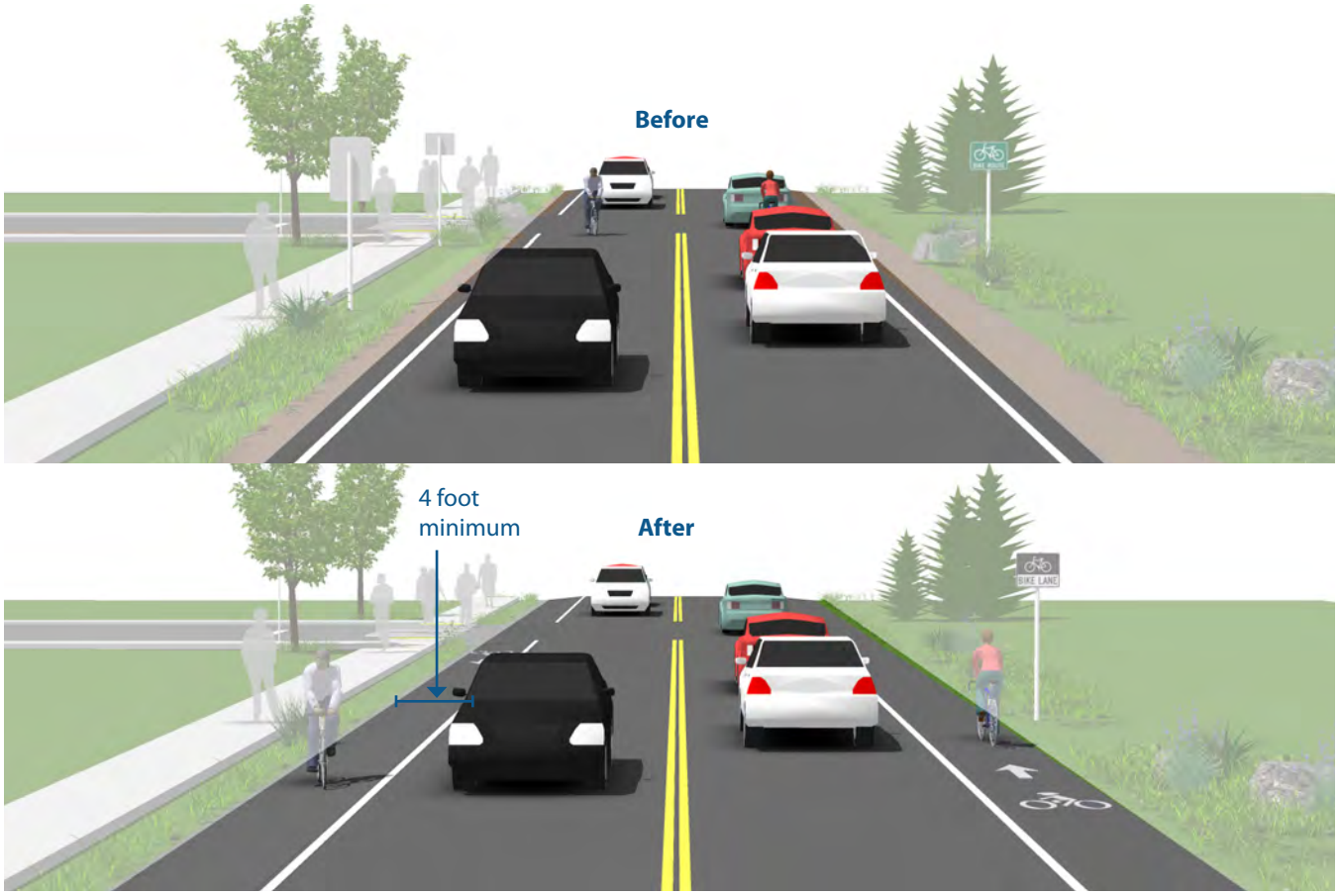
Roadway Widening

Description

Bike lanes can be accommodated on streets with excess right-of-way through shoulder widening. Although roadway widening incurs higher expenses compared with re-striping projects, bike lanes can be added to streets currently lacking curbs, gutters and sidewalks without the high costs of major infrastructure reconstruction.

Guidance

- Guidance on bicycle lanes applies to this treatment.
- 4 foot minimum width when no curb and gutter is present.
- 6 foot width preferred.



Discussion

Roadway widening is most appropriate on roads lacking curbs, gutters and sidewalks.

If it is not possible to meet minimum bicycle lane dimensions, a reduced width paved shoulder can still improve conditions for bicyclists on constrained roadways. In these situations, a minimum of 3 feet of operating space should be provided.

Additional References and Guidelines

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

Materials and Maintenance

The extended bicycle area should not contain any rough joints where bicyclists ride. Saw or grind a clean cut at the edge of the travel lane, or feather with a fine mix in a non-ridable area of the roadway.

Lane Narrowing

Description

Lane narrowing utilizes roadway space that exceeds minimum standards to provide the needed space for bike lanes. Many roadways have existing travel lanes that are wider than those prescribed in local and national roadway design standards, or which are not marked. Most standards allow for the use of 11 foot and sometimes 10 foot wide travel lanes to create space for bike lanes.

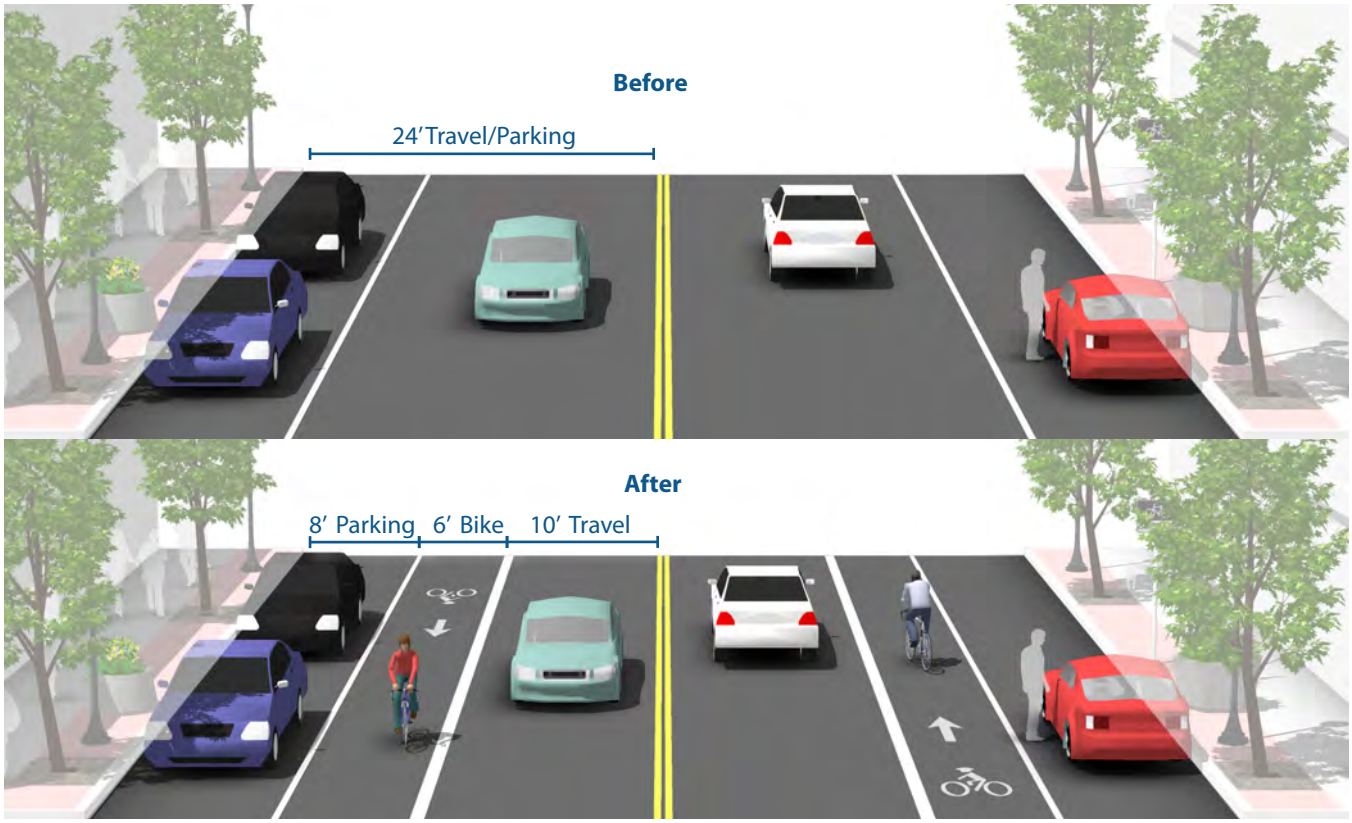
Guidance

Vehicle lane width:

- Before: 10-15 feet
- After: 10-11 feet

Bicycle lane width:

- Guidance on bicycle lanes applies to this treatment.



Discussion

Special consideration should be given to the amount of heavy vehicle traffic and horizontal curvature before the decision is made to narrow travel lanes. Center turn lanes can also be narrowed in some situations to free up pavement space for bike lanes.

AASHTO supports reduced width lanes in *A Policy on Geometric Design of Highways and Streets: "On interrupted-flow operation conditions at low speeds (45 mph or less), narrow lane widths are normally adequate and have some advantages."*

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.
AASHTO. *A Policy on Geometric Design of Highways and Streets.* 2004.
NACTO. *Urban Street Design Guide.* 2013.

Materials and Maintenance

Repair rough or uneven pavement surface. Use bicycle compatible drainage grates. Raise or lower existing grates and utility covers so they are flush with the pavement.

Lane Reconfiguration

Description

The removal of a single travel lane will generally provide sufficient space for bike lanes on both sides of a street. Streets with excess vehicle capacity provide opportunities for bike lane retrofit projects.

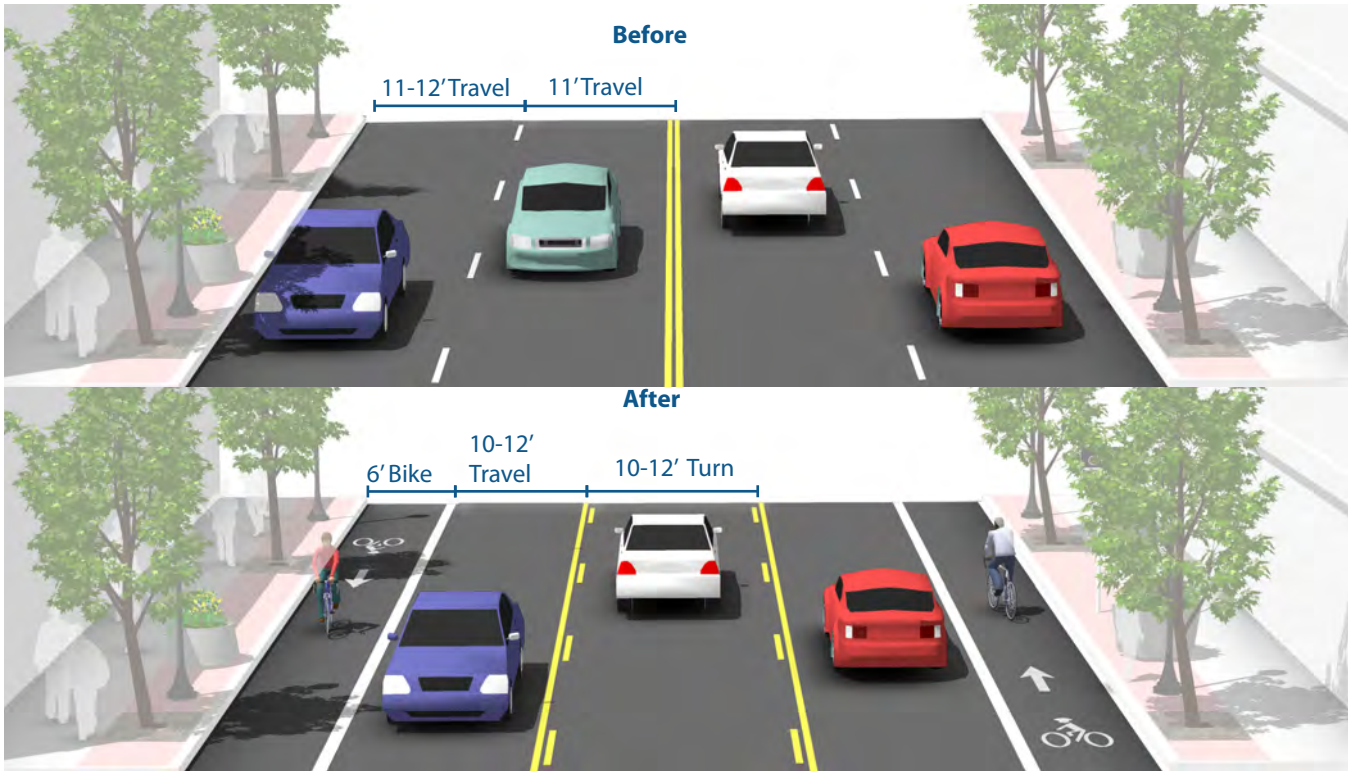
Guidance

Vehicle lane width:

- Width depends on project. No narrowing may be needed if a lane is removed.

Bicycle lane width:

- Guidance on bicycle lanes applies to this treatment.



Discussion

Depending on a street's existing configuration, traffic operations, user needs and safety concerns, various lane reduction configurations may apply. For instance, a four-lane street (with two travel lanes in each direction) could be modified to provide one travel lane in each direction, a center turn lane, and bike lanes. Prior to implementing this measure, a traffic analysis should identify potential impacts.

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.
FHWA. *Evaluation of Lane Reduction "Road Diet" Measures on Crashes.* Publication Number: FHWA-HRT-10-053. 2010.
NACTO. *Urban Street Design Guide.* 2013.

Materials and Maintenance

Repair rough or uneven pavement surface. Use bicycle compatible drainage grates. Raise or lower existing grates and utility covers so they are flush with the pavement.

Parking Reduction

Description

Bike lanes can replace one or more on-street parking lanes on streets where excess parking exists and/or the importance of bike lanes outweighs parking needs. For example, parking may be needed on only one side of a street. Eliminating or reducing on-street parking also improves sight distance for bicyclists in bike lanes and for motorists on approaching side streets and driveways.

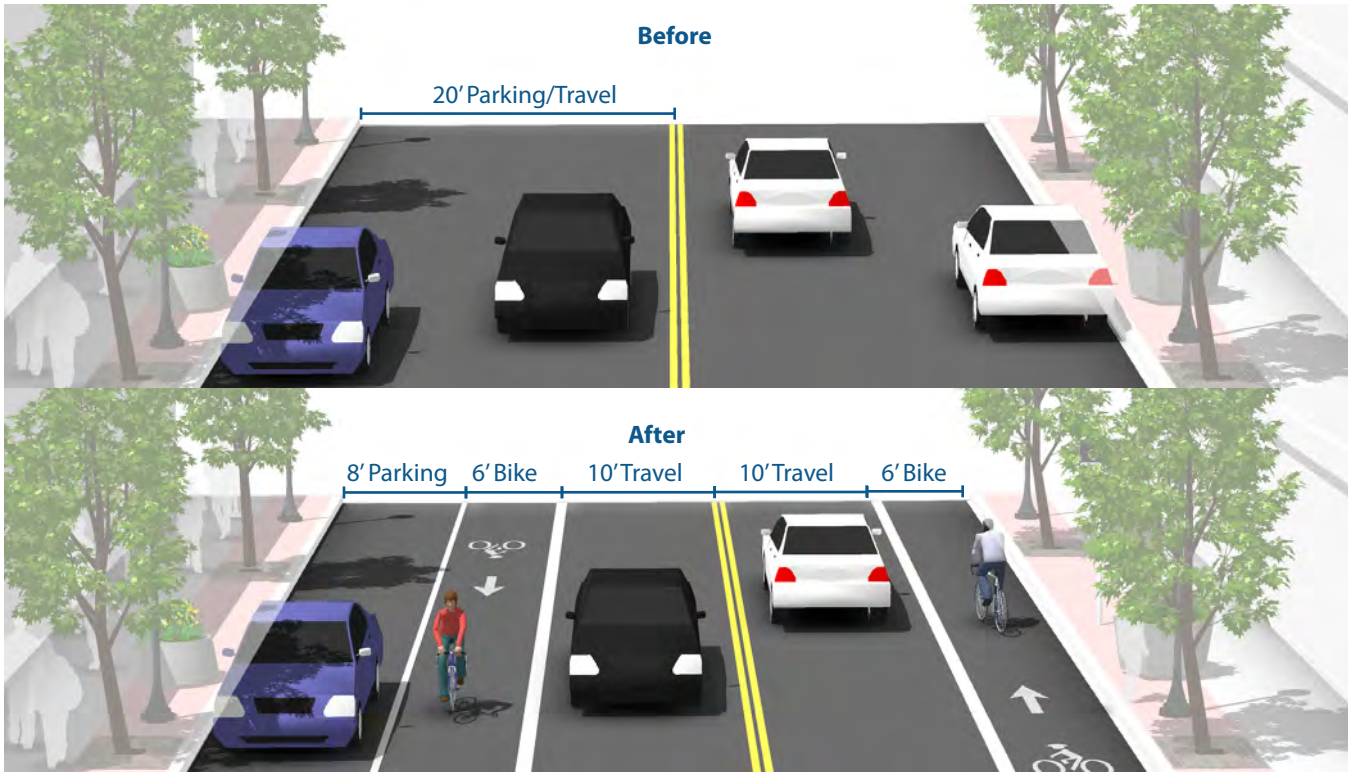
Guidance

Vehicle lane width:

- Parking lane width depends on project. No travel lane narrowing may be required depending on the width of the parking lanes.

Bicycle lane width:

- Guidance on bicycle lanes applies to this treatment.



Discussion

Removing or reducing on-street parking to install bike lanes requires comprehensive outreach to the affected businesses and residents. Prior to reallocating on-street parking for other uses, a parking study should be performed to gauge demand and to evaluate impacts to people with disabilities.

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities*. 2012.
AASHTO. *A Policy on Geometric Design of Highways and Streets*. 2004.

Materials and Maintenance

Repair rough or uneven pavement surface. Use bicycle compatible drainage grates. Raise or lower existing grates and utility covers so they are flush with the pavement

Shared Use Paths and Off-Street Facilities

A shared use path allows for two-way, off-street bicycle use and also may be used by pedestrians, skaters, wheelchair users, joggers and other non-motorized users. These facilities are frequently found in parks, along rivers, beaches, and in greenbelts or utility corridors where there are few conflicts with motorized vehicles. Path facilities can also include amenities such as lighting, signage, and fencing (where appropriate).

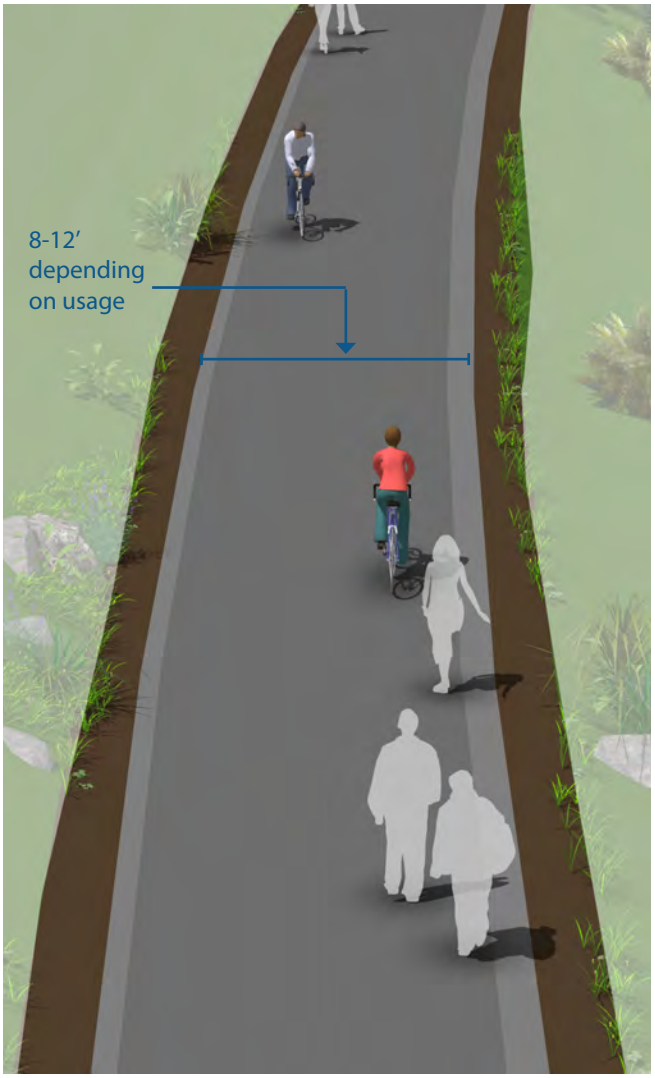
Key features of shared use paths include:

- Frequent access points from the local road network.
- Directional signs to direct users to and from the path.
- A limited number of at-grade crossings with streets or driveways.
- Terminating the path where it is easily accessible to and from the street system.
- Separate treads for pedestrians and bicyclists when heavy use is expected.

General Design Practices

Description

Shared use paths can provide a desirable facility, particularly for recreation, and users of all skill levels preferring separation from traffic. Bicycle paths should generally provide directional travel opportunities not provided by existing roadways.



Guidance

Width

- 8 feet is the minimum allowed for a two-way bicycle path and is only recommended for low traffic situations.
- 10 feet is recommended in most situations and will be adequate for moderate to heavy use.
- 12 feet is recommended for heavy use situations with high concentrations of multiple users. A separate track (5' minimum) can be provided for pedestrian use.

Lateral Clearance

- A 2 foot or greater shoulder on both sides of the path should be provided. An additional foot of lateral clearance (total of 3') is required by the MUTCD for the installation of signage or other furnishings.
- If bollards are used at intersections and access points, they should be colored brightly and/or supplemented with reflective materials to be visible at night.

Overhead Clearance

- Clearance to overhead obstructions should be 8 feet minimum, with 10 feet recommended.

Striping

- When striping is required, use a 4 inch dashed yellow centerline stripe with 4 inch solid white edge lines.
- Solid centerlines can be provided on tight or blind corners, and on the approaches to roadway crossings.

Discussion

Terminate the path where it is easily accessible to and from the street system, preferably at a controlled intersection or at the beginning of a dead-end street.

Additional References and Guidelines

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.
PA DCNR. *Pennsylvania Trail Design & Development principles.*

Materials and 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.

Shared Use Paths in Abandoned Rail Corridors

Description

Commonly referred to as Rails-to-Trails or Rail-Trails, these projects convert vacated rail corridors into off-street paths. Rail corridors offer several advantages, including relatively direct routes between major destinations and generally flat terrain.

In some cases, rail owners may rail-bank their corridors as an alternative to a complete abandonment of the line, thus preserving the rail corridor for possible future use.

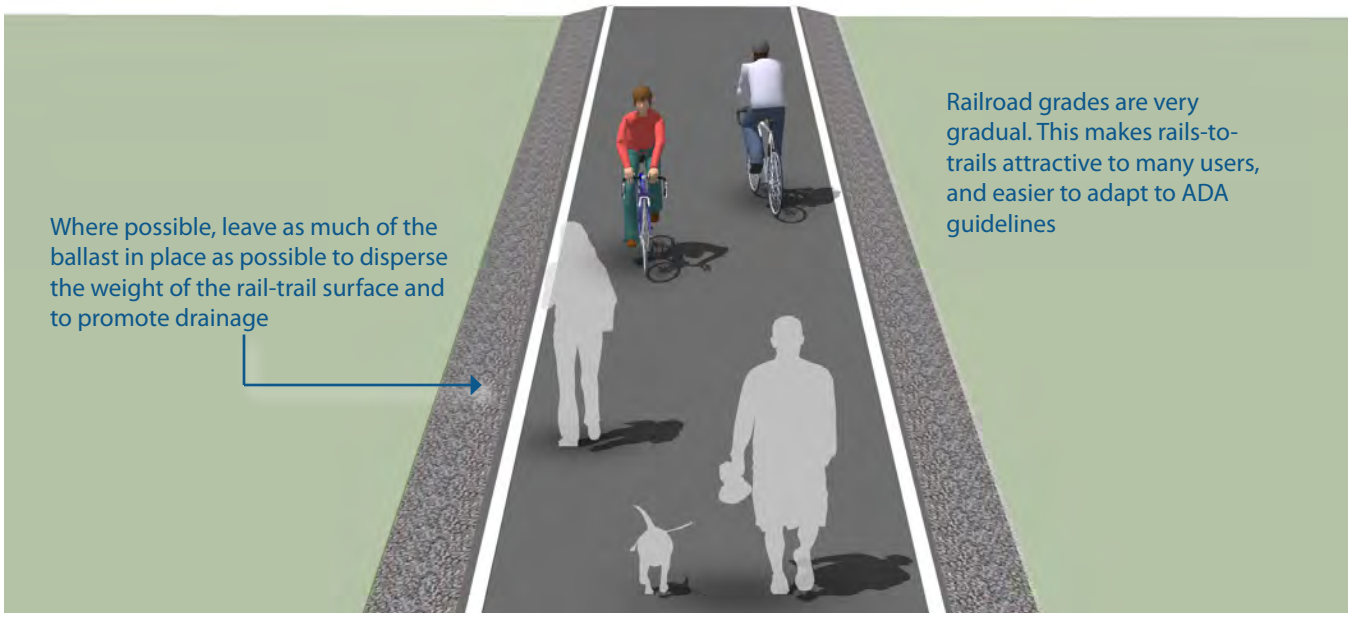
The railroad may form an agreement with any person, public or private, who would like to use the banked rail line as a trail or linear park until it is again needed for rail use. Municipalities should acquire abandoned rail rights-of-way whenever possible to preserve the opportunity for trail development.

Guidance

Shared use paths in abandoned rail corridors should meet or exceed general design practices. If additional width allows, wider paths, and landscaping are desirable.

In full conversions of abandoned rail corridors, the sub-base, superstructure, drainage, bridges, and crossings are already established. Design becomes a matter of working with the existing infrastructure to meet the needs of a rail-trail.

If converting a rail bed adjacent to an active rail line, see Shared Use Paths in Active Rail Corridors.



Discussion

It is often impractical and costly to add material to existing railroad bed fill slopes. This results in trails that meet minimum path widths, but often lack preferred shoulder and lateral clearance widths.

Rail-to-trails can involve many challenges including the acquisition of the right of way, cleanup and removal of toxic substances, and rehabilitation of tunnels, trestles and culverts. A structural engineer should evaluate existing railroad bridges for structural integrity to ensure they are capable of carrying the appropriate design loads.

Additional References and Guidelines

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.
PA DCNR. *Pennsylvania Trail Design & Development principles.*

Materials and 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.

Shared Use Paths in Active Rail Corridors

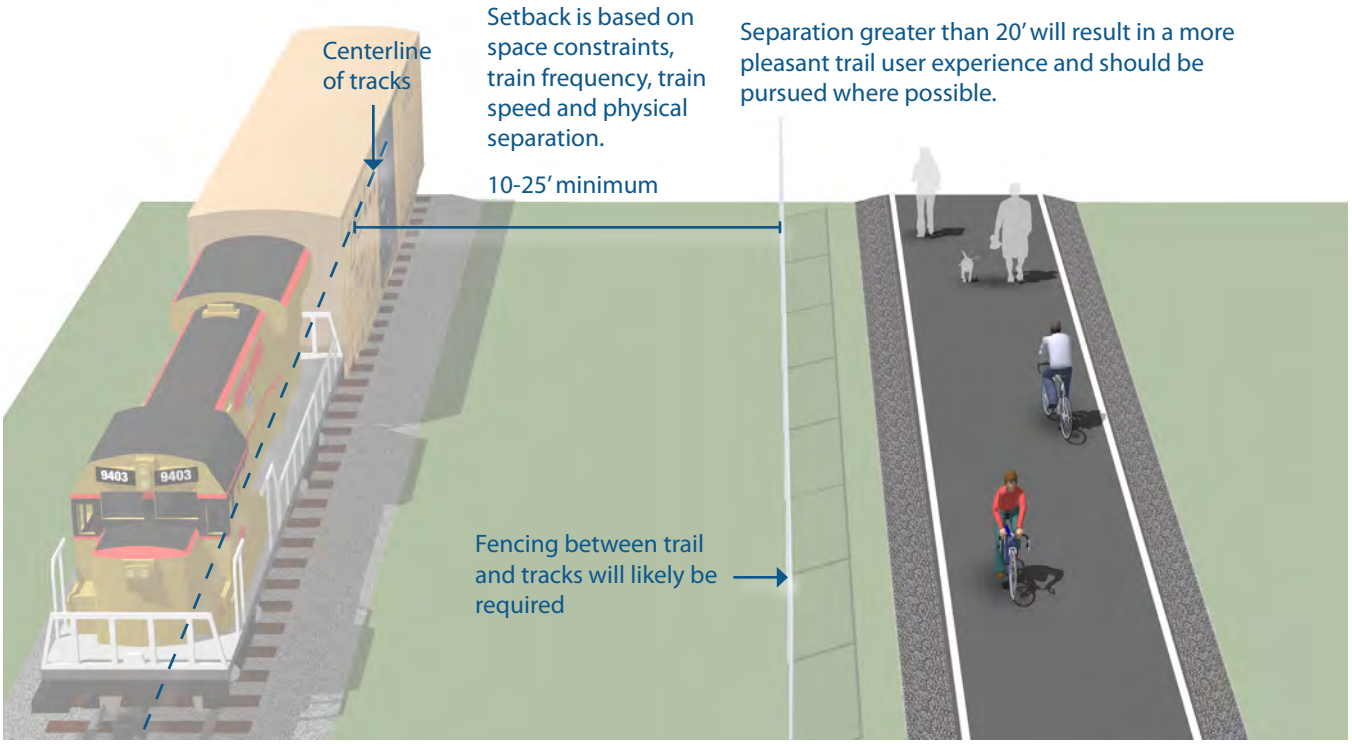
Description

Rails-with-Trails projects typically consist of paths adjacent to active railroads. It should be noted that some constraints could impact the feasibility of rail-with-trail projects. 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.

Guidance

Shared use paths in utility 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 feet in height with higher fencing than usual next to sensitive areas such as switching yards. Setbacks from the active rail line will vary depending on the speed and frequency of trains, and available right-of-way.



Discussion

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.

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities*. 2012.
FHWA. *Manual on Uniform Traffic Control Devices*. 2009.
FHWA. *Rails-with-Trails: Lessons Learned*. 2002.

Materials and 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.

Shared Use Paths in River and Utility Corridors

Description

Utility and waterway corridors often offer excellent shared use path development and bikeway gap closure opportunities. Utility corridors typically include powerline and sewer corridors, while waterway corridors include canals, drainage ditches, rivers, and beaches. These corridors offer excellent transportation and recreation opportunities for bicyclists of all ages and skills.

Guidance

Shared use paths in utility corridors should meet or exceed general design practices. If additional width allows, wider paths, and landscaping are desirable.

Access Points

Any access point to the path should be well-defined with appropriate signage designating the pathway as a bicycle facility and prohibiting motor vehicles.

Path Closure

Public access to the shared use path may be prohibited during the following events:

- Canal/flood control channel or other utility maintenance activities
- Inclement weather or the prediction of storm conditions

Discussion

Similar to railroads, public access to flood control channels or canals may be undesirable. Hazardous materials, deep water or swift current, steep, slippery slopes, and debris all may constitute risks for public access. Appropriate fencing may be desired to keep path users within the designated travel way. Creative design of fencing is encouraged to make the path facility feel welcoming to the user.

Additional References and Guidelines

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.
PA DCNR. *Pennsylvania Trail Design & Development principles.*

Materials and 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.

Local Neighborhood Accessways

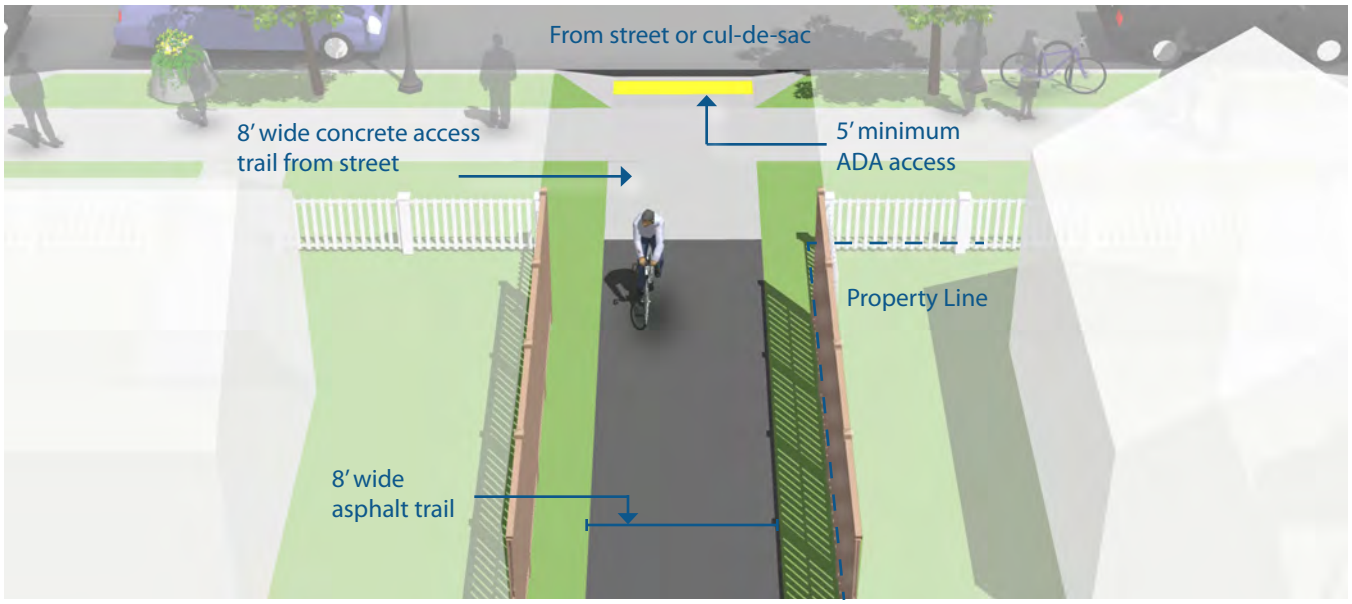
Description

Neighborhood accessways provide residential areas with direct bicycle and pedestrian access to parks, trails, greenspaces, and other recreational areas. They most often serve as small trail connections to and from the larger trail network, typically having their own rights-of-way and easements.

Additionally, these smaller trails can be used to provide bicycle and pedestrian connections between dead-end streets, cul-de-sacs, and access to nearby destinations not provided by the street network.

Guidance

- Neighborhood accessways should remain open to the public.
- Trail pavement shall be at least 8' wide to accommodate emergency and maintenance vehicles, meet ADA requirements and be considered suitable for multi-use.
- Trail widths should be designed to be less than 8' wide only when necessary to protect large mature native trees over 18" in caliper, wetlands or other ecologically sensitive areas.
- Access trails should slightly meander whenever possible.



Discussion

Neighborhood accessways should be designed into new subdivisions at every opportunity and should be required by City/County subdivision regulations.

For existing subdivisions, Neighborhood and homeowner association groups are encouraged to identify locations where such connects would be desirable. Nearby residents and adjacent property owners should be invited to provide landscape design input.

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.
FHWA. *Manual on Uniform Traffic Control Devices.* 2009.
FHWA. *Federal Highway Administration University Course on Bicycle and Pedestrian Transportation. Lesson 19: Greenways and Shared Use Paths.* 2006.
NACTO. *Urban Street Design Guide.* 2013.

Materials and 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.

Shared-Use Paths Along Roadways

Description

Shared Use Paths along roadways, also called Sidepaths, are a type of path that run adjacent to a street.

Because of operational concerns it is generally preferable to place paths within independent rights-of-way away from roadways. However, there are situations where existing roads provide the only corridors available.

Along roadways, these facilities create a situation where a portion of the bicycle traffic rides against the normal flow of motor vehicle traffic and can result in wrong-way riding where bicyclists enter or leave the path.

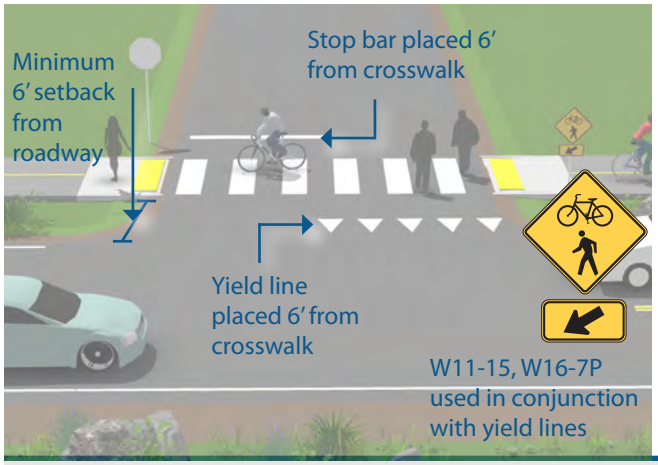
The AASHTO Guide for the Development of Bicycle Facilities cautions practitioners of the use of two-way sidepaths on urban or suburban streets with many driveways and street crossings.

In general, there are two approaches to crossings: adjacent crossings and setback crossings, illustrated below.

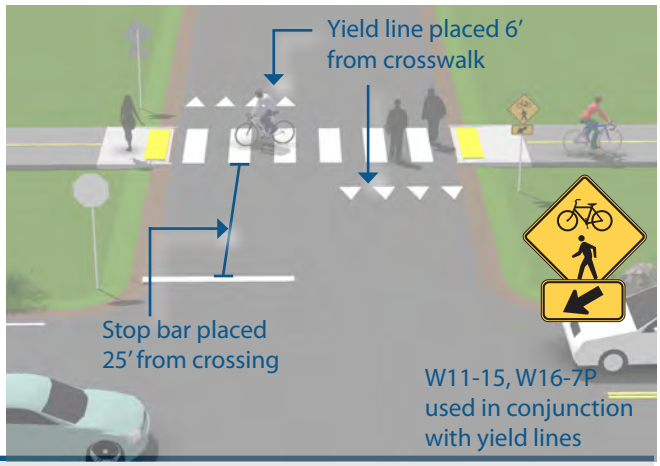
Guidance

- Guidance for sidepaths should follow that for general design practises of shared use paths.
- A high number of driveway crossings and intersections create potential conflicts with turning traffic. Consider alternatives to sidepaths on streets with a high frequency of intersections or heavily used driveways.
- Where a sidepath terminates special consideration should be given to transitions so as not to encourage unsafe wrong-way riding by bicyclists.
- Crossing design should emphasize visibility of users and clarity of expected yielding behavior. Crossings may be STOP or YIELD controlled depending on sight lines and bicycle motor vehicle volumes and speeds.

Adjacent Crossing - A separation of 6 feet emphasizes the conspicuity of riders at the approach to the crossing.



Setback Crossing - A set back of 25 feet separates the path crossing from merging/turning movements that may be competing for a driver's attention.



Discussion

The provision of a shared use path adjacent to a road is not a substitute for the provision of on-road accommodation such as paved shoulders or bike lanes, but may be considered in some locations in addition to on-road bicycle facilities.

To reduce potential conflicts in some situations, it may be better to place one-way sidepaths on both sides of the street.

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.
NACTO. *Urban Bikeway Design Guide.* See entry on Raised Cycle Tracks. 2012.

Materials and 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.

Natural Surface Trails

Description

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

Guidance presented in this section does not include considerations for bicycles. Natural surface trails designed for bicycles are typically known as single track trails.

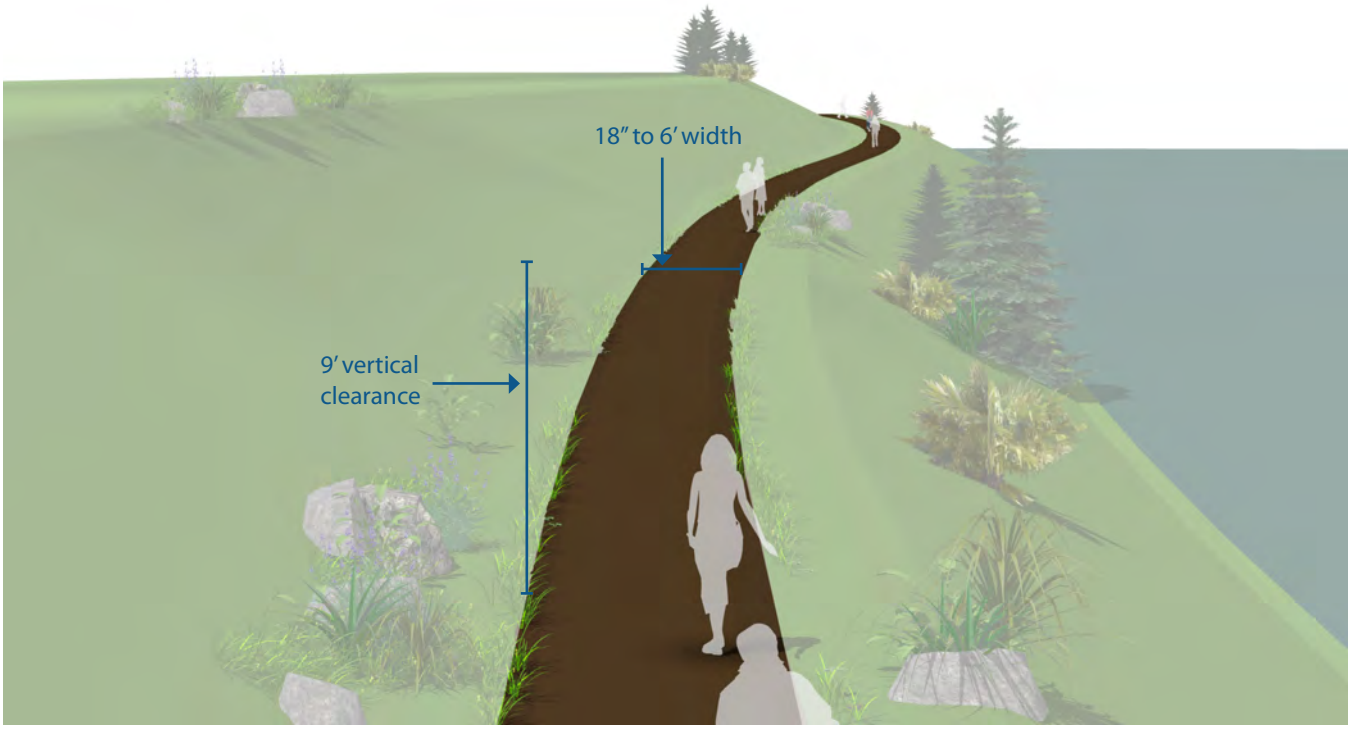
Guidance

Trails can vary in width from 18 inches to 6 feet or greater; vertical clearance should be maintained at nine-feet 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 five percent (typical).



Discussion

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.

Additional References and Guidelines

Flink, C. *Greenways: A Guide To Planning Design And Development.* 1993.
PA DCNR. *Pennsylvania Trail Design & Development principles.*

Materials and Maintenance

Consider implications for accessibility when weighing options for surface treatments.

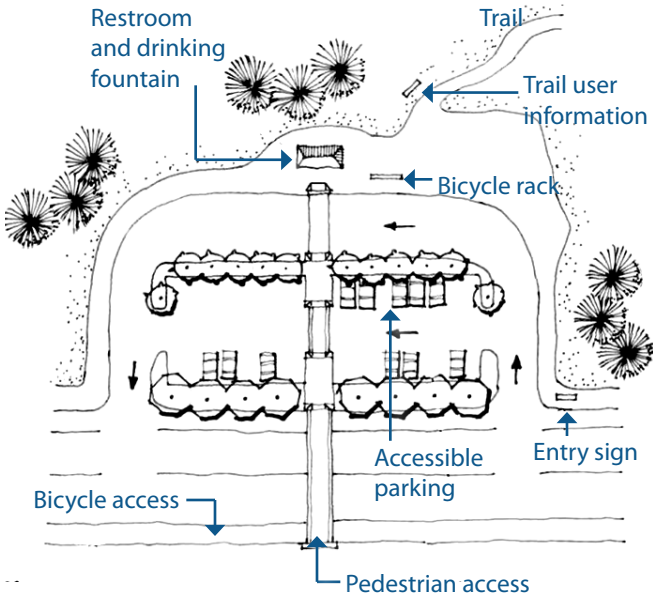
Trailheads

Description

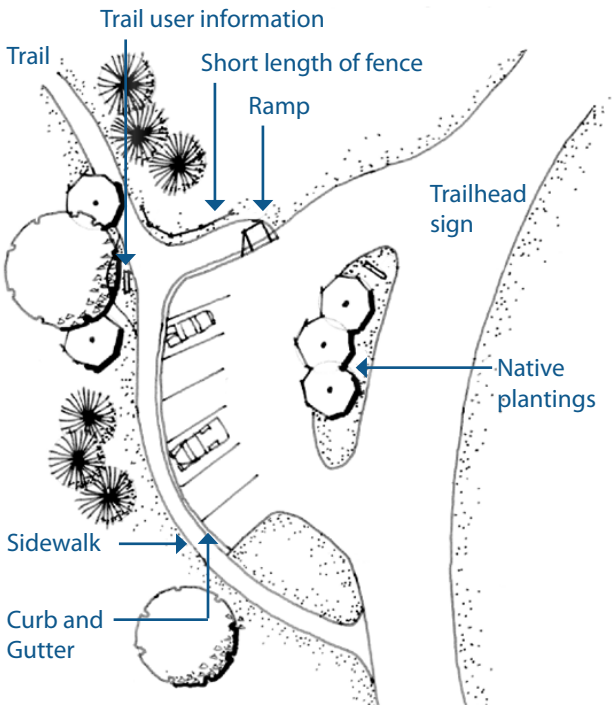
Good access to a path system is a key element for its success. Trailheads serve the local and regional population arriving to the path system by car, transit, bicycle or other modes. Trailheads provide essential access to the shared use path system and include amenities like parking for vehicles and bicycles, reestrooms (at major trailheads), and posted maps.

Guidance

- Major trailheads should include automobile and bicycle parking, trail information (maps, user guidelines, wildlife information, etc.), garbage receptacles and restrooms.
- Minor trailheads can provide a subset of these amenities.



Major Trailhead



Minor Trailhead

Discussion

Trailheads with a small motor vehicle parking area should additionally include bicycle parking and accessible parking.

Neighborhood access should be achieved from all local streets crossing the path. No parking needs to be provided, and in some situations "No Parking" signs will be desirable to minimize impact on the neighborhood. See Local Neighborhood Accessways for neighborhood connection guidance.

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.
PA DCNR. *Pennsylvania Trail Design & Development principles.*

Materials and Maintenance

Trailhead signage and lighting will require regular maintenance. Major trailheads will require regularg servicing.

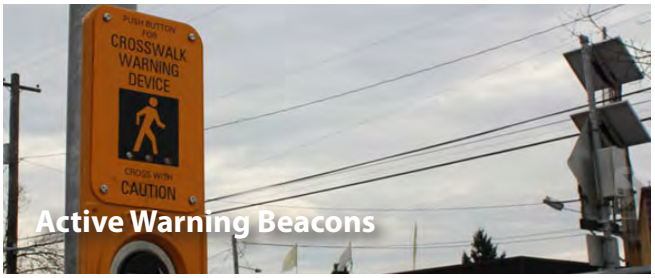
Path/Roadway Crossings

At-grade roadway crossings can create potential conflicts between path users and motorists, however, well-designed crossings can mitigate many operational issues and provide a higher degree of safety and comfort for path users. This is evidenced by the thousands of successful facilities around the United States with at-grade crossings. In most cases, at-grade path crossings can be properly designed to provide a reasonable degree of safety and can meet existing traffic and safety standards. Path facilities that cater to bicyclists can require additional considerations due to the higher travel speed of bicyclists versus pedestrians.

Consideration must be given to adequate warning distance based on vehicle speeds and line of sight, with the visibility of any signs absolutely critical. Directing the active attention of motorists to roadway signs may require additional alerting devices such as a flashing beacon, roadway striping or changes in pavement texture. Signing for path users may include a standard "STOP" or "YIELD" sign and pavement markings, possibly combined with other features such as bollards or a bend in the pathway to slow bicyclists. Care must be taken not to place too many signs at crossings lest they begin to lose their visual impact.

A number of striping patterns have emerged over the years to delineate path crossings. A median stripe on the path approach will help to organize and warn path users. Crosswalk striping is typically a matter of local and State preference, and may be accompanied by pavement treatments to help warn and slow motorists. In areas where motorists do not typically yield to crosswalk users, additional measures may be required to increase compliance.

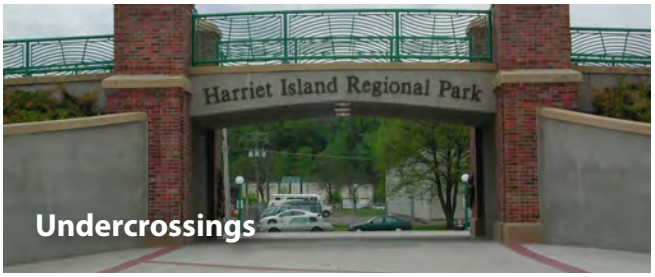

Marked/Unsignalized Crossings



Active Warning Beacons


Route Users to Existing Signals


Signalized/Controlled Crossings



Undercrossings


Overcrossings

Marked/Unsignalized Crossings

Description

A marked/unsignalized crossing typically consists of a marked crossing area, signage and other markings to slow or stop traffic. The approach to designing crossings at mid-block locations 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.

When space is available, using a median refuge island can improve user safety by providing pedestrians and bicyclists space to perform the safe crossing of one side of the street at a time.

Guidance

Maximum traffic volumes

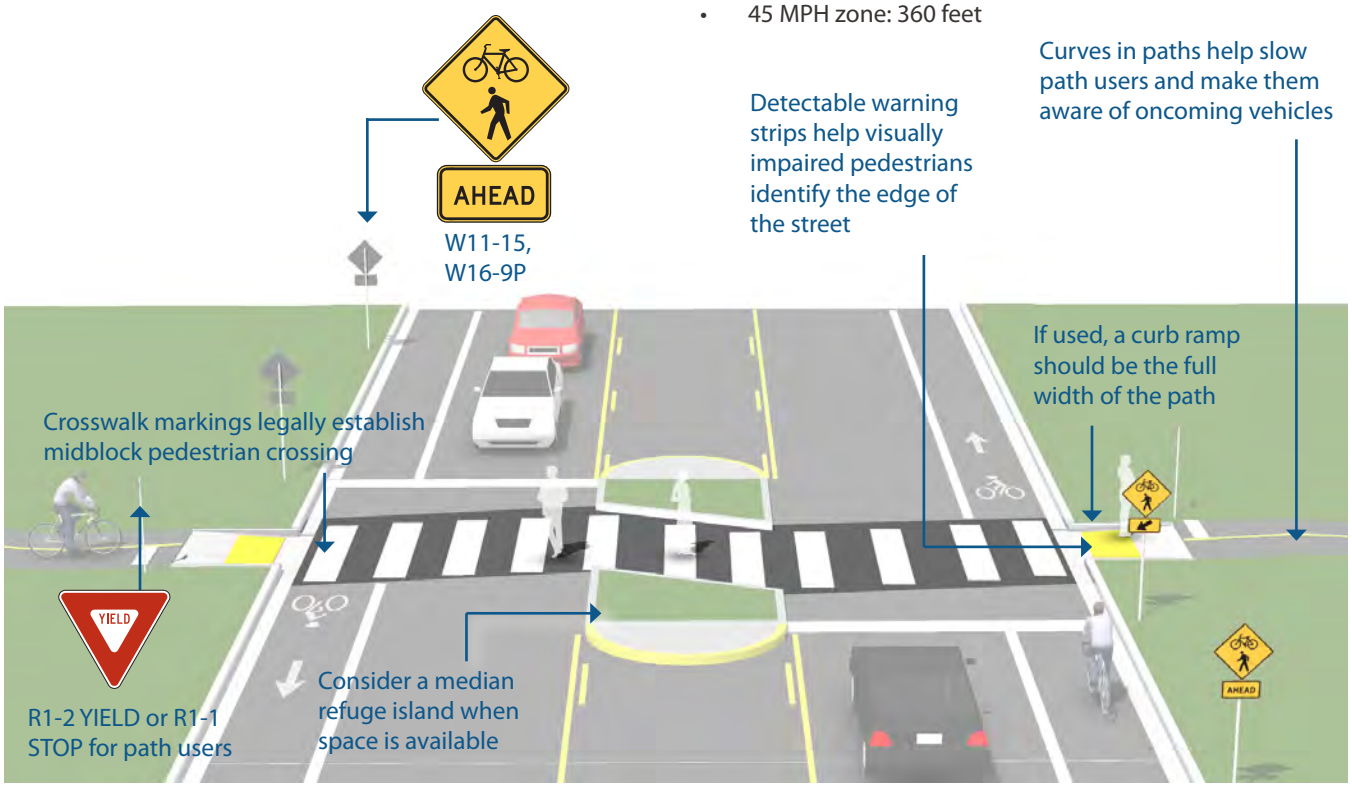
- ≤9,000-12,000 Average Daily Traffic (ADT) volume
- Up to 15,000 ADT on two-lane roads, preferably with a median
- Up to 12,000 ADT on four-lane roads with median

Maximum travel speed

- 35 MPH

Minimum line of sight

- 25 MPH zone: 155 feet
- 35 MPH zone: 250 feet
- 45 MPH zone: 360 feet



Discussion

Unsignalized crossings of multi-lane arterials over 15,000 ADT may be possible with features such as sufficient crossing gaps (more than 60 per hour), median refuges, and/or active warning devices like rectangular rapid flash beacons or in-pavement flashers, and excellent sight distance. For more information see the discussion of active warning beacons.

On roadways with low to moderate traffic volumes (<12,000 ADT) and a need to control traffic speeds, a raised crosswalk may be the most appropriate crossing design to improve pedestrian visibility and safety.

Additional References and Guidelines

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

Materials and Maintenance

Locate markings out of wheel tread when possible to minimize wear and maintenance costs.

Active Warning Beacons

Description

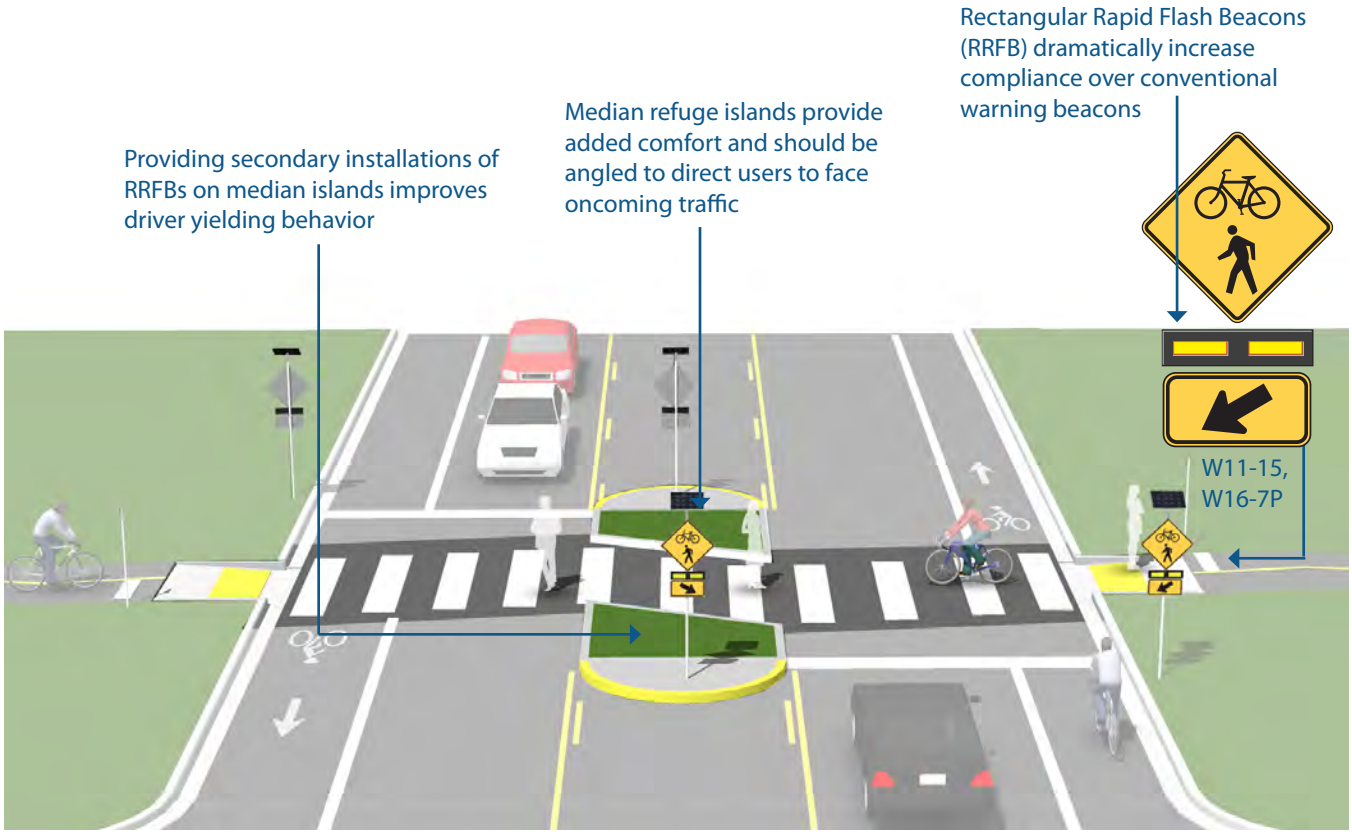
Enhanced marked crossings are unsignalized crossings with additional treatments designed to increase motor vehicle yielding compliance on multi-lane or high volume roadways.

These enhancements include pathway user or sensor actuated warning beacons, Rectangular Rapid Flash Beacons (RRFB) shown below, or in-roadway warning lights.

Guidance

Guidance for marked/unsignalized crossings applies.

- Warning beacons shall not be used at crosswalks controlled by YIELD signs, STOP signs, or traffic control signals.
- Warning beacons shall initiate operation based on user actuation and shall cease operation at a predetermined time after the user actuation or, with passive detection, after the user clears the crosswalk.



Discussion

Rectangular rapid flash beacons show the most increased compliance of all the warning beacon enhancement options.

A study of the effectiveness of going from a no-beacon arrangement to a two-beacon RRFB installation increased yielding from 18 percent to 81 percent. A four-beacon arrangement raised compliance to 88%. Additional studies of long term installations show little to no decrease in yielding behavior over time.

Additional References and Guidelines

NACTO. *Urban Bikeway Design Guide*. 2012.
FHWA. *Manual on Uniform Traffic Control Devices*. 2009.
FHWA. *MUTCD - Interim Approval for Optional Use of Rectangular Rapid Flashing Beacons (IA-11)*. 2008.
PennDOT. *Traffic Signal Design Handbook*. 2013

Materials and Maintenance

Locate markings out of wheel tread when possible to minimize wear and maintenance costs. Signing and striping need to be maintained to help users understand any unfamiliar traffic control.

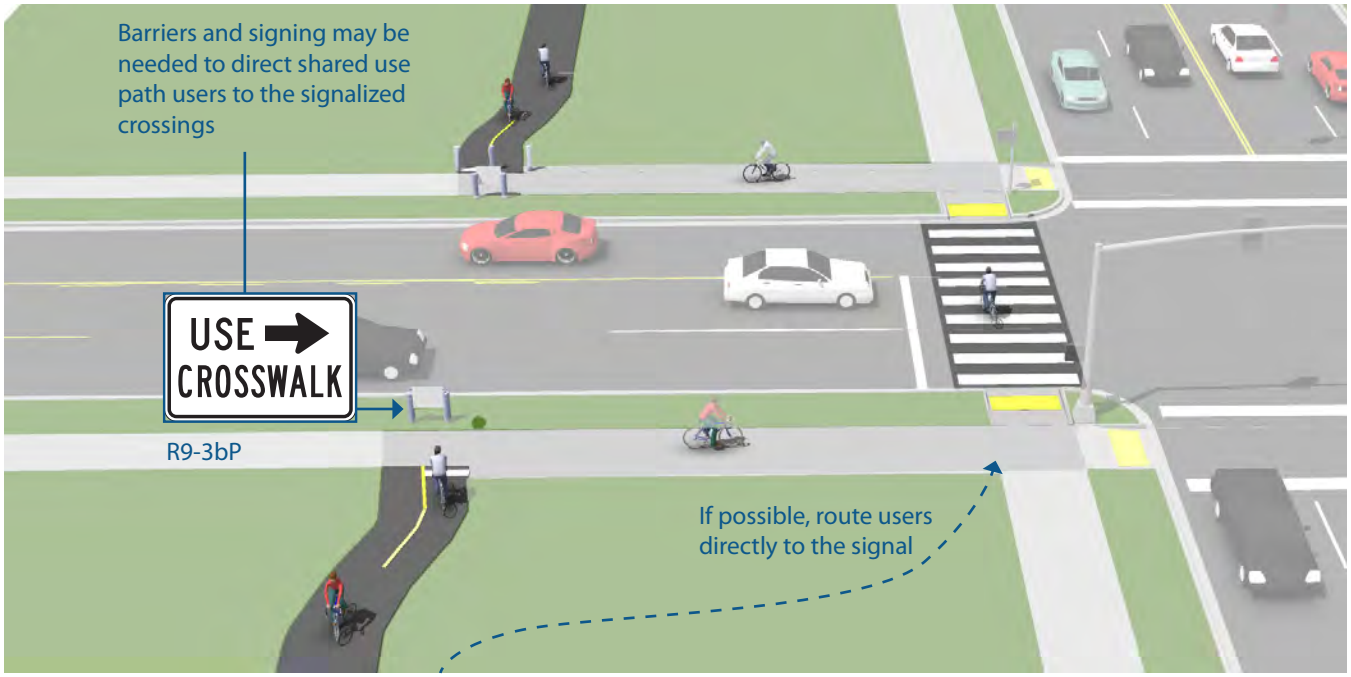
Route Users to Signalized Crossings

Description

Path crossings within approximately 400 feet of an existing signalized intersection with pedestrian crosswalks are typically diverted to the signalized intersection to avoid traffic operation problems when located so close to an existing signal. For this restriction to be effective, barriers and signing may be needed to direct path users to the signalized crossing. If no pedestrian crossing exists at the signal, modifications should be made.

Guidance

Path crossings should not be provided within approximately 400 feet of an existing signalized intersection. If possible, route path directly to the signal.



Discussion

In the US, the minimum distance a marked crossing can be from an existing signalized intersection varies from approximately 250 to 660 feet. Engineering judgement and the context of the location should be taken into account when choosing the appropriate allowable setback. Pedestrians are particularly sensitive to out of direction travel and undesired mid-block crossing may become prevalent if the distance is too great.

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.
AASHTO. *Guide for the Planning, Design, and Operation of Pedestrian Facilities.* 2004.
PA DCNR. *Pennsylvania Trail Design & Development principles.*

Materials and Maintenance

If a sidewalk is used for crossing access, it should be kept clear of snow and debris and the surface should be level for wheeled users.

Pedestrian Hybrid Beacon Crossings

Description

Pedestrian hybrid beacons provide a high level of comfort for crossing users through the use of a red-signal indication to stop conflicting motor vehicle traffic.

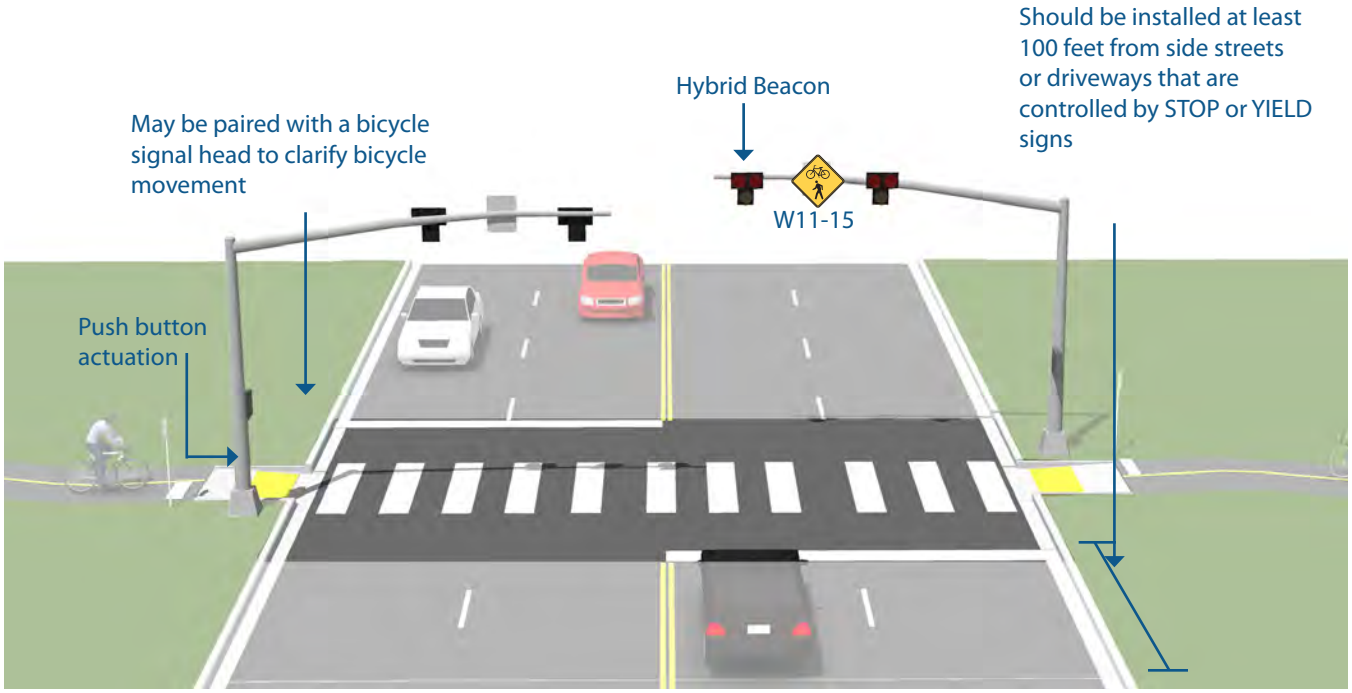
Hybrid beacon installation faces only cross motor vehicle traffic, stays dark when inactive, and uses a unique 'wig-wag' signal phase to indicate activation. Vehicles have the option to proceed after stopping during the final flashing red phase, which can reduce motor vehicle delay when compared to a full signal installation.

Guidance

Hybrid beacons (illustrated here) may be installed without meeting traffic signal control warrants if roadway speed and volumes are excessive for comfortable path crossings.

FHWA does not allow bicycle signals to be used with Hybrid beacons, though some cities have done so successfully.

To maximize safety when used for bicycle crossings, the flashing 'wig-wag' phase should be very short and occur after the pedestrian signal head has changed to a solid "DON'T WALK" indication as bicyclists can enter an intersection quickly.



Discussion

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.

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.

Additional References and Guidelines

FHWA. *Pedestrian Hybrid Beacon Guide - Recommendations and Case Study.* 2014.
NACTO. *Urban Bikeway Design Guide.* 2012.
FHWA. *Manual on Uniform Traffic Control Devices.* 2009.
PennDOT. *Traffic Signal Design Handbook.* 2013

Materials and Maintenance

Hybrid beacons are subject to the same maintenance needs and requirements as standard traffic signals. Signing and striping need to be maintained to help users understand any unfamiliar traffic control.

Full Traffic Signal Crossings

Description

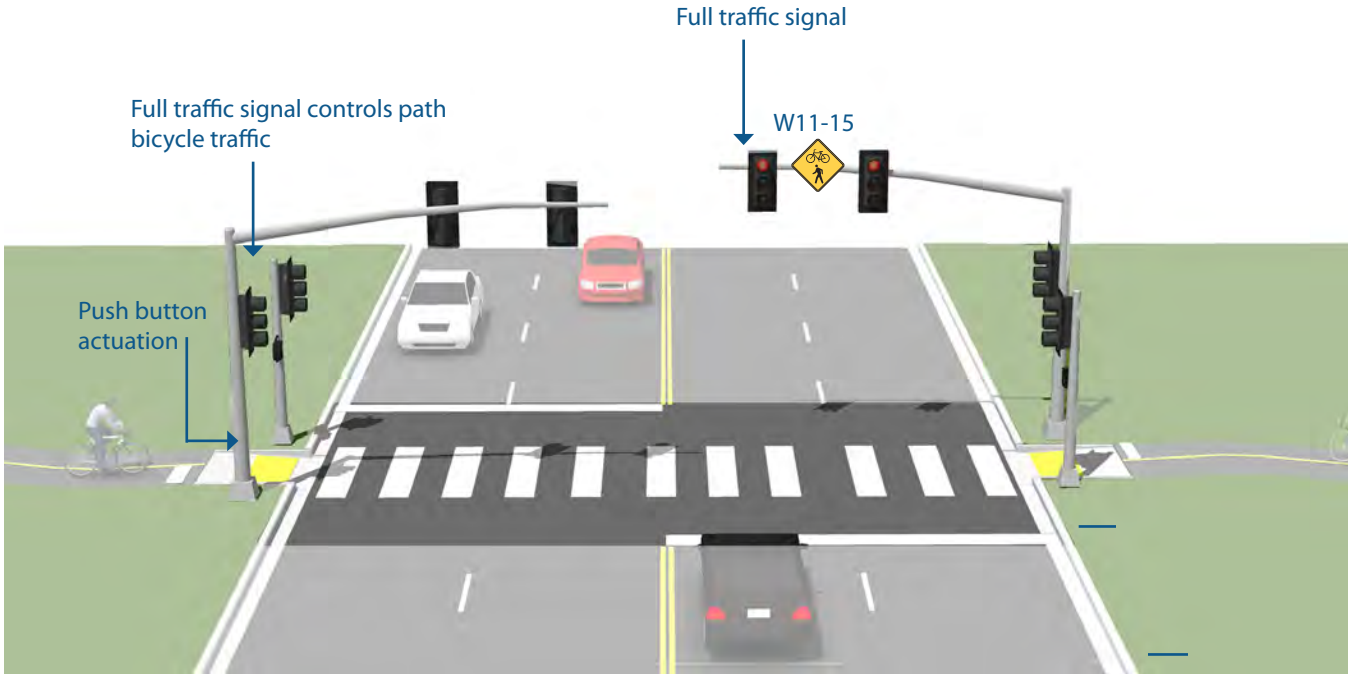
Signalized crossings provide the most protection for crossing path users through the use of a red-signal indication to stop conflicting motor vehicle traffic.

A full traffic signal installation treats the path crossing as a conventional 4-way intersection and provides standard red-yellow-green traffic signal heads for all legs of the intersection.

Guidance

Full traffic signal installations must meet MUTCD pedestrian, school or modified warrants. Additional guidance for signalized crossings:

- Located more than 300 feet from an existing signalized intersection
- Roadway travel speeds of 40 MPH and above
- Roadway ADT exceeds 15,000 vehicles



Discussion

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.

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.

Additional References and Guidelines

FHWA. *Manual on Uniform Traffic Control Devices.* 2009.
NACTO. *Urban Bikeway Design Guide.* 2012.
PennDOT. *Traffic Signal Design Handbook.* 2013

Materials and Maintenance

Traffic signals require routine maintenance. Signing and striping need to be maintained to help users understand any unfamiliar traffic control.

Undercrossings

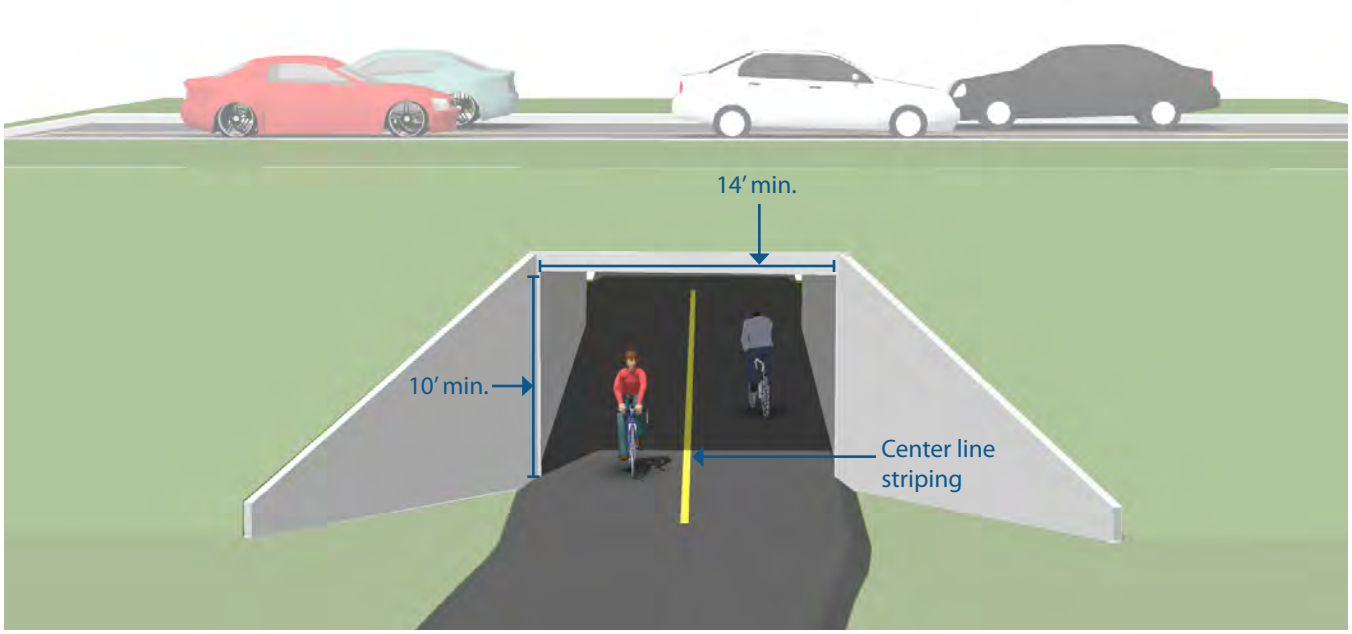
Description

Bicycle/pedestrian undercrossings provide critical non-motorized system links by joining areas separated by barriers such as railroads and highway corridors. In most cases, these structures are built in response to user demand for safe crossings where they previously did not exist.

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.

Guidance

- 14 foot minimum width, greater widths preferred for lengths over 60 feet.
- 10 foot minimum height.
- The undercrossing should have a centerline stripe even if the rest of the path does not have one.
- Lighting should be considered during the design process for any undercrossing with high anticipated use or in culverts and tunnels.



Discussion

Safety is a major concern with undercrossings. Shared use path users may be temporarily out of sight from public view and may experience poor visibility themselves. To mitigate safety concerns, an undercrossing 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.

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.
AASHTO. *Guide for the Planning, Design, and Operation of Pedestrian Facilities.* 2004.

Materials and Maintenance

14 foot width allows for maintenance vehicle access.

Potential problems include conflicts with utilities, drainage, flood control and vandalism.

Overcrossings

Description

Bicycle/pedestrian overcrossings 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.

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.

Overcrossings require a minimum of 17 feet of vertical clearance to the roadway below versus a minimum elevation differential of around 12 feet for an undercrossing. This results in potentially greater elevation differences and much longer ramps for bicycles and pedestrians to negotiate.

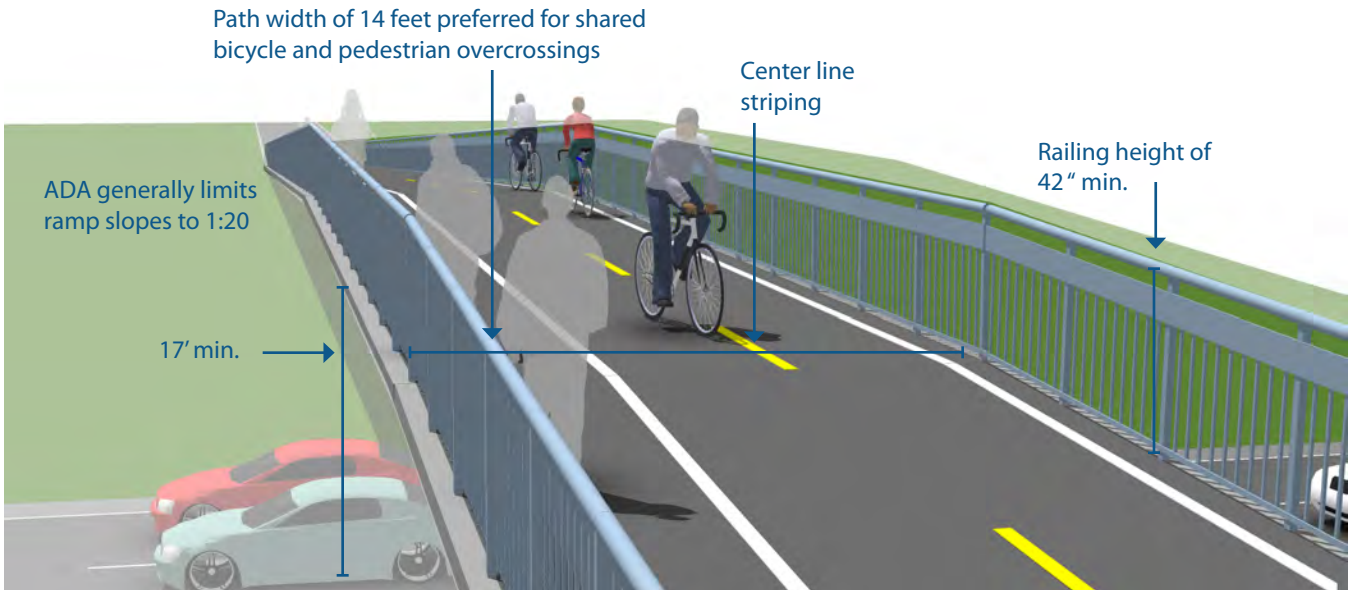
Guidance

8 foot minimum width, 14 feet preferred. If overcrossing has any scenic vistas additional width should be provided to allow for stopping. A separate 5 foot pedestrian area may be provided for facilities with high bicycle and pedestrian use.

10 foot headroom on overcrossing; clearance below will vary depending on feature being crossed.

Roadway:	17 feet
Freeway:	18.5 feet
Heavy Rail Line:	23 feet

The overcrossing should have a centerline stripe even if the rest of the path does not have one.



Discussion

Overcrossings 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 foot intervals, or 8.33% (1:12) with landings every 30 feet.

Overcrossings pose potential concerns about visual impact and functional appeal, as well as space requirements necessary to meet ADA guidelines for slope.

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities*. 2012.
AASHTO. *Guide for the Planning, Design, and Operation of Pedestrian Facilities.* 2004.

Materials and Maintenance

Potential issues with vandalism.

Overcrossings can be more difficult to clear of snow than undercrossings.

Bicycle Lane at Railroad Grade Crossing

Description

Bikeways that cross railroad tracks at a diagonal may cause steering difficulties or loss of control for bicyclists due to slippery surfaces, degraded rough materials, and the size of the flangeway gaps.

Angled track crossings also limit sight triangles, impacting the ability to see oncoming trains.

Bicyclist crashes at railroad tracks are often sudden and unexpected. Improvements to track placement, surface quality, flangeway opening width and crossing angle can minimize risks to people riding.

Guidance

- 6 ft minimum shoulder/bike lane width.
- If the skew angle is less than 45 degrees, special attention should be given to the sidewalk and bicycle alignment to improve the approach angle to at least 60 degrees (90 degrees preferred where possible).
- Consider posting W-10 or W-12 signs to alert bicyclists.
- Sight triangles of 50 feet by 100 feet will be provided at the railroad and street right of way. (Sight triangles are measured from the centerline of the railroad track.
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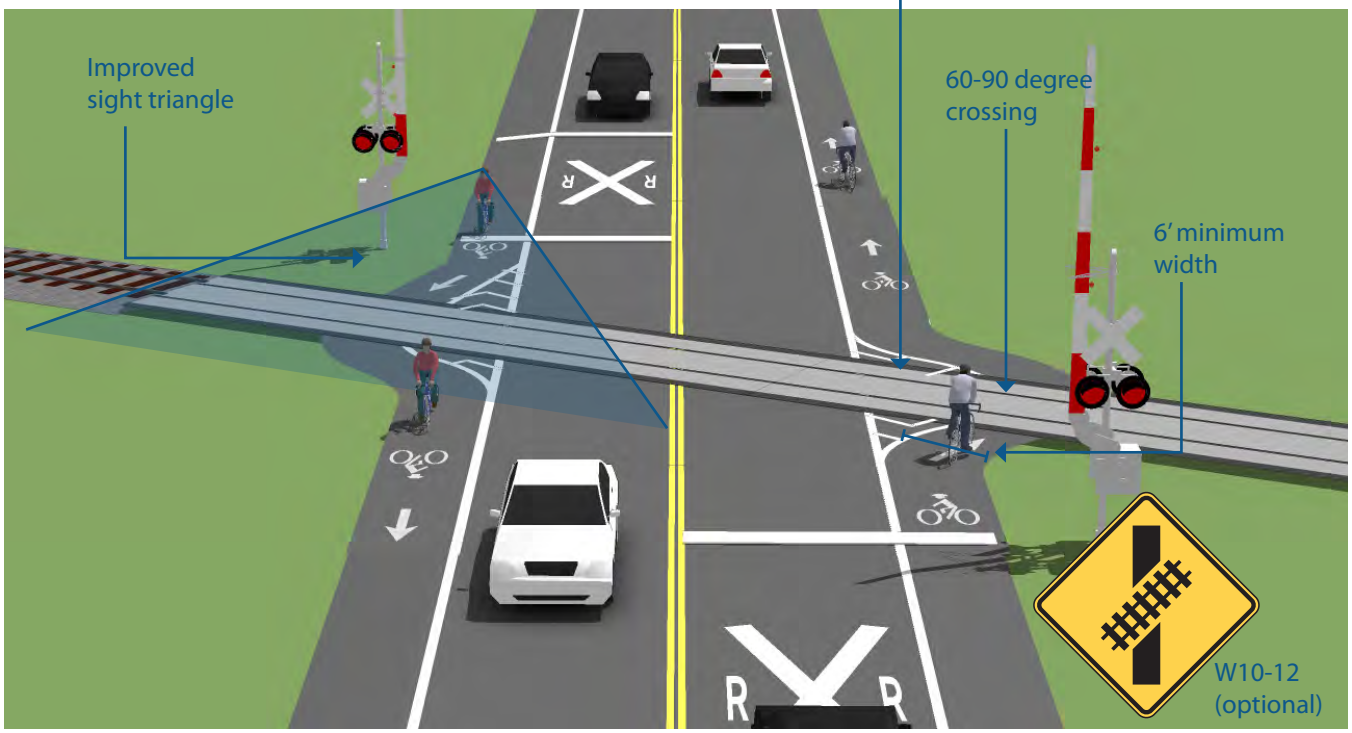


Discussion

Crossing design and implementation is a collaboration between the railroad company and highway agency. The railroad company is responsible for the crossbucks, flashing lights and gate mechanisms, and the highway agency is responsible for advance warning markings and signs. Warning devices should be recommended for each specific situation by a qualified engineer based on various factors including train frequency and speed, path and trail usage and sight distances.

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.
FHWA. *Manual on Uniform Traffic Control Devices.* 2009.
TRB. *TCRP 17: Integration of Light Rail Transit into City Streets.* 1996.
FHWA. *Railroad-Highway Grade Crossing Handbook.* 2007.
Rails-to-Trails Conservancy. *Rails-with-Trails: A Preliminary Assessment of Safety and Grade Crossings.* 2005.

Materials and Maintenance

Concrete is the preferred material for use at bikeway railroad crossings. Rubber crossings are ridable when new and dry, but become slippery when wet and degrade over time. (AASHTO 2012)

Bicycle Support Facilities

Bicycle Parking

Bicyclists expect a safe, convenient place to secure their bicycle when they reach their destination. This may be short-term parking of 2 hours or less, or long-term parking for employees, students, residents, and commuters.

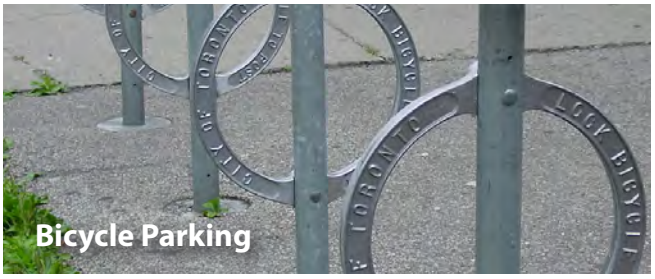
Access to Transit

Safe and easy access to bicycle parking facilities is necessary to encourage commuters to access transit via bicycle. Providing bicycle access to transit and space for bicycles on buses and rail vehicles can increase the feasibility of transit in lower-density areas, where transit stops are beyond walking distance of many residences. People are often willing to walk only a quarter- to half-mile to a bus stop, while they might bike as much as two or more miles to reach a transit station.

Roadway Construction and Repair

Safety of all roadway users should be considered during road construction and repair. Wherever bicycles are allowed, measures should be taken to provide for the continuity of a bicyclist's trip through a work zone area.

Only in rare cases should pedestrians and bicyclists be detoured to another street when travel vehicle lanes remain open. Contractors performing work should be made aware of the needs of bicyclists and be properly trained in how to safely route bicyclists through or around work zones.


Bicycle Parking

Bicycle Access to Transit


Access through Construction Areas

Bicycle Parking

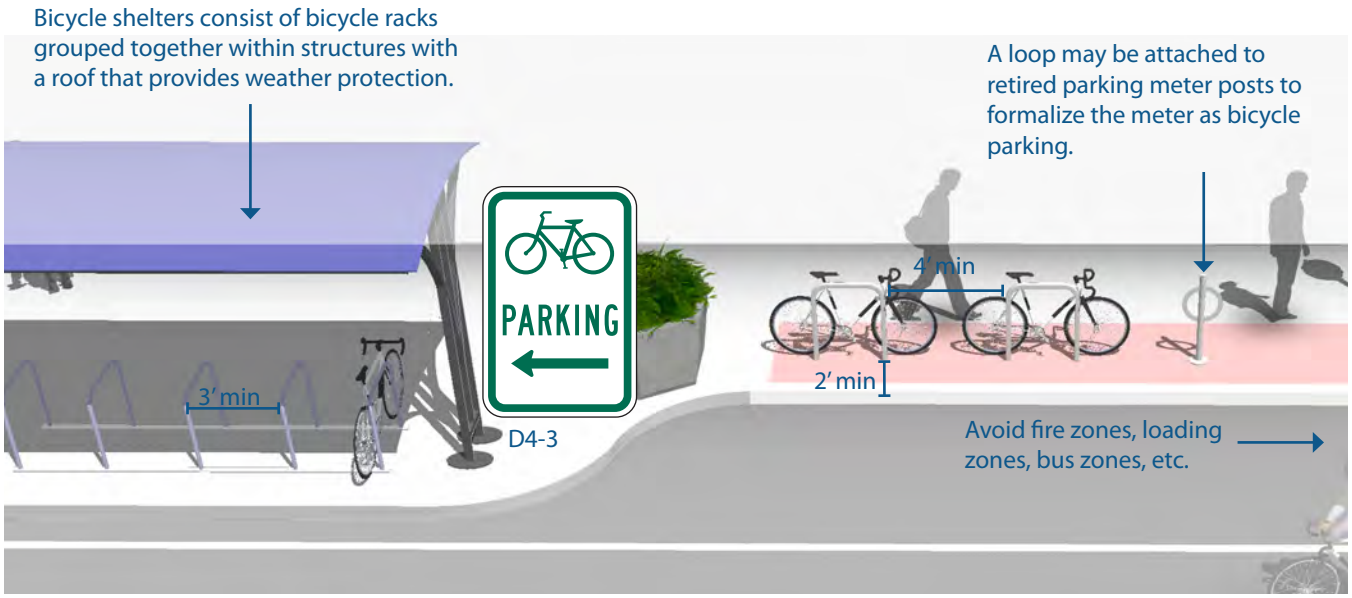
Description

Short-term bicycle parking is meant to accommodate visitors, customers, and others expected to depart within two hours. It should have an approved standard rack, appropriate location and placement, and weather protection. The Association for Pedestrian and Bicycle Professionals (APBP) recommends selecting a bicycle rack that:

- Supports the bicycle in at least two places, preventing it from falling over.
- Allows locking of the frame and one or both wheels with a U-lock.
- Is securely anchored to ground.
- Resists cutting, rusting and bending or deformation.

Guidance

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



Discussion

Where the placement of racks on sidewalks is not possible (due to narrow sidewalk width, sidewalk obstructions, street trees, etc.), bicycle parking can be provided in the street where on-street vehicle parking is allowed in the form of on-street bicycle corrals.

Some types of bicycle racks may meet design criteria, but are discouraged except in limited situations. This includes undulating "wave" racks, schoolyard "wheel bender" racks, and spiral racks.

Additional References and Guidelines

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

Materials and Maintenance

Use of proper anchors will prevent vandalism and theft. Racks and anchors should be regularly inspected for damage. Educate snow removal crews to avoid burying racks during winter months.

On-Street Bicycle Corral

Description

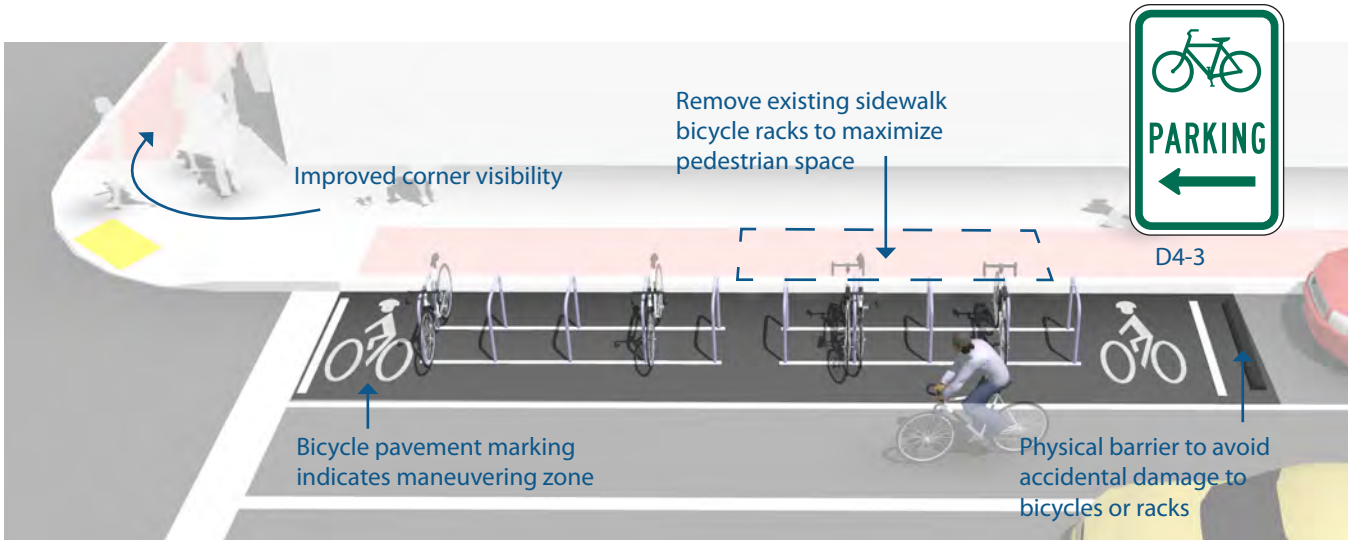
Bicycle corrals (also known as on-street bicycle parking) consist of bicycle racks grouped together in a common area within the street traditionally used for automobile parking. Bicycle corrals are reserved exclusively for bicycle parking and provide a relatively inexpensive solution to providing high-volume bicycle parking. Bicycle corrals 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.

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.

Guidance

See guidelines for sidewalk bicycle rack placement and clear zones.

- Bicyclists should have an entrance width from the roadway of 5' – 6'.
- 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.



Discussion

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.

Additional References and Guidelines

APBP. *Bicycle Parking Guide 2nd Edition.* 2010.

Materials and Maintenance

Physical barriers may obstruct drainage and collect debris. Establish a maintenance agreement with neighboring businesses. In snowy climates the bicycle corral may need to be removed during the winter months.

Bicycle Lockers

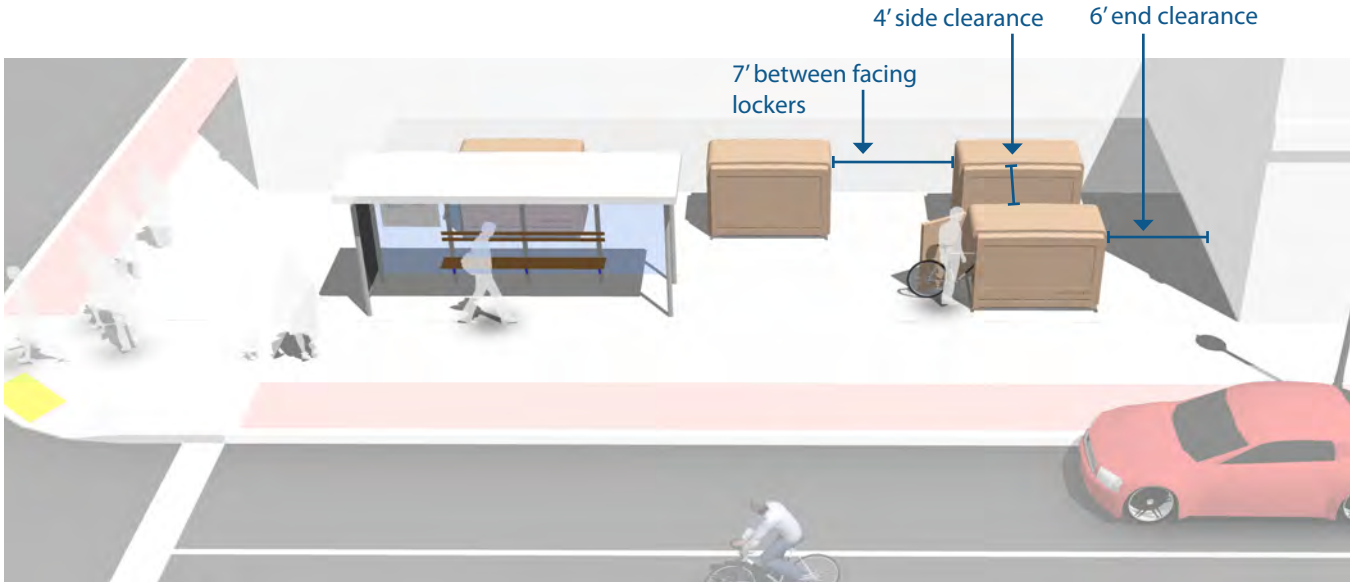
Description

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.

Bicycle lockers provide space to store a few accessories or rain gear in addition to containing the bicycle. Some lockers allow access to two users - a partition separating the two bicycles can help users feel their bike is secure. Lockers can also be stacked, reducing the footprint of the area, although that makes them more difficult to use.

Guidance

- Minimum dimensions: width (opening) 2.5'; height 4'; depth 6'.
- 4 foot side clearance and 6 foot end clearance.
- 7 foot 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.



Discussion

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.

Additional References and Guidelines

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

Materials and Maintenance

Regularly inspect the functioning of moving parts and enclosures. Change keys and access codes periodically to prevent access to unapproved users.

Secure Parking Areas (SPA)

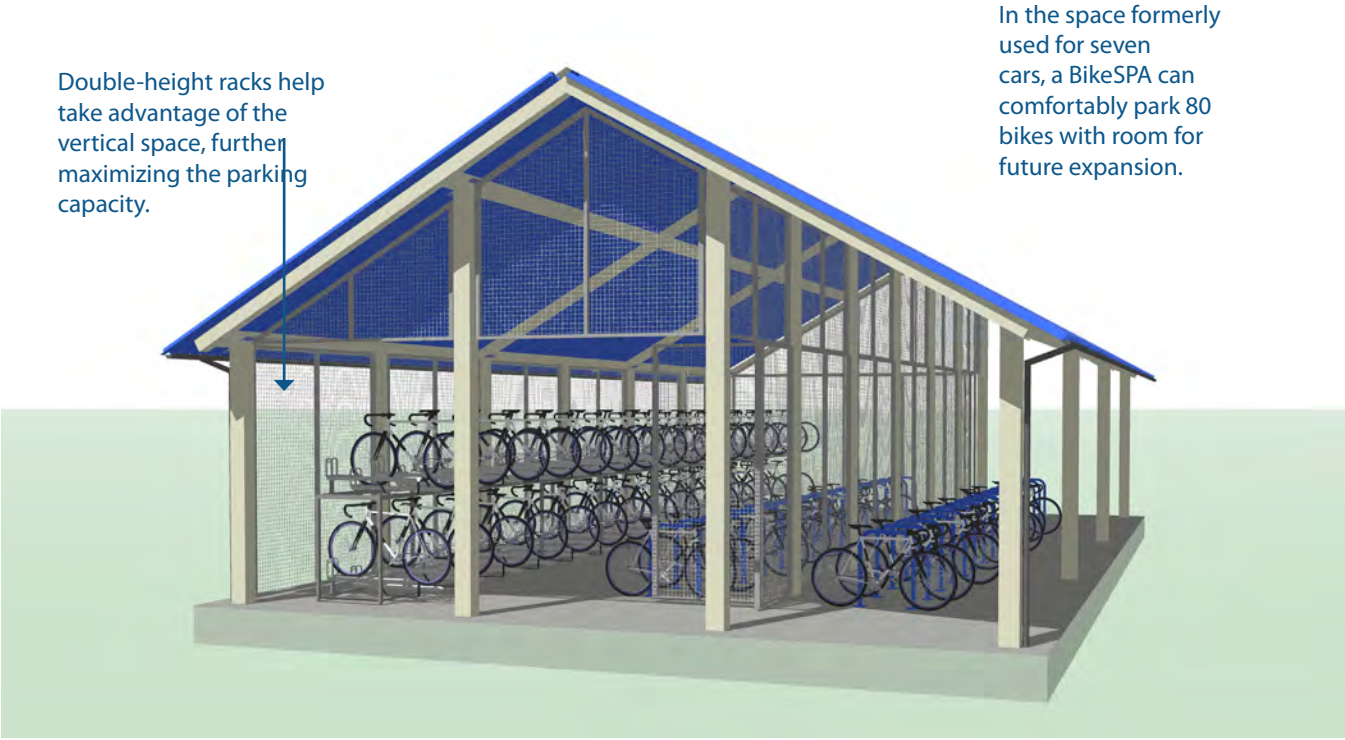
Description

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.

Guidance

Key features may include:

- Closed-circuit television monitoring.
- Double high racks & 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.



Discussion

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.

Additional References and Guidelines

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

Materials and Maintenance

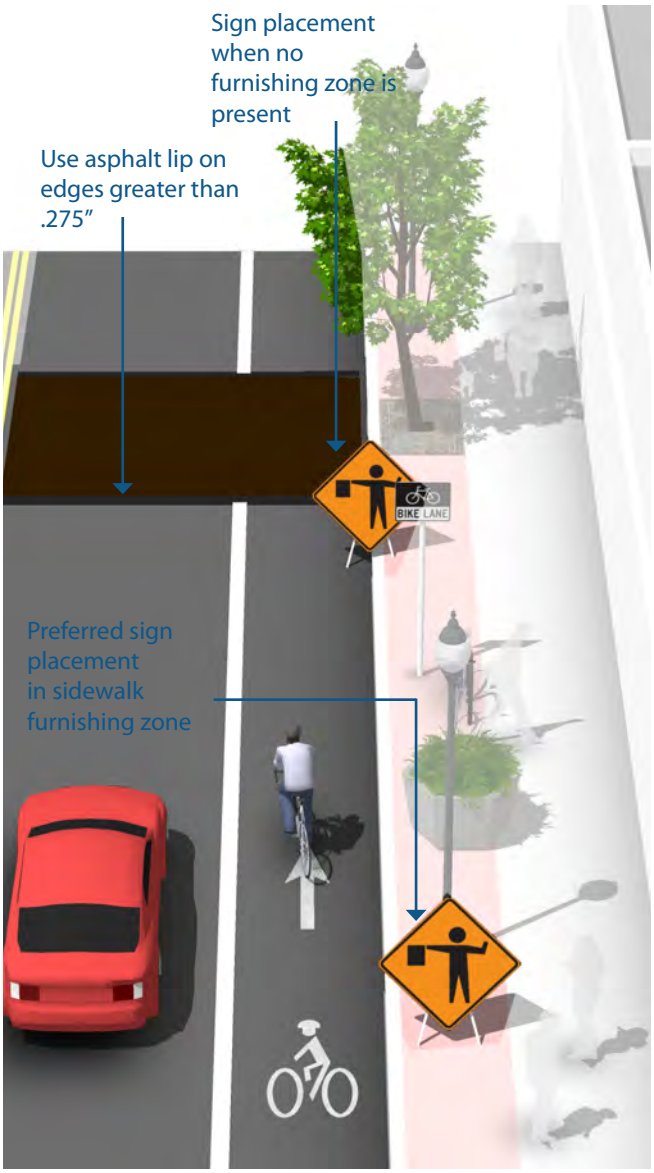
Regularly inspect the functioning of moving parts and enclosures. Change keys and access codes periodically to prevent access to unapproved users.

Bicycle Access Through Construction Areas

Description

Wherever bicycles are allowed, measures should be taken to provide for the continuity of a bicyclist's trip through a work zone area. Bicyclists should not be led into conflicts with work site vehicles, equipment, moving vehicles, open trenches, or temporary construction signage.

Efforts should be made to re-create a bike lane (if one exists) to the left of the construction zone. If this is impossible, then consider the closure of a standard-width travel lane to accommodate bicycle travel.



Guidance

Construction Signage

- Place in a location that does not obstruct the path of bicyclists or pedestrians.
- Detour and closure signs related to bicycle travel may be included on all bikeways where construction activities occur. Signage should also be provided on all other roadways.

Bicycle Travel around Steel Grates

- Require temporary asphalt (cold mix) around plates to create a smooth transition.
- Use steel plates only as a temporary measure during construction, not for extended periods.
- Use warning signs where steel plates are in use.
- Require both temporary and final repaving to provide a smooth surface without abrupt edges.

Discussion

Plates used to cover trenches tend to not be flush with pavement and have a 1"-2" vertical transition on the edges. This can puncture a hole in a bicycle tire and cause a bicyclist to lose control. Although it is common to use steel plates during non-construction hours, these plates can be dangerously slippery, particularly when wet.

Contractors performing work should be made aware of the needs of bicyclists and be properly trained in how to safely route bicyclists through or around work zones.

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.
FHWA. *Manual on Uniform Traffic Control Devices.* 2009.
FHWA. *Federal Highway Administration University Course on Bicycle and Pedestrian Transportation. Lesson 21: Bicycle and Pedestrian Accommodation in Work Zones.* 2006.

Materials and Maintenance

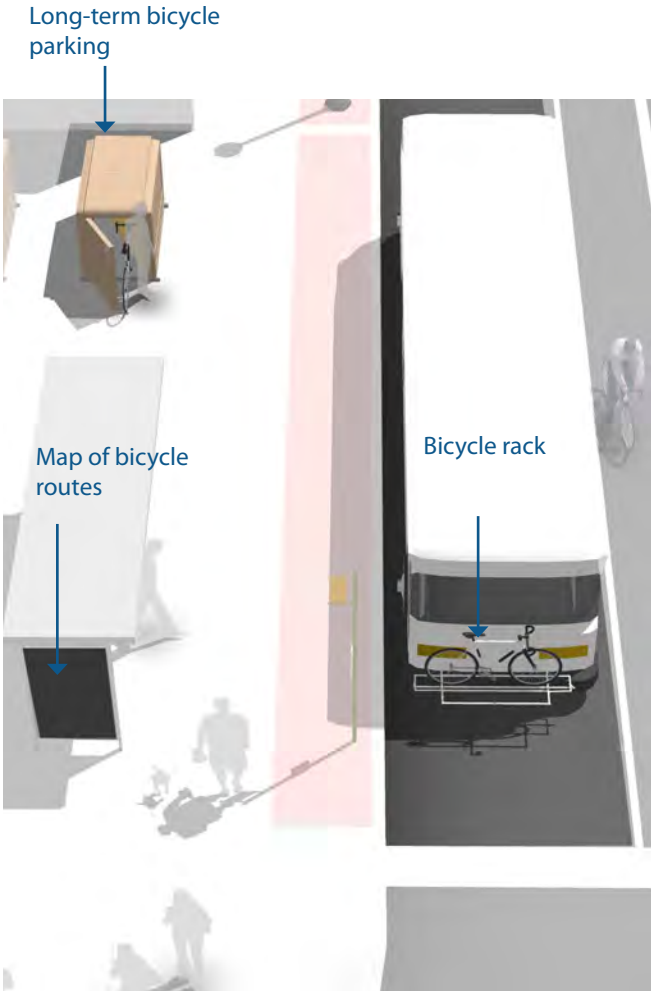
Debris should be swept to maintain a reasonably clean riding surface in the outer 5 - 6 ft of roadway.

Bicycle Access to Transit

Description

Safe and easy access to transit stations and secure bicycle parking facilities is necessary to encourage commuters to access transit via bicycle. Bicycling to transit reduces the need to provide expensive and space consuming car parking spaces.

Many people who ride to a transit stop will want to bring their bicycle with them on the transit portion of their trip, so buses and other transit vehicles should be equipped accordingly.



Guidance

Access

- Provide direct and convenient access to transit stations and stops from the bicycle and pedestrian networks.
- Provide maps at major stops and stations showing nearby bicycle routes.
- Provide wayfinding signage and pavement markings from the bicycle network to transit stations.
- Ensure that connecting bikeways offer proper bicycle actuation and detection.

Bicycle Parking

- The route from bicycle parking locations to station/stop platforms should be well-lit and visible.
- Signing should note the location of bicycle parking, rules for use, and instructions as needed.
- Provide safe and secure long-term parking such as bicycle lockers at transit hubs. Parking should be easy to use and well maintained.

Discussion

Providing bicycle routes to transit helps combine the long-distance coverage of bus and rail travel with the door-to-door service of bicycle riding. Transit use can overcome large obstacles to bicycling, including distance, hills, riding on busy streets, night riding, inclement weather, and breakdowns. High-visibility crosswalks and mid-block crossings are often appropriate treatments to provide safer bicycle and pedestrian access to bus stops, particularly at high-usage transit stops. If a bus stop is located mid-block, adequate crossing treatments should be provided, based on the level of traffic on the roadway. All transit riders will need to cross the street to access or leave the bus stop.

Additional References and Guidelines

AASHTO. *Guide for the Development of Bicycle Facilities.* 2012.
APBP. *Bicycle Parking Guide 2nd Edition.* 2010.
FHWA. *Federal Highway Administration University Course on Bicycle and Pedestrian Transportation. Lesson 18: Bicycle and Pedestrian Connections to Transit.* 2006.

Materials and Maintenance

Regularly inspect the functioning of long-term parking moving parts and enclosures. Change keys and access codes periodically to prevent access to unapproved users.

Bikeway Maintenance

Regular bicycle facility maintenance includes sweeping, maintaining a smooth roadway, ensuring that the gutter-to-pavement transition remains relatively flush, and installing bicycle-friendly drainage grates. Pavement overlays are a good opportunity to improve bicycle facilities. The following recommendations provide a menu of options to consider to enhance a maintenance regimen.

Recommended Walkway and Bikeway Maintenance Activities

Maintenance Activity	Frequency
Inspections	Seasonal – at beginning and end of Summer
Pavement sweeping/ blowing	As needed, with higher frequency in the early Spring and Fall
Pavement sealing	5 - 15 years
Pothole repair	1 week – 1 month after report
Culvert and drainage grate inspection	Before Winter and after major storms
Pavement markings replacement	As needed
Signage replacement	As needed
Shoulder plant trimming (weeds, trees, brambles)	Twice a year; middle of growing season and early Fall
Tree and shrub plantings, trimming	1 – 3 years
Major damage response (washouts, fallen trees, flooding)	As soon as possible

This Section Includes:

- Sweeping
- Signage
- Roadway Surface
- Pavement Overlays
- Drainage Grates
- Gutter to Pavement Transition
- Landscaping
- Maintenance Management Plan


Sweeping


Roadway Surface


Gutter to Pavement Transition


Drainage Grates


Landscaping


Maintenance Management Plan

Sweeping

Description

Bicyclists often avoid shoulders and bike lanes filled with gravel, broken glass and other debris; they will ride in the roadway to avoid these hazards, potentially causing conflicts with motorists. Debris from the roadway should not be swept onto sidewalks (pedestrians need a clean walking surface), nor should debris be swept from the sidewalk onto the roadway. A regularly scheduled inspection and maintenance program helps ensure that roadway debris is regularly picked up or swept.

Guidance

- Establish a seasonal sweeping schedule that prioritizes roadways with major bicycle routes.
- Sweep walkways and bikeways whenever there is an accumulation of debris on the facility.
- In curbed sections, sweepers should pick up debris; on open shoulders, debris can be swept onto gravel shoulders.
- Pave gravel driveway approaches to minimize loose gravel on paved roadway shoulders.
- Perform additional sweeping in the Spring to remove debris from the Winter.
- Perform additional sweeping in the Fall in areas where leaves accumulate .

Signage

Description

Bike lanes, shared shoulders, Bicycle Boulevards and paths all have different signage types for wayfinding and regulations. Such signage is vulnerable to vandalism or wear, and requires periodic maintenance and replacement as needed.

Guidance

- Check regulatory and wayfinding signage along bikeways for signs of vandalism, graffiti, or normal wear.
- Replace signage along the bikeway network as-needed.
- Perform a regularly-scheduled check on the status of signage with follow-up as necessary.
- Create a Maintenance Management Plan.

Roadway Surface

Description

Bicycles are much more sensitive to subtle changes in roadway surface than are motor vehicles. Various materials are used to pave roadways, and some are smoother than others. Compaction is also an important issue after trenches and other construction holes are filled. Uneven settlement after trenching can affect the roadway surface nearest the curb where bicycles travel. Sometimes compaction is not achieved to a satisfactory level, and an uneven pavement surface can result due to settling over the course of days or weeks. When resurfacing streets, use the smallest chip size and ensure that the surface is as smooth as possible to improve safety and comfort for bicyclists.

Guidance

- Maintain a smooth pothole-free surface.
- Ensure that on new roadway construction, the finished surface on bikeways does not vary more than ¼".
- Maintain pavement so ridge buildup does not occur at the gutter-to-pavement transition or adjacent to railway crossings.
- Inspect the pavement 2 to 4 months after trenching construction activities are completed to ensure that excessive settlement has not occurred.
- If chip sealing is to be performed, use the smallest possible chip on bike lanes and shoulders. Sweep loose chips regularly following application.
- During chip seal maintenance projects, if the pavement condition of the bike lane is satisfactory, it may be appropriate to chip seal the travel lanes only. However, use caution when doing this so as not to create an unacceptable ridge between the bike lane and travel lane.

Pavement Overlays

Description

Pavement overlays represent good opportunities to improve conditions for bicyclists if done carefully. A ridge should not be left in the area where bicyclists ride (this occurs where an overlay extends part-way into a shoulder bikeway or bike lane). Overlay projects also offer opportunities to widen a roadway, or to re-stripe a roadway with bike lanes.

Guidance

- Extend the overlay over the entire roadway surface to avoid leaving an abrupt edge.
- If the shoulder or bike lane pavement is of good quality, it may be appropriate to end the overlay at the shoulder or bike lane stripe provided no abrupt ridge remains.
- Ensure that inlet grates, manhole and valve covers are within ¼ inch of the finished pavement surface and are made or treated with slip resistant materials.
- Pave gravel driveways to property lines to prevent gravel from being tracked onto shoulders or bike lanes.

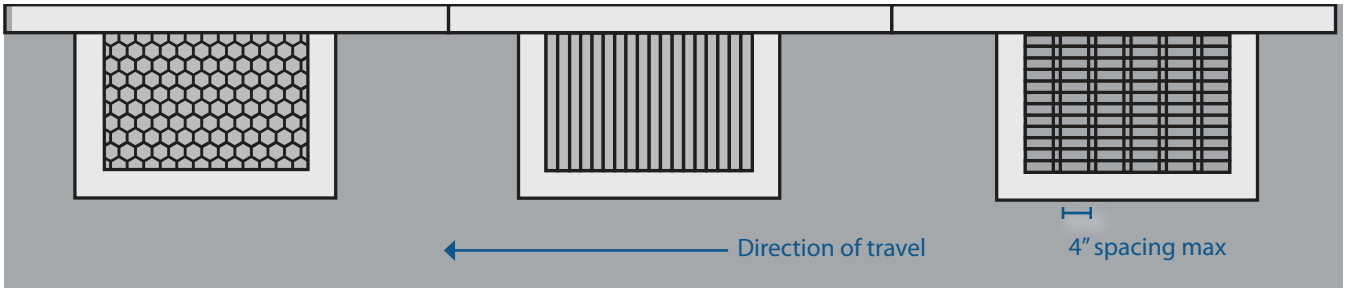
Drainage Grates

Description

Drainage grates are typically located in the gutter area near the curb of a roadway. Drainage grates typically have slots through which water drains into the municipal storm sewer system. Many older grates were designed with linear parallel bars spread wide enough for a tire to become caught so that if a bicyclist were to ride on them, the front tire could become caught in the slot. This would cause the bicyclist to tumble over the handlebars and sustain potentially serious injuries.

Guidance

- Require all new drainage grates be bicycle-friendly, including grates that have horizontal slats on them so that bicycle tires and assistive devices do not fall through the vertical slats.
- Create a program to inventory all existing drainage grates, and replace hazardous grates as necessary – temporary modifications such as installing rebar horizontally across the grate should not be an acceptable alternative to replacement.



Gutter to Pavement Transition

Description

On streets with concrete curbs and gutters, 1 to 2 feet of the curbside area is typically devoted to the gutter pan, where water collects and drains into catch basins. On many streets, the bikeway is situated near the transition between the gutter pan and the pavement edge. This transition can be susceptible to erosion, creating potholes and a rough surface for travel.

The pavement on many streets is not flush with the gutter, creating a vertical transition between these segments. This area can buckle over time, creating a hazardous condition for bicyclists.

Guidance

- Ensure that gutter-to-pavement transitions have no more than a ¼" vertical transition.
- Examine pavement transitions during every roadway project for new construction, maintenance activities, and construction project activities that occur in streets.
- Inspect the pavement 2 to 4 months after trenching construction activities are completed to ensure that excessive settlement has not occurred.
- Provide at least 3 feet of pavement outside of the gutter seam.

Landscaping

Description

Bikeways can become inaccessible due to overgrown vegetation. All landscaping needs to be designed and maintained to ensure compatibility with the use of the bikeways. After a flood or major storm, bikeways should be checked along with other roads, and fallen trees or other debris should be removed promptly.

Guidance

- Ensure that shoulder plants do not hang into or impede passage along bikeways
- After major damage incidents, remove fallen trees or other debris from bikeways as quickly as possible

Maintenance Management Plan

Description

Bikeway users need accommodation during construction and maintenance activities when bikeways may be closed or unavailable. Users must be warned of bikeway closures and given adequate detour information to bypass the closed section. Users should be warned through the use of standard signing approaching each affected section (e.g., "Bike Lane Closed," "Trail Closed"), including information on alternate routes and dates of closure. Alternate routes should provide reasonable directness, equivalent traffic characteristics, and be signed.

Guidance

- Provide fire and police departments with map of system, along with access points to gates/bollards
- Enforce speed limits and other rules of the road
- Enforce all trespassing laws for people attempting to enter adjacent private properties

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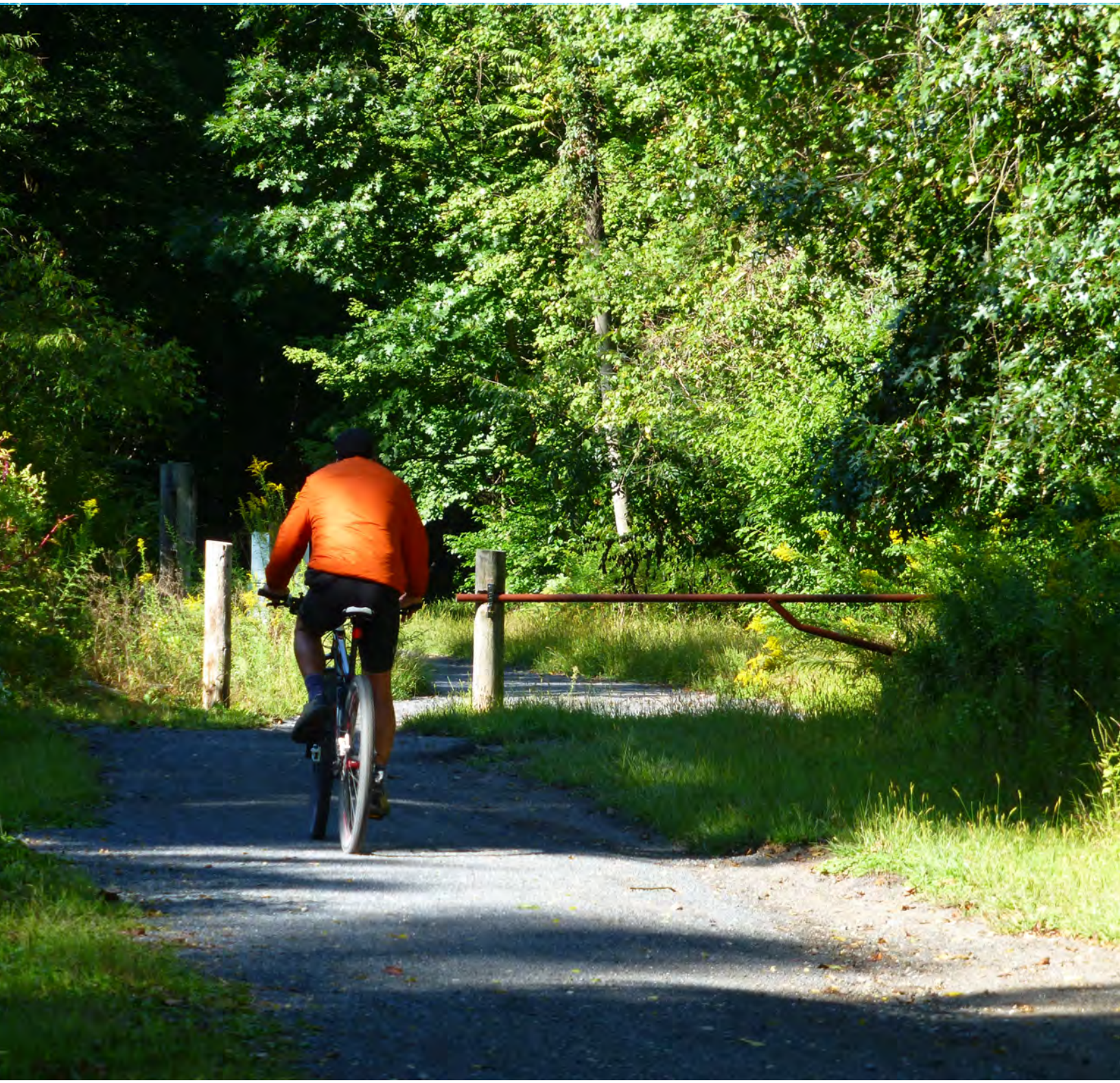
REGIONAL Bicycle Connections Study



Appendix B: Funding Resources

Overview

When considering possible funding sources for bicycle projects in the region, it is important to remember that not all construction activities or programs will be accomplished with a single funding source. It will be necessary to consider several possible sources of funding, that when combined, would support full project completion. Funding sources can be used for a variety of activities, including programs, planning, design, implementation, and maintenance. Given that incorporated and unincorporated areas may not have the same eligibility for these funding sources, a summary matrix at the end of this chapter has been developed to provide guidance on the applicability of each source.

This appendix outlines the most likely sources of funding from the federal, state, local government levels as well as from the private and non-profit sectors. It should be noted that this appendix reflects the funding available at the time of writing. The funding amounts, fund cycles, and even the programs themselves may change over time.

Federal Funding Sources

Federal funding from the United States Department of Transportation (US DOT) is typically directed through state agencies to local governments either in the form of grants or direct appropriations, independent from state budgets. Federal funding typically requires a local match of five percent to fifty percent, but there are sometimes exceptions; the recent American Recovery and Reinvestment Act stimulus funds did not require a match. The following is a list of possible Federal funding sources that could be used to support construction of bicycle improvements.

Moving Ahead for Progress in the Twenty-First Century (MAP-21)

The largest source of federal funding for pedestrian and bicycle projects is the US DOT's Federal-Aid Highway Program, which Congress has reauthorized roughly every six years since the passage of the Federal-Aid Road Act of 1916. The current legislation, Moving Ahead for Progress in the Twenty-First Century (MAP-21), was enacted in July 2012. The Act replaces the Safe, Accountable, Flexible, Efficient Transportation Equity Act – a Legacy for Users (SAFETEA-LU), which was valid from August 2005 through June 2012.

In Pennsylvania, federal monies are administered through the Pennsylvania Department of Transportation (PennDOT), Metropolitan Planning Organizations (MPOs), and Regional Planning Organizations (RPOs). Most, but not all, of these programs are oriented toward transportation rather than recreation, with an emphasis on reducing automobile trips and providing inter-modal connections.

Most of the MAP-21 programs are competitive and involve documentation of the project need, costs, and benefits. Furthermore, it is not possible to guarantee the continued availability of any listed MAP-21 programs or to predict their future funding levels or policy guidance. Nevertheless, many of these programs have been included in some form since the passage of the Intermodal Surface Transportation Efficiency Act (ISTEA) in 1991, and, thus, may continue to provide capital for active transportation projects and programs. Existing programs as of January 2015 are discussed below.

For more information, visit: http://www.fhwa.dot.gov/map21/summaryinfo.cfm

Transportation Alternatives

Transportation Alternatives (TA) is a new funding source under MAP-21 that consolidates three formerly separate programs under SAFETEA-LU: Transportation Enhancements (TE), Safe Routes to School (SRTS), and the Recreational Trails Program (RTP). These funds may be used for a variety of pedestrian, bicycle, and streetscape projects including sidewalks, bikeways, multi-use paths, and rail-trails. Unless the Governor of a given state chooses to opt out of Recreational Trails Program funds, dedicated funds for recreational trails continue to be provided as a subset of Transportation Alternatives. MAP-21 provides $85 million nationally for the RTP.

For the complete list of eligible activities, visit:

http://www.fhwa.dot.gov/environment/transportation_enhancements/legislation/map21.cfm

For funding levels, visit: http://www.fhwa.dot.gov/MAP21/funding.cfm

Surface Transportation Program

The Surface Transportation Program (STP) provides states with flexible funds which may be used for a variety of highway, road, bridge, and transit projects. A wide variety of bicycle and pedestrian improvements are eligible, including trails, bike lanes, sidewalks, crosswalks, pedestrian signals, and other ancillary facilities. Modification of sidewalks to comply with the requirements of the Americans with Disabilities Act (ADA) is also an eligible activity. Unlike most highway projects, STP-funded pedestrian facilities may be located on local and collector roads which are not part of the Federal-aid Highway System. 50 percent of each state's STP funds are allocated by population to the MPOs; the remaining 50 percent may be spent in any area of the state.

For more information: http://www.fhwa.dot.gov/map21/stp.cfm

Highway Safety Improvement Program

MAP-21 doubles the amount of funding available through the Highway Safety Improvement Program (HSIP) relative to SAFETEA-LU. HSIP provides $2.4 billion nationally for projects and programs that help communities achieve significant reductions in traffic fatalities and serious injuries on all public roads, bikeways, and walkways. MAP-21 preserves the Railway-Highway Crossings Program within HSIP but discontinues the High-Risk Rural roads set-aside unless safety statistics demonstrate that fatalities are increasing on these roads. Bicycle and pedestrian safety improvements, enforcement activities, traffic calming projects, and crossing treatments for non-motorized users in school zones are eligible for these funds.

For more information: http://www.fhwa.dot.gov/map21/hsip.cfm

Congestion Mitigation/Air Quality Improvement Program

The Congestion Mitigation/Air Quality Improvement Program (CMAQ) provides funding for projects and programs in air quality non-attainment and maintenance areas for ozone, carbon monoxide, and particulate matter which reduce transportation related emissions. States with no non-attainment areas may use their CMAQ funds for any CMAQ

or STP eligible project. These federal dollars can be used to build bicycle and pedestrian facilities that reduce travel by automobile. Purely recreational facilities generally are not eligible. Communities located in attainment areas who do not receive CMAQ funding apportionments may apply for CMAQ funding to implement projects that will reduce travel by automobile.

For more information: http://www.fhwa.dot.gov/map21/cmaq.cfm

Federal Transit Administration (FTA) Metropolitan Planning

This program provides funding for metropolitan coordinated transportation planning. Federal planning funds are first apportioned to State DOTs. State DOTs then allocate planning funding to MPOs. Eligible activities include pedestrian or bicycle planning to increase safety for non-motorized users and to enhance the interaction and connectivity of the transportation system across and between modes.

For more information, see: http://www.fhwa.dot.gov/map21/mp.cfm

Pilot Transit-Oriented Development Planning

MAP-21 established a new pilot program to promote planning for Transit-Oriented Development also administered by the FTA. The bill text states that the Secretary of Transportation may make grants available for the planning of projects that seek to "facilitate multimodal connectivity and accessibility" and "increase access to transit hubs for pedestrian and bicycle traffic". This program is purposed to support comprehensive planning.

For more information, see: http://www.fta.dot.gov/documents/MAP-21_Fact_Sheet_-_Transit-Oriented_Development_Planning_Pilot.pdf

Federal Transit Administration Enhanced Mobility of Seniors and Individuals with Disabilities

This program can be used for capital expenses that support transportation to meet the special needs of older adults and persons with disabilities, including providing access to an eligible public transportation facility when the transportation service provided is unavailable, insufficient, or inappropriate to meeting these needs.

For more information: http://www.fta.dot.gov/documents/MAP-21_Fact_Sheet_-_Enhanced_Mobility_of_Seniors_and_Individuals_with_Disabilities.pdf

Federal Lands Transportation Program (FLTP)

The FLTP funds projects that improve access within federal lands (including national forests, national parks, national wildlife refuges, national recreation areas, and other Federal public lands) on federally owned and maintained transportation facilities. $300 million per fiscal year has been allocated to the program for 2013 and 2014.

For more information: http://www.fhwa.dot.gov/map21/fltp.cfm

Partnership for Sustainable Communities

Founded in 2009, the Partnership for Sustainable Communities is a joint project of the Environmental Protection Agency (EPA), the U.S. Department of Housing and Urban Development (HUD), and the U.S. Department of Transportation (USDOT). The partnership aims to "improve access to affordable housing, more transportation options, and lower transportation costs while protecting the environment in communities nationwide." The Partnership is based on five Livability Principles, one of which explicitly addresses the need for bicycle and pedestrian infrastructure ("Provide more transportation choices: Develop safe, reliable, and economical transportation choices to decrease household transportation costs, reduce our nation's dependence on foreign oil, improve air quality, reduce greenhouse gas emissions, and promote public health").

The Partnership is not a formal agency with a regular annual grant program. Nevertheless, it is an important effort that has already led to some new grant opportunities (including TIGER grants). Pennsylvania jurisdictions should track Partnership communications and be prepared to respond proactively to announcements of new grant programs. Initiatives that speak to multiple livability goals are more likely to score well than initiatives that are narrowly limited in scope to pedestrian improvement efforts.

For more information: http://www.sustainablecommunities.gov/

http://www.epa.gov/smartgrowth/partnership/

Resource for Rural Communities: http://www.sustainablecommunities.gov/pdf/Supporting_Sustainable_Rural_Communities_FINAL.PDF

Community Development Block Grant Program

The Community Development Block Grant (CDBG) program, administered by the U.S. Department of Housing and Urban Development (HUD), provides annual grants on a formula basis to local governments and states. The program is designed to ensure decent affordable housing, to provide services particularly to low- and moderate-income residents, and to create jobs through the expansion and retention of businesses. Bicycle and pedestrian projects that can be demonstrated to benefit low- and moderate-income communities can qualify for CDBG funds.

For more information: http://portal.hud.gov/hudportal/HUD?src=/program_offices/comm_planning/communitydevelopment/programs

Land and Water Conservation Fund

The Land and Water Conservation Fund (LWCF) provides grants for planning and acquiring outdoor recreation areas and facilities, including trails. Funds can be used for right-of-way acquisition and construction. The program is administered by the Department of Environment and Natural Resources as a grant program for states and local governments. Maximum annual grant awards for county governments, incorporated municipalities, public authorities, and federally recognized Indian tribes are $250,000.

For more information, see: http://www.nps.gov/lwcf/

National Scenic Byways Discretionary Grant Program

The National Scenic Byways Discretionary Grants program provides merit-based funding for byway related projects each year, utilizing one or more of eight specific activities for roads designated as National Scenic Byways, All-American Roads, State scenic byways, or Indian tribe scenic byways. The activities are described in 23 USC 162(c). This is a discretionary program; all projects are selected by the US Secretary of Transportation. Eligible projects include construction along a scenic byway of a facility for pedestrians and bicyclists and improvements to a scenic byway that will enhance access to an area for the purpose of recreation. Construction includes the development of the environmental documents, design, engineering, purchase of right-of-way, land, or property, as well as supervising, inspecting, and actual construction.

For more information, see: http://www.bywaysonline.org/grants/

Rivers, Trails, and Conservation Assistance Program

The Rivers, Trails, and Conservation Assistance Program (RTCA) is a National Parks Service (NPS) program providing technical assistance via direct NPS staff involvement to establish and restore greenways, rivers, trails, watersheds and open space. The RTCA program provides only for planning assistance—there are no implementation funds available. Projects are prioritized for assistance based on criteria including conserving significant community resources, fostering cooperation between agencies, serving a large number of users, encouraging public involvement in planning and implementation, and focusing on lasting accomplishments. This program may benefit trail development in Pennsylvania locales indirectly through technical assistance, particularly for community organizations, but is not a capital funding source.

For more information, see: http://www.nps.gov/orgs/rtca/index.htm

Energy Efficiency and Conservation Block Grants

The Department of Energy's Energy Efficiency and Conservation Block Grants (EECBG) may be used to reduce energy consumptions and fossil fuel emissions and for improvements in energy efficiency. Section 7 of the funding announcement states that these grants provide opportunities for the development and implementation of transportation programs to conserve energy used in transportation including development of infrastructure such as bike lanes and pathways and pedestrian walkways. Although the current grant period has passed, more opportunities may arise in the future.

For more information: http://www1.eere.energy.gov/wip/eecbg.html

Additional Federal Funding

The landscape of federal funding opportunities for bicycle projects and programs is always changing. A number of Federal agencies, including the Bureau of Land Management, the Department of Health and Human Services, the Department of Energy, and the Environmental Protection Agency have offered grant programs inclusive of bicycle and pedestrian planning and implementation.

For up-to-date information: http://www.grants.gov

State Funding Sources

The funding sources covered in this section were updated in January 2015. The status of future funding sources is subject to change. Thus, the availability of these funding resources should be confirmed during the implementation of a project.

Transportation Alternatives Funding

As part of Map-21, previous Transportation Enhancement Program activities were grouped with other programs (RTP and Safe Routes to School) to establish a new program aptly named the Transportation Alternatives Program (TAP). TAP provides for four eligible activities that include planning, construction and design of bicycle and pedestrian facilities. The distribution of funding under MAP-21 divides TAP funds in half (after taking initial funds for RTP), with 50% of the funds distributed based on population and 50% distributed elsewhere statewide. Applications for funding are available through the Pennsylvania Department of Transportation (PennDOT) Center for Program Development and Management (http://www.dot.state.pa.us/Internet/Bureaus/CPDM.nsf/TAPHomepage?OpenFrameset).

PennDOT Multimodal Transportation Fund

The Multimodal Transportation Fund administered through PennDOT was created in 2013 with the passage of a new transportation funding bill known as Act 89. Through Act 89, the Pennsylvania legislature increased state transportation funding and dedicated $2 million per year to bicycle and pedestrian projects statewide. This is the first time that Pennsylvania has had a dedicated funding source for bicycle and pedestrian projects. The fund gives special emphasis to projects that address or include safety, shared use paths, pedestrian connectivity, bicycle lane policy, and partnerships with other state departments with overlapping missions (e.g., Department of Health, DCED), pedestrian and bicycle advocacy groups, and municipalities. Presently the fund requires a 30% match and no in kind contributions are permitted.

For more information, see: http://www.dot.state.pa.us/internet/web.nsf/Multimodal?OpenFrameSet

Commonwealth Financing Authority Multimodal Transportation Fund

The Multimodal Transportation Fund, administered by the Commonwealth Financing Authority (CFA), provides grants to encourage economic development and ensure that a safe and reliable system of transportation is available to the residents of the commonwealth. Note that the CFA Multimodal Transportation Fund is separate from the PennDOT Multimodal Transportation Fund described above. Funds may be used for the development, rehabilitation and enhancement of transportation assets to existing communities, streetscape, lighting, sidewalk enhancement, pedestrian safety, connectivity of transportation assets and transit-oriented development. Projects with a total cost of $100,000 to $3,000,000 are eligible for funding through the MTF. Municipalities, councils of governments, businesses, economic development organizations, public transportation agencies, ports, and rail/freight entities are eligible to apply.

For more information, see: http://www.newpa.com/find-and-apply-for-funding/funding-and-program-finder/multimodal-transportation-fund

Greenway, Trails, and Recreation Program (GTRP)

Act 13 of 2012 establishes the Marcellus Legacy Fund and allocates funds to the Commonwealth Financing Authority (the "Authority") for planning, acquisition, development, rehabilitation and repair of greenways, recreational trails, open space, parks and beautification projects using the Greenways, Trails and Recreation Program (GTRP).

For more information, see: http://www.newpa.com/find-and-apply-for-funding/funding-and-program-finder/greenways-trails-and-recreation-program-gtrp

Local Government Funding Sources

Municipalities often plan for the funding of pedestrian and bicycle facilities or improvements through development of Capital Improvement Programs (CIP). CIPs should include all types of capital improvements (water, sewer, buildings, streets, etc.) versus programs for single purposes. This allows municipal decision-makers to balance all capital needs. Typical capital funding mechanisms include the capital reserve fund, capital protection ordinances, municipal service district, tax increment financing, taxes, fees, and bonds. Each category is described below. A variety of possible funding options available to Pennsylvania jurisdictions for implementing bicycle projects are also described below. However, many will require specific local action as a means of establishing a program, if not already in place.

Capital Reserve Fund

Municipalities have statutory authority to create capital reserve funds for any capital purpose, including bicycle facilities. The reserve fund must be created through ordinance or resolution that states the purpose of the fund, the duration of the fund, the approximate amount of the fund, and the source of revenue for the fund. Sources of revenue can include general fund allocations, fund balance allocations, grants and donations for the specified use.

Transportation Improvement District (TID)

Transportation Improvement Districts (TIDs) are most often used by cities to construct localized projects such as streets, sidewalks, or bikeways. Through the TID process, the costs of local improvements are generally spread out among a group of property owners within a specified area. The cost can be allocated based on property frontage or other methods such as traffic trip generation.

Community Development Authorities (Special Tax Districts)

Municipalities and counties have statutory authority to establish community development authorities, to levy a property tax in the district additional to the city-wide property tax, and to use the proceeds to provide services in the district. Downtown revitalization projects are one of the eligible uses of service districts and can include projects such as street or bikeway improvements within the downtown taxing district.

Tax Increment Financing

Project Development Financing bonds, also known as Tax Increment Financing (TIF), is a relatively new tool allowing localities to use future gains in taxes to finance the current improvements that will create those gains. When a public project (e.g., bicycle or sidewalk improvements) is constructed, surrounding property values generally increase and encourage surrounding development or redevelopment. The increased tax revenues are then dedicated to finance the debt created by the original public improvement project. Tax Increment Financing typically occurs within designated development financing districts that meet certain economic criteria that are approved by a local governing body. TIF funds are generally spent inside the boundaries of the TIF district, but they can also be spent outside the district if necessary to encourage development within it.

Other local funding options

- Bonds/Loans
- Taxes
- Impact fees
- Exactions
- Installment purchase financing
- In-lieu-of fees
- Partnerships

Private and Non-profit Funding Sources

Private foundations and other conservation-minded benefactors are becoming an increasingly important source of funds for bicycle transportation projects. Many corporations or wealthy business families have related foundations that support social causes, and the many benefits of bicycle transportation are attracting public attention. Below are several examples of private funding opportunities available.

The Robert Wood Johnson Foundation

The Robert Wood Johnson Foundation was established as a national philanthropy in 1972 and today it is the largest U.S. foundation devoted to improving the health and health care of all Americans. Grant making is concentrated in four areas:

- To ensure that all Americans have access to basic health care at a reasonable cost
- To improve care and support for people with chronic health conditions
- To promote healthy communities and lifestyles
- To reduce the personal, social and economic harm caused by substance abuse: tobacco, alcohol, and illicit drugs

For more specific information about what types of projects are funded and how to apply, visit www.rwjf.org/applications/

Alliance for Biking & Walking: Advocacy Advance Grants

Bicycle and pedestrian advocacy organizations play the most important role in improving and increasing biking and walking in local

communities. Advocacy Advance Grants enable state and local bicycle and pedestrian advocacy organizations to develop, transform, and provide innovative strategies in their communities. With sponsor support, the Alliance for Biking & Walking has awarded more than $500,000 in direct grants, technical assistance, and scholarships to advocacy organizations across North America since the Advocacy Advance Grant program's inception. In 2009 and 2010, these one-year grants were awarded twice annually to startup organizations and innovative campaigns to dramatically increase biking and walking. The Advocacy Advance Partnership with the League of American Bicyclists also provides necessary technical assistance, coaching, and training to supplement the grants.

For more information, visit: http://www.bikewalkalliance.org/

Walmart State Giving Program

The Walmart Foundation financially supports projects that create opportunities for better living. Grants are awarded for projects that support and promote education, workforce development/economic opportunity, health and wellness, and environmental sustainability. Both programmatic and infrastructure projects are eligible for funding. State Giving Program grants start at $25,000, and there is no maximum award amount. The program accepts grant applications on an annual, state by state basis January 2nd through March 2nd.

Online resource: http://foundation.walmart.com/apply-for-grants/state-giving

The Rite Aid Foundation Grants

The Rite Aid Foundation is a foundation that supports projects that promote health and wellness in the communities that Rite Aid serves. Award amounts vary and grants are awarded on a one year basis to communities in which Rite Aid operates. A wide array of activities is eligible for funding, including infrastructural and programmatic projects.

Online resource: https://www.riteaid.com/about-us/rite-aid-foundation

Bank of America Charitable Foundation, Inc.

The Bank of America Charitable Foundation is one of the largest in the nation. The primary grants program is called Neighborhood Excellence, which seeks to identify critical issues in local communities. Another program that applies to greenways is the Community Development Programs, and specifically the Program Related Investments. This program targets low and moderate income communities and serves to encourage entrepreneurial business development.

For more information: www.bankofamerica.com/foundation

Dauphin County Gaming Grants

Funds are available through a grant program facilitated by the Hollywood Casino. Eligible projects include infrastructure (i.e. bicycle facilities), transportation, and public interest initiatives. Grant amounts are based on casino revenue.

Online resource: http://www.dauphincounty.org/government/Community-Economic-Development/Gaming-Advisory-Board/Pages/default.aspx

Marcellus Legacy Fund grants / Greenways, Trails, and Recreation Program (GTRP)

The greenways, trails and recreation program funds can go toward the planning, acquisition, development, rehabilitation and repair greenways, of recreational trails, open space, parks and beautification projects. The limit on funding is $250,000 and most projects require a 50 percent match. For profit businesses are eligible to apply, along with municipalities, non-profits, and watershed organizations. Developers in southeast Pennsylvania with projects that involve creating greenways or parks should consider including Marcellus Legacy grant funding.

Online resource: http://www.newpa.com/find-and-apply-for-funding/funding-and-program-finder/greenways-trails-and-recreation-program-gtrp

Local Trail Sponsors – "Adopt a Trail" Program

A sponsorship program for trail amenities allows smaller donations to be received from both individuals and businesses. Cash donations could be placed into a trust fund to be accessed for certain construction or acquisition projects associated with the greenways and open space system. Some recognition of the donors is appropriate and can be accomplished through the placement of a plaque, the naming of a trail segment, and/or special recognition at an opening ceremony. Types of gifts other than cash could include donations of services, equipment, labor, or reduced costs for supplies. A local trail sponsorship program is also useful as a community building effort for long-term trail maintenance and operations.

Corporate Donations

Corporate donations are often received in the form of liquid investments (i.e. cash, stock, bonds) and in the form of land. Municipalities typically create funds to facilitate and simplify a transaction from a corporation's donation to the given municipality. Donations are mainly received when a widely supported capital improvement program is implemented.

Private Individual Donations

Private individual donations can come in the form of liquid investments (i.e. cash, stock, bonds) or land. Municipalities typically create funds to facilitate and simplify a transaction from an individual's donation to the given municipality. Donations are mainly received when a widely supported capital improvement program is implemented.

Fundraising/Campaign Drives

Organizations and individuals can participate in a fundraiser or a campaign drive. It is essential to market the purpose of a fundraiser to rally support and financial backing. Often times fundraising satisfies the need for public awareness, public education, and financial support.

Volunteer Work

It is expected that many citizens will be excited about the development of a greenway corridor. Individual volunteers from the community can be brought together with groups of volunteers form church groups, civic groups, scout troops and environmental groups to work on greenway development on special community workdays. Volunteers can also be used for fund-raising, maintenance, and programming needs.

REGIONAL Bicycle Connections Study

Appendix C: Regional Bicycle Demand

Overview

The Bicycle Suitability Index (BSI) provides a general understanding of expected activity in the bicycling environment by combining categories representative of where people live, work, play, access public transit and go to school into a composite sketch of regional demand. Area specific land use and transportation factors, such as Capital Area Transit (CAT) and Lebanon Transit services, local cultural destinations, schools and trails are considered, as well as demographic factors. Suitability is used to identify levels of comfort of roadways and identify those that may by suitable for bicycle facilities.

A bicycle network is likely to attract a large portion of the population if its fundamental attribute is low stress connectivity. In other words, a network should provide direct routes between origins and destinations that do not include links that exceed one's tolerance for traffic stress. The Bicycle Suitability Index is objective, data-driven evaluation model which identify high traffic stress links, bicycle network gaps and gaps between "low stress" links and a score assessing the relative user comfort or level of stress a user may experience on each link is mapped.

As with all higher-level analyses, model results are a product of available data and should be used as a general guide rather than an absolute truth. The BSI analysis represents a high-level view of regional conditions and serves as a reference point early in the planning process. Ultimately a combination of the BSI, fieldwork, public input, and stakeholder discussion will collectively be used to craft Plan recommendations.

Bicycle Suitability Index Methodology

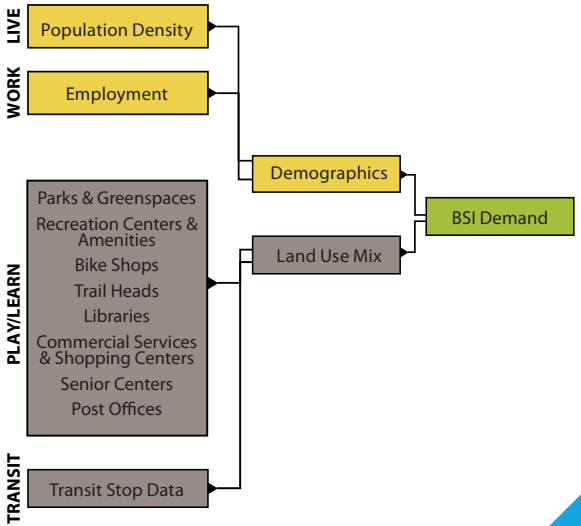
BSI overlays supply (bicycle and pedestrian network) and demand (activity) by quantifying factors that support or hinder user movements in the case of supply or generate activity in the case of demand. BSI results are presented as a composite Supply and Demand Typologies Model that indicates geographic patterns of supply and demand highs and lows.

The results of BSI can be used to identify areas for improvement and to prioritize potential bicycle projects where infrastructure need meets trip demand.

BSI Demand Analysis Development

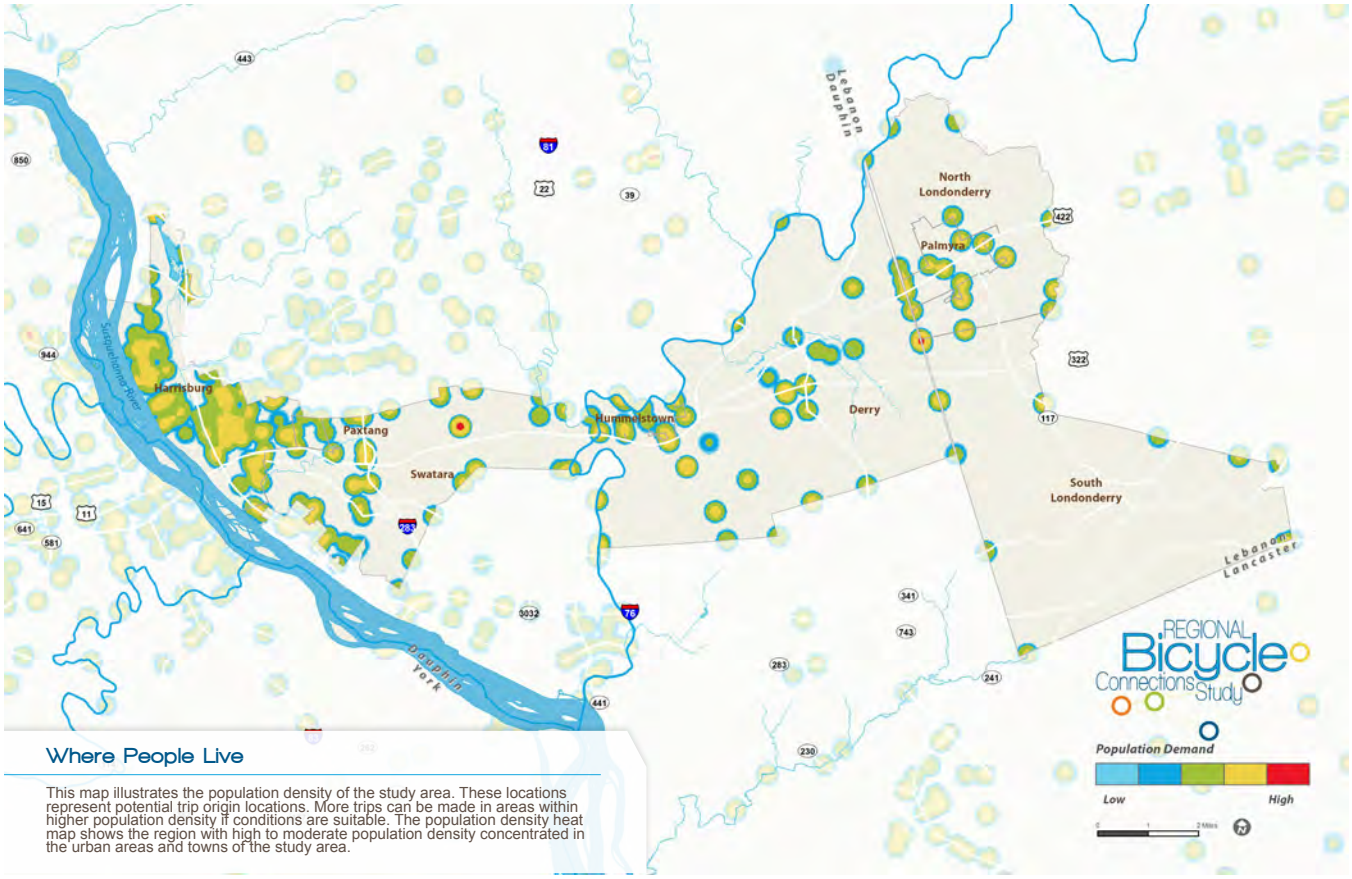
The demand anslysis shows areas of bicyclists activity based on the live, work, play/learn, and transit factors (attractors and generators). Areas of high demand show activity in the region, as well as, identify areas where bicyclists are likely to encourage and justify improvement projects.

The figures below illustrate and describe how the weighted features of live, work, play/learn, and transit factor into demand.



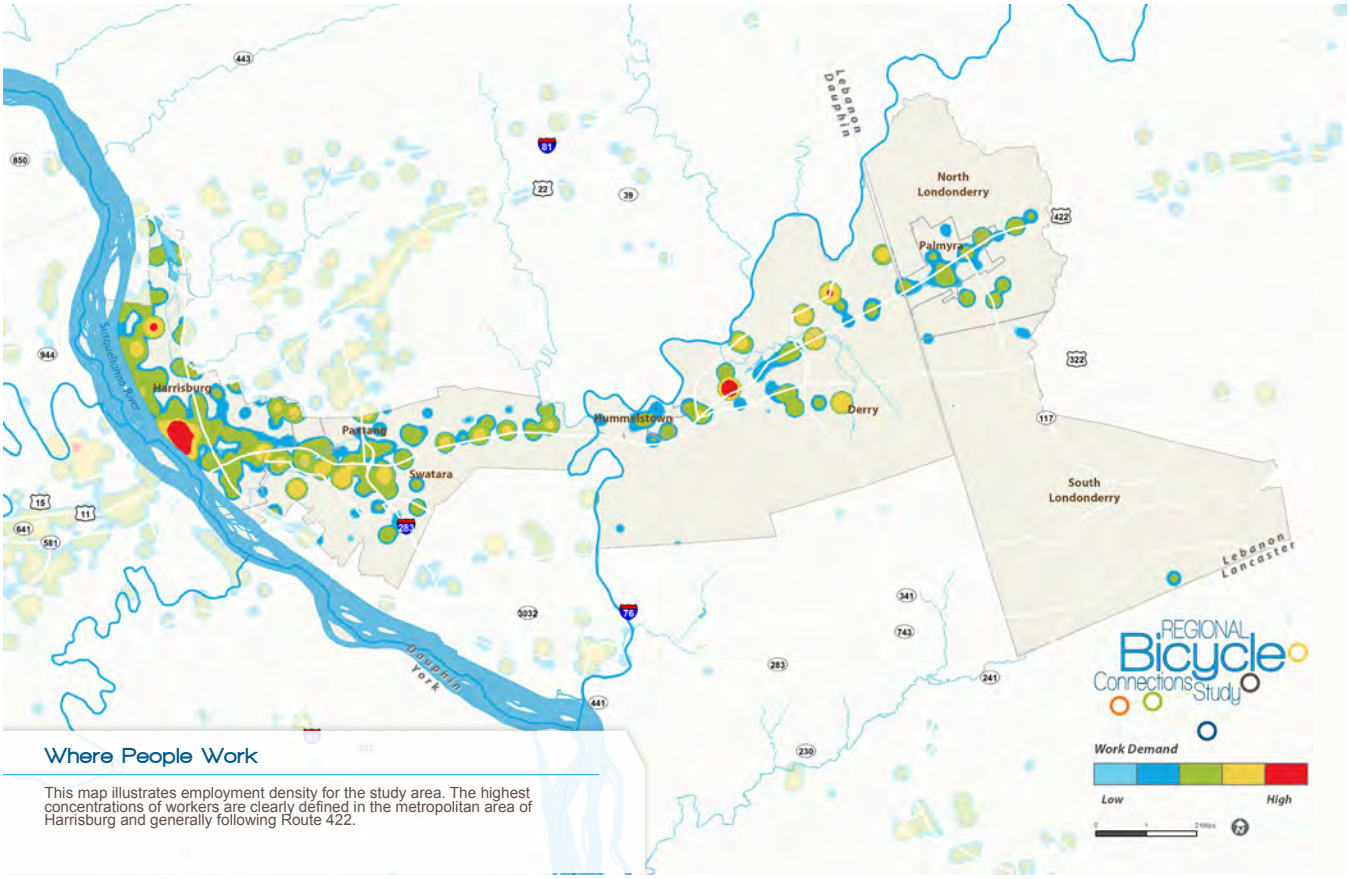
Where People Live (Population Demand)

This map illustrates 2008-2012 American Community Survey (ACS) block level census data including population density, percent of walk and bicycle commuters and percent of household with zero vehicle ownership. These locations represent potential trip origin locations. More trips can be made in areas within higher population density if conditions are suitable. The population density heat map shows the region with high to moderate population density concentrated in the urban areas and towns of the study area.



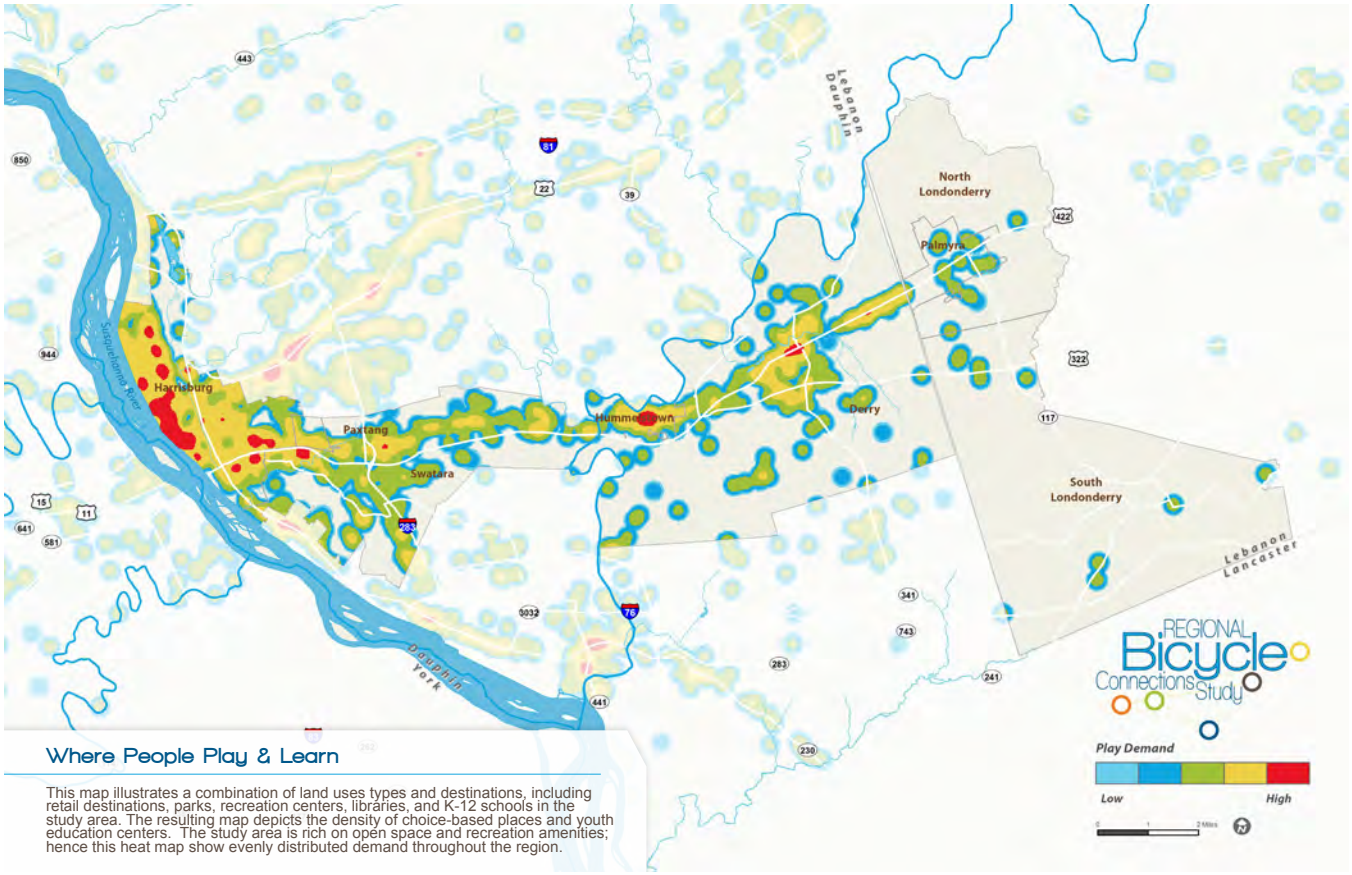
Where People Work

Trip end data is displayed for people working in the region regardless of residency. Its basis is 2011 total employment by census block. The highest concentrations of workers are clearly defined in the metropolitan area of Harrisburg.



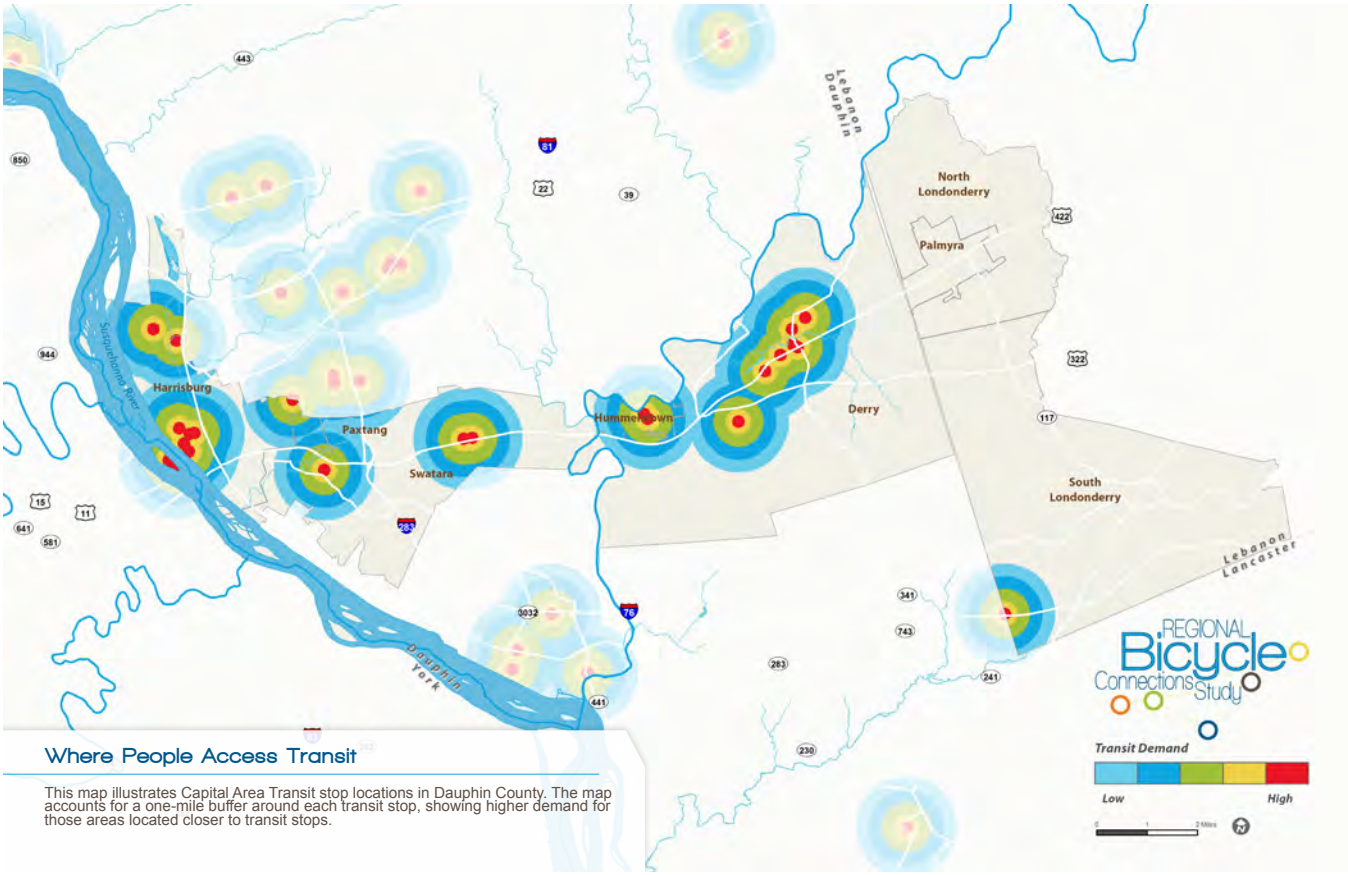
Where People Play & Learn

These locations are a combination of varied land uses types and destinations. Overlays such as retail destinations, parks, recreation centers, and libraries, as well as K-12 schools throughout the entire region are assembled to depict choice-based places and youth education centers. The study area is rich on open space and recreation amenities; hence this heat map show evenly distributed demand throughout the region.



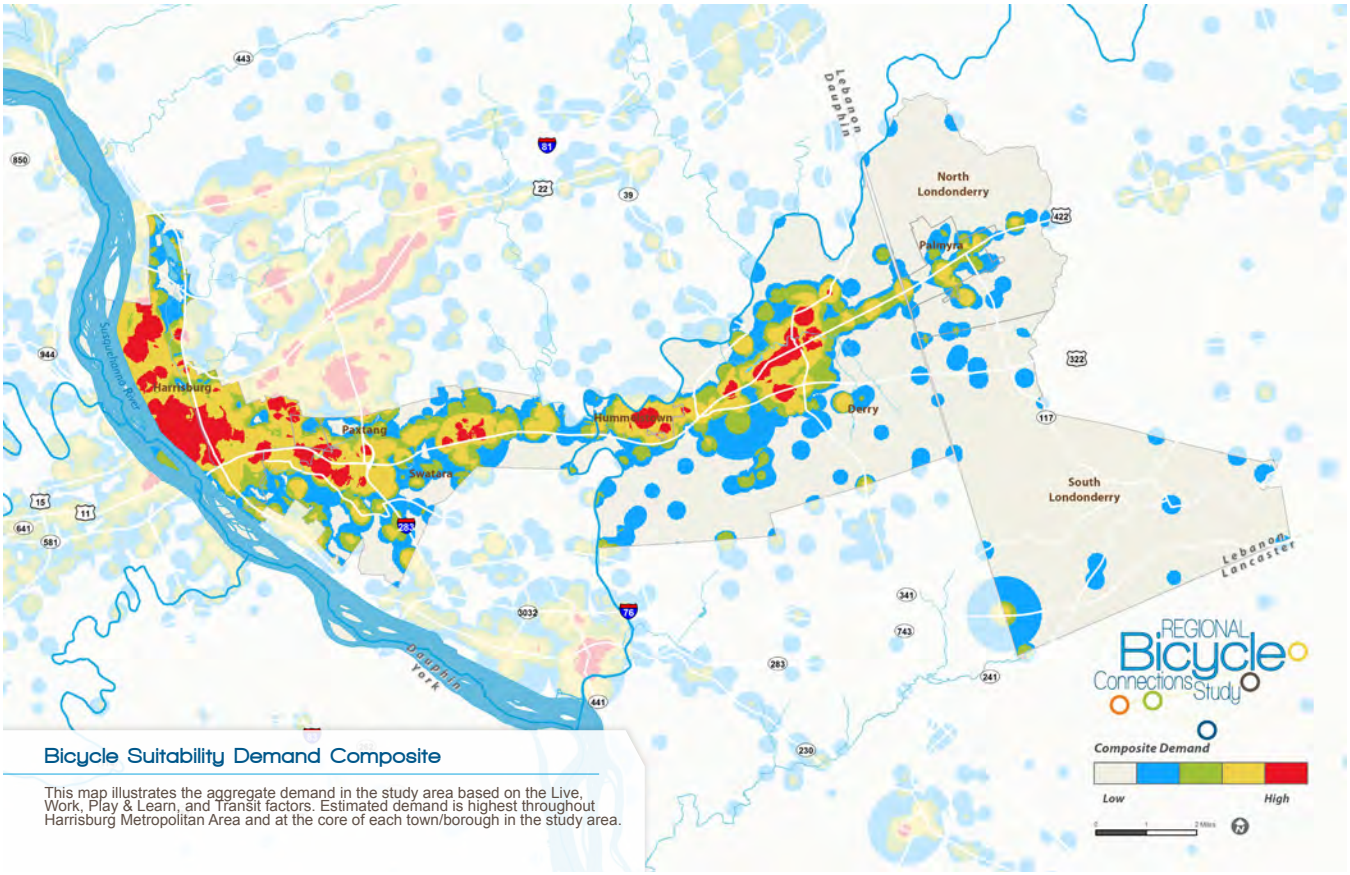
Where People Access Transit

This heat map is created by assessing the location of the CAT stop locations in Dauphin County. This category accounts for one-mile search radius of each stop giving higher scores to those areas located closer to the transit stops.



Bicycle Suitability Demand Composite

After independently processing each of the features described in previous maps, the composite model is created and grouped into five demand classes using breaks in the data values. Estimated demand is highest throughout Harrisburg Metropolitan Area and at the core of each town/borough in the study area.



Bicycle Suitability Demand Composite

This map illustrates the aggregate demand in the study area based on the Live, Work, Play & Learn, and Transit factors. Estimated demand is highest throughout Harrisburg Metropolitan Area and at the core of each town/borough in the study area.

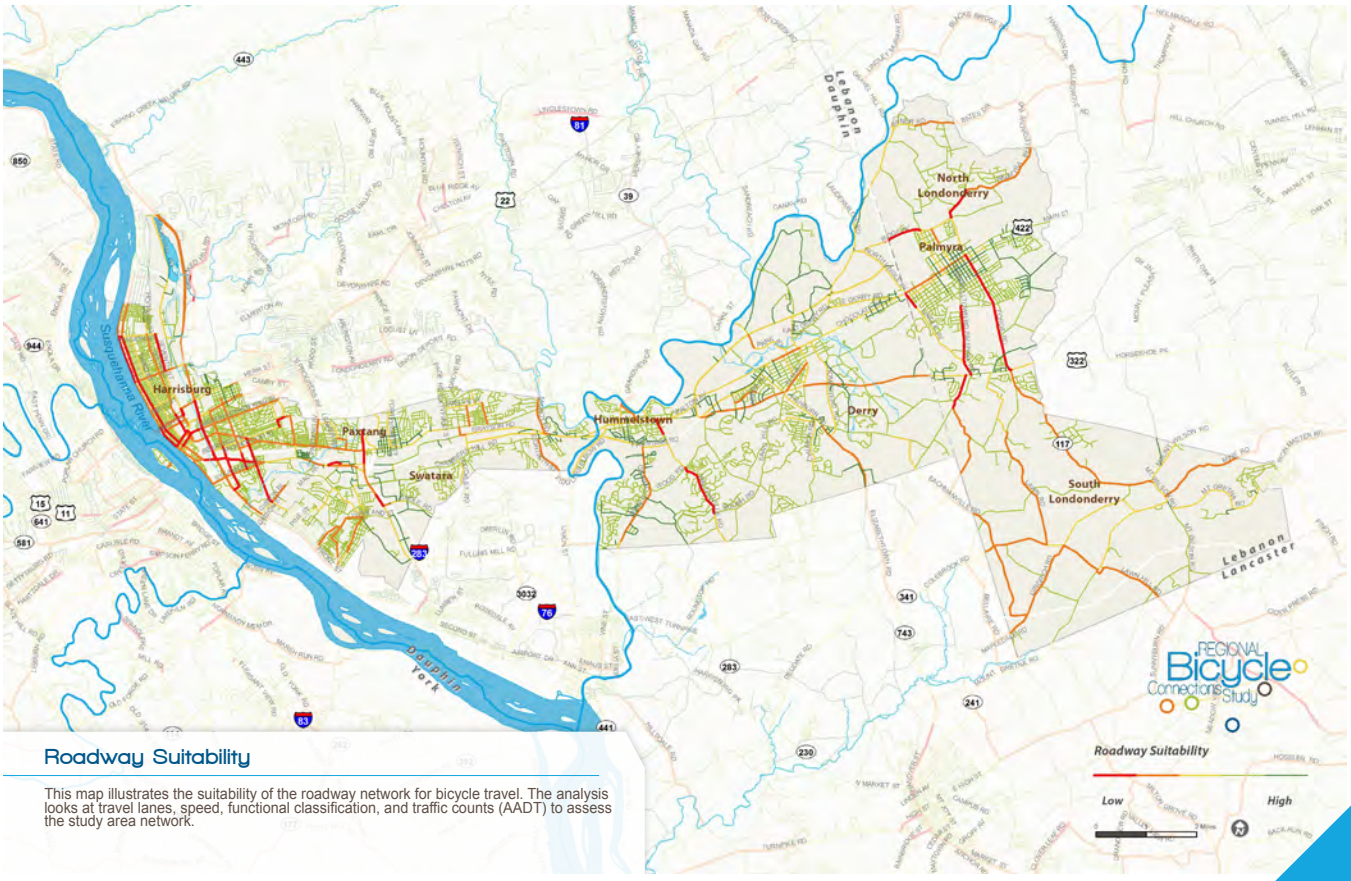
BSI Supply Analysis Development

Scores in BSI supply analysis are based on roadway characteristics that are perceived to have impact on bicycle safety, comfort, and ease of movement. The purpose of the supply analysis is to determine if infrastructure improvements are warranted given the existing conditions.

Using available data for the entire region, roadways were classified according to Feature Class, Speed limits, and 2012 AADT values among others. Roadways were assigned a score based on the level of stress a bicyclists is likely experience when traveling along the roadway. In addition, the roadways scored points based on proximity to existing bicycle facilities.

Table 1 - Data Required and Scoring for BSA Roadway Quality

Category Feature Dataset	BSI Score
Street Characteristics	
State Touring Bike Route	3
Collector or Arterial Roadway	1
Local Roadway	5
Lebanon County Bike Routes	3
4ft Shoulder Presence	5
PenDOT AADT Data (2012)	
< 1500	5
1500-3000	4
3000-8000	3
8000-10,000	2
> 10,000	1
AADT Unknown	4
Current Truck AADT	
Truck Volume < 5%	5



Roadway Suitability

This map illustrates the suitability of the roadway network for bicycle travel. The analysis looks at travel lanes, speed, functional classification, and traffic counts (AADT) to assess the study area network.

BSI Composite Activity Model

Development of the composite activity model of bicycling in the Region was conducted in two steps.

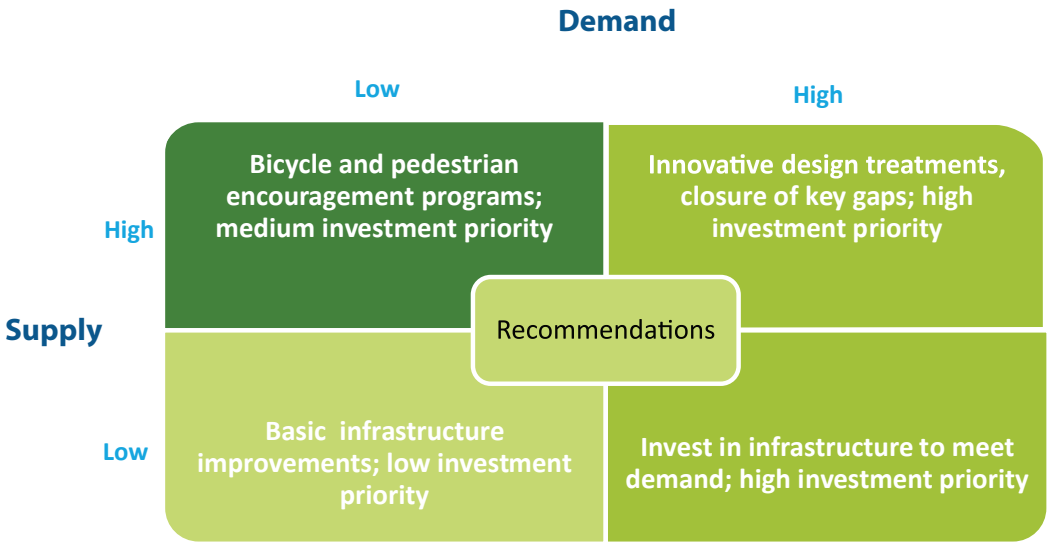
- First, by combining the scores for the places in the community where people live, work, play and learn (attractors and generators) to produce a composite set of scores for the areas of interest. This step approximates trip demand.
- Then, by overlaying the appropriate composite roadway quality scores. This step approximates trip supply

As illustrated in Figure 7, areas with **high demand** for bicycling and **most comfortable** infrastructure can benefit from innovative programs and capital projects that further support walking, closure of key gaps, and should be considered showcase areas where best practices can be modeled for the city. These areas provide opportunities for improvements and should be a high priority for investment.

Areas with **high demand** and **least comfortable** infrastructure can benefit from infrastructure improvements to improve bicycling conditions. These areas may require sidewalks, bicycle facilities, or intersection improvements to accommodate high level of demand. They should also be a high priority for investment.

Areas with **low demand** for bicycling and **most comfortable** infrastructure can benefit from programs to encourage bicycling, and land use changes or development to increase the density of attractors and generators. These areas should be a medium priority for investment.

Areas with **low demand** for bicycling and **least comfortable** infrastructure can benefit from basic infrastructure improvements. These areas should be a low-priority for investment.



BSI Composite Results

The BSI composite activity model is an important tool for assessing potential bicycle improvements and to guide fieldwork. The model for the study area reveals that estimated demand is highest throughout the Harrisburg Metropolitan Area and at the core of each town/borough in the study area within Dauphin County. These downtown areas are also largely composed of lower-speed, grid pattern streets that have a moderate roadway suitability ranking. As a result, these areas should be targeted as priority investment areas to invest in infrastructure to meet latent demand. Important corridors include, but are not limited to:

- N 2nd Street between Paxton Street and Maclay Street
- N 3rd Street between Walnut Street and Maclay Street
- Derry Street from Mulberry Street to N 72nd Street
- Harrisburg Street from Paxton Street to Chambers Street

Palmyra, North Londonderry, and South Londonderry indicate moderate demand for bicycle accommodations. These areas are likely best served with medium infrastructure investment coupled with biycle and pedestrian encouragement programs to induce demand.

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PLANNING + DESIGN

Sabra, Wang & Associates, Inc.