City of Virginia Beach

# ACTIVE TRANSPORTATION PLAN

*The Bikeways & Trails Component of the Comprehensive Master Plan*

February 16, 2021

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# ACKNOWLEDGMENTS


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# CHAPTER 1 | WALKING & BICYCLING BACKGROUND

# CHAPTER 1 | WALKING & BICYCLING BACKGROUND

## Introduction

The City of Virginia Beach is a remarkable place. Within the City borders, you can spend your morning kayaking or picking produce at a thriving family farm, spend your afternoon at one of the East Coast's most popular beach destinations, spend the evening enjoying high-quality shopping and entertainment in Virginia Beach Town Center, before going home to a quiet, sought-after suburban neighborhood. This mix of places and experiences is what makes Virginia Beach an attractive place for residents, businesses, and of course, a thriving tourism industry with over three million annual visitors.

Key to each of these different experiences is a safe, accessible, and enjoyable environment for walking and bicycling. Today, many parts of Virginia Beach can be challenging to navigate on foot or bicycle, as the network of sidewalks and bicycle facilities is incomplete. People often must walk or bike next to fast moving car and truck traffic, posing a significant hazard. Between 2011-2018, 35 people were killed while walking or bicycling in Virginia Beach.

Providing a complete, safe, and enjoyable pedestrian and bicycle network is not only important for health and safety, but for economic benefits as well. These benefits are lower transportation costs for residents and commuters and an enjoyable experience for shoppers and tourists. This section highlights the confluence of trends, both national and local, that justify a robust active transportation network in Virginia Beach.

Active transportation, also known as non-motorized transportation, is defined as self-propelled, human-powered mode of transportation, including walking, biking, small-wheeled transport (skates, skateboards, push scooters, and hand carts), and wheelchair travel. This plan also includes non-motorized watercraft transportation, such as kayaking and canoeing.

"For Bicycles Only" striped lane in this July 4, 1938 photo taken on the Boardwalk. Courtesy of Sargeant Memorial Collection, Norfolk Public Library.

June 29, 1936 Virginia Beach Boardwalk, Courtesy of Virginia Beach Public Library

# History of Transportation in Virginia Beach

Throughout the history of Virginia Beach, innovations in transportation have shaped the City's growth and development, going back to the digging of canals and draining of swamps in the 1850s, providing access for commercial and military ships, and the creation of buildable uplands.[1] The Norfolk, Virginia Beach, and Southern Railroad opened in 1883, connecting Norfolk to what was then a small resort area in Princess Anne County along the Atlantic Ocean called Virginia Beach.[2] In the following years, two spur lines opened to Munden Point and to today's Oceana Naval Air Station. A rail line to Cape Henry, completed in 1902, created a loop through Princess Anne County. The railroads carried tourists, soldiers, sailors, businesspeople, and farmers, providing reliable transportation and supporting the City's growth.[3]

In the 20th century, the advent of the automobile opened Virginia Beach to suburban development and the expansion of its tourism economy. The first paved road, Virginia Beach Boulevard (Route 58) was completed in the early 1920s and spanned between Virginia Beach and Norfolk. From 1940 to 1960, Princess Anne County (which merged into the City of Virginia Beach in 1963) quadrupled in population,[4] which led to the construction of the Virginia Beach Expressway (Route 44) in 1967.[5] The highway, now known as I-264, attracted significant commercial development near each of its interchanges, making Virginia Beach an economic engine for the region. The city is notably home to Hampton Roads' first enclosed shopping center, Pembroke Mall, which opened in 1966.

The City of Virginia Beach's waterway system is comprised of four major watersheds (Elizabeth River, Lynnhaven, Oceanfront, and Southern Rivers) and boasts 121 miles of navigable waterways. Since the 17th century, the City's expansive system of waterways has lent itself to the transport of people and goods from land to water, growing the economy and population. Internal


1918 Scooter to Munden Point - Ran from Norfolk to Munden Point 1910 to 1929. Initially gasoline and became electric in 1923. Courtesy of The Virginia Beach Public Library, Edgar T. Brown Collection.

ferries helped residents cross bodies of water such as the Lynnhaven River and North Landing River before the Pungo Ferry Bridge. External ferries, such as the connection between Little Creek and Cape Charles, also helped to access Virginia Beach. In addition, the City's extensive waterfront access enabled the growth of military installations, including Joint Expeditionary Base Fort Story, which opened in 1914, and Joint Expeditionary Base Little Creek, which opened in 1942.

Bicycling facilities were present in Virginia Beach as early as the 1930s, when the historic Oceanfront Boardwalk became overwhelmed with cyclists who rented bikes nearby.[6] This was the beginning of the separated bicycle path along Atlantic Avenue, now one of the City's numerous bicycle facilities.

1 https://www.pilotonline.com/history/article_7dfe3a14-fabc-5936-b70b-6398905af189.html

2 http://www.virginiaplaces.org/rail/norfolkvabeachsouthern.html

3 https://www.pilotonline.com/news/article_a4130d19-a99b-58de-8feb-a40ad9b15cad.html

4 Decennial Census

5 https://www.pilotonline.com/history/article_bee368bb-03eb-5378-9fe6-812132e5e83e.html

6 https://www.pilotonline.com/history/vp-nw-boardwalk-history-0905-20200907-kjhvwumozra2xhagf4x-kvlkise-story.html


Bicyclists of all ages enjoying a shared use path.

E-scooters are an increasingly popular mobility option in Virginia Beach.

Today, Virginia Beach is the largest city in Virginia with over 450,000 residents, and part of the Hampton Roads Metropolitan Statistical Area of 1.7 million residents.[7] Most of the southern one-half of the City is low-lying, low-density farmland that does not support future dense development, and the northern one-half of the City is largely built out. Future growth of Virginia Beach is encouraged within the Strategic Growth Areas (SGAs), which have been identified as having characteristics and opportunities suitable for higher-density redevelopment, such as the Virginia Beach Town Center. The scale of new development will be more compact and vertical, requiring a new approach to transportation.

This plan recognizes that many City residents and employees use active transportation because they cannot afford to own and maintain a personal car. In some cases they must walk or bicycle long distances on dangerous roads to access a bus stop, school, or place of work. This plan also recognizes that retirees, military veterans, and people with various disabilities make up a significant percent of Virginia Beach's population. While critical for those with limited mobility, the curb ramps, wide sidewalks, pedestrian signals, wayfinding, and other accessible design elements serve everyone in the community. Investing in accessible active transportation, such as walking and bicycling, will address these inequities and enable more people to travel short distances safely, comfortably, and efficiently.

7 https://censusreporter.org/profiles/31000US47260-virginia-beach-norfolk-newport-news-va-nc-metro-area/

# National and Local Trends

Whether in Virginia Beach or across the United States, the ways we get around are changing as more people shift from driving to other transportation modes. More Americans are walking: in 2017, 18% of Americans said they walk for social or recreational activities, and 13% for work or work-related activities, compared to 7% and 4%, respectively, in 1995.[8] This shift is especially pronounced among Millennials (adults born between 1981 and 1996) and Generation Z (those born 1997 or later), the two generations comprising a population majority in the United States today,[9] totaling over 166 million people.[10] Due to a combination of lower incomes, increases in the cost of gas and car ownership, and changing habits, younger people are driving less than previous generations did at the same age. In 2017, only 25% of 16-year-olds had driver's licenses, compared to 46% of 16-year-olds in 1983.

Young adults now consider transportation options as a factor in where they want to live. Research from the Hampton Roads Transportation Planning Organization (HRTPO) noted that 54% of Millennials nationwide would consider moving away to another city with more transportation options.[11] One response has been the rise of new transportation technologies, like bikesharing, carsharing, and e-scooters. In 2018, the Ford Motor Company bought e-scooter company Spin as a response to declining car ownership among young people.[12]

This trend is especially relevant here in Virginia Beach. HRTPO found that Millennials in the Hampton Roads area were twice as likely not to drive to work than the general population, with 4% of Millennial workers commuting by other travel modes. The City is one of the youngest communities in the Commonwealth, with adults between 18 and 34 making up 31.6% of the population in 2016.[13] Most of these residents are clustered around the City's military bases, as well as in its Strategic Growth Areas, where much of the City's future development will likely continue to occur.

Providing active transportation options, particularly in these communities, will be a main asset for attracting younger residents to the City and encouraging them to put down roots. Well-designed and maintained active transportation infrastructure intended to attract and retain the large cohort of now-young Millennial & Generation Z will continue to be of value as these generations age, staying true to the City's slogan, "A Community for a Lifetime."

## Benefits of Walking and Bicycling

There are health benefits to walkable and bikeable neighborhoods. People are more likely to walk or bike if they can do so to access daily needs and not solely for recreation. Studies show that walking reduces the risk of high cholesterol, increased blood pressure, diabetes and obesity, as well as improved mental health.[14] For senior citizens, walkable neighborhoods are

8 https://nhts.ornl.gov/assets/2017_nhts_summary_travel_trends.pdf

9 https://www.pewresearch.org/fact-tank/2018/03/01/millennials-overtake-baby-boomers/

10 https://www.brookings.edu/blog/the-avenue/2020/07/30/now-more-than-half-of-americans-are-millennials-or-younger/

11 https://t4america.org/wp-content/uploads/2014/04/Press-Release_Millennials-Survey-Results-FINAL-with-embargo.pdf

12 https://www.wsj.com/articles/driving-the-kids-are-so-over-it-11555732810

13 https://www.law.umn.edu/sites/law.umn.edu/files/metro-files/virginiabeach_incomechange_report.pdf

14 https://www.health.harvard.edu/staying-healthy/walking-your-steps-to-health

Walking and rolling on the South Beach Trail.

linked with greater physical activity,[15] which can slow down the aging process, and allow people to live independently for a longer time.[16] Places where driving is not the only travel option are also safer, as higher rates of driving mean a greater risk of car crashes.[17] Streets designed for walking and bicycling often have lower speeds, which reduces the risk of injury for everyone who uses that street, regardless of travel mode.

Active transportation also plays a significant role in the City's public transportation system. All trips involving public transportation are essentially multimodal because they require at least a short distance of travel, by foot, bicycle, or mobility device, to access the transit station or stop. For this reason and others, active transportation and public transportation are inherently linked. Strong mobility options provide the means by which opportunities critical for individual, economic, social, and community success may be accessed. Active transportation modes are recognized as the connectors between origin, public transportation, and destination in a multimodal network, and are frequently referred to as the first and last mile.

As more people embrace walking and bicycling, active transportation facilities increasingly have economic benefits. A survey from the National Association of Homebuilders found that prospective homebuyers rank trails as one of their most important community amenities.[18] Likewise, a study from the National Association of Realtors noted that 60% of households and 67% of families with children are willing to spend more on a home to live in a walkable neighborhood.[19] More businesses are seeking walkable and bikeable locations, and a study from the Urban Land Institute found that they will pay higher rents to be there.[20]

Trails, or shared use paths, are also a highly desirable amenity and are consistently ranked as one of the most needed or highest priority recreational facilities in the Virginia Beach Parks and Recreation Community Survey Priority Rating. Respondents to the 2017 survey gave "biking trails" and "paved walking & jogging trails" as the highest and second highest priority rating. This desire is also reflected throughout the region and state, where "trails" ranked fourth for the most needed recreational opportunity based on the 2017 Virginia Outdoors Demand Survey, and shown in the 2018 Virginia Outdoors Plan.

There are also environmental benefits to reducing reliance on fossil fuel-powered transportation modes, particularly in Virginia Beach, where climate change-related flooding has increased in recent years. The City of Virginia Beach has identified $3.8 billion dollars in infrastructure improvements needed to address the future threat of flooding caused by a projected three-foot rise in sea level by 2085.[21] With the center of the City largely built-out, the need for areas for stormwater storage and infiltration are increasing. The Virginia Beach Active Transportation Plan introduces the concept of a proposed network of greenways and blueways that can ribbon throughout the most vulnerable and flood prone areas, providing the most comprehensive solution that satisfies stormwater storage, a complete network of active transportation routes, and a boost to economic vitality and neighborhood revitalization. Thus, reducing our reliance on private automobiles and giving people more choices in how to get around safely is imperative. This includes a more robust pedestrian and bicycling network, which can be deployed alongside green infrastructure, flood mitigation efforts, and better stormwater management.

15 https://medicalxpress.com/news/2017-10-walkable-neighborhoods-linked-older-adults.html

16 https://www.health.harvard.edu/blog/walking-exercise-helps-seniors-stay-mobile-independent-201405287173

17 https://www.sightline.org/research_item/walkable-facts/

18 http://nahbnow.com/2016/02/3-community-amenities-that-top-all-home-buyers-wish-lists/

19 https://www.nar.realtor/sites/default/files/documents/2017%20Analysis%20and%20slides.pdf

20 https://urbanland.uli.org/news/walkable-downtowns-drawing-companies-talent/

21 https://www.pilotonline.com/news/environment/article_54a6f7be-19cc-11e9-a249-237d551545f7.html

# Local Trends

Over the past 50 years, Virginia Beach has developed from suburbs into one of Hampton Roads' main job centers; 62% of employed residents in Virginia Beach both live and work in the City. Residents are likely to commute shorter distances to jobs within the City boundaries, illustrated by the City's low average commute time of 23 minutes, which has remained stable since 1990.[22]

The way Virginia Beach residents commute to work has changed slightly during that time. Over four out of every five Virginia Beach residents commute to work (81.9%), a slight increase from 1990. Meanwhile, more residents are bicycling to work (an increase from 0.4% to 0.7%) and fewer are walking (a decrease from 3.5% to 2.3%)[23]. The greatest rates of people walking and bicycling to work are in areas where people are likely to live close to their jobs: near military installations, along the Oceanfront, and in the Strategic Growth Areas. However, changing demographics, combined with 4% of City households who do not have cars, may generate increased demand for active transportation options.

## Regional Growth and Congestion

As the second-largest metropolitan area in Virginia after Northern Virginia, the Hampton Roads area (which includes the City of Virginia Beach) is growing.[24] Over 1.7 million people call the area home today, and the HRTPO estimates that will increase to two million by the year 2045. During that same period, the City of Virginia Beach is expected to add 65,000 residents, 16,000 jobs, and as many as 45,000 vehicles.[25] HRTPO has identified several already congested corridors in the City, such as Kempsville Road, Princess Anne Road, Dam Neck Road, Independence Boulevard, and London Bridge Road, and anticipates that motor vehicle traffic will increase in the future.

Much of the City's growth is anticipated to happen in its eight Strategic Growth Areas: Burton Station, Centerville, Hilltop, Lynnhaven, Newtown, Pembroke, Resort, and Rosemont.[26] These areas are key opportunities for the City to add new residents and jobs without causing additional strain on the road network. Creating compact and mixed-use communities connected by walkable and bikeable streets will allow people to travel without a car safely and comfortably.

Cities around the United States are taking this approach to tackle congestion, improve public health, promote economic development, or protect the environment. People For Bikes, a national organization that promotes safer bicycling, has produced a Bicycle Network Analysis (BNA) that measures how well a city's bike network connects people with the places they want to go, focusing on low-stress bicycle routes. The BNA shows how Virginia Beach compares to other cities in Virginia, as well as peer cities around the nation with a similar population, geography, or demographics. Each city receives a score from 0 to 100. The score rates access to different types of destinations from a low-stress bicycle facility, including: public recreation facilities, shopping areas, transit, and core services like health care, jobs and education. Lower scores mean that city has poor access to these destinations, while higher scores reflect better access.

When compared to other cities around the Commonwealth, Virginia Beach continues to lag on access to core services, employment, recreation, retail, and transit (Table 1). To respond to public demand for enhanced quality of life through community-centered active transportation, the City will need to prioritize balancing its transportation system and connect its citizens and visitors to safe, accessible non-motorized travel options.

This is further supported by comparing Virginia Beach to similar cities around the nation, whereas similarly, Virginia Beach has less access to core services, employment, retail, and transit. However, despite not having a complete network of active transportation, Virginia Beach enjoys better access to recreation by bicycle (Table 2).

The higher rating in bicycle access to recreation can be, in part, based on Virginia Beach having a higher acreage of parks in the City than the other similar cities.[27] The city boasts of over 7,000 acres of municipal park lands, two state parks, a federal preserve, miles of public beaches, a myriad of internal

22 American Community Survey, Commuting Characteristics by Sex 1990-2019

23 American Community Survey, Commuting Characteristics by Sex 1990-2019

24 https://www.dailypress.com/news/newport-news/dp-nws-population-estimates-virginia-20190130-htmlstory.html

25 https://www.hrtpo.org/uploads/docs/Hampton%20Roads%202045%20Socioeconomic%20Forecast%20and%20TAZ%20Allocation%20Report.pdf

26 https://www.vbgov.com/government/departments/sga/strategic-growth-areas/Pages/default.aspx

27 https://www.tpl.org/city/virginia-beach-virginia

The Bicycle Network Analysis (BNA) below measures how well a city's bike network connects people with the places they want to go, focusing on low-stress bicycle routes. Each city receives a score from 0 to 100. Higher scores reflect better access. The score rates access to different types of destinations from a low-stress bicycle facility, including: public recreation facilities, shopping areas, transit, and core services like health care, jobs and education.

### Bicycle Access as Compared to Other Virginia Cities

| City | Virginia Beach | Norfolk | Chesapeake | Arlington | Richmond |
|---|---|---|---|---|---|
| Population | 447,867 | 250,396 | 234,600 | 221,847 | 213,084 |
| Core Services | 9 | 9 | 14 | 49 | 17 |
| Employment + Education | 21 | 22 | 16 | 27 | 51 |
| Recreation | 31 | 27 | 51 | 19 | 64 |
| Retail | 20 | 14 | 25 | 22 | 42 |
| Transit | 0 | 3 | 0 | 0 | 33 |

*Table 1: Virginia Beach's Bike Network Analysis compared to other Virginia cities.*

### Bicycle Access as Compared to National Peer Cities

| City | Virginia Beach | Raleigh, NC | Jacksonville, FL | New Orleans, LA | Long Beach, CA |
|---|---|---|---|---|---|
| Population | 447,867 | 429,177 | 839,691 | 345,392 | 486,282 |
| Core Services | 9 | 10 | 11 | 33 | 22 |
| Employment + Education | 21 | 13 | 13 | 41 | 30 |
| Recreation | 31 | 20 | 21 | 47 | 28 |
| Retail | 20 | 15 | 25 | 18 | 29 |
| Transit | 0 | 4 | 1 | 24 | 14 |

*Table 2: Virginia Beach's Bike Network Analysis compared to national peer cities.*

waterways, and a temperate climate (about 70 pleasant days a year).[28]

However, the current inventory of active transportation infrastructure within the City does not sufficiently accommodate the active lifestyles and potential connections of the community. Tables 1 and 2 support this finding as well as the independent research done by Walk Score and Places For Bikes.

- Walk Score, an index that rates the walkability of cities on a scale from 0 to 100, gave Virginia Beach a Walk Score of 32 and a Bike Score of 44.[29] This classifies the City as "Car-Dependent," meaning most errands require a car, and "Somewhat Bikeable,' meaning there is minimal bicycling infrastructure.
- Places for Bikes is an organization that scores communities nationwide for bikeability. Virginia Beach's 2020 City Scorecard rating is 1.3 out of 5 (Figure 1 and Appendix C).[30] The City scored poorly in the five categories of Ridership, Safety, Network, Reach, and Acceleration.

Compared to other similar communities, indicators demonstrate Virginia Beach needs to improve but has every opportunity to do so.

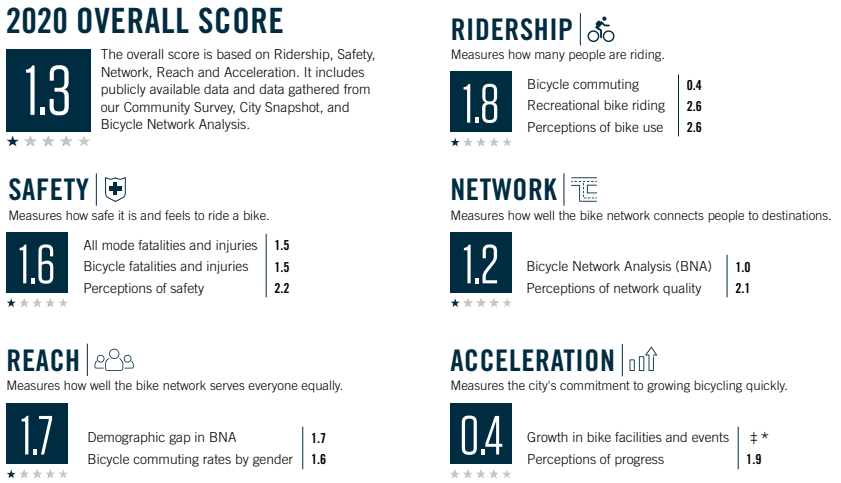



*Figure 1: Places for Bikes' 2020 City Scorecard for Virginia Beach*

28 https://kellegous.com/j/2014/02/03/pleasant-places

29 https://www.walkscore.com/VA/Virginia_Beach

30 https://cityratings.peopleforbikes.org/city/virginia-beach/

# City and Regional Plans

To transform Virginia Beach, the Active Transportation Plan must work in conjunction with other plans to coordinate all of the interrelated parts of the City. This plan builds upon many of the City's and greater Hampton Roads' regional planning efforts, some of which are summarized below.

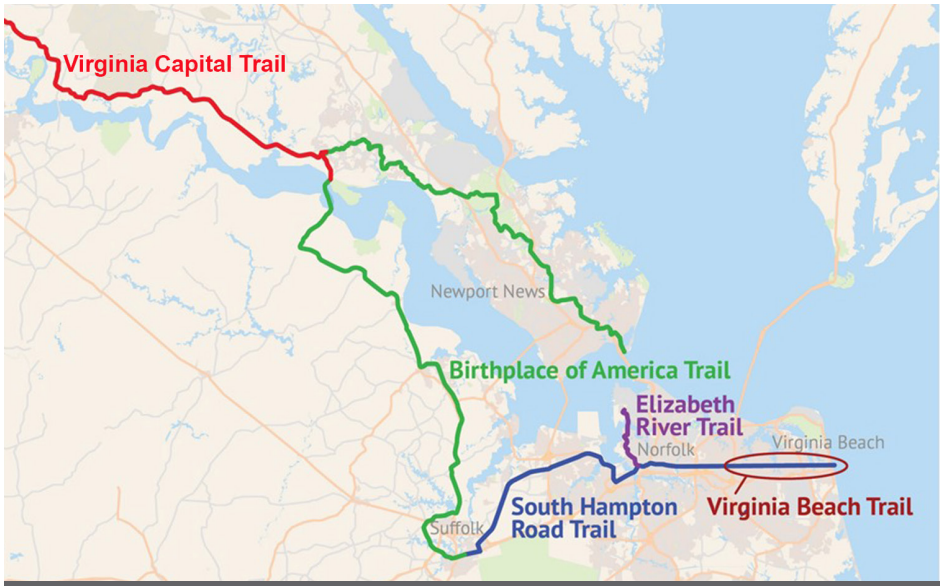
## City of Virginia Beach Comprehensive Plan

The City of Virginia Beach Comprehensive Plan (Comp Plan) is the current general land use plan for the municipality, guiding growth and development for the coming years and providing recommendations for zoning and policy changes. This Active Transportation Plan is a component of the Comprehensive Plan. The Comp Plan affirms the City's long-term vision of suburban neighborhoods in the northern part of the City, rural areas south of the Green Line, and eight Strategic Growth Areas that will receive much of the City's future urban growth. The Plan recommends walkable, "transit supportive," mixed-use development in these eight areas, which will provide more options for people to live closer to jobs, shops, schools, medical facilities, and other amenities. These land use changes allow people to make use of active transportation facilities, which can reduce congestion, lower air pollution, and improve public health and safety.

The Plan recommends several large-scale trail projects, including:

- The Virginia Beach Trail, an east-west trail following the former Norfolk Southern railroad alignment from the Newtown Road light rail station to Virginia Beach Town Center, and further east to the Oceanfront.
- The Thalia Creek Greenway, an urban greenway system of trails connecting Town Center to nearby waterways and adjacent residential neighborhoods.
- Regional trail projects, such as the South Hampton Roads Trail, Beaches to Bluegrass, and Bicycle Route 76, each of which will connect the City to surrounding communities.

The Comp Plan also recommends to identify opportunities to create new pedestrian and bicycle crossings of I-264 and I-64 and to improve existing crossings, particularly near Independence Boulevard and Town Center.




Virginia Beach regional trail network. Source: HRPTO

## City of Virginia Beach Bikeways and Trails Plan

Virginia Beach adopted its first Bikeways and Trails Plan in 1981 and has updated the plan six times. The last update was adopted in 2011 and was organized around the "5 E's" of active transportation planning: Education, Encouragement, Enforcement, Engineering, and Evaluation.

The following projects have been accomplished since the 2011 plan, either as stand-alone trail or bike line capital projects, road capital improvement projects, or repaving projects:

- Bike Buddies Program, which uses individual, group, or business sponsorship to install bicycle parking at designated sites around the city
- Lesner Bridge east-west bicycle and pedestrian connection
- Nimmo Parkway shared use path
- Princess Anne Road (Landstown to Municipal Center) shared use path
- Thalia Creek Greenway Phases I and II
- Birdneck Road shared use path

- Holland Road shared use path
- Hampton Roads Transit bus stop improvements, including shelters and bike racks
- Pacific Avenue median pedestrian crossings
- Restriping projects for on-road bike lanes on Rosemont Road, Princess Anne Road at the municipal center, and the Donna Drive road diet

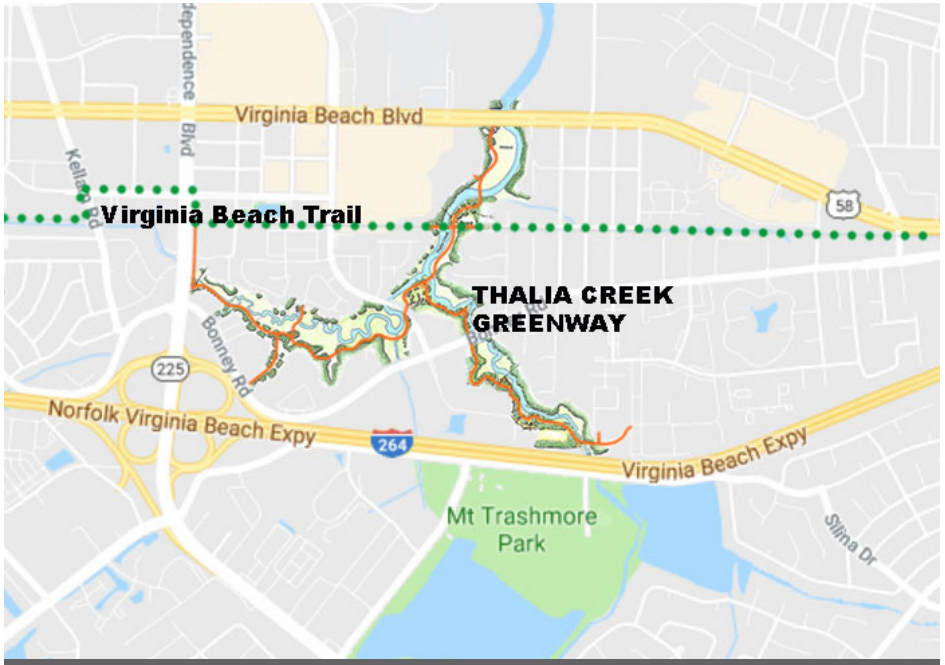
The 2011 Plan laid out 13 "top priority" goals to achieve the vision of "a City where people can walk, run, and ride anywhere safely, efficiently and enjoyably," many of which are being carried forward to this Active Transportation Plan:

- Goal 4.1: Virginia Beach will be seen as a destination for bike and pedestrian tourism.
- Goal 6A: Virginia Beach will have a comprehensive bikeways and trails system that serves all residents and visitors throughout the City.
- Goal 6B: Virginia Beach's comprehensive bikeways and trails system will connect neighborhoods and destinations to each other.
- Goal 6C: Virginia Beach will treat bike-ped facilities both as valued recreational amenities and as integral components of the City's transportation matrix.

Several projects yet to be accomplished from previous Virginia Beach Bikeways and Trails Plans, such as the Virginia Beach Trail and I-264 pedestrian bridge are also carried forward within this Plan.

## Virginia Beach Parks and Recreation Strategic Plan (2018)

The Strategic Plan builds a shared vision of Parks and Recreation programs, facilities, technology, and customer service. The plan establishes key issues and recommendations to continue and improve the quality offerings of Virginia Beach Parks and Recreation.




Map of Virginia Beach Trail and Thalia Creek Greenway.

## Virginia Beach Parks and Recreation Outdoors Plan (2016)

The Outdoors Plan is also a component of the Comp Plan for the parks and recreation systems in Virginia Beach to ensure open space, including parks, access to greenways, and coordination of rural trail networks within natural buffer areas. These amenities contribute to quality of life and provide safe, enjoyable, and sustainable options for outdoor recreation. The Plan establishes a vision and a framework for guiding actions that ensure a viable parks and recreation system.

A view of Town Center from Thalia Creek Greenway.

## Sea Level Wise (2020)

Sea Level Wise is the City's comprehensive plan for rising sea levels and recurrent flooding. The Adaptation Strategy has four layers to address flood risks holistically: Natural Mitigations, Engineered Defenses, Adapted Structures, and Prepared Communities. There is much opportunity to expand the active transportation system through the development of greenway and blueway networks. Some of these routes will be built as elements of sea level adaptation projects, though most will continue to be accomplished as part of larger roadway improvement CIP projects, administered and managed through the Public Works Department.

## City of Virginia Beach Comprehensive Sea Level Rise and Recurrent Flooding Response Plan (2017)

As our changing climate induces sea level rise and the associated flooding risk to Virginia Beach, this plan outlines anticipated changes to the floodplain and strategies for long-term resilience.

## HRTPO Linking Hampton Roads: A Regional Active Transportation Plan (2020)

Linking Hampton Roads is an effort to connect active transportation facilities across the region. The plan focuses on active transportation for both recreation and commute purposes. To create a regionally-connected community, Linking Hampton Roads establishes a framework for programs, policies, and connected walking and biking facilities throughout Hampton Roads in order to improve health outcomes, promote the regional economy, and improve safety. The plan proposes 11 regional routes in Virginia Beach which are incorporated into this plan's network.

## HRPTO Signature Paths of Hampton Roads (2016)

The Signature Paths of Hampton Roads studies 14 abandoned railroad tracks in the region and analyzed their conversion to multi-use trails, including the proposed Virginia Beach Trail. Trails built on inactive rail rights-of-way provide comfortable facilities for pedestrians and bicyclists away from the noise and danger of roadways. These rail-trails, if implemented, will provide connection to open space, improved quality of life, positive influence on local economics, ease of travel, and the creation of a destination. The planned projects seek to increase the number of active transportation commuters and real estate values.


Biking in the Resort Area.

# Plan Development

This plan reflects over a year of investigation and outreach into how Virginia Beach residents, workers, and visitors travel throughout the City, which is described in the following chapters. To start, the project team looked at existing conditions in the City, including travel habits, crash rates, and social, economic, and environmental issues. A review of existing planning documents for Virginia Beach and the entire Hampton Roads area also provided the foundation for this plan.

Over several months, the City conducted extensive outreach to community members, collecting feedback on where people already walk and bike today, where they would like to walk and bike, and barriers that may prevent them from doing so. The project team identified areas where the walking and bicycling experience in Virginia Beach needs improvement and went on a series of site visits to investigate those conditions in person. From there, the team developed a network of recommended pedestrian and bicycle routes, as well as recommendations to improve safety at key intersections.

The network shown in this plan is intended to be built over time, starting with high-priority projects that can make a substantial contribution to access and safety for people walking and bicycling. As identified in the Implementation chapter, plan build out ranges from near term (1-5 years), mid-term (5-10 years), and long-term (10+ years). Together, we can make the vision of a safer, healthier, more accessible Virginia Beach a reality.

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# CHAPTER 2 | GOALS & COMMUNITY ENGAGEMENT

# CHAPTER 2 | GOALS & COMMUNITY ENGAGEMENT

## Introduction

### Vision

One day soon, active transportation will be the backbone of daily life in Virginia Beach. Sidewalks, trails, blueways, and bike lanes will connect residents, workers, and tourists of all ages and abilities to all the great activities the City has to offer. While driving will still be a popular option for longer trips, walking and bicycling will be a safe, comfortable, and fun option for shorter trips throughout the City. Access to active transportation will bolster public health, support a thriving economy, and help protect our natural environment. The centerpiece of the City's active transportation network will be a state-of-the-art rail trail running 12 miles through the center of the City. Not only will the rail trail be a cherished public space, but also a spine connecting the Oceanfront, Virginia Beach Town Center, and the City's Strategic Growth Areas with Norfolk , the envisioned South Hampton Roads Trail, the Elizabeth River Trail, the Birthplace of America Trail, the Virginia Capital Trail, and beyond. This network will provide a safe and separate transportation alternative to alleviate vehicular roadway congestion while providing access to commerce, residential, and recreation via a diverse corridor that boasts of a variety of experiences from a lively city center to pristine greenways and waterways.

The analysis and recommendations in this plan are an expansion of ongoing pedestrian, bikeways and trails planning in the City of Virginia Beach. Using that framework, this plan applies updated planning and design strategies and tools that represent the evolution of an ever-growing active transportation field. From sophisticated public engagement techniques like our web-based interactive map to field work conducted with smart phone applications, development of this plan combines best practices with cutting edge technology to produce sound, data driven recommendations.

In March 2020, the Virginia Beach City Manager's Office presented to City Council the FY2020/2021 Proposed Budget. The upheaval by the COVID-19 pandemic has certainly generated changes to the budget. Despite challenges to the budget, the principles and priorities that guide the budget are based upon the established ten City Council Goals and a reaffirmed commitment to improving outcomes related to at least three out of the following six priority areas as identified by City Council: Sea Level Rise/Stormwater, Education, Public Safety, Transportation, Economic Development, and Affordable Housing. More specifically to active transportation are the following:

- Goal #1: Grow the Local Economy
  - Funding to include several Resort Area Strategic Action Plan (RASAP) 2030 recommendations, including a Resort Mobility Plan which in part focuses on micromobility and active transportation.
- Goal #3: Improve the Transportation System
  - Funding is included to meet the goals of improving the transportation system connectivity, providing multiple modes of transportation, and maintaining infrastructure.
- Goal #4: Revitalize Neighborhoods and Plan for the Future
  - New funding is proposed to create a Stormwater Green Infrastructure Project that will seek to mitigate and manage the recurring flooding within our more vulnerable neighborhoods. This generates the opportunity for the melding of storm water solutions and active transportation needs with the potential creation of green linear parks ribboned with active transportation routes that provide new and enhanced connections throughout the City.
  - To kick off this initiative, in 2019 the City of Virginia Beach was awarded a FEMA grant to conduct the "Bow Creek Greenway/Blueway Corridor Study at the Windsor Woods/Princess Anne Plaza/The Lakes Neighborhoods". This grant application was submitted by the Parks and Recreation Active Transportation Planner in cooperation with the Departments of Planning, Housing and Neighborhood Preservation, Emergency Management and Public Works. The grant will be administered by the SGA office to comprehensively master land use plan a solution to minimize the threat of blight generated by flooding and economic loss.

Pedestrians and bicyclists use the path near Rudee Loop.

# Section 1 | Goals

To achieve this vision, this plan lays out five goals for its active transportation network. Each of these goals relates to the City of Virginia Beach's broader goals, as well as feedback received from the public during the community engagement process. These goals will lay the groundwork for specific strategies for the City to improve the walking and bicycling experience. They are:

| | |
|---|---|
| **Connectivity** | Grow the City of Virginia Beach into a complete transportation network that integrates active transportation into the lifestyles of the communities for the enhanced health, safety, and welfare of all users. |
| **Safety** | Create a safe, attractive experience for walking and bicycling throughout the City of Virginia Beach by providing convenient, connected, and equitable development of active transportation facilities. |
| **Economic Vitality** | Create an active transportation network that supports a strong and thriving local economy by increasing commuting options, enriching recreational and tourism opportunities, promoting public health, and making the City an even more attractive place to live and work. |
| **Technology** | Craft strategies and guidelines to prepare our streets for changing needs and technologies, including ridehailing, micromobility vehicles like electric bicycles and scooters, and autonomous vehicles. |
| **Health** | Support public health benefits by creating an active transportation network that values and supports physical activity for people of all ages and abilities. |

*Table 3: Virginia Beach goals for active transportation.*

An explanation of each goal, as well as the strategies needed to make each goal a reality, appear on the following pages.

# Goal #1: Connectivity

**Grow the City of Virginia Beach into a complete transportation network that integrates active transportation into the lifestyles of the communities for the enhanced health, safety, and welfare of all users.**

## Objectives

- Update all City ordinances, the Public Works Design Manual, and policies and procedures, as necessary, to accommodate walking, biking, wheelchair travel, electric autonomous vehicles, muscle-powered boating, and equestrianism to:
  - Foster the construction of pedestrian and bike facilities along public rights-of-way.
  - Provide pedestrian and bike connections between adjacent developments without forcing users onto collector streets.
  - Accommodate emerging technologies, such as electric scooters and e-bikes. Consider regulating where these vehicles belong based on speed, such as, allowing scooters and e-bikes on shared use paths, bike lanes, and sidewalks where bicycles are allowed.
  - Facilitate the use of blueways with access points and routes free of impediments.
- Create an active transportation network within the SGAs and transit centers as the "hub" and "spokes" connecting to surrounding neighborhoods.
  - Implement a low stress pedestrian and bikeway network.
  - Design and implement facilities that separate people on foot, bicycle, etc. from cars and trucks with physical barriers.
  - Increase pedestrian safety and comfort with traffic calming measures, smaller turn radii at intersections and driveways, median refuges, and pedestrian-scaled lighting.
  - Increase bicyclist safety and comfort with turn queue boxes, intersection crossing markings, and designated traffic control devices.
- Continue constructing the Virginia Beach Trail. Nearly 1.5 miles of the Virginia Beach Trail have been constructed at the oceanfront, and a BUILD Grant application was submitted in 2019 to receive funding to complete the remaining 10.5 miles. As the top priority active transportation project for Virginia Beach, this trail will be a new commuter route and connects adjacent established neighborhoods and the Housing Resource Center to businesses, jobs, and the second largest commercial center in the City. The path is also an attractive amenity with many opportunities to encourage revitalization and trail-oriented development along the corridor.
- When plans for new subdivisions are approved, require paved trails between neighborhoods to provide pedestrian connections away from high-speed roads.
- Coordinate with federal, state, regional and local transportation organizations to include pedestrian, bike, blueway, and/or equestrian facilities in project development, and as a source of funding for pedestrian, bike, waterway, and equestrian projects.
- Integrate the Active Transportation Plan goals in planning and redevelopment processes, including the comprehensive planning, transit planning, and Complete Streets Policy.
- Continue to program Parks and Recreation CIP City Bikeways and Trails Plan Implementation for future active transportation projects with an emphasis on utilizing the appropriated funds to satisfy the required local match for state and federal grant applications; thus, generating local resources that have the potential of becoming a multiplier.
- Coordinate with City departments to implement identified on-street bike facilities through the City's cyclical repaving and/or restriping of roadways projects.
- Coordinate with utility companies, such as Dominion Energy, to create multi-use paths within utility rights of way.
- Develop signage on bridges and at intersections of streets and dedicated trails to educate the public about the City's network of waterways.
- Ensure that site planning for public schools, whether new construction or rebuilding projects, includes the establishment of Safe Schools travel routes from surrounding neighborhoods.

# Goal #2: Safety

**Create a safe, attractive experience for walking and bicycling throughout the City of Virginia Beach by providing convenient, connected, and equitable development of active transportation facilities.**

## Objectives

- Develop strategies that promote the League of American Bicyclists' six Es: Engineering, Education, Encouragement, Enforcement, Equity, and Evaluation and Planning.
- Reduce barriers to walking and bicycling across natural and man-made impediments, such as waterways, expressways, and railways, where there is currently no safe way to travel. In many cases, this may take the form of new pedestrian or bicycle bridges, such as the one proposed over I-264, just east of Town Center to Mount Trashmore, and highway underpass embankment paths.
- Continue to support efforts by the Virginia Beach Police Department to enforce laws against unsafe driving behaviors, such as speeding, reckless driving, and not stopping for pedestrians and bicyclists.
- Continue maintaining the City's existing bike and pedestrian infrastructure through Parks and Recreation CIP Bikeway and Trail Renovation and Repair to eliminate hazards and barriers to access, such as uneven pavement, cracked or heaving sidewalks, or missing or faded crosswalk striping.
- Revive traffic safety education in Virginia Beach City Public Schools to teach safe walking and bicycling habits. Launch a more robust Safe Routes to School program in Virginia Beach, which can provide funding and support for walking and bicycling programs in City schools and their neighborhoods.
- Continue to utilize programs such as the Transportation Safety Improvements (TSI) CIP to implement smaller scale projects with larger positive impact to pedestrian and bike safety.
- Continue installation of infrastructure such as bicycle racks and scooter parking to facilitate safe, attractive, and secure use of the alternative transportation network. Continue the Bike Buddies program to facilitate individual, group, or business sponsorship of bicycle parking at designated sites around the City.
- Work towards adopting a Vision Zero approach to implementing active transportation improvements.
- Integrate data from Virginia Beach Public Schools Safe Schools assessments, and prioritize remedial infrastructure projects enabling VBPS to maximize pedestrian and bicycling options for student travel to and from schools.
- Address personal safety using principals from Crime Prevention Through Environmental Design (CPTED), including frequent access points to trails, proper lighting, and planting and maintenance of slow-growing vegetation to improve visibility.

Leaf-shaped bicycle racks installed by the Bike Buddies program.

# Goal #3: Economic Vitality

**Create an active transportation network that supports a strong and thriving local economy by increasing commuting options, enriching recreational and tourism opportunities, promoting public health, and making the City an even more attractive place to live and work.**

## Objectives

- Develop an interactive map for finding pedestrian, bicycle, and micromobility options throughout the City, available both for mobile electronic devices and on desktop computers. This map should allow for route planning, finding facilities near a given point of entrance, and time and distance estimates.
- Coordinate with local Transportation Demand Management (TDM) organizations to market active transportation throughout the City for recreation, tourism, and for every day travel, including connections to local and regional transit options.
- Work with the SGA Office to create a Transportation Management Model for each of the Strategic Growth Areas, which will promote active transportation and transit options for visitors, residents, shoppers, and employees.
- Evaluate the quality of the active transportation network based on proximity to dwelling units and jobs, including the percentage of jobs located within a quarter-mile of mass transit. This allows the City to identify gaps in mass transit service, as well as gaps in walkability, bikeability, and ADA access.
- Discuss with the Planning Department the introduction of flexible zoning requirements or incentives to create more pedestrian and bicycle infrastructure in existing business districts or redevelopment projects.
- Work with stakeholders in Virginia Beach Town Center to promote a pedestrian connection over I-264 to Mount Trashmore.
- Coordinate with the Planning and Public Works Departments on land use planning to ensure that as mobility options increase and diversify, opportunities to access goods and services do so as well. Effective transportation networks allow users to travel and access destinations and opportunity.
- Support increased tourism and trip generation through the Resort Area Strategic Action Plan (RASAP 2030). Focus on development and implementation of a Mobility Plan as a top priority.
- Engage with businesses that provide and support active transportation services to ensure their input is heard as the network is implemented. From bike/scooter/kayak rental businesses to eco-tourism and race operators, equipment retailers, destination sites, and lodging operators. The existing segment of the Virginia Beach Trail through the VIBE District demonstrates the economic value of public investment in trails.

Aerial view of the South Beach trail over Lake Holly.


Town Center is an attractive place to walk to shops, dining and entertainment venues.

# Goal #4: Technology

**Craft strategies and guidelines to prepare our streets for changing needs and technologies, including ridehailing, micromobility vehicles like electric bicycles and scooters, and autonomous vehicles.**

## Objectives

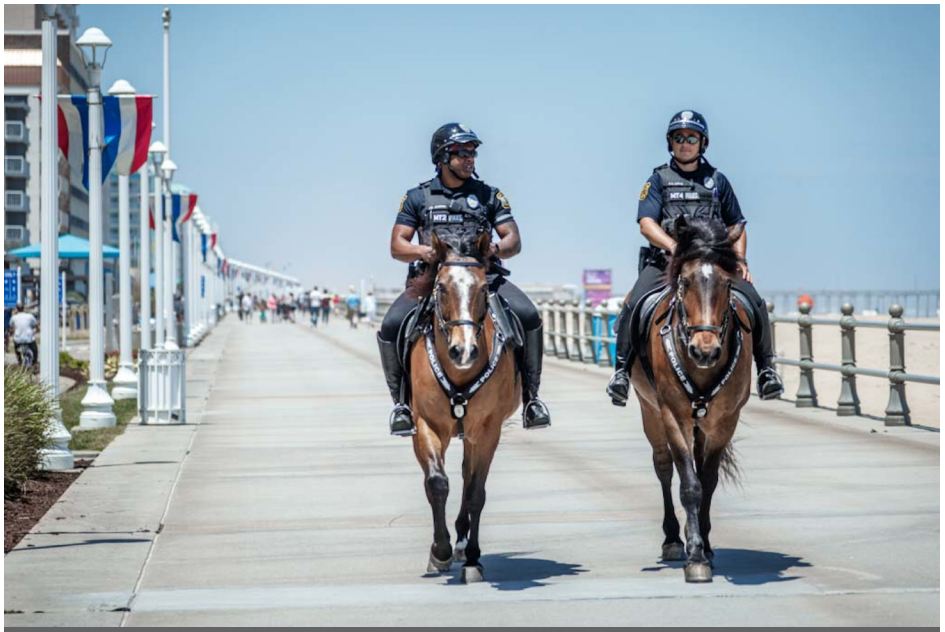
- Develop typical cross sections for City streets that accommodate emerging travel modes, including ridehailing vehicles, e-bikes, scooters, autonomous vehicles, and dedicated transit lanes.
- Design street improvements within and between the Strategic Growth Areas that are accessible to all transportation modes.
- Develop policies and guidelines for micromobility vehicles like e-bikes and scooters, including how and where to use them on sidepaths, bike lanes, and streets, as well as parking.
- Design the Virginia Beach Trail for efficient use of the former Norfolk-Southern right-of-way by other modes of transportation.
- Promote identified active transportation routes through online marketing initiatives and open source data. Enhance the City's existing mobile interface See-Click-Fix to allow residents to report concerns and suggestions for the active transportation network. Crowd-sourced input engages the community and allows the City to monitor changing conditions.
- Create a task force that includes the Active Transportation Planner, Transportation Planner, and Public Works Traffic and Transportation Engineering staff members to review Appendix A of this document for inclusion in the updated Public Works Design Manual.

# Goal #5: Health

**Support public health benefits by creating an active transportation network that values and supports physical activity for people of all ages and abilities.**

## Objectives

- Identify gaps in the existing pedestrian and bicycle network, and develop a plan to fill those gaps, giving priority to facilities that connect people to jobs, shopping, schools, parks, and other community destinations.
- Coordinate with the Virginia Beach Parks and Recreation, Department of Public Health, health care providers, and Virginia Beach City Public Schools to promote walking and bicycling as a transportation option that supports improved health.
- Promote walking, bicycling, and paddling as a tool for environmental stewardship.
- Develop "walking circuits," or easy to identify walking routes within parks and neighborhoods with signs and unique branding. These routes could offer safe, accessible paths for recreation and help direct people to nearby destinations such as schools, shopping centers, and transit.
- Identify high conflict areas in existing pedestrian and bicycle facilities, such as where bike trails cross sidewalks, and improve pavement markings and signage to reduce the potential for user confusion and collisions.
- Coordinate with local liaisons from the Department of Veterans Affairs and Department of Defense installations to promote the active transportation network for both rehabilitation and ongoing fitness goals.



Virginia Beach police officers patrolling on horseback at the Boardwalk.

Bicycling on a bike lane.

# Section 2 | Public Process

As part of this plan, the City of Virginia Beach conducted extensive community outreach to best understand the needs and wants of people who live, work, and visit the City. The efforts of this plan's public process build upon the data collection and outreach and engagement undertaken during a previous phase of this project in 2017. As part of this approach, the City collaborated with internal and external stakeholders, the Bikeways and Trails Advisory Committee, as well as the greater community through face to face and online outreach and engagement methods.

## Stakeholder Meetings

During the spring of 2019, the project team spoke to community members, organizations, and City agencies that work closely on pedestrian and bicycle issues in Virginia Beach. The information collected from those meetings was used to inform the development of the draft pedestrian and bicycle network. They included:

- A Technical Committee made up of Virginia Beach city staff who work closely on pedestrian and bicycle issues, including the City's Active Transportation Planner and representatives from agencies including Parks and Recreation, Public Works/Traffic Engineering, Transportation Planning, Planning and Strategic Growth, and GIS/Information Technology.
- Representatives from other City agencies, including the City Manager's Office, Virginia Beach City Public Schools, and Departments of Economic Development, Housing and Neighborhood Preservation, Cultural Affairs, and Public Works/Facilities.
- The City of Virginia Beach Bikeways and Trails Advisory Committee (BTAC), a City Council appointed committee that meets regularly to discuss bicycling and trail topics and advise City Council. This committee has representatives from the Virginia Beach City Council and Planning Commission, neighborhood citizen advisory committees, local businesspeople, and residents.

The first stakeholder meeting, held April 18, 2019, launched this project and introduced participants to different types of pedestrian and bicycle facilities, how bicycle networks are designed, and the process that the project team would use to design an active transportation network in Virginia Beach. The project team also asked participants to share their goals for the Active Transportation Plan, which was used to craft an approach for later community outreach.

An active boardwalk in Virginia Beach.

A month later, on May 20, 2019, the project team held meetings with the Technical Committee and BTAC to update each group on the plan's progress. Each group participated in a charrette, or design workshop, where members used large-scale maps to identify where they would like new pedestrian and bicycle facilities to go, important destinations for walking and bicycling in the City, and locations that were barriers to walking and bicycling. This information was digitized and added to an online, interactive map, where it could be incorporated into the draft active transportation network.

# Connecting with the Public

Starting in the summer of 2019, the project team expanded their outreach to the City as a whole, asking community members for their input. The Virginia Beach Parks and Recreation Department Office of Marketing and Branding invited community members to participate via its email list, which has over 50,000 subscribers, a Facebook page with more than 30,000 followers, the Parks and Recreation Department website, and a press release. In addition, all seven recreation centers in Virginia Beach had a display with information about the Active Transportation Plan, allowing people to learn about it and directing them to the survey.

The City's Active Transportation Planner also held a series of presentations and input gathering sessions to various City Council appointed commissions, including the Planning Commission, Bikeways & Trails Advisory Committee, the Bayfront Advisory Commission, the Resort Area Commission Planning/ Design Review Committee and Transportation Parking Pedestrian Committee, and the Transition Area/Interfacility Traffic Area Citizens Advisory Committee.

The project team collected input from the public in two ways. An online survey asked community members specific questions about their bicycling and walking habits and asked for feedback on potential goals and priorities for the Active Transportation Plan. In addition, there was an online interactive map, where community members could provide specific information about important destinations, desired routes, network gaps, challenging crossings, and informal connections. Participants could drop specific points on the map for destinations, or crash hotspots, or locations that are difficult to navigate by bicycle or walking. Respondents were also asked to add routes where they wish they could ride, or routes they use now to access their desired destinations.

The goal of this outreach was to capture the largest possible audience base and the significant portion of the population who now rely on or prefer electronic communication. The public comments received were collected, analyzed, summarized, and used to identify existing conditions, needs, and opportunities for the active transportation network. The data collected from the online interactive map was disaggregated by basic demographic information of zip code, gender, and race, to best understand the needs of different segments of Virginia Beach's population.

The full contents of the online survey are included as Appendix B. The survey carries a 95% confidence level and 3% margin of error when comparing 1448 responses against a population of 457,832 Virginia Beach citizens with an industry standard set at a 95% confidence level target.

# Evaluation of Public Participation

This plan would be incomplete without the contributions of a wide cross-section of Virginia Beach community members. Having a high degree of participation in the stakeholder meetings, interactive map, and online survey ensures that the resulting pedestrian and bicycle network reflects the community's needs, and that the community has consensus on the Active Transportation Plan's goals.

Throughout this process, the project team closely monitored its public outreach tools and strategies, making adjustments as needed to increase engagement. The following is a list of the outreach strategies the project team used, and the information from community members that was used to increase public participation.

Future Virginia Beach Trail within city-owned transportation corridor (former NSSR Corridor).

### Outreach Strategies and Potential Information Collected

| Outreach Strategies | | Information Collected |
|---|---|---|
| **Online** | Social Media Posts | Number of posts, shares, and potential reach data |
| **Stakeholder Meetings** | Community Meetings | Number of meetings, geographic analysis |
| | Attendance | Total attendance |
| | Input collected | Onsite polls, surveys, and comments |
| **Input** | Survey Responses | Number of responses |
| | Mapped comments | Number of mapped comments received |
| | Citizen Satisfaction Survey | Questions posed at outreach events |
| | Comments Received | Number of comments received for the period |
| | Comment Categorization | Summary of topics and evaluation |
| | Comment Use | Identify needs to update information and materials or adjust plan |
| | Citizen Recommendations Used | Summary |
| **Database** | Stakeholder Database | Total number of contacts |
| | Number Added | Number of contacts added during the period |
| **Outreach** | Email Updates | Number of updates |
| | Email Distribution List | Number of email addresses |
| | Email Opens/Click-Through Rate | Number and/or percentage of click-throughs |
| | Responses to Email Inquiries | Number of responses |
| **Media** | Media Coverage | Number of stories or mentions |
| **Participation** | Demographics, Participant Details and habits | Collected through surveys |

*Table 4: Outreach strategies and potential information collected.*

# Approval

Following the stakeholder meetings and public engagement period, the project team presented its findings, as well as the draft active transportation network, to the technical committee, various City Council appointed committees and commissions, and Virginia Beach Planning Commission for review and to answer any questions that arose.

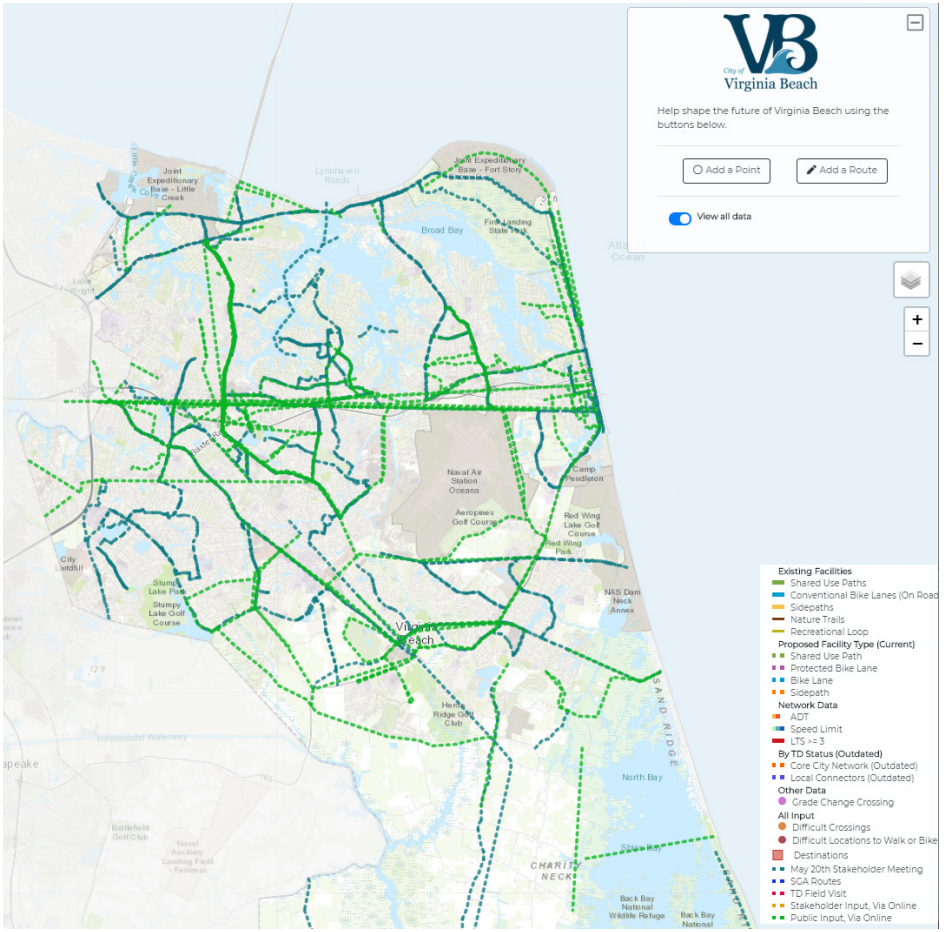



*Figure 2: On-line interactive map*

# Section 3 | Feedback

During the public engagement process, people across Virginia Beach gave feedback about their experiences walking or bicycling in the City. The following is a summary of what they said, which later shaped the Active Transportation Plan goals and network.

## How People Get Around

The City received over 1400 responses in its online survey, which indicated that Virginia Beach residents like to walk and bike and want opportunities to walk and bike more. Sixty-one percent of survey respondents said they bicycle for recreation "frequently" or "very frequently", while 75% of survey respondents said they walk for recreation "frequently" or "very frequently." Residents would also like to use active transportation for running errands or going to work: 70% said they would like to walk, and 64% said they would like to bike.

A majority of survey respondents said that road safety for pedestrians is "fair", "poor", or "very poor".

Despite a strong interest in active transportation, most survey respondents (77%) felt they could not walk or bike as much as they'd like to. Nearly three-quarters, or 74%, felt they could not get where they want to go by foot or bicycle. Safety was a primary concern: 59% of residents said road safety for pedestrians in Virginia Beach is "poor" or "very poor", while 33% said it was "fair," and just 9% of respondents said road safety is "good" or "very good" (Figure 5).

This aligns with feedback received from stakeholders during in-person meetings, who said that active transportation in Virginia Beach is "disconnected", "limited", and "unsafe", but said there was also "potential" to improve it. Stakeholders identified several challenges to walking and bicycling in the City, including traffic, a lack of walking or bicycling paths, and barriers like major roads (particularly I-264), military installations, and waterways.

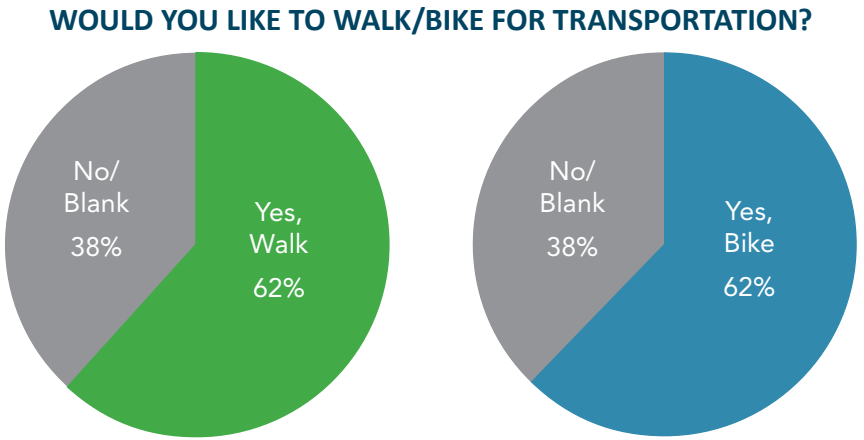



*Figure 3: Percent of survey respondents who would like to walk (left) or bike (right) for transportation varies dramatically from current walking and biking for transportation rates.*

# Facility Preferences

Both in the online survey and at stakeholder meetings, respondents preferred active transportation facilities where people could walk or bicycle away from car traffic. The online survey asked respondents what kind of facilities would encourage them to bicycle more often, with the ability to select more than one type of facility. Of the 1448 respondents, 982 selected shared use paths, 845 selected separated bike lanes, and 730 selected improved crossings (Figure 4). In addition, 331 people selected bicycle boulevards, which are narrow, typically residential streets that are designed to slow motor vehicle traffic and make bicycling more comfortable but have no physical separation from drivers.

Likewise, stakeholders at in-person meetings listed several priorities for improving the active transportation network, including more trails and separated bikeways, and safer intersection crossings.

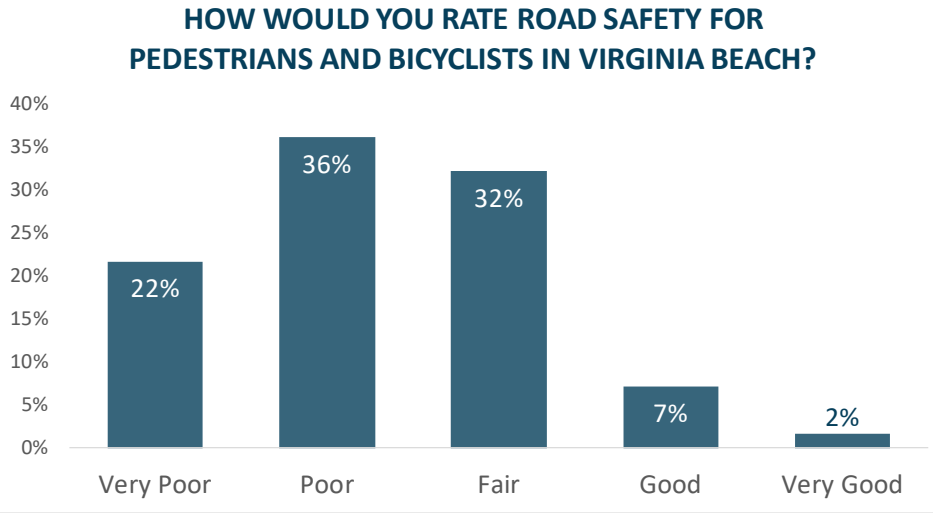



*Figure 5: Only 9% of respondents said road safety is "good" or "very good."*

# Focus Areas

Community members identified several areas where they would prefer to see improved active transportation infrastructure. At the stakeholder meetings, participants said they want better east-west access, highlighting the demand for development of the Virginia Beach Trail within the former Norfolk Southern railroad corridor, and safe north-south connections over or under I-264. They also want better connections to major employers, Virginia Beach Town Center, and the beaches.

# Support for the ATP Goals

The five Active Transportation Goals listed earlier in this chapter (Connectivity, Safety, Economic Vitality, Technology, and Health) were developed with considerable input from community members, who strongly supported the draft goals presented in the online survey. Between 78% and 80% of respondents said they "strongly agree" with each goal, while 14% to 15% of respondents said they "somewhat agree" with each goal.

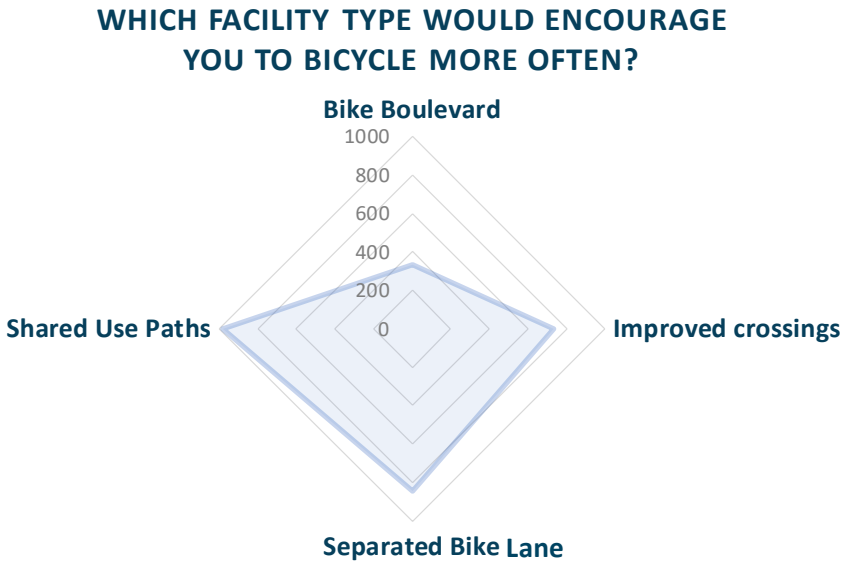



*Figure 4: Survey respondents prefer shared use paths and separated bike lanes.*

# Demographics

The online survey received a significant number of responses. Of the 1448 people who participated in the survey, 98% lived in the City of Virginia Beach, and the remaining 2% were based in neighboring communities, such as Chesapeake and Norfolk. Survey respondents were evenly distributed throughout the City: 21% came from zip code 23451, 15% from zip code 23456, and between 10% and 13% of respondents lived in zip codes 23452, 23454, 23455, 23462, and 23464. 6% of respondents came from zip codes 23453 and 23457 (Figure 6).

51% of respondents identified as female, comparable to the City's demographics, while 43% identified as male. 6% identified as non-binary or a third gender or did not list their gender.

79% of respondents identified as white, a substantially greater share than the City's population, which is 68% white. Just 4% of respondents identified as Black (compared to 20% of the City's population), 2% identified as Asian (compared to 7% of the City's population), and 1% each identified as American Indian or Pacific Islander. The remaining 13% did not list a racial category.

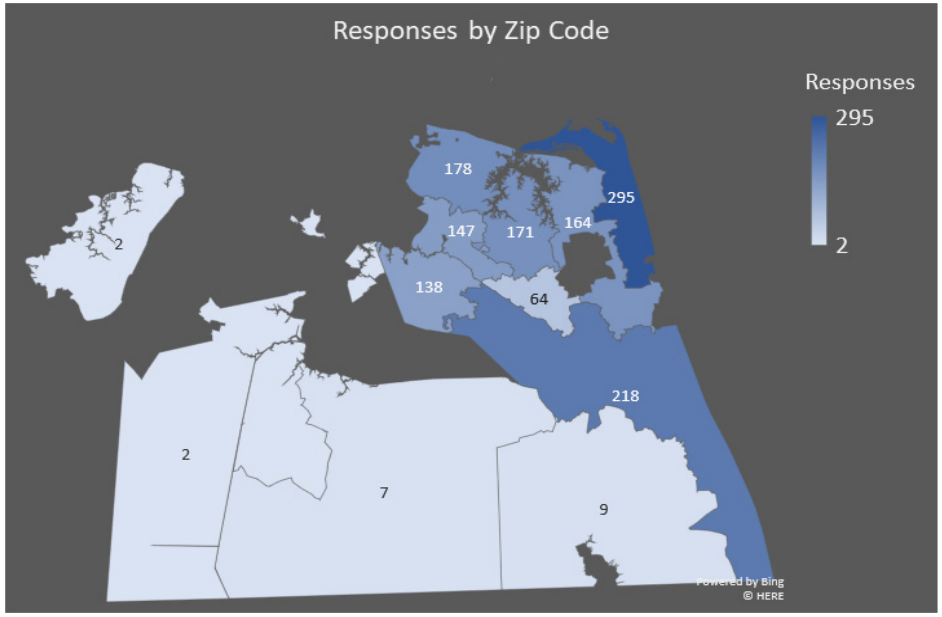



*Figure 6: Distribution of survey responses by zip code.*

Survey respondents felt that active transportation in Virginia Beach was "disconnected", "limited", and "unsafe."


Gaps in sidewalk connectivity on Seaboard Road force pedestrians into roadway.


*Figure 7: Dashboard of survey responses*

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# CHAPTER 3 | NETWORK

# CHAPTER 3 | NETWORK

In the very near future, the City of Virginia Beach will be a place where people of all ages and abilities can walk, bike, or scoot to all places safely and comfortably. This chapter describes the proposed active transportation network, which will provide low-stress routes to neighborhoods and destinations throughout Virginia Beach. It will explain the concept of a low-stress network, how the Active Transportation Plan goals shape the network, and how the project team developed the routes in the network.

## What is a Low Stress Network?

Residents and visitors of all ages and abilities feel comfortable traveling in a low stress network. As the large demographic cohorts of Millenials and Generation Z age and transition through life's phases, the network will be in place to continuously meet their changing needs: from getting to schools, commuting to work, and eventually engaging in middle age and senior recreational activities.

In a low stress network, sidewalks are continuous and meet Americans with Disabilities Act (ADA) requirements for accessibility. Bicycle facilities provide separation from fast-moving motor vehicle traffic. Trails are designed to accommodate the anticipated number of trail users. At intersections and crossings, people have a clear, well-marked place to cross without risk of vehicle collisions. All users of the public right-of-way are safely and comfortably provided for in this low-stress active transportation network. Multimodal transit opportunities will exist to seamlessly and easily allow travelers to complete their routes using a combination of modes.

The Active Transportation Plan calls for a connected, low-stress network for people walking, bicycling, paddling, traveling by wheelchair, using micromobility, or riding transit. This can be accomplished through analysis, network planning, and design guidance, which are explained in this chapter and in the following chapters.

| Low-Stress Networks are for all users, including: | Facilities in Low-Stress Networks include: |
|---|---|
| • Children<br>• Seniors<br>• Tourists<br>• Commuters<br>• People from all backgrounds<br>• People of all income levels<br>• People with disabilities<br>• Transit riders<br>• Bikeshare users<br>• Confident bicyclists | • Well-maintained sidewalks with buffers<br>• ADA-accessible curb ramps with detectable warning surfaces<br>• ADA-accessible curb extensions<br>• ADA-accessible blueway launch points<br>• Audible pedestrian signals<br>• Bicycle signals<br>• High-visibility and raised crosswalks<br>• Median refuge islands<br>• Bicycle boulevards<br>• Buffered and separated bike lanes<br>• Sidepaths and shared use paths<br>• Wayfinding<br>• Designated parking sites for bikes & micromobility devices |

*Table 5: Low-stress network users and infrastucture components.*

## How the Network Aligns with the Plan Goals

Chapter 2 describes the goals of the Active Transportation Plan, which were developed with input from community members. These goals shaped the proposed network, which is presented in further detail on the following pages.

# Network Inputs

Development of Virginia Beach's active transportation network was a collaborative effort, as the project team strove to create a vision that serves everyone in the City and reflects the needs and concerns of all users. As explained in previous chapters, existing plans, studies, and conditions were used as a foundation for the recommendations in this plan. The team also used new strategies and tools that have emerged since previous planning efforts.

To understand where the desire for active transportation exists, a demand analysis was performed to predict areas of the City that would have high demand for pedestrian and bicycle facilities (Figure 8). This analysis built upon the public feedback received to encompass people and communities who may not have participated in order to create the most cohesive analysis. It considers several factors that community members said were important, including population density, proximity to major job centers and popular destinations, and proximity to transit. The analysis identified several areas that could support additional walking and bicycling routes, notably each of the City's eight Strategic Growth Areas, the Independence Boulevard corridor, Seaboard Road, and the Bayfront.

With these two pieces of information in hand, community stakeholders were able to provide feedback on the current walking and bicycling experience in Virginia Beach and opportunities for improvement. The City collected public feedback to understand what the community's wants and needs were, a process that included an interactive map where community members and City staff could provide crowdsourced recommendations for new active transportation routes and safety improvements.

The project team also assessed the presence and condition of existing active transportation infrastructure from data provided by the City and aerial and satellite imagery. Based on this effort, the demand analysis, and the public feedback, a study network was developed to identify key gaps in the pedestrian and bicycling network. This study network was further investigated in person during a three-day fieldwork trip.

| Goal | | Impact on Network |
|---|---|---|
| **Connectivity** | Grow the City of Virginia Beach into a complete transportation network that integrates active transportation into the lifestyles of the communities for the enhanced health, safety, and welfare of all users. | **Proposed pedestrian and bicycle facilities will connect to one another and to existing facilities, providing access to neighborhoods and destinations throughout the City.** |
| **Safety** | Create a safe, attractive experience for walking and bicycling throughout the City of Virginia Beach by providing convenient, connected, and equitable development of active transportation facilities. | **The proposed network provides safe and comfortable routes for walking and bicycling, and alternatives to walkng bicycling on high-stress roadways.** |
| **Economic Vitality** | Create an active transportation network that supports a strong and thriving local economy by increasing commute options, enriching recreational and tourism opportunities, promoting public health, and making the City an even more attractive place to live and work. | **Pedestrian and bicycle facilities offer more transportation options at a relatively low cost, using taxpayer funds more efficiently, while supporting access to jobs, education, and tourist destinations. Active transportation produces accessible neighborhoods, thus attracting new residents and tourists to a higher quality of life in a complete live, work, play community.** |
| **Technology** | Craft strategies and guidelines to prepare our streets for changing needs and technologies, including ridehailing, micromobility vehicles like electric bicycles and scooters, and autonomous vehicles. | **The proposed network will create safe, comfortable routes for emerging technologies, particularly micromobility vehicles, and complement other emerging travel modes.** |
| **Health** | Support public health benefits by creating an active transportation network that values and supports physical activity for people of all ages and abilities. | **Greater access to walking and bicycling facilities gives people more chances for physical activity, improving public health. The Surgeon General's 2015 call to action promotes walkable communities to promote a healthy lifestyle.** |

*Table 6: Influence of active transportation goals on the proposed network.*

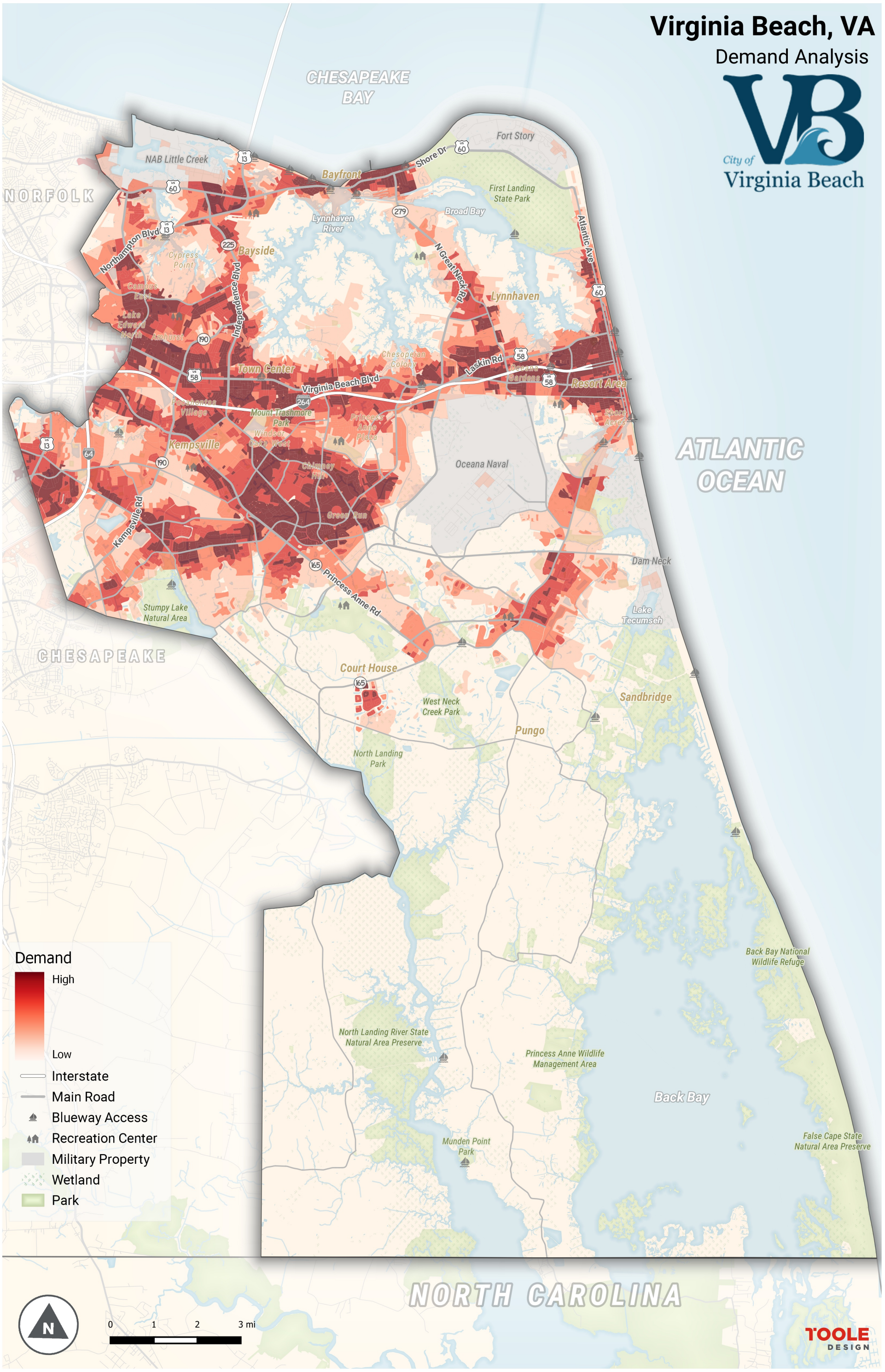



*Figure 8: The demand analysis identified areas where walking and bicycling infrastructure is needed.*

The Neptune Statue along the Oceanfront Boardwalk.

## Community Access

A key function of the low-stress network is to connect Strategic Growth Areas (SGAs), proposed transit centers, and Virginia Beach's community assets, including museums, libraries, business districts, recreation centers, and schools. For students, pedestrian/bicycling commuting zones are authorized by Virginia Beach Public Schools to be up to one mile for each elementary school and up to 1.5 miles for each secondary school. Currently, active commuting zones are much less at many schools due to lack of sidewalks and other safe travel concerns.

Connecting these resources with pedestrian and bikeway facilities ensures equitable access for all residents and visitors of Virginia Beach. The "hub and spoke" model in Figure 9 helps to illustrate the areas of community interest and general need for connections between these concentrations.

First day of school at Thoroughgood Elementary School, Courtesy of Virginia Beach City Public Schools.

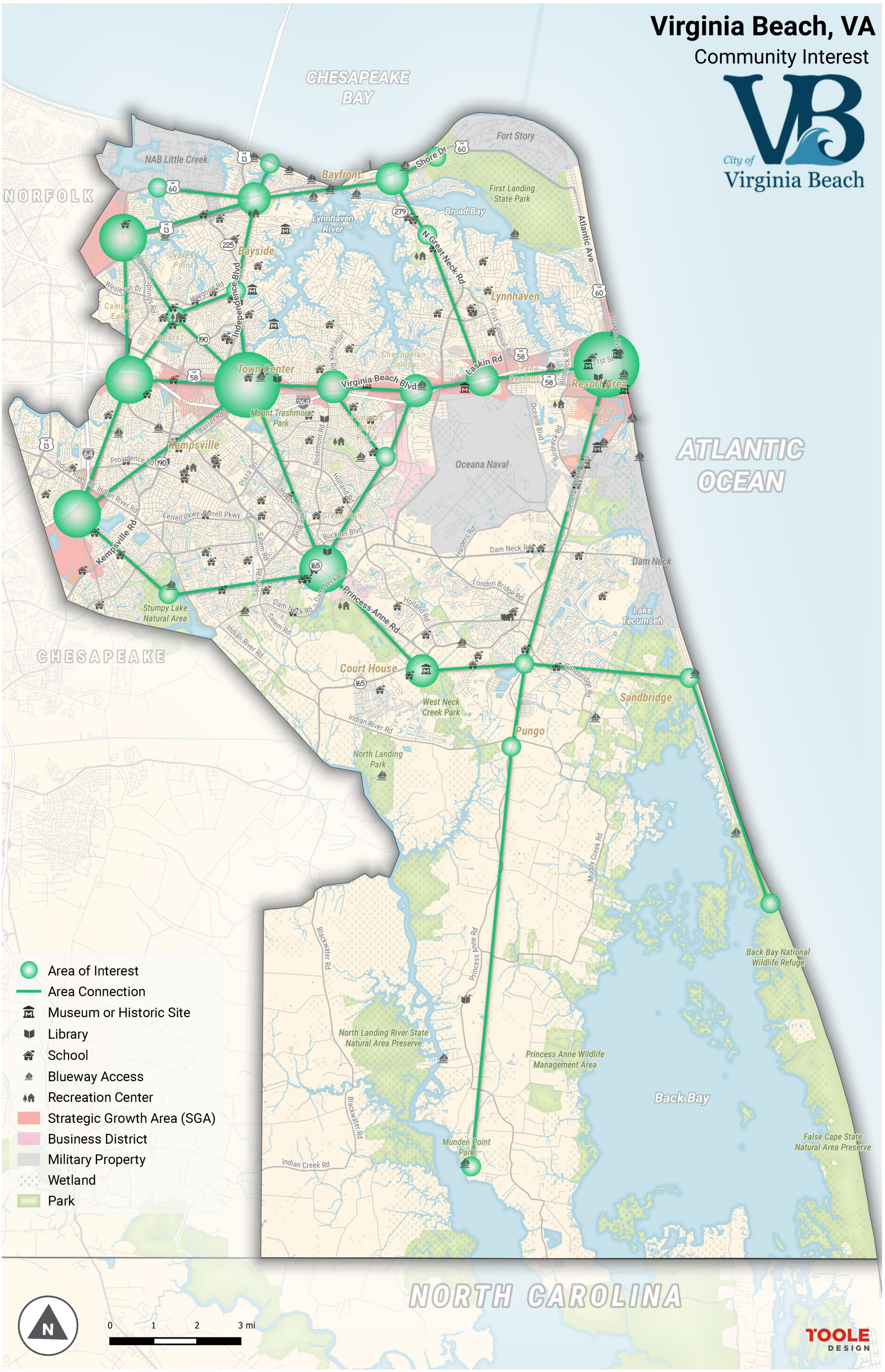



*Figure 9: Community areas of interest that should be connected by active transportation facilities*

## Fieldwork and Network Development

Fieldwork was conducted in the summer of 2019 on the study network routes to investigate existing facilities and routes that had potential for improvement, with a focus on areas with a high pedestrian or bicyclist crash rate (Figure 10). This analysis focused on facilities that can support walking and bicycling for transportation. The analysis did not look at unpaved trails or trails within parks. During this phase, the team focused on identifying on-road facilities that would provide low-stress routes for all users.

The fieldwork revealed that the walking and bicycling experience in Virginia Beach varies widely. Some areas, particularly Bay Area/Cape Henry Trail, Dam Neck/Nimmo/Princess Anne Road, Oceanfront, and General Booth/Birdneck/Norfolk Ave Trail Loop, are in excellent condition and have ample space for people to walk or bike safely and comfortably. Others need repair or do not provide complete protection from motor vehicle traffic. In much of the City, particularly older communities in the northern and western portions of the city, there were notable gaps between safe walking and bicycling facilities, or none were present at all.

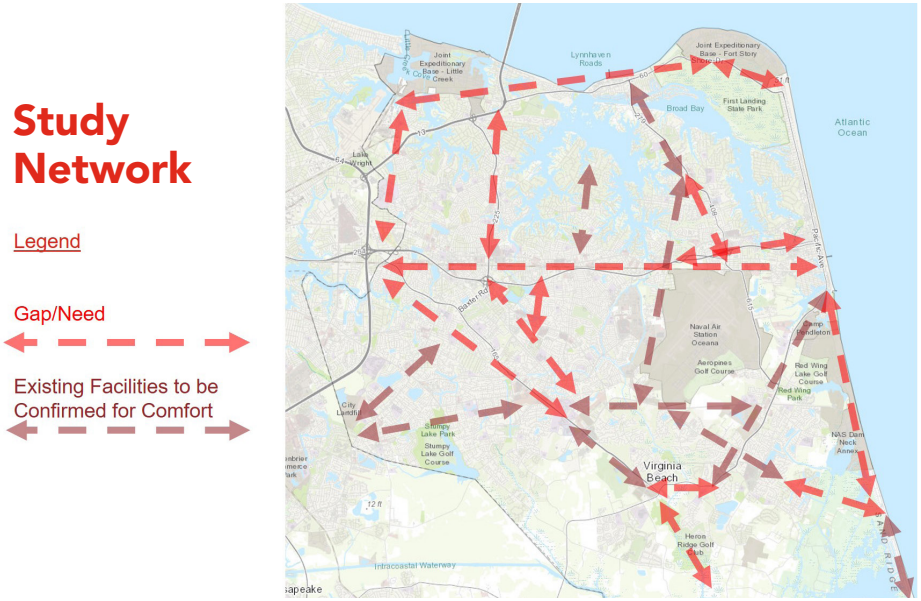



*Figure 10: The study network used to identify potential routes in the Active Transportation Network.*

Each corridor was assessed to determine if a low-stress facility was present on that route, and if not, if a low-stress facility could be installed. If space or conditions did not permit installation, the analysis determined if an alternative route was available. The project team identified five types of pedestrian and bicycle facilities that are currently on the ground in the City of Virginia Beach (Figure 11):

- Shared use paths, which have ample room to accommodate both pedestrians and bicyclists and are located adjacent to a street.
- Trails, which pedestrians and bicyclists share and are located away from a street.
- Sidewalks, which are defined by Public Works as five feet wide concrete facilities. Sidewalks are not included in this inventory.
- Sidepaths, which are located adjacent to a street, are designed for pedestrians but may have enough room to accommodate bicyclists. They are narrower than a shared use path and may not have a buffer between users and motor vehicle traffic. Sidepaths were previously identified as wide sidewalks in the Bikeways and Trails Plan (2011).
- On-street bike lanes, which may or may not have a buffer between bicyclists and motor vehicle traffic.

Moving forward, and for the purposes of this plan, the term "sidepath" is intended to replace the term "wide sidewalk" as consistent with national standards and recognized by the Virginia Department of Transportation. AASHTO's Guide for the Development of Bicycle Facilities (2012) defines a sidepath as "a shared use path located immediately adjacent and parallel to a roadway." Sidepaths are recommended to be wide enough for both pedestrians and bicyclists if space allows. Defining wide sidewalks as sidepaths allows for current substandard sidepaths to be upgraded to AASHTO-standard sidepaths or shared use paths.

There are also facilities that may be marked walking or bicycling routes, such as soft dirt trails or wide outside travel lanes shared by bicyclists and motor vehicles. These facilities may not provide the same level of comfort or protection for users and were not included in the fieldwork.

The fieldwork also assessed thirty-five intersections throughout the City where a high number of pedestrian and bicycle crashes have occurred, and developed recommendations for reducing the likelihood of future collisions.

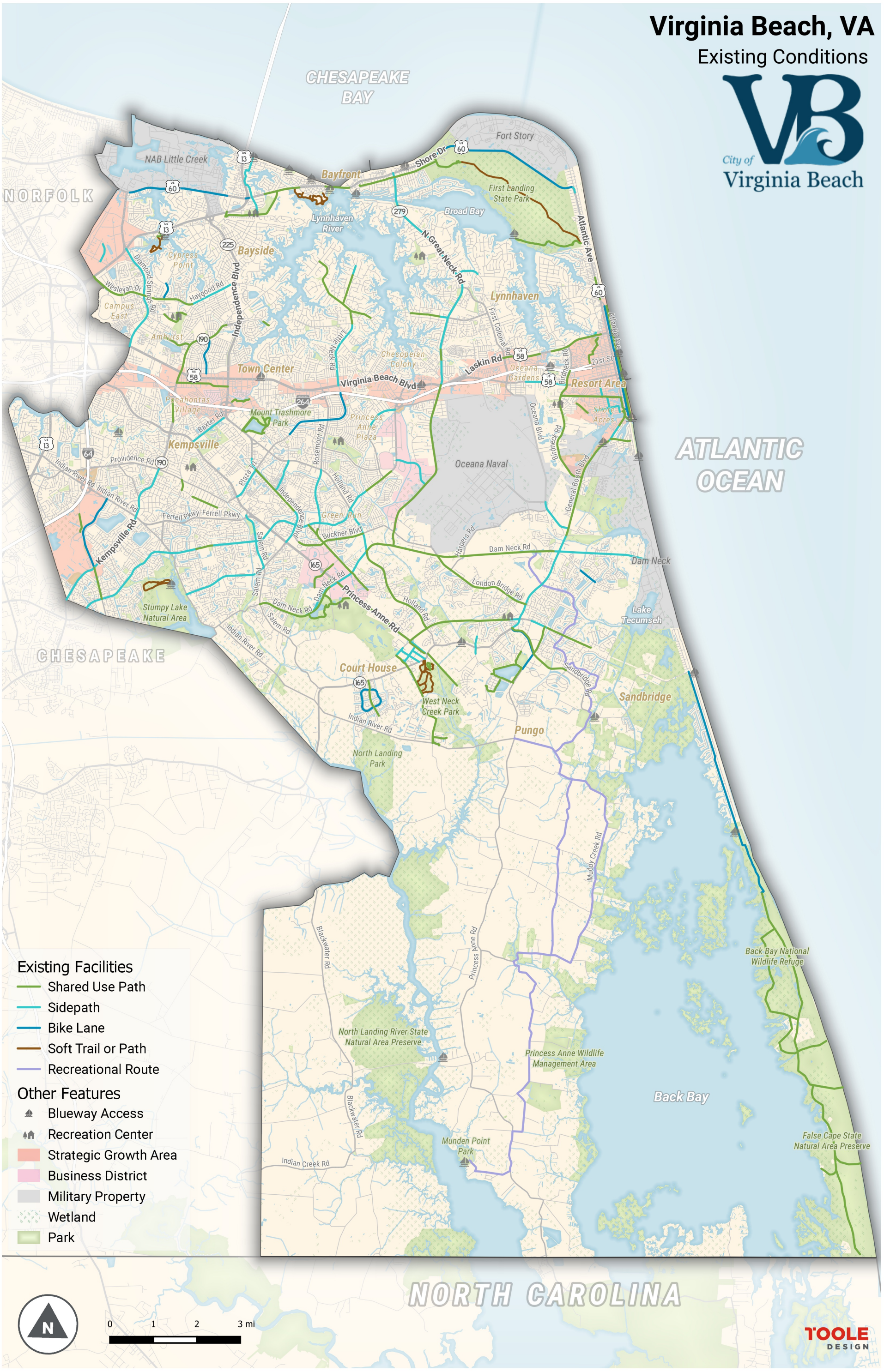


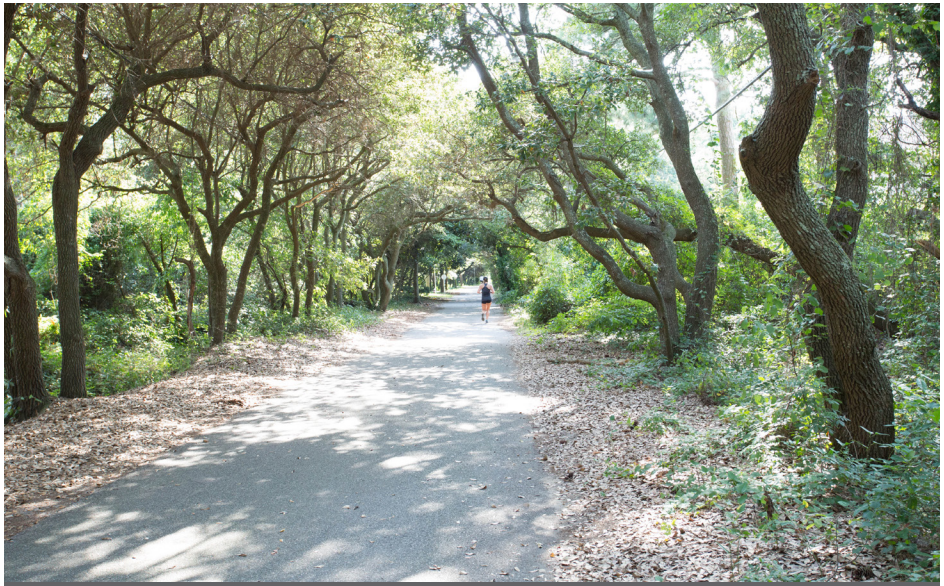

*Figure 11: Existing Active Transportation Facilities, includes approved and funded capital improvement projects in the process of being designed or built*

Table 7 is a chart listing the length of each type of pedestrian and bicycle facility in the City today, and Figure 12 is a graph showing the percentages of each type of facility as part of the existing network.

The project team investigated each of the corridors in the study network and, for those that need improvement, selected one of three preliminary recommendations:

- place a low-stress facility on that route
- place a low-stress facility on a parallel route with fewer constraints
- identify existing facilities on that route that could be upgraded to low-stress facilities

From there, the project team recommended specific types of bicycle facilities for each corridor, based on observations from fieldwork, the design and configuration of that street, and feedback from community members. This will be described in further detail in the Pedestrian Recommendations and Bicycle Recommendations sections of this document.



Cape Henry Trail in First Landing State Park.

| Existing Facilities | Existing Mileage* |
|---|---|
| **Shared Use Path** | 69.5** |
| **Signed Shared Route** | 37 |
| **Sidepath / Wide Sidewalk** | 55.7 |
| **Soft Trail or Path** | 36*** |
| **Paved Shoulder** | 48 |
| **Bike Lane** | 21 |
| **Wide Outside Lane** | 68.6 |
| **Total** | **335.8** |

*Table 7: Existing Facility Mileage*

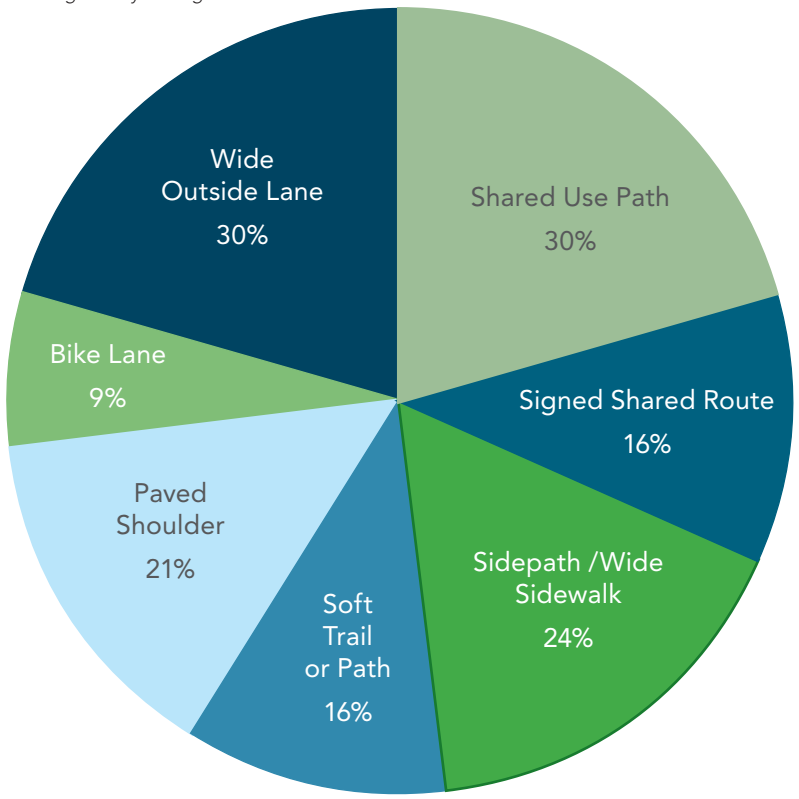



*Figure 12: Existing Mileage of Active Transportation Facilities*

*Includes funded capital improvement projects in process of being designed or built

**10 miles of which are substantial networks within parks

***Includes City of Virginia Beach (9 miles) plus state/federal (27 miles) within city limits

# The Network

The Active Transportation Plan envisions a network that functions as a unified, connected whole. Virginia Beach today has many barriers, particularly the water, military installations, and major roadways like I-264, that prevent direct connections between different parts of the City. These barriers discourage people walking or bicycling by requiring them to take long, circuitous routes, or even preventing certain trips from being made altogether.

When completed, the active transportation network will provide safe, comfortable access for anyone walking or bicycling in Virginia Beach, by creating low-stress routes that directly connect destinations. The network fills in gaps between existing bicycle and pedestrian facilities, which both eliminates barriers and leverages the City's previous investments to significantly improve access. It also creates new routes where they do not exist now, by upgrading existing sidewalks into separated paths or bike lanes and creating new off-street trails. This network will also expand access to low-stress walking and bicycling facilities.

The project team conducted a Level of Traffic Stress analysis for each street in Virginia Beach, measuring how stressful the walking or bicycling experience is based on traffic speed, the number of travel lanes, and the separation between pedestrian or bicycle facilities and vehicle traffic (Figure 13). This analysis found that most streets in Virginia Beach are low-stress routes, many of which are small residential streets that carry little through traffic. Larger streets, such as collector roads and major arterials, are high-stress walking and bicycling routes. This is especially acute in the Strategic Growth Areas and along Virginia Beach Boulevard, which along with I-264 form barriers for north-south walking and bicycling trips across the City. Some routes in Figure 13 may be represented as high-stress if there is a combination of standard and substandard facilities. The Level of Traffic Stress analysis calculates a higher stress level if there are gaps in a low-stress facility. Improvements to high-stress routes are crucial to the active transportation network. The ability to walk and bike safely along or across them is the difference between whether people view active transportation solely for recreation or very short trips, and whether it can be used as transportation to jobs, shopping, schools, or other activities.

Scooter and bicycle parking on Atlantic Avenue.

Many of the streets in the network are large thoroughfares that provide important connections in the City of Virginia Beach, allowing people to travel between neighborhoods, to access daily needs, and to commute to work or school. These streets also typically have large rights-of-way, high speeds, and heavy traffic volumes, which may make them difficult or dangerous to walk or bicycle on or across. This network focuses on these corridors, as they are an opportunity to improve walking and bicycling access and make active transportation a viable choice for as many residents and visitors as possible. In order to support an active transportation network within the confines of an existing right-of-way of these corridors should be analyzed for vehicular travel lane reduction, in width and/or number, to promote a Complete Streets community with destinations accessible to all.

**Improvements to high-stress routes are crucial to the active transportation network. The ability to walk and bike safely along or across them is the difference between whether people view active transportation solely for recreation or very short trips, and whether it can be used as transportation to jobs, shopping, schools, or other activities.**

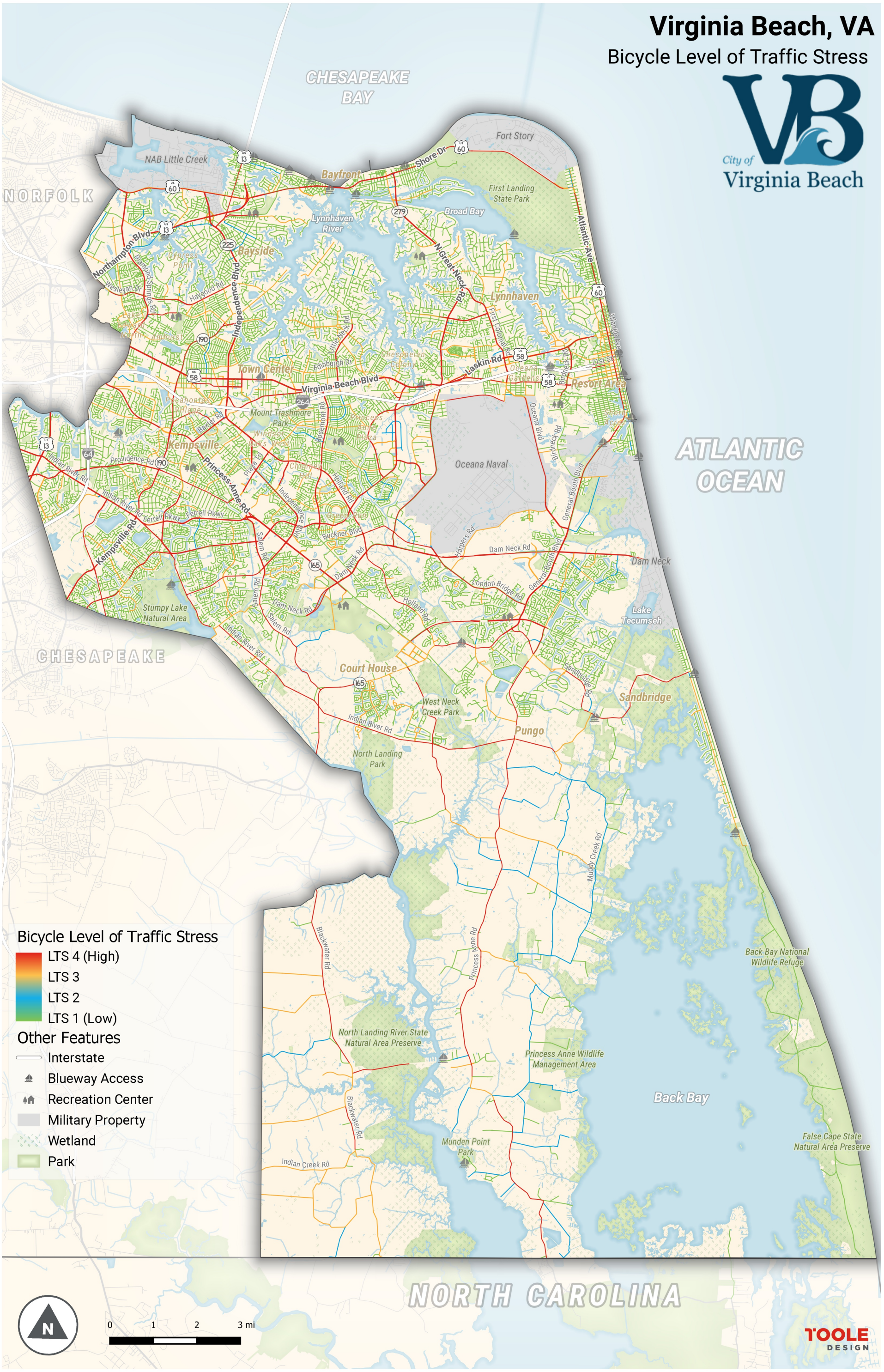



*Figure 13: Bicycle Level of Traffic Stress shows how stressful the bicycling experience is based on traffic speed, the number of travel lanes, and the separation between bicycle facilities and vehicle traffic.*

This network largely does not include recommendations for smaller neighborhood streets, which may have lower speeds that are more comfortable for walking and bicycling or are circuitous and do not provide through-connections. It does include recommendations for local streets within each of the Strategic Growth Areas, as these areas will see a significant amount of future residential and commercial growth. As land uses in the Strategic Growth Areas change, particularly as new housing is built in these communities, new walking and bicycling facilities will be necessary. They also complement the proposed Virginia Beach Trail and provide access to major destinations and transit across the City.

Each corridor within the network serves different communities with different characteristics, and as such has a unique purpose, as well as distinct challenges. Thus, the Active Transportation Plan network consists of three components: Core City Network, Local Connectors and Neighborhood Routes. Each has a specific role within the City. This network arose from fieldwork and from the project team, looking at the City's most heavily-traveled roadways and intersections with the highest number of crashes. Each of the three components complement each other but are not organized by the order in which they should be built. The Implementation chapter will identify individual routes that the City can pursue in the near-term, medium-term, and long-term time frames. The following is an explanation of the Core City Network, Local Connectors, and Neighborhood Routes, and the distinct role it serves.

Figure 15 is a map that shows the proposed routes of the network. This map also includes Locally Identified Routes, provided by the SGA Office. Table 8 lists the mileage by network component.

| Type | Mileage |
|---|---|
| **Core City Network** | 113.3 |
| **Local Connectors** | 131.6 |
| **Mapped Locally Identified** | 32.8 |
| **Recreational** | 37.1 |

*Table 8: Proposed route mileage*

Lack of pedestrian infrastructure on Seaboard Road creates a high stress environment.

Visitors to Carolanne Farms Park can hike and access the Elizabeth River for paddling.

## Core City Network

The Core City Network forms the centerpiece of the City's pedestrian and bicycling network (Figure 14). These routes fill gaps between existing facilities and provide a safe, comfortable experience between the City's most significant destinations. The spine of the Core City Network is the proposed Virginia Beach Trail (the former Norfolk Southern corridor), as it provides a fully separated off-street connection between six of the eight Strategic Growth Areas, Norfolk's Tide Light Rail station, Virginia Beach Town Center, and the Oceanfront Resort Area, where a 1.5 mile-long segment through the VIBE district is already thriving. There are also several major north-south corridors that intersect with the Virginia Beach Trail, providing access to communities north and south of Interstate 264. These routes provide crucial connections to additional destinations, including the City's military installations, the Bayfront, all eight Strategic Growth Areas, the Virginia Beach Municipal Center, Tidewater Community College, Historic Kempsville, and the Princess Anne Athletic Complex (PAAC).

Most of the Core City Network uses major roads, such as Independence Boulevard, Princess Anne Road, and Shore Drive. These corridors are often the most direct routes between destinations, and where walking and bicycling can be the most treacherous. Many Hampton Roads Transit bus stops are on roads in the Core City Network, allowing travel throughout the region. Safe and convenient access to these transit routes along these major roads is crucial to enable multimodal transit in Virginia Beach.

In addition to the Virginia Beach Trail, this network also includes two other off-street trails. A proposed Southeastern Parkway Trail would follow the former Southeastern Parkway right-of-way, providing access to fast-growing communities in the southern portion of the City and the Oceana Naval Air Station. Additionally, a new pedestrian overpass on I-264 near Independence Boulevard will connect Town Center and Mount Trashmore. Mount Trashmore is the most popular park in Virginia Beach and receives approximately 900,000 visitors annually. Current access to the park from the north is limited by the major barrier of I-264. A pedestrian bridge would eliminate this barrier and connect one of the most densely populated areas of the City to a signature park with amenities for all ages.

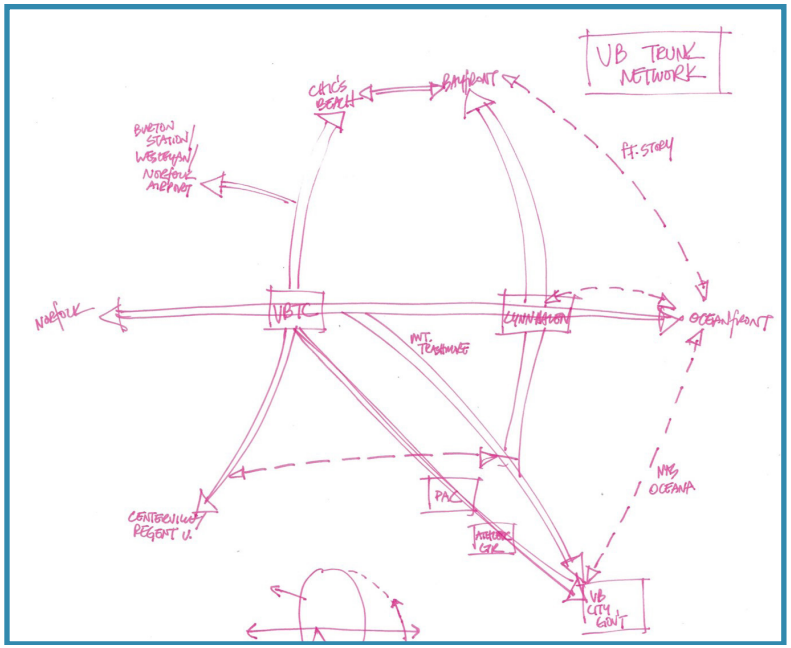



*Figure 14: Concept drawing of the Virginia Beach Core City Network*


Bicycle racks along the bayfront allow visitors to cycle to the beach.


Great Neck Road is part of the Core City Network.


Birdneck Road is part of the Local Connectors network.

## Local Connectors

Local Connectors are the next layer of the City's pedestrian and bicycling network. These routes provide access to the City's residential neighborhoods, smaller commercial districts, and rural areas. Local Connectors are intended to serve trips within sections of the City and work with the Core City Network routes to support short trips and long trips alike. Local Connectors primarily serve local destinations, like schools, libraries, recreation centers, and neighborhood commercial areas. Local connectors also have many Hampton Roads Transit bus stops and are key for first mile or last mile travel.

Some of the Local Connectors are collector streets within residential areas, such as Bow Creek Boulevard or Edinburgh Drive. Others are adjacent or parallel to Core City Network routes, such as Bonney Road or Virginia Beach Boulevard, providing an alternative route or a connection to a neighborhood or destination the Core City route does not reach. A third category of Local Connectors run within commercial areas and provide direct access to shops or businesses.

While most Local Connectors are on existing streets, others are off-street trails following power lines, former railroad corridors, or other rights-of-way that have not yet been developed. Other Local Connectors may not be built until individual properties are redeveloped.

## Neighborhood Routes

Neighborhood Routes are routes that were previously included in other planning efforts or provide local connections between existing or proposed facilities. These are the smallest-scale connections, serving neighborhood streets and smaller commercial areas and tying the Core City Network and Local Connectors to homes and businesses. Many multimodal trips will begin and end on Neighborhood Routes.

While Neighborhood Routes are located throughout the City, most of them are in or adjacent to one of the eight Strategic Growth Areas, where the bulk of the City's future residential and commercial growth will occur. As these areas develop a more urban, mixed-use built form, a comprehensive active transportation network will allow people living, working, studying, or visiting to have as many travel options as possible, reducing the impact of future growth on motor vehicle traffic while increasing the quality of life.

The Neighborhood Routes network also includes future phases of the Thalia Creek Greenway, an off-street trail that provides options for both active transportation and recreation in the Town Center area, ultimately connecting to the proposed Virginia Beach Trail to the north and the proposed pedestrian land bridge/fly-over to the south. Like the Local Connectors, some of these routes do not currently exist, and will require redevelopment to occur before being built.

## Locally Identified Routes

Locally identified routes were provided by the SGA Office. Many of these routes were absorbed into the network and played a key role in knitting the network together. Local connectors are important as they often serve as first mile/last mile access and align with the City's Strategic Growth Areas, which focuses on concentrated growth.

A bike/pedestrian bridge over I-264 could connect Virginia Beach Town Center (background) to Mount Trashmore and communities to the south.

Pedestrian bridge concept over Independence Blvd within the transportation corridor.

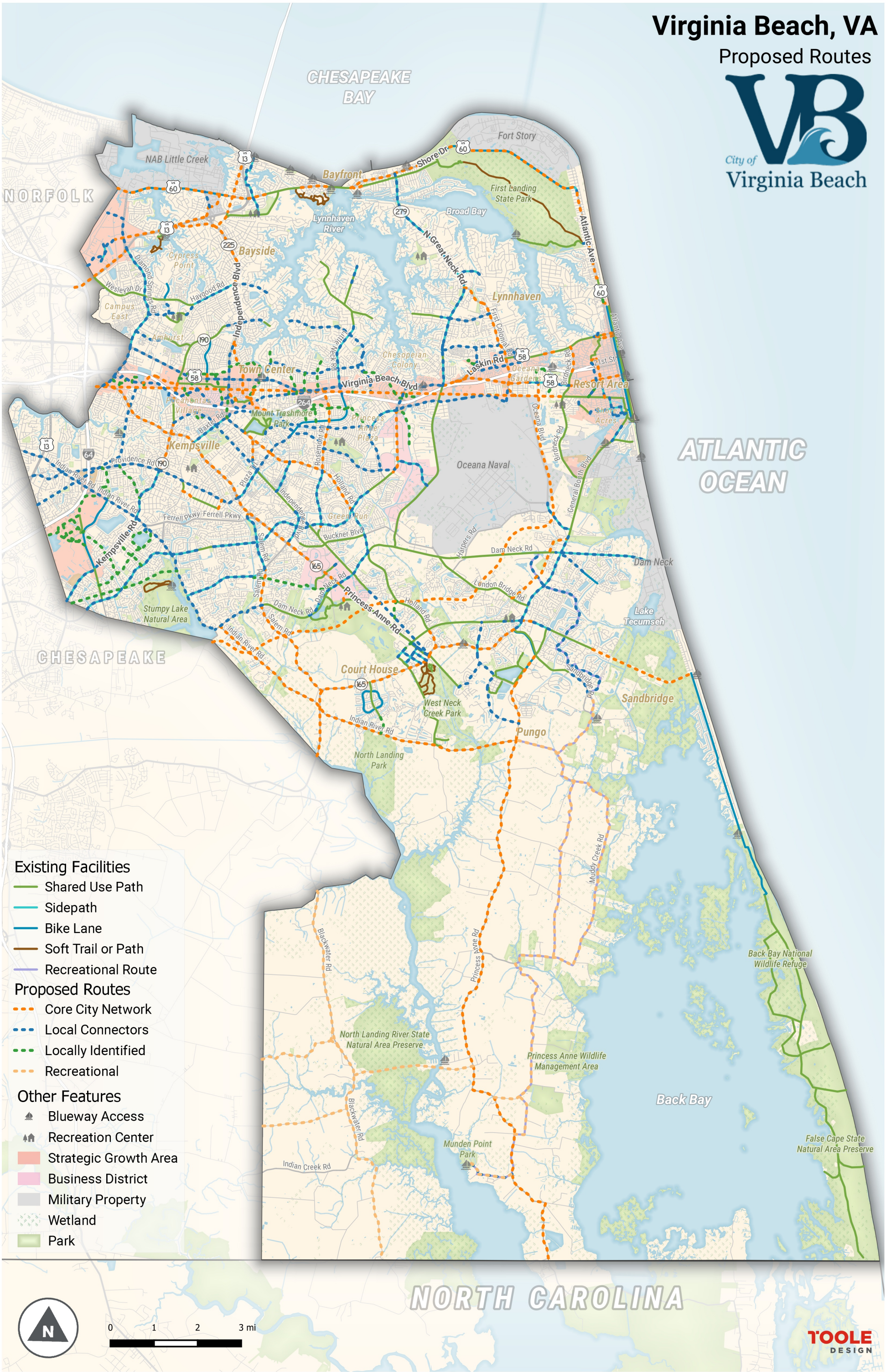



*Figure 15: Proposed Routes*

# Blueways

Blueways are water trails, much like greenways are land trails. Typically, both blueways and greenways are long enough to be officially or unofficially designated as travel routes for either transportation or recreation. According to the Virginia Department of Conservation and Recreation, public access points are necessary to a successful water trail as well as additional amenities such as access to parking, food and water to effectively support ecotourism and water travel as an additional mode of transportation.[1]

The City of Virginia Beach has a vast network of waterways that ribbon throughout our coastal plains. Our network of waterways, consisting of tributaries, necks, and four distinct watersheds, are ultimately bounded by the Atlantic Ocean, fostering a unique way of life and the potential for a culture destined for learning to better live with the water. The Southern Rivers Watershed is the largest, encompassing over one-half of the City or approximately 205 square miles. In addition to being bounded to the east by the Atlantic Ocean and to the north by the Chesapeake Bay, the City has 121 miles of internal navigable waterways. Key blueways include the Elizabeth River, Lynnhaven River, North Landing River, West Neck Creek, Back Bay, Owl Creek/Rudee Inlet, and Stumpy Lake (Figure 16). A section of the North Landing River in Virginia Beach is part of the Intracoastal Waterway.

Combined with the 1,769 miles of vehicular roadway network, the collective sum of Virginia Beach travel routes is an impressive 1,890 miles. Of these, 282 centerline miles are identified as part of the pedestrian and bicycle network. The evolution of active transportation in Virginia Beach melds these two unique and sustainable modes of travel through comprehensive networking that has a multiplying effect on the total usable network. The original modes of Virginia Beach travel – walking and boating - were around long before we engineered our 20th Century to accommodate our single-occupancy vehicular lifestyles. However, public opinion has shifted to acknowledge that in order to achieve the greatest quality of life, maintaining a balance and valuing a multi-modal transportation system is key.

As sea levels rise and recurrent flooding increases, the City of Virginia Beach is planning its infrastructure for adaptation. Sea level rise projections indicate

Blueways support ecotourism and water travel as a transportation alternative.

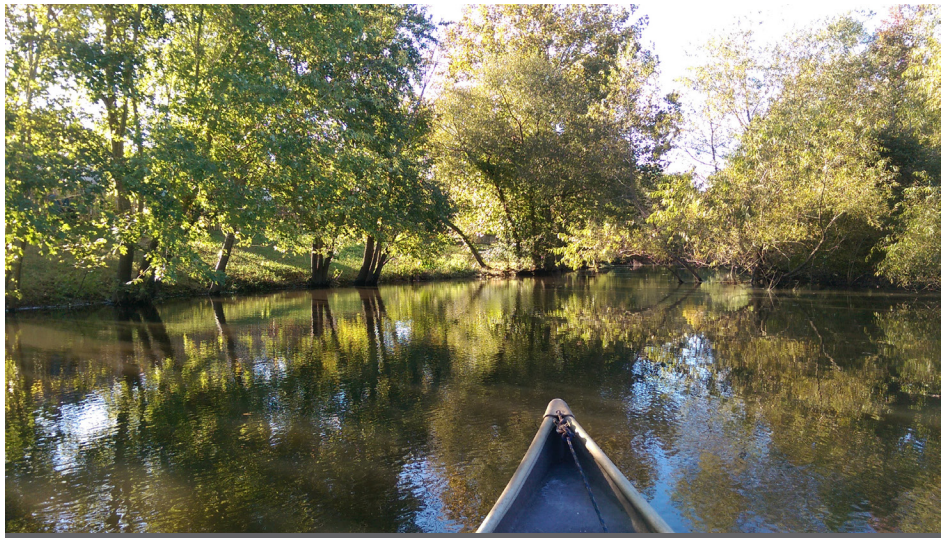
Kayaking along Lake Lawson/Lake Smith.

1 https://www.dcr.virginia.gov/recreational-planning/wal-wtrails

that by 2050, water transport is likely to reemerge as a viable means of transportation within the City of Virginia Beach. However, this is not just our future trend, it is also our past. Historic Princess Anne County was founded on the economic viability of transporting goods and services via this vast blueway system. As with most municipalities, transportation evolved over the past two hundred years into a robust system of roadways. However, oftentimes these roadways and waterways intersect, creating unintentional barriers to both land and water transportation networks. Although we predominately think of the effects that a waterbody imposes upon a roadway network, by looking through the lens of Active Transportation, this Plan recommends additional study be conducted to analyze barriers, such as undersized culverts and low bridges, impacting water travel as a result of constructed roadway infrastructure.

Best practices for accommodating waterway travel that provide sufficient clear zones on the underside of vehicular bridges to ensure navigability of a waterway should be identified within this future study and considered in future Public Works transportation improvement projects. The Blueways Map (Figure 16) is created as part of the Active Transportation Network to highlight primary and secondary waterway networks, waterway access points, and potentials for water taxi routes that best promote water navigation as a reliable mode of transportation within the City of Virginia Beach. The Blueways Map also identifies specific potential multi-modal points of intersection that may accommodate a land to water connection. It should be noted, however, the breadth and analysis of a proper blueways study is beyond the scope of this Active Transportation Plan and the recommendation is for a more in-depth study and analysis as a separate project that intertwines active transportation and Virginia Beach's waterway planning.

Here, emphasis is placed on the advancement of the system of active transportation by identifying existing and potential opportunities for incorporation into a connected network for travel. The City of Virginia Beach boasts a number of public access points to water with a variety of facility types for the purpose of launching vessels for taxiing people from one area to another or solely for recreation. A myriad of facility types have been categorized in the City of Virginia Beach Outdoors Plan and the Hampton Roads Planning District Commission's Regional Strategic Plan for Public Access to Waterways in Hampton Roads (HRPDC 2018), such as boat ramps, kayak/canoe launches, fishing piers, observation/boardwalk/trails,



Upper North Landing River, courtesy of Walter Camp.

Recreational paddling is a great social and physical activity.

Virginia Beach was established as a community on the water.

and beaches/swimming. Some of the waterways within Virginia Beach are designated segments of the regional water trails netowrk. This includes the Southeast Coast Saltwater Paddling Trail that spans from the Chesapeake Bay, south through the length of the City of Virginia Beach, and continues on all the way to the State of Georgia. Additionally, there is the Eastern Branch of the Elizabeth River Water Trail that extends through Virginia Beach and Norfolk. Both of these navigable waterways connect with the Captain John Smith Chesapeake National Historic Trail, which is well known for its destinations and activities. Additional local and regional studies and adopted plans provide support and cross reference this Plan as well as the following: the Virginia Beach Parks and Recreation Outdoors Plan, 2016; the Virginia Beach Interfacility Traffic Area and Vicinity Master Plan, 2017; and The Green Sea Blueway and Greenway Management Plan, 2015; and the Back Bay National Wildlife Refuge Alternative Transportation Study, 2015.

The National Park Service encourages water trail planning to be created with a vision that these amenities would engage, educate, and unify the community, as well as increasing the user's quality of life.[2] Blueways are a tool to promote a flourishing economy and a healthy community while preserving and sharing the natural and cultural legacy of the City of Virginia Beach with our residents and the millions of annual visitors. Blueways serve as outdoor classrooms for people of all ages. Use of the City's waterways are a way to engage students in the Virginia Beach City Public School System, adult residents in the area, and the tourists of the Resort Area. As a foundation for ecotourism, the existing access points to the water serve as a gateway to a healthy community and economy. The revenue brought in by ecotourism will provide additional funding to maintain these natural amenities. The City of Virginia Beach can embark on a journey to reconnect its history and its culture through increased accessibility to our waterways for transport and tourism.

The Blueways Map is just the beginning of the exploration and identification of points for greater connectivity within our community. Active transportation routes are greatly enhanced where trailheads and water access points intersect. Further study should analyze these potentials for connectivity, including integrating linear greenways with green infrastructure as a stormwater solution and improving 10-minute walk times to parklands and 10-minute drive times to public water access. Oftentimes, simple and cost-effective improvements can make a big impact, such as combining canoe/kayak launch points with trailheads that provide bicycle and vehicular parking. Initial analysis indicates a viable and potential market demand for water taxis for eco-tourism at three primary areas: Back Bay, Owl Creek to Rudee Inlet, and First Landing to "restaurant row" at Lesner Bridge. These locations have the potential for multi-modal excursions that combine canoeing/kayaking/boating to landward cycling back to the point of origin. Additionally, eco-tourism potentials are identified for their historical significance at the Bayside

2 https://www.nps.gov/subjects/nationaltrailssystem/national-water-trails-system.htm

History Trail (western branch of the Lynnhaven River), and the State Scenic Waterway North Landing River (Munden Point Park to John Smith Trails (NPS) connection). With the 121 miles of navigable Virginia Beach waterways, innumerable other possibilities exist to explore throughout the City.

The Virginia Department of Transportation (VDOT) recently announced its plans to conduct a rail to trail feasibility study on the Eastern Shore.[3] This will be an exciting additional opportunity for Virginia Beach eco-tourism. With the addition of a water taxi, cyclists could be shuttled to the Cape Charles shore for a weekend of riding on this future 49-mile paved shared use path.

Virginia Beach was established as a community on the water, rich with history, culture, and an abundance of resources. With our changing climate, coastal rising sea levels, and regional land subsidence, now more than ever it matters for our City to promote our resources and share our heritage in order to cultivate nature-based appreciation, active transportation, and eco-tourism.

Stumpy Lake, courtesy of Walter Camp.


Bridges can accommodate blueway travel if designed with clear zones for kayaks and canoes.

3 https://www.virginiadot.org/projects/hamptonroads/eastern_shore_rail_to_trail_study.asp

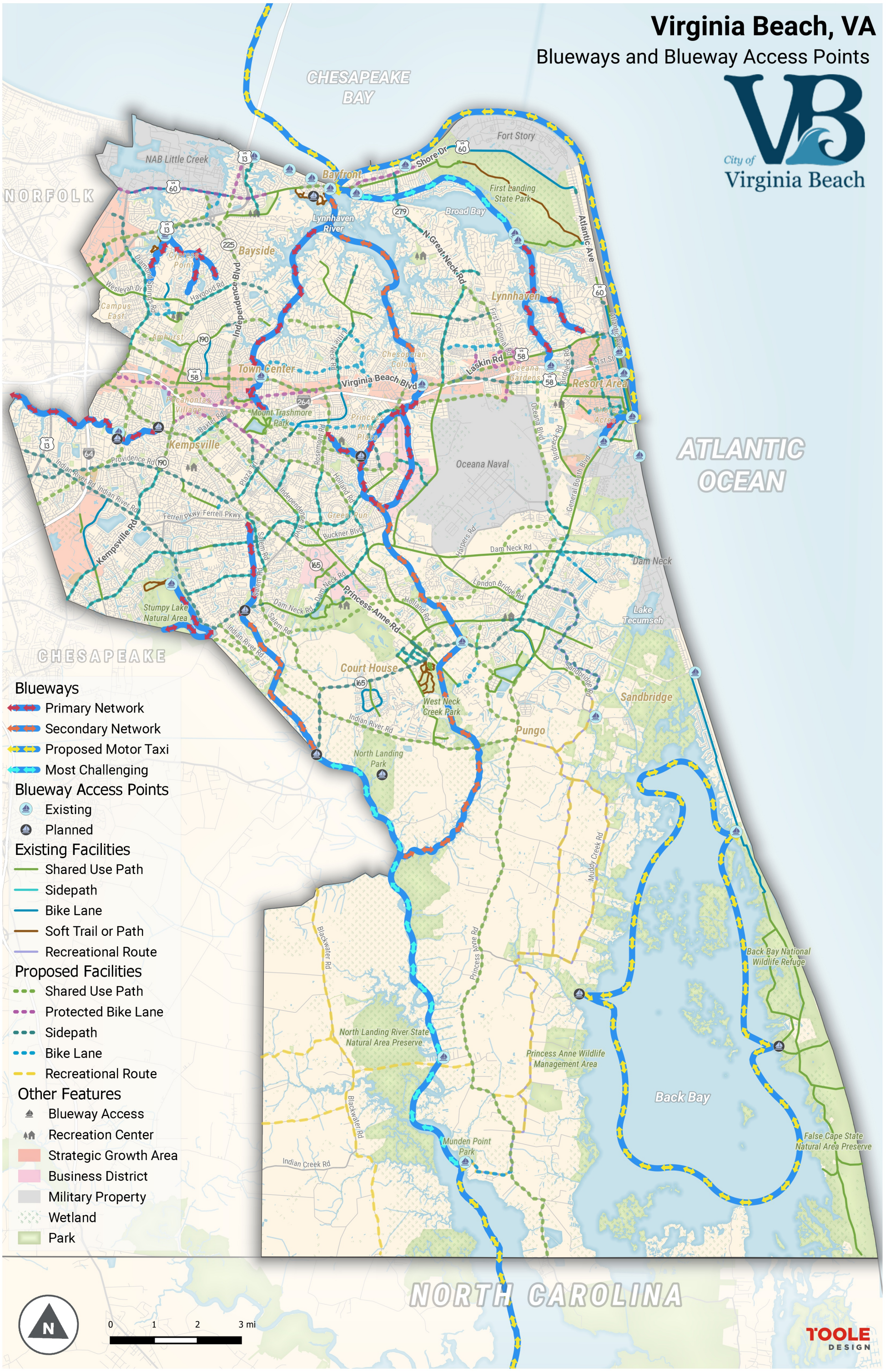



*Figure 16: Blueways and Blueway Access Points*

# Network Recommendations

Whether you're walking, bicycling, riding a scooter, or using an assistive device, you need a safe, comfortable space to move. However, different travel modes have different needs. The following sections include distinct recommendations for policy, planning, and routes designed primarily for walking, and routes designed primarily for bicycling.

## Pedestrian Recommendations

At some point on your journey, you will walk (or use an assistive mobility device) while traveling to or from your destination. The Active Transportation Plan's recommendations make walking safer and comfortable for everyone, regardless of the trip.

Walking trips are typically shorter than other types of trips. The recommendations in this plan are designed to support short walking trips within the high-demand areas identified in Figure 8. It eliminates gaps between existing facilities in the walking network, and in doing so, can improve access to local destinations that provide daily needs. The pedestrian recommendations also connect existing and future trail facilities throughout the City, with a primary focus on major thoroughfares.

The recommendations in this section include two types of pedestrian facilities currently on the ground in Virginia Beach:

- Sidepaths, formerly referred to as wide sidewalks in the 2011 Bikeways and Trails Plan, are the Public Works standard concrete sidewalk with a minimum width of five feet to a more accommodating width of eight to ten feet, based on volume of use. This allows two groups of people to pass one another comfortably. Sidepaths may or may not have a buffer from vehicle traffic. In general, this plan recommends sidepaths wide enough for both pedestrians and bicyclists, though this may not always be possible due to space constraints.
- Shared use paths or trails are typically 11 feet wide or greater and provide a physical buffer from vehicle traffic. Shared use paths are always designed to accommodate both pedestrians and bicyclists passing one another. AASHTO's Guide for the Development of Bicycle Facilities (2012) recommends a width of at least 11 feet on pathways frequented by both pedestrians and wheeled users. Refer to the Active Transportation Design Guidelines (Appendix A) for further information on the design specifications of bicycle and pedestrian facilities.

These recommendations reflect information from public feedback and fieldwork, but will need further study based on property lines, traffic patterns, and other potential issues.

The Active Transportation Facility Design Standards (see Appendix A) include specifics on how to design pedestrian facilities, based on these seven Principles of Good Pedestrian Design. The following design principles represent a set of ideals which should be incorporated into every pedestrian improvement. They are ordered roughly in terms of relative importance:

1. The pedestrian environment should be safe. Sidewalks, walkways and crossings should be designed and built to be free of hazards, offer a sense of security and minimize conflicts.
2. The pedestrian network should be accessible to all. Sidewalks, walkways and crosswalks should ensure the mobility of all users by accommodating the needs of people regardless of age or ability.
3. The pedestrian network should connect to places people want to go. The pedestrian network should provide continuous direct routes and convenient

Sidepaths, like this one on Inlynnview Road, provide space for walking and bicycling but do not have a buffer.

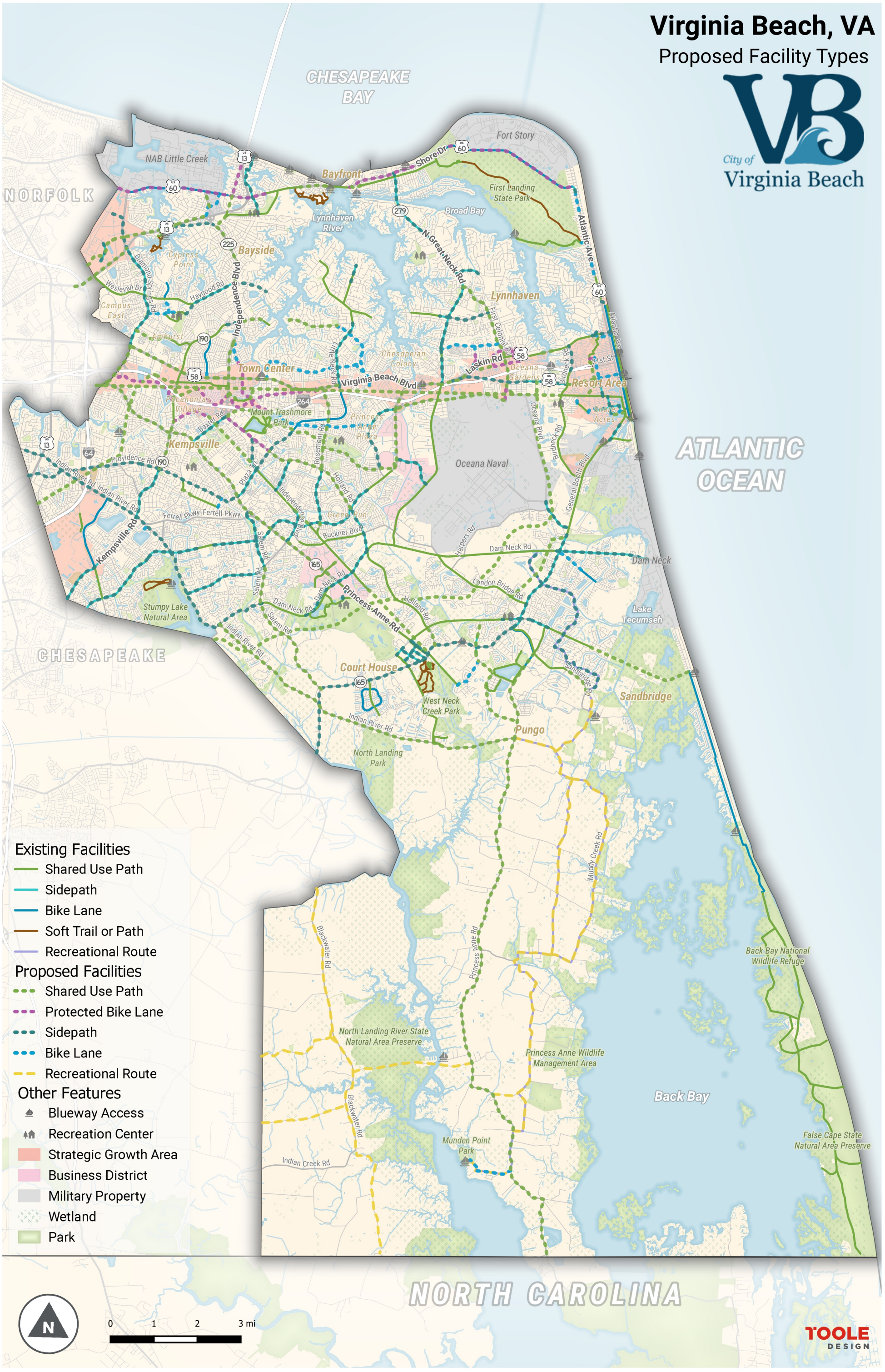



*Figure 17: Proposed Facility Types*

connections between destinations.

4. The pedestrian environment should be easy to use. Sidewalks, walkways and crossings should be designed so people can easily find a direct route to a destination and will experience minimal delay.
5. The pedestrian environment should provide a sense of place. Good design should enhance the look and feel of the pedestrian environment. Amenities such as seating, street furniture, banners, art, trees, plantings, shading, and special paving, along with historical elements and cultural references, should promote a sense of place.
6. The pedestrian environment should serve multiple functions. It should be a place where public activities are encouraged. Commercial activities such as dining, vending and advertising may be permitted when they do not interfere with safety and accessibility.
7. Pedestrian improvements should preserve or enhance the qualities of the City. Good design will allow pedestrians to experience a sense of Virginia Beach's unique character.

## Bicycling Recommendations

Bicycling trips, which for this purpose includes other micromobility vehicles like scooters and skateboards, come with different challenges than walking trips. They can be longer, and bicyclists travel at a higher speed than pedestrians. Streets that may feel comfortable for walking may not feel the same way for bicycling, and vice versa. This presents different design considerations to ensure their safety, from the width and layout of bike paths and lanes to the configuration of intersections and crossings.

The recommendations in this plan are designed to support bicycling trips both within the high-demand areas identified in Figure 8 and Figure 9, but also between those high-demand areas. They serve major corridors that cross large parts of the City and connect to regional destinations. They also serve neighborhood streets, providing access to local destinations and daily needs. The bicycling recommendations also connect existing and future trail facilities.

These recommendations include three types of bicycle facilities, including separated bike lanes, which are currently not present in Virginia Beach:

- Sidepaths, formerly referred to as wide sidewalks in the 2011 Bikeways and

A traditional striped bike lane on South Plaza Trail.


Cyclists using the bicycle facilities on the Oceanfront.

Trails Plan, are the Public Works standard concrete sidewalk with a minimum width of five feet to a more accommodating width of eight to ten feet, allow two groups of people to pass one another comfortably. Sidepaths may or may not have a buffer from vehicle traffic. In general, this plan recommends sidepaths to be eight to ten feet wide for both pedestrian and bicyclist use, though this may not always be possible due to space constraints.

- Shared use paths or trails, which are typically 11 feet wide or greater, provide a physical buffer from vehicle traffic. Shared use paths are always designed to accommodate both pedestrians and bicyclists passing one another. AASHTO's Guide for the Development of Bicycle Facilities (2012) recommends a width of at least 11 feet on pathways frequented by both pedestrians and wheeled users. Refer to the Active Transportation Design Guidelines (Appendix A) for further information on the design specifications of bicycle and pedestrian facilities.
- Separated bike lanes, also known as protected bike lanes or cycletracks, have a buffer (either physical or visual) from vehicle traffic.

Figure 17 is a map of the proposed pedestrian and bicyle routes and their relevant facilities. Table 10 is a chart listing the length of each recommended type of pedestrian and bicycle facility in the City, and Figure 18 is a chart showing the percentages of each type of facility as part of the recommend network. The proposed mileage is calculated by centerline miles.

| Existing Facilities | Existing Mileage* |
|---|---|
| **Shared Use Path** | 69.5** |
| **Signed Shared Route** | 37 |
| **Sidepath / Wide Sidewalk** | 55.7 |
| **Soft Trail or Path** | 36*** |
| **Paved Shoulder** | 48 |
| **Bike Lane** | 21 |
| **Wide Outside Lane** | 68.6 |
| **Total** | **335.8** |

*Table 9: Existing Facility Mileage*

*Includes funded capital improvement projects in process of being designed or built

**10 miles of which are substantial networks within parks

***Includes City of Virginia Beach (9 miles) plus state/federal (27 miles) within city limits

| Proposed Facilities | Proposed Mileage |
|---|---|
| **Shared Use Path** | 119.9 |
| **Sidepath / Wide Sidewalk** | 85.1 |
| **Protected Bike Lane** | 21.4 |
| **Bike Lane** | 18.5 |
| **Recreational Route** | 37.1 |
| **Total** | **282** |

*Table 10: Proposed Facility Mileage in Centerline Miles (excluding mapped Locally Identified Routes)*

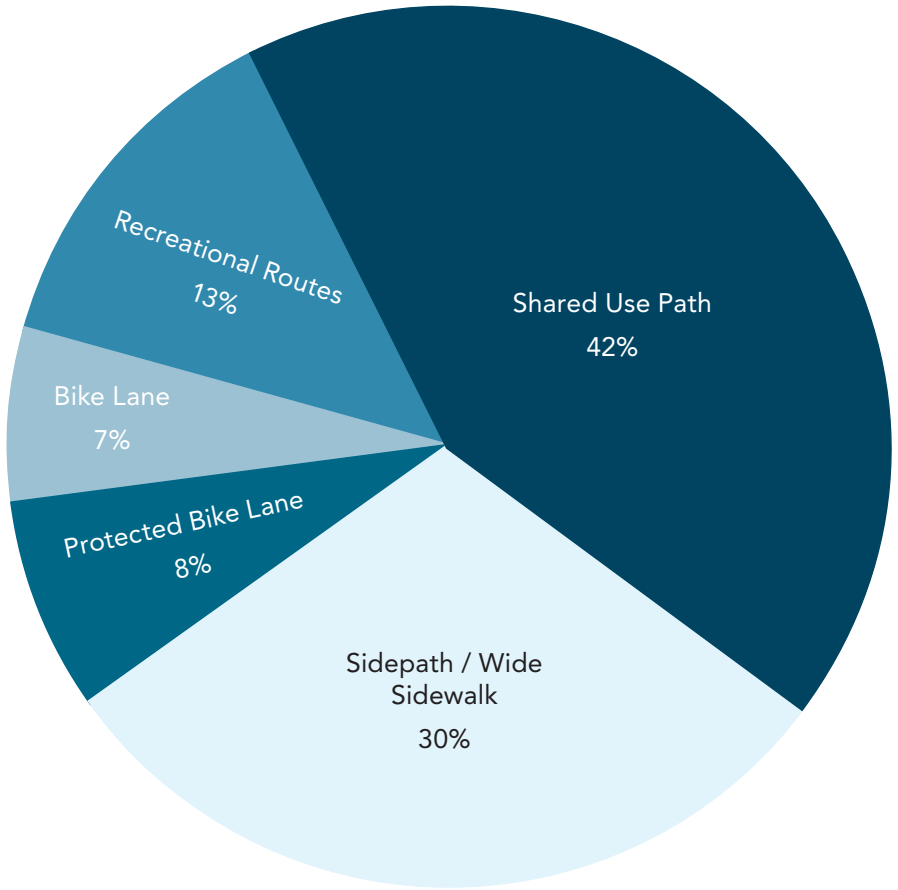



*Figure 18: Ratios of Proposed Facility Mileage*


A bicyclist riding along General Booth Boulevard. Shared use paths and off-street trails provide the greatest protection from vehicle traffic.

Existing and proposed facility types differ for multiple reasons. In general, facilities will be upgraded as well as built new. It is important to note that when existing facilities were inventoried and compiled, several of the classifications and design specifications of some on-road and off-road facilities did not meet current national best practices (see Appendix A for detailed information on facility types and design specifications). This reclassification, or in some cases, elimination of mileage accounts for the differences in mileage in each chart presented here. For example, wide outside lanes were not counted in the total for the proposed network given that many were found to not meet current standards for safe, accessible bicycle facilities. In some cases, upgraded bicycle facilities were recommended to take their place and in others a new route was identified. Similarly, many of the wide sidewalks inventoried fell short of current sidepath design recommendations consistent with best practices. The intent of the proposed network is to recommend upgraded facilities for a system that may be used by people of all ages and abilities.

These recommendations primarily focus on major streets, and as such, some types of bicycle facilities are allowed in Virginia Beach but are not included in these recommendations for a specific street, such as Bike Boulevards, a low-speed street designed to prioritize bicycle travel over motor vehicle travel. These recommendations reflect information from public feedback and fieldwork, but will need further study based on property lines, traffic patterns, and other potential issues.

Shared use path in Mount Trashmore Park.

The Active Transportation Design Guidelines (Appendix A) include specifics on how to design bicyclist facilities, based on these seven Principles of Good Bicycling Design. The following design principles represent a set of ideals which should be incorporated into every bicycling improvement. They are ordered roughly in terms of relative importance:

1. The bicycling environment should be safe. Paths, bike lanes, trails, and crossings should be designed and built to be free of hazards, offer a sense of security and minimize conflicts.
2. The bicycling network should be accessible to all. Paths, bike lanes, trails, and crossings should ensure the mobility of all users by accommodating the needs of people regardless of age or ability.
3. The bicycling network should connect to places people want to go. The bicycle network should provide continuous direct routes and convenient connections between destinations.
4. The bicycling environment should be easy to use. Paths, bike lanes, trails, and crossings should be designed so people can easily find a direct route to a destination and will experience minimal delay.

5. The bicycling environment should provide a sense of place. Good design should enhance the look and feel of the bicycling environment, particularly on off-street trails. Amenities such as wayfinding, banners, art, trees, plantings, shading, and special paving, along with historical elements and cultural references, should promote a sense of place.
6. The bicycling environment should welcome other travel modes where appropriate. Small, low-speed vehicles such as bikeshare bikes, scooters, or skateboards (also called micromobility vehicles) should be able to use bicycle lanes and paths for transportation when they do not interfere with safety and accessibility.
7. Bicycling improvements should preserve or enhance the qualities of the city. Good design will allow bicyclists to experience a sense of Virginia Beach's unique character and should be recognizable and readily navigable by visitors.

## Recreational Routes

Most of the active transportation network in Virginia Beach is intended to serve suburban neighborhoods and urban destinations, and to support safe, comfortable walking and bicycling trips within those places. Another popular category of active transportation trips involves recreational activities, like getting exercise, enjoying nature, or visiting the City's rural southern section. To that end, this plan also recommends designated Recreational Routes, which are geared towards trips that are not solely for commuting. There are two types of Recreational Routes:

- Recreational Routes within Rights-of-Way are typically two-lane roads in the southern portion of the city with limited shoulders and no curbs, where bicyclists will share the lane with motor vehicle traffic. In the interim, these routes will have signs indicating that they are shared routes and/or sharrows instructing drivers that bicyclists will be present. In the long term, these corridors are opportunities to install on-road bicycle facilities or shared use paths for both walking and bicycling.
- State and City Park Routes are shared use paths and trails that are found within the City's extensive park system, including both City parks and Virginia state parks. Some of these routes are paved, while others are unpaved with dirt or gravel. Examples of Recreational Routes within parks include the paths around Mount Trashmore. State and City Park Routes are represented in Figure 17 as existing shared use paths and soft trails within parks.

## Policy and Planning Recommendations

In 2019, City staff applied to renew the City's Bicycle Friendly Community status with the national organization The League of American Bicyclists. Virginia Beach was again awarded Bronze status and predominately scored in the average to acceptable ranges (see Appendix C). Areas in need of improvement are noted by the lower scores in safety, encouragement and enforcement. Additionally, the average Silver rated community scored much higher with an average program staff to population ratio of 1:78,000 compared to Virginia Beach's only 1:450,000 staff to population ratio. This paired with limited funds allocated to the construction of new bicycle facilities have produced a lower than average total bicycle network mileage. The average Silver community has a much higher Total Bicycle Network Mileage to Total Roadway Network Mileage of 48% compared to Virginia Beach's 14%. These indicators suggest that the City may benefit from an assessment into how best to consolidate and grow its transportation resources. The whole of the City of Virginia Beach Active Transportation staff is comprised of one senior planner within the Parks and Recreation Department. Other transportation planning staff are within the SGA Office and work together with the Transportation Engineering Division in the Public Works Department. Areas to examine include exploring measures to improve proximity between staff and enhance communication and collaboration with all City transportation professionals for increased potential to quicken future network implementation. Consider integrating the transportation planning staff with the Public Works Department for streamlining project delivery.

## Intersection Recommendations

Almost every active transportation trip requires crossing a street, and in the City of Virginia Beach, intersections can be a major barrier to safe walking and bicycling. The City's intersections are busy places, as many of its largest employment and retail destinations are centered on the crossing of two or more major roads, such as the intersection of Laskin Road and First Colonial Road or Virginia Beach Boulevard and Independence Boulevard. A pedestrian bridge was proposed and under design at the latter intersection to connect the south side of the city to Pembroke Mall. Consideration should be given to

either enhancing the pedestrian crossings in this are or approving and funding this pedestrian bridge.

Many trips pass through these intersections, including drivers making right or left turns, which can potentially result in collisions with people crossing the street on foot or bike. In addition, roads may become wider at intersections due to the addition of right- and left-turn lanes, and in some cases, multiple turn lanes in each direction. This increases the distances and the length of time it takes for people to cross, placing people with limited mobility in danger if they cannot cross the street in a single traffic signal phase. Wide turning radii or slip lanes make it easy for drivers to make right turns at high speeds, increasing the likelihood of pedestrian-automobile collisions and fatalities. Other safety issues at intersections, such as non-compliant or missing curb ramps, can also make it difficult or impossible for people using wheelchairs or other mobility devices to access sidewalks.

The project team identified nearly 40 intersections around the City where there have been a high rate of vehicular crashes involving pedestrians or bicyclists (Figure 21). These intersections were also classified as high priority based on network connectivity needs and consideration by the public. The team visited each intersection during fieldwork to identify design-related issues that may have contributed to these crashes. The five most common issues identified at these intersections are:

- Crossings at roads with high speed limits. Drivers traveling at high speeds would have a shorter reaction time if they needed to stop. Pedestrian or bicyclist collisions at higher speeds are also more likely to result in severe injuries or death. When motor vehicle speeds are reduced from 30 to 20 mph, the likelihood of a pedestrian being killed or suffering a serious injury decreases by more than half from 40 percent to 13 percent.[4] See Figure 19.
- Long crossing distances with no median refuge. Wide roads with multiple through lanes and turn lanes lengthen the time it takes for pedestrians to cross, particularly those with limited mobility, thus increasing the chance of a collision.
- Non-compliant or missing curb ramps. Curb ramps allow people using assistive mobility devices such as wheelchairs and strollers, or bicyclists and pedestrians with rolling carts to get on or off the sidewalk. Where curb ramps are not present or do not meet ADA guidelines, people may travel in the street instead.


*Figure 19: Higher motor vehicle speeds increase the likelihood of a pedestrian fatality in the case of a crash. This risk can be mitigated by lower speeds and various infrastructure treatments. Source: Tefft, B. C. Impact speed of a pedestrian's risk of severe injury or death. Accident Analysis & Prevention. 50. 2013..*

- Wide curb radii. Intersections with a wide curb radius at the corner allow vehicles to travel at higher speeds while turning, increasing the likelihood of a severe or fatal collision with another vehicle or with a pedestrian crossing the street.
- Unsafe U-turns. Drivers making U-turns where there is not adequate space to do so may have limited visibility of oncoming traffic or people crossing the street, increasing the chance of a collision.

The City of Virginia Beach Public Works Department develops, maintains, and enforces compliance of design standards and specifications for implementation of infrastructure improvements within the right-of-way to ensure the safety of all users. The Public Works Traffic Engineering and Transportation Divisions have established a collaborative process for stakeholders, such as the City's transportation planners, the SGA Office, and Virginia Beach City Public Schools, to participate in recommended traffic safety improvements.

4 Tefft, B. C. Impact speed of a pedestrian's risk of severe injury or death. Accident Analysis & Prevention. 50. 2013..

There are a variety of treatments that may be considered to address safety issues at these priority intersections, and may be applied to additional intersections. These treatments are often context-dependent. Further site-specific study of the feasibility of each treatment should be performed prior to design and implementation. General treatments include:

- New curb ramp
- Median refuge island
- Traffic control
- Pedestrian signals
- Add lighting
- Tighten curb radii
- Install or repaint crosswalk
- Curb extensions
- Replace existing curb ramps
- Eliminate slip lane

Refer to the Active Transportation Design Guidelines (Appendix A) for recommendations on design guidance.

Figure 20 shows locations in Virginia Beach with the highest bicycle and pedestrian crash densities. Figure 21 identifies 38 of the most critical intersections in need of the above improvements. These priority intersections were identified through an analysis of the bicycle and pedestrian crashes that occurred between 2011 and 2018 in Virginia Beach.[5] Crashes were weighted by severity, where a crash that resulted in a fatality was weighted three times that of a crash that resulted in an injury or property damage only. The analysis weighted crashes that resulted in a severe injury twice that of a crash that resulted in an injury or property damage only. The team used subsequent fieldwork to identify the intersections in need of improvement and are included in the Plan. Public input on these intersections was considered throughout the planning process and in many cases overlapped with the intersections identified by the project team.

Addressing these priority intersections will improve safety and accessibility for all active transportation users. These treatments may also be applied to other intersections to enhance the walking and bicycling network.

Bicycle parking on Atlantic Avenue.

5 Crash data obtained from VDOT.

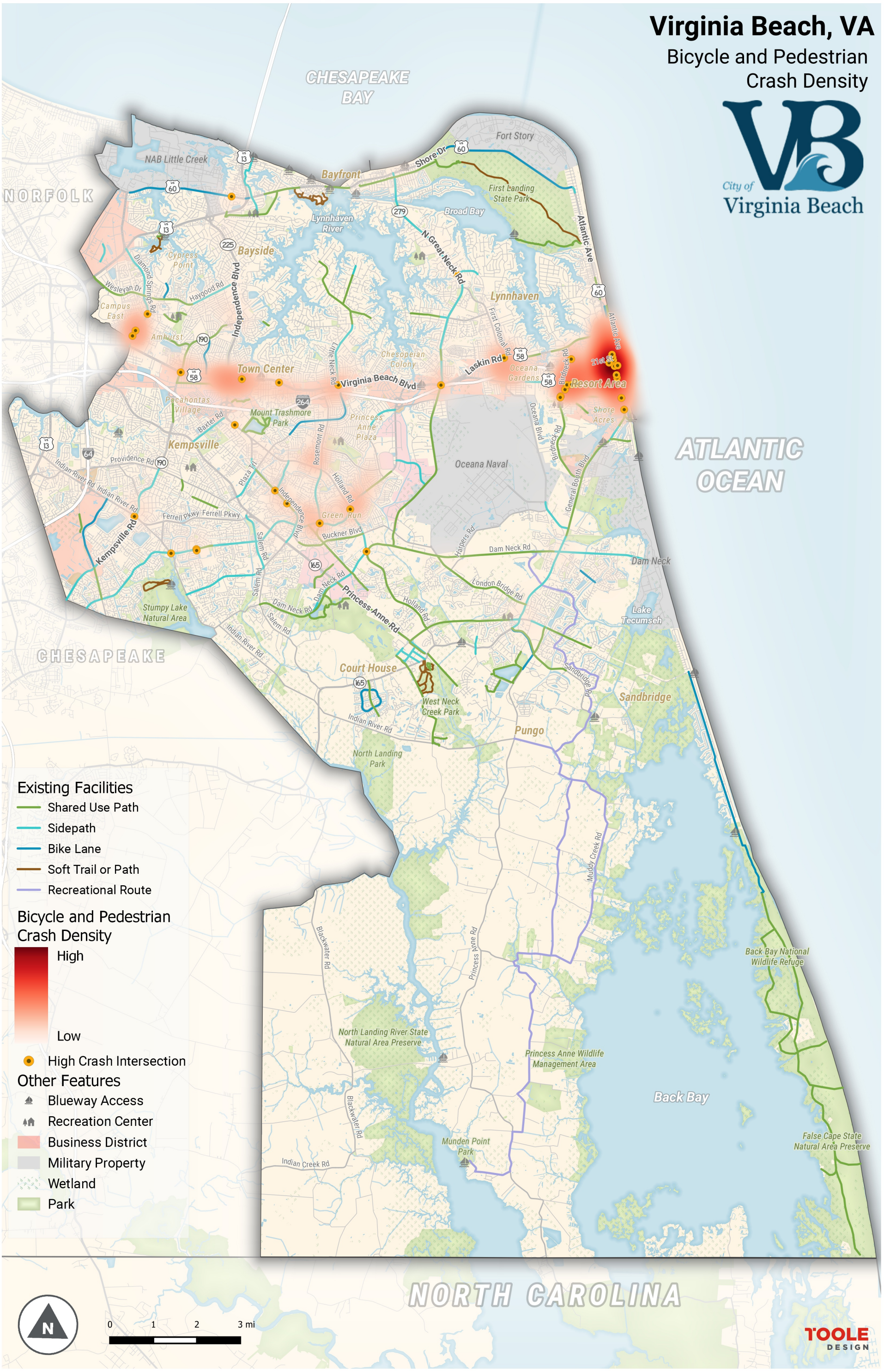



*Figure 20: Bicycle and pedestrian crash intensity hot spots.*

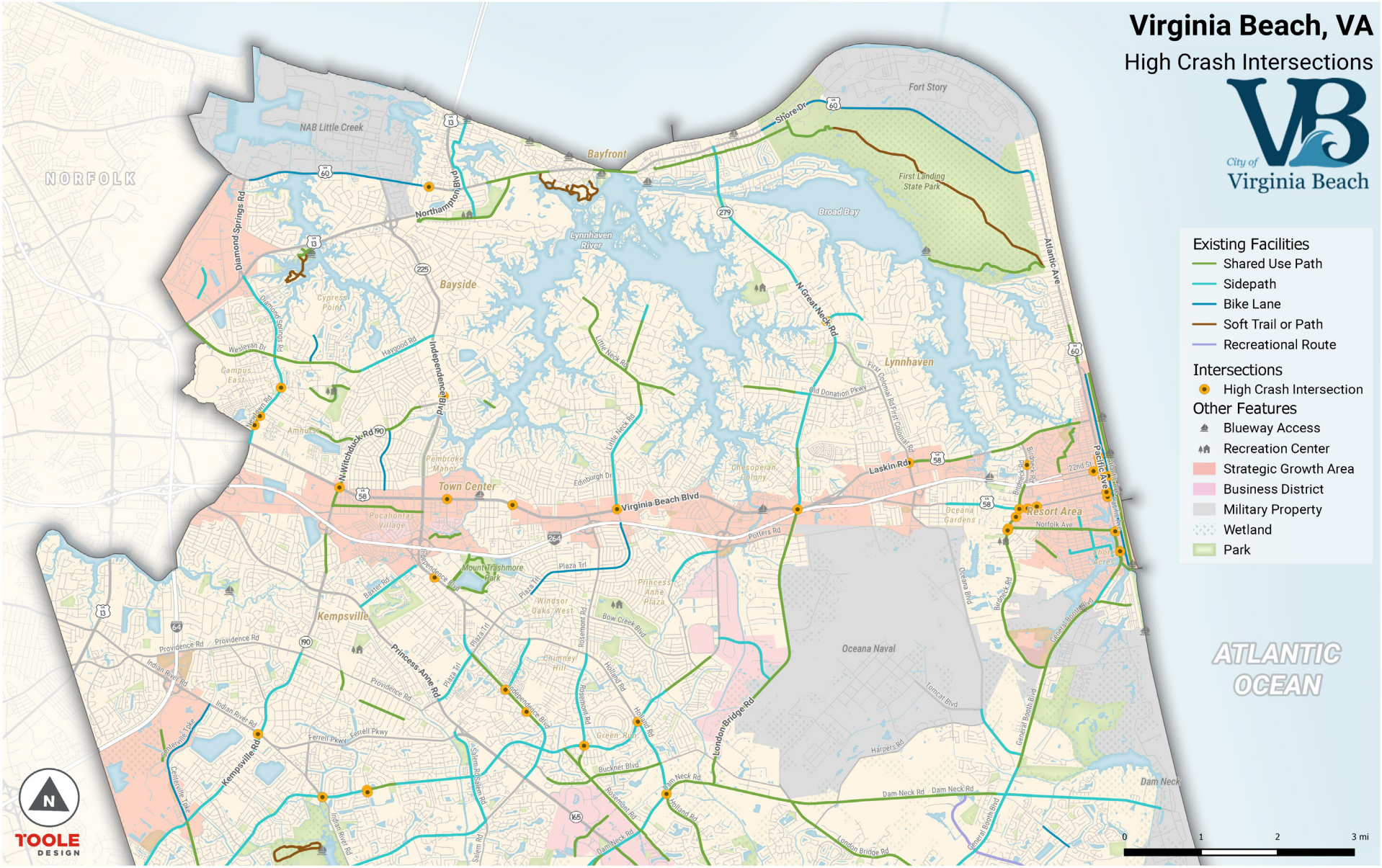



*Figure 21: High-crash intersections identified through crash analysis*

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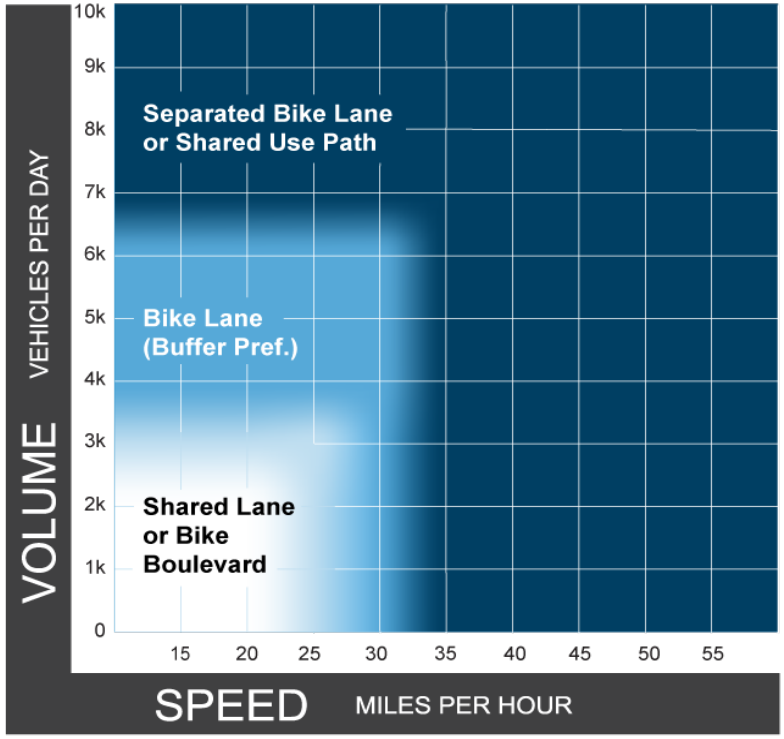
# CHAPTER 4 | IMPLEMENTATION

# CHAPTER 4 | IMPLEMENTATION

The network outlined in this Plan will have a dramatic effect on active transportation, accessibility, and mobility in Virginia Beach. However, it will take considerable effort and funding to plan, design, and implement. The City must use its resources judiciously, while being mindful of its long-term goals. In addition, the projects in the active transportation network will require coordination between the Parks and Recreation and Public Works Departments and other stakeholders, including VDOT and private developers or property owners.




**Notes**

1 *Chart assumes operating speeds are similar to posted speeds. If they differ, use operating speed rather than posted speed.*

2 *Advisory bike lanes may be an option where traffic volume is <3K ADT.*

3 *See Section 4.5.2 for a discussion of alternatives if the preferred bikeway type is not feasible.*

*Figure 22: Facility selection for Interested but Concerned bicyclists*

How should the City make the active transportation network a reality? This chapter discusses how to implement the City's vision, how to select from different types of pedestrian and bicycle facilities, funding sources, priority projects the City should pursue, and performance measures to ensure the network's success.

## Facility Selection

The first step in implementing an active transportation network is designing the spaces where people will walk, roll, bike, or scoot. The quality of pedestrian and bicycle facilities plays a critical role in the character, function, livability, and accessibility of neighborhoods. Virginia Beach will have a low-stress active transportation network that people of all ages and abilities can use, emphasizing that the City is a community for a lifetime.

The Active Transportation Design Guidelines (Appendix A) provides design guidance to support safe, convenient, and accessible travel for people who walk, people with disabilities who use assistive devices, and those who ride bicycles. It includes topics such as providing enough space for people to move comfortably, ensuring adequate protection from motor vehicle traffic, and creating safe, convenient street crossings.

**Virginia Beach will have a low-stress active transportation network that people of all ages and abilities can use.**

Two important considerations that affect the safety and comfort of people using active transportation facilities are the volume of traffic on a given road, and the speed of vehicle traffic. The following chart indicates what types of pedestrian or bicycle facilities are appropriate for different types of road conditions and is explained in further detail in Appendix A.

| Low-Stress Networks are for all users, including: | Facilities in Low-Stress Networks include: |
|---|---|
| • Children<br>• Seniors<br>• People of all genders<br>• People from all backgrounds<br>• People of all income levels<br>• People with disabilities<br>• Transit riders<br>• Bikeshare users<br>• Confident bicyclists | • Well-maintained sidewalks with buffers<br>• ADA-accessible curb ramps with detectable warning surfaces<br>• ADA-accessible curb extensions<br>• ADA-accessible blueway launch points<br>• Audible pedestrian signals<br>• Bicycle signals<br>• High-visibility and raised crosswalks<br>• Median refuge islands<br>• Bicycle boulevards<br>• Buffered and separated bike lanes<br>• Sidepaths and Trails<br>• Wayfinding<br>• Designated parking sites for bikes & micromobility devices |

*Table 11: Low-stress network users and infrastructure components.*

# Funding

This section provides information that the City of Virginia Beach can use to develop a funding strategy for active transportation infrastructure. Funding for pedestrian and bicycle projects can come from many different sources, including the City, the Commonwealth of Virginia, and the federal government. There are programs for specific kinds of projects, such as those that serve recreational or cultural sites, or help students travel to school, and programs for projects in specific locations. When pursuing funding, smaller projects can often be grouped with larger, more complex projects that may require a mix of funding sources.

Table 12 presents a few of the most common sources of funding for active transportation projects. The City of Virginia Beach has successfully used local funds alongside many of these state and federal opportunities to expand its active transportation network. Another resource for funding information is the City's Capital Improvements Program list, which includes approved planned projects and their projected funding sources.

In order to fully realize the vision in this Plan, the City must be creative, using as many sources as possible and even seeking out innovative funding strategies. One approach is adding pedestrian and bicycle facilities to already planned roadway improvements, which would only be a small portion of the overall project budget. Additionally, active transportation projects have a place in stormwater and recurrent flooding response planning and projects in the form of greenways that double as stormwater storage. Another approach is partnering with institutions such as Virginia Beach City Public Schools, health groups, universities, or large employers, to fund and support active transportation programs. Finally, several projects, such as those in Strategic Growth Areas, are intended to be implemented as a part of future development. With these projects, the City can ensure that those development plans accommodate recommended projects. The earlier and clearer the request, the more likely a developer can include improvements in their plan.

| Program Name | Funding Source | Description |
|---|---|---|
| **Traffic Safety Improvement (TSI) CIP** | Local | The TSI program is a Capital Improvement Program account that provides funding for infrastructure improvement projects throughout the City. This program is "ongoing" in nature, with CIP funding received each fiscal year. Public Works chairs a staff committee, including various City departments, that develops a prioritized program of projects for each of the CIP accounts on a quarterly basis. The TSI program has a funding cap of $250,000 for individual projects. The TSI program receives $2.3 million each year. |
| **City Bikeways and Trails Plan Implementation CIP** | Local | This program funds the construction of improvements to the network of bikeways and trails identified in the City Bikeways and Trails Plan and the Virginia Beach Outdoors Plan. Projects include the design and construction of improvements to major bikeway routes to support safe cycling and pedestrian use. This program supports the designation and signage of bike routes and scenic trails, as well as informing citizens of the bikeways and trails network available to them. $475,000 appropriated annually. |
| **Bikeways/Trails Repairs and Renovations CIP** | Local | This program funds capital maintenance of the bikeways and trails system, including the repaving and repair of shared use paths and sidepaths, repair and renovation of pedestrian-scale bridges, and assuring the continued viability of the bikeways and trails system. Projects are based primarily on an annual review and assessment of the conditions of each component in the system. $280,000 appropriated annually. |
| **Public Works Transportation CIP** | Local | This program funds the planning, engineering, project management, building, and maintenance of the the City's primary and secondary roads. This includes much of the City's bicycling and walking network. Public Works also develops an annual pavement maintenance schedule to preserve the City's roadways for all users. |
| **Tourism Development Financing Program (TDFP)** | Virginia Tourism Corporation | The TDFP program funds localities who have identified a deficiency in the local tourism activity, including active transportation. The locality must identify a developer and project to fill such a deficiency. Eligible projects must show significant benefit to the locality and existing tourism business community. |
| **Recreational Trails Program (RTP)** | Virginia Department of Conservation and Recreation. | RTP funds are federal funds that are disbursed through the Virginia Department of Conservation and Recreation. These funds can be used to build and maintain trail facilities. RTP grants require a 20% local match. |
| **Transportation Alternatives Program (TAP)** | Virginia Department of Transportation | TAP funds are federal funds authorized under MAP-21 and disbursed through VDOT. These funds are designated for non-motorized transportation projects such as trails, bicycle facilities, and sidewalks. In Virginia, projects that also qualify as Safe Routes to School Projects can receive TAP funds. TAP requires a 20% local match. |
| **Recreational Access** | Virginia Department of Transportation | This program assists local communities in providing access to recreational or historic areas owned by the Commonwealth of Virginia or a local government. |
| **Safe Routes to School (SRTS) Non-Infrastructure Grants** | Virginia Department of Transportation | SRTS non-infrastructure grants are disbursed by VDOT and can be used to hire a SRTS Coordinator and to pay for SRTS activities within a school division, such as in-school bicycle and pedestrian safety education. |
| **National Highway Performance Program** | US Department of Transportation | This Federal Highway Administration program disburses funds through VDOT and Metropolitan Planning Organizations (MPOs) and has been used to fund construction of new and retrofit crosswalks. To be qualified for NHPP funds, projects must be identified in a statewide or MPO long range plan. |
| **Highway Safety Improvement Program** | US Department of Transportation | This Federal Highway Administration program disburses funds through VDOT and has been used to administer bicycle and pedestrian safety projects. |
| **BUILD Transportation Discretionary Grant Program** | US Department of Transportation | BUILD Transportation Discretionary Grants, previously known as TIGER Discretionary Grants, are used to fund multi-modal, multi-jurisdictional projects. Grants are distributed by a merit-based process. |
| **Hazard Mitigation Grant Programs** | Federal Emergency Management Agency | FEMA offers three grants (Hazard Mitigation Grant Program, Pre-Disaster Mitigation, and Flood Mitigation Assistance) designed for communities trying to manage natural hazards, such as flooding, by creating greenways or open spaces designed to collect and disperse flood waters. All three grants require a local match of up to 25%, and can be used for activities such as acquiring properties, demolishing structures, mitigation (such as levees), or soil stabilization. The Hazard Mitigation Grant Program can also be used for planning and study efforts. |

*Table 12: Potential funding sources.*

# Prioritization

The Active Transportation Plan contains 282 centerline miles of new or improved paths, trails, and bikeways that cannot be built all at once. Limited funding and institutional capacity mean the City will have to decide how and when to implement the remaining active transportation network.

While this plan does not contain recommendations for the order of individual improvements, the project team has identified six projects that the City should pursue for short-, medium-, and long-term implementation (Figure 23). These projects were identified using the following criteria: key network connectivity, public support, recognition of existing planning efforts, and consultation with stakeholders. These six projects will make a significant contribution to improving access, increasing safety, and promoting economic development. Three of these projects are transformational moves that will make future investments in active transportation more effective by eliminating significant barriers to walking and bicycling across the City. The other three are major impact moves that will complete notable gaps in the active transportation network in the short-medium term.

These projects are preliminary recommendations that require further feasibility studies to determine constructability. 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 these recommendations is actually feasible. For example, land acquisition costs, adjustments to stormwater drainage, and historical and environmental impacts need to be carefully considered to determine if the following facility recommendations require alteration.

## Transformational Moves

- **The Virginia Beach Trail.** A century ago, the existing Norfolk Southern rail corridor helped spur the creation of Virginia Beach as a resort town. Turning this historic rail line into a 12-mile contiguous trail will provide a fully-separated, off-street trail connection between six of the eight Strategic Growth Areas, from the Newtown Road Tide Light Rail station, through Virginia Beach's Town Center, and to the Oceanfront Resort Area.
- **Constitution Drive Protected Bicycle Lane.** This street, which turns into Bendix Drive at its southern end, will provide a direct connection between Virginia Beach Town Center, Pembroke Mall, Princess Anne High School, the Virginia Beach Trail and the Thalia Creek Greenway.
- **Interstate 264 Pedestrian Bridge/Fly-over.** I-264 is the primary barrier to north-south travel within the City, and a flyover trail bridge would provide a safe, comfortable connection across the highway. Located east of Bendix Drive, the flyover would connect Virginia Beach Town Center to Mount Trashmore and provide an alternative to walking or bicycling through the complex and dangerous Independence Boulevard/I-264 interchange.

## Major Impact Moves

- **Shore Drive Protected Bicycle Lane at First Landing State Park.** Shore Drive is a popular route between the Oceanfront and the Bayfront, but the current bike lane lacks a buffer from fast-moving motor vehicle traffic. Creating a protected bike lane with a physical buffer between Kendall Street and Atlantic Avenue will improve safety while calming traffic. The right-of-way already exists for this improvement with minimal disruption to First Landing State Park. Conduct a feasibility study to determine the optimum bicycle facility improvement to accommodate all users.
- **Atlantic Avenue Bicycle Lane.** The frontage road parallel to Atlantic Avenue is commonly used by bicyclists but is currently unmarked. Establishing bicycle lanes on this parallel roadway between Shore Drive and 50th Street will dedicate part of the roadway to active transportation users and would connect the facilities on Shore Drive and bicycle infrastructure on Atlantic Avenue and the Boardwalk further south.
- **Seaboard Road Shared Use Path.** Seaboard Road passes through the Transition Zone, while providing access to two local schools and emerging residential areas. A shared use path built within the designated buffer zone would create a safe, protected place for walking and bicycling as this area continues to develop.

## Additional Phases

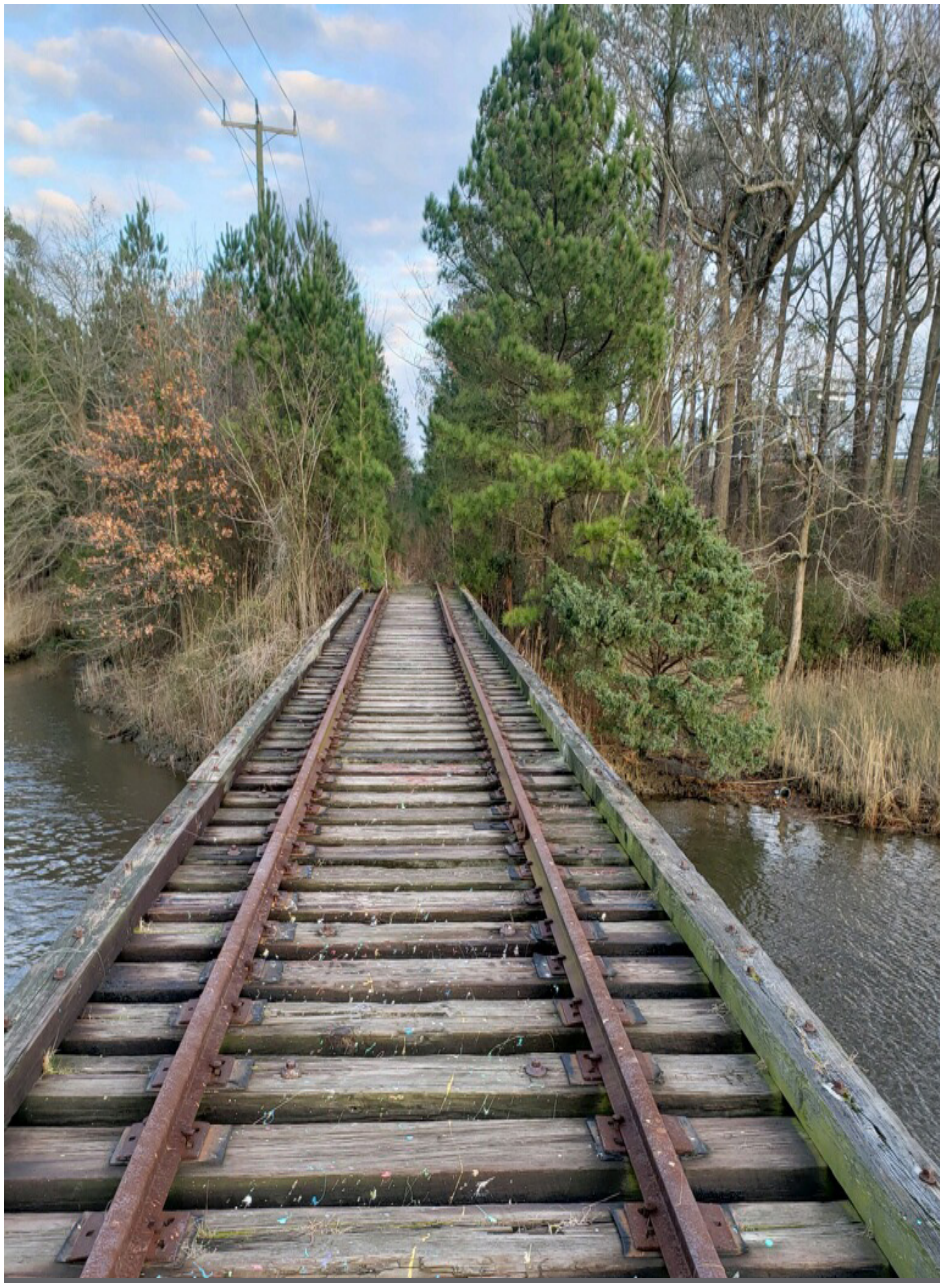
Beyond these six projects, the City should consider breaking up the rest of the active transportation network into three phases, based on available funding and feasibility. Using these three phases as a guideline, along with the performance measures outlined later in this chapter, will help the City become a place where walking, bicycling, and paddling is practical, safe, convenient, and pleasant.

**Near-Term (1-5 years):** During this phase, the City should pursue projects that build upon the existing foundation of walking and bicycling, particularly by completing gaps between existing facilities that will make them more effective or improving existing facilities to modern standards. The Blueways Plan referenced earlier should be undertaken within this timeframe to guide prioritization and design of that portion of the overall Active Transportation Network.

Pedestrian and bicycle projects in this phase will make traveling safer and more convenient. Priorities should include projects that maximize VBCPS Safe Schools travel routes, especially where such improvements also benefit other user groups. To save time and money, projects in this phase should be buildable within existing rights-of-way or can be added to already-planned roadway projects, including early-term Sea Level Rise Adaptation projects with bikeways and trails co-utilization opportunities. Long-planned blueway access points temporarily deferred due to adjoining Public Works projects should be installed, such as at Pleasure House Point, and access points incorporated into adjoining park redevelopment plans, such as at Bow Creek, should follow to achieve cost economies.

This phase is also a time to begin planning for recommended routes through properties that may be redeveloped in the future. Redevelopment projects, such as along portions of Atlantic Avenue at the Oceanfront, should incorporate these concepts. In addition, as new opportunities present themselves that bring a longer-term proposed facility to the forefront, whether based on citizen demand for action, political climate, or additional identified grant funding sources, these projects may then also spring forward in priority and timeline.

Public awareness of active transportation should be raised during this phase. Webpages and apps described earlier should be developed for



Segment of proposed Virginia Beach Trail shared use path through the center of the City. Courtesy of Walter Camp.

public education. Public agencies and private developers should become comfortable with the standards in the Design Guidelines, as well as best practices for maintaining walking and bicycling infrastructure. Introducing and expanding programs such as Safe Routes to School will build a culture around active transportation that drives support for further expansion of the active transportation network. The City's experience with new micromobility devices, such as rental scooters, should be analyzed for ongoing refinement of needs, opportunities, and priorities not presently foreseeable regarding such emerging technologies.

**Mid-Term (5-10 years):** Actions taken during this phase expand upon the first phase to make active transportation a part of daily life in the City. Projects should seek to meaningfully expand the system, with a focus on new facilities that may be more time- and capital-intensive to implement. As the active transportation network is built out, there may be chances to group individual projects together. The City should remain flexible and consider all projects during each phase in order to take advantage of opportunities to implement other projects should they arise. As properties develop and redevelop, citywide and within the Strategic Growth Areas in particular, this mid-term timeline most appropriately accommodates the Plan's recommended new facilities, either by the City or by private developers.

As the active transportation network builds out, this phase should be guided by the performance measures as identified in the section on the following page. Tracking how people use the network and its effectiveness in meeting the Plan's goals will help the City determine how to prioritize projects and how to best use its resources. This is also the time period when Sea Level Adaptation Projects will be well underway, creating significant opportunities for concurrent build-out of the active transportion network while also requiring long term commitments to future alignments and land-use decisions. It may be necessary to change the scope or order of planned improvements over time.

**Long-Term (10+ years):** As the active transportation network is built out, this phase will see both smaller projects that fill in gaps within the network, as well as large, transformative projects that may require the most planning and funds. By this period, much of the City may be built out, and the majority of new pedestrian and bicycle facilities will be built along existing roads that may have constrained rights-of-way. This phase may require the City to make difficult decisions with trade-offs between motor vehicles and active transportation, especially in urbanizing communities like the Strategic Growth Areas where the increase in active transportation trips may be the highest.

Construction of a sidepath underneath I-264 at Witchduck Road. Courtesy of Walter Camp.

During this period, new technologies, shifting demographics, and the ongoing growth of the City will cause travel habits to shift in ways we cannot predict today. A decade's dedication under this Plan will have added a defined blueways component to a then well-developed greenways network, leveraging quality of life, tourism, and economic benefits for the City, its residents, businesses, and visitors. It is possible that some of the recommendations in this plan may need to be revisited in 10 or more years. As the City continues to grow its active transportation network, continued public engagement and extensive tracking of performance measures are necessary to ensure that pedestrian, bicycle, micromobility, and paddling facilities reflect the travel needs of this community.

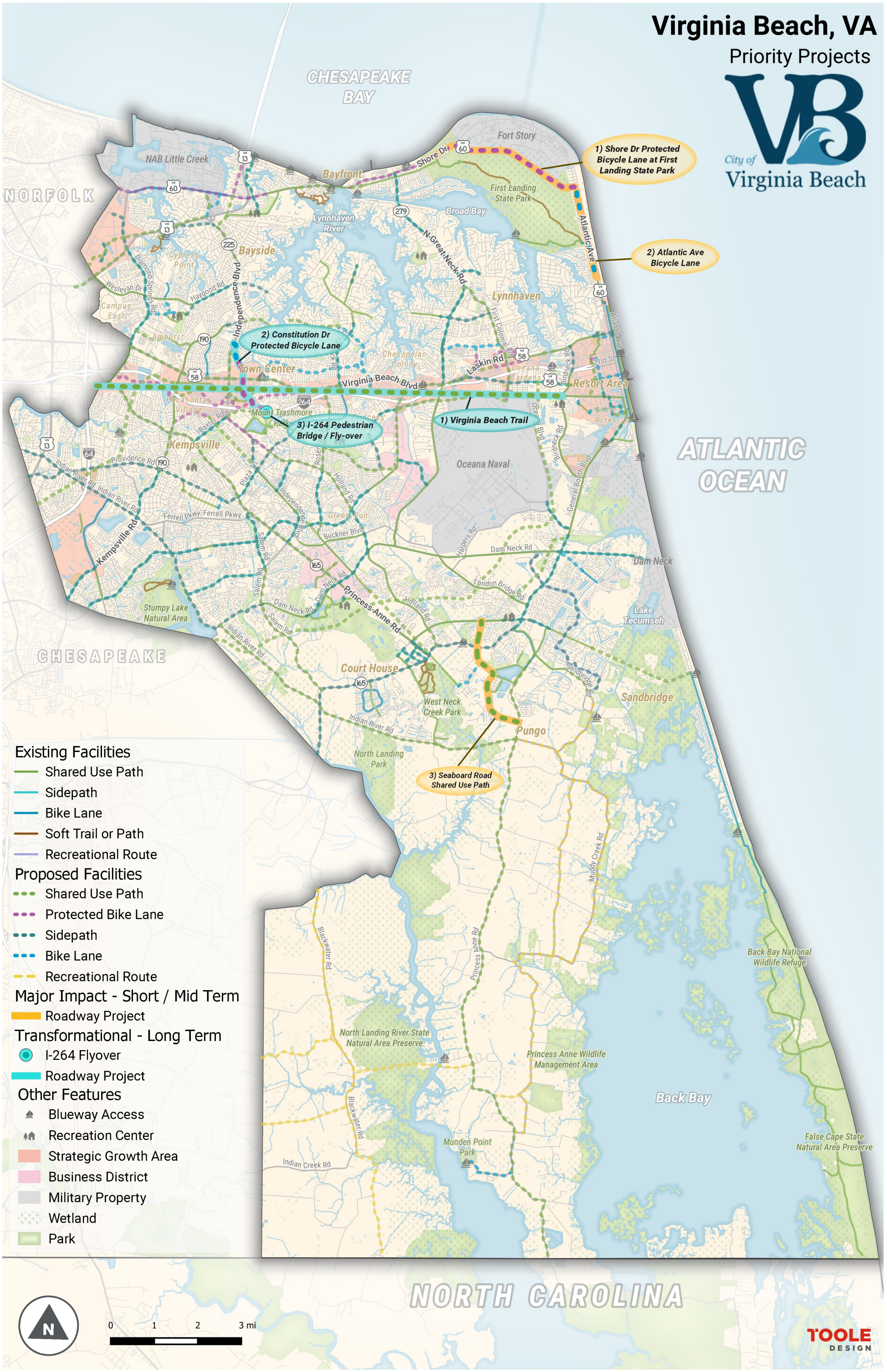



*Figure 24: Priority Projects*

# Cost Estimates

This plan recommends several different types of bicycle and pedestrian facilities, which in turn may require changes to the street or other available right-of-way. The typical costs in Table 13 offer the City a starting point to determine feasibility and phasing for implementing the proposed network over time. To provide a per mile range of costs consistent with the Virginia Department of Transportation estimates, this chart categorizes planning level cost estimates from VDOT's Transportation and Mobility Planning Division, see Appendix D. These general statewide planning level construction cost estimates are provided for several different bicycle and pedestrian facility types including shared-use paths, sidepaths, bike lanes (urban and rural), and other related improvements costs. These are estimates of cost per mile and include 25% for preliminary engineering and construction contingencies. They have been calculated for cost year 2020 with a 3% annual inflation rate.

The typical section estimates represented in the chart do not include bridge, right-of-way (ROW), stormwater mitigation, or other improvement costs. For a breakdown of bridge cost estimates for a planned improvement, see Appendix D. As indicated by VDOT, the costs in the "other improvements" categories should be added to the construction costs when applicable. The overall estimates are intended to be general and used for planning purposes. Construction costs will vary based on the ultimate project scope (i.e. potential combination of projects), schedule, and economic conditions at the time of construction.

| Facility or Other Improvement | Low Cost Estimate | High Cost Estimate |
|---|---|---|
| **Bicycle Lane (Urban)** | $690,300 | $1,051,380 |
| **Bicycle Lane (Rural)** | $579,852 | $872,964 |
| **Shared Use Path / Sidepath** | $1,194,750 | $2,336,400 |
| **Wide Curb Lane (2 additional ft. of pavement in each direction)** | | |
| **C&G not added** | $509,760 | $663,750 |
| **With C&G** | $1,755,486 | $2,315,160 |
| **Paved Shoulder (4 ft. wide paved shoulder in both directions)** | | |
| **GS-4** | $526,752 | $645,696 |
| **GS-3** | $751,896 | $921,816 |
| **Other Improvements** | | |
| **Provide New Signal** | $281,430 | $619,146 |
| **Modify Existing Signal** | $174,168 | $360,018 |
| **Improve Phasing for Signalized Intersection** | $13,806 | $20,178 |
| **Provide Pedestrian Signal Phase** | $63,720 | $84,960 |
| **Provide Pedestrian Crosswalk** | $31,860 | $42,480 |

*Table 13: 2020 VDOT cost estimates based on facility or improvement type.*

# Performance Measures

While this Active Transportation Plan will have a transformative effect on people and communities across Virginia Beach, tracking progress is key to ensuring the Plan's success. Measuring the success of the Active Transportation Plan will help the City maintain its pedestrian and bicycle network, while allowing the City to communicate its benefits to the public.

Through the public engagement process, community members have established their goals for active transportation in Virginia Beach, as described in Chapter 2 and in the table below.

To ensure that the Active Transportation Plan meets these five goals, the Plan contains thirteen measurable performance indicators that will help the City track the Plan's development to ensure that the community is able to benefit from them. Some of these indicators are measured year by year, while others are projected out over the next 25 years as long-range projects to be accomplished by the year 2045. While it may take up to 25 years to accomplish many of the specific performance measures, it is recommended that the city establish milestone targets on the way to the 25 year measures. Setting 10 to 15 year target measures are necessary to keep pace with the recommended project development time lines. This will also allow the City the time necessary to effectively plan for compliance with federal, state, and regional funding requirements, ensuring that the active transportation network will continue to grow. These long-term measures also acknowledge the city's budget constraints with new bicycle/pedestrian infrastructure and on-going maintenance. These performance measures are designed to help the City achieve each of its five goals for active transportation. They are based on best practices on performance measure development, such as the ITE's Putting Active Transportation Performance Measures into Practice and FHWA Guidebook for Developing Pedestrian & Bicycle Performance Measures.

| Goal | | Impact on Network |
|---|---|---|
| **Connectivity** | Grow the City of Virginia Beach into a complete transportation network that integrates active transportation into the lifestyles of the communities for the enhanced health, safety, and welfare of all users. | Proposed pedestrian and bicycle facilities will connect to one another and to existing facilities, providing access to neighborhoods and destinations throughout the City. |
| **Safety** | Create a safe, attractive experience for walking and bicycling throughout the City of Virginia Beach by providing convenient, connected, and equitable development of active transportation facilities. | The proposed network provides safe and comfortable routes for walking and bicycling, and alternatives to walking or bicycling on high-stress roadways. |
| **Economic Vitality** | Create an active transportation network that supports a strong and thriving local economy by increasing commute options, enriching recreational and tourism opportunities, promoting public health, and making the City an even more attractive place to live and work. | Pedestrian and bicycle facilities offer more transportation options at a relatively low cost, using taxpayer funds more efficiently, while supporting access to jobs, education, and tourist destinations. |
| **Technology** | Craft strategies and guidelines to prepare our streets for changing needs and technologies, including ridehailing, micromobility vehicles like electric bicycles and scooters, and autonomous vehicles. | The proposed network will create safe, comfortable routes for emerging technologies, particularly micromobility vehicles, and complement other emerging travel modes. |
| **Health** | Support public health benefits by creating an active transportation network that values and supports physical activity for people of all ages and abilities. | Greater access to walking and bicycling facilities gives people more chances for physical activity, improving public health. |

*Table 14: Influence of active transportation goals on the proposed network.*

## Connectivity

- By 2045, 75% of residents will live within ¼ mile of protected walking and bicycling facilities.
- Increase the mileage of new sidepaths, shared use paths, separated bicycle facilities, and trails 5% per year.
- Identify existing and potential opportunities for incorporating blueways in a connected active transportation network.

## Safety

- By 2025, adopt a comprehensive Vision Zero policy.
- By 2045, eliminate fatal and serious crashes involving pedestrians and bicyclists. This Vision Zero goal recognizes that people make mistakes, but roadway policy and infrastructure can be designed to ensure these inevitable mistakes do not result in severe injuries or fatalities in pedestrian and bicycle crashes.[1]
- By 2045, reduce the severity and occurence of all crashes.
- Increase the percentage of existing walking and bicycling facilities in good condition 2.5% per year.
- By 2045, expand existing walking and bicycling zones for 85% of elementary schools and middle schools in Virginia Beach. Safe walking and bicycling routes should be implemented within a 1-mile radius of elementary schools and a 1.5-mile radius of middle schools.

## Economic Vitality

- By 2045, the Strategic Growth Areas and large employment centers will be accessible to 50% of Virginia Beach residents within 30 minutes by foot, bike, or transit, via protected pedestrian or bicycle facilities.
- By 2045, 75% of residents will be able to access at least three daily needs (such as schools, grocery stores, health care facilities, or transit) within a one mile walk or bike ride or 20 minute walk.

## Technology

- By 2045, increase the number of trips *not* made by a single-occupancy vehicle in Virginia Beach to 30%.
- Reduce the amount of vehicle miles traveled (VMT) per capita by 10% each decade beginning in 2021.

## Health

- By 2045, 75% of Virginia Beach residents will live in a Census Tract with an average, high, or very high score on Virginia's Health Opportunity Index .

1 https://visionzeronetwork.org/

# Conclusion

This plan presents a vision for how Virginia Beach can transform our way of life by incorporating the active transportation experience into our every day living. These past few years of inventorying, analysis and planning have been a process of the City setting out to get a better understanding of what it is like for people to walk, bike, roll, scoot, and paddle in Virginia Beach. We have heard from community members that to do so today is, at best, uncomfortable and, at worst, unsafe. Further research identified communities and segments of the population where walking and bicycling is a lifeline to daily needs, economic opportunities, and public health. Over several months, the project team developed a network of new and upgraded facilities for walking and bicycling that serves all parts of the City, and refined with further community input.

This plan is ambitious, however the majority of the recommendations can be completed in the next 20 years with inter-agency coordination and strong public support. The City will not be able to do it alone, and only with the help of dedicated community members, and assistance from major institutions, regional agencies, the Commonwealth of Virginia, and the federal government, can this active transportation network become a reality. When this network does reach fruition, Virginia Beach will be a safer, more comfortable, and more enjoyable place for people to walk, bike, roll, scoot, or paddle. Together, the City will work to create a transportation network that makes our economy, our environment, and our communities stronger, better, and more sustainable.

A young Virginia Beach resident enjoys the sun on a shared use path.

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# APPENDIX A | ACTIVE TRANSPORTATION DESIGN GUIDELINES

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# APPENDIX A | ACTIVE TRANSPORTATION DESIGN GUIDELINES

## Contents

# 1. Introduction

These active transportation design guidelines provide updated guidance on the design of facilities for use by people walking, using a personal assistive mobility device, bicycling, or using other forms of active transportation, pursuant to Virginia Beach's Complete Streets Policy. They also provide updated guidance for some aspects of motor vehicle facilities that studies have shown disproportionately impact the safety and comfort of non-motorized, active transportation users (for example, the number of motor vehicle lanes, or the width of motor vehicle lanes, on a given roadway that pedestrians or bicyclists must cross).

This guidance is based on current best practices and safety research, including FHWA's Proven Safety Countermeasures (e.g. road diets, medians, and corridor access management), the FHWA Bikeway Selection guide, and the draft AASHTO Guide for the Development of Bicycle Facilities, also referred to as the AASHTO Bike Guide (which includes significant updates from the 2012 guide).

Given significant advances in bicycle and pedestrian safety research and design guidance since Virginia Beach developed its previous 2011 Bikeways and Trails Plan, and the synergistic impacts and tradeoffs between bicycle, pedestrian, and motor vehicle facility design, a committee should be created from the different divisions within Parks and Recreation and Public Works—including Traffic Engineering—that are involved in implementing, reviewing and maintaining these facilities. This committee should review the City of Virginia Beach Public Works Design Standards to determine necessary changes throughout the Standards to safely accommodate active transportation users and reflect current active transportation best practices, including all typical cross-sections and other standards.

The design guidance in this appendix will in some cases differ from current Virginia Beach practices. The intent of this information is to provide updated facility guidance based on current best practices that can be reviewed by the joint committee as the City updates its own standards. This committee is a high priority to convene as soon as the Active Transportation Plan is published.

This design guideline document demonstrates best practices and their applications and is for planning purposes only. This document proposes how to implement the proposed network described throughout the Active Transportation Plan. Continued discussions with Public Works is required to determine the priority and feasibility of the suggestions made within these guidelines for incorporation into the Public Works Design Manual and related sections.

## Principles of Good Pedestrian Design

The following design principles represent a set of ideals which should be incorporated into every pedestrian improvement. They are ordered roughly in terms of relative importance.

1. **The pedestrian environment should be safe.** Sidewalks, walkways and crossings should be designed and built to be free of hazards, offer a sense of security and minimize conflicts.
2. **The pedestrian network should be accessible to all.** Sidewalks, walkways and crosswalks should ensure the mobility of all users by accommodating the needs of people regardless of age or ability.
3. **The pedestrian network should connect to places people want to go.** The pedestrian network should provide continuous direct routes and convenient connections between destinations.
4. **The pedestrian environment should be easy to use.** Sidewalks, walkways and crossings should be designed so people can easily find a direct route to a destination and will experience minimal delay.
5. **The pedestrian environment should provide a sense of place.** Good design should enhance the look and feel of the pedestrian environment. Amenities such as seating, street furniture, banners, art, trees, plantings, shading, and special paving, along with historical elements and cultural references, should promote a sense of place.
6. **The pedestrian environment should serve multiple functions.** It should be a place where public activities are encouraged. Commercial activities such as dining, vending and advertising may be permitted when they do not interfere with safety and accessibility.
7. **Pedestrian improvements should preserve or enhance the qualities of the city.** Good design will allow pedestrians to experience a sense of Virginia Beach's unique character.

The quality of pedestrian and bicycle facilities plays a critical role in the character, function, livability, and accessibility of neighborhoods. This appendix provides design guidance to support safe, convenient, and accessible travel for people who walk, people with disabilities who use assistive devices, and those who ride bicycles. Design topics include roadway and facility considerations and guidance, intersection design.

# 1.1 Virginia Beach Active Transportation Plan

The City of Virginia Beach Active Transportation Plan (ATP) replaces and supersedes the former 2011 Bikeways and Trails Plan. The ATP provides comprehensive guidance for the planning of trails, shared use paths, sidewalks, and bicycle facilities. The Active Transportation Facility Design Guidelines is intended to be used as a complementary resource to the Active Transportation Plan.

# 1.2 Design Needs of Pedestrians and Bicyclists

## 1.2.1 Pedestrian Facility Accessibility Requirements

As the most vulnerable road user, design features that increase pedestrian safety and comfort should be integral to all new and retrofit street designs. When pedestrian facilities are designed to accessibility standards such as the Proposed Guidelines for Pedestrian Facilities in the Public Right-of-Way (PROWAG), it also improves accessibility for pedestrians of any age, including the elderly and children.

Legal accessibility requirements influence the minimum functional design and implementation of sidewalks, street crossings, curb ramps, signals, street furniture, transit stations, on-street parking, loading zones, shared use paths, and more. At the network level, connecting accessible pedestrian routes reduces conflicts by providing access across barriers. This enables safe and comfortable walking trips from beginning to end for pedestrians of all abilities.

The U.S. Access Board is the Federal agency responsible for developing and updating accessibility guidelines under the Americans with Disabilities Act (ADA) of 1990. The Access Board published its PROWAG in 2011. At the time of publication of this document, the Board had not issued a final PROWAG rule. The PROWAG will become an enforceable standard only after the Board publishes a final rule and after the U.S. Department of Justice (USDOJ) and/or the U.S. Department of Transportation (USDOT) adopts the final guidelines into their respective ADA and Section 504 of the Rehabilitation Act regulations. Until that time, the USDOJ 2010 ADA Standards and the USDOT 2006 ADA and Section 504 Standards provide enforceable standards applicable to the public right-of-way.

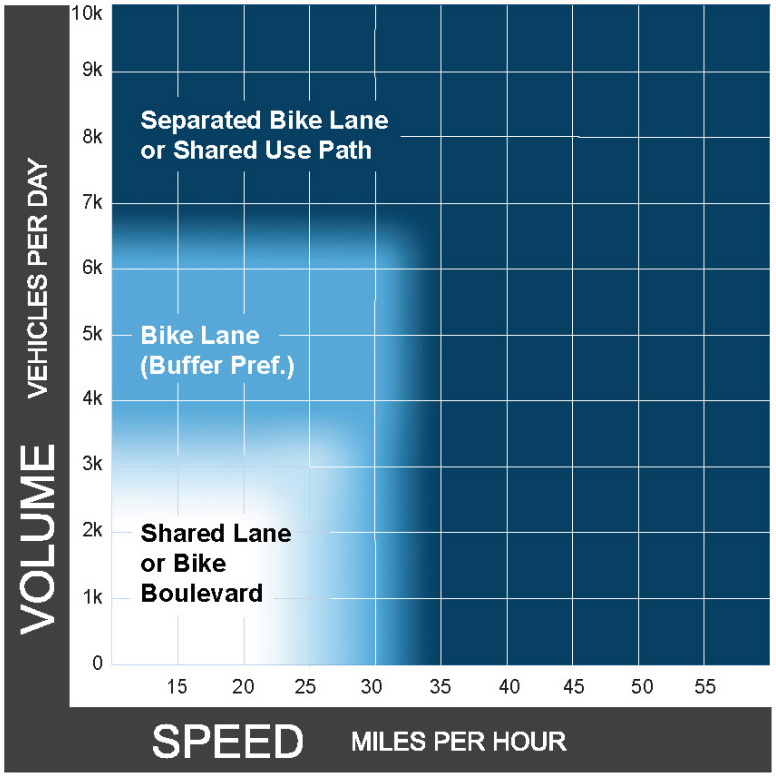
Where the 2010 ADA Standards or the 2006 ADA and Section 504 Standards do not address a specific issue in the public right-of- way, the Federal Highway Administration encourages public entities to look to the draft PROWAG for best practices. Several jurisdictions have chosen to apply the draft PROWAG as an alternative to, or equivalent facilitation for, the ADA Standards because they provide more specific coverage of accessibility issues in the public-right-of-way. Jurisdictions that have adopted the draft PROWAG as their standard should consistently apply all provisions of the draft PROWAG. Public entities and/or recipients of Federal financial assistance are responsible for complying with the current ADA and Section 504 accessibility standards and/or demonstrating equivalent facilitation.

## 1.2.2 Bicycle Facility Selection

Both traffic volume and traffic speed are important considerations when choosing an appropriate bikeway type for a given location.

The Bicycle Facility Selection Chart (Figure 25) combines both speed and volume into a single chart to help identify an appropriate treatment for a given roadway assuming different design users. Research indicates that providing less protection/separation on roads with higher speeds and volumes will result in fewer people comfortable with bicycling on those roads. These charts are based on Level of Traffic Stress (LTS) Analysis, which was also conducted for the Active Transportation Plan to identify how comfortable corridors may be for certain bicycling user types. The LTS methodology should be referenced for understanding how different bicycle facilities affect user comfort and safety. The provision of low-stress, connected bicycle networks reduces crash risk and encourages bicycling for a broader range of people.

See Section IV. Bicycle Facility Design for explanations and typical widths of the facilities described in this chart. For more information on bicycle user types and bicycle facility selection, see the FHWA Bikeway Selection Guide (2019).




**Notes**

1 *Chart assumes operating speeds are similar to posted speeds. If they differ, use operating speed rather than posted speed.*

2 *Advisory bike lanes may be an option where traffic volume is <3K ADT.*

3 *See Section 4.4 for a discussion of alternatives if the preferred bikeway type is not feasible.*

*Figure 25: Facility selection for Interested but Concerned bicyclists*

# 1.3 References for Active Transportation Facility Design

Numerous resources are available to guide active transportation facility design. FHWA and NACTO have provided multiple recent guidebooks on how to design safer bicycle and pedestrian facilities and networks.

## 1.3.1 Design Guidelines

- AASHTO Guide for the Development of Bicycle Facilities
- AASHTO Roadside Design Guide (2011)
- AASHTO Guide for the Planning, Design, and Operation of Pedestrian Facilities (2004)
- NACTO Urban Bikeway Design Guide: Don't Give Up at the Intersection (2019)
- NACTO Transit Street Design Guide (2016)
- NACTO Urban Bikeway Design Guide (2012)
- NACTO Urban Street Design Guide
- NACTO Global Design Guide (2016)
- FHWA Bikeway Selection Guide (February 2019)
- FHWA Achieving Multimodal Networks (2016)
- FHWA Resource Guide for Separating Bicyclists from Traffic (2018)
- FHWA Incorporating On-Road Bicycle Networks into Resurfacing Projects (2016)
- FHWA Separated Bike Lane Planning and Design Guide (2015)
- FHWA Manual on Uniform Traffic Control Devices (2009)
- FHWA Guidance for State and Local Governments
- FHWA A Guide for Maintaining Pedestrian Facilities for Enhanced Safety (2003)
- ITE Recommended Design Guidelines to Accommodate Pedestrians and Bicycles at Interchanges (2016)
- ITE Traffic Control Devices Handbook (2013)
- ITE & CNU Designing Walkable Urban Thoroughfares: A Context Sensitive Approach (2010)
- FHWA Manual on Uniform Traffic Control Devices (MUTCD) (2009)

- Virginia Supplement to the MUTCD (2011)
- US Access Board Public Right-of-Way Accessibility Guidelines (PROWAG)
- US DOJ ADA Standards for Accessible Design

### 1.3.2 Other Resources

- APBP Essentials of Bike Parking (2015)
- APBP Bicycle Parking Guidelines, 2nd Edition (2010)
- US DOT Policy Statement on Bicycle and Pedestrian Accommodation Regulations and Recommendations (2010)
- FHWA A Residents Guide to Walkable Communities (2015)
- FHWA Bicycle Intersection Safety Index (2007)
- TRB Highway Capacity Manual (2010)
- AASHTO A Policy on Geometric Design of Highways and Streets (2011)
- AASHTO Highway Safety Manual
- FHWA PedSafe
- FHWA BikeSafe
- FHWA Pedestrian Bicycle Crash Analysis Tool
- LAB Commute by Bike
- PBIC Pedestrian and Bicycle Design Resource Index
- National Bicycle and Pedestrian Documentation Center
- Complete Streets Coalition
- Rails to Trails Conservancy
- Pedestrian and Bicycle Information Center
- National Center for Bicycling & Walking
- Virginia Department of Transportation (VDOT) Road and Bridge Specifications (2020)
- Virginia Department of Transportation (VDOT) Road and Bridge Standards (2016)
- City's Amendments to the 2016 VDOT Road and Bridge Specifications and Standards
- Hampton Raods Transit Design Criteria Manual (2016)

# 2. Roadway Design

## 2.1 Travel lanes and On-Street Parking

Street space in Virginia Beach is physically constrained by buildings, mature trees, existing curb lines, and narrow rights-of-way. However, many of the City's arterial and collector streets exhibit wide lanes that exceed contemporary standards.

To better balance the allocation of public right-of-way from a Complete Streets perspective, designers will seek opportunities to minimize travel lane, shoulder, and on-street parking widths. Narrower lanes help lower motor vehicle operating speeds and improve safety for all users without reducing roadway capacity or increasing congestion. Narrower widths may be needed when applying a Complete Streets approach in urban areas and village centers. As of 2015, FHWA no longer considers lane and shoulder width as controlling criteria for streets with less than 50 mph design speeds, allowing for increased flexibility to implement narrower lanes.

There are many jurisdictions across the country that use 10' for all standard motor vehicle lanes and 11' for outside lanes only on designated transit or truck routes. These lane widths enhance bicyclist and pedestrian safety. The motor vehicle lane width guidelines in this section are consistent with current national guidance and safety research for all suburban and urban roads where people may be walking or bicycling. This is true even if expected near- or long-term bicyclist or pedestrian volumes are low. [1]

FHWA explicitly supports design flexibility in all aspects of bicycle and pedestrian facility design, including motor vehicle lane widths and road diets. Per the 2013 FHWA Bicycle and Pedestrian Facility Design Flexibility memo: "FHWA encourages agencies to appropriately use these guides and other resources to help fulfill the aims of the 2010 US DOT Policy Statement on Bicycle and Pedestrian Accommodation Regulations and Recommendations" and "US DOT encourages transportation agencies to go beyond the minimum requirements, and proactively provide convenient, safe, and context-sensitive facilities that foster increased use by bicyclists and pedestrians of all ages and abilities, and utilize universal design characteristics when appropriate."[2]

On low-volume local streets, narrow street widths and unmarked lanes are recommended to reinforce low design speeds and create a comfortable shared environment, particularly along bicycle boulevards.

An update of the City of Virginia Beach's lane width standards and standard cross sections may be necessary to align with these design guidelines, protect bicyclists and pedestrians on Virginia Beach's roads, avert serious injuries and fatalities, and implement its Complete Streets policy.

### 2.1.1 Design Guidelines

| Functional Classification | Sidewalk | Bikeway | Parking Lane | | Travel Lane | |
|---|---|---|---|---|---|---|
| | | | Recommended | Maximum | Recommended | Maximum |
| Arterial Street | | | 7'–8' [2] | 9' | 10'–11' [3] | 12' |
| Collector Street | | | 7'–8' [2] | 9' | 10' | 11' |
| Local Street[1] | | | Unmarked | Unmarked | Varies by parking[4] | 10' |

1 Striping for travel lanes or parking is not recommended for local streets.
2 8' recommended when adjacent to 10' travel lane or for any designated commercial loading zones.

*Figure 27: Recommended and maximum travel lane and on-street parking widths*

1 https://nacto.org/publication/urban-street-design-guide/street-design-elements/lane-width/

2 https://www.fhwa.dot.gov/environment/bicycle_pedestrian/guidance/design_flexibility.cfm

### 2.1.2 Consider the following when designing travel lanes and shoulders:

1. Travel lane and shoulder widths should be minimized in Virginia Beach to provide the space to accommodate all roadway users, reduce total impervious surface area, and support the City's established safety goals.
2. Centerlines are required on arterial and collector streets with ≥ 6,000 ADT and ≥ 20' traveled way, per MUTCD.
3. Visually narrow travel lanes with pavement markings or contrasting materials in retrofit situations where excess pavement cannot be reduced. Consider providing bicycle facilities in these situations if sufficient width is present.
4. Local streets should be designed for low-speed, shared operations between people riding bicycles and people driving motor vehicles. See Traffic Calming Treatments for design options.
5. Sidewalk Curb Buffer Zones and sidepath or separated bike lane buffers accommodate traditional shoulder functions of drainage, snow storage, and lateral support of pavement.
6. Fire truck outriggers require an 18-foot clear area for deployment; however, a travel way narrower than 18-feet may still accommodate an 18-foot clear area if a stabilized area is provided adjacent to travel way.

### 2.1.3 Consider the following when designing on-street parking:

1. Restrict on-street parking near pedestrian crossings to provide adequate sight distance. Bollards or curb extensions can be placed within 25 feet of a pedestrian crossing to prevent parking.
2. Refer to PROWAG R309 for accessible parking guidance.
3. On-street parking can be integrated into the design of separated bike lanes.
4. Where angled parking is considered, back-in parking is preferable to front-in parking to increase motorist visibility when exiting a parking spot. When situated at a 45 degree angle, parking stalls should be striped to be 9' wide and 15' – 17' deep.
5. Permeable pavement may be used for parking lanes to reduce impervious surface area. Permeable pavers also provide a traffic calming benefit by visually narrowing travel lanes.

# 3. Pedestrian Facility Design

Sidewalks provide pedestrians with a space to travel within the public right-of-way that is separated from motor vehicles. The quality of the sidewalk network contributes to the degree of safety, comfort, and enjoyment people experience when walking along a street. Sidewalks are also used for social interaction, making shopping trips, accessing transit, and accessing jobs and homes, among other everyday trip purposes. The area between the curb and the building face is one of the most vibrant and active sections of the overall right-of-way.

Sidewalks must be wide enough to support pedestrian activity and accessibility for people in wheelchairs. Virginia Beach currently has many wide sidewalk facilities which function as shared use paths. For example, bicycles are allowed on all sidewalks except at the Oceanfront and Town Center. These facilities should be upgraded to sidepaths where indicated in the Active Transportation Plan and follow the sidepath design criteria outlined in the Bicycle Facilities section of this appendix. ADA regulations also require that pedestrian routes have a smooth, level surface; characteristics such as accessible push buttons and curb ramps help satisfy this requirement and facilitate travel for people with mobility disabilities.

**A Note on Sidewalks also Intended for use by Bicyclists**

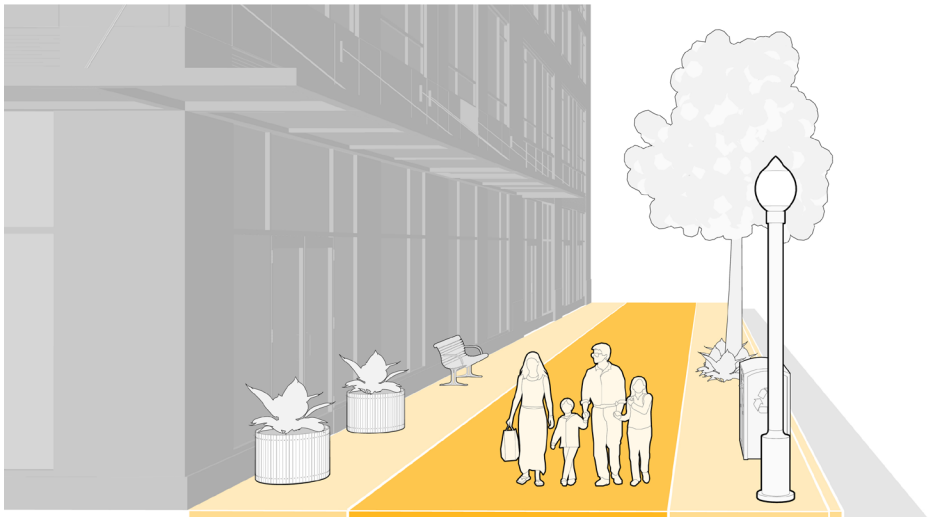
If a sidewalk is intended for use by both pedestrians and bicyclists, guidance on sidepath design in Section IV. Bicycle Facility Design should be followed. There are additional requirements to accommodate bicyclists beyond those of pedestrian facilities, and the sidepath design guidance addresses the safety and comfort needs of both pedestrians and bicyclists.

## 3.1 Sidewalk Zones

The typical sidewalk consists of three parts: 1) the Curbside Buffer Zone, 2) the Clear Pedestrian Zone, and 3) the Frontage Zone. See Figure 28.

### 3.1.1 Frontage Zone

The Frontage Zone is the area of sidewalk is the area between the Clear Pedestrian Zone and the building frontages or lot lines. In residential areas, the Frontage Zone may be occupied by front porches, stoops, lawns, or other landscape elements that



| Street Type Environment | Frontage Zone *desirable width* | Clear Pedestrian Zone *desirable width* | Curbside Buffer Zone *desirable width* | Total *desirable width* |
|---|---|---|---|---|
| Urban Connector | 6' (2' min.) | 8'-10' (6' min.) | 6' (5' min.) | 22' (13' min.) |
| Urban Main | 6' (2' min.) | 8'-10' (6' min.) | 6' (5' min.) | 22' (13' min.) |
| Urban Neighborhood | 6' (2' min.) | 8'-10' (6' min.) | 6' (5' min.) | 22' (13' min.) |
| Neighborhood Corridor | - | 6' (5' min.) | 6' (6' min.) | 12' (10' min.) |
| Neighborhood | - | 6' (5' min.) | 6' (5' min.) | 12' (10' min.) |
| Industrial Access | - | 6' (5' min.) | 6' (5' min.) | 12' (10' min) |

6" Curb

*Figure 28: Sidewalk zones in different land use contexts*

extend from the front door to the sidewalk edge. The Frontage Zone of commercial properties may include architectural features or projections, outdoor retail displays, café seating, awnings, signage, and other intrusions into or use of the public right-of-way. In other areas this zone may contain vegetation or other non-building features. This area acts as a transition between the public realm and the private realm.

#### 3.1.1.1 Design Guidelines

1. The Frontage Zone accommodates building entrances, café seating, and other public or semi-private accommodations.
2. Where buildings are located against the back of the sidewalk and constrained situations do not provide width for the Frontage Zone, the effective width of the Clear Pedestrian Zone is reduced by 2 feet, as pedestrians will shy from the building edge.

3. People with vision disabilities sometimes use the building edge for navigational purposes. Consider the use of directional indicators to guide people with vision disabilities along the Clear Pedestrian Zone if the frontage zone is not delineated by a detectable edge.
4. The Frontage Zone should be wide enough to accommodate amenities along building facades, but not at the expense of reducing the Clear Pedestrian Zone beyond the recommended minimum widths.
5. The Frontage Zones should be wide enough to act a clear zone from open doors, trash receptacles and other obstructions.

## 3.1.2 Clear Pedestrian Zone

The Clear Pedestrian Zone is the portion of the sidewalk space used for active travel. It must be kept clear of any obstacles and at a minimum width of 5' to 8' to accommodate expected pedestrian volumes including people using mobility assistance devices, pushing strollers, or pulling carts. The width of the Clear Pedestrian Zone should accommodate pedestrians passing singly, in pairs, or in small groups as anticipated by density and adjacent land use.

### 3.1.2.1 Design Guidelines

1. When reconstructing sidewalks and relocating utilities, above ground utility access points should be relocated outside of the Clear Pedestrian Zone to the extent possible. When this is not possible, utility caps/covers should be maintained fully flush with the sidewalk (seamless), and not create a tripping hazard.
2. For ease of maintenance and to communicate to pedestrians that this is space designated for their public use, pavement materials should be as uniform as possible.
3. Sidewalk materials will vary, but all materials should be chosen and applied to be slip resistant in all weather conditions to comply with ADA guidelines.
4. The Clear Pedestrian Zone should, as much as possible, keep to the natural path of pedestrian travel parallel to the roadway. It should be located in a position that naturally aligns with crosswalks at intersections.
5. It may be necessary in some locations for the Clear Pedestrian Zone to curve to form a more direct route to an intersecting walkway, to preserve or create space for larger trees, or to provide a greater degree of separation between the sidewalk and the roadway.
6. All new sidewalks and curb ramps must comply with Americans with Disabilities Act regulations and US Access Board guidelines.
7. All new sidewalks and curb ramps must also comply with the VDOT Specifications & Standards and City's Amendments.
8. The Clear Pedestrian Zone should be 5' minimum, 6' preferred, and 7' or greater on streets with high existing or expected pedestrian activity.
9. The cross slope of the sidewalk shall be between 1 - 2%.
10. A shy space of up to 2' on both sides of the Clear Pedestrian Zone that is clear of obstructions can help facilitate passing between pedestrians and more comfortable use of the sidewalk.
11. Detectable warning surfaces are required where sidewalks intersect driveways to commercial parking lots and other structures with frequent vehicle access such as multifamily apartment buildings.
12. Detectable warning surfaces must comply and be installed according to the City's Amendments, VDOT's Road and Bridge Standards and the US Access Board PROWAG requirement that detectable warning surfaces at curb ramps should be truncated domes spaced two inches apart.
13. Where sidewalks intersect residential driveways and alleys, detectable warning surfaces shall not be implemented.
14. Above-grade and surface-mounted utilities should be placed to minimize disruption to pedestrian travel, and to maintain required widths for pedestrian access routes. In almost all cases, utilities should be placed outside the Clear Pedestrian Zone.

## 3.1.3 Curbside Buffer Zone

The Curbside Buffer Zone is where many public amenities and utilities are located from street signs and light poles, to trees, benches, bike racks, newspaper racks, and landscaping. This width considers the need to set objects 1.5 feet away from the street (to ensure they are not hit by vehicles) and the width of the objects themselves. See Figure 29.

### 3.1.3.1 Design Guidelines

1. Green infrastructure elements such as native plant strips should be considered for stormwater runoff from the sidewalk and the street, to provide additional buffer between motor vehicles and pedestrians, and to beautify the pedestrian travel area.

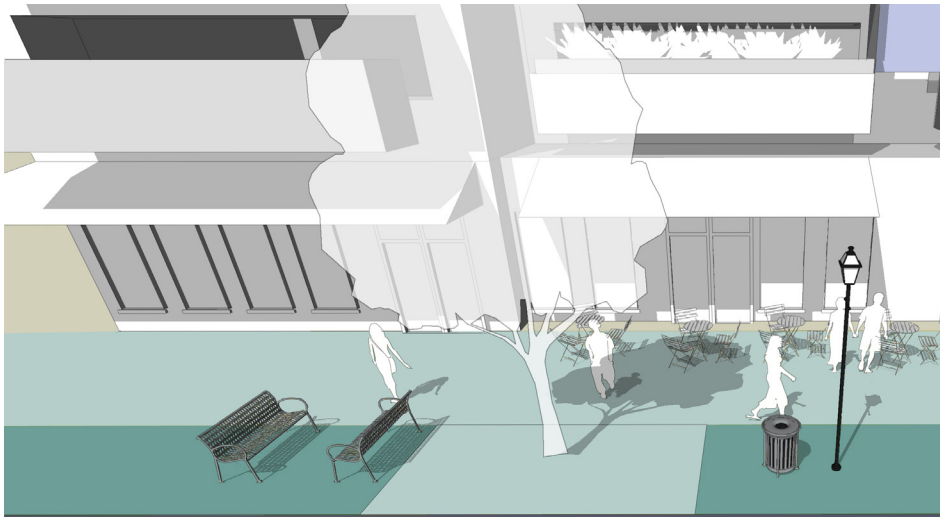


*Figure 29: Benches, street lighting, and trash cans in the Curbside Buffer Zone (darker green)*

Permeable pavement may be considered. For more information on vegetation, see Section 3.2 Street Trees and Landscaping.

2. Private retail/restaurant seating may be located in this zone.
3. Utilities, street trees, and other sidewalk furnishings should be set back from the curb face a minimum of 1.5 feet but should not obstruct the Clear Pedestrian Zone.
4. Vertical objects in the Curbside Buffer Zone must be placed in locations that do not obstruct sight lines, avoid damage from vehicles on the street, and allow for access to and from parked cars and transit stops.
5. Clear sight lines must be maintained through the Curbside Buffer Zone in a minimum 25 foot by 25 foot triangular space at the intersection of two streets, or a 10 foot by 10 foot triangular space on both sides of a driveway or alley. No structure, object, or plant of any type may obstruct vision between an area where pedestrians can walk and adjacent streets or driveways from a height of 24 inches to a height of 11 feet above the top of the curb, including, but not limited to buildings, fences, walks, signs, trees, shrubs, parked cars, trucks, etc. Longer sight distances should be calculated using vehicle and bicyclist sight distance formulas from the Public Works Design Standards and AASHTO Guide for the Development of Bicycle Facilities.

## 3.2 Street Trees and Landscaping

Landscaping defines the character of a street by enhancing pedestrian comfort and separating pedestrians from motor vehicle traffic. Landscaping can also create a perceived narrowing of the street and has a traffic calming effect that is an important contributor to achieve safer motor vehicle speeds. This section discusses landscaping in the context of the pedestrian experience; however, many of these elements may also serve as valuable stormwater management infrastructure.

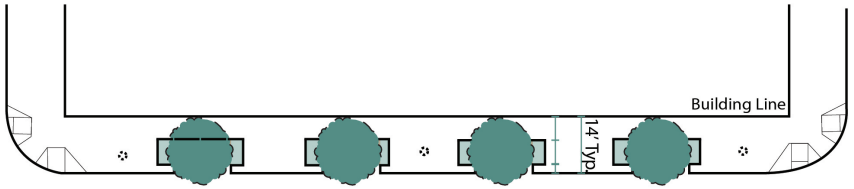



*Figure 30: Continuous planting strips in the Curbside Buffer Zone*

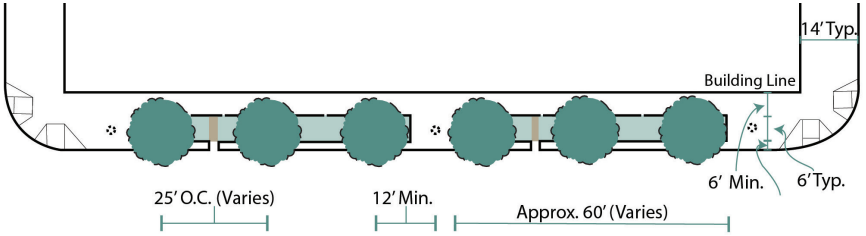



*Figure 31: Tree wells in the Curbside Buffer Zone*

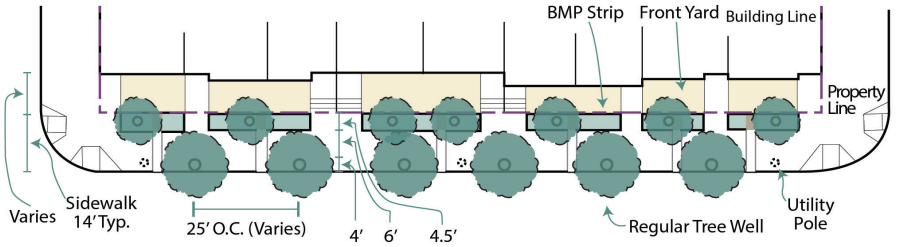



*Figure 32: Continuous planting strips in the Frontage Zone*

### 3.2.1 Design Guidelines

**1.** Street trees improve walkability by providing necessary shade, filtering light, and reducing the heat island.

**2.** Street tree enclosure can have positive effects in slowing traffic and increasing driver attentiveness and awareness of their surroundings.

**3.** Planting in the public right-of-way typically occurs in the Curbside Buffer Zone and medians; however, this is not the only place that can accommodate planting. Wherever there is an opportunity for landscape features, street, or development projects should also look for opportunities to incorporate plantings.

**4.** In dense urban areas or those with limited Clear Pedestrian Zone width, ADA-compliant tree grates may be necessary.

**5.** Consider rectangular (rather than square) tree wells, as they maximize the width of the Clear Pedestrian Zone.

**6.** Consider curb cuts with and drainage to leverage green stormwater infrastructure benefits from tree wells.

**7.** Tree wells provide a space for trees to be planted and for water to access their roots.

**8.** A 6 foot minimum pedestrian zone should be left adjacent to a tree well.

**9.** A typical tree well width is 6 feet.

**10.** Allow 15 feet of space between tree wells.

**11.** Continuous planting strips provide a space for multiple plantings and more green space than tree wells.

**12.** On local streets, a 5 foot minimum Clear Pedestrian Zone should be left adjacent to a continuous planting strip.

**13.** The typical planting strip width is 6 feet.

**14.** Allow a minimum of 12 feet of space between utility poles and tree centers.

## 3.3 Curb Ramps

The Americans with Disabilities Act (ADA) standards require all pedestrian crossings be accessible to people with disabilities by providing curb ramps at intersections and mid-block crossings as well as other locations where pedestrians can be expected to enter the street if vertical alignment changes. See Figure 33.

### 3.3.1 Design Guidelines

**1.** Curb ramps within the public right-of-way shall be designed according to United States Access Board, Proposed Guidelines for Pedestrian Facilities in the Public Right-of-way (PROWAG) R304, R406 and R407 and VDOT's Road and Bridge Standards (CG-12).

**2.** Separate curb ramps should be provided for each crosswalk at an intersection rather than a single ramp at a corner for both crosswalks. The separate curb ramps improve orientation for people with visual disabilities by directing them toward the correct crosswalk, and also enhance comfort for people pushing strollers, many elderly pedestrians, and others. If possible, separate curb ramps should be provided for each crosswalk at an intersection. However, in constrained locations,

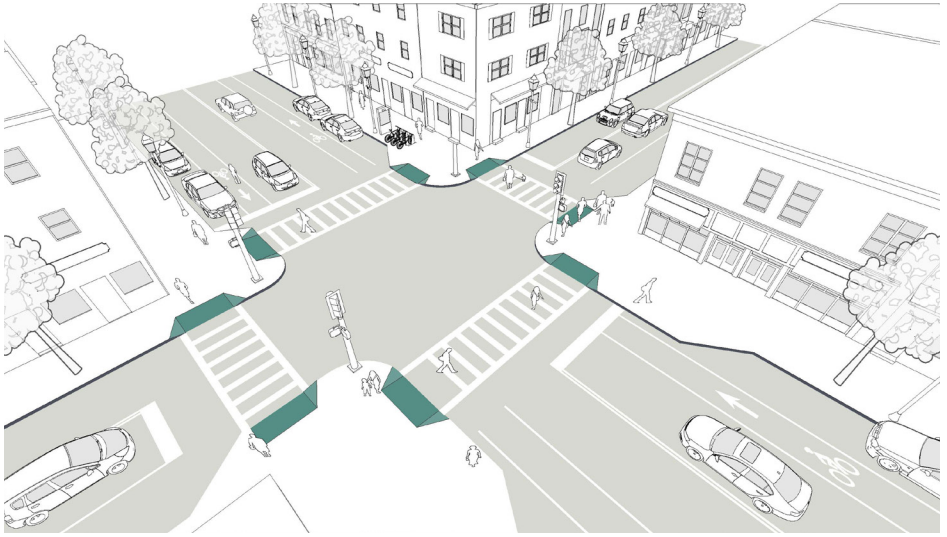


*Figure 33: Example intersection with curb ramps at all approaches*

a single curb ramp may be provided and must comply with US Access Board PROWAG and VDOT's Road and Bridge Standards (CG-12).

**3.** Whenever feasible, curb ramp locations should reflect a pedestrian's desired path of travel through an intersection. In general, this means providing two separate perpendicular curb ramps at a corner instead of a single ramp that opens diagonally at the intersection.

**4.** Each curb ramp must include a landing/turning space for wheelchair maneuverability and a detectable warning surface to alert pedestrians with a visual disability that they are entering or exiting the roadway.

**5.** The minimum width of a curb ramp is either 4' or 5' as shown in the VDOT's Road and Bridge standards, CG-12. 5' minimum is recommended by PROWAG. However, in areas of high pedestrian volumes and cross activities, wider curb ramps should be considered. On shared use paths and sidepaths, curb ramps shall be as wide as the path.

**6.** PROWAG allows for different maximum cross slopes depending on the traffic control in place at the crossing (2011, R302.6).[3] Generally, the maximum cross-slope is: 2% (1–2% with tight tolerances recommended).

**7.** Flares are required when the surface adjacent to the ramp's sides are walkable; however, they are unnecessary when this space is occupied by a landscaped buffer. Flares shall comply to US Access Board PROWAG and VDOT's Road and Bridge Standards (CG-12).

**8.** Curb ramps shall direct pedestrians into the crosswalk. The bottom of the ramp should lie within the area of the crosswalk.

**9.** Curb ramps may be perpendicular (VDOT CG-12A) or parallel (VDOT CG-12B) or a combination of both (VDOT CG-12C) to the pedestrian access route. The minimum running slope is 5% and the maximum running slope is 8.3%.

**10.** Detectable warning surfaces shall consist of truncated domes aligned in a square or radial grid pattern and shall comply with R305. Truncated domes shall be placed at the back of the curb and cover the full ramp width and a depth of 2 feet, unless otherwise specified by PROWAG (2011, R305.2).[4]

**11.** Truncated domes shall also be placed across the full width of any blended transitions (i.e., crossings with a running slope less than 5 percent), raised crossings, and at pedestrian crossing islands.

**12.** Detectable warning surface shall have a light-on-dark or dark-on-light contrast with the adjacent walking surface. The detectable warning surface shall be "Brick Red", Federal Color No. 31136 or No. 11302 for applications on standard concrete curb ramps and "Light Gray", Federal Color No. 26280 for applications on red brick pavers or red brick concrete pavers or as approved by the City. The color shall be integral with the detectable warning device and shall not be a surface applied coating or paint.

**13.** Under no circumstances should a curb ramp be installed allowing a pedestrian to enter a crossing without providing a curb ramp (or at grade sidewalk if no curb is present) on the opposite side of the crossing.

3 https://www.fhwa.dot.gov/environment/bicycle_pedestrian/publications/sidewalk2/pdf.cfm

4 https://www.fhwa.dot.gov/environment/bicycle_pedestrian/publications/sidewalk2/pdf.cfm

# 3.4 Transit Stops

Any marked or signed location where transit vehicles stop and service passenger boarding and alighting occurs is a transit stop. All transit stops should be readily identifiable, comfortable, safe, and accessible. The design of the stop, including length and location, should be determined in consultation with the Hampton Roads Transit Design Criteria Manual. Width should be adequate to ensure waiting transit patrons do not block or constrain pedestrian flow on the sidewalk. All stops are required to be accessible, including providing landing pads and curb heights that allow for the loading and unloading of passengers in wheelchairs.

Transit stops should be designed to accommodate passenger activity at all doors of the transit vehicles. If landscape strips or street trees are provided in the bus zone, they should be located outside the pedestrian path between the stop and sidewalk. Street trees must be trimmed or located to reduce conflict with the approaching transit vehicle. See Figure 34.

## 3.4.1 Design Guidelines

**1.** Bus bulbs improve the passenger experience by adding additional pedestrian space and enhance transit performance by reducing the need to merge with traffic; however, they may only be utilized on streets where curb lanes are not used for travel and generally where posted speeds are 35 MPH or less.

**2.** Transit stops should be well lit and highly visible to improve the sense of safety and comfort at all times of the day and night.

**3.** Consider seating at or near transit stops. Seating need not be a unique and dedicated element, but may include leaning rails, planters, ledges, or other street elements.

**4.** Consider opportunities for shade in the vicinity of transit stops such as street trees, awnings, or other elements to improve passenger comfort while waiting, especially in hot or inclement weather.

**5.** Whenever possible, provide bicycle racks at or near transit stops to accommodate intermodal transfers. Bicycle racks should not impede access to or from transit stops or pedestrian flow on the adjacent sidewalk or crosswalk but should generally be located within 25 feet from a transit stop or shelter if possible.

**6.** Transit stops shall comply with PROWAG accessibility guidelines (R308).

**7.** Transit stops are typically located at the natural curb line or on a bus bulb or transit island. Dedicated transit facilities may use medians. Transit operations, curbside uses, posted speed limits, traffic volumes, transit frequency and typical bus dwell time all influence location decisions for transit stops.

**8.** Transit stops may be located near-side, far-side, or mid-block. Near-side stops are immediately prior to intersections. Far-side stops are immediately after an intersection. Mid-block stops are located between intersections.

**9.** Transit stops should be proximate to crosswalks. Mid-block stops should provide access to mid-block crosswalks, if present.

**10.** The landing zone at each transit vehicle door shall be a clear zone 5′ long, (parallel to the curb) by 8′ deep (beginning immediately adjacent to the curb). Newly constructed sidewalks should have a 10′ by 8′ landing zone to provide an accessible space for loading and unloading. If the sidewalk is not wide enough to support an 8′

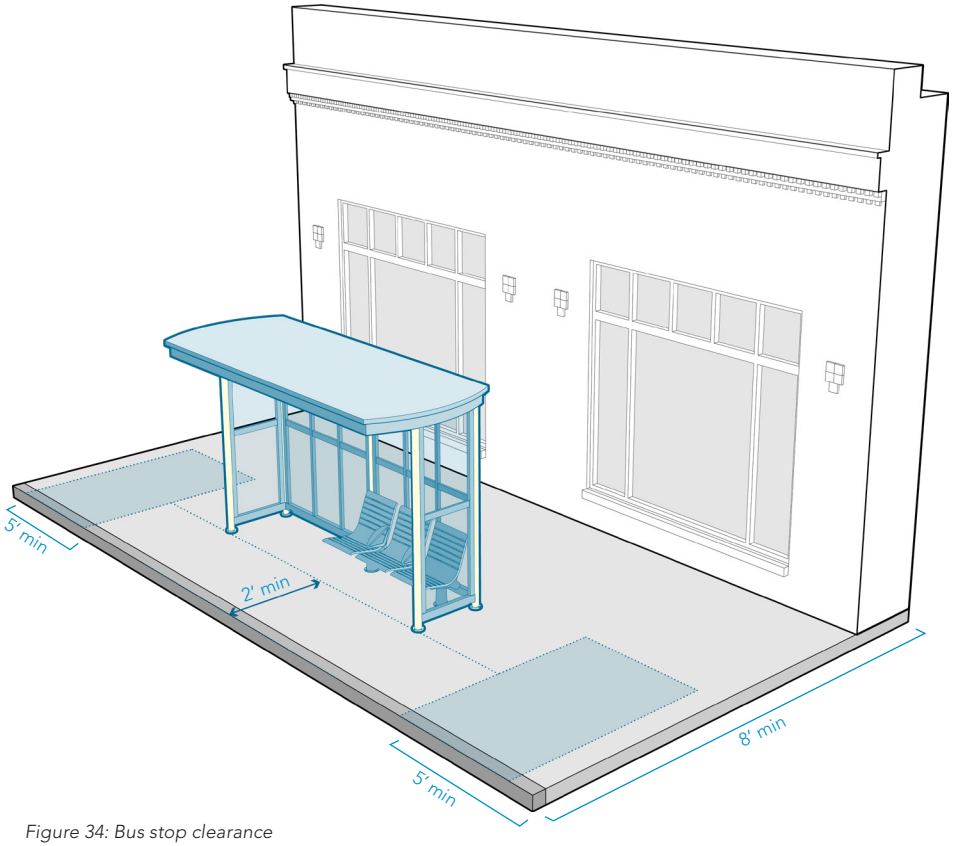



*Figure 34: Bus stop clearance*

landing zone, a curb extension (bus bulb) should be built where on-street parking is present to accommodate the minimum width. Bus bulbs should extend to 6" to 2' of the edge of travel lane. All transit stops should meet ADA Standards.

**11.** Landing zones shall be provided at all doors of the transit vehicle. For articulated buses, the distance between the front and rear landing zones is 18'. Different length buses have different door configurations and landing zones should be designed in coordination with all transit providers.

**12.** The landing zone should be clear of all obstructions including street trees, signal or light poles, and signposts.

**13.** When street trees are desired near or within bus stops, the transit provider must be consulted, and the following standards should be followed to avoid conflicts between transit vehicles and street trees:

- **a.** Trees should be excluded from a 40 ft. zone which represents the length of the bus as it is serving the stop (60 ft. in the case of articulated buses).
- **b.** Trees within both the 10 ft. departure zone and the 20 ft. approach zone (on either side of the 40 ft. zone) should be selectively located to minimize conflict with vehicles and to allow direct line of sight for approaching buses.

**14.** The length of the stop depends on vehicle type as well as the location of the stop, (i.e., near-side, far-side or mid-block) and should be determined in consultation with the transit provider. High frequency routes or stops serving multiple transit routes may require additional space; however, in general:

- **a.** Far-side stops should be at minimum 60' long, 80' for routes with articulated buses.
- **b.** Near-side stops should be at minimum 90' long, 100' for routes with articulated buses.
- **c.** Mid-block stops should be at minimum 100' long, 120' for routes with articulated buses.

**15.** Transit stops should be setback a minimum of 5' from crosswalks. Where feasible, a 10' setback is preferred. Where stops are not at an intersection, pedestrian crossings should be accommodated behind the departing transit vehicle.

**16.** Install signposts indicating the transit providers and routes servicing the stop at the front of the transit stop 2' behind the curb. The signpost is generally used as the stop measure for transit operators indicating the stop point of the front of the vehicle. The rough location of bus doors may be measured from this point.

**17.** Where possible, trash and recycling receptacles should be placed near the front of the transit stop, at a minimum of 18" from landing zones, minimum 3' away from benches or shelters, and in the shade where possible. They should also be anchored to the pavement to deter theft.

**18.** Consider wayfinding signing at transit stops and shelters.


*Figure 35: Bicycle parking at a bus stop on the Burke-Gilman Trail in Seattle, Washington.*

## 3.5 Bike Parking

Without bicycle parking, bicycle networks are of limited use. Bicycle parking enables bicyclists to safely leave their bicycles and enjoy the offerings of the street or to patronize businesses and destinations in the city. Bicycles take up substantially less space than automo¬biles–in fact, 10-12 bicycles can typically park in the area needed for a single car. Therefore, by providing bicycle parking, Virginia Beach can ensure access for many while using a relatively small area of the right-of-way. The most common means of providing bicycle parking is with bicycle racks and bicycle corrals. Bike share stations are a unique form of bicycle parking utilized only by bicycles associated with that system. More information on bike parking can be found in the APBP Bicycle Parking Guidelines, 2nd Edition (2010). See Figure 36.[5]

*The following minimum spacing requirements apply to some common installations of fixtures like inverted-U or post-and-ring racks that park one bicycle roughly centered on each side of the rack. Recommended clearances are given first, with minimums in parentheses where appropriate. In areas with tight clearances, consider wheelwell-secure racks (page 6), which can be placed closer to walls and constrain the bicycle footprint more reliably than inverted-U and post-and-ring racks. The footprint of a typical bicycle is approximately 6' x 2'. Cargo bikes and bikes with trailers can extend to 10' or longer.*

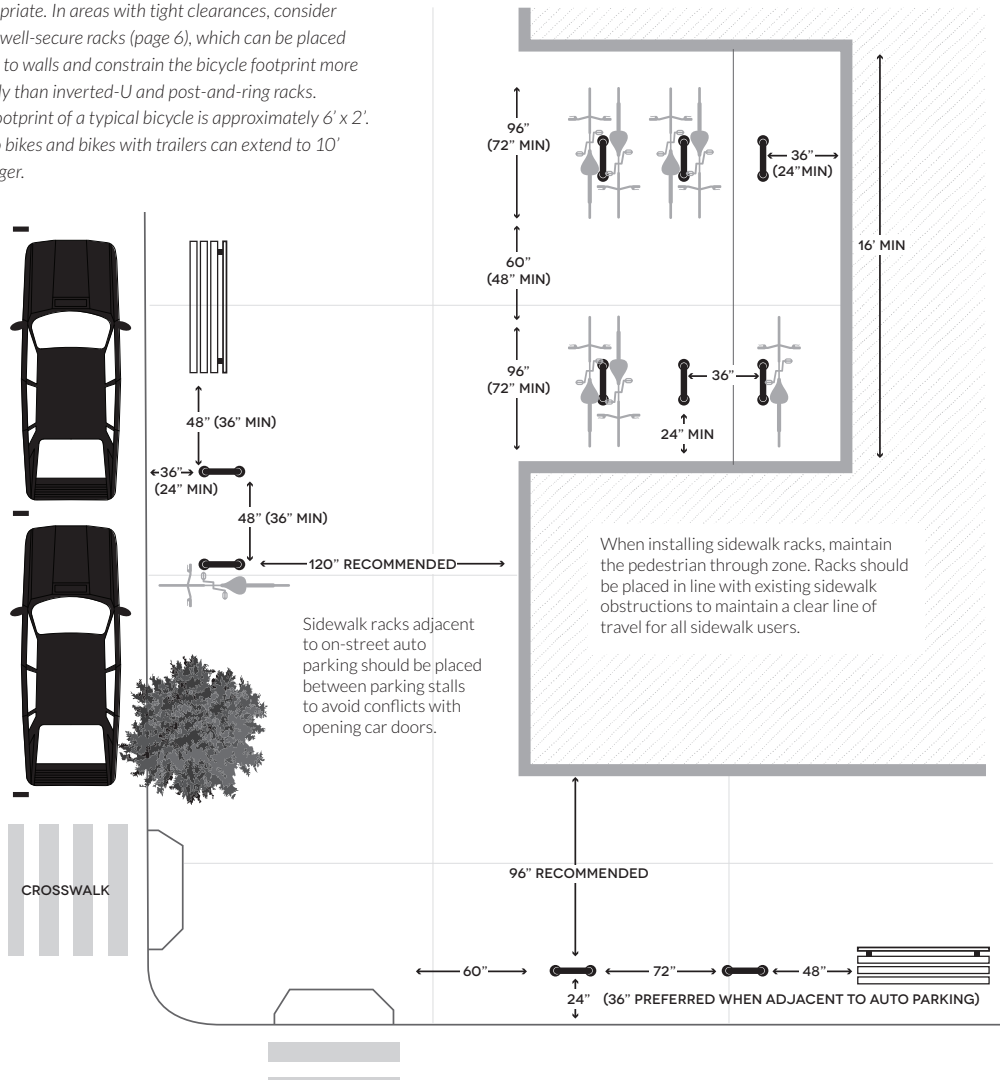



*Figure 36: Bicycle parking placement*

5 APBP Essentials of Bicycle Parking, 1st edition, page 10, www.apbp.org, used with permission from the copy-right holder.

# 4. Bicycle Facility Design

This section identifies bikeway design guidelines including recommended widths. Refer to the following resources for additional design guidance on bikeways as well as intersection treatments:

AASHTO Guide for the Development of Bicycle Facilities

NACTO Urban Bikeway Design Guide

NACTO Don't Give up at the Intersection

Continuous facilities shall be provided through intersections to maintain safety and comfort where most conflicts occur. At a minimum, designers should provide bicycle crossings (see Conflict Area Markings) and should consider supplemental intersection treatments such as bike boxes, two-stage turn queue boxes, and protected intersections. Additional geometric and signal strategies at intersections should be considered to reduce motor vehicle speeds and reduce bicyclist exposure at intersections (see Intersection Design).

Shared lane markings should only be implemented along with traffic calming treatments on local streets (i.e. bike boulevard, see **Bike Boulevards**). Along physically constrained arterial or collector streets where dedicated bikeways are not feasible, designers should consider lane or road diets or other traffic calming treatments to reduce operating speeds and encourage speed differentials ≤ 10 mph between people driving and biking (see Traffic Calming).

*Figure 37: Sidepath on Princess Anne Road in Virginia Beach*

## 4.1 Sidepaths

A sidepath is a two-way multi-use path, adjacent to and separated from the roadway, serving both pedestrians and cyclists (i.e., a trail that runs alongside a road). Sidepaths are typically 11' wide but may need to be wider depending on the number of users, the types of users, and the differences in their speeds. In constrained circumstances, a sidepath may be as narrow as 8' minimum, but this is not recommended for the full length of a corridor. By widening the path to provide space to accommodate passing movements, conflicts can be reduced. See Figure 39.

### 4.1.1 Sidepath Intersection Design

To reduce bicyclist and pedestrian conflict with motor vehicles at intersections with roadways and driveways, the following strategies should be considered:

**Establish priority**- right-of-way for sidepath users should be established with yield or stop signs for drivers at reasonable intersections like driveways and unsignalized intersections

**Signal Phasing**- an exclusive sidepath signal phase, similar to the Leading Pedestrian Interval, discussed later in the guide, could increase visibility of and prioritize sidepath use movement.

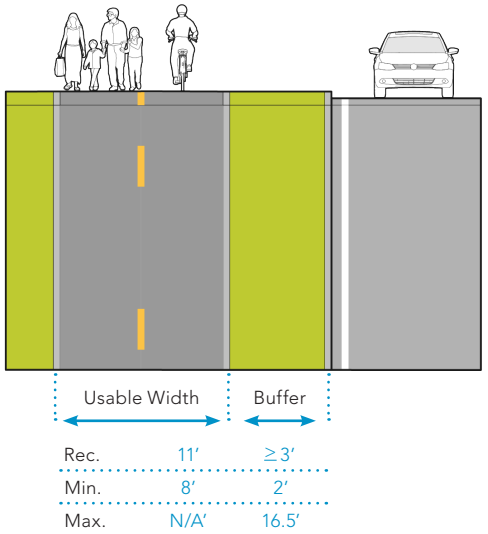
**Signs and Markings**- signs and markings can increase motorist awareness of the presence of bicyclists and pedestrians.

**Crossing geometry**- modifying roadway geometry can increase sidepath use visibility. Increasing the offset distance between the sidepath crossing and the primary roadway modifies the timing and positioning of the turning vehicle such that the turning vehicle will see the crossing pedestrian or bicyclist. Reducing the turning radius from the primary roadway may also cause the motorist to slow down.

For more information on sidepath intersection design, see Section V. Intersections.

### 4.1.2 Design Guidelines

1. Sidepaths are most appropriate where driveways and intersections are limited. In areas with high concentrations of driveways and intersections, on-street accommodations (including bike lanes, buffered bike lanes, and separated bike lanes) are preferred because they are proven to be safer.
2. Sidepaths typically have a lower design speed for bicyclists than on-street facilities and may not provide appropriate accommodation for more confident bicyclists who desire to travel at greater speeds.
3. A path may benefit from the separation of users by user speed, type, or direction. When separating users, consider the path width and paving material preferred by each user.
4. Proximity to vertical obstructions and objects along the route can affect the operation of a sidepath. To maintain comfort and safety of users, a shy distance (clear zone) of between 6" (minimum) and 24" (preferred) should be provided between the edge of the sidepath and adjacent benches, sign posts, or other objects.




*Wider for high-volume facilities
**8' minimum in constrained circumstances (see AASHTO Bike Guide for requirements).

*Figure 39: Sidepath typical cross-section*

## 4.2 Shared Use Paths

Shared Use Paths, also known as trails, are paths fully separated and independent from the roadway and are shared by bicyclists, pedestrians, and other non-motorized users. Shared use paths provide off-road transportation routes and can supplement a network of other bike facilities described in this guide. Shared use paths should be designed for use by people of all ages and abilities and should be designed to meet all applicable pedestrian accessibility requirements.

### 4.2.1 Design Speed

An important design consideration that affects the comfort level of the users is the design speed used to determined geometric features of the trail. Since design speed is context sensitive and based on the user profile of the trail, there is not a single recommended design speed for all shared use paths. The table below provides examples of different path and user characteristics and their corresponding typical design speed.

| Path Surface | Bicyclist and Pedestrian Volume | Grade | Bicyclist and Pedestrian Separation | Typical Design Speed |
|---|---|---|---|---|
| Unpaved | Any | Any | Any | 12 mph |
| Paved | High | Flat or moderate | None or minimal | 15 mph |
| Paved | Lower | Any | Any | 18-30 mph |
| Paved | Any | Steep | Robust or bicyclist-only path | Anticipated bicyclist downhill speed, up to 30 mph |

*Table 15: Design speed examples*

### 4.2.2 Facility Width

Shared use paths are typically 11 to 14 feet wide, but the appropriate paved width of trails is dependent on the context, volume, mix of users, and the design speed. The minimum paved width of two-directional trail is 10 feet, but paths wider than 10 feet should be considered to provide an acceptable level of service on trails frequently used by both pedestrians and bicyclists. Eleven feet is the minimum width required to allow a bicyclist to pass another path user going the same direction at the same time a path user is approaching from the opposite direction.

Eight-foot wide trails can be used for short distances in constrained situations to accommodate a physical barrier such asa bridge abutment or pier, utility structure, or property fence. Warning signs that indicate the trail narrows should be considered at these locations. Appropriate channelization tapers should also be included to effect any changes in trail width ahead of fixed objects. On a two-directional path, when narrower path widths occur at discrete locations, consider including a marked center line to help define each direction of travel.

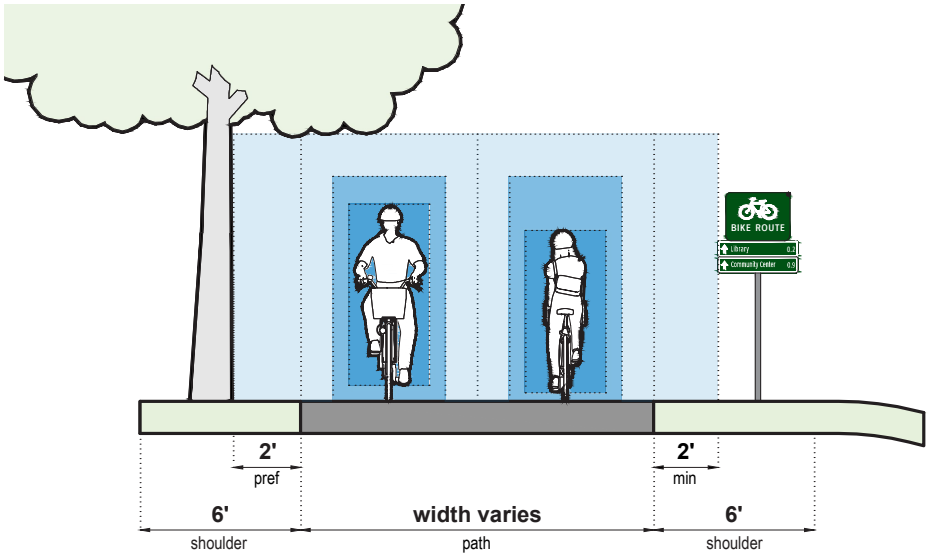



*Figure 41: Trail width requirements*

## 4.2.3 Separation of Bicycles and Pedestrians

Pedestrians and bicyclists may be separated to increase comfort. This is recommended for trails with a high volume of more than 300 total users in the peak hour and 30% mix of pedestrians. This solution should only be used when a minimum width of 15 feet is provided, with at least 10 feet for two-way bicycle traffic, and at least five feet for pedestrians. Where this type of separation is used on a path with a view, such as beside a lake or river, the pedestrian lane should always be placed on the side with the view. Where a trail has separated pedestrian and bicycle traffic, it can be beneficial to pedestrians who have vision disabilities to include measures that help them differentiate between the pedestrian walkway and the lanes designated for bicycling. Some examples of ways to differentiate between the pedestrian and bike portions of the trail include the following:

- **a.** Landscape buffer
- **b.** Clear visual contrast so that pedestrians with low vision can distinguish between the two areas (e.g., concrete versus asphalt, or through use of pavement markings)
- **c.** Directional indicator (a raised guidance surface)


*Figure 40: Well-defined separation between pedestrians and bicyclists on the Virginia Beach Boardwalk*

Care should be taken to ensure that any detectable separation is not a tripping hazard. For people who are fully blind a combination of clear visual contrast and directional indicators would have to be employed to be effective if continuous vertical separation is not present.

## 4.2.4 Trail Design Guidance

### 4.2.4.1 Surface Types

1. Surfaces should be stable, firm and slip resistant to be accessible to and usable by people with disabilities.
2. All-weather concrete or asphalt pavement is preferred over surfaces of crushed aggregate, sand, clay, or stabilized earth.
3. On trails, loads should be substantially less than on roadways. However, to prevent pavement damage, which can contribute to bicycle crashes, trails should be designed to sustain wheel loads of occasional emergency, patrol, maintenance, and other motor vehicles that are expected to use or cross the path.

### 4.2.4.2 Cross Slope and Drainage

1. A cross slope between 1 and 2 percent is recommended for trail drainage to be accessible to all users.

2. Cross slope in the direction of the existing terrain will typically provide sheet flow of surface runoff and avoid the need for channelizing flow in ditches, cross culverts, and closed pipe systems.
3. Where a trail is constructed on a side-slope that has considerable runoff, a ditch should be placed on the uphill side to intercept the slope's drainage.
4. Ditches adjacent to the trail should be designed with bicycle safety in mind. Where needed, catch basins and manholes should be located outside of the trail and clear zones.

### 4.2.4.3 Pavement Marking

*Figure 42: Centerline and edgeline marking*

### 4.2.4.4 Centerline

1. For trails with high user volumes (continuous stripe)
2. On curves with restricted sight distance, or design speeds less than 14 mph (localized stripe)
3. On unlit trails where night-time riding is permitted (continuous stripe)
4. Approaching intersections (localized stripe)
5. Approaching obstructions within the center of the trail, such as bollards (localized stripe)

### 4.2.4.5 Edgeline Markings

1. Where night-time use is permitted or routinely occurs
2. At approaches to intersections to alert path users of changing conditions
3. To separate pedestrians from bicyclists
4. When the path width changes rapidly
5. At approaches to marked constraints on the outside edge of the trail, entrances to tunnels, or when passing bridge abutments
6. To establish a shy distance from an obstruction that may otherwise not be noticeable, such as a short stretch of curbing or the foot of an adjacent retaining wall

### 4.2.4.6 Advance pavement markings

1. Advance pavement markings should be used where the crossing is unexpected or where there is a history of crashes, conflicts, or complaints
2. If a supplemental word marking, such as HWY XING is used, leading edge should be located at or near point where users pass the intersection warning sign
3. Additional markings may be placed closer to crossing; across the entire width of the path; and to supplement, but not replace, appropriate signs

### 4.2.4.7 Obstruction Markings

1. Obstructions should not be located within the clear width of a trail because they present a crash hazard to bicyclists and other trail users. Where an obstruction on the traveled portion cannot be avoided (for example, in situations where bollards are used or where a trail splits around a natural feature), channelizing lines of appropriate color (yellow for center line, otherwise white) should be used to guide bicyclists around it with sufficient advance warning of the presence of the obstruction.

### 4.2.4.8 Signage

1. Roadway users may be warned of a trail crossing by using a combined bicycle-pedestrian warning sign, or a bicycle warning sign. See Figure 43.
2. Placement should be at the distance recommended for the approach speed in Table 2C-4 of the MUTCD.

3. This sign assembly should not be installed at the crossing if the roadway traffic is yield-, stop-, or signal-controlled.
4. The trail name plaque may be mounted on the sign assembly to notify approaching roadway users.
5. YIELD and STOP signs are used to assign priority at controlled but unsignalized trail–roadway intersections.


*Figure 43: Bicycle-pedestrian warning sign at trail crossing*

### 4.2.4.9 Wayfinding

1. Wayfinding helps direct users to important destinations.
2. Road and path name signs should be placed at crossings.

### 4.2.4.10 Intersections and Transitions

1. Unauthorized use of trails by motor vehicles occurs occasionally. A three-step approach is recommended to address this concern.
2. The Three-Step Approach to Prevent Unauthorized Motor Vehicle Entry:
   a. Post NO MOTOR VEHICLE (R5-3 MUTCD SIGNS)
   b. Use center island at trail entrance
   c. Assess whether signing and trail entry design prevents or reduces unauthorized traffic.

Bollards may be used to restrict motor vehicles; however, it is not recommended since they present an obstacle and may be struck by bicyclists and other path users and can cause serious injury. If no other option exists, flexible bollards (flexposts) may be used. Metal or wooden bollards are not recommended.

*Figure 44: Railings prevent unauthorized motor vehicle entry*

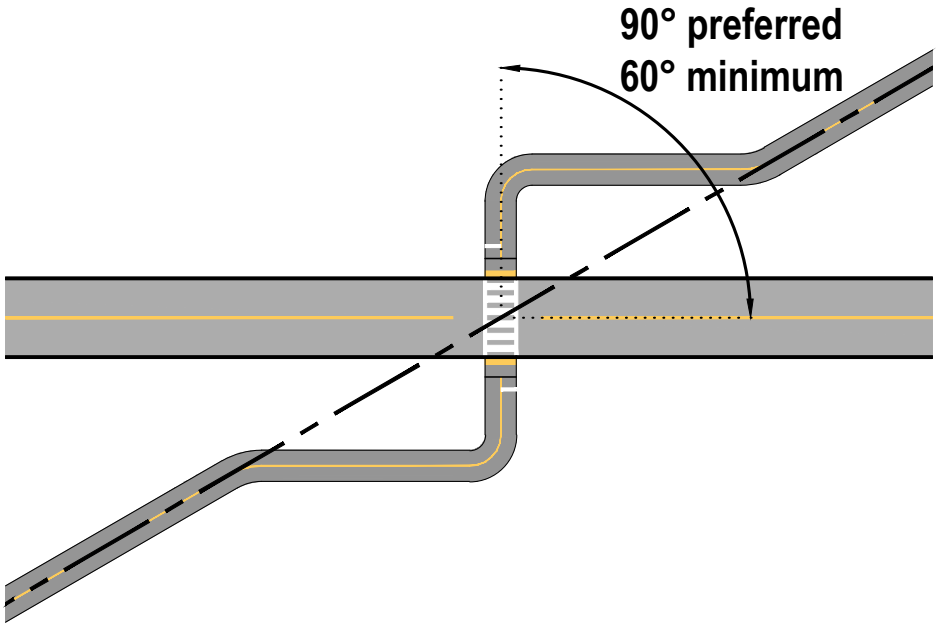



*Figure 45: Shared use path alignment*

3. Reducing speeds on path approaches to intersections:
   a. Chicanes, or horizontal curves, can reduce speeds on intersection approaches.
   b. A solid centerline stripe is recommended.
   c. Shared use path design speeds at intersection approaches should be greater than 8 mph.
   d. Use of Z-gates to force cyclists to dismount is not recommended because it poses a crash hazard and can force queueing into intersections to navigate the obstructed area.
4. Widening at intersections
   a. Trails can be wider at intersections to reduce queueing and increase crossing capacity.
   b. Widened trails can help reduce conflicts at trail entrances.
   c. Crosswalks should match trail width.
5. Trails may transition to other bicycle facilities (on- or off-road) to accommodate

bicyclists or transition to sidewalks to accommodate pedestrians and other path users. It is important to design a comfortable merging or diverging environment.

- **a.** Appropriate signing is needed to warn and direct bicyclists, pedestrians, and motorists at such transition areas.
- **b.** Transitions should be designed to ensure visibility and predictability for all users.
- **c.** Signalized or stop-controlled intersections should be considered.
- **d.** Transitions should not be abrupt, which can be hazardous or confusing.

**6.** Provide trail users with clear guidance to ensure they are going in the correct direction of travel when they exit the trail and enter the roadway.

**7.** Crossing realignment (See Figure 45).

- **a.** It is preferable for crossings to be as close to 90 degrees as possible to minimize the crossing distance and maximize sight lines.
- **b.** A minimum 60-degree crossing may be acceptable to minimize right-of-way needs.

### 4.2.4.11 Recommended Amenities

**1.** Trail amenities are essential for improving user experience and enhancing trail safety. The following list of amenities are recommended on trails:

- **a.** Trailheads
- **b.** Bicycle Parking
- **c.** Signage and Wayfinding
- **d.** Pedestrian-Scale Lighting
- **e.** 911 emergency markers.
- **f.** Bike Repair Stations
- **g.** Art Installations
- **h.** Shared Mobility Stations (bicycles, e-scooters, etc.)
- **i.** Drinking Fountains
- **j.** Landscaping
- **k.** Restrooms
- **l.** Shade
- **m.** Site Furnishings, such as benches, trash receptacles, and pet waste stations.

### 4.2.4.12 Trail Access

Trails shall be designed to be accessed at multiple points. Long stretches of trail with no access points can feel isolated to users. More access points and intersections also increase a sense of security because they create moments of visibility and permeability between the trail and surrounding uses. They also provide opportunities for people to exit the trail if they suddenly feel unsafe. Access points should be no more than ¼ mile to a ½ mile apart, and placement of access points should take into consideration the nearby on-street transportation network, transit stops, bike share stations, and points of interest. Access points should provide adequate signage and wayfinding, though they do not all need to be designed as trailheads. Primary design considerations are equitability, accessibility, and safety.

Safety is also important in terms of personal security. Crime Prevention Through Environmental Design (CPTED) is an approach to use design to reduce crime and increase perceptions of personal safety from criminal intent.[1] CPTED operates on the idea that design of a space can influence user decision. Principles of CPTED include access control and maintenance. For all trails, frequent access points are key for emergency and public safety vehicles. For landscaped trails, best practices can include proper lighting and control of vegetation or the planting of slow-growing vegetation. Sense of security can also increase the attractiveness of a trail.

Trails are a source of community identity and pride. These effects are magnified when communities use trails to highlight and provide access to historic and cultural resources. Many trails themselves preserve historically significant transportation corridors. Incorporating a unified vision and character into a trail's design can help transform trails from basic transportation corridors into cherished community gathering places.

# 4.3 Separated Bike Lanes

Separated bike lanes (also known as protected bicycle lanes or cycle tracks) combine the user experience of a sidepath with the on-street infrastructure of a conventional bicycle lane. Separated bike lanes are separated from pedestrian pathways by a vertical object, a change in elevation, or a visual delineation. Separated bike lanes may be either one-way or two-way and are physically separated from motor vehicle traffic and distinct from the sidewalk (although they may be at sidewalk level). Separated bike lanes provide separation from motor vehicles both a) horizontally, by providing an exclusive bicycling lane, and b) vertically, by including physical objects and/or a change in elevation from the street surface.

## 4.3.1 Design Guidelines

1. Physically separated bicycle facilities should generally be installed on any road with streetlights and with one or more of the following characteristics:
   - **a.** Total traffic lanes: 3 lanes or greater
   - **b.** Posted speed limit: 30 mph or higher
   - **c.** Average Daily Traffic: 6,000 vehicles or greater
   - **d.** Parking turnover: frequent
   - **e.** Streets that are designated as truck or bus routes
2. See the 2020 Active Transportation Plan for a list of roadways where separated bike lanes are the designated facility type. See the FHWA Bikeway Selection Guide for additional guidance on facility selection for streets where bikeway types are not designated in the 2020 Active Transportation Plan.
3. A minimum clear zone of 1 foot should be provided between vertical objects in the sidewalk or street buffer and the bicycle lane.
4. Intersections with separated bike lanes should be designed to ensure slow-speed turning movements for motor vehicles (10 mph or less) to improve yielding.
5. Protected intersections clearly define pedestrian and bicyclist operating spaces within the intersection and minimize potential conflicts between users. (see **Separated Bicycle Lanes at Intersections, Protected Intersections**).
6. Separated bike lanes can provide different levels of separation:
   - **a.** Separated bike lanes with flexible delineator posts ("flexposts") alone offer the least separation from traffic and are only appropriate as an interim solution, depending on the land use context. Flexible delineator posts can be visually obtrusive in single-family neighborhoods. Examples of acceptable barriers are include, but are not limited to planters, flexible delineators, concrete barriers, bollards, and parking stops. However, flexible delineators and parking stops should only be used as an interim solution.

*Figure 46: Two-way separated bike lane on an arterial street*

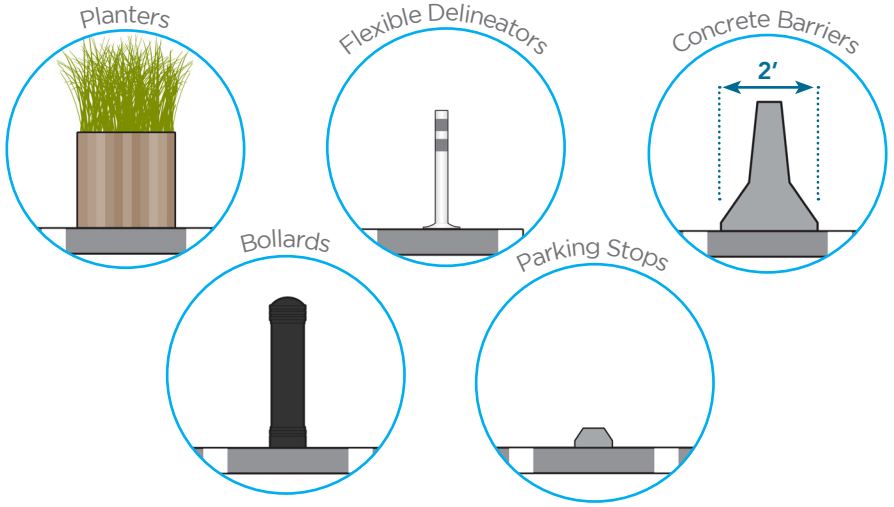



*Figure 47: Separated bike lane buffer options*

**b.** Separated bike lanes that are raised with a wider buffer from traffic provide the greatest level of separation from traffic, but often require road reconstruction.

**7.** On two-way streets, one-way separated bike lanes on each side of the street are typically preferred over a two-way separated bike lane or side path on one side of the street. This configuration provides intuitive and direct connections with the surrounding transportation network, including simpler transitions to existing bike lanes and shared travel lanes. It is also the most consistent with driver expectation since bicyclist operation is in the same direction as motor vehicle operation.

**8.** It may be beneficial to locate the separated bike lane on one side of the street to better connect to the bicycle network or provide access to destinations such as businesses, schools, transit centers, employment centers, parks, and neighborhoods.

**9.** Separated bike lanes can be integrated with a variety of transit stop designs because they are compatible with mid-block, near-side and far-side transit stop locations. Where feasible, separated bike lanes should be routed between the transit stop and the curb to eliminate conflicts between buses and bicyclists.

**10.** See Section VI. Bridge Design for considerations of separated bike lanes on bridges.

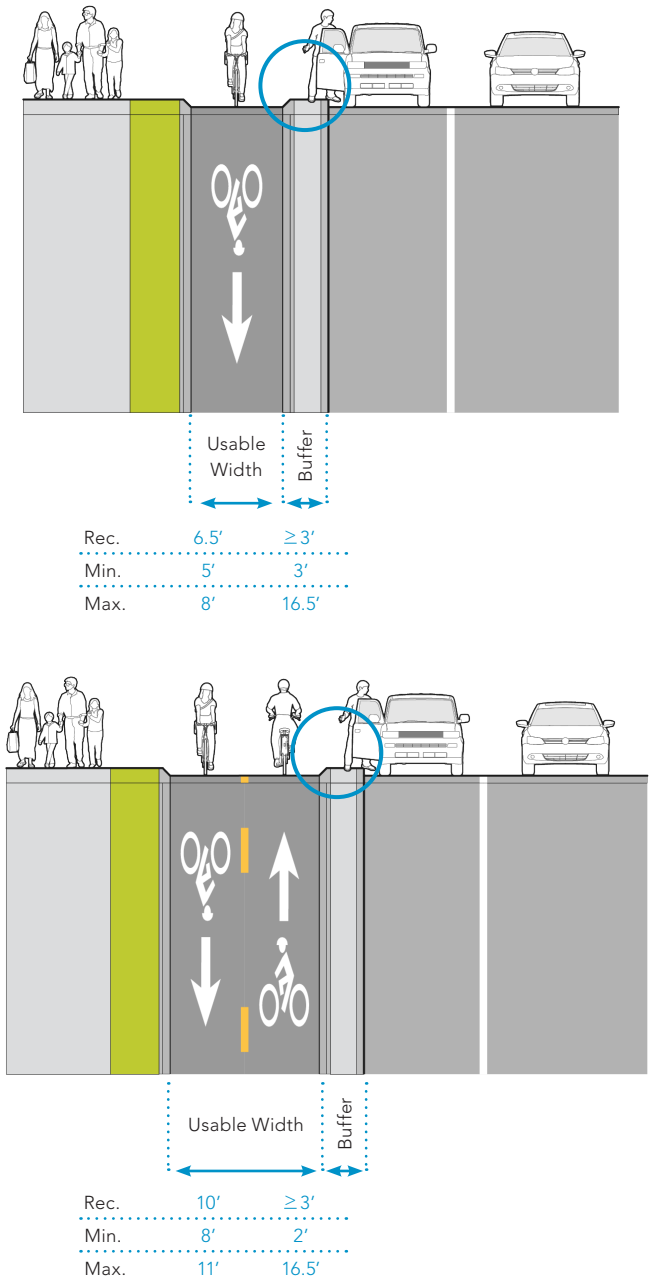



*Figure 48: One-way and two-way separated bike lane design*

## 4.4 Sidewalk-Level Bike Lanes

Sidewalk-level bike lanes are physically separated from traffic with a vertical curb and located at the same level as the sidewalk. They can be designed for one-way or two-way operation. A clear delineation between the bike lane and sidewalk shall be provided. A sidewalk buffer zone with trees or other streetscape elements adjacent to the bike lane is recommended to prevent encroachment (see **Pedestrian Facility Design - Curb Buffer Zone**). In constrained corridors, a physical or visual barrier between the bike lane and sidewalk is recommended where an amenity zone is infeasible. In the case of a visual barrier, directional indicators are recommended to assist people with visual disabilities in navigation and avoiding entering the bike lane.

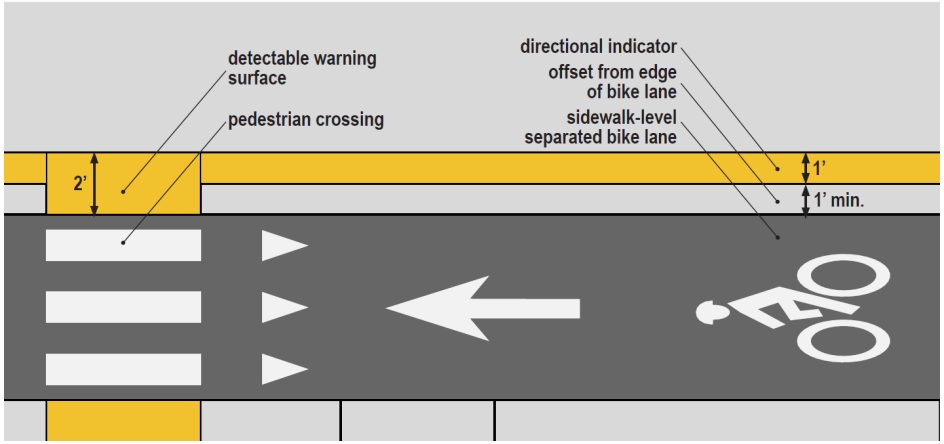



*Figure 50: Sidewalk-level bike lane design*

## 4.5 Buffered Bike Lanes

A buffered bike lane is an on-street bikeway separated from an adjacent travel lane or on-street parking lane by a striped buffer area. This buffer may be placed on either side of the bike lane but is preferred against high turnover parking, where present, to reduce dooring risks to bicyclists. Buffered bike lanes are recommended on streets with low curbside activity or congestion. A separated bike lane is recommended where a combined usable width and buffer width is ≥ **7'** to prevent vehicular encroachment.

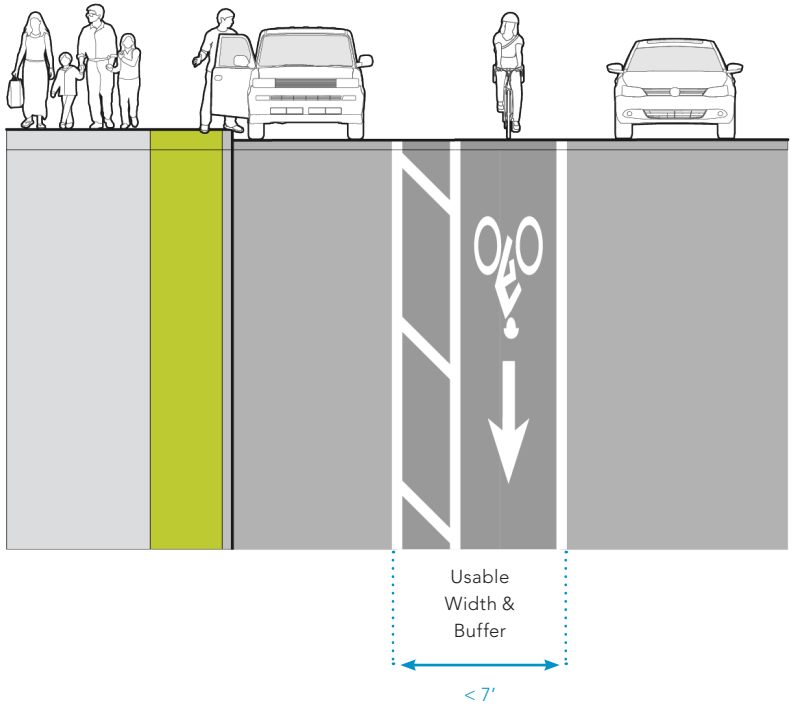



*Figure 51: Buffered bike lane design*

## 4.6 Conventional Bike Lanes

A conventional bike lane is an on-street bikeway delineated from an adjacent travel lane or on-street parking lane with pavement markings. Conventional bike lanes are recommended on streets with low curbside activity or congestion pressure. The desirable bike lane width adjacent to a curbface is 6 feet. The desirable ridable surface adjacent to a street edge or longitudinal joint (e.g. gutter pan) is 4 feet. Bike lanes >6′ may be interpreted as on-street parking lanes by motor vehicles; designers should consider separated bike lanes where available width is ≥ 7′. A 4′ foot minimum bike lane may be used in constrained circumstances, but 5′ or 6′ bike lanes are preferred for bicyclist safety and comfort.

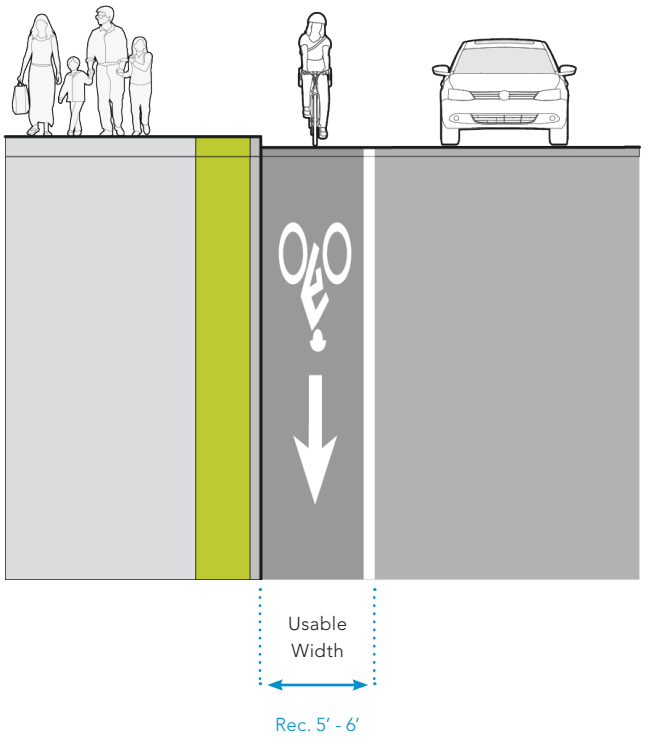



*Figure 52: Conventional bike lane width*

## 4.7 Contraflow Bike Lanes

Contraflow bicycle lanes enable bicyclists to operate in two directions on one-way streets. Contra-flow lanes reduce distances bicyclists must travel and can make bicycling safer by creating facilities that help other roadway users understand where to expect bicyclists. Contraflow bike lanes are recommended where one-way streets and irregular street grids make bicycling to specific destinations within short distances difficult.

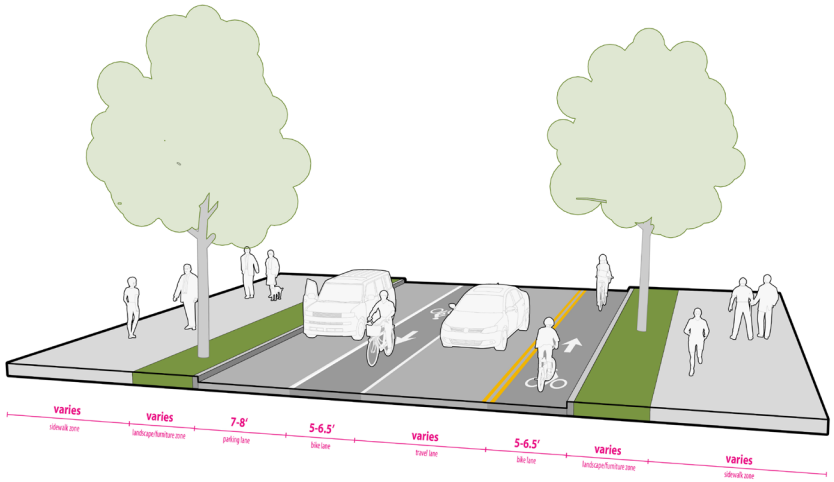



*Figure 53: Contraflow bike lane width*

## 4.8 Bike Boulevard

Bike boulevards are low-volume, low-speed streets—typically local streets—that have been designed to prioritize bicycle travel with signs, pavement markings, traffic calming measures, and, at major crossings, enhanced crossing treatments (see Traffic Calming Measures).

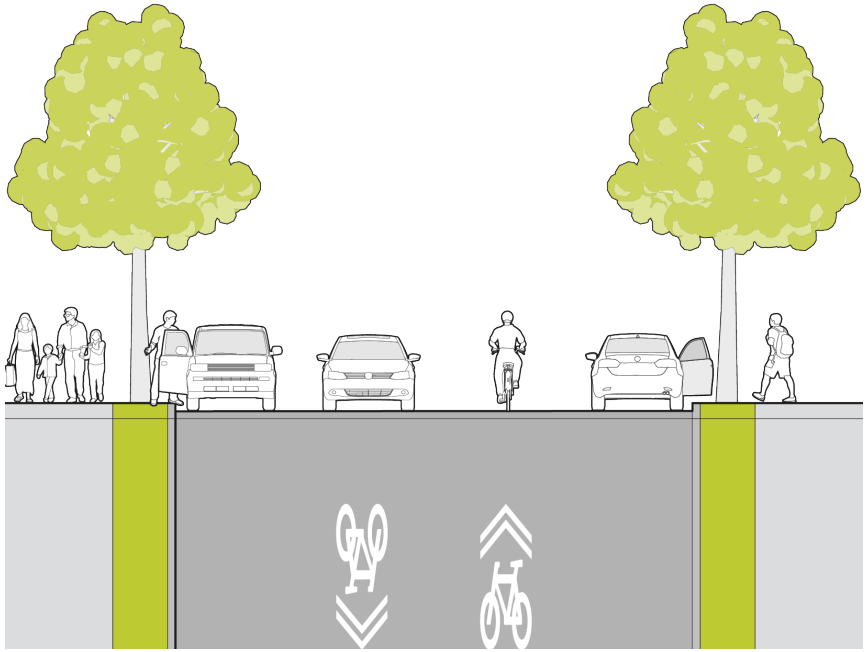


*Figure 54: Typical bike boulevard*

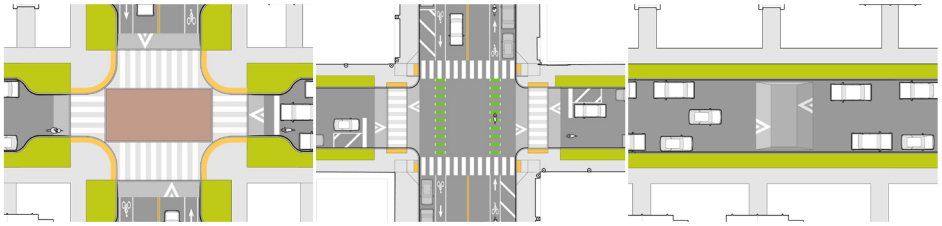
## 4.9 Traffic Calming Measures

Traffic calming measures should be incorporated at every opportunity for the enhanced safety of active transportation users. Vertical deflection is designed to be traversed at operating speeds between 20–25 mph.

### 4.9.1 Design Guidelines

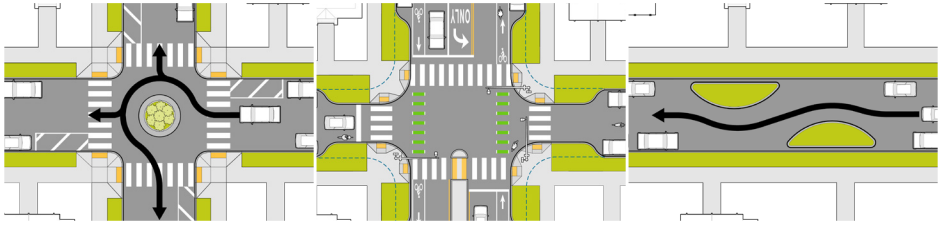
1. A full reveal height (typically **6"**)
2. A **flat profile** for all approach ramps (i.e., linear slope); other profiles are difficult to construct, which may result in improper installation that causes wear and tear
3. **6'** approach ramp lengths except for raised driveway crossings where narrower ramps are encouraged
4. Design speed should target posted speed. Designing higher than the posted speed encourages faster driving and should be avoided.
5. Maintain a sense of enclosure through the use of street furnishings, trees, and walking and biking facilities provides a traffic calming effect.
6. Evaluate potential drainage impacts of any vertical traffic calming technique that spans the full curb-to-curb width of the street.

**Vertical Deflection**



Raised Intersection | Raised Crosswalks | Speed Table

**Horizontal Measures**



Neighborhood Traffic Circle | Roadway Narrowing | Chicanes

*Figure 55: Traffic calming measures*

# 5. Intersections

## 5.1 Conflict Area Markings

Conflict area markings are intersection pavement markings designed to improve visibility, alert all roadway users of expected behaviors, and to reduce conflicts with turning vehicles. See Figure 56.

### 5.1.1 Design Guidelines

1. The appropriate treatment for conflict areas can depend on the desired emphasis and visibility. Dotted lane lines may be sufficient for guiding bicyclists through intersections; however, consider providing enhanced markings with green pavement and/or symbols at complex intersections or at intersections with safety concerns.
2. Symbol placement within intersections should consider vehicle wheel paths and minimize maintenance needs associated with wheel wear.
3. Driveways with higher volumes may require additional pavement markings and signage.
4. Consideration should be given to using intersection conflict markings as spot treatments or standard intersection treatments. A corridor treatment can maintain consistency; however, spot treatments can be used to highlight conflict locations.
5. The width of conflict area markings should be as wide as the bicycle lanes on either side of the intersection.
6. Dotted white lane lanes should conform to the latest edition of the MUTCD. These markings can be used through different types of intersections based on engineering judgment.
7. A variety of pavement marking symbols can enhance intersection treatments to guide bicyclists and warn of potential conflicts.
8. Green pavement may be used along the length of a corridor or in select conflict locations.

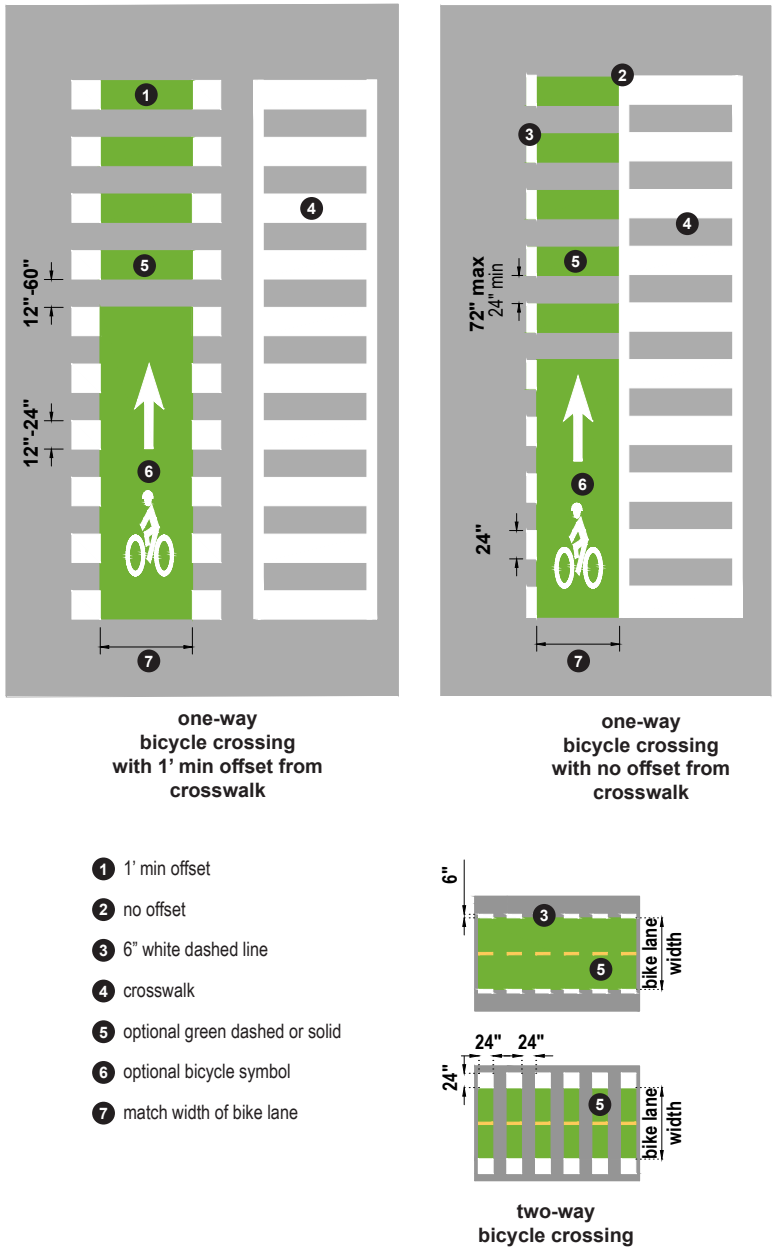



*Figure 56: Bicycle crossing markings*

# 5.2 Intersection Geometry

The design of intersections should consider how bicyclists and other users navigate both the approach, departure, and the crossing of the intersection. Where bicycle facilities cross roadways within intersections, the smallest feasible curb radius should be selected for corner designs based upon the design vehicle's effective turning radius to slow navigating the turn.

## 5.2.1 Design Guidelines

**1.** Intersection design should strive for an actual curb radius that is between 10 to 25 feet. The default curb radius for two intersecting residential streets should be 10 to 15 feet. For all other street classifications, including streets that intersect with residential streets, corner design should strive for an actual curb radius that is no more than 15 feet.

**2.** On low volume (less than 4,000 vehicles per day), two-lane streets, corner design should assume that a large vehicle will use the entire width of the departing and receiving travel lanes, including the oncoming traffic lane.

**3.** The geometric design features should complement traffic control devices to promote compliance as well as improve safety and comfort where users are expected to yield right of way.

**4.** Where elimination of conflicts is not possible or practical, intersection designs should limit the amount of time and space bicyclists are exposed to moving or crossing traffic in locations where:

- **a.** Bicyclists cross multiple vehicular travel lanes.
- **b.** Bicyclists operate between moving vehicular travel lanes.
- **c.** Bicyclists wait in areas exposed to moving motor vehicle traffic (e.g., waiting to turn left in a shared lane).
- **d.** Motorists merge with, or turn across the path of, bicyclists.
- **e.** Bicyclists cross pedestrian or other bicycle facilities.

**5.** Protected intersections shall provide clear right of way assignment, promote predictability of movement, and allow eye contact between motorists, bicyclists, and pedestrians.

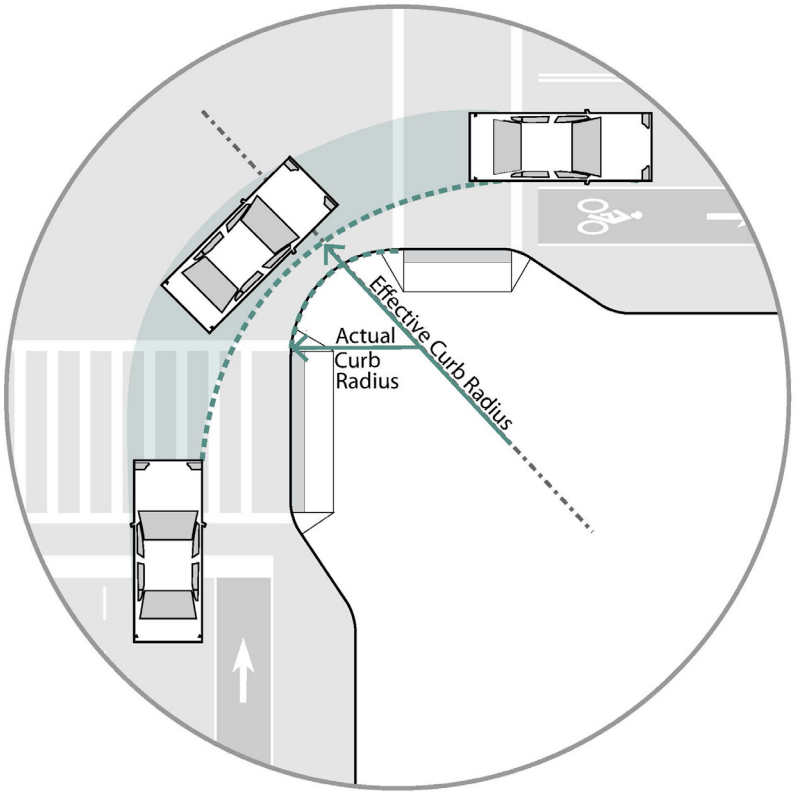



*Figure 57: Effective and actual corner radius*

**6.** If conflict points cannot be eliminated, intersection design should minimize the speed differential between users at the points where travel movements intersect. Consider applying conflict area markings.

**7.** Incorporate crossing islands to effectively reduce crashes at uncontrolled locations on busy multi-lane roadways where gaps are difficult to find, particularly for slower pedestrians, such as pedestrians with disabilities, older pedestrians and children.

**8.** NO TURN ON RED (R10-11) restrictions should be used to prevent vehicles from entering the bike lane queuing area.

# 5.3 Signal Design

Best practices in signalized intersection treatments for pedestrians include the following:

## 5.3.1 Leading Pedestrian Interval

The leading pedestrian interval is used to allow pedestrians to enter the intersection prior to vehicular traffic. Between three to seven seconds of additional walk time is added to the start of the pedestrian phase, while the vehicular traffic remains in the red phase. With this additional time, pedestrians are able to travel far enough to establish their position in the crosswalk before turning traffic is released.


*Figure 58: Leading Pedestrian Interval phases*

## 5.3.2 Countdown Timers

Include pedestrian countdown timers at all signalized intersections, per the Virginia Beach Public Works Design Standards for pedestrian facilities.

## 5.3.3 Accessible Pedestrian Signals

Accessible pedestrian signals (APS) and accessible detectors are devices that communicate information in non-visual formats about the pedestrian phase to pedestrians with visual and/or hearing disabilities. APS and detectors may include features such as audible tones, speech messages, detectable arrow indications and/or vibrating surfaces.

## 5.3.4 Right Turn on Red Restrictions

Motorists making a right turn on red are typically focused on looking for traffic on their left and, as a consequence, may be unaware of pedestrians crossing on their right side. A traffic study may be needed to determine the appropriate use of a right turn on red treatment. This method is accomplished by adding a "NO TURN ON RED" sign or using more effective measures like adding a red ball in the center of the sign or providing a red turn arrow in addition to the sign.

## 5.3.5 Bicycle Signals

Bicycle movements may be controlled by the same indications that control motor vehicle movements, by pedestrian signals, or by bicycle-specific traffic signals. The introduction of separated bicycle lanes creates situations that may require leading or protected phases for bicycle traffic, or place bicyclists outside the cone of vision of existing signal equipment. In these situations, signals for bicycle traffic will be required. Based on traffic conditions, consider the value of applying a "hot call" for activating signals.

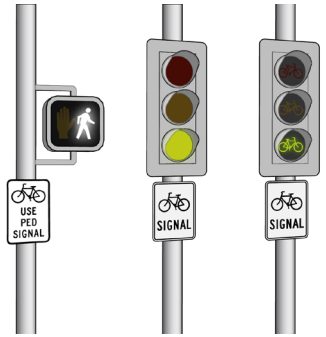



*Figure 59: Example bicycle signals*

### 5.3.5.1 Design Guidelines

1. Along a corridor, it is recommended that traffic signal indications for bicyclists are consistent and as uniform as possible.
2. An intersection's signal cycle length can have a tremendous impact on bicyclists travel.
3. Signal cycle lengths of 60 to 100 seconds are common in urban areas.
4. In suburban areas where vehicle traffic is consolidated on a small number of arterials, signal cycle lengths are typically longer - between 100 and 120 seconds.
5. The decision to provide a protected bicycle phase should be based on a need to eliminate conflicts and improve safety at an intersection. The volume thresholds are lower if a vehicle is crossing a two-way separated bike lane or sidepath compared to a one-way separated bike lane.
6. Bicycle-specific signals may be appropriate to provide additional guidance or separate phasing for bicyclists per the AASHTO Guide for the Development of Bicycle Facilities.

**7.** Consider installing advanced bicycle detection on the intersection approach to extend the phase, or to prompt the phase and allow for continuous bicycle through movements.

**8.** Video detection, microwave, and infrared detection can be an alternative to loop detectors.

**9.** Another strategy in signal timing is coordinating signals to provide a "green wave," such that bicycles will receive a green indication and not be required to stop.

**10.** A "green wave" allows bicyclists to clear an intersection in as little as 10 seconds, as opposed to 20 seconds of delay to motorists if bicyclists were to come to a full stop.

**11.** A stationary, or "standing," cyclist entering the intersection at the beginning of the green indication can typically be accommodated by increasing the minimum green time on an approach per the AASHTO Guide for the Development of Bicycle Facilities.

**12.** A moving, or "rolling," bicyclist approaching the intersection towards the end of the phase can typically be accommodated by increasing the red time (change and clearance intervals) per the AASHTO Guide for the Development of Bicycle Facilities.

**13.** Set loop detectors to the highest sensitivity level possible without detecting vehicles in adjacent lanes and field check. Type D and type Q loops are preferred for detecting bicyclists.

**14.** Install bicycle detector pavement markings and signs per the MUTCD, AASHTO Guide for the Development of Bicycle Facilities, and the NACTO Urban Bikeway Design Guide.

## 5.3.6 Mid-block Crossing Treatments

Mid-block crossings are those located outside of the functional area of any adjacent roadway intersection. Midblock crossings are used in locations with significant pedestrian or bicycle movement or long distances between intersections. Bulb-outs and median islands should be installed to protect pedestrians waiting to cross the street. Crossing islands allow pedestrians to navigate only one direction of traffic at a time by enabling them to stop partway across the street and wait for an adequate gap in traffic before crossing the second half of the street. Crossing islands are effective at reducing crashes at uncontrolled locations on busy multi-lane roadways where gaps are difficult to find, particularly for slower pedestrians, such as pedestrians with disabilities, older pedestrians and children.

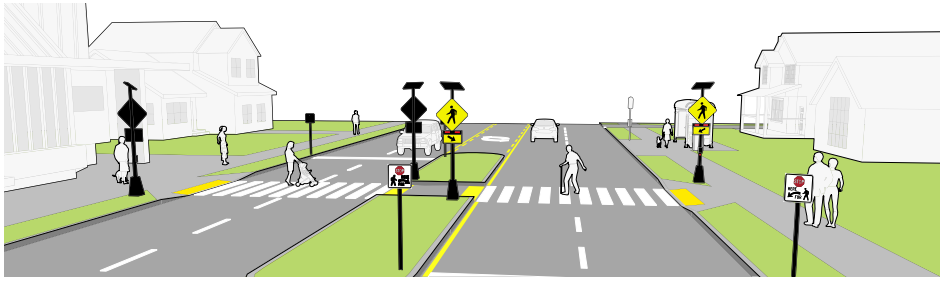


*Figure 60: A mid-block crossing example with raised refuge island*

### 5.3.5.1 Design Guidelines

**1.** Crossing islands should be a minimum of 6-feet wide to meet ADA standards and accommodate the typical width of a bicycle.

**2.** Crossing islands should be aligned directly with marked crosswalks and provide an accessible route of travel.

**3.** Where mid-block or intersection crosswalks are installed at uncontrolled locations (i.e., where no traffic signals or stop signs exist), crossing islands should be considered as a supplement to the crosswalk, and should be designed with a slight stagger forcing pedestrians to face oncoming traffic before progressing through second phase of the crossing.

**4.** Islands are appropriate at signalized crossings and may improve safety for vehicles by dividing traffic streams.

**5.** If there is enough width, center crossing islands and curb extensions can be used together to create a highly visible pedestrian crossing and effective traffic calming.

6. It is preferable for crossings to be as close to 90 degrees as possible to minimize the crossing distance and maximize sight lines. Retrofitting skewed shared use path crossings can reduce the roadway exposure for path users.

7. Rectangular rapid flashing beacons (RRFBs) can be used to improve pedestrian safety at certain crossing locations in conjunction with other safety countermeasures. See the FHWA Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations for more information on when to consider RRFBs.

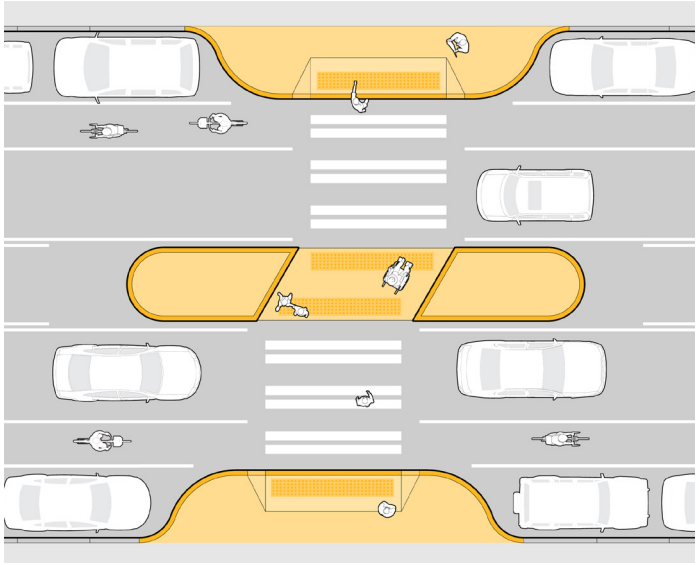


*Figure 61: Raised refuge island and curb extensions at a mid-block crossing*

## 5.3.7 Minimizing Bicyclist Exposure at Intersections

It is particularly important to ensure bicycle facility design maintains separation through intersections, given the prevalence of crashes involving people riding bikes at these locations. As demonstrated in the diagram below, with increased separation, the number of conflict points between bicyclists and motorists is reduced, thereby enhancing safety.

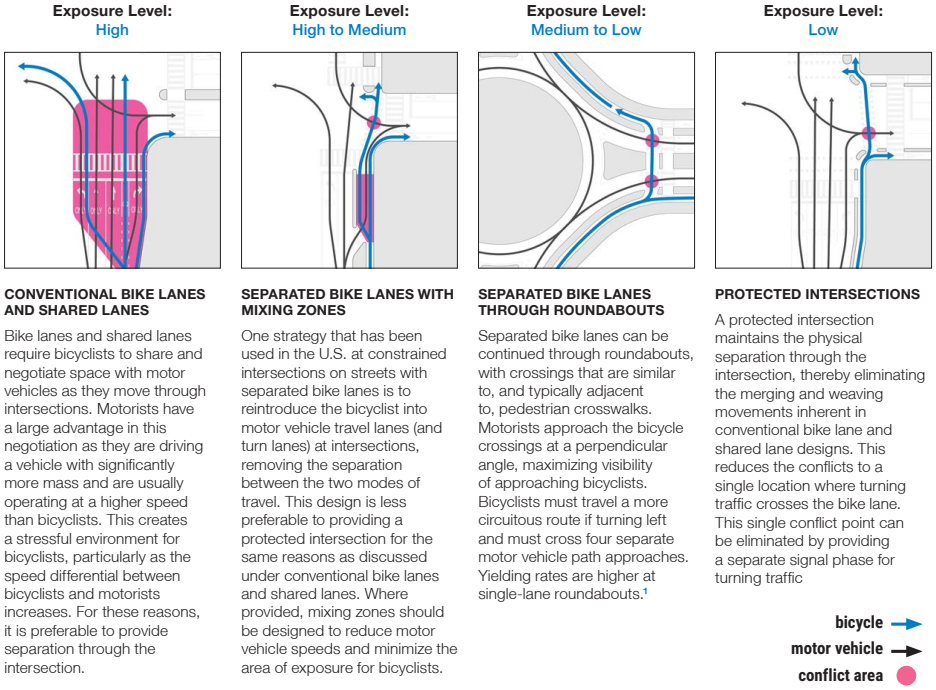



*Figure 62: Comparison of bicyclist exposure at intersections. Source: MassDOT Separated Bike Lane Guide*

## 5.3.8 Bicycle Boxes

A bicycle box provides dedicated space between the crosswalk and vehicle stop line where bicyclists can wait during the red light at signalized intersections. The bicycle box allows a bicyclist to take a position in front of motor vehicles at the intersection which improves visibility and motorist awareness and allows bicyclists to "take the lane" if desired. Bicycle boxes provide queuing space for multiple bicyclists at intersections and allow for safer turning. In locations with high volumes of turning movements by bicyclists, a bicycle box should be used to allow bicyclists to shift towards the desired side of the travel way. Depending on the position of the bicycle lane, bicyclists can shift sides of the street to align themselves with vehicles making the same movement through the intersection. In locations where motor vehicles can continue straight or cross through a right-side bicycle lane while turning right, the bicycle box allows bicyclists to move to the front of the traffic queue and make their movement first, minimizing conflicts with the turning. When a bicycle box is implemented in front of a vehicle lane that previously allowed right turn on red, the right turn on red movement must be restricted using signage and enforcement following.

*Figure 63: Example bicycle box*

### 5.3.8.1Design Guidelines

1. Bicycle boxes are painted green, are a minimum of 10 feet in depth, and are the width of the entire travel lane(s).
2. Bicycle box design should be supplemented with appropriate signage according to the latest version of the MUTCD.
3. Bicycle box design should include appropriate signalization adjustment in determining the minimum green time.
4. Where right-turn lanes for motor vehicles exist, bicycle lanes should be designed to the left of the turn lane. If right turns on red are permitted, consider ending the bicycle box at the edge of the bicycle lane to allow motor vehicles to make this turning movement.

## 5.3.9 Mixing Zones

A mixing zone requires turning motorists to merge across a separated bicycle lane at a defined location in advance of an intersection. Unlike a standard bicycle lane, where a motorist can merge across at any point, a mixing zone design limits bicyclists' exposure to motor vehicles by defining a limited merge area for the turning motorist. Mixing zones are compatible only with one-way separated bicycle lanes.

### 5.3.9.1 Design Guidelines

1. Protected intersections that incorporate separated bike lanes are preferable to mixing zones. (See 52 for Protected Intersections) Mixing zones are generally appropriate as an interim solution or in situations where severe right-of-way constraints make it infeasible to provide a protected intersection.
2. Mixing zones are only appropriate on street segments with one-way separated bicycle lanes. They are not appropriate for two-way separated bicycle lanes due to the contra-flow bicycle movement.
3. Locate merge points where the entering speeds of motor vehicles will be 20 mph or less by (a) minimizing the length of the merge area and (b) locating the merge point as close as practical to the intersection.
4. Minimize the length of the storage portion of the turn lane
5. Provide a buffer and physical separation (e.g., flexible delineator posts) from the adjacent through lane after the merge area, if feasible.
6. Highlight the conflict area with green surface coloring and dashed bicycle lane markings or shared lane markings placed on a green box.

**7.** Provide a BEGIN RIGHT (or LEFT) TURN LANE YIELD TO BICYCLES sign (R4-4) at the beginning of the merge area.

**8.** Restrict parking within the merge area.

**9.** At locations where raised separated bicycle lanes approach the intersection, the bicycle lane should transition to street elevation at the point where parking terminates.

**10.** Where posted speeds are 35 mph or higher, or at locations where it is necessary to provide storage for queued vehicles, consider providing a deceleration/storage lane in advance of the merge point.

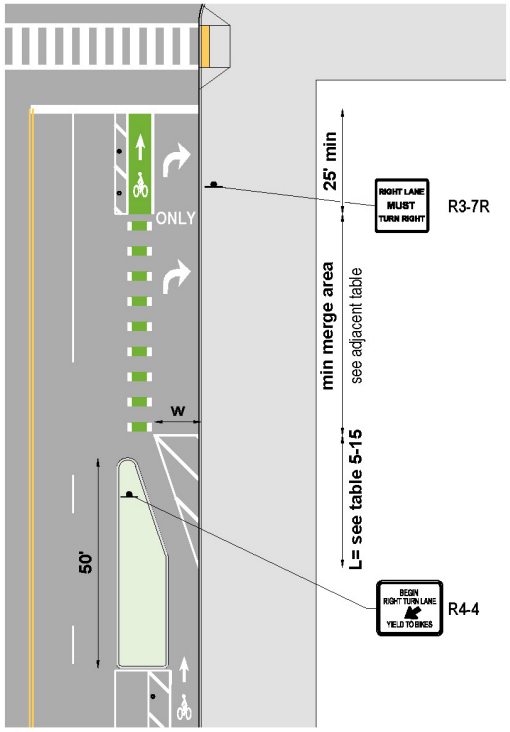


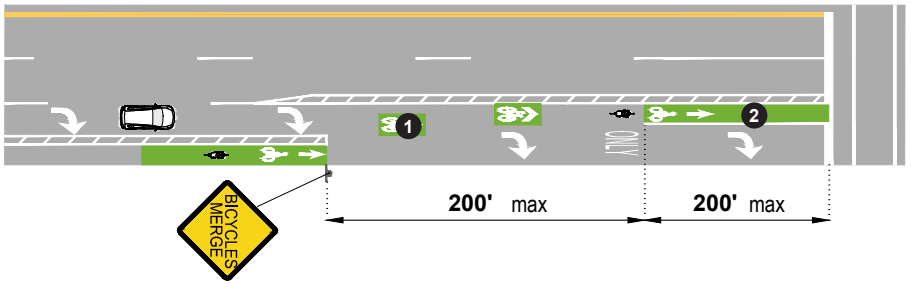

*Figure 64: Preferred mixing zone design*

| Shifting Taper Equation | | |
|---|---|---|
| $L = \frac{WS^2}{60}$ | | |
| Where: | | |
| $L$ | = | longitudinal lane shift (ft), minimum 20 ft |
| $W$ | = | lateral width of offset (ft) |
| $S$ | = | target bicyclist operating speed (mph) |

*Figure 65: Shifting Taper Equation*

## 5.3.10 Through Bicycle Lane Approach

A through bicycle lane requires turning motorists to merge across a bicycle lane at a defined location in advance of an intersection. A through bicycle lane design reduces potential for "right hook" and limits bicyclists' exposure to motor vehicles by defining a limited merge area for the turning motorist.




1 optional shared lane markings if posted speed ≤35 mph
the shared lane markings are appropriate to assist bicyclists with positioning, with or without a bicycle lane at the intersection.

2 green-colored pavement (optional)

*Figure 66: Preferred design of a through bicycle lane approach*

### 5.3.10.1 Design Guidelines

**1.** Through lanes for bicyclists should be used where right turn only lanes exist.

**2.** Pavement markings should be dotted lines or green dashes to define the merging space.

**3.** The desired width of the bicycle lane should be 6 feet and a minimum width of 4 feet.

**4.** Locate merge points where the entering speeds of motor vehicles will be 20 mph or less. Minimize the length of the merge area and locate the merge point as close as practical to the intersection.

**5.** Minimize the length of the storage portion of the turn lane.

**6.** Use a bicycle lane symbol to designate that portion of street for bicyclists.

**7.** Highlight the conflict area with green surface coloring and dashed bicycle lane markings or shared lane markings placed on a green box.

**8.** Restrict parking within the merge area.

**9.** Where posted speeds are 35 mph or higher, or at locations where it is necessary to provide storage for queued vehicles, consider providing a deceleration/storage lane in advance of the merge point.

## 5.3.11 Two-Stage Turn Queue Box

A two-stage turn queue box should be considered where bicycle lanes are continued up to an intersection and a protected intersection is not provided. The two-stage turn queue box designates a space for bicyclists to wait while performing a two-stage turn across a street at a location outside the path of traffic.

Two-stage turn queue box dimensions will vary based on the street operating conditions, the presence or absence of a parking lane, traffic volumes and speeds, and available street space. The turn box may be placed in a variety of locations including in front of the pedestrian crossing (the crosswalk location may need to be adjusted), in a 'jug-handle' configuration within a sidewalk, or at the tail end of a parking lane or a median island.

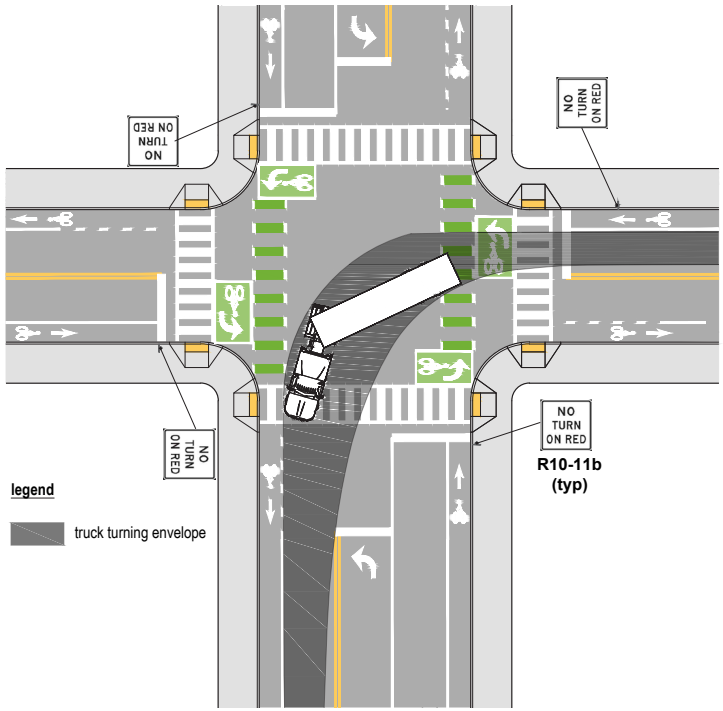



*Figure 67: Two-stage turn queue box design with consideration of truck turning movements.*
**FHWA granted interim approval to two-stage turn queue boxes on July 13, 2017.**

### 5.3.11.1 Design Guidelines

A minimum width of 10 feet and depth of 6.5 feet is recommended. Dashed bicycle lane extension markings may be used to indicate the path of travel across the intersection.

## 5.3.12 Separated Bicycle Lanes at Driveways

Bicycle crossings at cross streets, driveways, or alleys should be designed to 1) delineate a preferred path for people bicycling through the intersection with the driveway and 2) to encourage driver yielding behavior. Bicycle crossings may be supplemented with green pavement, yield lines, and/or regulatory signs.

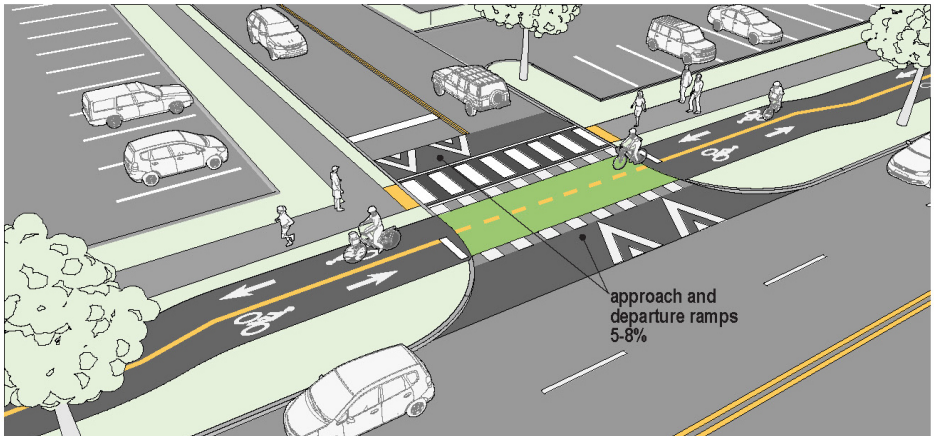



*Figure 68: Example design of a separated bicycle lane at a driveway*

### 5.3.12.1 Design Guidelines

**1.** Supplemental yield lines, otherwise known as shark's teeth, can be used to indicate priority for people bicycling and may be used in advance of unsignalized crossings at driveways, at signalized intersections where motorists may turn across a bicycle crossing during a concurrent phase, and in advance of bicycle crossings located within roundabouts.

**2.** Raised bicycle crossings further promote driver yielding behavior by slowing their speed before the crossing and increasing visibility of people bicycling.

**3.** The bicycle crossing may be bounded by 12 inch (perpendicular) and 24 inch (parallel) white pavement dashes, otherwise known as elephant's feet. Spacing for these markings should be coordinated with zebra, continental, or ladder striping of

the adjacent crosswalk.

4. The bicycle crossing should be 6 feet minimum in width for one-way travel and 10 feet minimum in width for two-way travel, measured from the outer edge of the elephant's feet. Bicycle lane symbol markings should be avoided in bicycle crossings. Directional arrows are preferred within two-way bicycle crossings.
5. Dashed green colored pavement may be utilized within the bicycle crossing to increase the conspicuity of the crossing where permitted conflicts occur. Green color may be desirable at crossings where concurrent vehicle crossing movements are allowed, and where sightlines are constrained, or where motor vehicle turning speeds exceed 10 mph.

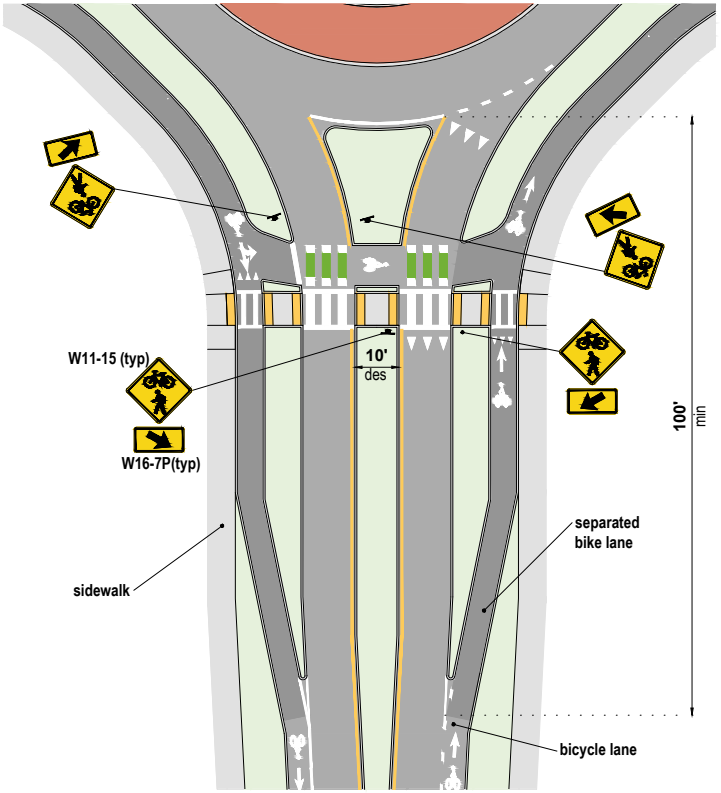



*Figure 69: Example protected roundabout design*

## 5.3.13 Separated Bicycle Lanes at Roundabouts

When separated bicycle lanes are provided at roundabouts, they should be continuous around the intersection and parallel to the sidewalk. Separated bicycle lanes should follow the contour of the circular intersection. See Figure 69.

### 5.3.13.1 Design Considerations

1. At crossing locations of multi-lane roundabouts or roundabouts where the exit geometry will result in faster exiting speeds by motorists (thus reducing the likelihood that they will yield to bicyclists and pedestrians), additional measures should be considered to encourage yielding, such as providing an actuated device such as a rapid flashing beacon or pedestrian hybrid beacon.
2. The bicycle crossing should be immediately adjacent to and parallel with the pedestrian crossing, and both should be at the same elevation.
3. Consider providing supplemental yield lines at roundabout exits to indicate priority at these crossings.
4. The decision of whether to use yield control or stop control at the bicycle crossing should be based on sight distance.
5. The separated bicycle lane approach to the bicycle crossing should result in bicyclists arriving at the queuing area at a perpendicular angle to approaching motorists.
6. Median designs should apply a "Z" crossing design, whenever median width permits.
7. Consider the added value of lean rails.
8. Curb radii should be a minimum of 5 feet to enable bicyclists to turn into the queuing area.
9. Channelizing islands are preferred to maintain separation between bicyclists and pedestrians but may be eliminated if different surface materials are used.

## 5.3.14 Separated Bicycle Lanes at Intersections (Protected Intersections)

Separated bicycle lanes provide an exclusive travel way for bicyclists alongside roadways that is separate from motor vehicle travel lanes, parking lanes, and sidewalks. Separated bicycle lane designs at intersections should manage conflicts with turning vehicles and increase visibility for all users. See Figure 70.

### 5.3.14.1 Design Guidelines

1. Separated bicycle lane designs at intersections should consider signal operation and phasing to manage conflicts between turning vehicles and bicyclists. Bicycle signal heads should be considered to separate conflicts.
2. Shared lane markings and/or colored pavement can supplement short dashed lines to demarcate the protected bicycle lane through intersections, where engineering judgment deems appropriate.
3. At non-signalized intersections, design treatments to increase visibility and safety include:
   - **a.** Warning signs
   - **b.** Raised intersections
   - **c.** Special pavement markings (including colored surface treatment)
   - **d.** Parking restrictions in advance of the intersection
4. Designs should maintain the separation of the bicycle lane through the intersection rather than introduce the bicyclist into the street with a merge lane. Where this separation is not possible, see guidance on Mixing Zones.
5. Increasing visibility and awareness are two key design goals for separated bicycle lanes at intersections. If visibility is a concern, restrict parking within 20 to 40 feet of the intersection to ensure the visibility of bicyclists on the intersection approaches. Use markings and signage at intersections to give priority to separated bicycle lanes.
6. Separated bicycle lanes should be routed behind transit stops (i.e., the transit stop should be between the bicycle lane and motor vehicle travel lanes). If this is not feasible, the separated bicycle lane design should include treatments such as signage and pavement markings to alert bicyclists to stop for buses and pedestrians accessing transit stops.

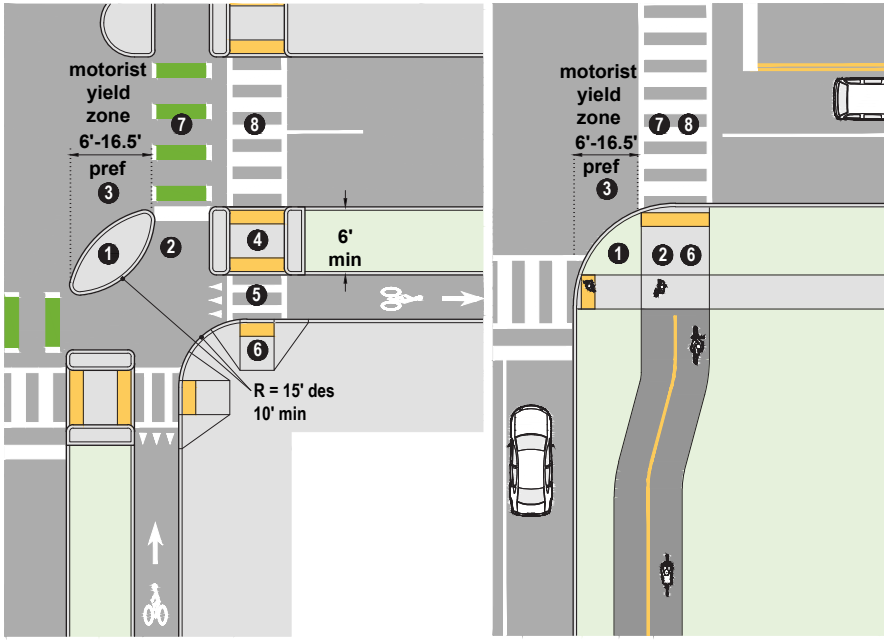



*Figure 70: Preferred protection intersection designs*

# 6. Bridge Design

Bridge crossings are significant investments and therefore typically occur infrequently. However, bridges provide critical access linkages in a community, and when they are designed, it is important that they accommodate pedestrians, bicyclists, kayakers, and canoers as well as anticipate future uses and connectivity needs. A bridge without walking and bicycling access can result in a lengthy detour that discourages the trip or requires the use of unsafe facilities.

## 6.1 Design Guidelines

1. Shy distances should be accounted for when providing the clear width. On each side, 1.5 feet is generally needed to provide shy distance from railings and other vertical objects.
2. Railing height on bridges should be between 42" and 54" depending on the site location. Bridge approaches and span should not exceed 5% slope in order to accommodate ADA access.
3. The 10 "receiving" clear width (from inside of rail or wall to inside of opposite rail or wall) should allow for an additional 2 feet of shy space on each side of the facility.
4. Designing the edge of the approaching bicycle facility to exactly match into the leading edge of a bridge railing or tunnel wall should be avoided. In locations where it cannot be avoided, conspicuous reflective markers should be placed on the leading edge of the bridge railing.
5. Where possible, consider widening the physical entrance to a tunnel, such that bicycles traveling near the edge of the bicycle facility approaching the tunnel have an opportunity to recognize the tunnel's edge constraint and alter their course inward to avoid running into the edge of the tunnel entrance.
6. Accommodations for pedestrian and bicycle travel should be provided on both sides of bridges. While an accessible route will be required to access a bridge, stairs may provide a more direct and shorter route, and should be considered to complement the accessible route. Stairs can accommodate bicycles by providing a bicycle channel.
7. Accommodations for kayak and canoe travel should be provided when possible. Establish sufficient clear zones to accommodate waterway travel, especially if blueway network connections can be made.
8. Install signage to indicate the waterway being crossed to educate the public.

*Figure 71: Lesner Bridge in Virginia Beach accommodates pedestrians and bicyclists with separated facilities*

# 7. Lighting

Forty-two percent (42%) of pedestrians killed on Virginia roads occurred in darkness with the road not lighted.[1] Better lighting at intersections, including crosswalks and mid-block crossings is essential for pedestrian safety. The placement of luminaires can have a significant impact on the visibility of crossing pedestrians and bicyclists. Segment of the Thalia Creek Greenway, Pacific Avenue Trail, and the Boardwalk have updated LED lighting that properly illuminate active transportation users.

In addition to ensuring that the intersection lighting meets recommended levels, streetlights should be located to front-light crosswalks, with the light source situated between the crosswalk and the motor vehicle, in the direction of motor vehicle travel. For wider intersections, it may be necessary to place light poles on all four corners of each intersection to achieve required illuminance levels.

## 7.1 Design Guidelines

**1.** Improves visibility and increases a feeling of personal security

**2.** Lighting should reflect the character and urban design of the street type to create a recognizable hierarchy of roads and spaces.

**3.** Comply with lighting requirements of Design Standards Section 11, Roadway Lighting.

**4.** Pedestrian scale lighting should be provided for all new development projects.

**5.** Lighting should be oriented toward travelers both in the roadway and on the sidewalk. Adequate lighting at intersections and crossings is essential.

**6.** All intersections and mid-block crosswalks (pedestrian crossings away from intersections) should be lit.

**7.** Lighting should be located in concert with street trees–often alternating trees and lights–so that trees do not block the illumination.

**8.** Pedestrian scale lighting (lower than 20') should be used alone or in combination with roadway scale lighting to increase pedestrian safety and as a traffic calming device.

**9.** Designers should provide additional lighting near high pedestrian areas such as schools, parks, village centers, and transit stations, or in areas where personal safety is a concern.

**10.** On paved paths where night-time use is permitted, trail lighting is recommended at trail–roadway intersections at a minimum, and along other segments of the corridor based on context.

**11.** Lighting is also useful on trails with high commuting volumes.

**12.** Minimize light trespass onto adjacent properties. Generally, light spillover should be limited to 0.25 fc at the property line. Many jurisdictions require 0 fc at the property line, but this may be difficult to achieve in an urban environment.

**13.** Dimmable lighting, motion sensors, and/or timer control can be installed to provide lighting only when people are present or during certain times of the day. Photocells may be installed on controller cabinets to shut off lights during daylight hours.

*Figure 72: A well-lit mid-block pedestrian and bicyclist crossing and sidewalk with pedestrian-scale lighting*

1 Virginia Highway Safety Plan, 2018, https://www.dmv.virginia.gov/safety/highway_safety_plan.pdf

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# APPENDIX B | ONLINE SURVEY

# APPENDIX B | ONLINE SURVEY

## Virginia Beach Active Transportation Plan Online Survey

Welcome to the VB Active Transportation Plan survey. Your feedback is very important to us. Please tell us a little bit about yourself and help us finalize the plan's goals by completing the brief survey below. Then use the interactive map on the next screen to identify priority and challenging areas for walking and bicycling. Please note, this survey is entirely anonymous.

### How often do you bike for exercise or recreation?

- ❑ Very Frequently
- ❑ Frequently
- ❑ Occasionally
- ❑ Rarely
- ❑ Very Rarely
- ❑ Never

### Would you like to bike for transportation such as for running errands or to work?

- ❑ Yes
- ❑ No

### How often do you walk for exercise or recreation?

- ❑ Very Frequently
- ❑ Frequently
- ❑ Occasionally
- ❑ Rarely
- ❑ Very Rarely
- ❑ Never

### Would you like to walk for transportation such as for running errands or to work?

- ❑ Yes
- ❑ No

### Do you feel you are able to walk or bicycle as much as you would like?

- ❑ Yes
- ❑ No

### Do you feel that you can get to where you would like to go by bicycle or walking?

- ❑ Yes
- ❑ No

### How would you rate road safety for pedestrians and bicyclists in Virginia Beach?

- ❑ Very Good
- ❑ Good
- ❑ Fair
- ❑ Poor
- ❑ Very Poor

### Please check which facility type would encourage you to bicycle more often.

- ❑ Shared Use Paths (an off-road facility that is shared with joggers, walkers, etc)
- ❑ Separated Bike Lane (an on-road lane with physical separation from vehicles)
- ❑ Bike Boulevard (an on-road, shared space with cars, marked as a bicycle priority route)
- ❑ Improved crossings at intersections with barriers such as highways.

### What is your zip code? _____

### What is your gender?

- ❑ Male
- ❑ Female
- ❑ Non-binary/Third Gender
- ❑ Prefer not to say

### What is your race?

- ❑ White
- ❑ Black or African American
- ❑ American Indian or Alaska Native
- ❑ Asian
- ❑ Native Hawaiian or Other Pacific Islander
- ❑ Prefer not to say

**What is your email (Optional)?**_____

# Plan Goals

The current Bikeways and Trails Plan was adopted in 2011. The new 2020 plan has five draft goals. They were developed based on stakeholder meetings and interviews conducted in 2017. Before finalizing these goals for the 2020 Plan, we would like to hear from you. Please let us know if you agree or disagree with these goals as priorities for walking and bicycling in Virginia Beach.

## The plan should do the following:

### Develop a complete, multimodal transportation network for the City of Virginia Beach.

Sidewalks, bikeways, and safe crossings will be incorporated into the existing transportation network to provide for more transportation choices.

- ❑ Strongly Agree
- ❑ Somewhat Agree
- ❑ Somewhat Disagree
- ❑ Strongly Disagree

### Promote the safety and attractiveness of walking and bicycling through the convenient, connected, and equitable development of active transportation facilities.

Walking and bicycling infrastructure will be designed for user safety and comfort. Projects will be prioritized to address safety concerns.

- ❑ Strongly Agree
- ❑ Somewhat Agree
- ❑ Somewhat Disagree
- ❑ Strongly Disagree

### Improve, highlight, and build additional recreational amenities for residents and visitors that will continue to attract economic development and contribute to the fiscal strength of the City.

The City of Virginia Beach will implement walking facilities and bikeways as a recreational amenity, and a viable transportation alternative.

- ❑ Strongly Agree
- ❑ Somewhat Agree
- ❑ Somewhat Disagree
- ❑ Strongly Disagree

### Create a network that will evolve with changing technology and transportation modes.

The City of Virginia Beach will establish strategies and guidelines to incorporate pedestrian and bike facilities into the new and changing streetscape and to respond to new transportation technologies, such as autonomous vehicles.

- ❑ Strongly Agree
- ❑ Somewhat Agree
- ❑ Somewhat Disagree
- ❑ Strongly Disagree

### Create additional opportunities for healthy, active lifestyles.

The City of Virginia Beach will reduce barriers to walking and bicycling so that healthy transportation choices are easy and attractive options for everyone.

- ❑ Strongly Agree
- ❑ Somewhat Agree
- ❑ Somewhat Disagree
- ❑ Strongly Disagree

### Are there any important goals or priorities that we are missing?If you disagreed with anything, please tell us why here.

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# APPENDIX C | CITY REPORT CARDS

# Virginia Beach, VA | CITY SCORECARD

placesforbikes

## 2020 OVERALL SCORE

**1.3**

★ ☆ ☆ ☆ ☆

The overall score is based on Ridership, Safety, Network, Reach and Acceleration. It includes publicly available data and data gathered from our Community Survey, City Snapshot, and Bicycle Network Analysis.

## RIDERSHIP

Measures how many people are riding.

**1.8**

★ ☆ ☆ ☆ ☆

| | |
|---|---|
| Bicycle commuting | **0.4** |
| Recreational bike riding | **2.6** |
| Perceptions of bike use | **2.6** |

## SAFETY

Measures how safe it is and feels to ride a bike.

**1.6**

★ ☆ ☆ ☆ ☆

| | |
|---|---|
| All mode fatalities and injuries | **1.5** |
| Bicycle fatalities and injuries | **1.5** |
| Perceptions of safety | **2.2** |

## NETWORK

Measures how well the bike network connects people to destinations.

**1.2**

★ ☆ ☆ ☆ ☆

| | |
|---|---|
| Bicycle Network Analysis (BNA) | **1.0** |
| Perceptions of network quality | **2.1** |

## REACH

Measures how well the bike network serves everyone equally.

**1.7**

★ ☆ ☆ ☆ ☆

| | |
|---|---|
| Demographic gap in BNA | **1.7** |
| Bicycle commuting rates by gender | **1.6** |

## ACCELERATION

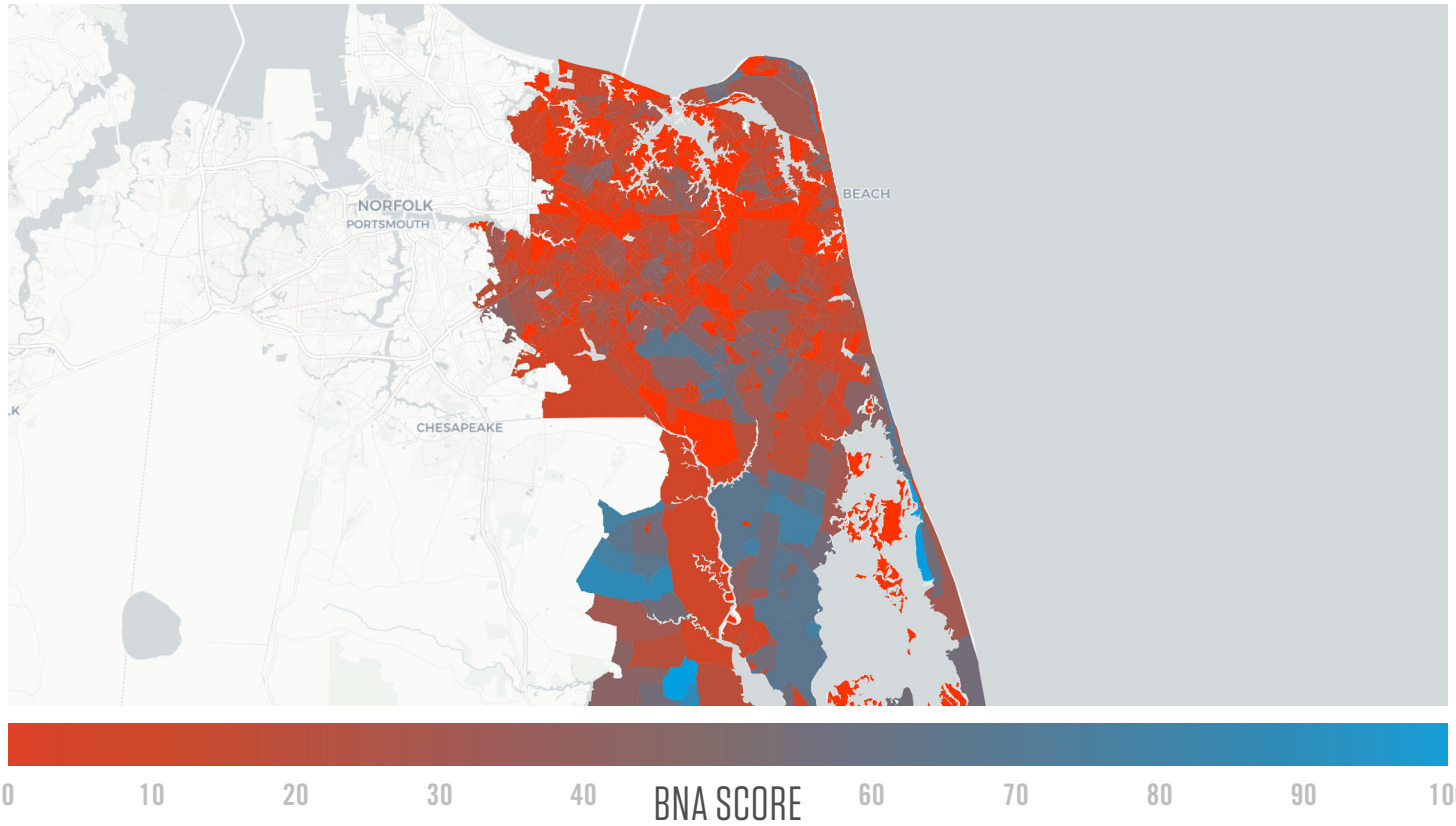
Measures the city's commitment to growing bicycling quickly.

**0.4**

☆ ☆ ☆ ☆ ☆

| | |
|---|---|
| Growth in bike facilities and events | ‡ * |
| Perceptions of progress | **1.9** |

* City Snapshot missing ‡ Data unavailable



# BICYCLE NETWORK ANALYSIS | bna.peopleforbikes.org

» **WHAT IS IT?** The Bicycle Network Analysis (BNA) is data analysis software that measures how well the bike network in a city connects people with the places they want to go safely and comfortably.

» **WHAT CAN IT TELL ME?** The BNA rates every street within a city as high or low stress and analyzes where the network is strong and where it is weak. A city's BNA score factors into its City Ratings Network and Reach scores.

## DID YOU KNOW?

**32% of Americans ages 3 and older rode a bicycle in the past year**

Learn more from the U.S. Bicycling Participation Study **peopleforbikes.org/resources/u-s-bicycling-participation-report/**

» **SPEED LIMITS IN THE BNA.** Speed limits play an important role in street safety and in the BNA. Since most city streets are in residential areas, speed limits on residential streets can have a large impact on the BNA score.

Residential speed limits ≤ 25 mph create **low-stress** streets for bikes.

Residential speed limits > 25mph create **high-stress** streets for bikes.

Virginia Beach, VA's residential speed limit is* 25 mph

*Based on state law and City Snapshot submissions

# ADDITIONAL RESOURCES

### » A Guide for City Leaders

Identify strategies to address common barriers to building great bicycling infrastructure. **peopleforbikes.org/placesforbikes/resources/**

### » PeopleForBikes Community Grant Program

Non-profit organizations and local governments can apply for funding for bicycle projects and advocacy initiatives. **peopleforbikes.org/apply-now/**

### » Advocacy Alert Program

Local and state advocacy groups can apply to communicate and share their issues with PeopleForBikes supporters in their area. **peopleforbikes.org/local-engagement-portal/**

### » Better Bike Share Partnership

Learn best practices for engaging underserved communities through bike share programs. **betterbikeshare.org**

### » Ride Spot

Find, create and share bike rides and events in your area with an app designed to help connect people with great places to ride. **ridespot.org**

### » E-Bike Regulations

Review a comprehensive list of e-bike regulations in each state. **peopleforbikes.org/our-work/e-bikes**

peopleforbikes

**LEARN MORE** CityRatings.PeopleForBikes.org

placesforbikes

CITY RATINGS

# VIRGINIA BEACH, VA

BICYCLE FRIENDLY COMMUNITY
Fall 2019
BRONZE
THE LEAGUE OF AMERICAN BICYCLISTS

TOTAL POPULATION
592,602

POPULATION DENSITY
896

TOTAL AREA *(sq. miles)*
497

# OF LOCAL BICYCLE FRIENDLY BUSINESSES 0

# OF LOCAL BICYCLE FRIENDLY UNIVERSITIES 0

## 10 BUILDING BLOCKS OF A BICYCLE FRIENDLY COMMUNITY

| | *Average Silver* | *Virginia Beach* |
|---|---|---|
| High Speed Roads with Bike Facilities | 35% | 0% |
| Total Bicycle Network Mileage to Total Road Network Mileage | 48% | 14% |
| Bicycle Education in Schools | GOOD | EXCELLENT |
| Share of Transportation Budget Spent on Bicycling | 11% | UNKNOWN |
| Bike Month and Bike to Work Events | GOOD | ACCEPTABLE |
| Active Bicycle Advocacy Group | YES | YES |
| Active Bicycle Advisory Committee | MEETS EVERY TWO MONTHS | MEETS EVERY TWO MONTHS |
| Bicycle–Friendly Laws & Ordinances | GOOD | AVERAGE |
| Bike Plan is Current and is Being Implemented | YES | SOMEWHAT (2011) |
| Bike Program Staff to Population | 1 PER 78K | 1 PER 593K |

## CATEGORY SCORES

| | |
|---|---|
| **ENGINEERING** *Bicycle network and connectivity* | 3.5/10 |
| **EDUCATION** *Motorist awareness and bicycling skills* | 3.5/10 |
| **ENCOURAGEMENT** *Mainstreaming bicycling culture* | 2.2/10 |
| **ENFORCEMENT** *Promoting safety and protecting bicyclists' rights* | 2.3/10 |
| **EVALUATION & PLANNING** *Setting targets and having a plan* | 4.5/10 |

## KEY OUTCOMES

| | *Average Silver* | *Virginia Beach* |
|---|---|---|
| **RIDERSHIP** *Percentage of Commuters who bike* | 2.7% | 0.58% |
| SAFETY MEASURES **CRASHES** *Crashes per 10k bicycle commuters* | 537 | 770 |
| SAFETY MEASURES **FATALITIES** *Fatalities per 10k bicycle commuters* | 6.3 | 5.84 |

## KEY STEPS TO SILVER

» Continue to expand the bike network and increase connectivity through the use of different types of bicycle facilities appropriate for the speed and volume of motor vehicle traffic on each road. Develop an inventory of on-road bicycle facilities by posted roadway speeds to better evaluate the current bikeway network.

» Consider launching a city-wide bike share system that is open to the public, including residents and visitors.

» Develop in-person bicycle education opportunities for adults. Consider ways to target demographics who currently do not feel safe riding with classes or events that address their concerns.

» Increase the number of local League Cycling Instructors (LCIs) in your community, either by hosting an LCI seminar or sponsoring a City staffer, Police Officer, and/or local bike advocate to attend an existing seminar elsewhere.

» Improve Bike Month activities by creating a Bike to Work Day event for commuters and a Bike to School Day event for local students.

» Provide education to law enforcement officers on bicycle safety, bicycling skills, and traffic laws as they apply to bicyclists and motorists. Expand the bike patrol unit to improve bicyclist/officer relations.

» Adopt a comprehensive road safety plan or a Vision Zero policy to create engineering, education, and enforcement strategies to reduce traffic crashes and deaths for all road users, including bicyclists and pedestrians. Road diets, lane diets, and traffic calming treatments are important engineering components for addressing safety.

» Work with law enforcement to ensure that enforcement activities are targeted at motorist infractions most likely to lead to crashes, injuries and fatalities among bicyclists. Traffic enforcement activities should be data-based and responsive to behaviors that have been observed to lead to crashes, injuries, and fatalities.

» Adopt a target level of bicycle use (percent of trips) to be achieved within a specific timeframe, and ensure data collection necessary to monitor progress.

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# APPENDIX D | VDOT COST ESTIMATES

# APPENDIX D | VDOT COST ESTIMATES

**TRANSPORTATION & MOBILITY PLANNING DIVISION**

**STATEWIDE PLANNING LEVEL COST ESTIMATES**

**BICYCLE AND PEDESTRIAN FACILITIES**

**Cost Year: 2017**

Inflation Rate: 3.0% annually

| | | Cost Year: 2017 | |
|---|---|---|---|
| ***Costs include 25% for PE and Construction Contingencies*** | **Cost Per Mile** | **Bristol, Culpeper, Fredericksburg, Lynchburg, Richmond, Salem, Staunton** | **NOVA Hampton Roads** |

**The following typical section estimates do not include bridge, right-of-way (ROW) or other improvement costs. Use the bridge unit costs, ROW percentages and other improvement costs (highlighted in gray) figures provided below to add these additional costs to the planning level construction estimate.**

| **Urban Typical Sections** | | | **LOW** | **HIGH** | **LOW** | **HIGH** |
|---|---|---|---|---|---|---|
| Bike Lanes | 4' pavement both sides | CPM | $560,000 | $840,000 | $650,000 | $990,000 |
| **Rural Typical Sections** | | | | | | |
| Bike Lanes | 4' pavement both sides | CPM | $467,000 | $690,000 | $546,000 | $822,000 |

**As noted above, bridge costs are not included in the typical section CPM figures above. Bridges represent a significant cost and it is important to use the figures below to estimate bridge costs for a planned improvement. Estimates are calcluated based on the square footage of the bridge ->Bridge Cost = (total bridge length in feet x total bridge width in feet) x Square Footage Costs**

| **Bridge Cost** | | | **LOW** | **HIGH** | **LOW** | **HIGH** |
|---|---|---|---|---|---|---|
| Under 3000 Sq. Ft. | | | $250 | $450 | $300 | $500 |
| 3000 Sq. Ft. to 12,500 Sq. Ft. | | | $200 | $300 | $240 | $330 |
| Over 12,500 Sq. Ft. | | | $150 | $225 | $180 | $250 |

When applicable, the costs highlighted should be added to the construction costs when developing a planning level estimate. All other improvement costs (not highlighted) are for developing stand alone improvement cost estimates.

| **Other Improvement Cost** | | | **LOW** | **HIGH** | **LOW** | **HIGH** |
|---|---|---|---|---|---|---|
| Provide New Signal | | | $228,000 | $424,000 | $265,000 | $583,000 |
| Modify Existing Signal | | | $138,000 | $297,000 | $164,000 | $339,000 |
| Improve phasing for signalized intersection | Cost Per Intersection | | $11,000 | $16,000 | $13,000 | $19,000 |
| Provide pedestrian signal phase | | @ | $50,000 | $60,000 | $60,000 | $80,000 |
| Provide pedestrian crosswalk | | @ | $20,000 | $30,000 | $30,000 | $40,000 |
| Provide 5 ft. sidewalk ( Based on Exist Projects) | | CPM | $313,000 | $1,013,000 | $382,000 | $1,167,000 |
| Provide 5 ft. sidewalk ( Based on PCES) | | | $212,000 | $255,000 | $276,000 | $308,000 |
| Wide Curb Lane (2 additional feet of pavement in each direction) | | | | | | |
| 2 additional feet of pavement in each direction) | C&G not added | | $400,000 | $500,000 | $480,000 | $625,000 |
| 2 add feet of pvmnt in each direction with C&G | With C&G | | $1,450,000 | $1,920,000 | $1,653,000 | $2,180,000 |
| Paved Shoulder (4 foot wide paved shoulder in both directions) | GS-4 | | $406,000 | $518,000 | $496,000 | $608,000 |
| | GS-3 | | $580,000 | $740,000 | $708,000 | $868,000 |
| Provide 10 ft. paved shared use path off road | | CPM | $1,120,000 | $1,800,000 | $1,125,000 | $2,200,000 |

| Right of Way & Utilities Cost % of Cost Estimate | LOW | HIGH | LOW | HIGH |
|---|---|---|---|---|
| Rural | 25% | 35% | 30% | 40% |
| Residential/Suburban low density | 50% | 65% | 55% | 70% |
| Outlying business/Suburban high density | 60% | 100% | 75% | 125% |
| Central business district | 100% | 125% | 125% | 150% |
| **Note: Recommend consulting right of way staff or using professional judgement when applying these.** | | | | |
| **Planning Level Cost Estimate = ((Typical Section CPM x project length in miles) + (Other Improvement Costs) x (ROW%+1)); Bridge Costs =(Bridge 1 total square footage x bridge unit cost)+(Bridge 2 total square footage x bridge unit cost)…** | | | | |

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