MEMORANDUM

Separated Bike Lane Definitions and Design Standards

Abington Separated Bike Lane Action Plan

Prepared for Abington Township by WSP | August 15, 2025

Table of Contents

Glossary

BIKE FACILITY TERMINOLOGY	
All Ages & Abilities (AA&A) bikeways	Bike facilities which incorporate NACTO design standards to accommodate various types of bicycles, speeds, and levels of comfort, with the goal being to support cyclists of all ages and abilities.
Bike facilities	Improvements and provisions to accommodate or encourage cycling, including parking, storage facilities, and shared roadways not specifically defined for bicycle use.
Bike box	A designated area on the approach to a signalized intersection, between an advance motorist stop line and the crosswalk or intersection, intended to provide bicyclists a visible place to wait in front of stopped motorists during the red signal phase.
Contraflow bike lane	A bike lane going in the opposite direction of car traffic.
Conventional bike lane	An on-road bicycle lane without any buffer or separation from car lanes.
Bicycle Crossing or Crossbike	A designated bike lane or crossing that continues through an intersection, often adjacent to a crosswalk. They are typically painted like a crosswalk with green and white striping.
Cycle track	Typically refers to a two-way separated bike lane, can sometimes reference a one-way separated bike lane.
Dooring	The action of a bicyclist striking a car door as a driver or passenger opens it.
Gore striping	The application of pavement markings, typically chevron or solid white lines, in areas where a road or highway merges with an exit or entrance ramp to guide drivers as to where they should and should not be driving.
Killed or Seriously Injured (KSI)	A category of crashes which resulted in serious injury or death. KSI is used to distinguish more dangerous crashes from those which result in property damage or minor injury.
Micromobility	Transportation using lightweight vehicles, either manually or electrically powered, such as bicycles or scooters.
Midblock	Roadway segments that are not at an intersection, usually defined as areas 250 feet or more away from an intersection.

Protected intersection	Intersections which include physical features (e.g., raised curbs, bollards, pylons) to separate bicyclists from motor vehicle traffic in certain areas.
Separated bike lane	Bicycle lane which is separated from both car lanes and pedestrians by a buffer and some form of physical protection, such as flexible delineators, curbs, medians, or elevation changes. Used interchangeably with the term "protected bike lanes."
Vehicular cycling	The practice of riding bicycles on a road in a manner that is in accordance with the principles for driving vehicles in traffic.

ORGANIZATIONAL ACRONYMS	
AASHTO	American Association of State Highway Transportation Officials
FHWA	Federal Highway Administration
MUTCD	Manual on Uniform Traffic Control Devices
NACTO	National Association of City Transportation Officials
NCHRP	National Cooperative Highway Research Program
NTSB	National Transportation Safety Board

1. Introduction

Separated bike lanes (SBLs) are bike lanes which are separated from both car lanes and pedestrians with a buffer and some form of physical protection, such as flexible delineators (also known as flexposts), curbs, medians, or elevation changes. SBLs are also referred to as "protected bicycle lanes." When developed with a focus on network connectivity, SBLs are an essential component of cycling safety, helping to encourage people of all ages and abilities to cycle. SBLs are particularly critical to parts of the bicycle network which have high car volumes and speeds.

Research and experience show that SBLs result in safer conditions for all road users. In 2023, the Federal Highway Administration (FHWA) completed a study which found that converting conventional bike lanes, which do not include any physical protection, to protected bike lanes cut the number of bicycle/vehicle crashes in half, on average.[1] Research consistently demonstrates that streets designed with the comfort and safety of cyclists in mind are safer for all road users alike—cyclists, drivers, passengers, pedestrians, and people using mobility devices.

Traffic safety, particularly for pedestrians and cyclists, is a key concern for both Abington residents and stakeholders. Eighteen total crashes involving cyclists occurred from 2021 to 2023 either within Abington or within a quarter mile of Abington. Of the crashes involving cyclists, two resulted in injuries and one resulted in a fatality. In 2023, Kevin McCreary Jr. was cycling along Old York Road in Jenkintown, just south of Noble Station, when he was struck and killed by a vehicle. Kevin's death prompted residents of both Abington and Jenkintown to renew their push for improved bicycle facilities. Defining and implementing high-quality, connected cycling infrastructure—particularly on some of the Township's busiest streets, where cyclists are most at risk—is an urgent issue for the Abington community.

Abington Township has contracted with WSP to prepare the Abington Separated Bike Lane Action Plan. This document (Separated Bike Lane Definitions and Design Standards) is the first of four memos that make up this Action Plan. It is organized into the following four sections:

1. **Literature Review:** Contextualizes why SBLs are best practice, trends in cyclist behavior and safety, and how components of SBL design impact safety for all road users.
2. **Existing Township Standards:** Reviews existing bicycle infrastructure in Abington and plans for infrastructure upgrades.
3. **Design Standards Best Practices:** Summarizes guides and manuals that will inform the selection, planning, design, and maintenance of SBLs in Abington.
4. **SBL Definition for this Action Plan:** Outlines the recommended standards for SBLs within the context of this Action Plan.

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[1] Federal Highway Administration (FHWA). (2023, September). *Developing Crash Modification Factors for Separated Bicycle Lanes.* Publication No. FHWA-HRT-23-078.

2. Literature Review

2.1. Historical Context

2.1.1. Shift from Vehicular Cycling Towards Separated Bike Lanes

Separated bicycle facilities have become established as best practice for road design in the last two decades. Prior to this, the principle that cyclists should be treated as if they are operating a vehicle — known as **vehicular cycling**— guided bikeway planning and design. The concept of vehicular cycling was popularized by cycling advocate John Forester in the 1970s.[2] Forester's philosophy on bicycle infrastructure design, which he summarized in *Bicycle Transporting: A Handbook for Cycling Transportation Engineers,* strongly influenced the 1978 Caltrans Bicycle Guide, much of which was ultimately adopted into the 1981 American Association of State Highway Transportation Officials (AASHTO) *Guide for the Development of Bicycle Facilities.* The 1981 guide discouraged SBLs and recommended cyclists practice vehicular cycling, changing course from the agency's 1974 *Guide for Bike Routes* which actually recommended the separation of bikes from motor vehicle traffic.[3]

Vehicular cycling requires cyclists to take it upon themselves to minimize crashes. For Forester, a "cyclist" was an able-bodied person who was able to ride at least 15 miles per hour (mph) and respond quickly to cars and other cyclists. **This assumption does not recognize the varying needs of cyclists, particularly people of differing abilities, younger and older people, and less confident cyclists, many of whom are unable to respond as quickly to potential conflicts**. Design decisions made to promote vehicular cycling resulted in a built environment that has caused cyclists to be overrepresented as a share of crashes compared to the number of trips taken.

More research on cycling safety, as well as more comprehensive advocacy, has resulted in a shift away from vehicular cycling towards improved road designs which consider the needs of a variety of cyclists. The passage of the Intermodal Surface Transportation Efficiency Act (ISTEA) in 1991 marked the first substantial investment in bicycle facility research, which found that **SBLs are the safest bikeway facilities as well as the most popular with different kinds of cyclists**. The first National Association of City Transportation Officials (NACTO) Urban Bikeway Design Guide was published in 2011 to provide guidance on how to develop conventional and separated bike lanes in denser, more developed areas. In 2024, AASHTO released an updated *Guide for the Development of Bicycle Facilities* which endorses separated bike infrastructure to better protect all cyclists, officially moving away from a vehicular cycling philosophy and towards "bikeways that the average bicyclist will find comfortable."

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[2] Schmitt, A. (2018, March 2). A brief history of how American transportation engineers resisted bike lanes. Streetsblog USA.
[3] Schultheiss, W. (2023). "A Historical Perspective on the AASHTO Guide for the Development of Bicycle Facilities and the Impact of Vehicular Cycling." *Transportation Research Record* 2672, Issue 13.

2.1.2. Emerging Trends in Micromobility

Micromobility refers to transportation using lightweight vehicles such as bicycles or scooters. The recent proliferation of micromobility beyond bicycles (e.g. e-scooters) underscores the need for infrastructure which reduces conflict between vehicles, bicycles, e-bicycles, other micromobility vehicles, and pedestrians. The most recently published literature regarding separated bicycle facility design assumes that other forms of micromobility will make use of bicycle facilities.[4]

E-scooter adoption has been slower in Pennsylvania cities and towns than similar cities and towns around the country due to heavily restrictive state law that makes them effectively illegal to operate. E-scooters are regulated like motorcycles, which means there are titling and registration requirements. However, e-scooters don't have the necessary equipment to be registered and insured (i.e. turn signals and mirrors), making them ineligible for registration. Furthermore, state law prohibits their use on public sidewalks. Despite these strict laws, varying levels of enforcement and confusion regarding vehicle classifications mean private ownership and use of e-scooters is growing across the state. Unlike e-scooters, e-bikes are classified as bicycles and are subject almost all of the same regulations as conventional bicycles.

Additionally, Pennsylvania state law does not allow for the operation of e-scooter sharing systems. Legislation allowed "cities of the second class" (i.e. Pittsburgh) to pilot e-scooter sharing programs from 2021 to 2023.[5] Abington is a first class township under the municipal classification system and therefore was not eligible to conduct a pilot program.[6] Some political momentum to legalize e-scooter use and sharing programs in more areas of Pennsylvania has grown from this Pittsburgh pilot. As e-scooter and e-bike use continues to grow—regardless of regulatory status—SBLs will become more essential to provide for the comfort and safety of all road users.

2.2. Impact of Road Design on Cyclist Behavior and Safety

2.2.1. Impact of Bicycle Facilities on Behavior and Use

The body of research on cycling has indicated that different people have different risk tolerances while cycling, as well as varied thresholds for what constitutes a safe and comfortable bike ride. There is a strong relationship between the number of bicycle lanes and the number of bicycle trips made on the road, the number of different cyclists who use the roads, and safety outcomes for cyclists.[7] The presence of bike lanes is even more likely to encourage women, seniors, and inexperienced cyclists to cycle.

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[4] NCHRP. (2025). *On-street bicycle facility design features: a guide.* Research Report 1136. National Academies.

[5] Forstadt, J. (2023, April 13). *The future of Pittsburgh's polarizing e-scooter program hinges on state lawmakers*. WESA.

[6] Pennsylvania General Assembly Council on Local Government (2025). "Municipalities – How They Change: Boundaries, Classification or Forms of Government."

[7] Pucher, J., et al. (2011). "Bicycling renaissance in North America? An update and re-appraisal of cycling trends and policies." Transportation Research, Volume 45, Issue 6.

In 2006, Roger Geller completed a study for Portland, Oregon, that argued people could largely be sorted into four types of cyclists—Strong & Fearless, Enthused & Confident, Interested but Concerned, and No Way No How (***Figure 1***). His typology demonstrates how different types of bicycle facilities and levels of separation have variable impacts on cycling behavior depending on the person. Geller's typology was validated at a national level through a 2011 survey across fifty of the largest United States metro areas.[8]

Figure 1. Roger Geller's Typology of Cyclists by Estimated Percent of Population

The characteristics of the different cyclist typologies include:

- **'Strong & Fearless'** and **'Enthused & Confident'** individuals, 12% of the population, tend to feel comfortable riding in mixed traffic and do not necessarily care to have SBLs present.
- **'Interested but Concerned'** individuals, 51% of the population, are the largest group and **the group SBLs will have the greatest impact on**. SBLs have been shown to help 'Interested but Concerned' people feel more comfortable cycling, and more likely to ride bikes more frequently and for longer durations.
- **'No Way No How'** individuals, 37% of the population, are not interested in cycling at all, regardless of the facilities available to them.

Geller's cyclist typology matches closely with demographic groups such as age and gender. Women and people over 65 are disproportionately in the 'Interested but Concerned' group, while men ages 18 to 65 are disproportionately in the 'Strong & Fearless' and 'Enthused & Confident' groups.

2.2.2. Reported Collisions and Cyclist Safety

Per the Pennsylvania Crash Information Tool, developed by PennDOT, Abington experienced a higher average rate of bicycle crashes (12.3 crashes per 100,000 people) from 2019 to 2023 compared to Montgomery County (8.5) or Pennsylvania (7.0). **The higher rate of bicycle crashes suggests there is a critical need for safer bicycle infrastructure in the Township**. Abington had a similar average rate of bicycle crashes which caused death or serious injury (0.7 crashes per 100,000 people) as Montgomery County (1.0) and Pennsylvania (1.0) during the same period.

[8] Dill, J., & McNeil, N. (2012). "Four Types of Cyclists?: Examination of Typology for Better Understanding of Bicycling Behavior and Potential." Portland State University.

While recorded crashes provide some indication of safety issues, they do not tell the whole story about cyclist safety. Crashes where a cyclist was injured, but not killed, have been shown to be underreported across the United States; the National Transportation Safety Board (NTSB) found that there were as many as four times the number of reported bicyclists with nonfatal injuries in emergency medical records as there were in police reports. Conversely, collision statistics may make it seem like large, busy roads are safer than they actually are because bicyclists avoid riding on them, resulting in fewer recorded bicycle crashes.[9] **The fact that bicycle-related collisions tend to be underreported further supports the need for SBLs in Abington Township.**

2.2.3. Impact of SBLs on Safety and Use

Installing SBLs yields substantial improvements to cyclist safety. Recent research into the safety impact of bicycle infrastructure includes the NTSB's *Bicyclist Safety on US Roadways: Crash Risks and Countermeasures* (2019) and the National Cooperative Highway Research Program's (NCHRP's) *Safety Evaluation of On-Street Bicycle Facility Design Features* (2025). The NTSB research found that strategies for improving cyclist safety should have three major components:

1. **Improving roadway infrastructure for cyclists:** The design of safe and convenient bicycle facilities which are suited to their local context is critical for cyclist safety. Dedicated bike infrastructure such as SBLs can drastically reduce the rates of serious bicycle crashes.

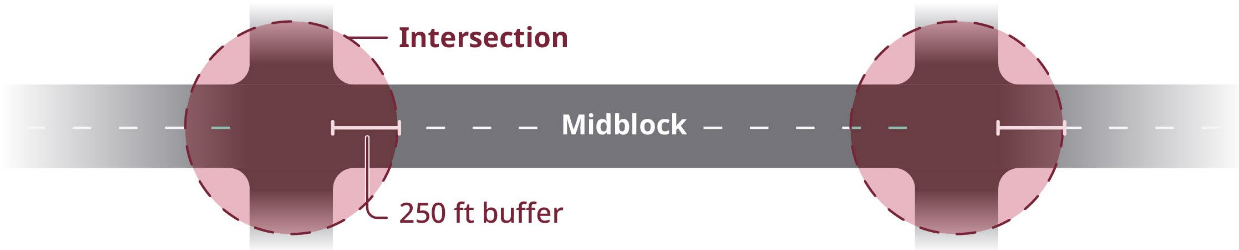
2. **Enhancing cyclists' conspicuity (i.e. visibility of cyclists to motorists)**: Around 45% of bike crashes occur at night despite an estimated 20% of trips taken at night. Reflectivity and crash detection systems can help make cyclists more visible to cars.

3. **Reducing head injury**: 62% of bicyclist fatalities were due to head trauma, and nearly all cyclist head trauma is a result of vehicle-bike crashes. Helmet use has been shown to reduce the severity of head trauma, but helmet use remains relatively low across the United States with an estimated 46% of cyclists never wearing a helmet.

SBLs accomplish all three of these goals by drastically reducing bike crashes, particularly the most serious vehicle-bike crashes. Bike crashes are generally sorted into three categories—midblock, intersection, and driveway. NCHRP distinguishes between intersections and midblock by using a 250-foot buffer zone (see ***Figure 2***). These three categories of bike crashes result from different types of bicycle facilities being present in the different locations, as well as varying risks of conflict between bicyclists and other modes. SBLs are most effective at preventing midblock and driveway crashes, reducing what's called "vertical" conflict between modes (vehicles and bikes traveling next to each other). SBLs should be supported by complementary intersection designs the preserve the overall quality and safety of the bike network.

[9] AASHTO. (2024). Guide for Development of Bicycle Facilities, 5th Edition. AASHTO.

Figure 2. Intersection and Midblock as Defined by NCHRP



All bike facility types installed at midblock locations reduce total and KSI crashes. **While more bicycle crashes occur in intersections (59%) than at midblock (30%) or driveway (11%) locations, midblock crashes are much more dangerous for cyclists**. 59% of fatal bicycle crashes occurred midblock, while 66% of injury-only crashes occurred at an intersection.[10, 11] Many bicyclist fatalities (47%) are a result of a motorist attempting to overtake a cyclist midblock.[12]

SBLs all but eliminate the potential for mid-block crashes, as well as other crashes due to vertical conflict such as being hit from behind, sideswipes, and dooring.[13] Adding physical vertical protection (such as a curb) to a conventional bike lane marked by paint and/or painted buffers alone has been found to reduce vehicle-bike crashes by 50%, while adding an SBL where there is no bike facility can decrease crashes by up to 90%.[14]

In addition to lowering the rates of the most severe crashes, SBLs can create a sense of "safety in numbers" by generating more bicycle trips. Studies have found evidence that developing a network of low stress bicycle facilities leads to more bike trips, resulting in drivers becoming more attuned to the presence of cyclists, and in turn leading to fewer crashes and lower crash severity.[15]

2.3. Design

While the installation of midblock bicycle facilities can provide baseline safety improvements, there are a variety of design factors which influence the degree of impact these facilities have. Much of the literature on the impact of on-street facility design is captured by NCHRP's 2025 *On-Street Bicycle Facility Design Features: A Guide*. **Separated bike facilities are defined by two key components[16]**:

- Vertical separators from car traffic
- Vertical separation, elevation change, or a detectable change of surface materials from sidewalks and pedestrians.

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[10] NTSB. (2019). Bicyclist Safety on US Roadways: Crash Risks and Countermeasures. NTSB.
[11] NCHRP. (2025). Safety Evaluation of On-Street Bicycle Facility Design Features. National Academies.
[12] NTSB. (2019). Bicyclist Safety on US Roadways: Crash Risks and Countermeasures. NTSB.
[13] Ibid.
[14] NACTO. (2025). Urban Bikeway Design Guide, 3rd Edition. Covelo Island Press.
[15] AASHTO. (2024). Guide for Development of Bicycle Facilities, 5th Edition. AASHTO.
[16] Ibid.

The design and context of SBLs further impacts the quality of the facilities and the extent to which they add to cyclists' comfort and safety.

2.3.1. SBL Design Choices and Cyclist Safety

The main factor which can degrade the quality of a SBL is whether there are long and/or frequent gaps in vertical separation, such as spaces to provide access to parking lots. Gaps break up the continuity of the vertical protection and increase conflict points between cyclists and other modes. Design choices to mitigate gaps include increasing sight distance for motorists and cyclists (e.g. curb bumpouts or bend-out deflections depending on area of the roadway), improved lighting, on-street parking regulations, and traffic control devices.

2.3.2. Contextual Factors

Some of the contextual factors that can impact the quality of SBLs include:

- **Side of the road:** On one-way streets, one-way SBLs that are located to the left of car travel lanes tend to make cyclists more visible to drivers who are turning left, which reduces the likelihood of motorist and cyclist collisions. Stakeholders, including the Bicycle Coalition of Greater Philadelphia and Montgomery County Planning Commission, recommend this based on use cases in Philadelphia.
- **Roadway grade**: Downhill approaches to intersections (4% grade or greater) increase speed of cyclists and drivers, increasing the likelihood of crashes.
- **Proximity to pedestrian generators**: Proximity to bus stops is positively correlated with bicycle crashes. However, it does not make sense to divert cyclist traffic away from pedestrian connections, which means that high-quality pedestrian design with an emphasis on accessibility is equally as important as designing bicycle facilities that improve connectivity and safety for all road users.
- **Driveways:** Driveways associated with commercial parking lots, gas stations, and residential single-family homes can introduce conflict where the SBL protection is removed and car traffic mixes with bikes. The frequency, width, and volumes of vehicles going through these driveways all impact the likelihood of a vehicle/bicycle crash.

SBLs should be implemented alongside complementary facilities, such as bike boxes, bike signals, bike parking, and traffic-calmed, mixed mode neighborhood streets, to create a low-stress bicycle network that maximizes the impact of investments in SBLs[17].

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[17] Pucher, J., et al. (2011). Bicycling renaissance in North America? An update and re-appraisal of cycling trends and policies. Transportation Research, Volume 45, Issue 6.

3. Existing Township Bicycle Facilities, Planning, & Design Standards

3.1. Existing Bicycle Facilities & Township Standards

Abington Township, home to approximately 58,000 people, is the second largest municipality by population in Montgomery County. Although it is suburban in character, Abington is densely developed, with a population density of 3,754 residents per square mile and many downtown commercial nodes. Abington is close to Philadelphia and is well served by major amenities such as public transit, trails, and parks. Abington's relatively dense, well established built environment combined with its proximity to major transit and open space amenities make the Township ripe for additional investments in bicycle connectivity.

Existing bicycle facilities in Abington are limited to mixed-use trails and conventional on-road facilities. The conventional bike lanes and shared lane markings, also known as sharrows, give cyclists little to no separation or protection from vehicular traffic. A protected bike lane would require both a buffer as well as a vertical separation element (e.g. a curb).

The township does not have distinct standards that have been adopted or informally used with the township departments. The Department of Public Works typically follows existing PennDOT design standards for bicycle facilities, even on township-owned roads. This effort is aimed at developing bicycle design standards for SBLs that are appropriate to Abington and that the Township can use when designing and implementing SBLs to maximize bicyclist safety, comfort, and connectivity.

3.2. Active Transportation Planning in Abington

The SBL Action Plan builds on eight years of planning for connected and safe bicycle facilities in Abington Township. The *Abington Master Bicycle Plan* (2016) recommended 47 miles of new bicycle routes to develop a Township-wide bicycle network that links residential neighborhoods and important Township destinations. The routes were also designed to provide connections to the regional Circuit trail network. Notably, none of the routes recommended in the *Abington Master Bicycle Plan* were SBLs. The plan recommended the development of off-road trails, conventional bike lanes, or shared lanes within the road right-of-way.

Through the process of developing the *Abington Master Bicycle Plan*, a variety of transportation challenges were identified beyond cycling that spurred the creation of additional planning resources. *Walk, Park, Train Abington* (2017) was developed to address the challenges identified in the *Abington Master Bicycle Plan* and outlines a strategic approach to improving Abington's transportation system, including increasing connections to SEPTA Regional Rail service.

Walk, Park, Train indicates how upgrades to cycling infrastructure might complement other transportation investments, and how cycling facilities might play a key role in better connecting Abington residents to Regional Rail.

Most recently, the *Abington Noble Area Action Plan* (2023) established a 5-year roadmap to enhance multimodal access in a busy section of the Township. The plan was motivated by two major planned investments—the renovation of Noble Regional Rail Station and the reconstruction of the adjacent Old York Road Bridge. The plan recommended localized investments to enhance safe and accessible connections to Noble Station. Recommendations included a variety of investments in cycling infrastructure, such as coordinating with SEPTA to install bicycle racks at Noble Station and installing SBLs along The Fairway.

4. Design Standards Best Practices

As SBLs are on-road facilities, the planning, design, engineering, and maintenance of SBLs is influenced by a web of guidelines and standards. These guides and manuals, both from governmental and non-governmental organizations, either govern design and engineering decisions or serve as supplements for more cutting-edge best practices. The three national-level, comprehensive guides for bike facilities have been re-released in the last two years after substantial revisions, giving the Township a wealth of information on best practices for SBLs to incorporate into the SBL Action Plan.

The bikeway planning, selection, and design guides and manuals that were reviewed for this memo include:

Table 1. SBL Planning, Selection, and Design Guidance Manuals

ORGANIZATION	TITLE	YEAR	PURPOSE
AASHTO	*Guide for Development of Bicycle Facilities, 5th Edition*	2024	Documents the planning, selection, and design of on-road bicycle facilities. Adopted as a guideline for engineering and design decisions for bicycle facilities in Pennsylvania, as well as nationally.
NACTO	*Urban Bikeway Design Guide, 3rd Edition*	2025	Documents the planning, selection, and design of bicycle facilities. Includes greater detail and flexibility compared to the AASHTO guide, enabling stakeholders to fine tune bike infrastructure for dense town centers, suburbs, and cities. Not adopted as a basis for engineering or design decisions in Pennsylvania.
PennDOT	*Design Manual Part 2: Contextual Roadway Design*	2021	Supplements AASHTO, NACTO, and FHWA with Pennsylvania specific standards and guidelines. Supersedes standards for bike facilities on state-owned roads if standards are in conflict with AASHTO or NACTO.
FHWA	*Manual on Uniform Traffic Control Devices, 11th Edition* (MUTCD)	2023	Governs selection and design of traffic control devices (i.e. signals and signage) related to bicycle facilities.*

ORGANIZATION	TITLE	YEAR	PURPOSE
FHWA	*Bikeway Selection Guide*	2019	Supplements design manuals by providing guidance on implementation; including policy, planning, and decision-making.

**The MUTCD 2009 edition, with Revisions 1,2 and 3 incorporated, has been adopted by Pennsylvania; the 11th Edition is pending state adoption.*

4.1. Primary Guidance

4.1.1. AASHTO *Guide for Development of Bicycle Facilities*

The American Association of State Highway Officials (AASHTO) released the 5th Edition of the AASHTO *Guide for the Development of Bicycle Facilities* in 2024. The 5th Edition represents a significant change from the 4th Edition released in 2012. Much of the manual was rewritten to move away from a vehicular cycling philosophy and towards designing "bikeways the average bicyclist will find comfortable." Some chapters reflecting this shift, such as Bicyclist Operation and Safety, are brand new to this Edition. This means that the 5th Edition will be a valuable tool for siting and designing SBLs in Abington.

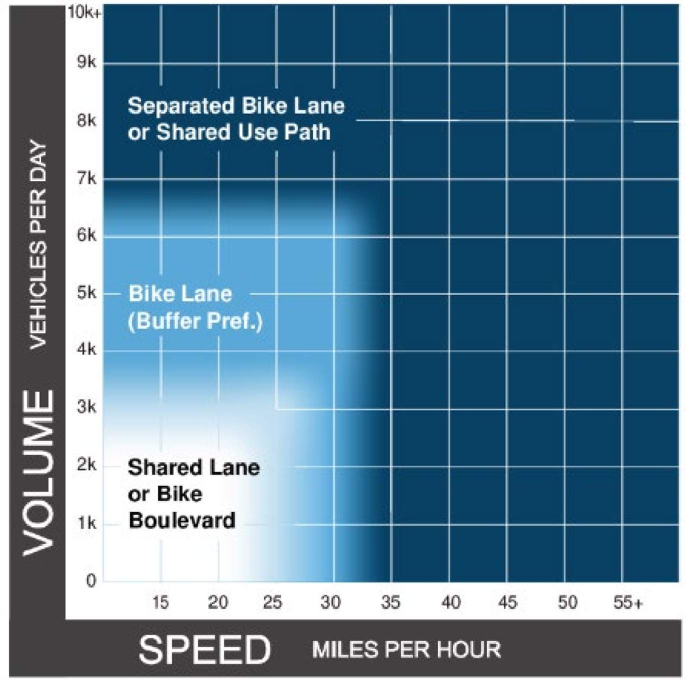
One chapter that is particularly relevant to the SBL Action Plan is *Chapter 4: Guidance for Choosing a Bikeway Type*. At a high level, choosing a bikeway type is driven by traffic volume (both car and bicycle) and car speed. AASHTO suggests that a threshold of 6,000 to 7,000 cars per day at a speed of 30 to 35 mph makes SBLs an appropriate bikeway treatment (see ***Figure 3***). Chapter 4 identifies a few situations beyond the basic speed/volume matrix criteria where greater separation between bicycles and vehicles might be necessary:

- **Unusual Vehicle Peak-Hour Volumes:** Roads next to schools, hospitals, or event locations that have periods of heavy traffic might create periods of high conflict between bicyclists and motorists.
- **Traffic Vehicle Mix:** More buses and large trucks on the road can increase crash risks and discomfort for cyclists.
- **Parking Turnover and Curbside Activity:** More curbside parking can increase the likelihood of cyclists experiencing conflict with curbside loading or cars opening doors ("dooring").
- **Vulnerable Populations:** Many children and seniors may only feel comfortable biking on SBLs regardless of the speed of volume of traffic.
- **Network Connectivity Gaps:** Adding SBLs might be necessary to provide a "uniform level of comfort" across a bicycle network.

- **Transit Considerations:** Developing bicycle facilities on routes with relatively frequent bus service may generate conflict. Installing bicycle facilities across the street from bus stops or on a nearby parallel corridor can reduce conflict while retaining connectivity to transit.

Chapter 7: Design of Separated Bike Lanes and Bike Paths discusses numerous design and planning decisions that go into SBLs. Specific guidelines about the width of buffers and lanes vary according to expected vehicle and bicycle traffic along the corridor and roadway conditions.

Figure 3. Preferred Bikeway Type for Suburban Contexts (AASHTO 4.3.1)



4.1.2. NACTO *Urban Bikeway Design Guide*

The National Association of City Transportation Officials (NACTO) is a 501(c)(3) non-profit comprised of North American cities and transit agencies to promote and share best practices on transportation challenges. NACTO design standards for bicycle facilities are often more cutting edge, inclusive, and flexible compared to the design standards recommended by other organizations. For example, NACTO presents speed and traffic volumes thresholds across six different bikeway treatment options, as opposed to just three like in AASHTO (shown in ***Table 3***). NACTO's more granular guidance helps municipalities pinpoint facilities best tailored to the bikeway's context.

The 3rd Edition of the *Urban Bikeway Design Guide* was published in January 2025. It expands on the 2nd Edition with more detailed technical guidance, as well as guidance on network planning, community engagement, project delivery, and maintenance. The 3rd Edition aims to design **All Ages & Abilities (AA&A) bikeways** that are comfortable and safe for all current and potential cyclists.

The AA&A philosophy influences recommendations such as design speed. AA&A bikeways should be designed to serve people riding conventional bikes, e-bikes, cargo bikes, and more. NACTO research shows that an **average conventional bike travels at 8.5 mph,** while an **average e-bike travels at 14 mph**. More confident and capable cyclists as well as those with less confidence or physical challenges will be using bike facilities at a range of speeds.

Design speed impacts motorist sight distances, and therefore the design of a bike facility. A driver needs more time and distance to see and react to a faster cyclist compared to a slower one, therefore an SBL designed for cyclists going 15 mph requires a greater line of sight for motorists and pedestrians than an SBL designed for cyclists going 10 mph.

Having a higher bicycle design speed means tradeoffs like extending curbs or eliminating other obstructions such as parked cars and trees/plantings in order to give motorists and pedestrians enough time to respond appropriately.

The Urban Bikeway Design Guide was federally recognized by the Infrastructure Investment and Jobs Act (IIJA) and can be adopted as the design standard for federally funded projects on municipally owned streets. While NACTO standards can be used for federally funded projects, PennDOT is not one of the nine state DOTs that have adopted the NACTO design guidelines, so Abington Township should defer to AASHTO and PennDOT standards if there are conflicting standards.

4.1.3. PennDOT *Design Manual Part 2: Contextual Roadway Design*

The PennDOT *Design Manual Part 2: Contextual Roadway Design* provides Pennsylvania-specific guidance for the design of on-road bicycle facilities. **Where there is conflict between PennDOT or AASHTO and NACTO standards for facilities proposed for state-owned roads, PennDOT standards take precedence.** The Design Manual tends to rely heavily on AASHTO and MUTCD guidance with some references to NACTO, but it does not reflect the most recent versions of any of these manuals, all of which now have more robust documentation on SBLs and bike facilities.

4.1.4. FHWA *Manual on Uniform Traffic Control Devices* (MUTCD)

The Federal Highway Administration's (FHWA) *Manual on Uniform Traffic Control Devices*, commonly known as the MUTCD, governs the design and use of traffic control devices. Traffic control devices are the signs, signals, markings, and other devices used to regulate, warn, or guide traffic on roadways. MUTCD is the only manual which gives substantive guidance for bikeway signage, while the AASHTO, NACTO, and PennDOT guidance is more focused on roadway geometry and bikeway design and selection.

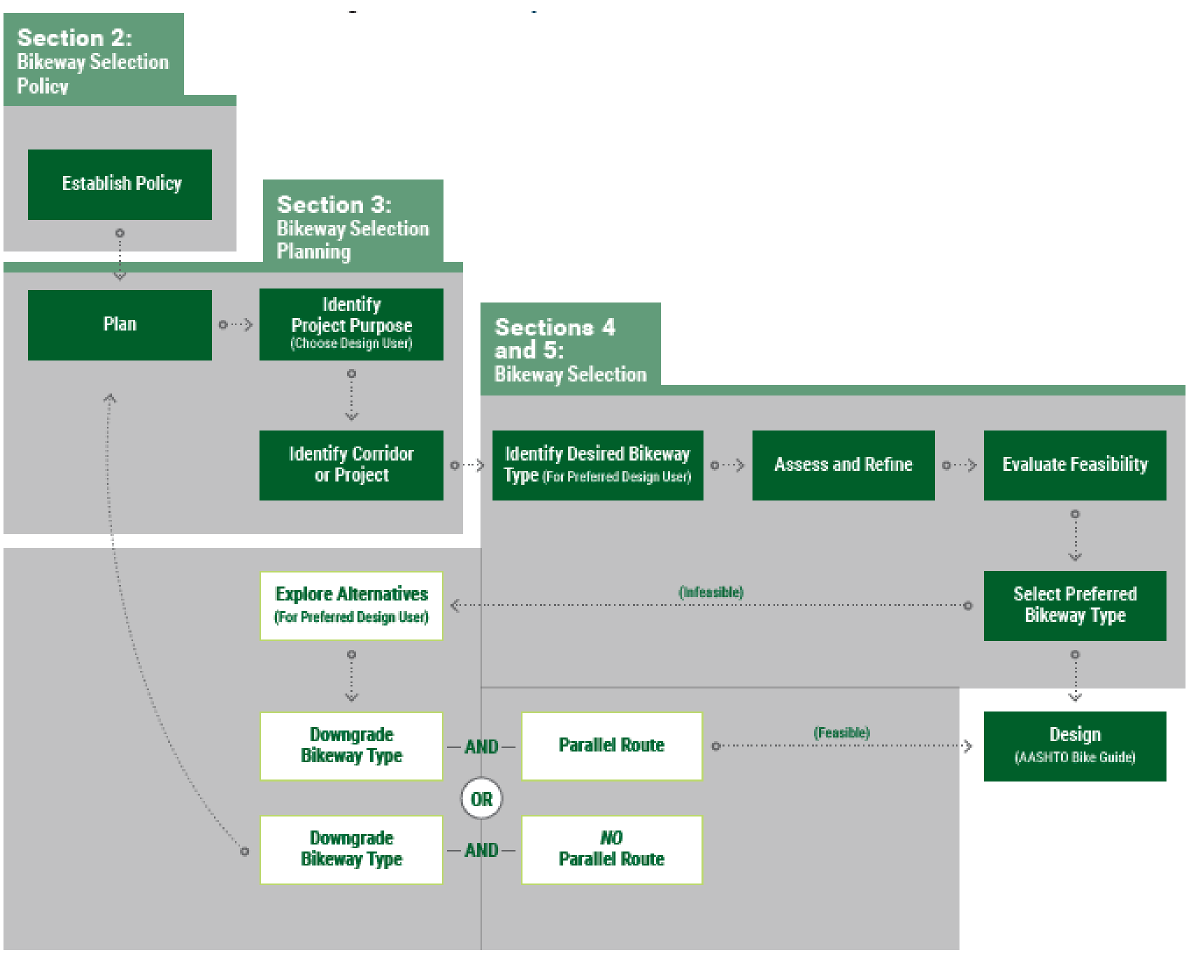
The 11th Edition of the MUTCD, which was released in 2023, incorporates more guidance for multimodal transportation. Some bicycle-related traffic control devices for separated bikeways, protected intersections, transit lanes, and two-stage bike boxes are now in the MUTCD. Pennsylvania has yet to adopt the 11th Edition, but it is likely to adopt the new edition soon alongside the release of a state supplement (Publication 46).

4.2. Supplementary Guidance

4.2.1. FHWA *Bikeway Selection Guide*

The FHWA's *Bikeway Selection Guide*, published in 2019, is designed to supplement the AASHTO and NACTO manuals by providing information on trade-off decisions related to the selection of bikeway types. It covers bikeway types, planning, selection, feasibility, and other practical considerations. ***Figure 4*** shows an overview of the bikeway selection process as described by the FHWA guide. The Bikeway Selection Guide will be particularly important for this Action Plan because it presents a decision-making framework that incorporates best practices from AASHTO and NACTO.

Figure 4. FHWA Bikeway Selection Process and Guide Outline



4.3. Comparison

Ultimately, guidance and recommendations for SBLs in Abington will include standards from all of the manuals described in this memo. ***Table 2*** compares standards and guidelines for one-way SBLs based on what is presented in the AASHTO, NACTO, and PennDOT manuals.

Table 2. Comparison of Standards and Guidelines for One-Way SBLs

	ORGANIZATION		
CATEGORY	PennDOT *(Published 2021)*	AASHTO *(Published 2024)*	NACTO *(Published 2025)*
Minimum one-way bike lane width	4 ft	4.5 ft	5 ft
Preferred one-way bike lane width	5–7 ft	6–8 ft[2]	6–9 ft
Bike lane treatment	*No guidelines*	*No guidelines*	• Bike lane symbols every 500 ft after intersections and major driveways • Recommended use of green surface treatments
Minimum buffer width	• 1 ft if adjacent to travel lane • 2 ft if adjacent to parking lane	• Variable, but at least 6 ft measured from the white edge line • 2 ft if adjacent to parking lane	• 2–3 ft if adjacent to travel lane • 3 ft if adjacent to parking lane to accommodate the full swing of a car door
Preferred buffer width	*No guidelines*	4 ft if adjacent to parking lane	2–5+ ft
Buffer treatment	Gore striping (painted chevron pattern) if buffer is 3ft or wider	• Continuous barriers (i.e. raised island, concrete barriers, or car parking) • Intermittent barriers (i.e. precast curbs, planters, rigid bollards, or flexible delineators)	• Parking lane with flexible delineators • Low barriers with flexible delineators • Mid-height barriers (tall curbs) • Constructed medians
Design Speed *(Speed of an average or typical cyclist)*	• 15 mph along SBLs • 10 mph through intersections	• 15 mph along SBLs • 8 mph through intersections	• 8.5 mph for conventional bikes • 14 mph for e-bikes
Threshold of motor vehicle traffic volume and speed for SBL treatment	SBLs are **recommended** bikeway treatment beyond: • 6k cars per day • 35 mph	SBLs are **recommended** bikeway treatment beyond: • 6–7k cars per day • 30–35 mph	SBLs are **strongly recommended** bikeway treatment beyond: • 6k cars per day or 600 cars at peak hours • 25 mph

	ORGANIZATION		
CATEGORY	PennDOT *(Published 2021)*	AASHTO *(Published 2024)*	NACTO *(Published 2025)*
Intersection design treatments	• Use protected intersection design (maintain separation between bicyclists and vehicle traffic leading up to and through the intersection) • Remove parking 30–60 ft ahead of an intersection with an SBL • Protected intersection includes use of bicycle signal phase	• Do not narrow SBLs at intersections • Maintain separation between bike and car lanes through intersection • Design to keep car speeds to <10 mph	Prioritize enhanced street geometry for cyclists at all signalized intersections: • Dedicated intersection: bikeway has dedicated path through intersection with right-of-way over turning vehicles • Protected intersection: keeps bike traffic set back and protected from car traffic up to the intersection
Intersection signal treatments (bike signalization)	Bike signals are most effective at intersections with: • A high volume of peak hour cyclists • A high number of vehicle-bicycle crashes caused by turning vehicles • T-intersections with major bicycle movement along the top of the "T" • Where an off-street bike path and a roadway intersection meet • Where separated bike paths run parallel to arterial streets	Thresholds to consider bike signalization include: • SBL type (one or two-way) • Turn direction of motorists • Number of car lanes a left-turning driver crosses before reaching the bikeway	No guideline on where signalization is most appropriate. Emphasizes roadway geometry that protects cyclists as the basis of safety at intersections.
Driveway design treatments	• If raised, the height of the SBL should be maintained through the crossing • Parking should be removed 30 feet prior to the driveway • Crossing area identified by colored pavement markings and/or shared-lane markings as well as warning signage	Varies by volume of daily crossings: • <25: marked crossings may be unnecessary • 25 to 500: marked with bicycle crossing • >500: designed to intersection standards	• Use bicycle crossings for all driveways • Consider corner islands, turn wedges, or medians to slow vehicle turns across SBLs

[1] *Bike lane width should be determined based on maintenance vehicles designed to clear snow or other obstructions, which can range from 4 to 8 ft.*

[2] *These numbers are "practical minimums" independent of peak hour bicycle volumes, which dictate minimum bike lane widths according to AASHTO.*

5. SBL Definition for this Action Plan

Table 3 describes the standard of SBLs for this Action Plan. These measures and guidelines are a synthesis of the PennDOT, AASHTO, and NACTO guidance presented in ***Table 2.*** The standard and treatment for each SBL will depend heavily on constraints in the existing roadway geometry, the cost of these upgrades, and the road's context (e.g. land use or ownership).

Table 3. Standards and Guidelines for One-Way SBLs for the Abington SBL Action Plan

CATEGORY	STANDARD OR TREATMENT
Minimum bike lane width	4 ft
Preferred bike lane width	6–8 ft
Bike lane treatments	• Bike lane symbols every 500 ft after intersections and major driveways • Green surface treatments to be used in areas of conflict
Width of buffer	• 2–3 ft if adjacent to travel lane • 3–4 ft if adjacent to parking lane
Buffer treatments	• Car parking lane with pre-cast curbs or flexposts[1] • Pre-cast, mid-height barriers (tall curbs) • Continuous concrete barrier • Constructed medians • Planters
Design speed	• 8.5 mph for conventional bikes • 14 mph for e-bikes • 8 mph through intersections
Threshold of motor vehicle traffic volume and speed for SBL treatment	• 6k cars per day and/or 600 cars at peak hour • 25–30 mph speed limit
Intersection treatments	• Maintain full width and separation of SBL up to the intersection • Provide cyclists with dedicated path through intersection with right-of-way over turning vehicles • Bicycle signal phasing if appropriate
Driveway treatments	• Parking removed 30 ft prior to driveway if applicable • Marked with bicycle crossings and warning signage • Roadway geometry changes to slow turning vehicles where possible, including but not limited to corner islands, turn wedges, or medians

[1] Parking protected bike lanes are currently prohibited by Pennsylvania law. H.B. 291, which would legalize parking protected bike lanes, was passed by the Pennsylvania State House in February 2025 and has been introduced to the State Senate as of the time this memo was written in April 2025.

Appendix A: References

Table A-1. References by Author and Year

ORGANIZATION/ AUTHOR	NAME	YEAR	LINK
AASHTO	Guide for Development of Bicycle Facilities, 5th Edition	2024	Available for purchase
Dill, Jennifer, et al	Four Types of Cyclists?: Examination of Typology for Better Understanding of Bicycling Behavior and Potential	2013	View here
Dill, Jennifer, et al.	Influence of Bike Lane Buffer Types on Perceived Comfort and Safety of Bicyclists and Potential Bicyclists	2012	View here
FHWA	Bikeway Selection Guide	2019	View here
FHWA	Developing Crash Modification Factors for Separated Bicycle Lanes	2023	View here
FHWA	Manual on Uniform Traffic Control Devices, 11th Edition	2023	View here
NACTO	Urban Bikeway Design Guide, 3rd Edition	2025	Available for purchase
NCHRP	On-Street Bicycle Facility Design Features: A Guide	2025	View here
NCHRP	Safety Evaluation of On-Street Bicycle Facility Design Features	2025	View here
NTSB	Bicyclist Safety on US Roadways: Crash Risks and Countermeasures	2019	View here
PA General Assembly Local Government Commission	Municipalities – How They Change: Boundaries, Classification or Forms of Government	2025	View here
PennDOT	Design Manual Part 2: Contextual Roadway Design (April 2021 Edition, Change No. 5).	2024	View here
Pucher, John, et al.	Bicycling renaissance in North America? An update and re-appraisal of cycling trends and policies	2011	View here

ORGANIZATION/ AUTHOR	NAME	YEAR	LINK
Schultheiss, William, et al.	A Historical Perspective on the AASHTO Guide for the Development of Bicycle Facilities and the Impact of Vehicular Cycling	2023	View here