WASHINGTON AVENUE & COLUMBUS BOULEVARD

CONCEPTUAL BICYCLE AND PEDESTRIAN PLAN

DECEMBER 2016

DELAWARE VALLEY dvrpc REGIONAL PLANNING COMMISSION

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Acknowledgments

DVRPC would like to acknowledge the following individuals for their contributions to the study:

Jeannette Brugger, *City of Philadelphia*
Michael Carroll, *City of Philadelphia*
Angela Dixon, *City of Philadelphia*
Vadim Fleysh, *City of Philadelphia*
David Kanthor, *City of Philadelphia*
Richard Montanez, *City of Philadelphia*
Gustave Scheerbaum, *City of Philadelphia*
Lizzie Woods, *Delaware River Waterfront Corporation*

Introduction

Chapter 1: Introduction

The *Washington Avenue and Columbus Boulevard Conceptual Bicycle and Pedestrian Plan* is part of an umbrella project of conceptual design work for Philadelphia bicycle and pedestrian facilities. This project is done as part of the Delaware Valley Regional Planning Commission's (DVRPC) Bicycle and Pedestrian Planning Program. Developing designs to improve conditions for those walking and biking in selected locations is the primary intention of work done under the conceptual design project.

Washington Avenue approaching Columbus Boulevard was selected by the City of Philadelphia and DVRPC because of the underused right-of-way (ROW) on Washington Avenue and the need for non-motorized transportation improvements, especially because this stretch of road is an access point to a regional trail, the Delaware River Trail. Because of the size and flexibility of the ROW, design interventions in the study area have the potential to be transformative, which was another consideration for selecting this location. Furthermore, this block of Washington Avenue is a transition point between strong and growing neighborhoods to the west and commercial, industrial, and recreational uses to the east.

Finally, it is timely to study this location because it is adjacent to many ongoing studies. The city has been studying Washington Avenue farther west with the intention of improving operating conditions for all users and to make it more of a destination than a barrier. The Delaware River Waterfront Corporation (DRWC) continues to regenerate the Delaware River waterfront, including pier improvements, and has led efforts to reconstruct and improve the sidepath on the east side of Delaware Avenue.

Study Area

The study area for this plan, shown in Figure 1, is approximately 800 feet along Washington Avenue, including the complex intersection of Washington Avenue and Columbus Boulevard. Part of that includes the entrance to the busy Riverview Shopping Center. The northernmost tenant is a Dunkin' Donuts with a drive-through that attracts both car and walk-up business. On the northern side of the street, between Water Street and Columbus Boulevard, is a large institutional land use, the Gloria Dei Swedes Episcopal Church. The church is surrounded by a tall wall that creates a hard, blank edge adjacent to the sidewalk. Across Water Street, to the west of the church, is private surface parking. The study area is also an access route, or adjacent, to a number of neighborhood and destination recreational facilities, including Rizzo Rink, at the corner of Front and Washington, and Washington Avenue Green and the Delaware River Trail on the waterfront. The study area is within walking distance of the Shot Tower Recreation Center and Jefferson Square and Sacks Playground.

The portions of Washington Avenue and Columbus Boulevard in the study area each have pedestrian facilities in the form of a complete sidewalk network and marked crosswalks. Bicycle facilities include standard bicycle lanes on Washington Avenue and Columbus Boulevard, although both stop at the intersection, and a green-outlined bike box on Washington Avenue, at the intersection. There are also green skip-marks painted in the bike lanes at the entrance to the southbound slip lane on Washington Avenue to mark the conflict area.

The streets are wide and the traffic volumes are high, so increased separation and simplification of movements are necessary to provide safety and comfort for people walking and bicycling, especially for young and older users and families.

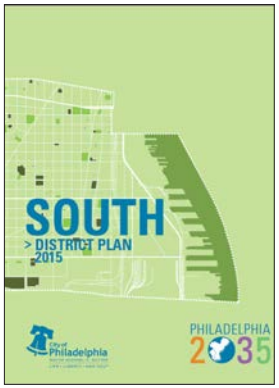
As mentioned in the introduction, other ongoing planning activities may affect the study area. Additional improvements are planned for Washington Avenue to the west through city efforts. DRWC is pursuing the reconstruction of the existing sidepath on the east side of Columbus Boulevard. There is also periodic interest and discussion on reviving passenger rail along Columbus Boulevard.

Figure 1 | Study Area

Source: City of Philadelphia, 2015; DVRPC, 2016

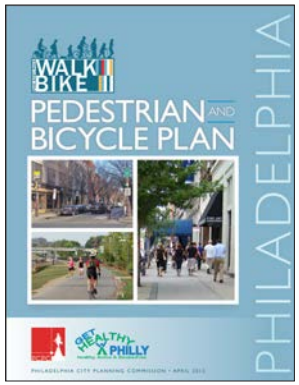
Related Work

A number of city agencies and groups have completed or have ongoing work that covers the portion of Washington Avenue from Front Street to Columbus Boulevard. This project seeks to expand on the goals and recommendations of these studies, offering conceptual designs that meet or surpass the recommended infrastructure changes on Washington Avenue and Columbus Boulevard.



South and Central District Plans, Philadelphia City Planning Commission, 2015

The Philadelphia City Planning Commission's South and Central District plans recommend that Washington Avenue serve as a connector between the Schuykill and Delaware waterfronts by implementing complete street policies, increasing pedestrian safety at high-use intersections, building green stormwater infrastructure, and striping continuous conventional bicycle lanes along the entirety of Washington Avenue.



Pedestrian and Bicycle Plan, Philadelphia City Planning Commission, 2012; 2015

The 2012 Pedestrian and Bicycle Plan and its 2015 update recommended that Washington Avenue feature continuous striping of bicycle facilities and listed it as a top priority within the city. The report also suggest that a two-way cycle track along Washington Avenue should be considered if feasible.

Masterplan for the Central Delaware, Delaware River Waterfront Corporation, 2011

DRWC's plan focuses on the creation of 13 parks connected by the proposed Delaware River Trail, a roughly two-mile multi-use trail along the eastern side of Columbus Boulevard between Washington Avenue and Spring Garden Street. The plan also identified 16 primary "connector streets"—Washington Avenue among them—that require bicycle and pedestrian improvements in order to provide east-west connection to the waterfront for residents and visitors.

Existing Conditions

Chapter 2: Existing Conditions

The first step in developing conceptual plans to improve access for pedestrians and people who bicycle is evaluating what the current conditions are. Project staff gathered data and performed analysis on a number of features in the study area. This included detailed measuring and documenting of the road widths and configurations, and investigating other conditions that affect current usage and determine the opportunities and weaknesses of the study area today. What follows are explanations and depictions of the relevant study area elements.

Cross Sections

Washington Avenue at Front Street

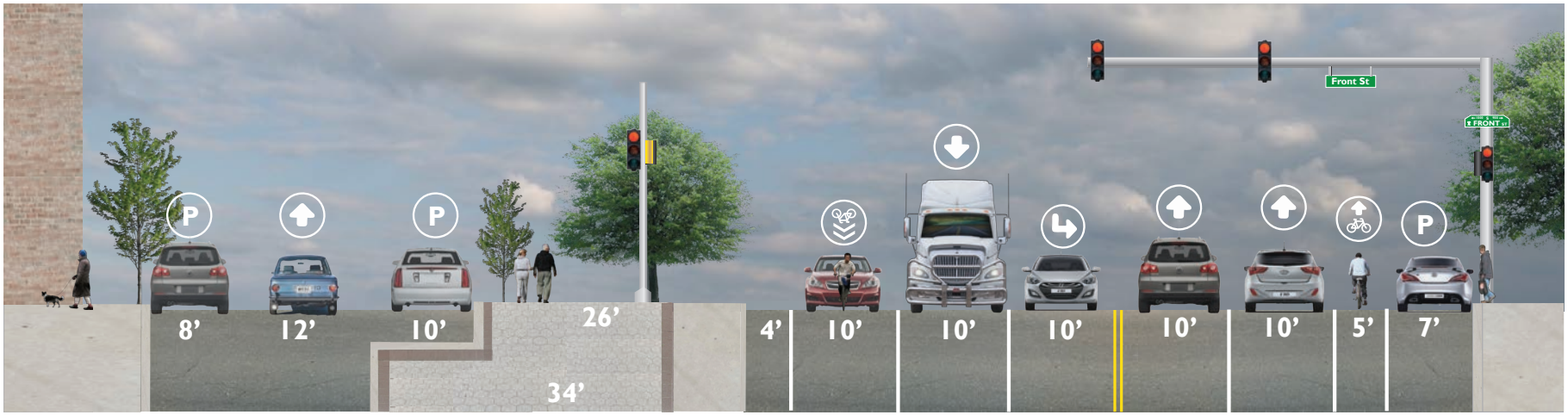
Washington Avenue at Front Street, shown in Figure 2, is approximately 122 feet wide (including the raised median and frontage street). There are two bike facilities along Washington: an eastbound sharrowed lane on the south side of the cartway and a five-foot conventional bike lane on the north side. There is also a marked shoulder on the south side of the cartway that some cyclists use instead of the sharrowed lane.

The raised median between Washington Avenue and the Washington frontage street extends to Jefferson Square Park, ending at 4th Street. The raised median is a generous width for pedestrian use (26 feet); however, the trees planted in the median are not well maintained, and the species is not suited to the location due to its tendency to grow wide rather than tall, producing low-hanging branches that impede walking through the central part of the median.

The frontage street on the south side of Washington Avenue has a wide through lane and is signed for parking on both sides of the cartway. This portion of Washington has low traffic volumes and, despite changes in traffic direction, is sometimes used by cyclists instead of the bicycle facilities in the main cartway.

Washington Avenue at Front Street, looking west.
Photo Credit: DVRPC, 2016

Figure 2 | Washington Avenue at Front Street, Looking West



Source: DVRPC, 2016

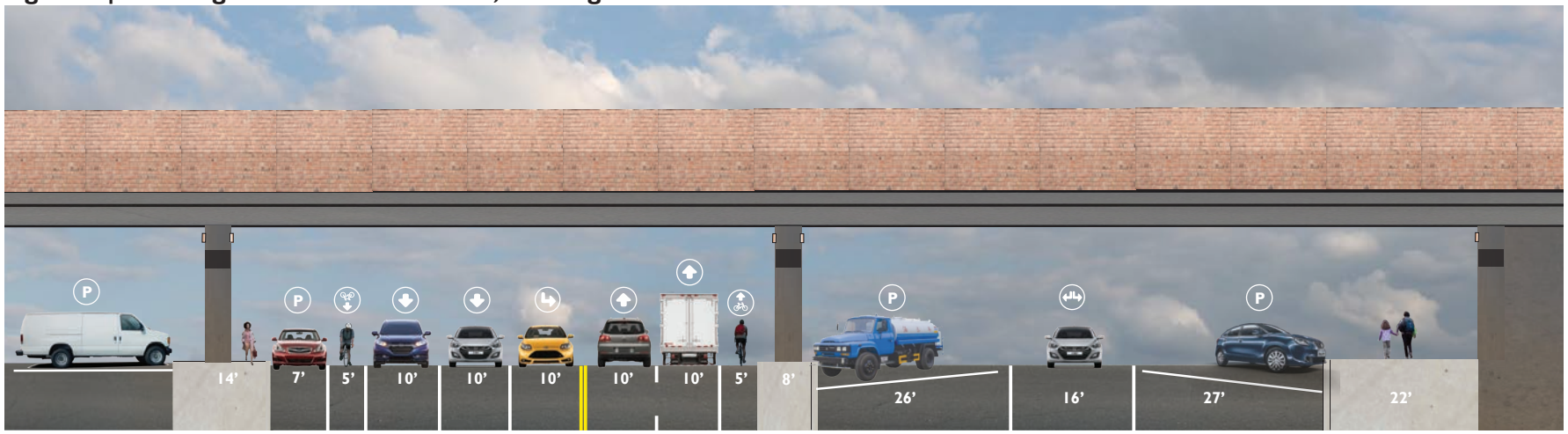
Washington Avenue at I-95

The portion of Washington Avenue beneath Interstate 95 (see Figure 3) is approximately 142 feet wide, including the median with overpass piers and a frontage road to the south of the main cartway. The sharrowed lane marked along the south of the cartway at Front Street transitions into a conventional bike lane below I-95, adjacent to a median. The westbound conventional bike lane is adjacent to curbside parking. The bike lanes are located on either side of five lanes of vehicular traffic where nearly 1,000 vehicles pass per hour in each direction during peak periods. Due to high vehicle volumes directly next to the bike lanes and the lack of physical separation, conditions are often only suitable to those cyclists with a very high tolerance for traffic stress.

The pedestrian median at the corner of Front Street and Washington Avenue features a crosswalk that leads pedestrians to an eight-foot median that divides the cartway and the frontage road. Despite its centrality, the median is a poor east-west connector due to the presence of highway support columns that leave only a small amount of space for walking, and it is unpassable for someone in a wheelchair. Existing lighting beneath the bridge provides some illumination, but the dim orange tone is not optimal for creating a comfortable pedestrian condition during low-light hours.

The frontage street on the southern side of Washington Avenue is 68 feet wide with angled parking stalls that are 26–27 feet long and a through lane that is 16 feet wide. The parking spaces are considerably longer than a standard angled parking space (15 to 20 feet, depending on the angle), and the through lane is significantly wider than standard practice, contributing to an overall design that provides sub-standard bike and pedestrian connections and makes poor use of the available space within the frontage street.

Figure 3 | Washington Avenue under I-95, Looking East



Source: DVRPC, 2016

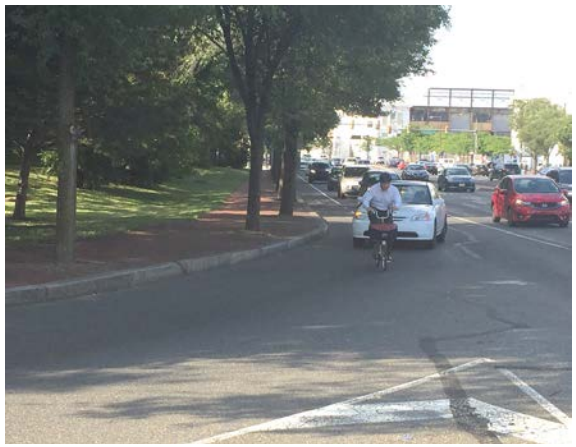
Westbound bicycle lane on Washington Avenue beneath I-95, looking east.
Photo Credit: DVRPC, 2016

Angled parking along the Washington Avenue frontage street beneath I-95, looking west.
Photo Credit: DVRPC, 2016

Washington Avenue at Columbus Boulevard

The intersection of Washington Avenue and Columbus Boulevard features a channelized right turn with a single vehicular lane, a gore area, and a buffered bike lane that starts halfway through the turn on to Washington Avenue (see Figure 4). In the southbound approach to the right channelized turn, street markings for the bicycle lane discontinue and cyclists are forced to negotiate a complicated and high-volume intersection without dedicated infrastructure. The channelized turn lane currently provides a level of service F, meaning that vehicles attempting to make the turn from Columbus Avenue experience gridlock during peak hours. This can be attributed to the stacking of southbound and right-turning vehicles, which share the right-hand lane at the intersection of Columbus Boulevard and Washington Avenue. Vehicle stacking can alter the amount of space motorists have to make the right turn onto Washington Avenue, and because facilities are unmarked and unprotected, vehicles often wait in the bicycle lane, blocking the paths of cyclists heading south on Columbus Boulevard and west onto Washington Avenue, creating an uncomfortable and potentially dangerous condition for cyclists.

The main cartway of Washington Avenue at Columbus Boulevard features bidirectional traffic with four through lanes, two gore areas (one on the north side of the street and another in the center), and a bicycle lane on the south side. Like the portions of Washington Avenue farther west, the bicycle lane at Columbus Boulevard is directly adjacent to several lanes of high-volume traffic, mostly turning left. In the approach to the intersection, vehicles use a slip lane to make right turns onto Columbus Boulevard, crossing the path of the eastbound bicycle lane. The geometry of the slip lane is such that the turn can be made at high speeds, creating a dangerous situation for cyclists attempting to cross the slip lane on the way to Columbus Boulevard.



Cyclist approaching the right channelized turn lane at Columbus Boulevard and Washington Avenue.
Photo Credit: DVRPC, 2016

The raised median on Washington Avenue between I-95 and Columbus Boulevard is 57 feet wide and is constructed with impermeable concrete and pavers. The median is difficult for pedestrians to safely access due to complicated turning movements and a lack of safe, accessible, and well-marked crossings.

The frontage road along the south side of Washington Avenue features one right-turning vehicle lane that is 20 feet wide. The lane is wider than standard practice and creates a longer than necessary crossing distance for pedestrians walking along Columbus Boulevard.

Raised medians east of I-95.
Photo Credit: DVRPC, 2016

Figure 4 | Washington Avenue at Columbus Boulevard, Looking East

Source: DVRPC, 2016

There are no bicycle lane markings through the intersection at Columbus Boulevard despite the presence of high traffic volumes and complex turning movements.
Photo Credit: DVRPC, 2016

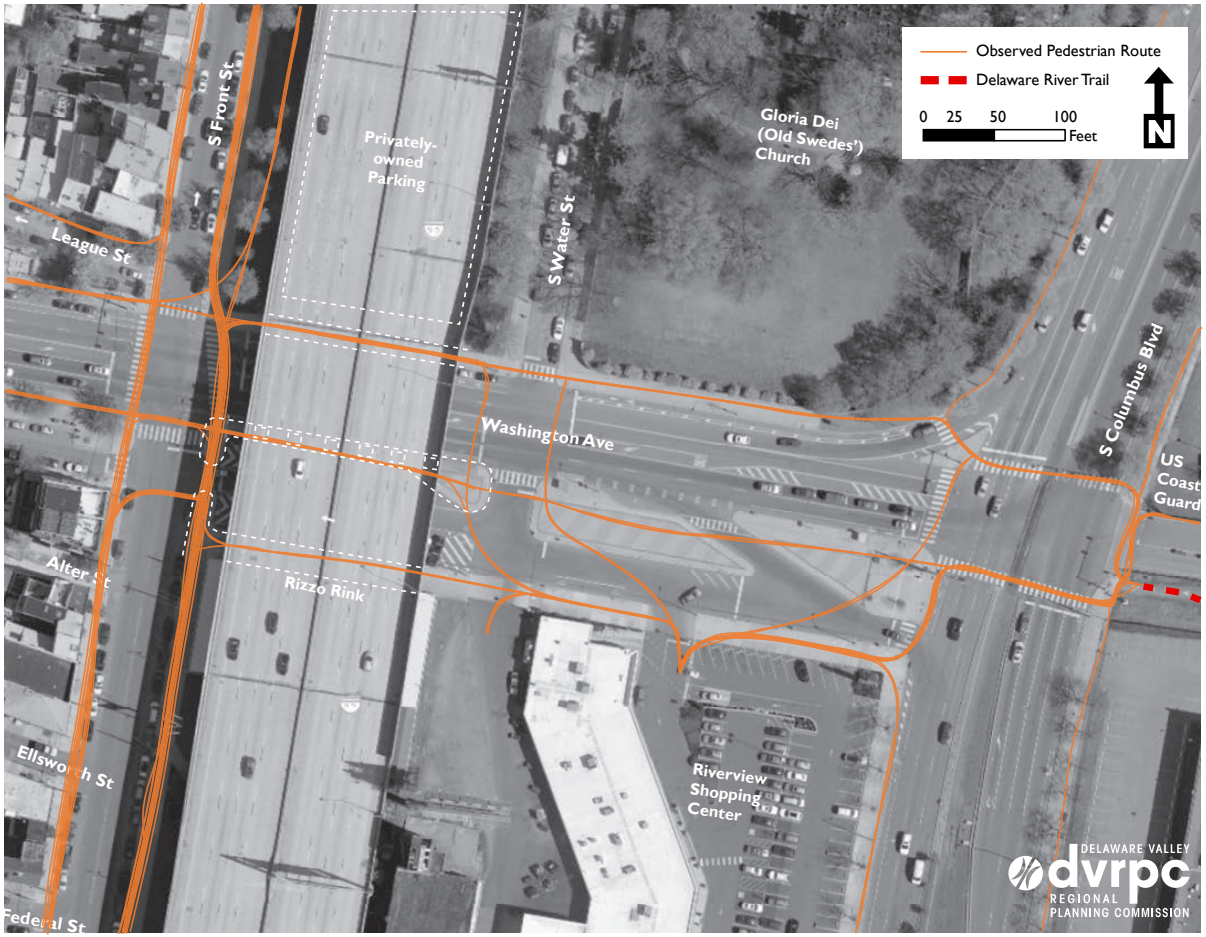
A slip lane cuts through the bicycle lane and raised median east of I-95 on Washington Avenue.
Photo Credit: DVRPC, 2016

The bicycle lane and bike box on Washington Avenue at Columbus Boulevard.
Photo Credit: DVRPC, 2016

Pedestrian and Bicyclist Routes

During an hour-long period roughly between 8:30 and 9:30 AM, the study team monitored pedestrian movement through the study area. Figure 5 shows the observed pedestrian routes in orange. The number of different paths demonstrates that there is not a clear route through the area, and people are often choosing the most direct path even if it is not the safest. Bicyclists were also observed using a number of different paths through the study area. Some were using the business frontage road, going against traffic at points, to avoid using the bike lane on Washington Avenue, suggesting that the current bicycle facility on Washington Avenue is not comfortable for all users.

Figure 5 | Pedestrian Routes



Sources: City of Philadelphia, 2015; DVRPC, 2016

Traffic Volumes

Figure 6 | Annual Average Daily Traffic

Sources: City of Philadelphia, 2015; DVRPC, 2016

Figure 6 displays all of the recent counts in and around the study area. All counts were automated seven-day counts taken by DVRPC between 2008 and 2015. All bicycle, pedestrian, and slip lane counts were completed in the fall of 2015. In the study area, the highest vehicle volumes are on Columbus Boulevard, with almost three times as many vehicles as Washington Avenue. For this study, counts of the two slip lanes—southbound Columbus Boulevard to westbound Washington Avenue and eastbound Washington Avenue to southbound Columbus Boulevard—were important so that the proposed design is responsive to these volumes. The southbound lane from Columbus Boulevard has about double the volume of the other slip lane.

The only pedestrian count was taken at the entrance to the Delaware River Trail. The bicycle counts in the study area show relatively few bicyclists compared to other segments of Washington Avenue; the most were counted at the trail entrance. Given the high vehicle and truck volumes, bicyclists may be avoiding this intersection and choosing to use other adjacent streets to access Columbus Boulevard, despite the existing bicycle infrastructure.

Pedestrian Crashes

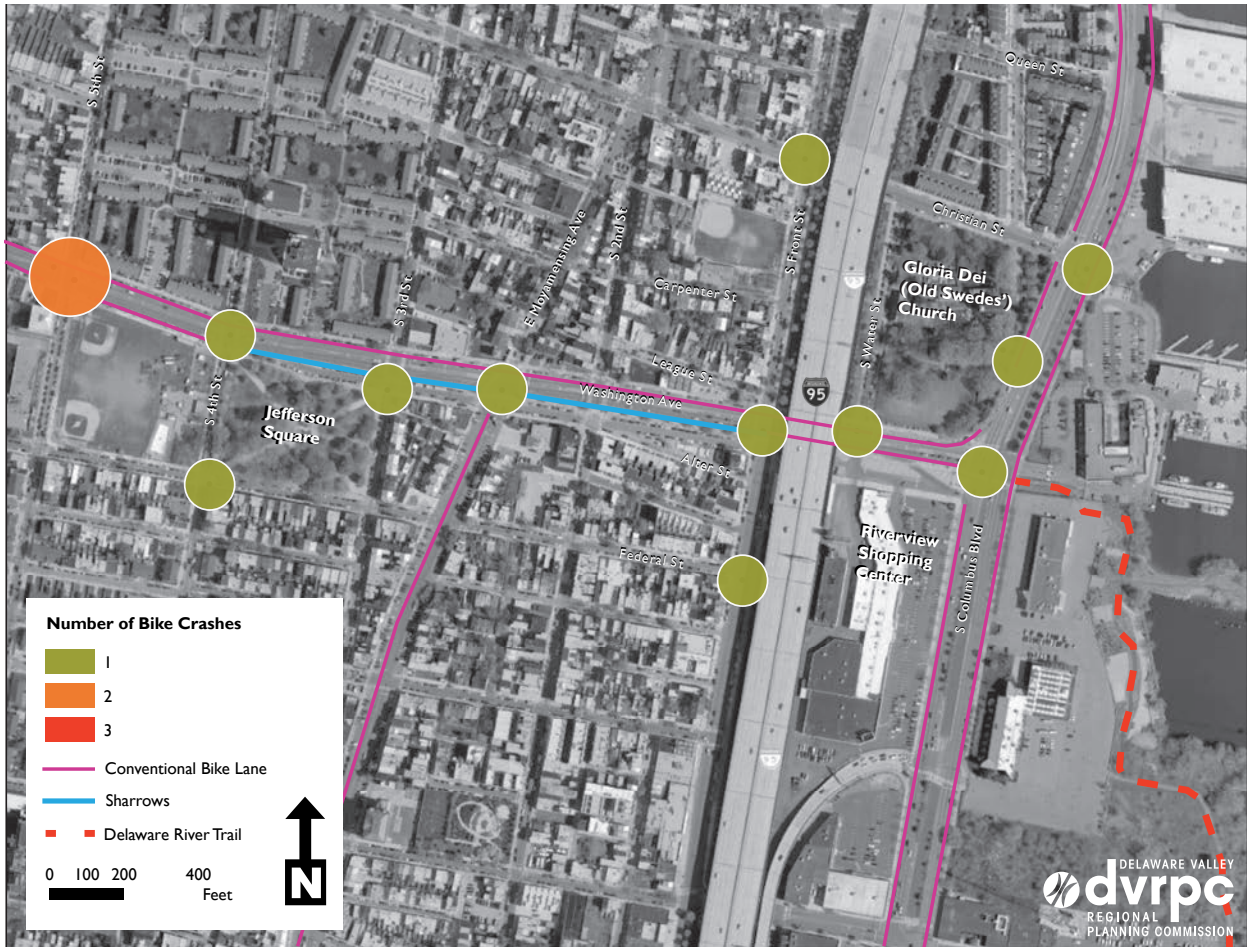
Pedestrian crashes in and around the study area from 2007 to 2014 are shown in Figure 7. Only one crash was reported within the study area, at the intersection of Washington Avenue and Columbus Boulevard. The intersection of Christian Street and Columbus Boulevard has more crashes, but because pedestrian volumes at each intersection are unknown, it is unclear if the rates at each are different. Otherwise, pedestrian crashes are more or less evenly spread through the surrounding neighborhood.

Figure 7 | Pedestrian Crashes, 2007–2014

Sources: City of Philadelphia, 2015; Pennsylvania Department of Transportation, 2015

Bicycle Crashes

Figure 8 | Bicycle Crashes, 2007–2014



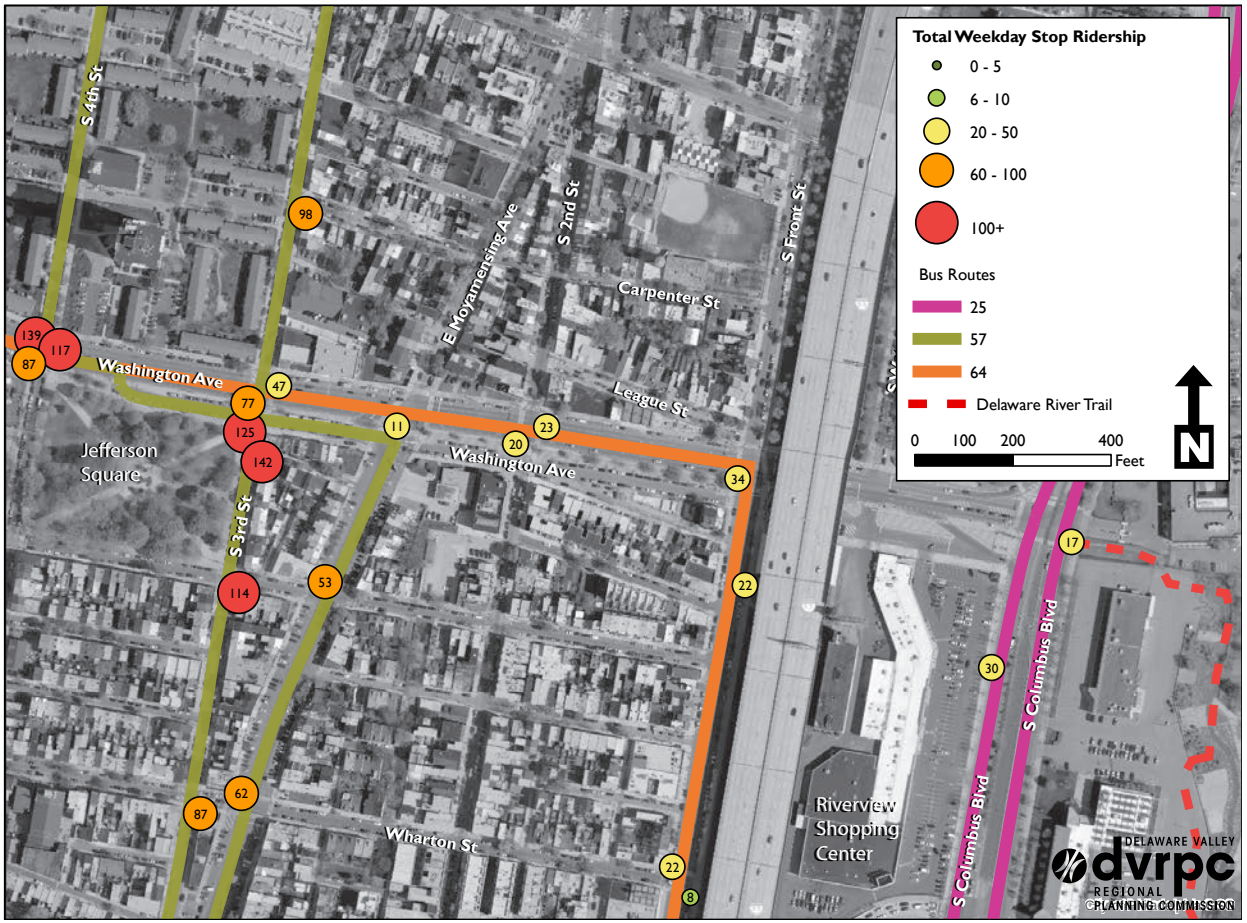
Sources: City of Philadelphia, 2015; Pennsylvania Department of Transportation, 2015

Figure 8 shows reported bicycle crashes from 2007 to 2014. Unlike the pedestrian crashes, bicycle crashes are concentrated along Washington Avenue. Four were reported in the study area. Since the number of bicyclists riding in the study area is lower than on other segments of Washington Avenue, such as at 5th Street, this suggests that there is a higher rate of crashes and a need for safety improvements for bicyclists in the study area, despite the existing bicycle infrastructure. This need for improved safety drove many of the design recommendations.

Bus Routes and Stop Ridership

The study area is straddled by three bus routes: the 57, 64, and 25 (see Figure 9). The stops in the study area are relatively low volume compared to high-volume stops on 4th and 3rd streets. Space for these stops can be built into the proposed designs, as appropriate. If specific conflicts emerge, there may be potential to consolidate study area stops with adjacent stops because of the relatively low volumes.

Figure 9 | Bus Routes and Stop Ridership



Sources: City of Philadelphia, 2015; SEPTA, 2016

Land Use and Attractions

Figure 10 | Land Use and Attractions

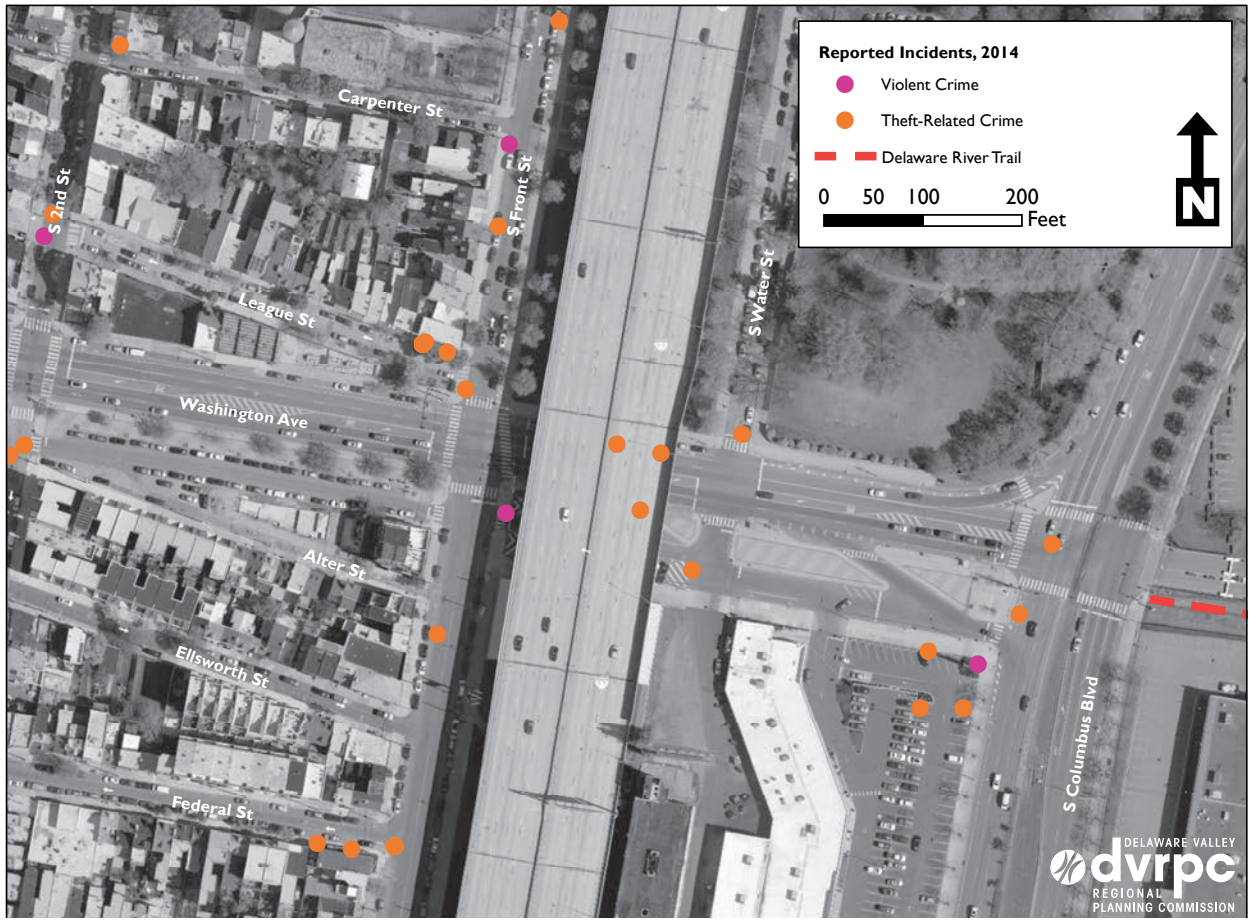
Sources: City of Philadelphia, 2015; DVRPC, 2010

The neighborhood surrounding the study area is physically divided by the elevated portion of I-95 (see Figure 10). To the west is dense residential housing. There are a number of recreation facilities and open spaces adjacent to and near the study area, including Jefferson Square; Shot Tower Recreation Center; and Washington Avenue Green, which is a part of the Delaware River Trail. The major trip generator in the study area is the Riverview Shopping Center. At the northernmost end is a Dunkin' Donuts with a drive-through that also has a steady amount of walk-up traffic. The study area has the potential to provide a better connection for nearby residents to these community assets.

Reported Incidents

Figure 11 shows the approximate locations of violent and theft-related incidents reported by the Philadelphia Police Department in 2014. Four violent incidents and numerous thefts occurred in the study area, with a cluster of incidents occurring beneath or adjacent to Interstate 95. Designs developed for the area should work to enhance feelings of safety for users and discourage theft wherever possible.

Figure 11 | Reported Incidents

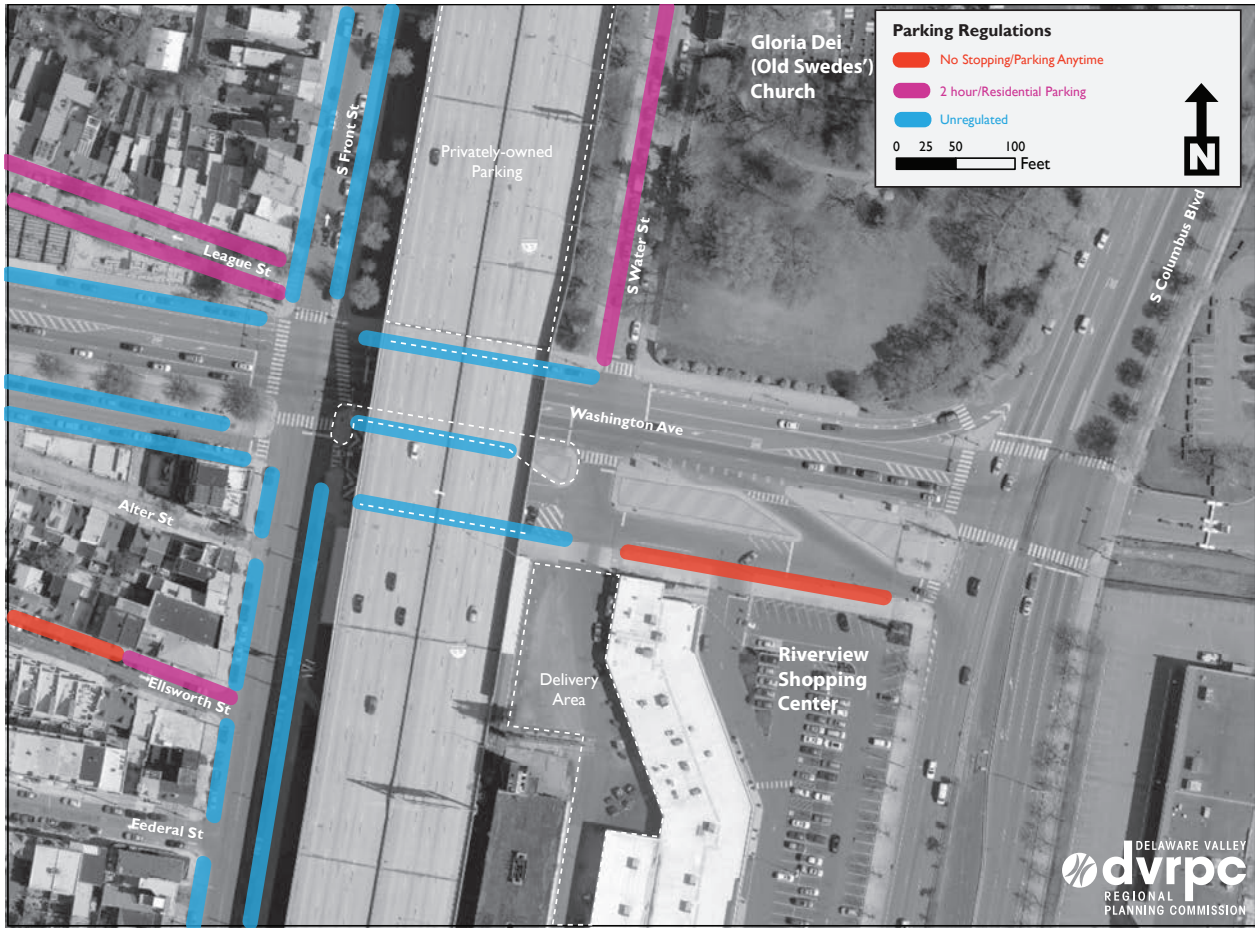


Sources: City of Philadelphia, 2015; Philadelphia Police Department, 2014

Parking Regulations

On-street parking (shown in Figure 12) is allowed on most street frontages, and the majority of it is unregulated and free. There is an opportunity to more efficiently arrange existing parking in order to maintain or expand the number of spaces, while also improving safety and comfort for pedestrians and bicyclists moving through the study area and crossing at its intersections.

Figure 12 | Parking Regulations



Sources: City of Philadelphia, 2015; DVRPC, 2016

Combined Sewer Service Area

The study area is within Philadelphia's combined sewer service area (shown in Figure 13), which means that during heavy rain or snowmelt, stormwater may mix with sewage and discharge into the Delaware and Schuylkill rivers or area creeks. During these discharge events, wastewater introduces pollutants and raw sewage into these water bodies. Reducing, and slowing, the amount of water that enters the sewer during precipitation events can lead to less contamination. Green stormwater management along the street, through rain gardens, bioswales, etc., can be a successful way to limit runoff. Because the study area is within the combined sewer overflow area, incorporating green stormwater elements into the proposed designs was considered to add both landscaping and stormwater benefits.

Figure 13 | Combined Sewer Service Area

Sources: City of Philadelphia, 2015

Obstacles and Opportunities

DVRPC staff synthesized the existing conditions' findings to identify the study area's constraints and opportunities. The constraints identified highlight the challenges the study area faces and where planning efforts should be focused. The opportunities show key improvement areas and serve as a tool to identify potential recommendations.

Obstacles

Parking
The long, angled parking along the frontage road beneath I-95 makes inefficient use of the available space and tends to attract larger vehicles (tour buses, semi-trucks) to park, reducing visibility for both pedestrians and other vehicles.

Pedestrian barriers
The median between Washington Avenue and its service road, beneath I-95, is too narrow for pedestrian use due to large support columns in the center of the median and parked vehicles hanging over the curb to the south.

Pedestrians rarely use the medians east of I-95 due to the complicated and high-volume traffic patterns that run between them. The medians are connected with crosswalk markings but do not have curb ramps, making them inaccessible for those in wheelchairs.

Crosswalks
The intersection at Washington Avenue and Columbus Boulevard is separated by three very wide pedestrian crossings that have no refuge areas for those unable to cross before the signal changes. This creates a particularly hazardous condition for pedestrians with mobility impairments and long periods of exposure to moving vehicles for all users.

Bicycle facilities
Conventional bicycle lanes on Washington Avenue and Columbus Boulevard are situated directly next to travel lanes that carry high volumes of traffic—a condition only suitable for cyclists who might be identified as "strong and fearless." The intersection and approaches at Washington and Columbus do not include markings or separation to indicate the appropriate path for cyclists to use, creating several potentially dangerous vehicle-mixing areas.

Lighting
The existing light fixtures beneath I-95 are scaled for vehicle use but are not bright enough, or the proper hue, to create an area that encourages safe pedestrian use during low-light hours.

Traffic movements
The frontage road and raised median area east of I-95 have a number of complicated traffic movements that are difficult for pedestrians to interpret due to variation in the direction of lanes, confusing signage, and the number of fast-moving vehicles using the slip lane to turn south onto Columbus Boulevard. This assortment of complicated movements likely discourages pedestrians and cyclists from making greater use of the raised median area, despite the direct connection it offers to Columbus Boulevard and the Washington Avenue Green and the Delaware River Trail.

Impervious surface
Much of the study area is covered with impervious material that directs water to combined sewers during precipitation events. When overwhelmed, these sewers will discharge into local waterways, introducing potentially harmful contaminants. Many of the existing surfaces, particularly in the medians east of I-95, have potential to be redesigned with green stormwater infrastructure.

Opportunities

Green infrastructure
Many of the existing surfaces, particularly in the medians east of I-95, have potential to be redesigned with green stormwater management. Green stormwater management can be a successful way to limit runoff. Because the study area is within the combined sewer overflow area, incorporating green stormwater elements (like rain gardens, bioswales, etc.) into the proposed designs was considered a way to add landscaping and stormwater benefits.

Simplify the street
Reducing the number of vehicle movements, narrowing crossings, and improving the visibility of pedestrians and cyclists in conflict areas would improve the overall legibility of the street, making it easier for all modes to use.

Create well-lit areas
Providing additional lighting can help to improve real and perceived safety in low-light sections of Washington Avenue, while also creating a visual connection that serves as a link from the intersection at Washington Avenue and Front Street to the entrance of the Washington Avenue Green and the Delaware River.

Build low-stress/protected bicycle facilities
At present, Washington Avenue's bicycle lanes do not provide a comfortable riding condition for users of all abilities. The generous width of the street, particularly within the underused median areas, provides the opportunity to build a protected, low-stress facility that would create a direct connection between the neighborhoods and recreation facilities west of Front Street and the Washington Avenue Green.

Design more efficient parking configuration
Reconfiguring the existing parking facilities and regulations below I-95 and adjacent to the Riverview Shopping Center has the potential to create more parking spaces, while making room for improved pedestrian and bike facilities.

Conceptual Design

Chapter 3: Conceptual Design

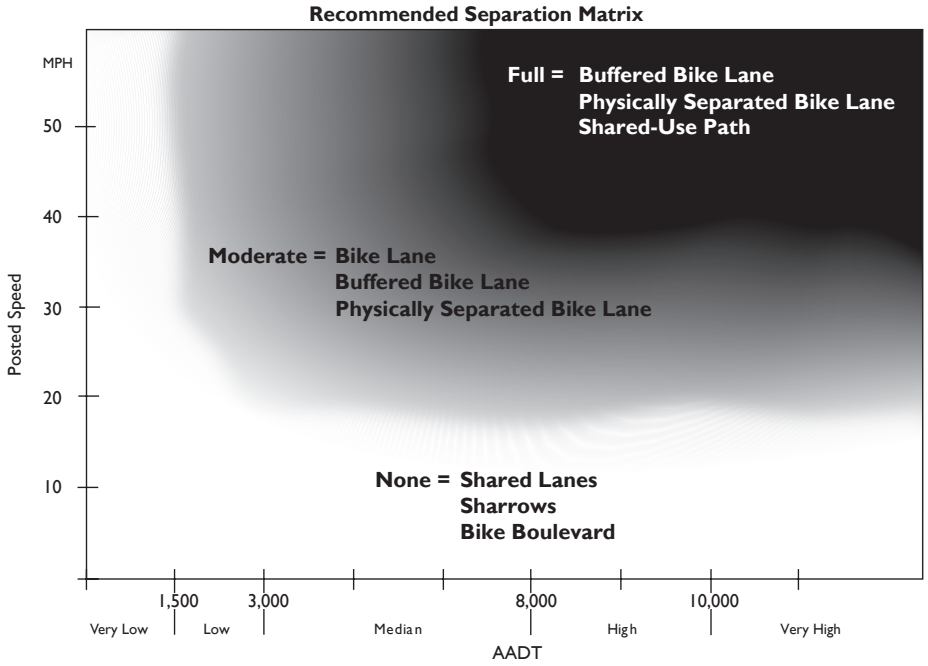
Building on the existing conditions analysis, as well as the opportunities and constraints that came from it, DVRPC staff, with input from stakeholders, developed two conceptual design proposals for the study area. Elements of the designs were informed by the project goals to improve conditions and safety for pedestrians and people on bikes, and national and state-adopted design guides.

These include:

- *Separated Bike Lane Planning and Design Guide*, Federal Highway Administration (2015)
- *Separated Bike Lane Planning and Design Guide*, Massachusetts Department of Transportation (2015)
- *Urban Bikeway Design Guide*, National Association of City Transportation Officials (2014)
- *Design Guidance for Channelized Right-Turn Lanes*, National Cooperative Highway Research Program (2011)

Generally, both designs are meant to increase separation between motorized and non-motorized traffic, given the high vehicle volumes on both Washington Avenue and Columbus Boulevard (see Figure 14).

Figure 14 | Separation Matrix for Bicycle Facilities, Based on Road Speed and Volume



Source: Oregon Department of Transportation, 2011

The two designs share many features, which are summarized next. Then the unique elements of each concept are described.

Shared Design Features

Visibility and Continuity
To improve safety and make it more apparent that the Delaware River is nearby and accessible, both designs feature lighting along the entirety of the sidepath, as well as an installation along the frontage road beneath I-95 that combines public art and lighting to pull visitors toward the Washington Avenue Green and Delaware River Trail. Plantings adjacent to the sidepath west of I-95 would be similar to those found at the entrance to the trail on the east side of Columbus Avenue in order to fortify the connection between the two paths. Additionally, both designs aim to increase bike parking in the study area by placing racks on the sidewalk next to Rizzo Rink.

Sidepath
The designs developed for Washington Avenue represent best practice approaches to pedestrian and bicycle facility design, emphasizing separated, low-stress facilities in an area that has high traffic volumes and complicated traffic movements. The central facility of each design is an 18-foot-wide, shared-use sidepath that begins at Front Street and connects to the existing southbound bicycle lane on Columbus Boulevard, across from the entrance to the Washington Avenue Green and the proposed two-way sidepath along the east side of Columbus Boulevard. Beneath I-95 the sidepath would be built along the north side of the frontage street. The angled parking would be reconfigured into parallel spaces along the adjusted curb line. On the east side of I-95, the access point to the frontage road would feature a raised crosswalk to provide traffic calming, improve the visibility of pedestrians and cyclists, and provide a consistent crossing grade so that curb ramps would not be necessary.

Slip lane closure/turn lane creation
Both designs remove the existing slip lane through the raised median for vehicles turning right onto Columbus Boulevard from Washington Avenue, to eliminate the existing conflict between vehicles and people. The slip lane is replaced by a right-turn-only lane along the south side of the cartway, which is created by using space vacated by the existing eastbound bicycle lane and a portion of the existing raised median.

Intersection interventions
Columbus Boulevard has very high traffic volumes at the intersection with Washington Avenue (20,000+ annual average daily traffic in each direction), and 14 distinct vehicular traffic movements occur at the intersection. Movement is further complicated by the train tracks running down the center of Columbus Boulevard and the channelized right-turn lane at the northeast corner of the intersection. The entrance to the Washington Avenue Green and the Delaware River Trail at the southeast corner of the intersection is obscured by the large scale of the street and the high volume of vehicles passing in front of it. The intersection provides very little protection or prioritization for its most vulnerable users: bicycles and pedestrians. To prioritize the safety of non-motorized users of the intersection, the designs adapt elements of a protected intersection, including:

- "elephant track," a dotted white marking through the intersection that indicates the path cyclists should take;
- corner safety islands that provide separation from traffic for cyclists waiting to cross the intersection; and
- setback crossings that provide space for turning vehicles to yield to pedestrians.

Raised crosswalk at channelized turn
The markings for the southbound conventional bicycle lane on Columbus Boulevard discontinue at the approach to the right channelized turn and begin again on the south side of the intersection, forcing cyclists to mix with large volumes of vehicular traffic. To address this lack of protection, the designs

institute a protected bicycle lane that starts at the approach to the right channelized lane and continues to the corner of Washington Avenue and Water Street. Southbound cyclists use a mountable curb that leads to a queuing area on the sidewalk and traverse the channelized right turn using a raised crosswalk that leads to an enlarged bicycle and pedestrian median area. From the median, cyclists follow elephant tracks across the intersection.

Protected intersection design in Vancouver, British Columbia, Canada.
Photo Credit: Kathleen Corey, Brian Gould, 2015

Raised crosswalk at channelized right-turn lane in Boulder, Colorado.
Photo Credit: National Cooperative Highway Research Program, 2011

The Race Street Connector was designed to enhance connectivity for pedestrians walking beneath I-95 between Old City and the Delaware River waterfront in Philadelphia.
Photo Credit: Delaware River Waterfront Corporation, 2015

Conceptual Design A

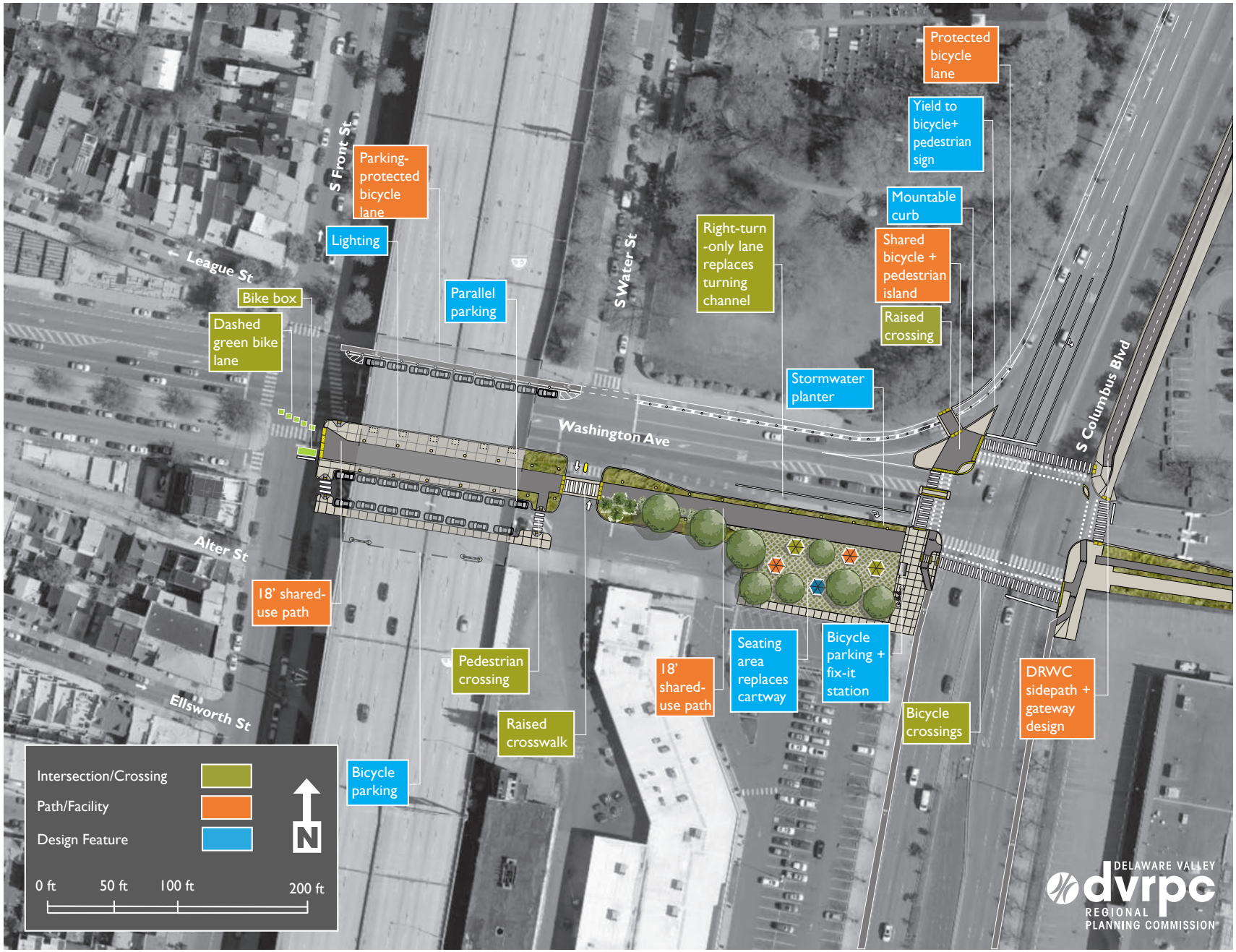
Both designs for Washington Avenue use best practice approaches to pedestrian and bicycle facility design, emphasizing separated, low-stress facilities because of high traffic volumes and complicated traffic movements. Design A's approach emphasizes placemaking through the creation of a small plaza area with a number of features geared toward bicyclists and pedestrians. This design is detailed in Figure 15.

The design closes the right-turning slip lane and the portion of the frontage street east of the shopping center entrance, connecting the existing center median to the southern curb to create a small plaza with tables and chairs, bike parking, and a bike fix-it station with tools to make minor repairs. The plaza space is meant to be largely permeable and feature green infrastructure that can guide stormwater away from sewers and into planted areas that can absorb or slowly release water.

Design A features a different treatment at the southwest corner of Washington Avenue and Columbus Boulevard, which provides a physically seperated lane at the intersection that transitions back into a conventional bike lane and a protected refuge area for cyclists waiting to cross Columbus Boulevard heading east.

Overall, Design A will cost more to construct and maintain but will provide more traffic calming and a better gateway for connecting bicycle and pedestrian infrastructure, green spaces, and neighborhoods west of the I-95 with the Washington Avenue Green and the Delaware River Trail. For these reasons, Conceptual Design A was the preferred design of project stakeholders, resources permitting.

Figure 15 | Conceptual Design A

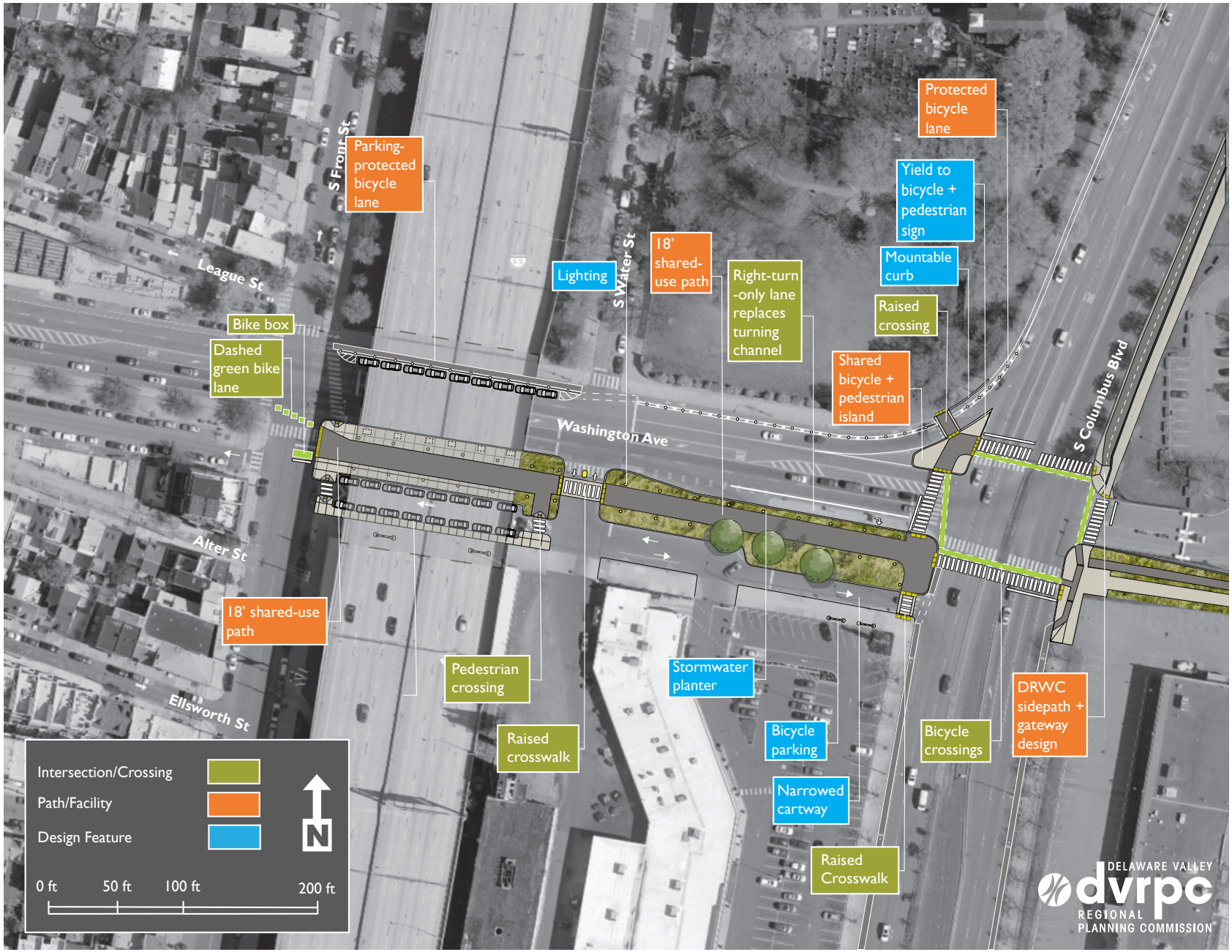


Source: DVRPC, 2016; City of Philadelphia, 2015

Conceptual Design B

Design B forgoes the creation of a programmed area and focuses primarily on developing a direct, low-stress connection between Front Street and the Delaware River Trail. Design B has lower construction and upkeep costs, achieved by keeping a narrowed frontage road connection to Delaware Avenue open, and forgoing corner safety islands at intersections, in favor of green-painted bicycle crossings. These painted crossings are intended to improve the visibility of bicyclists moving through the intersection to other existing and proposed infrastructure. Design B is shown in Figure 16.

Figure 16 | Conceptual Design B



Source: DVRPC, 2016; City of Philadelphia, 2015

Cost Estimates

Tables 1 and 2 provide itemized construction cost estimates for the two design concepts. These unit costs were gathered from recent bid prices in the Pennsylvania Department of Transportation's Engineering and Construction Management System, and online quotes from well-known manufacturers. These estimates are separate from design and engineering costs and do not include ongoing maintenance or costs related to train track modification.

Table 1 | Conceptual Design A Cost Estimate

Category	Measurement	Unit	Unit Cost	Total	Notes
Demolition					
Curb	2,600	LF	$50	$130,000	
Asphalt	333	CY	$60	$19,980	Excavation measured in CY; assumed 6" of asphalt depth
Concrete sidewalk	117	CY	$60	$7,020	Excavation measured in CY; assumed 4" of conc depth
Clearing and grubbing	1	LS		$30,000	
Utility Relocation					
Lights	6	EA	$5,000	$30,000	
Signs	16	EA	$150	$2,400	
Hydrants	2	EA		$20,000	
Signal poles	3	EA	$5,000	$15,000	
Inlet and manhole adjustment				$10,000	
Street marking removal	3000	SF	$5.75	$17,250	Eradication is measured per SF
Installation					
Concrete (sidewalk)	550	SY	$120	$66,000	
Sub-base 6" depth 2A	550	SY	$20	$11,000	At least same quantity as sidewalk
Asphalt sidepath	1,020	SY	$100	$102,000	
Asphalt roadway	175	SY	$100	$17,500	
Curbing	1,100	LF	$50	$55,000	
Permeable paver	7,200	SF	$15	$108,000	
Raised crosswalk	1	EA	$5,000	$5,000	
Markings					
Elephant tracks (transitions)	310	LF	$5	$1,550	Assumed thermoplastic
Crosswalks (continental)	310	LF	$5	$1,550	Assumed thermoplastic
Buffered bike lane striping	220	LF	$5	$1,100	Assumed thermoplastic
Turn lane (painted striping)	185	LF	$5	$925	Assumed thermoplastic
Left arrow	1	EA	$400	$400	Assumed thermoplastic
Bike box	1	EA	$500	$500	

Category	Measurement	Unit	Unit Cost	Total	Notes
ADA + Safety Features					
Detectable warning strip	320	SF	$50	$16,000	
Curb ramps	5	EA	$6,000	$30,000	
Flexible bollards	30	EA	$50	$1,500	
Signage	10	EA	$150	$1,500	
Landscaping					
Landscaping	1	LS		$20,000	
Amenities					
Bike fix-it station	1	EA	$2,500	$2,500	
Bistro-style tables with chairs	5	EA	$200	$1,000	
Bicycle rack (5 loop)	4	EA	$500	$2,000	
Lighting (ground-mounted) + conduit	30	EA	$300	$9,000	
Sub-Total					
				$735,675	
Additional Considerations					
Maintenance and Protection of Traffic @ 3–5%				$36,784	
Mobilization @ 5–6%				$44,141	
Contingency @ 10–20%				$110,351	
Construction inspection @ 12–15%				$88,281	
*Construction engineering items @ $50–60k				$50,000	*If federal funds are being used to construct

ADA= Americans with Disabilities Act
CY=Cubic Yards
EA=Each
LF=Linear Feet
LS=Lump Sum
SF = Square Feet
SY = Square Yards

Total Cost $1,065,232

Table 2 | Conceptual Design B Cost Estimate

Category	Measurement	Unit	Unit Cost	Total	Notes
Demolition					
Curb	2,400	LF	$50	$120,000	
Asphalt	242	CY	$60	$14,520	Excavation measured in CY; assumed 6" of asphalt depth
Concrete sidewalk	117	CY	$60	$7,020	Excavation measured in CY; assumed 4" of concrete depth
Clearing and grubbing	1	LS	$30,000	$30,000	
Utility Relocation					
Lights	4	EA	$5,000	$20,000	
Signs	10	EA	$150	$1,500	
Hydrants	3	EA	$5,000	$15,000	
Signal poles	3	EA	$5,000	$15,000	
Inlet and manhole adjustment		LS		$10,000	
Street marking removal	3,000	SF	$5.75	$17,250	Eradication is measured per SF
Installation					
Concrete (sidewalk)	650	SY	$120	$78,000	
Sub-base 6" depth 2A	650	SY	$20	$13,000	Quantity at least that of sidewalk
Asphalt Sidepath	430	LF	$100	$43,000	$100 / SY
Asphalt roadway	175	SY	$100	$17,500	
Curbing	1,450	LF	$50	$72,500	
Raised Crosswalk	1	EA	$5,000	$5,000	
Markings					
Elephant tracks (transitions)	310	LF	$5	$1,550	Assumed thermoplastic
Crosswalks (continental)	310	LF	$5	$1,550	Assumed thermoplastic
Buffered bike lane striping	220	LF	$5	$1,100	Assumed thermoplastic
Turn Lane (painted striping)	185	LF	$5	$925	Assumed thermoplastic
Left Arrow	1	EA	$400	$400	Assumed thermoplastic

Category	Measurement	Unit	Unit Cost	Total	Notes
ADA + Safety Features					
Detectable warning strip	260	LF	$50	$13,000	
Curb Ramps	5	EA	$6,000	$30,000	
Flexible Bollards	30	EA	$50	$1,500	
Signage	10	EA	$150	$1,500	
Landscaping					
Landscaping		LS		$15,000	
Amenities					
Bike box	1	EA	$500	$500	
Bicycle rack (5 loop)	4	EA	$500	$2,000	
Lighting (ground mounted) + conduit	30	EA	$300	$9,000	
Sub-Total					
				$542,315	
Additional Considerations					
Maintenance and Protection of Traffic @ 3–5%				$27,116	
Mobilization @ 5–6%				$32,539	
Contingency @ 10–20%				$81,347	
Construction inspection @ 12–15%				$65,078	
*Construction Engineering items @ $50–60k				$50,000	*If federal funds being used to construct

ADA= Americans with Disabilities Act
CY=Cubic Yards
EA=Each
LF=Linear Feet
LS=Lump Sum
SF = Square Feet
SY = Square Yards

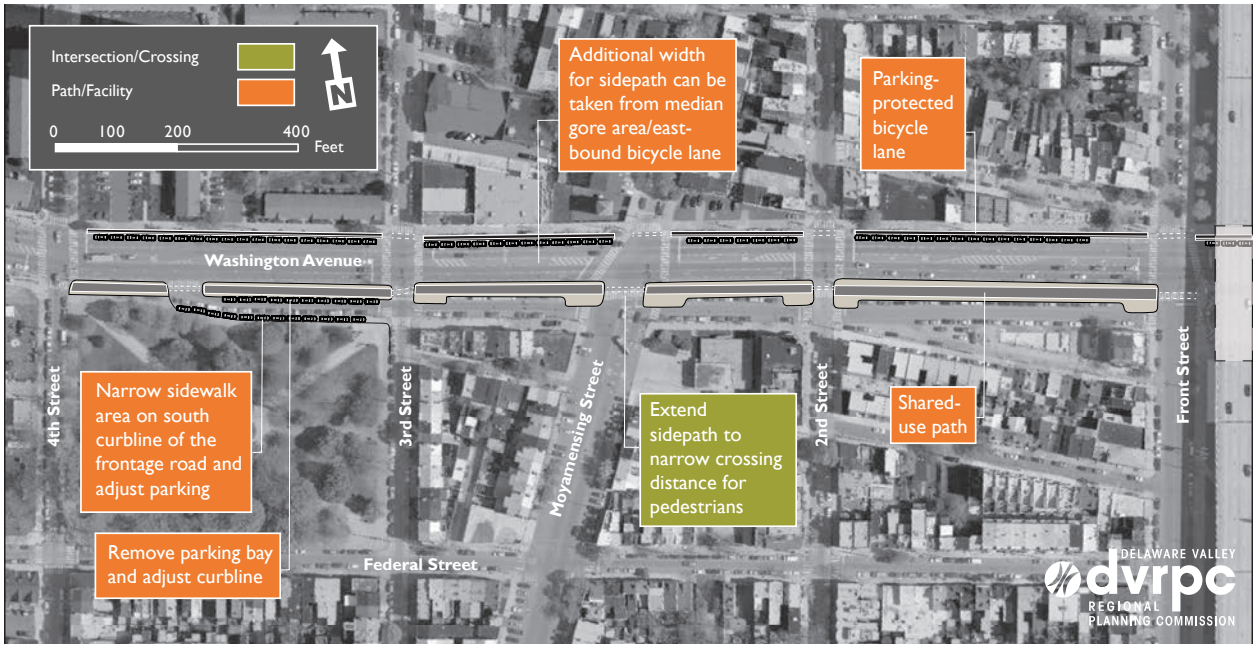
Total Cost $819,095

Next Steps

To move the project forward, the city will need to do outreach and gather input from adjacent communities and the appropriate elected officials. Partnering with the DRWC to do this outreach could be a successful strategy since they have done similar outreach in the past and they manage a number of connected, ongoing projects adjacent to the study area. Once input has been gathered, the city will need to complete final design and engineering for the selected concept. This could be done by city engineers, or the city could apply for or use existing funds to have the design and engineering done by an outside consultant. During design and engineering, consider maintenance needs and who the responsible agencies will be. Then any considerations can be built into the designs, if necessary. The final step is to apply for construction funding. This presents another opportunity to collaborate with DRWC to strengthen an application and build upon previous successful projects done by both entities. Once funds are secured, the project can be constructed.

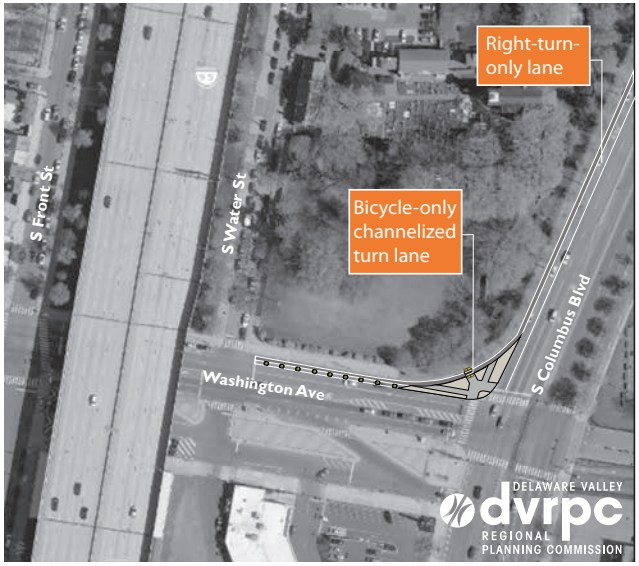
As the project unfolds, the city should continuously monitor connected projects and activities that might have an impact on this project, like the construction of the sidepath on Columbus Boulevard and the redesign of Washington Avenue to the west. Opportunities to coordinate projects or leverage investments should be fully taken advantage of.

Figure 17 | Future Opportunity: Extended Shared-Use Path and Parking-Protected Bike Lane



Source: DVRPC, 2016; City of Philadelphia, 2015

Figure 18 | Future Opportunity: Bike-Only Channelized Right Turn at Columbus Boulevard



Source: DVRPC, 2016; City of Philadelphia, 2015

Future Opportunities

When one of the proposed designs is implemented, there are possibilities for further improving bicycle and pedestrian infrastructure in the study area. Extending the proposed shared-use path and parking-protected bike lane on Washington Avenue from Front Street to 4th Street, shown in Figure 17, would create a protected connection between Jefferson Square and Sacks Playground and the Delaware River Trail.

Another improvement for bicycle and pedestrian safety would be to close the right channelized turn lane from southbound Columbus Boulevard onto Washington Avenue and replace it with a standard right-turn-only lane that begins at Christian Street. This design change may ease congestion at the intersection that is caused by vehicles blocking through lanes while queuing to make a right turn, and it would better protect southbound cyclists and pedestrians on Columbus Boulevard. A traffic study would be necessary before moving this element forward. A conceptual design for this change is shown in Figure 18.

Washington Avenue and Columbus Boulevard Conceptual Bicycle and Pedestrian Plan

Publication Number: 16034

Date Published: December 2016

Geographic Area Covered: City of Philadelphia

Key Words: Philadelphia, Bicycle, Pedestrian, Sidepath, Trail, Delaware River,

Abstract: The *Washington Avenue and Columbus Boulevard Conceptual Bicycle and Pedestrian Plan* was created by Delaware Valley Regional Planning Commission staff in collaboration with the City of Philadelphia. The plan includes a comprehensive analysis of existing conditions along Washington Avenue between Front Street and Columbus Boulevard in Philadelphia and offers two conceptual designs that identify opportunities to improve bicycle and pedestrian movement in the area, along with estimated construction costs.

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