STAFFORD SOUTHERN GATEWAY BICYCLE AND PEDESTRIAN STUDY

MULTI-MODAL TRANSPORTATION OPPORTUNITIES

STAFFORD COUNTY VIRGINIA
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ACKNOWLEDGMENTS

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Unless credited otherwise, all photos, maps, and illustrations in this study were provided by OIPI, its project partners, or its consultants.

ABOUT GAP-TA

The Growth and Accessibility Planning Technical Assistance (GAP-TA) program supports Virginia localities in planning and developing multi-modal transportation opportunities. The program has four components, and each component has differences in eligible applicants, eligible activities, expected outcomes, and application evaluation criteria. Component 1 involves conducting multi-modal planning within existing or planned Urban Development Areas or Growth Areas. Component 2 involves developing or evaluating strategies to address emerging planning issues. Component 3 involves developing an accessibility planning process, Finally, Component 4 involves conducting multi-modal planning outside urbanized areas. Visit vtrans.org/about/gap-ta for more information about the GAP-TA program.

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1. INTRODUCTION

1.1. Background

Stafford County is one of the fastest-growing jurisdictions in Virginia. As the County continues to develop and urbanize, it must contend with overtaxed transportation infrastructure and congestion. Accommodating growth while maintaining the County's quality of life is a key challenge for the community. Investments in multi-modal transportation, notably improved pedestrian and bicycle facilities, can go a long way to improving mobility. These relatively low-cost investments provide residents an alternative to driving, offer recreation opportunities, and help support compact, sustainable development.

The Southern Gateway UDA/US Highway 17[1] corridor (i.e., the Warrenton Road Planning Area) is a key destination in southern Stafford County and a gateway to nearby Fredericksburg. Today, the area features a mix of residential and commercial development, with auto-oriented land uses and roadway infrastructure. The current lack of sidewalks and bicycle lanes, long blocks, disconnected street grid, and high-speed suburban arterials (notably Route 17), all make cycling and walking less attractive. This Stafford Southern Gateway Bicycle and Pedestrian Study ("the study") explores how the Southern Gateway UDA can become more multi-modal, including identifying specific projects that the County and its regional partners can pursue to improve multi-modal transportation in the study area.

The study is a project through the Commonwealth of Virginia's Office of Intermodal Planning and Investment's (OIPI) Growth and Accessibility Planning Technical Assistance (GAP-TA) Program. Localities across the Commonwealth can apply to the GAP-TA program for technical assistance that falls into one of the program's four component areas:

1. Conduct multi-modal planning within existing or planned Urban Development Areas (UDAs).
2. Develop or evaluate strategies to address emerging planning issues.
3. Develop an accessibility planning process.
4. Conduct multi-modal planning outside urbanized areas.

The Stafford Southern Gateway Bicycle and Pedestrian Study was envisioned to address Component 1 of the GAP-TA program. The study area encompasses the Southern Gateway Urban Development Area (UDA), a rapidly developing suburban area just outside the City of Fredericksburg. The UDA, bisected by Route 17, is set among largely auto-oriented land-uses, with limited cycling and pedestrian facilities.

1. US Highway 17, known locally as Warrenton Road, becomes US Highway 17-B east of Interstate 95. The entire corridor is referred to as "Route 17" throughout this study.

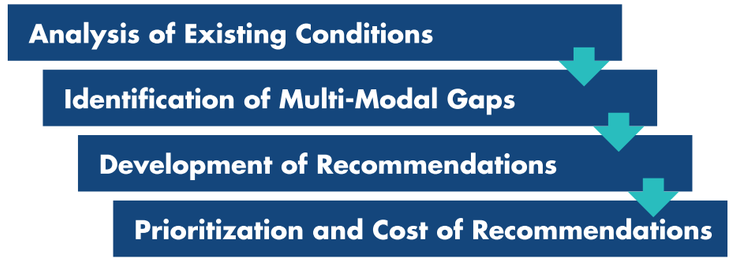
1.2. Study Outcomes

The study provides Stafford County technical guidance that achieves several outcomes, including:

- Identifying needs and planning for multi-modal transportation infrastructure.
- Identifying location-specific multi-modal improvements through performance-based planning.
- Developing a planning process that recipients of the GAP-TA program can utilize for future analysis.

1.3. Study Process

The study team followed a sequential approach, with each subsequent task building on the previous one to arrive at a set of prioritized multi-modal infrastructure recommendations:



The study starts with an **existing conditions** analysis. A range of data, such as socio-demographic statistics and safety data, provided the study team a performance-based understanding of multi-modal transportation needs.

Based on the existing conditions, the study team **identified specific multi-modal gaps.** Gaps represent geographic areas where bicycle and pedestrian infrastructure could help address a deficiency in the study area's multi-modal network.

The study team developed a toolbox of possible improvements that address the types of infrastructure needs observed in each gap. The study team **outlined specific recommendations** for addressing infrastructure gaps based on this toolbox.

Recognizing that costs and time are major constraints to addressing infrastructure gaps, the study team provided high-level guidance on **infrastructure costs and prioritized recommendations** based on a set of metrics.

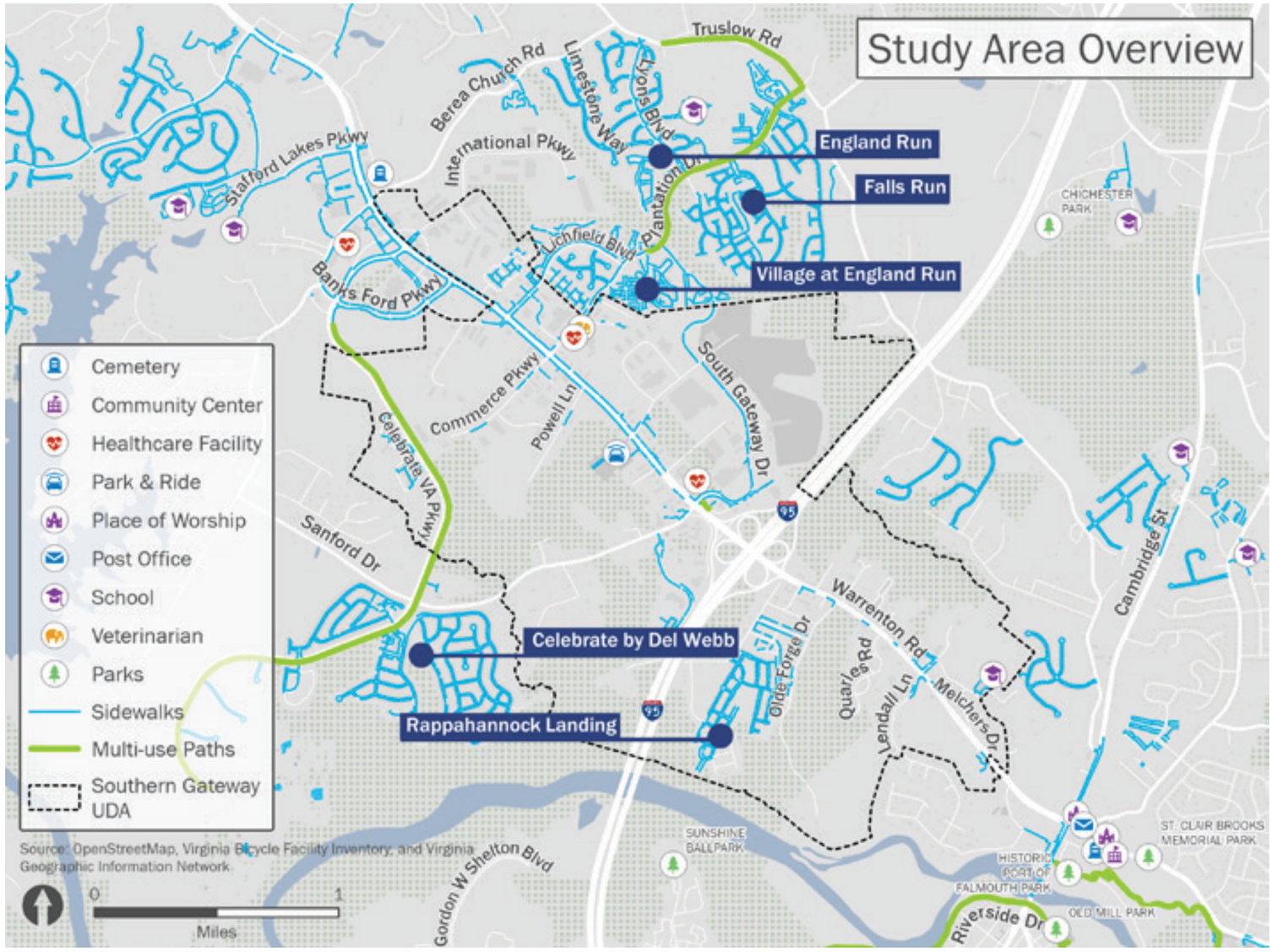
2. EXISTING CONDITIONS

2.1. Study Area Overview

The study area consists of the Southern Gateway Urban Development Area (UDA) and the surrounding area, as shown in **Figure 1.** Route 17 runs through the heart of the Southern Gateway UDA. Along this corridor, gas stations, fast-food restaurants, and other auto-oriented retail destinations abound; surrounding the corridor is a mix of light industrial, commercial, and residential land uses.

The UDA has developed largely around the automobile. Outside of residential subdivisions, sidewalks and bicycle infrastructure are limited, resulting in infrastructure gaps that make traveling by bike or foot difficult. For example, Interstate 95 bisects the study area without any infrastructure to accommodate active transportation crossings; as a result, residents of the subdivision immediately east of Interstate 95 are unable to safely access the amenities along Route 17 west of the interstate on foot or bicycle. Where multi-use paths exist (e.g., along Celebrate Virginia Parkway and Plantation Drive), they end before reaching Route 17, limiting their connectivity.

Figure 1: Amenities, Sidewalks, and Cycling Infrastructure in the Southern Gateway UDA



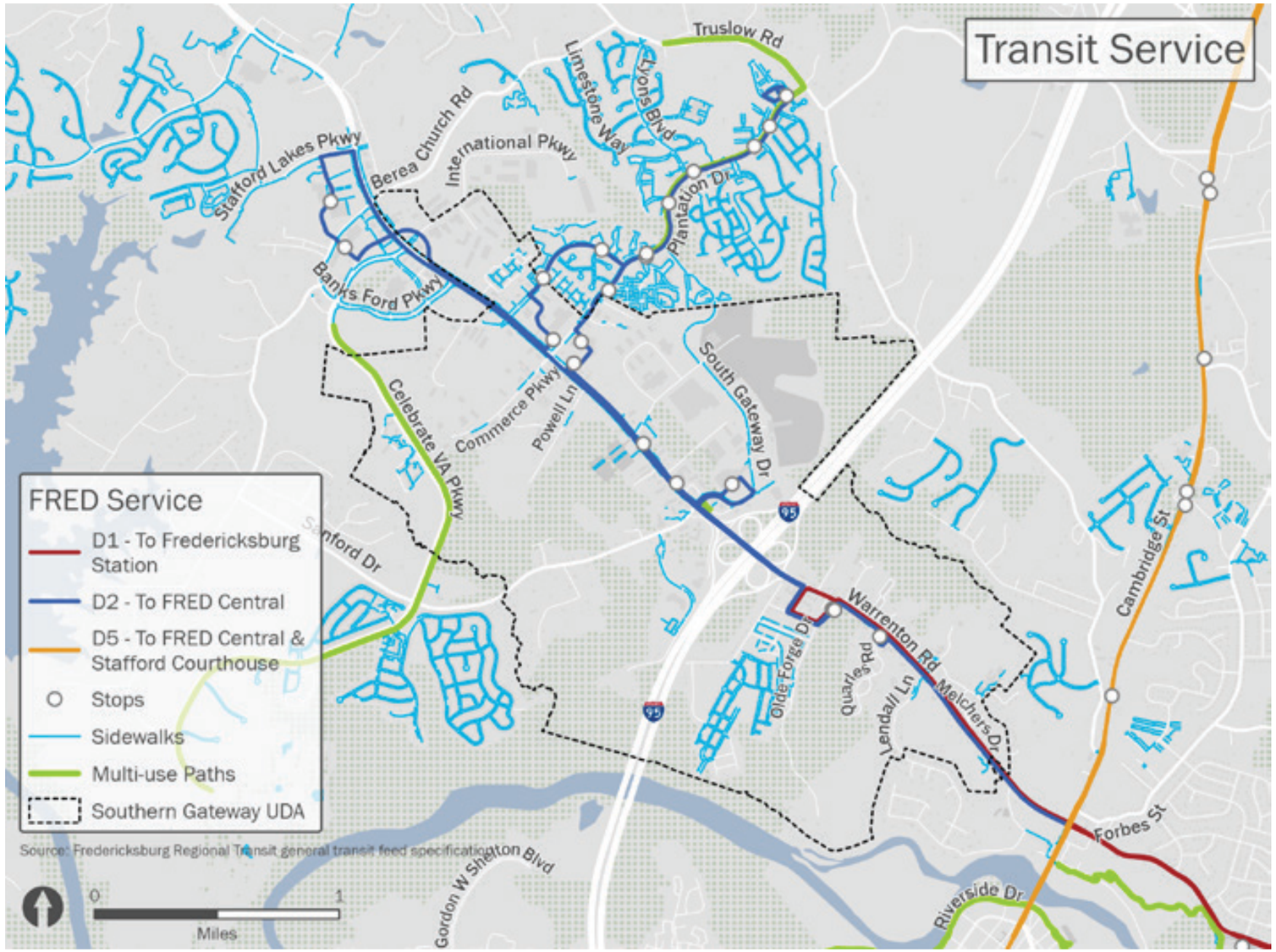
2.1.1. TRANSIT SERVICE

Figure 2 depicts the three Fredericksburg Regional Transit (FRED) bus routes operating within and around the study area:

- **D1** connects the eastern portion of the study area to Fredericksburg Station (served by Virginia Railway Express and Amtrak) by way of Falmouth, Dahlgren Junction, and Brookfield; this route operates hourly from 9:00 a.m. to 5:00 p.m.
- **D2** connects Berea and FRED Central in Fredericksburg, with service to the subdivisions along Plantation Drive and to the Route 17 Park and Ride; this route operates hourly from 8:00 a.m. to 7:00 p.m.
- **D5** connects FRED Central to the Stafford County Courthouse along Cambridge Street; this route operates hourly from 7:00 a.m. to 6:00 p.m.

FRED stops are oriented around job and population centers, though not all stops are co-located with active transportation to ensure that area residents and workers can safely access them. For example, the stop at the subdivision east of Interstate 95 lacks connectivity to that subdivision's sidewalk network. The stop at the Route 17 Park and Ride requires riders to cross nine lanes of traffic without a crosswalk or pedestrian signal to reach their vehicles.

Figure 2: Transit Service in the Southern Gateway UDA



2.1.2. BICYCLE AND PEDESTRIAN CRASHES

Figure 3 depicts crashes involving cyclists and pedestrians from 2017 to 2020 based on data from the Virginia Traffic Records Electronic Data System (TREDS). While the absence of crashes involving cyclists and pedestrians does not necessarily indicate that the area is safe for active transportation users, and in fact may indicate the area is so unsafe that cyclists and pedestrians have found other routes, the presence of crashes is an important consideration in planning for new and/or improved active transportation infrastructure. From 2017 to 2020, eight crashes were reported within the study area. Six of these crashes involved pedestrians, and two involved cyclists. While no crashes resulted in a fatality, three involving a pedestrian and one involving a cyclist resulted in severe injuries.

The highest density of crashes in the study area exists along Route 17 between Falls Run Drive and Hornets Nest Lane. In addition to the challenges for active transportation users posed by the Route 17/Interstate 95 interchange, this stretch of the corridor is characterized by frequent, wide curb cuts and a lack of sidewalks. While located outside the immediate study area, the intersection of Route 17 and Cambridge Street also has a cluster of crashes.

2.2. Existing Plans

On the following page, **Table 1** indicates several projects that address cycling and pedestrian infrastructure in and around the Southern Gateway UDA, which helped inform the development of active transportation recommendations for the study area. Projects in the table are classified as either proposed, meaning the project has appeared in a plan, or funded, meaning the project has been funded by the Stafford County Capital Improvement Program or FAMPO Transportation Improvement Program.

Figure 3: Crashes Involving Active Transportation Users from 2017 to 2020

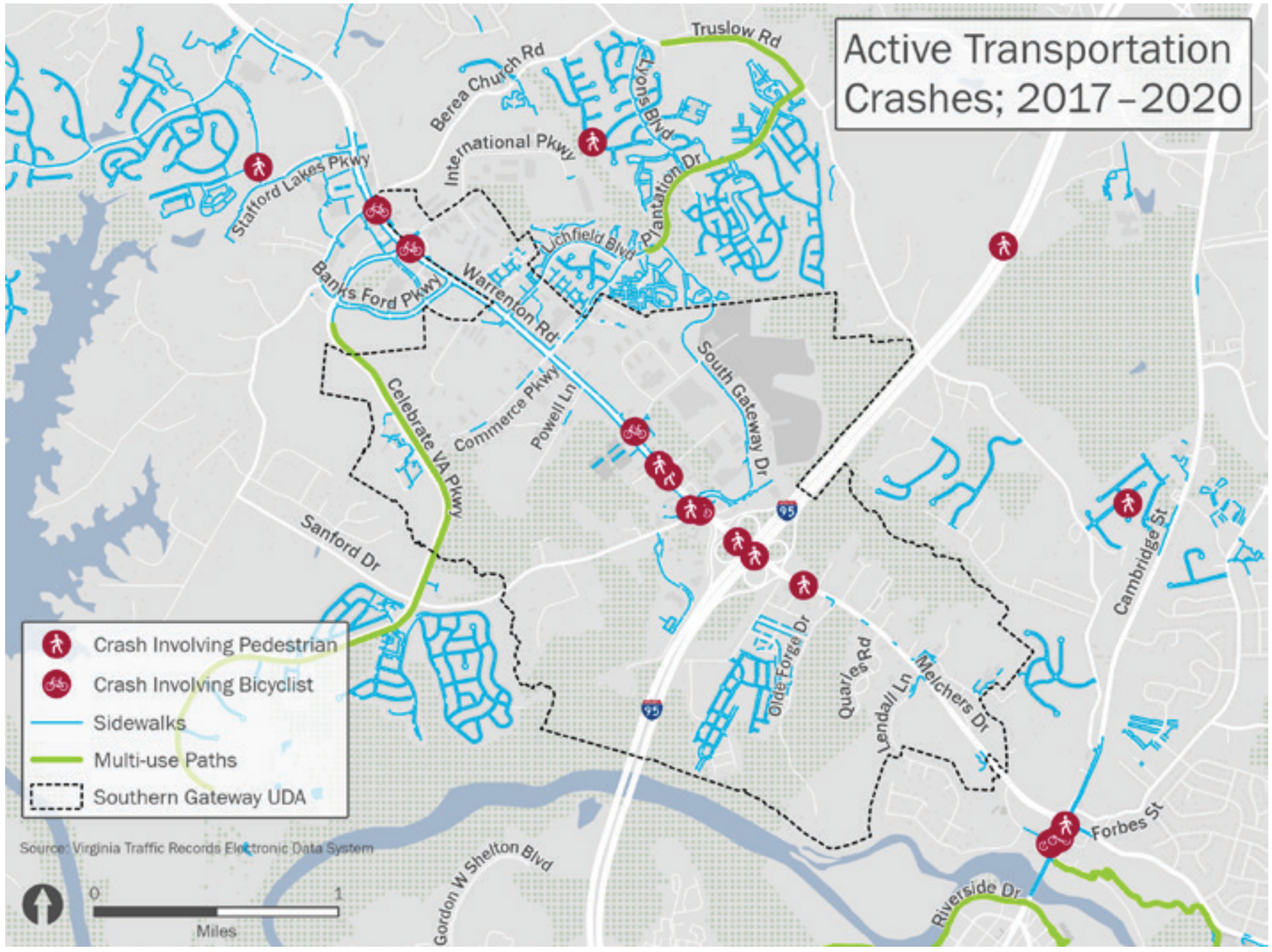


Table 1: List of Funded or Proposed Cycling and Pedestrian Projects in Study Area

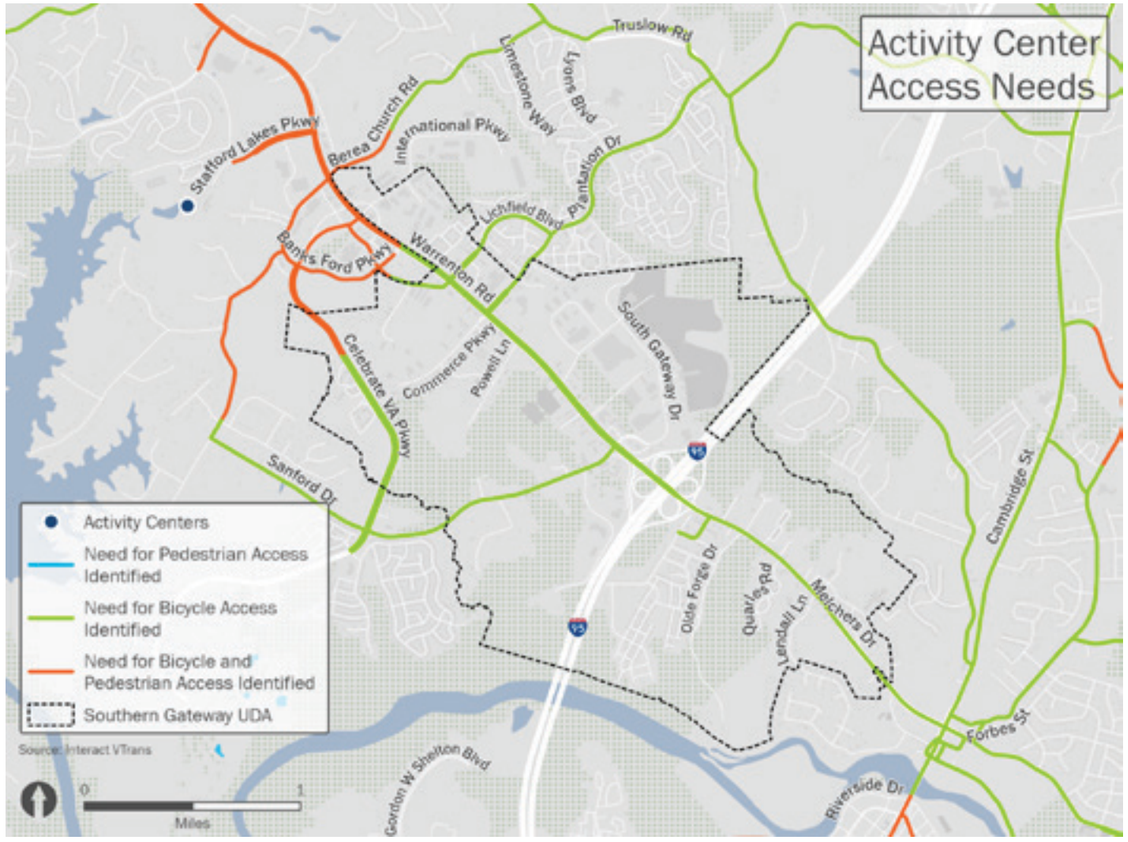
Name	Description	Location	Status	Source	Timeframe
Berea Church Road improvements	Cycling and pedestrian improvements utilizing the paved shoulder	Berea Church Road between Truslow Road and Route 17	Funded	Stafford County Capital Improvement Program FY2021 Adopted Budget	December 1, 2022
Truslow Road safety/ widening improvements	Trimming roadside brush and trees to improve sightlines, widening/ hardening roadway shoulders with asphalt pavement, additional signage/markers, asphalt pavement resurfacing, etc.	Truslow Road between Berea Church Road and Cambridge Street	Funded	Stafford County Capital Improvement Program FY2021 Adopted Budget	Variable
McWhirt Loop safety/ widening improvements	Trimming roadside brush and trees to improve sightlines, widening/ hardening roadway shoulders with asphalt pavement, additional signage/markers, asphalt pavement resurfacing, etc.	McWhirt Loop	Funded	Stafford County Capital Improvement Program FY2021 Adopted Budget	Variable
Falls Run Drive safety/ widening improvements	Trimming roadside brush and trees to improve sightlines, widening/ hardening roadway shoulders with asphalt pavement, additional signage/markers, asphalt pavement resurfacing, etc.	Falls Run Drive	Funded	Stafford County Capital Improvement Program FY2021 Adopted Budget	Variable
Rappahannock River Scenic Trail	Multi-use recreation trail	Precise alignment TBD	Proposed	2019 Stafford County Bicycle and Pedestrian Facilities Plan	Unknown
Trail connection	Multi-use recreation trail	Precise alignment TBD	Proposed	2019 Stafford County Bicycle and Pedestrian Facilities Plan	Unknown
Route 17 Park and Ride covered bicycle parking	Covered bicycle parking	Route 17 Park and Ride	Proposed	2045 George Washington Region Bicycle and Pedestrian Plan	Unknown
East Coast Greenway	Multi-use recreation trail	Belmont-Ferry Farm Trail to Embrey Mill Park along Lendall Lane, Route 17, Truslow Road, and future connector roads	Proposed	2019 Stafford County Bicycle and Pedestrian Facilities Plan, 2021 George Washington Regional Greenway Feasibility Study	Unknown
Proposed cycling and pedestrian facilities	Multi-use recreation trail or bicycle lane and sidewalk	Truslow Road from Berea Church Road to Poplar Road	Proposed	2019 Stafford County Bicycle and Pedestrian Facilities Plan	Unknown
Proposed cycling and pedestrian facilities	Multi-use recreation trail or bicycle lane and sidewalk	Village Parkway south of Route 17	Proposed	2019 Stafford County Bicycle and Pedestrian Facilities Plan	Unknown
Proposed cycling and pedestrian facilities	Multi-use recreation trail or bicycle lane and sidewalk	Banks Ford Parkway	Proposed	2019 Stafford County Bicycle and Pedestrian Facilities Plan	Unknown
Proposed cycling and pedestrian facilities	Multi-use recreation trail or bicycle lane and sidewalk	Lichfield Boulevard	Proposed	2019 Stafford County Bicycle and Pedestrian Facilities Plan	Unknown
Proposed cycling and pedestrian facilities	Multi-use recreation trail or bicycle lane and sidewalk	McWhirt Loop	Proposed	2019 Stafford County Bicycle and Pedestrian Facilities Plan	Unknown
Route 17 sidewalk network connections	Sidewalks	Route 17 between McLane Drive and Cambridge Street	Proposed	2019 Stafford County Bicycle and Pedestrian Facilities Plan, 2045 George Washington Region Bicycle and Pedestrian Plan	Unknown
Route 17 crossing improvements	Crosswalks and pedestrian signals	Berea Church Road, Celebrate Virginia Parkway, Interstate 95, and Solomon Drive	Proposed	2045 George Washington Region Bicycle and Pedestrian Plan	Unknown
Truslow Road crossing improvements	Crosswalks and pedestrian signals	Enon Road and Cambridge Street	Proposed	2045 George Washington Region Bicycle and Pedestrian Plan	Unknown

2.3. VTrans Mid-Term Infrastructure Needs

The Commonwealth of Virginia maintains VTrans, a multi-modal transportation plan that advances the Commonwealth Transportation Board's (CTB) vision for transportation. Within VTrans, Mid-Term Needs, or transportation challenges that should be addressed within ten years, identify the most urgent issues affecting mobility in the Commonwealth and provide a framework for the prioritization of investments. Accordingly, VTrans Mid-Term Needs provide a foundation for the identification of active transportation network gaps as well as the prioritization of their mitigation.

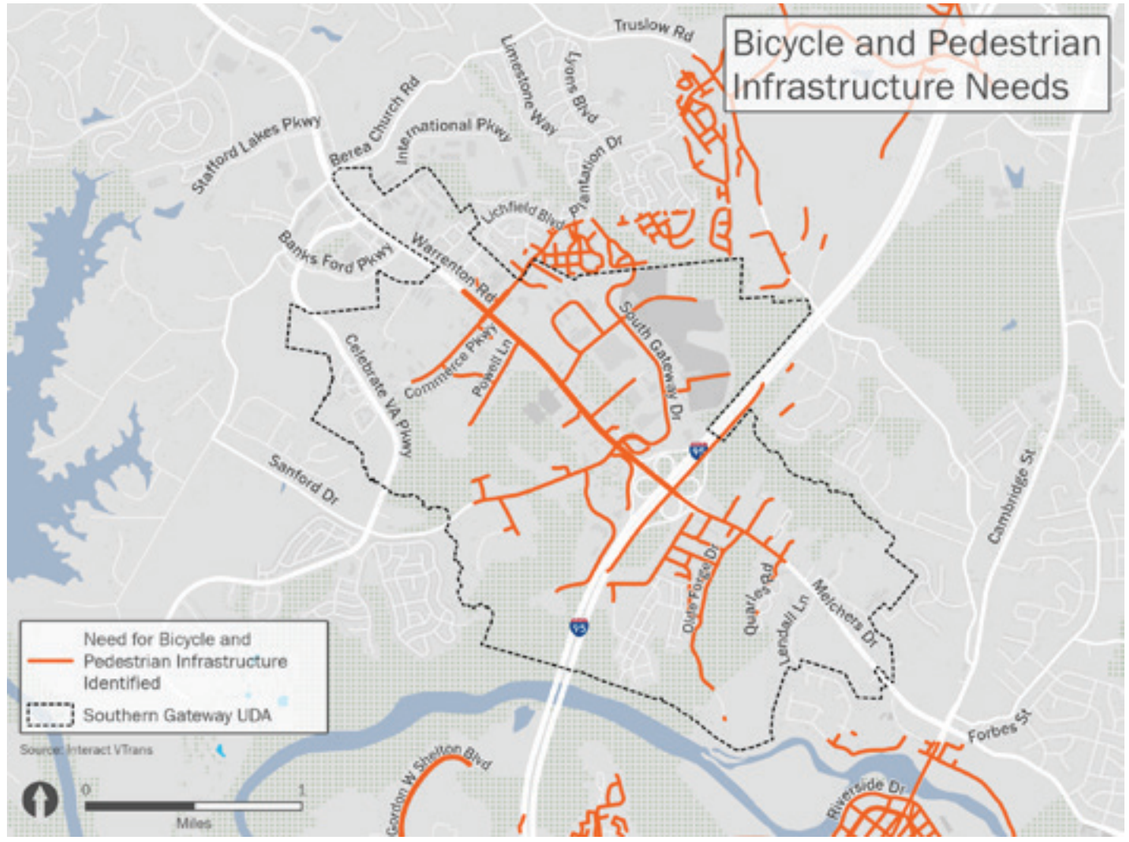
VTrans identifies a need for active transportation access to Activity Centers (areas of regional importance that have a high density of economic and social activity). **Figure 4** depicts roadway segments within cycling and/or walking distance of activity centers that should facilitate active transportation. VTrans also identifies roadway segments within and immediately surrounding UDAs with active transportation infrastructure needs; **Figure 5** depicts these segments within the study area. Several other VTrans needs, which fall within the bicycle and pedestrian infrastructure needs, were also considered when evaluating Southern Gateway's active transportation networks, including sidewalks, complete streets, traffic calming, safety features, and pedestrian safety improvements.

Figure 4: VTrans Needs; Active Transportation Access to Activity Centers



Map utilizes Interact VTrans Layer 2021 Mid-Term Needs/Need-Bicycle Access (RN) and Pedestrian Access (RN).

Figure 5: VTrans Needs; Urban Development Area Bicycle and Pedestrian Infrastructure Needs



Map utilizes Interact VTrans Layer 2021 Mid-Term Needs/Need-Bicycle Infrastructure (UDA) and Pedestrian Infrastructure (UDA).

2.4. Socio-Demographic Analysis

Sociodemographic data can help reveal the underlying need for active transportation infrastructure, including who might benefit most from these investments. To understand the needs within the study area, the study team completed a sociodemographic analysis that examined a range of factors related to infrastructure needs and equity. These factors are compiled into a propensity analysis that summarizes the findings in one map.

Population statistics are derived from the US Census Bureau's 2019 American Community Survey 5-Year Estimates, while employment data is derived from the 2018 Longitudinal Employer-Household Index (LEHD). Accordingly, the analysis does not reflect new housing developments, new employment opportunities, and other demographic changes since 2019 and 2018, respectively. This is particularly important since the Southern Gateway UDA is rapidly developing, and there are almost certainly inconsistencies between this data and reality; where identified, these inconsistencies are noted. Finally, Census boundaries are not contiguous with the scope of this study, and portions of several block groups extend beyond the geography under review; nevertheless, the entirety of these block groups are depicted in the applicable maps.

2.4.1. PEOPLE AND JOBS

The presence of residents and jobs indicates potential demand for active transportation infrastructure. **Figure 6** depicts population density by Census block group, calculated as residents per square mile, and **Figure 7** depicts employment density calculated as jobs per square mile. Population density is highest north of Route 17 and west of Interstate 95 in and around the Village at England Run and England Run subdivisions. The Falls Run subdivision also contributes to the potential demand for cycling and pedestrian infrastructure in this area. East of I-95, the Rappahannock Landing and adjacent mobile home community represent another major cluster of residential development. Finally, several large developments along the Celebrate Virginia Parkway are increasing the population density at the far southwestern end of the Southern Gateway.

Within the Southern Gateway UDA, employment is concentrated along the north side of the Route 17 corridor. Auto-oriented commercial businesses, including strip malls, big-box stores, and fast-food outlets, stretch along both sides of the road. To the north of Route 17 is a cluster of light industrial businesses, including food distribution, automotive sales/repair, chemical manufacturing, and building supply/services that have a large concentration of jobs. Immediately outside of the Southern Gateway UDA, employment is concentrated to the south side of Route 17 in Berea. In addition to retail destinations typical of the study area, a large GEICO office, employing upwards of 4,000 individuals, is located along Stafford Lakes Parkway.

Figure 6: Population Density Calculated as Residents Per Square Mile

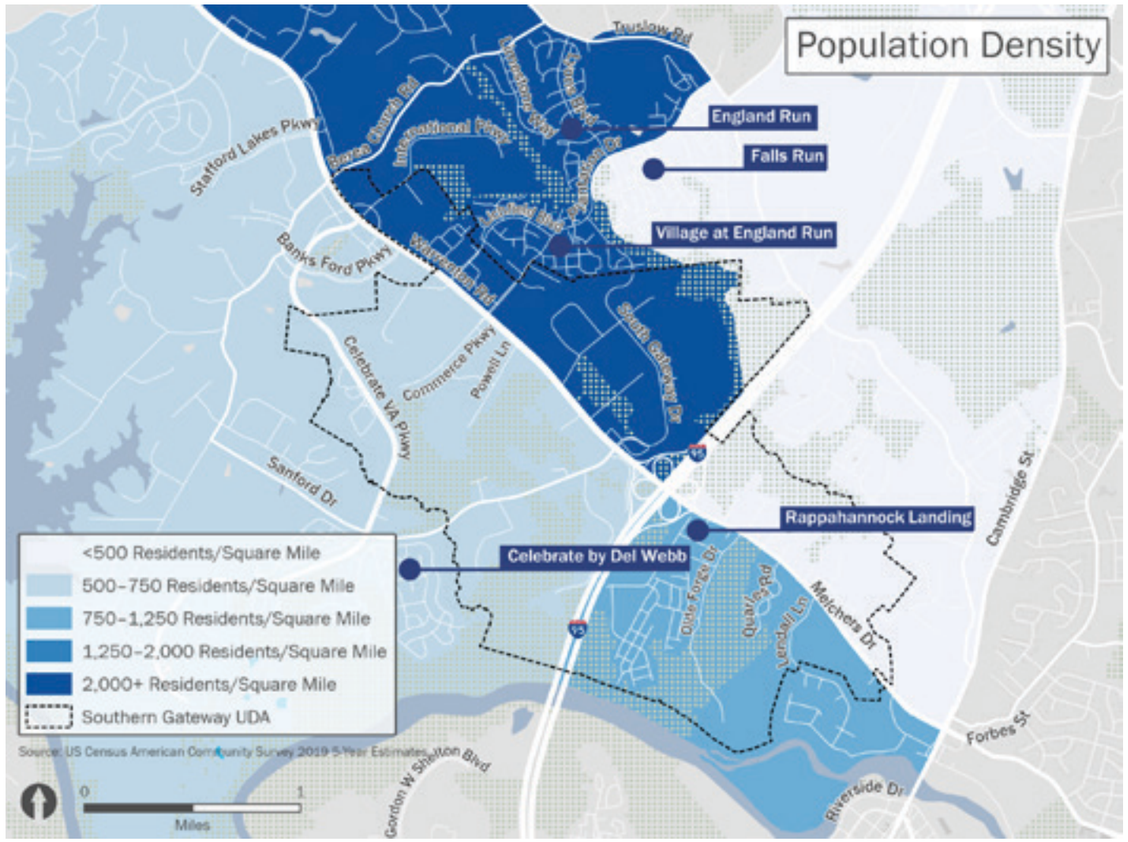
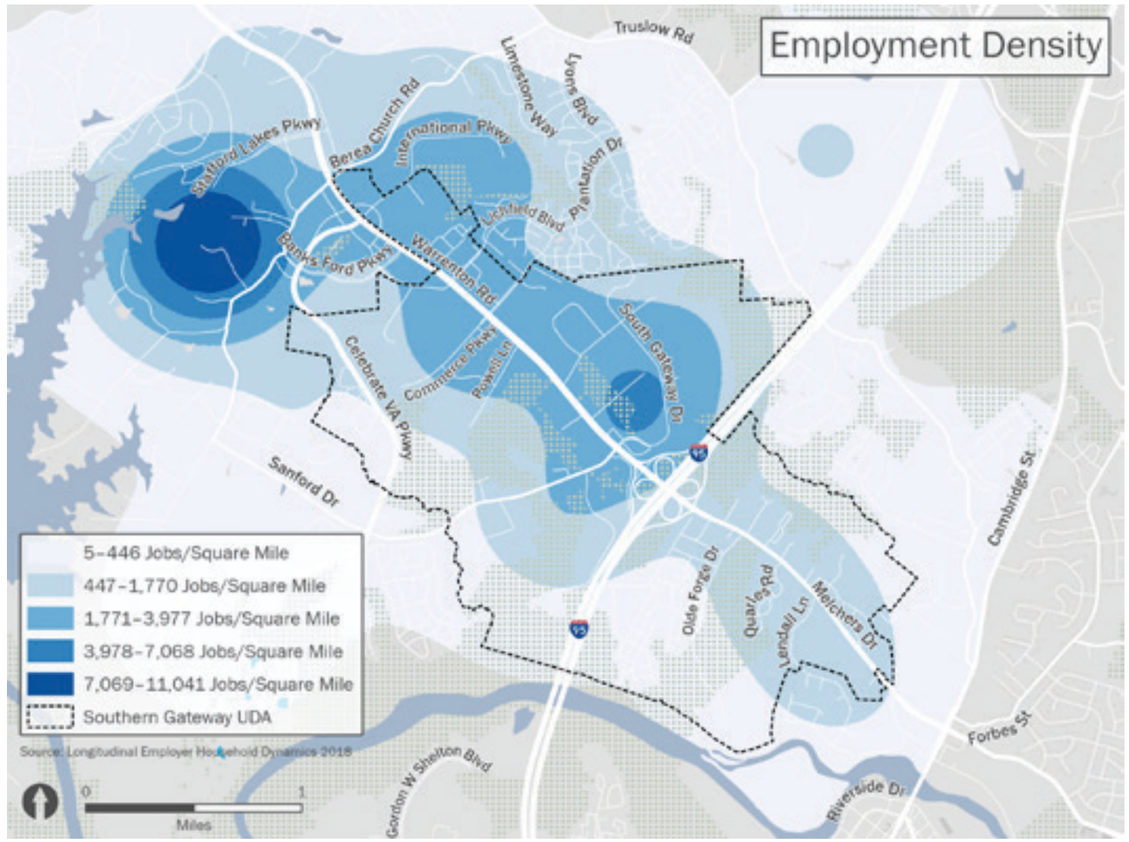


Figure 7: Employment Density Calculated as Jobs Per Square Mile



2.4.2. LOW-INCOME POPULATION

Ensuring that cycling and walking provide a safe means of accessing jobs and services is critical to promoting transportation equity. Low-income individuals are more likely to rely on cycling, walking, and transit (which typically begins and ends with a cycling and/or walking trip), because as income falls, the cost of owning and using a private vehicle becomes more burdensome. Since disposable income is largely a factor of household size and income, this calculation considers household income and the number of members in the household in classifying whether a household is in poverty.

The highest concentration of low-income individuals is south of Route 17 and east of Interstate 95 (in and around the Rappahannock Landing subdivision); within this block group, an estimated 27 percent of the population lives in a household earning less than 150 percent of the federal poverty line. Emphasizing the importance of active transportation infrastructure along the Route 17 corridor, the second-largest concentration of low-income individuals is north of Route 17 west of Interstate 95; 14 percent of residents within the block group containing the Village at England Run subdivision and 11 percent of residents within the block group containing the England Run subdivision live in low-income households. Because most of the residential development in these areas is set back from Route 17, active transportation infrastructure connecting residents to services along Route 17 is critical.

2.4.3. OLDER ADULT AND YOUTH POPULATIONS

For several reasons, older adults are a key population for cycling and pedestrian improvements. From a safety perspective, the prevalence of disabilities affecting one's mobility increases with age. Seniors may choose not to or be unable to drive, resulting in their reliance on other modes of transportation. The socio-demographic analysis includes the population of individuals aged 65 years and older as a percentage of the total population by Census block group. The highest concentration of older adults exists on the eastern side of the study area.

Individuals aged 17 years and younger are also more likely to engage in active transportation because the vast majority cannot drive. This population was also included in the socio-demographic analysis; in contrast to the population of older individuals, the concentration of younger individuals is greatest on the west side of the study area. In considering how to plan for the active transportation needs of this population, it is critical to ensure adequate cycling and pedestrian infrastructure around schools. While most schools in the study area offer sidewalks in their immediate vicinities, these networks are often incomplete and unconnected to students' homes.

2.4.4. PEOPLE OF COLOR AND/OR HISPANIC POPULATION

From an equity perspective, it is important to understand where there are concentrations of ethnic or racial minorities in the study area. These populations were included in the socio-demographic analysis, and the highest concentrations of Hispanic and/or People of Color are found in the densest parts of the study area, in and around the Village at England Run and England Run subdivisions north of Route 17 and west of Interstate 95. Within the block group containing the England Run subdivision, 53 percent of residents identify as non-white; similarly, 69 percent of individuals living in the block group containing the Village at England Run subdivision identify as non-white.

2.4.5. EQUITY EMPHASIS AREAS

OIPI classifies two of the five Census block groups included in the study area as Equity Emphasis Areas, based on their concentration of residents living with a disability, whose income is below 150 percent of the poverty level, who are 75 or older, who identify as non-white, and/or who do not speak English "very well." To identify Equity Emphasis Areas, the share of each of these populations is estimated by Census block group and divided by the regional concentration (based on OIPI Regional Networks) to determine the ratio of concentration (ROC). The ROCs are then reclassified by converting all ROCs above 3 to 3, low-income ROCs below 1 to 0, and ROCs for the other categories below 1.5 to 0 and summed into an index. Equity Emphasis Areas are subsequently identified as Census block groups with an index of two or greater and an ROC for low-income or disability greater than or equal to one.

For more information on the methodology used to calculate Equity Emphasis Areas, see the Technical Guide for the Identification and Prioritization of the VTrans Mid-Term Needs.

2.4.6. ACTIVE TRANSPORTATION MODE SHARE

For self-evident reasons, understanding where workers who already walk or cycle to work informs planning for improved active transportation infrastructure. Despite the auto-oriented nature of the study area, estimates of workers who commute by walking are quite high. Within the block group that includes the Falls Run subdivision, as well as areas north of Route 17 east of Interstate 95, an estimated five percent of commuters, walk to work; other concentrations of individuals utilizing active transportation to get to work are found south of Route 17 on either side of Interstate 95, where an estimated two percent of commuters walk to their job. When evaluating these figures, it should be noted that because the absolute number of people walking to work is very small, the margin of error for these estimates is relatively high. Cycling commute mode share was also assessed; however, each study area Census block group is estimated to have zero individuals commuting by bicycle. This may be attributed to the limited connectivity of cycling infrastructure within the study area and difficult and/or dangerous connections to nearby employment centers (for example, the narrow, unprotected sidewalk along the Falmouth Bridge that cyclists would need to traverse to reach Fredericksburg).

2.4.7. ZERO-CAR HOUSEHOLDS

Similar to individuals who already walk and cycle to work, individuals living in households that do not have access to an automobile are particularly likely to use active transportation infrastructure. As might be expected given the prevailing land use patterns, only four percent of households in and around Southern Gateway lack access to a car. Nevertheless, 19 percent of households in the area south of Route 17 and east of Interstate 95, which lacks cycling or pedestrian infrastructure access to the Route 17 commercial corridor and other area amenities, do not have access to an automobile; in contrast, an estimated zero households within the block groups immediately west of Interstate 95 are estimated to lack automobile access.

2.4.8. INDIVIDUALS LIVING WITH DISABILITIES

Individuals living with disabilities are an important population to consider when identifying active transportation needs. An estimated 14 percent of Southern Gateway residents aged 18 years and older live with a disability; understanding where these individuals reside helps target interventions where they may have the most impact. The largest concentration of residents living with a disability, 19 percent of all adults, is found within the block group that includes the Falls Run subdivision and areas north of Route 17 east of Interstate 95. A significant number of individuals living with a disability (approximately 12 percent of all adults) also reside south of Route 17 and east of Interstate 95.

2.5. Active Transportation Propensity

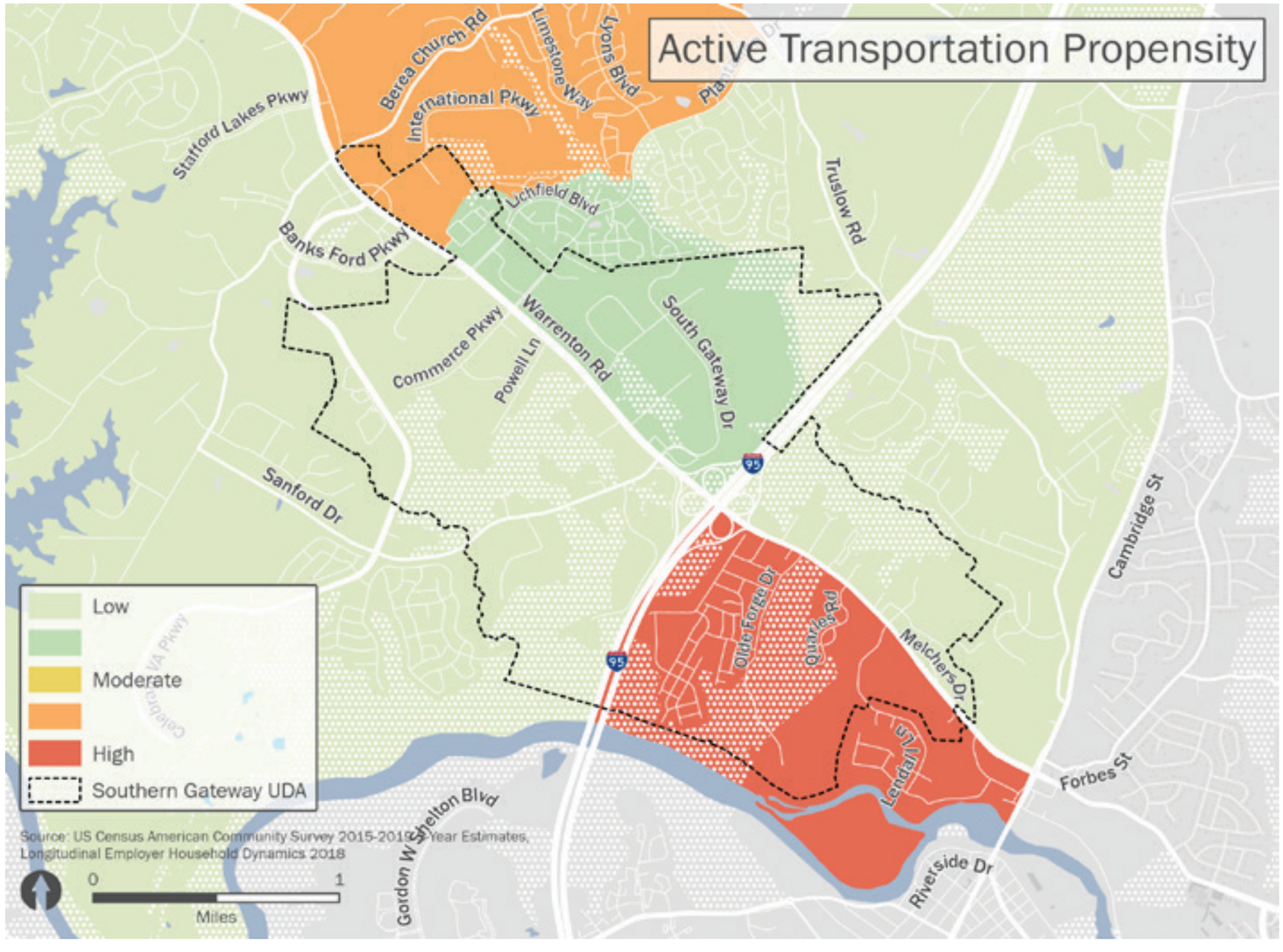
Figure 8 combines the socio-demographic analyses above into an estimated relative propensity for active transportation based on population density and the presence of old, young, disabled, and low-income populations, as well as zero- and one-car households.

Table 2 summarizes the weighting of these variables used in developing this measure. Based on this analysis, the areas of the greatest propensity for active transportation exist on opposite ends of the study area, slightly removed from the densest parts of the Route 17 corridor. Though the area of greatest propensity does not include cycling or pedestrian infrastructure to facilitate safe or comfortable active transportation, this population is uniquely positioned between the amenities along Route 17 and downtown Fredericksburg.

Table 2: Active Transportation Propensity Index Weighting

Variable	Dataset	Weight
Population	Population Density	30
	Non-White and Hispanic/Latino Population Density	
Age	Senior (65+) Density	5
	Seniors as Percentage of Total Population	
	Youth (<18) Density	5
	Youths as Percentage of Total Population	
Income	Low-Income Households as Percentage of Total Number of Households	20
	Low-Income Household Density	
	Percentage of Low-Income Households as Percentage of Total Number of Households	
Vehicle Ownership	Percentage of Zero-Car Households as Percentage of Total Number of Households	20
	Zero-Car Household Density	
	Percentage One-Car Households as Percentage of Total Number of Households	10
	One-Car Household Density	
Disabled	Disabled Population Density	10

Figure 8: Propensity for Active Transportation Based on Population Density and the Presence of Old, Young, Disabled, and Low-Income Populations, as Well as Zero- and One-Car Households

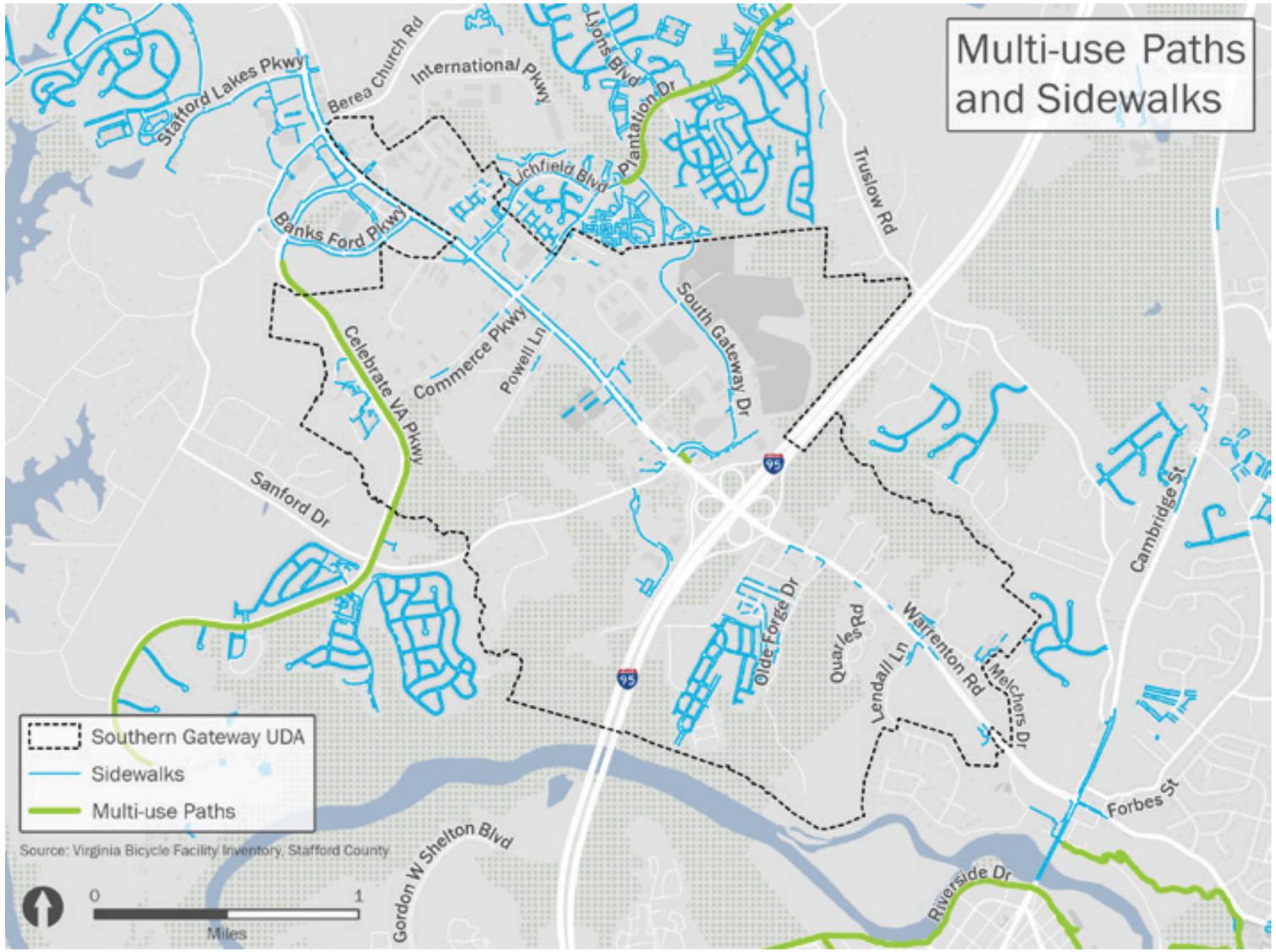


2.6. Existing Cycling and Pedestrian Infrastructure

Figure 9 depicts existing cycling and pedestrian infrastructure in and around the Southern Gateway UDA. Two multi-use paths serve neighborhoods along Plantation Drive and Celebrate Virginia Parkway; however, they foster limited connectivity as both terminate before reaching Route 17. The longer of the two multi-use paths, which runs along Celebrate Virginia Parkway, connects several existing neighborhoods and several proposed developments, with a wide, grade-separated path featuring gentle grade changes. In contrast , as shown below, the multi-use path along Plantation Drive is much narrower, making it difficult or impossible for cyclists to pass one another. It requires that users share the road shoulder with automobiles in several locations. To the east of the study area, connecting Falmouth to Chatham Heights, the Belmont-Ferry Farm Trail serves riverfront destinations such as the historic Chatham Manor, with plans to eventually connect to the cycling lanes along Deacon and Cool Spring Roads.

The auto-oriented land use patterns and associated roadways create very uninviting environments for cycling. There are no on-road bicycle lanes in the Southern Gateway UDA. A few roadways (e.g., Southern Gateway Drive) are signed cycling routes but do not have dedicated space for cyclists. Along the Route 17 corridor, driveways served by slip lanes and the Interstate 95 interchange make cycling not only uncomfortable but unsafe, as evidenced by the numerous crashes involving cyclists from 2017 to 2020 at these locations. Other critical network connections, including South Gateway Drive, Plantation Drive, Truslow Road, and Cambridge Street, feature similarly inhospitable conditions. As a result, while most cyclists can comfortably and safely navigate many of Southern Gateway's residential subdivisions, only a select few will feel comfortable venturing beyond that point.

Figure 9: Multi-Use Paths and Sidewalks In and Around the Southern Gateway UDA



As shown below, frequent driveways, sidewalk network gaps, a lack of infrastructure to facilitate crossings, and the Route 17/Interstate 95 interchange detract from the safety and comfort of walking along Route 17. While the sidewalk network is largely intact west of Interstate 95, virtually no sidewalks exist east of the interchange. While most neighborhoods feature complete sidewalk networks, convenient connections between neighborhoods and between neighborhoods and the amenities along Route 17 are rare. Additional observations on existing cycling and pedestrian infrastructure can be found in the **Field Assessment.**

Frequent driveways along Route 17 pose obstacles for pedestrians.

Crosswalks across Route 17 are nonexistent at many intersections.

Plantation Drive's multi-use path is narrow, and in some locations only a shoulder is available.

2.7. Bicycle Levels of Traffic Stress (BLTS)

2.7.1. BLTS ANALYSIS

A BLTS analysis rates linkages in the cycling transportation network (i.e., roads and multi-use paths) by their approachability for cyclists. Cycling comfort level and risk tolerance vary by individual; a commonly used framework divides the public into four types based on interest in cycling: strong and fearless, enthused and confident, interested but concerned, and no-way/no-how.[2]

Strong and fearless riders show no hesitance to cycle in a wide variety of environments, including with fast-moving or congested automobile traffic. Conversely, the no-way/no-how group avoids cycling regardless of the circumstance. Interested but concerned individuals, willing to cycle in places where there is limited to no interaction with automobiles, make up most of the population; accordingly, in developing a cycling network, infrastructure that attracts these potential cyclists is critical.

This BLTS analysis ranks street segments on a scale of one to four, with four representing a very high-stress environment, suitable only for strong and fearless cyclists, and one representing a low-stress environment, suitable for interested but concerned cyclists of all ages and abilities. By rating street segments in this manner, we identify gaps in the transportation network that pose barriers for cycling in and around Southern Gateway.

2.7.2. BLTS METHODOLOGY

Variables used in ranking street segments[3] include the presence of cycling infrastructure,[4] number of travel lanes, posted speed limits, annual average daily traffic (AADT) where available, and historical crash data.[5] **Table 3** summarizes the assignment of BLTS scores based on each of these variables except historical crash data. Serving as a proxy for several difficult to operationalize variables, historical crash data instead informs a one-point upward adjustment in the BLTS score for segments longer than 0.02 miles with more than the median number of crashes per mile from 2017 to 2020.

Table 3: BLTS Street Segment Scoring Rubric

		AADT		
		3,000	3,001 to 6,000	6,001
Speed Limit	**Lanes**	**Mixed Traffic**		
≤25	≤3	1	2	3
	4 or 5	3	3	3
	≥6	4	4	4
>25	≤3	3	4	4
	4 or 5	4	4	4
	≥6	4	4	4
Speed Limit	**Lanes**	**Sharrows**		
≤25	≤3	1	1	3
	4 or 5	3	3	3
	≥6	4	4	4
>25	≤3	3	4	4
	4 or 5	4	4	4
	≥6	4	4	4
Speed Limit	**Lanes**	**Dedicated Lanes**		
≤25	≤3	1	1	2
	4 or 5	1	2	3
	≥6	2	3	4
>25	≤3	2	2	3
	4 or 5	2	3	4
	≥6	3	4	4

2. Jennifer Dill and Nathan McNeil. Revisiting the Four Types of Cyclists: Findings from a National Survey. Transportation Research Record: Journal of the Transportation Research Board, January 1, 2016.

3. Virginia Geographic Information Network (2021). Virginia Road Centerlines. Retrieved September 3, 2021.

4. Virginia Department of Transportation (2019). Bicycle Facility Inventory. Retrieved September 3, 2021.

5. Virginia Department of Transportation (2017). Virginia Crashes. Retrieved July 22, 2021.

2.7.3. BLTS RESULTS

Figure 10 depicts the BLTS for all road and multi-use path segments in and around the study area. Slower traffic speeds, low volumes, and straightforward lane configurations characterize BLTS "1" segments; conversely, higher speeds, high volumes, and multiple lanes in each direction characterize BLTS "4" segments. Put another way, most cyclists would feel comfortable riding along a BLTS "1" street while very few would feel comfortable riding along a BLTS "4" street.

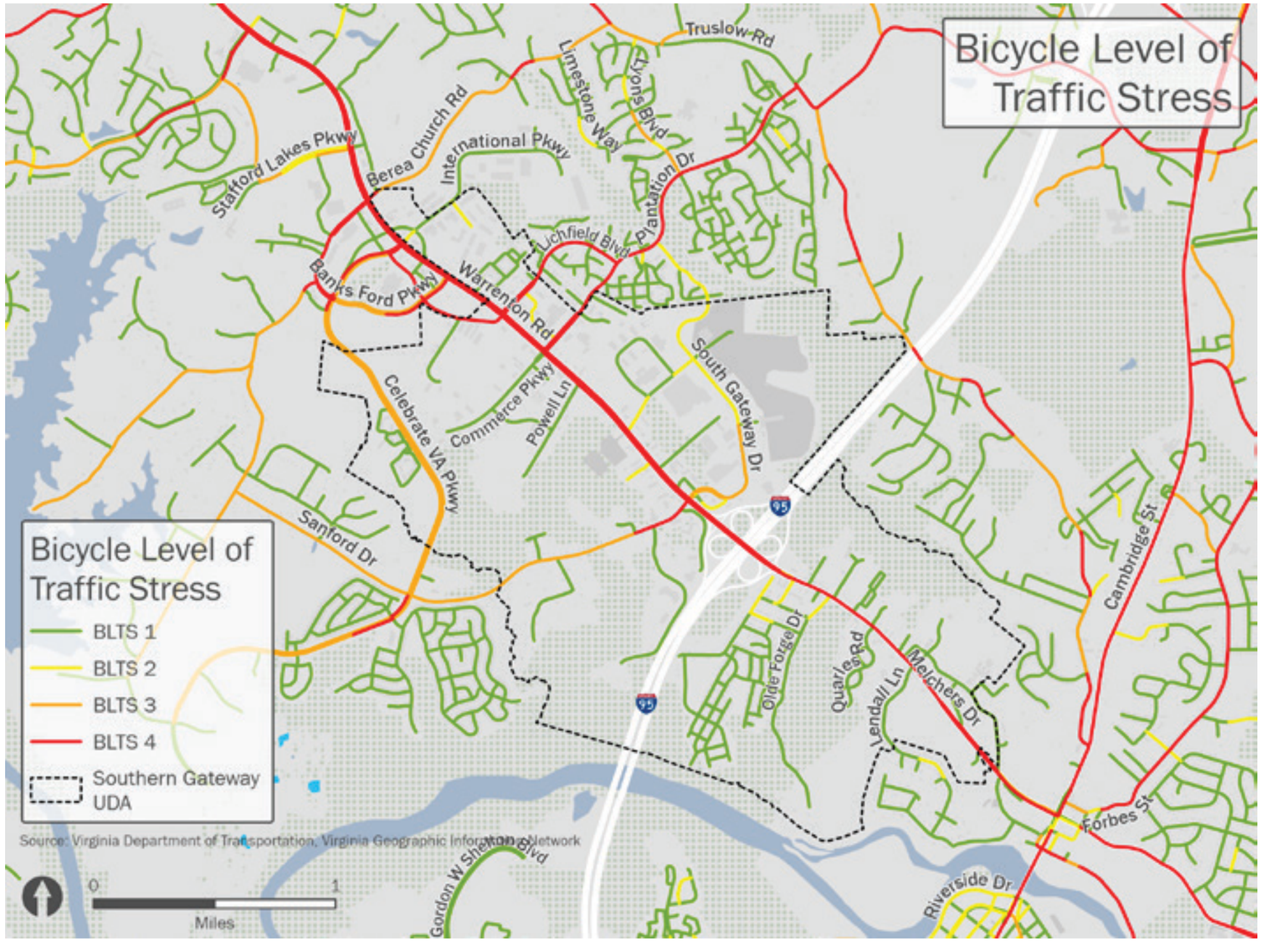
Despite robust low-stress networks within neighborhoods in and around the Southern Gateway UDA, very few roads connecting these neighborhoods facilitate low-stress cycling (indicated by BLTS "1" and/or BLTS "2" segments). Segments of Celebrate Virginia Parkway, Plantation Drive, South Gateway Drive, Sanford Drive, and Berea Church Road, as well as the entirely of Route 17, create barriers between these pockets of low-stress streets. The presence of these high-stress segments discourages cycling by interrupting the network of streets most cyclists feel comfortable riding along. In addition to these challenges within and immediately surrounding the Southern Gateway UDA, the high-stress conditions of Route 17 and Cambridge Street effectively act as a barrier for cycling to Fredericksburg or the Belmont-Ferry Farm Trail, both of which are otherwise within easy cycling distance.

2.7.4. LOCATION-BASED SERVICES DATA

Understanding travel patterns allows gaps in existing active transportation infrastructure to be identified and prioritized for mitigation. Walking and cycling patterns identify locations where infrastructure enhancements would increase the safety of journeys that are being made and encourage active transportation by increasing the comfort of those journeys. The study team looked at data generated by StreetLight to better understand local travel patterns. StreetLight analyzes travel flows from over 110 million electronic devices in the United States and Canada to compile indices illustrating cycling and pedestrian activities, resulting in a granular picture of active transportation trips within Southern Gateway and the surrounding area.

Both bicycle and pedestrian traffic indices for trips occurring within Southern Gateway and the surrounding area were analyzed to determine areas of activity. Activity is concentrated along the Route 17 corridor west of Interstate 95, an auto-oriented stretch of commercial development, highlighting the importance of enhanced infrastructure to improve the safety of active transportation travel along this roadway. Notably, while this suggests cyclists avoid traveling through the BLTS "4" Route 17/Interstate 95 interchange, it appears pedestrians are traversing this high-crash segment. With some of

Figure 10: Bicycle Level of Traffic Stress



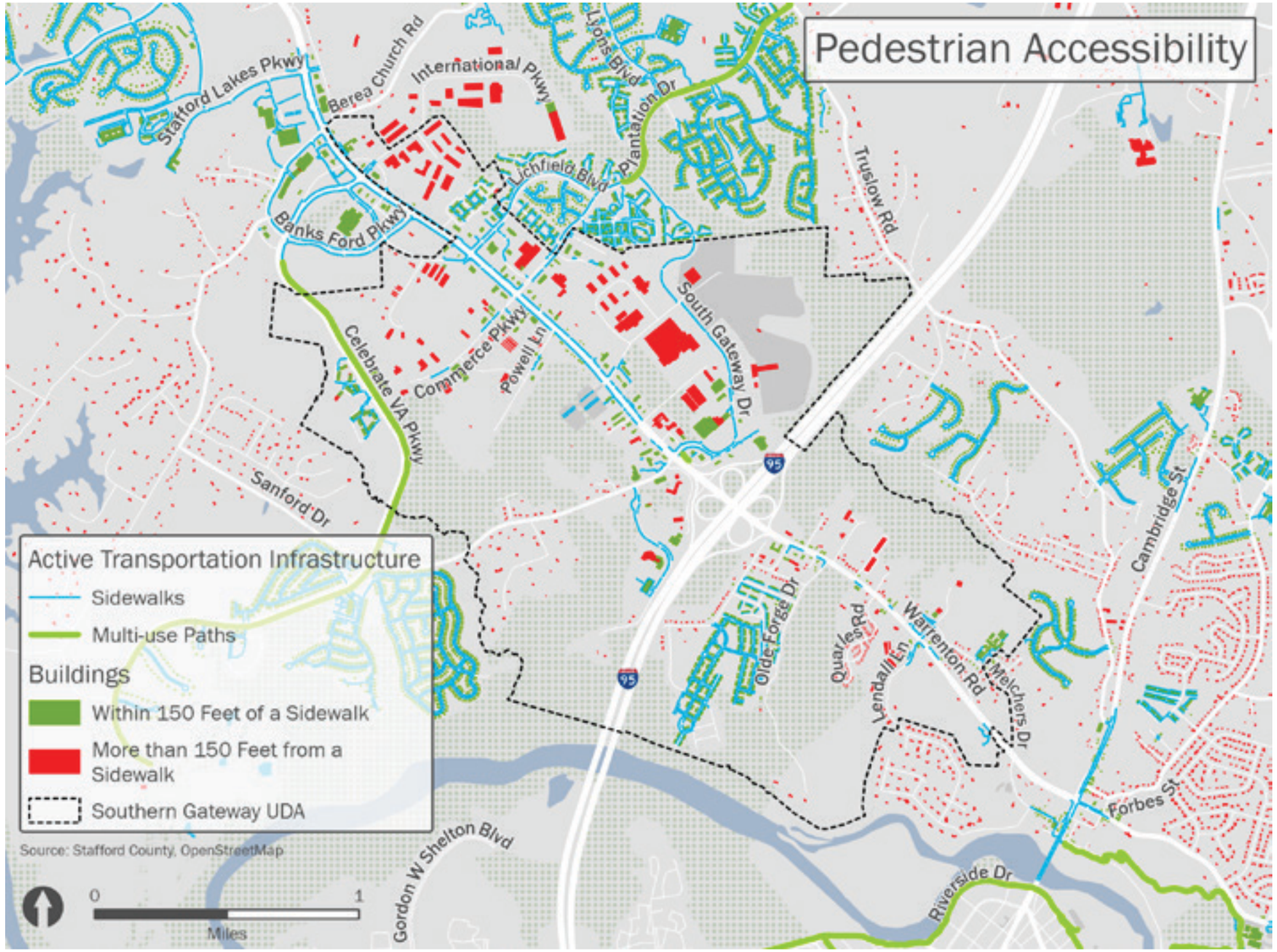
the largest flows found between zones on opposite sides of Route 17, these indices also highlight the need for infrastructure to accommodate walking and cycling across this arterial.

To understand where new connections might shorten journeys, active transportation trip circuity, or the ratio of actual travel distance to the direct distance from the start of a trip to the end of a trip was analyzed. High circuity near the Interstate 95 interchange suggests demand for infrastructure connections facilitating cycling and pedestrian trips north of Route 17 near Interstate 95 (along Truslow Road) and south of Route 17 east of Interstate 95 (connecting the Rappahannock Landing subdivision to the amenities along Route 17 west of Interstate 95 and Cambridge Street in Fredericksburg).

2.8. Pedestrian Accessibility Analysis

Sidewalk access is a good proxy for overall pedestrian accessibility. Areas without sidewalks lack fundamental pedestrian connectivity. Exploring sidewalk access also helps the study team understand gaps and barriers in pedestrian access. While many residential subdivisions and shopping centers have sidewalks within them, these sidewalks often do not connect to neighboring land uses, creating isolated clusters of pedestrian infrastructure. **Figure 11** depicts buildings in and around the Southern Gateway UDA, classified by whether they fall within 150 feet of an existing sidewalk. While homes within the denser residential subdivisions lie along sidewalks, homes in less densely developed subdivisions, as well as many points of interest along Route 17, do not.

Figure 11: Pedestrian Accessibility as Determined by Proximity to Existing Sidewalks



2.9. Field Assessment

To verify the technical analyses described above, a field assessment across Southern Gateway and surrounding areas was conducted by project staff to examine existing conditions and further understand how cyclists and pedestrians travel through the study area. This assessment was used in conjunction with study area maps and Google Street View imagery to complement the existing conditions analysis and better analyze previously identified active transportation gaps to inform future recommendations for improvement. The field assessment was conducted on Wednesday, October 15, 2021, from 2:00 p.m. to 5:00 p.m., with weather conditions suitable for cyclists and pedestrians. Key observations and takeaways from the field assessment are as follows:

2.9.1. INFRASTRUCTURE AND NETWORK OBSERVATIONS:

- **Celebrate Virginia Parkway Multi-Use Trail:** The trail offers a low-stress option for pedestrians and cyclists but with limited connections to amenities or destinations. The trail serves as a foundation for creating an interconnected cycling/pedestrian network in the area and has the potential for increased practicality if it is connected to intersecting low-stress roadways.
- **Plantation Drive:** This roadway offers a potential alternative for cyclists and pedestrians to avoid Route 17 and serves as a signed cycling route. Still, the roadway has limited to nonexistent cycling and pedestrian infrastructure, lacks shoulders, and lacks crosswalks at many intersections.
- **Route 17 between I-95 and Stafford Lakes Parkway:** This segment of Route 17 sees a high volume of high-speed automobile traffic, with auto-centric and industrial land, uses and a lack of cycling/pedestrian infrastructure. The conditions along this segment create an inhospitable environment for cyclists and pedestrians.
- **Route 17 and I-95 Interchange:** This interchange creates an inhospitable environment for pedestrians and cyclists, with a complicated network of lane changes and heavy automobile traffic, as well as a lack of cycling/pedestrian infrastructure. It also creates a barrier between residents east of the interchange and amenities west of the interchange. This interchange is also where the highest volume of crashes within the study area occurs.
- **Rappahannock Landing and Quarles Mobile Home Parks:** These developments include low-stress residential streets and expansive sidewalk networks with no connections to surrounding areas. The lack of safe connections isolates pedestrians and cyclists who may reside in these developments from accessing surrounding areas without an automobile.

Route 17 is inhospitable to pedestrians due to its high-speed traffic, incomplete sidewalk network, and limited crosswalks.

The segment of Route 17 at the Interstate 95 interchange is particularly inhospitable to pedestrians due to numerous on/offramps.

The few existing crosswalks across Route 17 are poorly marked; the study team recommends repainting these as zebra crosswalks.

2.9.2. QUALITATIVE AND ENVIRONMENTAL OBSERVATIONS:

- The largely industrial and auto-focused land uses along and surrounding Route 17 creates an environment that is designed for drivers, not pedestrians or cyclists. The lack of infrastructure, large setback from the street, lack of landscaping, and high traffic volumes make the area inhospitable to active transportation users.
- Existing cycling and pedestrian infrastructure is disjointed, limiting connectivity and utility, and hindered by the study area's disconnected street grid. In some scenarios, these factors create extensive detours, both to avoid high-stress roadways and/or due to a lack of direct connections between key destinations. These conditions result in potential cycling or pedestrian trips being longer and more inefficient than necessary, sometimes even making potential trips infeasible.

The Celebrate Virginia Parkway multi-use path offers a low-stress cycling and walking option, but with limited connections.

Plantation Drive is a signed cycling route but otherwise lacks cycling, pedestrian, and crossing infrastructure in many places.

The low-stress streets in the Rappahannock Landing and Quarles Mobile Home Parks are not connected to other neighborhoods.

3. GAP IDENTIFICATION

The existing conditions analysis in the previous chapter, in addition to the field assessment, allow the study team to identify the cycling and pedestrian network gaps that currently serve as barriers to active transportation in and around the Southern Gateway UDA. Mitigating these gaps will help establish an interconnected grid of cycling and pedestrian routes, laying the foundation for a more walkable and human-scaled Southern Gateway.

The pedestrian and cycling challenges identified in the existing conditions analysis and field assessment culminated in 18 discrete gaps in the study area that inhibit walking and cycling, listed in **Table 4** on the following page. **Figure 12** illustrates these gaps alongside existing cycling and pedestrian infrastructure. In the following chapters, these gaps are discussed individually to explore which improvements may be effective in reducing the barriers to walking and cycling. The gaps are prioritized for improvements to determine where resources should be dedicated first.

Mitigating these gaps will help establish an interconnected grid of bicycle and pedestrian routes, laying the foundation for a more walkable and human-scaled Southern Gateway.

3.1. Relationship Between Gaps and VTrans Mid-Term Needs

The infrastructure gaps identified by the study team mostly align with the roadways identified by the VTrans Mid-Term Needs for access, activity centers, and urban development areas (UDAs). The study area is largely confined to the Southern Gateway UDA boundary. A few gaps fall just outside the UDA but were included in the analysis as they facilitate bicycle and pedestrian access to the UDA; most of these gaps outside the UDA align with the VTrans "Access to Activity Centers" needs category.

A handful of gaps (Gaps 7, 8, 9, and 11) are not captured in VTrans' Mid-Term Needs as they do not align with existing roadways and represent potential new infrastructure needs. The study team identified these infrastructure gaps as they represent missing connections that would improve bicycle and pedestrian access within the UDA.

Figure 12: Identified Active Transportation Gaps

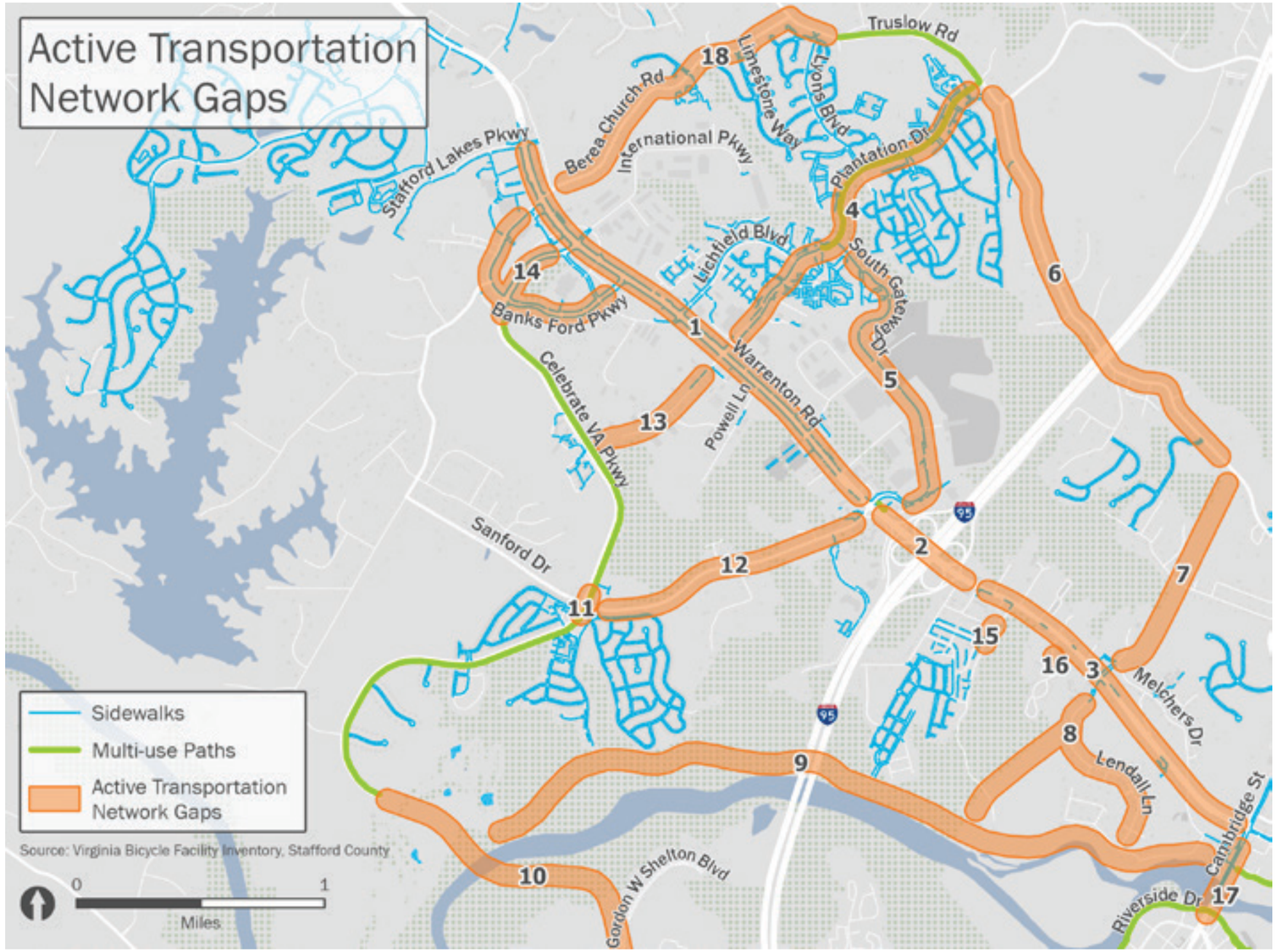


Table 4: Identified Active Transportation Gaps

Gap	Corridor	Endpoints
1	Route 17	Stafford Lakes Parkway to South Gateway Drive/Sanford Drive
2	Route 17	Interstate 95 Interchange
3	Route 17	Short Street to Cambridge Street
4	Plantation Drive	Route 17 to Truslow Road
5	South Gateway Drive	Route 17 to Plantation Drive
6	Truslow Road	Plantation Drive to Solomon Drive Extension
7	Solomon Drive Extension	Route 17 to Truslow Road
8	Lendall Lane	Route 17 to Rappahannock River Trail
9	Rappahannock River Trail	Cambridge Street to Celebrate Virginia Parkway Extension
10	Celebrate Virginia Parkway Extension	New river crossing connecting Southern Gateway to Gordon W. Shelton Boulevard
11	Celebrate Virginia Parkway	Sanford Drive Intersection
12	Sanford Drive	Celebrate Virginia Parkway to Route 17
13	Connection Near Commerce Parkway	Celebrate Virginia Parkway to Route 17
14	Celebrate Virginia Parkway and Banks Ford Parkway	Jewett Lane to Route 17
15	Olde Forge Drive	Bellows Avenue to Route 17
16	Quarles Road	Petroleum Lane to Route 17
17	Cambridge Street	Route 17 to Hanson Avenue
18	Berea Church Road	Route 17 to Truslow Road

4. PROPOSED RECOMMENDATIONS

Based on the existing conditions and identification of gaps, the study team has proposed a range of infrastructure recommendations intended to create an interconnected network of bicycle and pedestrian routes in and around the Southern Gateway UDA. This section outlines the range of improvements considered and details the recommendations by network gap.

4.1. Recommendations Toolbox

Stafford County has a wide range of solutions at its disposal to address the cycling and pedestrian needs of the Southern Gateway UDA. This chapter begins with a toolbox of potential infrastructure solutions that can be applied to the gaps identified earlier. These facilities vary widely in terms of the cost of construction, their relative impact on active transportation users, their right-of-way requirements, and their complexity.

The cycling and pedestrian improvement tools in **Table 5** are designed to make cycling and walking easier, more comfortable, and safer at their most basic level. Interventions range from creating new dedicated infrastructure to roadway interventions that signal where spaces are intended for multiple modes. While multiple solutions could be applied to the same gap in some cases, not all the solutions in this toolbox are appropriate for each gap. High-cost interventions (e.g., a cycle-track) may not be warranted for low-traffic corridors. Similarly, low-impact improvements (e.g., shared lane markings and signage) may not meaningfully improve cycling or walking conditions along busier roadways.

Table 5: Summary of Cycling and Pedestrian Toolbox Components

Improvement	Description
Shared Lane Markings and Signage	Pavement markings and signage indicate that automobiles should share the travel lane with cyclists. Low impact and most suitable for areas with low traffic.
Bicycle Lanes	On-street rights-of-way dedicated to cycling. No physical separation from traffic (e.g., no bollards or curbs). These reduce interactions between cars and cyclists, but there are no barriers protecting cyclists from car traffic.
Cycle-Tracks	On-street rights-of-way dedicated to cycling that are physically separated from automobile traffic.
Bicycle Boulevards	Streets designed to prioritize cycling through signage and traffic calming.
Multi-Use Paths	Off-street rights-of-way for cycling and walking. These often run adjacent to roadways but do not necessarily need to.
Sidewalks	Paved rights-of-way for walking that are adjacent to but separated from the street.
Crosswalks	Striping and signage demarcating where pedestrians can cross the street.
Pedestrian Signals	Signals at crosswalks indicating when cars must yield and pedestrians can cross.
Curb Extensions	Narrowing of roadways at intersections to shorten crossing distances for pedestrians and calm traffic.

SHARED LANE MARKINGS AND SIGNAGE

PAVEMENT MARKINGS AND SIGNAGE INDICATING THAT AUTOMOBILES SHOULD SHARE THE TRAVEL LANE WITH CYCLISTS

Applications and Considerations:

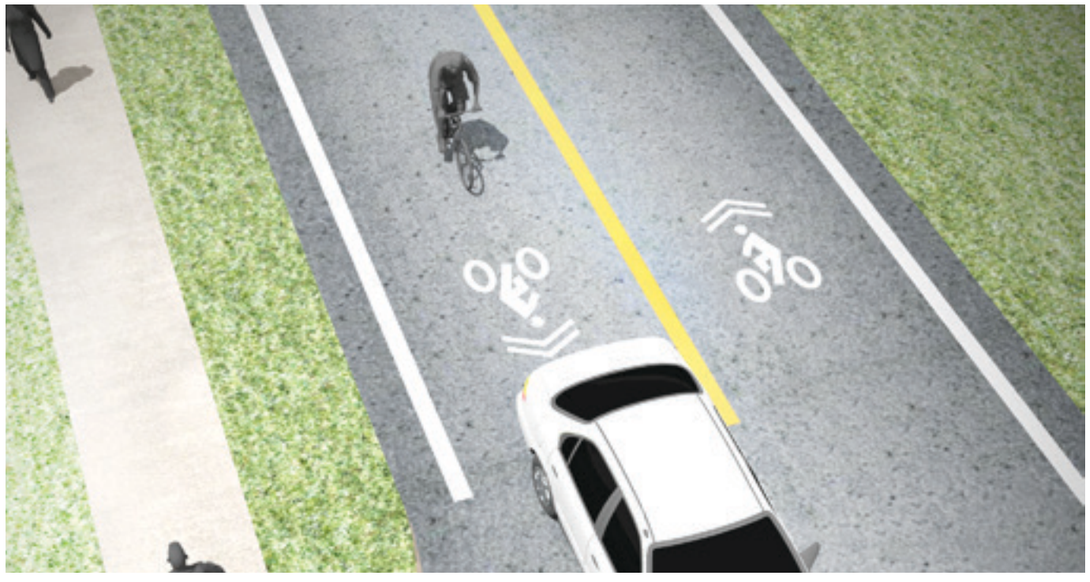
- Sharrows and signage clearly identify cycling routes, providing a wayfinding element for cyclists and indicating to drivers that they should expect to share the lane with non-motorized users
- Sharrows encourage cyclists to ride in the safest location (i.e., outside of the "door zone") and discourage drivers from undertaking unsafe passing maneuvers

Indications:

- Streets with modest speed discrepancies between cyclists and other vehicles (e.g., low-volume streets with traffic calming and a speed limit below 25 mph)
- Streets where roadway geometry precludes the implementation of a bicycle lane
- Travel lanes cyclists use to transition between dedicated infrastructure

Right-of-Way Impact: LOW

Implementation Complexity: LOW



BICYCLE LANES

ON-STREET RIGHTS-OF-WAY FOR CYCLING, SOMETIMES BUFFERED BY ADDITIONAL PAVEMENT MARKINGS; TYPICALLY ONE-WAY

Applications and Considerations:

- Bicycle lanes separate cyclists and automobiles, increasing the comfort and safety of cyclists
- Buffered bicycle lanes may be used to increase the shy distance between cyclists and automobiles, to provide opportunities for cyclists to pass one another without entering a lane dedicated to motor vehicle traffic, and to encourage "interested but concerned" cyclists

Indications:

- Streets with annual average daily traffic exceeding 3,000 vehicles
- Streets with a speed limit greater than 25 mph
- Streets with on-street parking that experiences high turnover
- Streets with considerable truck traffic

Right-of-Way Impact: MEDIUM

Implementation Complexity: MEDIUM

CYCLE-TRACKS

ON-STREET RIGHTS-OF-WAY FOR CYCLING, PHYSICALLY SEPARATED FROM AUTOMOBILE TRAFFIC; ONE- OR TWO-WAY

Applications and Considerations:

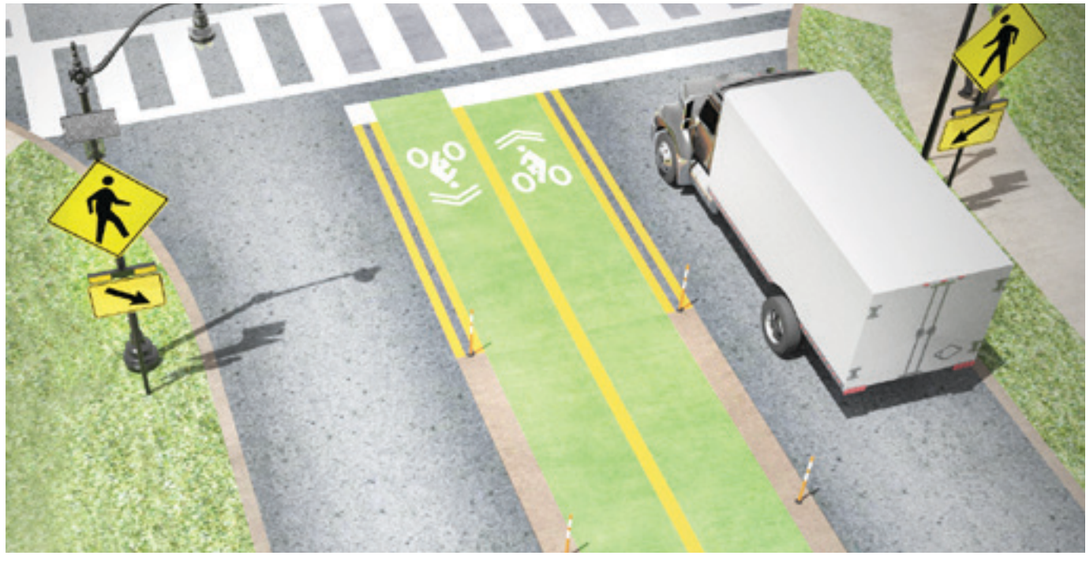
- Cycle-tracks provide the most protection for users of any on-street infrastructure
- Physical barriers prevent drivers from parking in a manner that obstructs cycling
- Utilizing the existing right-of-way, cycle-tracks offer a cycling experience similar to a multi-use path for a fraction of the cost

Indications:

- Streets with annual average daily traffic exceeding 3,000 vehicles
- Streets with a speed limit greater than 25 mph
- Streets with on-street parking that experiences high turnover and/or frequent double parking
- Streets with multiple lanes in each direction

Right-of-Way Impact: MEDIUM

Implementation Complexity: HIGH



BICYCLE BOULEVARDS

NETWORK OF NEIGHBORHOOD STREETS OPTIMIZED FOR CYCLING THROUGH INFRASTRUCTURE AND SIGNAGE

Applications and Considerations:

- Bicycle boulevards leverage traffic calming and signage to foster a safe and comfortable environment for cycling
- Cost-effective means of expanding a cycling network
- Bicycle boulevards should complement alternative routes with separated cycling infrastructure (i.e., bicycle lanes and cycle-tracks)

Indications:

- Streets with annual average daily traffic (AADT) below 3,000 vehicles (ideally below 1,500 vehicles)
- Streets with a speed limit below 25 mph
- Contexts where traffic calming measures benefit pedestrians (e.g., residential areas)

Right-of-Way Impact: LOW/MEDIUM

Implementation Complexity: MEDIUM

Photo: Example of a bicycle boulevard in Berkeley, CA. CC BY-NC-ND 2.0 by Carrie Cizauskas on Flickr.

MULTI-USE PATHS

OFF-STREET RIGHTS-OF-WAY DEDICATED TO CYCLING AND WALKING

Applications and Considerations:

- Multi-use paths provide cyclists and pedestrians opportunities for travel and recreation with few or no interactions with automobiles

Indications:

- Alignments without an existing roadway
- Alignments where the existing roadway cannot safety accommodate cycling
- Locations where active recreation is desirable

Right-of-Way Impact: HIGH

Implementation Complexity: HIGH

SIDEWALKS

PAVED RIGHTS-OF-WAY FOR PEDESTRIAN TRAVEL, ADJACENT TO, BUT SEPARATED FROM STREET

Applications and Considerations:

- Sidewalks provide a level surface on which pedestrians of all abilities can safely and comfortably travel
- Sidewalks should be scaled in accordance with the areas they are serving; e.g., sidewalks adjacent to vehicular traffic should incorporate a buffer of at least two feet
- Lighting and/or shade may be critical to creating an environment that makes pedestrians feel safe and comfortable

Indications:

- All urban and suburban streets, particularly those connecting residents to points of interest including schools, shopping centers, civic buildings, hospitals, and transit stops

Right-of-Way Impact: MEDIUM

Implementation Complexity: MEDIUM

CROSSWALKS

STRIPING AND SIGNAGE DEMARCATING PEDESTRIAN CROSSING LOCATIONS

Applications and Considerations:

- Crosswalks ensure that pedestrians know the safest location for crossing and drivers to expect their presence
- Pedestrians are generally willing to spend up to three minutes to navigate a crossing (i.e., walk to a crosswalk, wait for a signal, and cross); crosswalk spacing and signal timing should reflect this and promote safety by discouraging unsignalized crossings[6]
- Midblock crossings may be implemented in cases where intersections are not aligned with pedestrian destinations

Indications:

- Streets with annual average daily traffic exceeding 3,000 vehicles or streets with more than two lanes
- Intersections near points of interest including schools, shopping centers, civic buildings, hospitals, and transit stops

Right-of-Way Impact: N/A

Implementation Complexity: LOW

6. Urban Street Design Guide. National Association of City Transportation Officials, 2013.

CROSSING SIGNALS

SIGNALS THAT EITHER INDICATE TO PEDESTRIANS THAT IT IS SAFE TO CROSS OR ALERT DRIVERS TO PEDESTRIAN PRESENCE; CAN BE IMPLEMENTED AS TIMED SIGNALS OR WARNING BEACONS ACTIVATED BY THE USER ON DEMAND

Applications and Considerations:

- Crossing signals ensure that pedestrians know the safest time to cross the street; leading pedestrian intervals may further increase visibility
- Active warning beacons alert drivers to crossing pedestrians at locations otherwise devoid of traffic control devices

Indications, Crossing Signals:

- Streets with annual average daily traffic exceeding 3,000 vehicles or more than two lanes
- Intersections near points of interest including schools, shopping centers, civic buildings, hospitals, and transit stops

Indications, Active Warning Beacons:

- Unsignalized crossings of streets with annual average daily traffic in excess of 3,000 vehicles
- Unsignalized crossings utilized infrequently
- Midblock crossings

Right-of-Way Impact: N/A

Implementation Complexity: HIGH

CURB EXTENSIONS

CURBS AND ISLANDS TO NARROW THE ROADWAY, SHORTENING CROSSING DISTANCES AND CALMING TRAFFIC

Applications and Considerations:

- Curb extensions slow traffic by narrowing the roadway and decreasing vehicular turning radii
- Curb extensions can be deployed at bus stops to allow buses to pick up or drop off passengers without exiting the flow of traffic
- Pedestrian islands reduce pedestrian exposure to vehicular traffic on longer crossings

Indications:

- Streets with on-street parking
- Crossings of three or more travel lanes

Right-of-Way Impact: MEDIUM

Implementation Complexity: MEDIUM

4.2. Recommendations Summary

Table 6 summarizes improvements recommended for the 18 active transportation gaps depicted in **Figure 13** on the following page.

While the 18 active transportation gaps shown here were previously identified as posing significant obstacles to pedestrians and cyclists, it is understood that all 18 gaps cannot be improved at once. If the gaps are incrementally improved in accordance with their priorities in Chapter 5, these improvements over time will establish a network of interconnected active transportation routes.

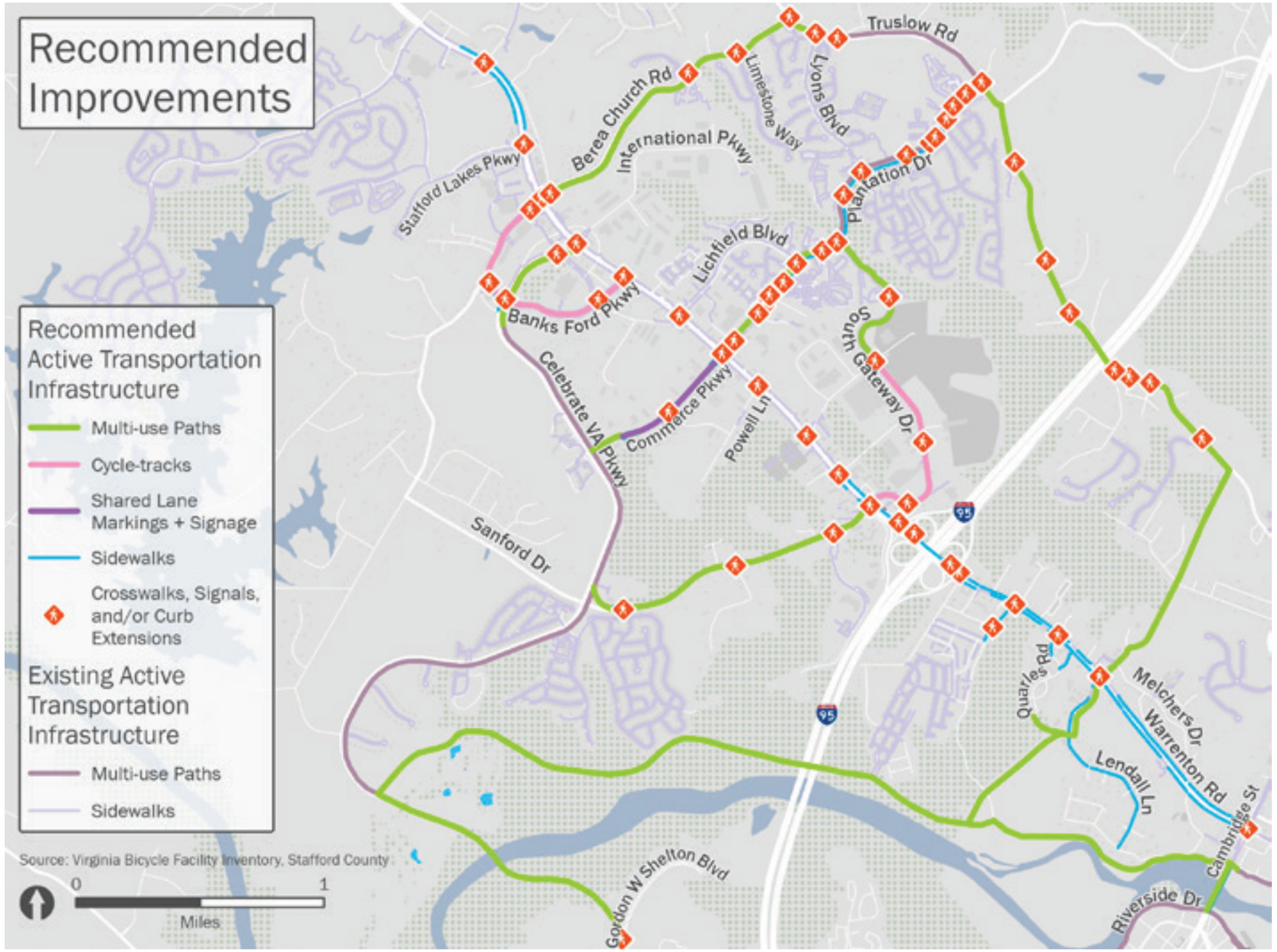
This recommendations summary is followed by a detailed walk-through of gap-specific multi-modal recommendations. Detailed walk-throughs may contain multiple recommendations addressing the same obstacle in a given gap; this ensures that near-term option(s) for mitigating these gaps exist in cases where the implementation complexity of the most comprehensive improvement(s) is too high.

A prioritization methodology and cost comparison follows the detailed walk-throughs and is intended to provide more information on the differences between low and high implementation complexity recommendations.

Table 6: Multi-Modal Recommendations for Each Gap

Gap	Corridor	Description	Recommended Improvement(s)
1	Route 17	Stafford Lakes Parkway to South Gateway Drive/Sanford Drive	Sidewalks, crosswalks, and crossing signals
2	Route 17	Interstate 95 Interchange	Sidewalks, crosswalks, and crossing signals
3	Route 17	Short Street to Cambridge Street	Sidewalks, crosswalks, and crossing signals
4	Plantation Drive	Route 17 to Truslow Road	Sidewalks, crosswalks, and a multi-use path
5	South Gateway Drive	Route 17 to Plantation Drive	Crosswalks, cycle-track, and a multi-use path
6	Truslow Road	Plantation Drive to Solomon Drive Extension	Crosswalks and a multi-use path
7	Solomon Drive Extension	Route 17 to Truslow Road	Multi-use path
8	Lendall Lane	Route 17 to Rappahannock River Trail	Sidewalks or a multi-use path along parallel right-of-way
9	Rappahannock River Trail	Cambridge Street to Celebrate Virginia Parkway Extension	Multi-use path and vertical circulation (e.g. stairs or ramp)
10	Celebrate Virginia Parkway Extension	New river crossing connecting Southern Gateway to Gordon W. Shelton Boulevard	Multi-use path and vertical circulation
11	Celebrate Virginia Parkway	Sanford Drive Intersection	Multi-use path
12	Sanford Drive	Celebrate Virginia Parkway to Route 17	Sidewalks, traffic calming, shared lane markings and signage, and a multi-use path
13	Connection Near Commerce Parkway	Celebrate Virginia Parkway to Route 17	Sidewalks, shared lane markings and signage, and a multi-use path
14	Celebrate Virginia Parkway and Banks Ford Parkway	Jewett Lane to Route 17	Crosswalks, crossing signals, curb extensions, sidewalk, a multi-use path, and a cycle-track
15	Olde Forge Drive	Bellows Avenue to Route 17	Sidewalks and crosswalks
16	Quarles Road	Petroleum Lane to Route 17	Sidewalks, crosswalks, and a multi-use path
17	Cambridge Street	Route 17 to Hanson Avenue	Sidewalks, multi-use path, and vertical circulation
18	Berea Church Road	Route 17 to Truslow Road	Multi-use path

Figure 13: Map of Existing and Recommended Active Transportation Infrastructure



4.3. Recommendations Walk-Through

On the following pages, each corridor gap from **Table 6** is listed on its own page, and the following elements are provided for each gap:

1. **Extents:** The gap's start and end points.
2. **Recommended Improvements:** A list of recommended improvements for the gap sorted from low to high implementation complexity. Sometimes more than one improvement is listed, in which case it is possible to start with a low-complexity recommendation, proceeding to more complex recommendations as resources permit.
3. **Illustrated Diagram of Typical Improvements:** An annotated illustration of a typical portion of the gap, showing some or all of the recommendations in the list. Illustrated recommendations are conceptual and should not be interpreted as final designs.
4. **Illustrated View of Typical Improvements:** A closer perspective view of a typical portion of the gap, showing some or all of the recommendations in the list. Illustrated recommendations are conceptual and should not be interpreted as final designs.
5. **Map of Gap Location:** A thumbnail map of the corridor gap within the context of other nearby gaps. All thumbnail maps are oriented north.

GAP #1: ROUTE 17

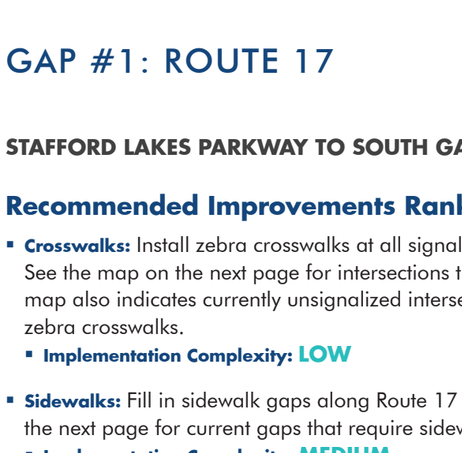
STAFFORD LAKES PARKWAY TO SOUTH GATEWAY DRIVE/SANFORD DRIVE

Recommended Improvements Ranked by Implementation Complexity:

- **Crosswalks:** Install zebra crosswalks at all signalized and high-traffic intersections along Route 17. See the map on the next page for intersections that require new or additional zebra crosswalks. The map also indicates currently unsignalized intersections that could benefit from crossing signals and zebra crosswalks.
  - **Implementation Complexity: LOW**
- **Sidewalks:** Fill in sidewalk gaps along Route 17 to complete the sidewalk network. See the map on the next page for current gaps that require sidewalks.
  - **Implementation Complexity: MEDIUM**
- **Crossing Signals:** Install crossing signals at the locations identified in **Figure 14** to increase the number of locations where pedestrians can cross Route 17.
  - **Implementation Complexity: HIGH**

Current/Upcoming Construction:

None.



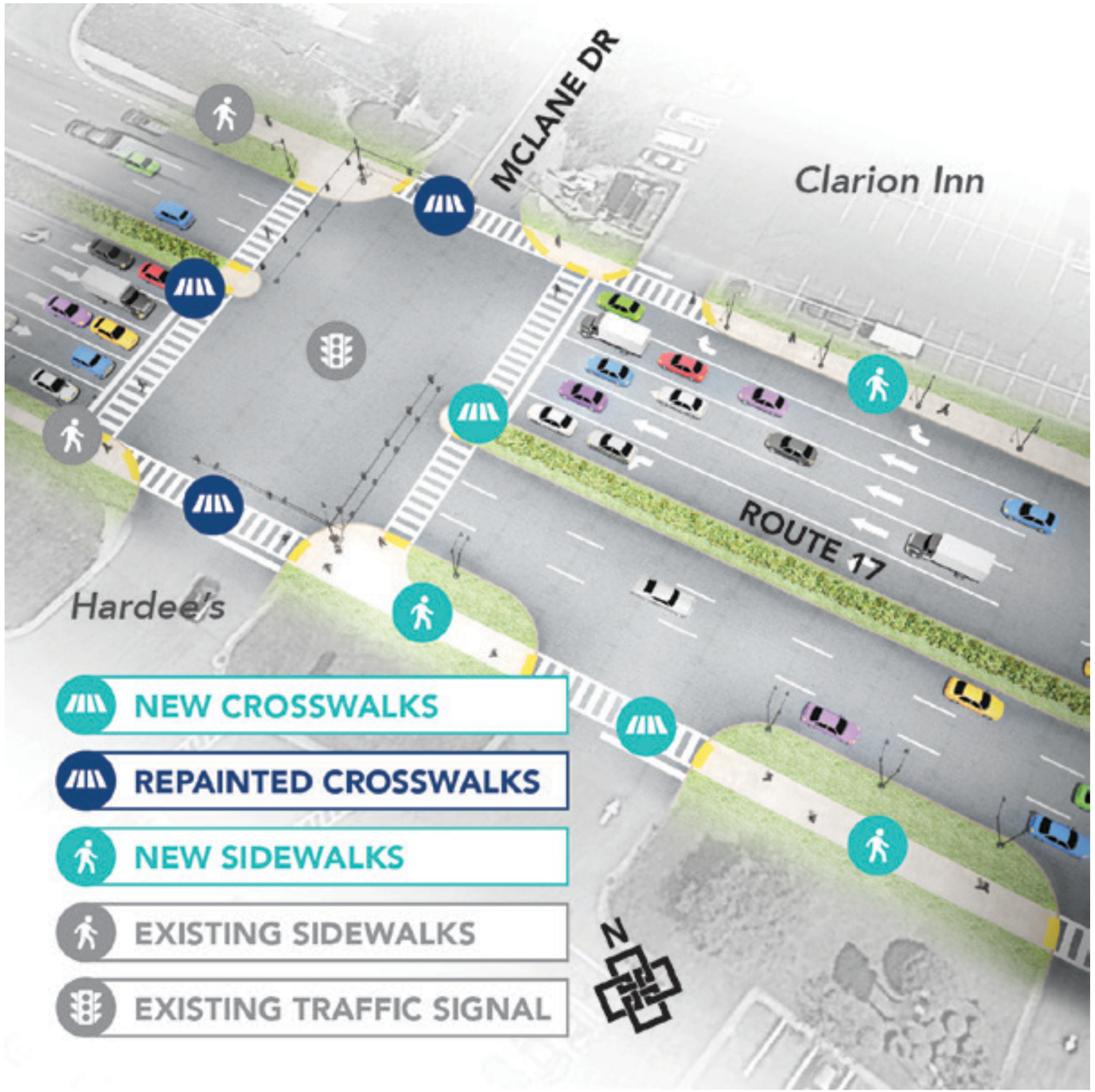
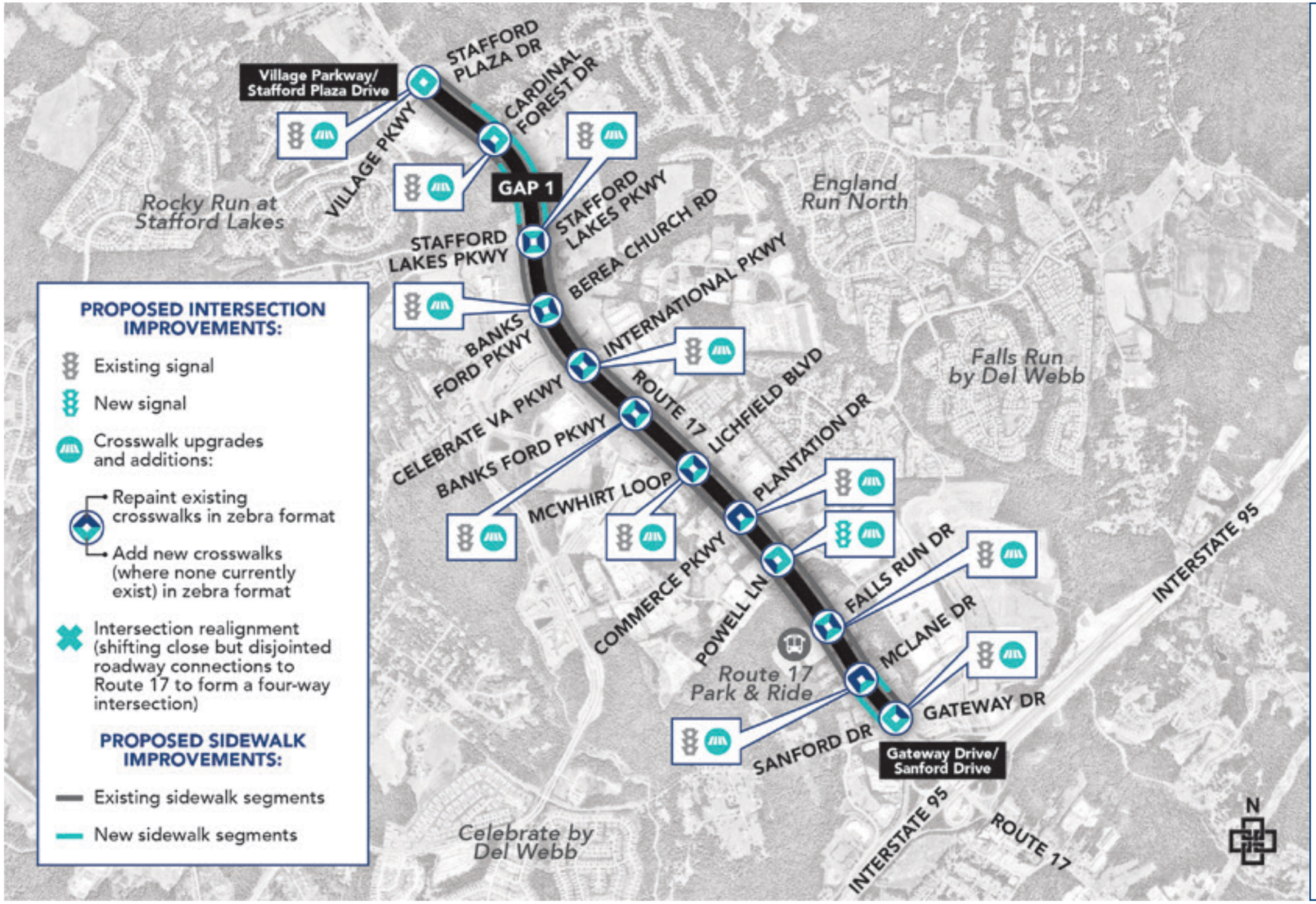


Figure 14: Map of Crosswalk, Sidewalk, and Signalized Intersection Needs Along Gap 1



LIST OF ROUTE 17 INTERSECTIONS WITH PROPOSED IMPROVEMENTS WITHIN GAP 1, EAST TO WEST:

1. SANFORD DRIVE/GATEWAY DRIVE
2. MCLANE DRIVE
3. FALLS RUN DRIVE (ROUTE 17 PARK AND RIDE)
4. POWELL LANE
5. COMMERCE PARKWAY/PLANTATION DRIVE
6. MCWHIRT LOOP/LICHFIELD BOULEVARD
7. BANKS FORD PARKWAY
8. CELEBRATE VIRGINIA PARKWAY/ INTERNATIONAL PARKWAY
9. BANKS FORD PARKWAY/BEREA CHURCH ROAD
10. STAFFORD LAKES PARKWAY
11. CARDINAL FOREST DRIVE
12. VILLAGE PARKWAY/STAFFORD PLAZA DRIVE

GAP #2: ROUTE 17

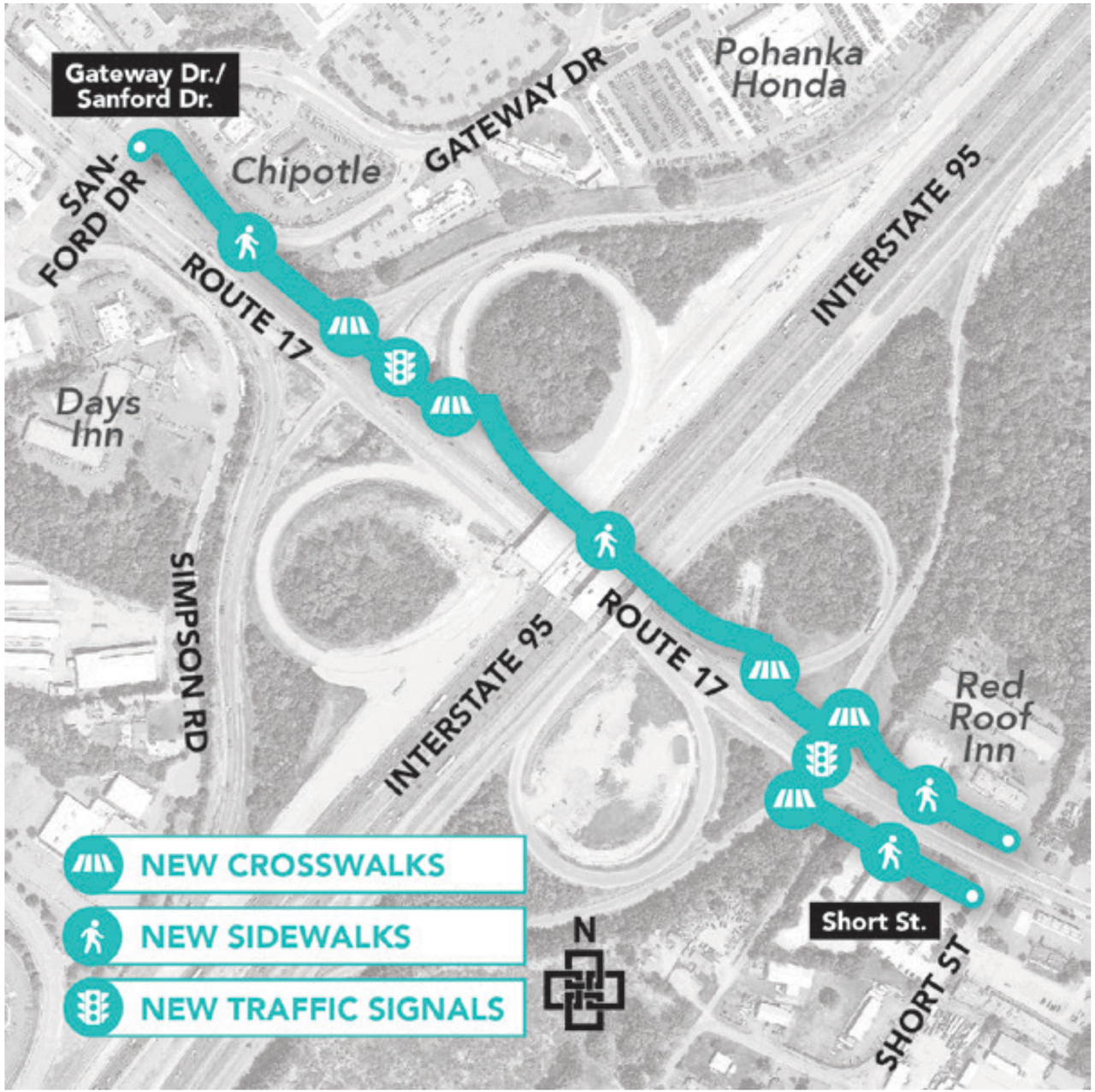
INTERSTATE 95 INTERCHANGE

Recommended Improvements Ranked by Implementation Complexity:

- **Crosswalks:** Provide zebra crosswalks in locations where sidewalks need to cross the onramps and offramps between Route 17 and Interstate 95. Consider automatic pedestrian beacons to increase visibility of people at crosswalks.
  - **Implementation Complexity: LOW**
- **Sidewalks:** Fill in sidewalk gaps along the Route 17/Interstate 95 interchange to complete the sidewalk network.
  - **Implementation Complexity: MEDIUM**
- **Crossing Signals:** Install crossing signals at the locations identified at right to increase the number of locations where pedestrians can cross Route 17.
  - **Implementation Complexity: HIGH**

Current/Upcoming Construction:

As shown at right, VDOT has already begun the process of building new crosswalks and a sidewalk through this segment of Route 17. The sidewalk will run along the north side of Route 17.



GAP #3: ROUTE 17

SHORT STREET TO CAMBRIDGE STREET

Recommended Improvements Ranked by Implementation Complexity:

- **Crosswalks:** Install zebra crosswalks at all signalized and high-traffic intersections along Route 17. See the map on the next page for intersections that require new or additional zebra crosswalks. The map also indicates currently unsignalized intersections that could benefit from crossing signals and zebra crosswalks.
  - **Implementation Complexity: LOW**
- **Sidewalks:** Fill in sidewalk gaps along Route 17 to complete the sidewalk network. See the map on the next page for current gaps that require sidewalks.
  - **Implementation Complexity: MEDIUM**
- **Crossing Signals:** Install crossing signals at the locations identified in **Figure 15** to increase the number of locations where pedestrians can cross Route 17.
  - **Implementation Complexity: HIGH**

Current/Upcoming Construction:

None.

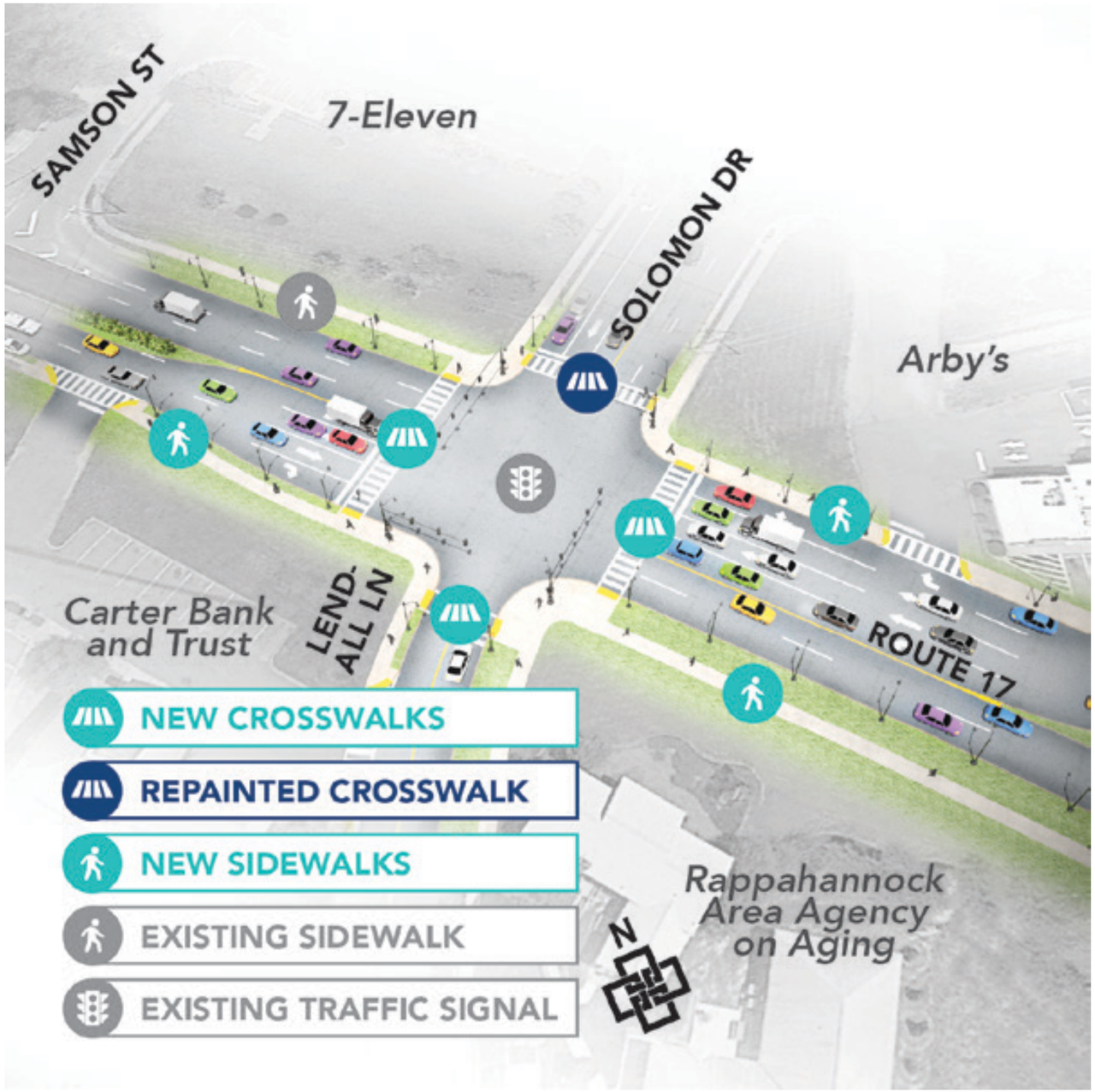
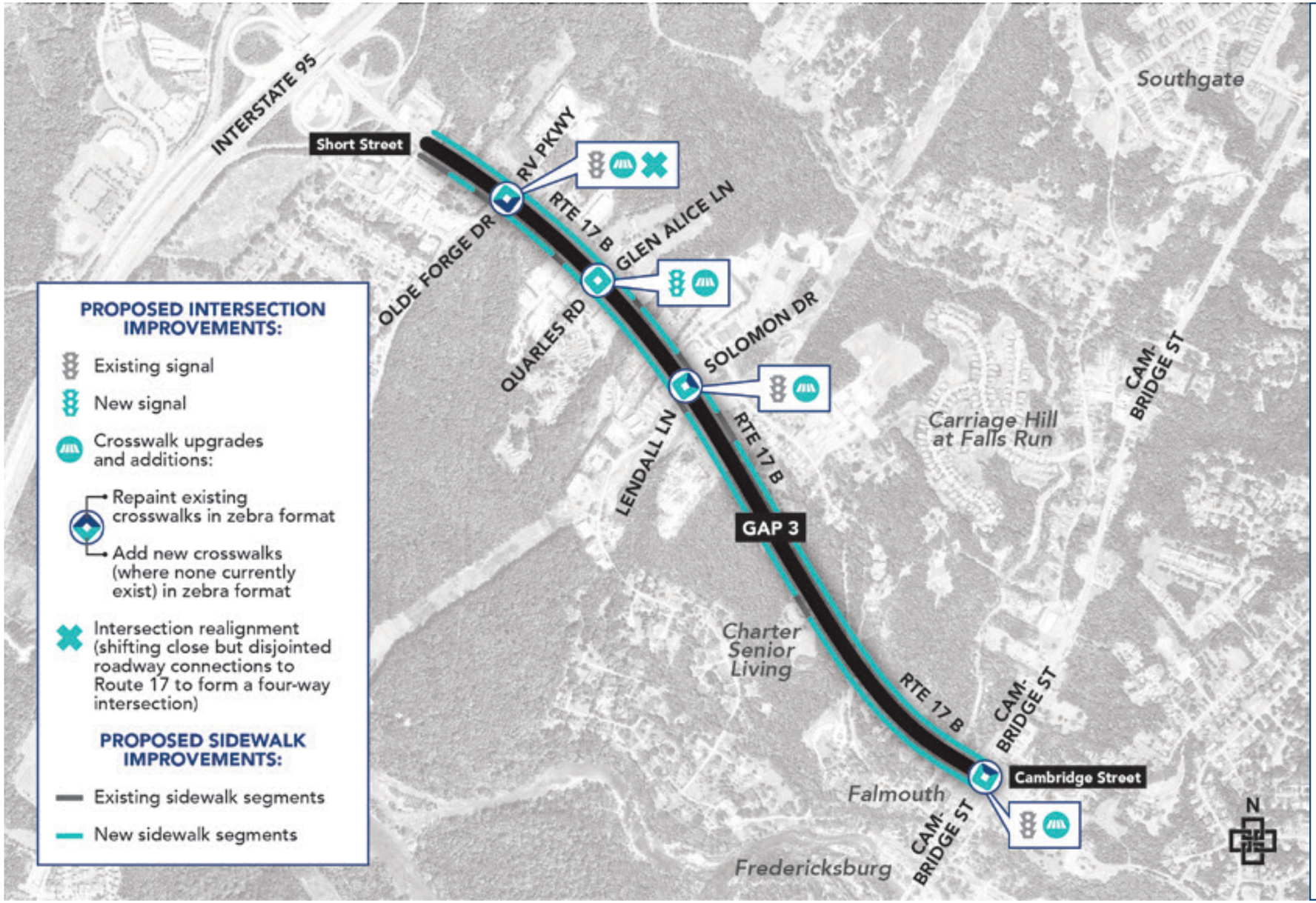


Figure 15: Map of Crosswalk, Sidewalk, and Signalized Intersection Needs Along Gap 3



LIST OF ROUTE 17 INTERSECTIONS WITH PROPOSED IMPROVEMENTS WITHIN GAP 3, EAST TO WEST:

1. CAMBRIDGE STREET
2. LENDALL LANE/SOLOMON DRIVE
3. QUARLES ROAD/GLEN ALICE LANE
4. OLDE FORGE DRIVE/RV PARKWAY

GAP #4: PLANTATION DRIVE

ROUTE 17 TO TRUSLOW ROAD

Recommended Improvements Ranked by Implementation Complexity:

- **Crosswalks:** Install zebra crosswalks at all intersections along roadway; add zebra crosswalks to facilitate safe crossing to adjacent paths.
  - **Implementation Complexity: LOW**
- **Sidewalk:** Install sidewalk along the roadway; connect this sidewalk to the existing sidewalk networks of adjacent apartment complexes.
  - **Implementation Complexity: MEDIUM**
- **Multi-Use Path:** Extend the multi-use path along the western side of the roadway to Route 17.
  - **Implementation Complexity: HIGH**

Current/Upcoming Construction:

None.

GAP #5: SOUTH GATEWAY DRIVE

ROUTE 17 TO PLANTATION DRIVE

Recommended Improvements Ranked by Implementation Complexity:

- **Crosswalks:** Install zebra crosswalks at all intersections along the roadway, as well as across South Gateway Drive near the Sullivan Auto Trading Shop, where the existing sidewalk network terminates, to facilitate safe crossings.
  - **Implementation Complexity: LOW**
- **Multi-Use Path:** Install a multi-use path beginning north of Falls Run Drive and extending to Plantation Drive.
  - **Implementation Complexity: HIGH**
- **Cycle-Track:** Convert the existing median/turning lane between Stanstead Road and Falls Run Drive into a cycle-track.
  - **Implementation Complexity: HIGH**

Current/Upcoming Construction:

None.

GAP #6: TRUSLOW ROAD

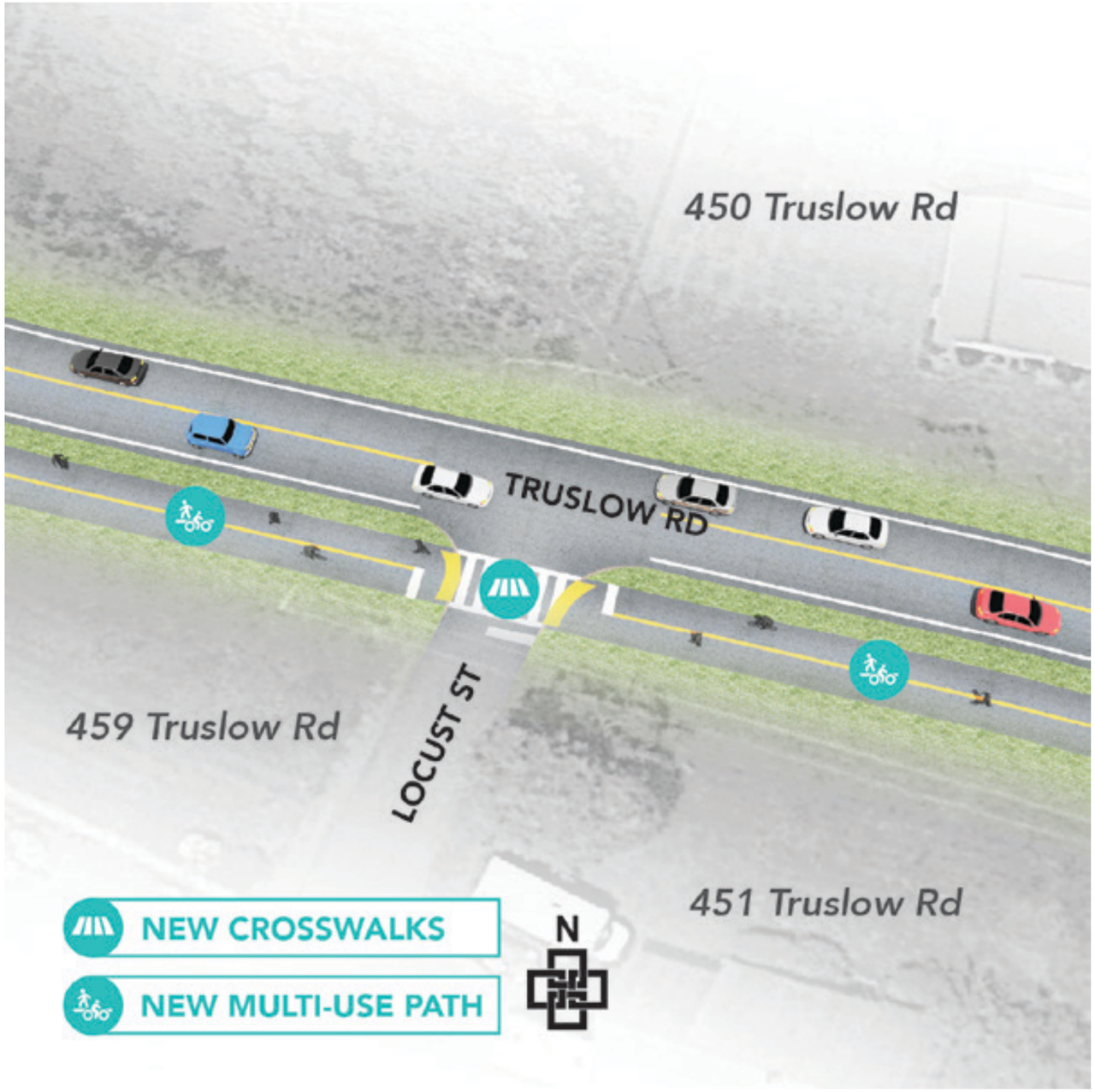
PLANTATION DRIVE TO SOLOMON DRIVE EXTENSION

Recommended Improvements Ranked by Implementation Complexity:

- **Crosswalks:** Install zebra crosswalks at all points where the proposed multi-use path crosses a roadway to facilitate safe crossings.
  - **Implementation Complexity: LOW**
- **Multi-Use Path:** Install a multi-use path connecting the existing multi-use path along Plantation Drive (Gap #4) with the proposed multi-use path along the utility easement north of Solomon Drive (Gap #7).
  - **Implementation Complexity: HIGH**

Current/Upcoming Construction:

The overpass over Interstate 95 was recently rebuilt with shoulders on both sides of Truslow Road, which could connect a multi-use path on either side.



GAP #7: SOLOMON DRIVE EXTENSION (UTILITY EASEMENT)

ROUTE 17 TO TRUSLOW ROAD

Recommended Improvements Ranked by Implementation Complexity:

- **Multi-Use Path:** Install a multi-use path along the utility easement north of Solomon Drive to provide a pedestrian and cycling connection between Truslow Road (Gap #6) and Lendall Lane (Gap #8). The multi-use path may require circuitous graded routing in some locations due to the utility easement's hilly topography.
  - **Implementation Complexity:** HIGH

Current/Upcoming Construction:

None.

GAP #8: LENDALL LANE

ROUTE 17 TO RAPPAHANNOCK RIVER TRAIL

Recommended Improvements Ranked by Implementation Complexity:

- **Sidewalks:** Install sidewalks along Lendall Lane between Route 17 and the Rappahannock River Trail to facilitate safe connections and a complete sidewalk network.
  - **Implementation Complexity: MEDIUM**
- **Multi-Use Path:** Install a multi-use path to extend the Solomon Drive Extension (Utility Easement) multi-use path (Gap #7) south to the Rappahannock River Trail and/or to Cambridge Street (Falmouth Bridge) to facilitate a connection to the Belmont-Ferry Farm Trail.
  - **Implementation Complexity: HIGH**

Current/Upcoming Construction:

None.

GAP #9: RAPPAHANNOCK RIVER TRAIL

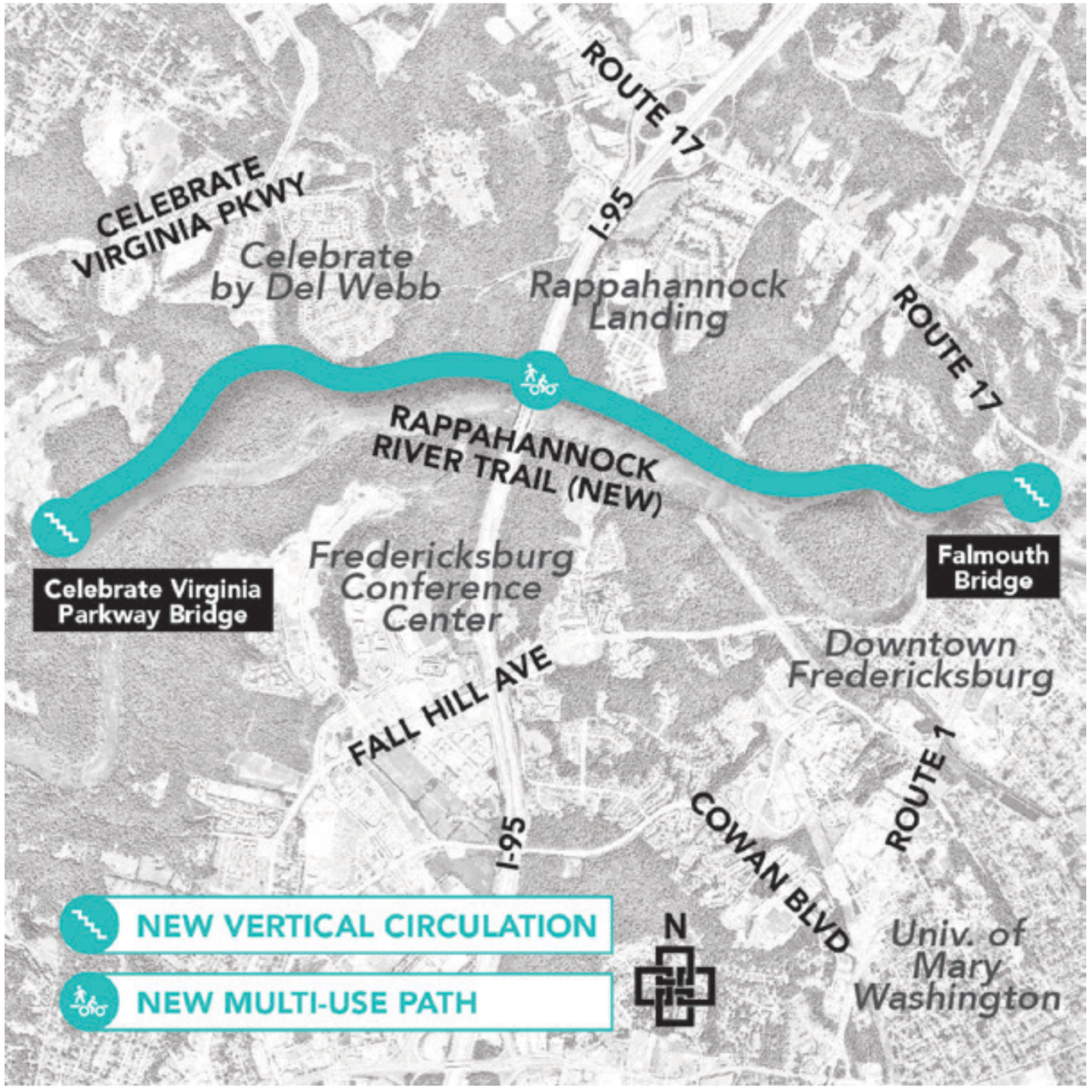
CAMBRIDGE STREET TO CELEBRATE VIRGINIA PARKWAY EXTENSION

Recommended Improvements Ranked by Implementation Complexity:

- MULTI-USE PATH: Add a multi-use path along the north side of the Rappahannock River between the Celebrate Virginia Parkway Extension (Gap #10) and the Belmont-Ferry Farm Trail along Cambridge/King Streets (Gap #17).
  - **Implementation Complexity: HIGH**
- VERTICAL CIRCULATION: Install a cycling/pedestrian staircase to facilitate a connection between the Belmont-Ferry Farm Trail and the future Falmouth Bridge replacement (Gap #17).
  - **Implementation Complexity: HIGH**

Current/Upcoming Construction:

None.



GAP #10: CELEBRATE VIRGINIA PARKWAY EXTENSION

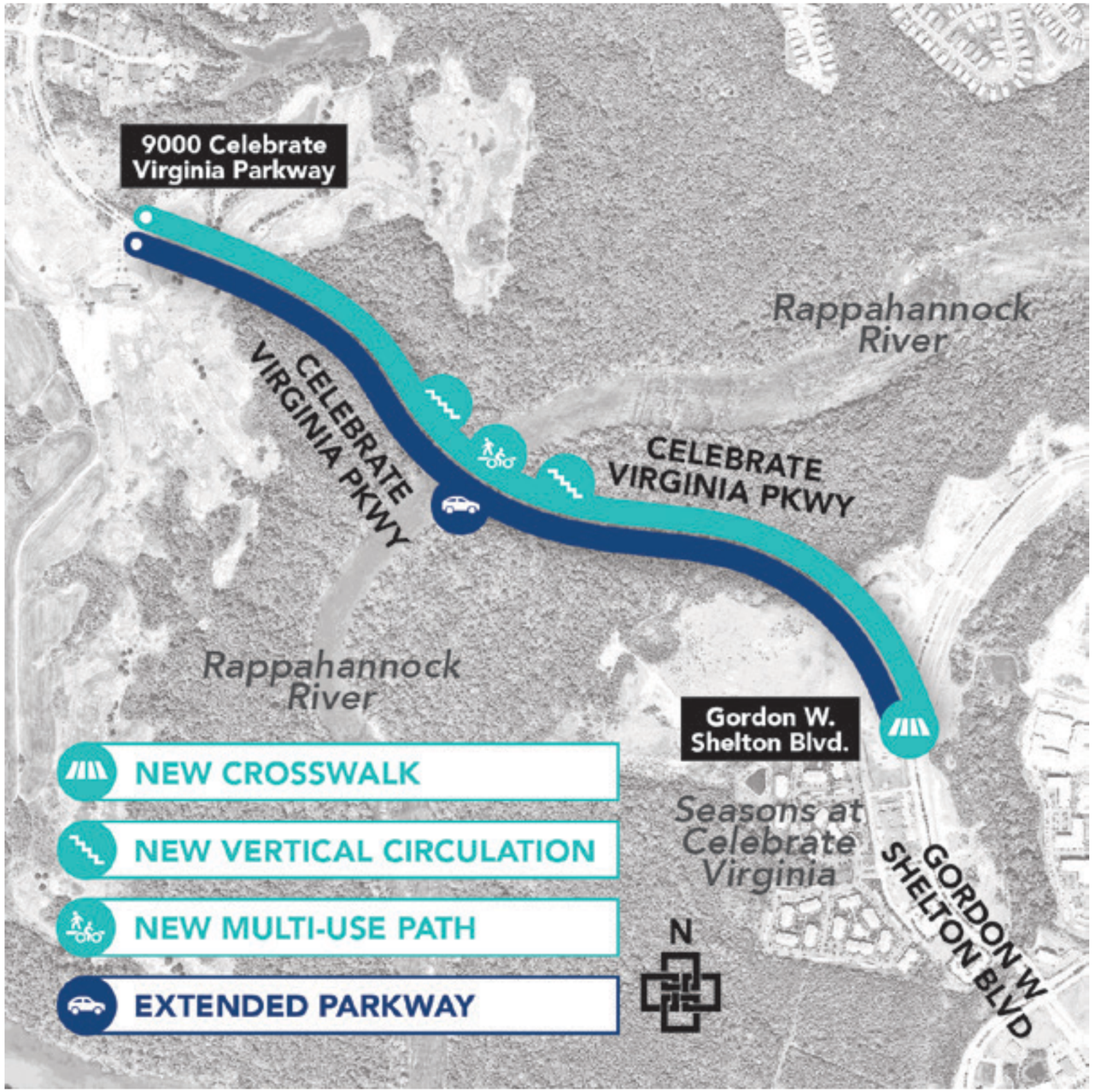
9000 CELEBRATE VIRGINIA PARKWAY TO GORDON W. SHELTON BOULEVARD

Recommended Improvements Ranked by Implementation Complexity:

- **Crosswalk:** Install a zebra crosswalk at the intersection of the proposed multi-use path and Gordon W. Shelton Boulevard.
  - **Implementation Complexity: LOW**
- **Multi-Use Path:** Install a multi-use path to facilitate a connection across the Rappahannock River to the Fall Hill Avenue Trail along Gordon W. Shelton Boulevard. Incorporate the multi-use path as part of the extended roadway/bridge as it crosses the Rappahannock River.
  - **Implementation Complexity: HIGH**
- **Vertical Circulation:** Install cycling/pedestrian staircases to facilitate a connection between the Celebrate Virginia Trail extension down to the proposed (Gap #9) and existing Rappahannock River Trails on both sides of the river.
  - **Implementation Complexity: HIGH**

Current/Upcoming Construction:

None.



GAP #11: CELEBRATE VIRGINIA PARKWAY

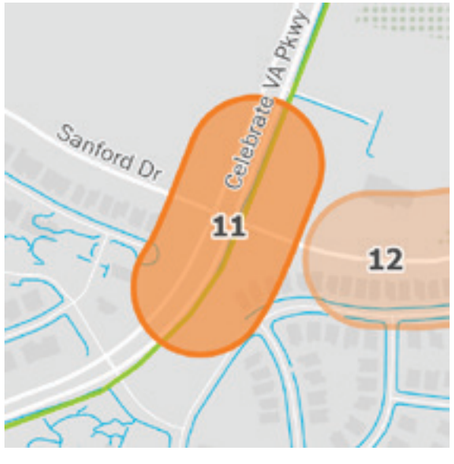
SANFORD DRIVE UNDERPASS CONNECTION

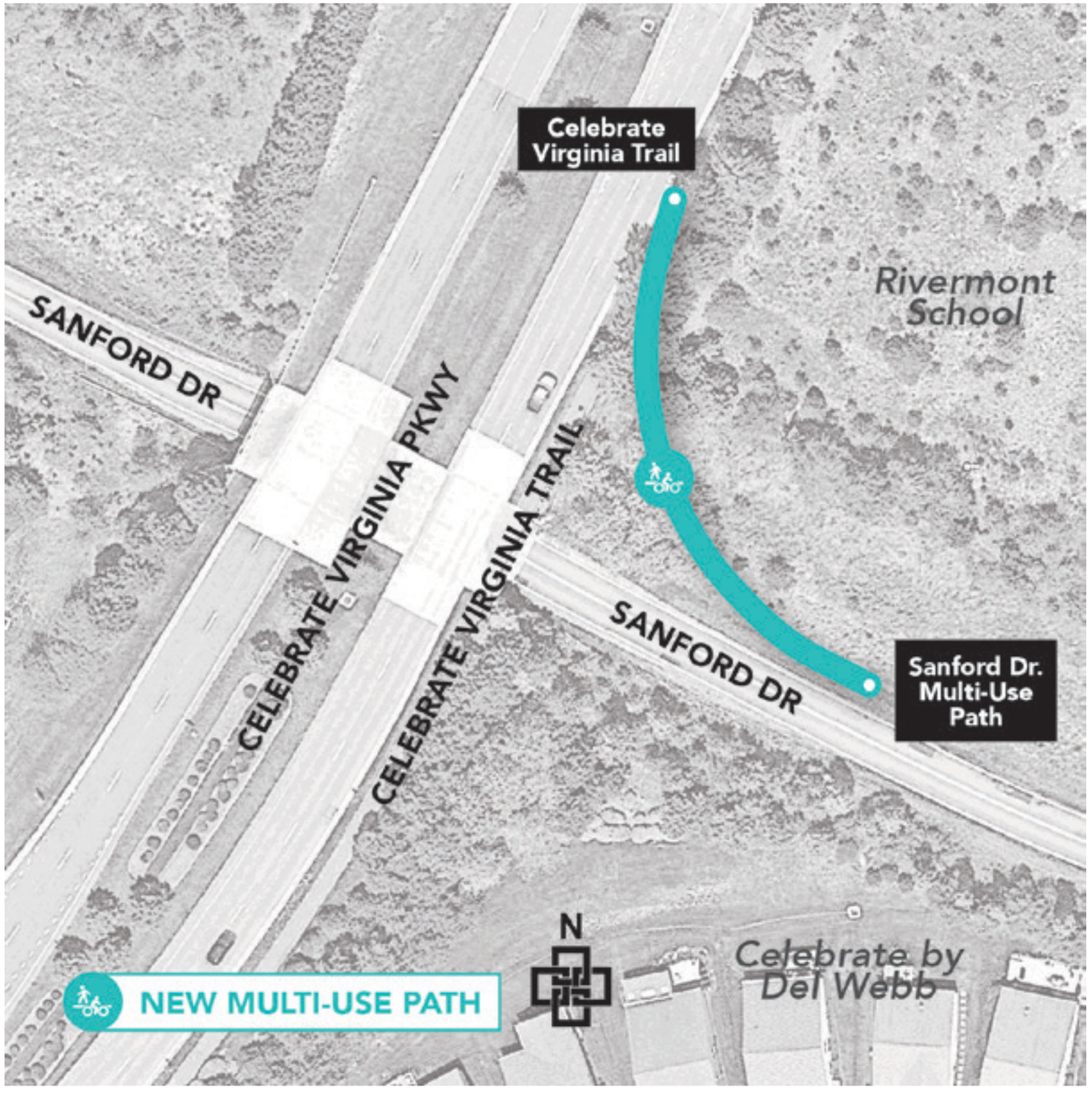
Recommended Improvements Ranked by Implementation Complexity:

- **Multi-Use Path:** Install a graded, curved, multi-use path "ramp" to facilitate a connection between the Celebrate Virginia Trail and Sanford Drive, which passes under the Celebrate Virginia Trail.
  - **Implementation Complexity:** HIGH

Current/Upcoming Construction:

None.





GAP #12: SANFORD DRIVE

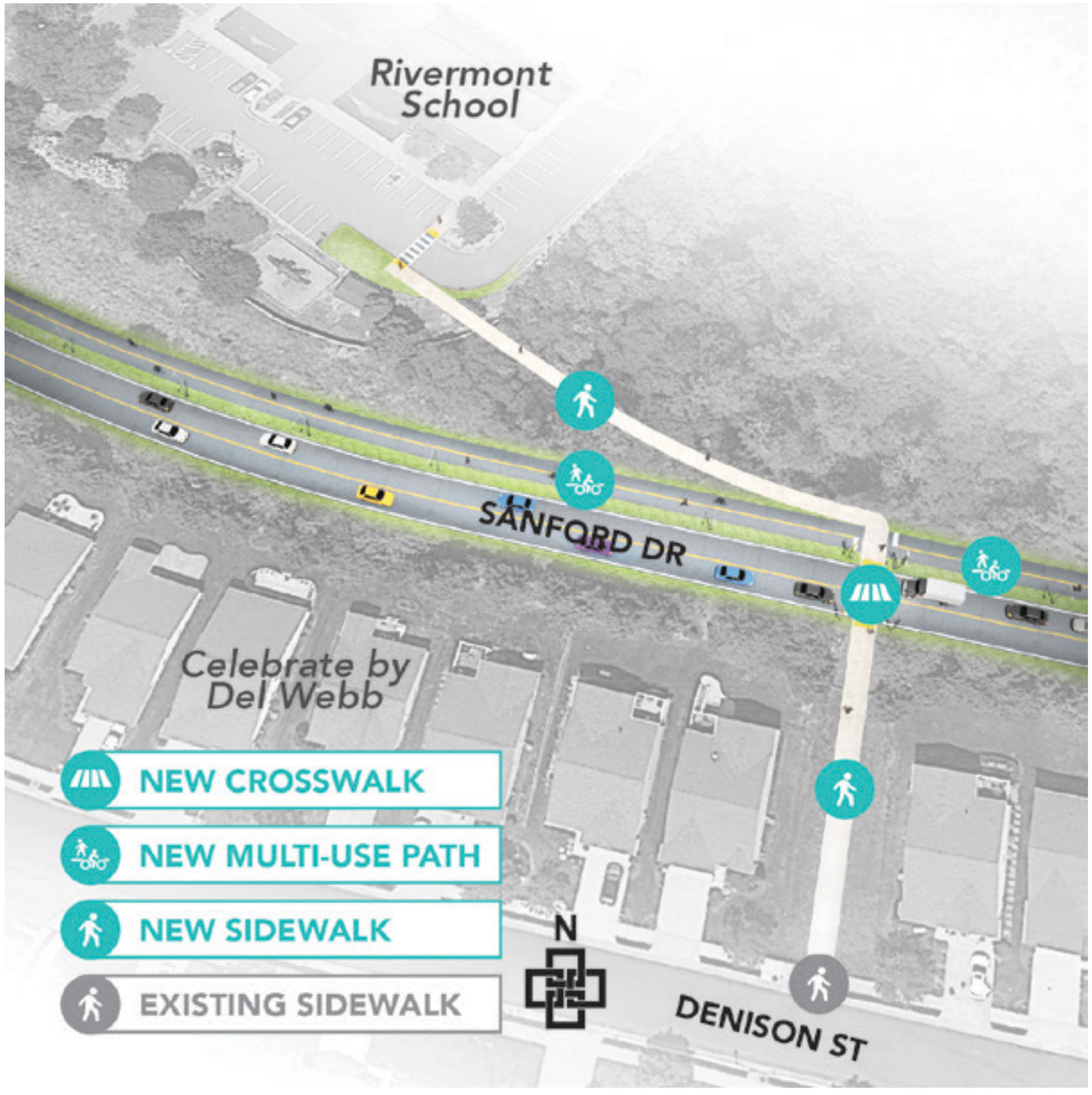
CELEBRATE VIRGINIA PARKWAY TO ROUTE 17

Recommended Improvements Ranked by Implementation Complexity:

- **Shared Lane Markings + Signage:** Add shared bicycle lane markings and signage ("sharrows") along roadway.
  - **Implementation Complexity: LOW**
- **Crosswalk:** Install a zebra crosswalk across Sanford Drive to connect the Celebrate by Del Webb development with the multi-use path and Rivermont School.
  - **Implementation Complexity: LOW**
- **Sidewalks:** Install sidewalks to connect the development adjacent to Rivermont School to Denison Street using the development's existing emergency access drive.
  - **Implementation Complexity: MEDIUM**
- **Traffic Calming:** Apply traffic calming along Sanford Drive, particularly along segments lacking a multi-use path. Traffic calming could include (but is not limited to) lane narrowing, raised crosswalks, pedestrian refuges at crosswalks, chicanes, and speed humps.
  - **Implementation Complexity: MEDIUM to HIGH** (varies depending on the number/type of traffic calming methods proposed)
- **Multi-Use Path:** Install a multi-use path along Sanford Drive between the Sanford Drive underpass connection to Celebrate Virginia Parkway (Gap #11) and Route 17.
  - **Implementation Complexity: HIGH**

Current/Upcoming Construction:

None.



GAP #13: COMMERCE PARKWAY

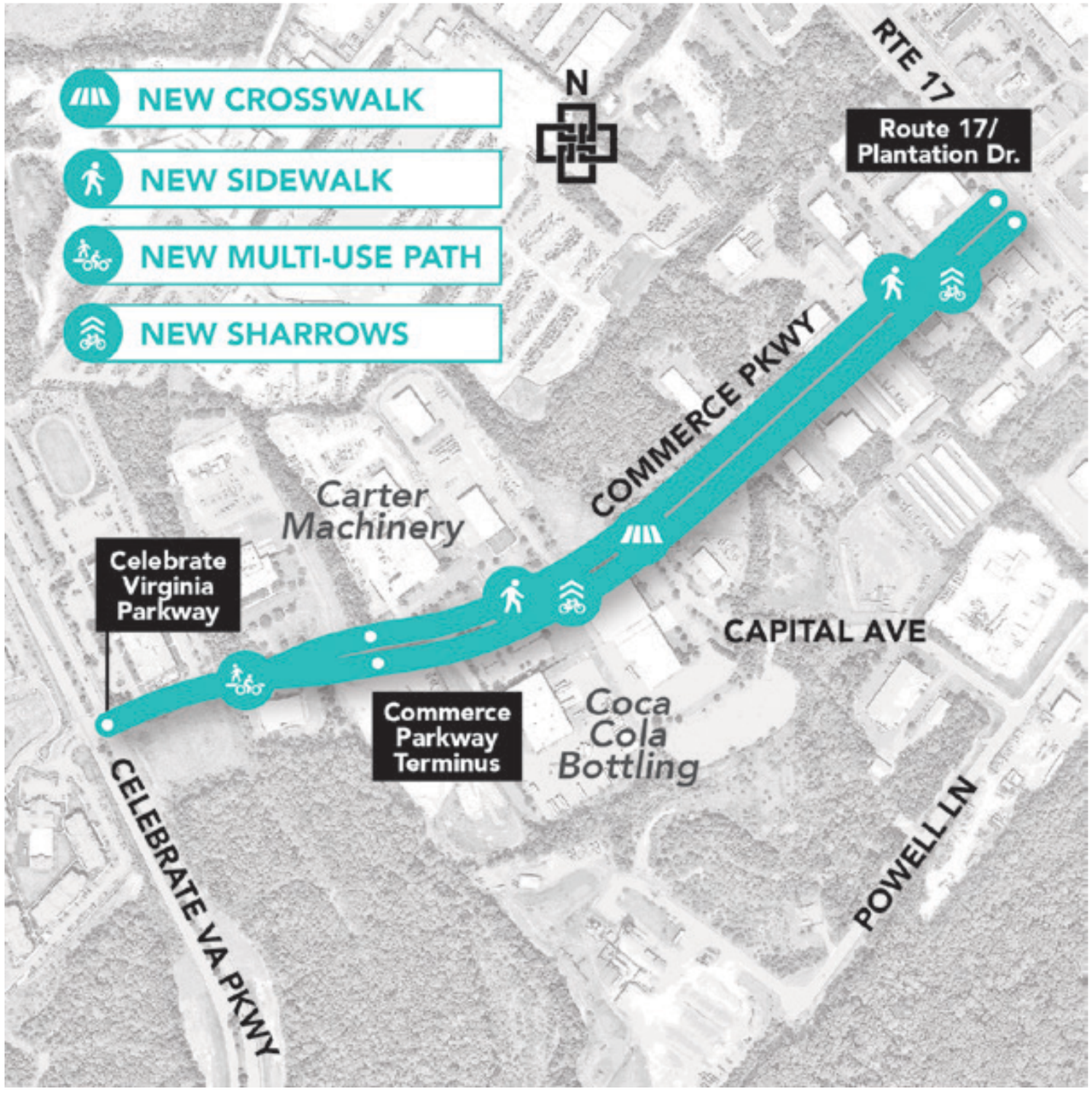
CELEBRATE VIRGINIA PARKWAY TO ROUTE 17

Recommended Improvements Ranked by Implementation Complexity:

- **Shared Lane Markings + Signage:** Add shared bicycle lane markings and signage ("sharrows") along Commerce Parkway between the Celebrate Virginia Trail and Route 17.
  - **Implementation Complexity: LOW**
- **Crosswalk:** Install zebra crosswalk at the intersection of Commerce Parkway and Capital Avenue.
  - **Implementation Complexity: LOW**
- **Sidewalk:** Install sidewalk along Commerce Parkway between the Celebrate Virginia Trail and Route 17 to fill in sidewalk gaps and complete the sidewalk network.
  - **Implementation Complexity: MEDIUM**
- **Multi-Use Path:** Install a multi-use path connecting the terminus of Commerce Parkway with the Celebrate Virginia Trail, with even greater impacts when paired with cycling infrastructure improvements recommended for Plantation Drive (Gap #4).
  - **Implementation Complexity: HIGH**

Current/Upcoming Construction:

None.

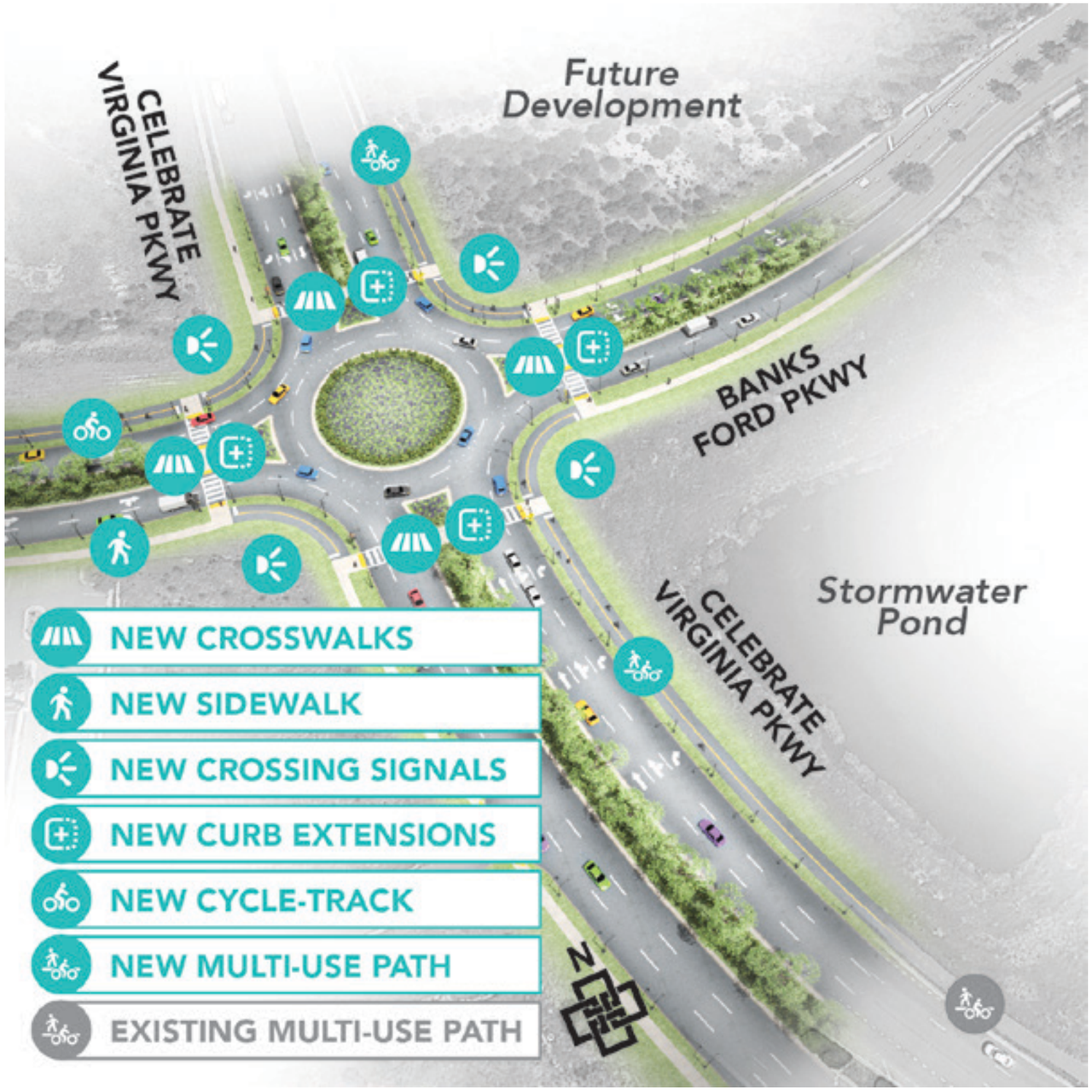


GAP #14: CELEBRATE VIRGINIA AND BANKS FORD PKWYS

JEWETT LANE TO ROUTE 17

Recommended Improvements Ranked by Implementation Complexity:

- **Crosswalks:** Install zebra crosswalks across Celebrate Virginia Parkway and Banks Ford Parkway.
  - **Implementation Complexity: LOW**
- **Sidewalk:** Add a sidewalk along the west side of Banks Ford Parkway between Celebrate Virginia Parkway and Route 17.
  - **Implementation Complexity: MEDIUM**
- **Curb Extensions:** Enlarge and extend existing medians on Banks Ford Parkway and Celebrate Virginia Parkway.
  - **Implementation Complexity: MEDIUM**
- **Crossing Signals:** Install crossing signals at each crosswalk around the roundabout so pedestrians can safely cross it.
  - **Implementation Complexity: HIGH**
- **Multi-Use Path:** Extend the Celebrate Virginia Trail multi-use path from its existing terminus near Jewett Lane north to Route 17.
  - **Implementation Complexity: HIGH**
- **Cycle-Track:** Install a cycle-track along Banks Ford Parkway to facilitate connections between Route 17, the Celebrate Virginia Trail, and Berea Church Road (Gap #18).
  - **Implementation Complexity: HIGH**
- **Roundabout:** Replace the unsignalized Celebrate Virginia Parkway/Banks Ford Parkway intersection with a roundabout complete with zebra crosswalks, curb/median extensions, and crossing beacons where needed.
  - **Implementation Complexity: HIGH**



GAP #15: OLDE FORGE DRIVE

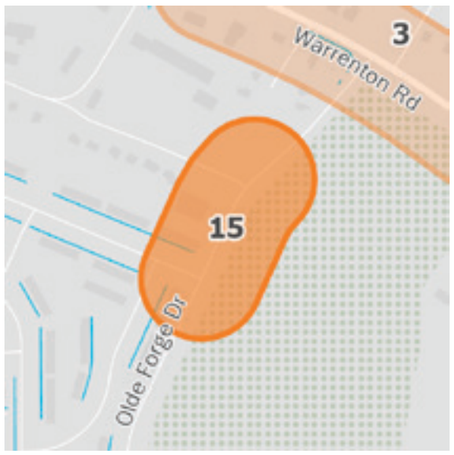
BELLOWS AVENUE TO ROUTE 17

Recommended Improvements Ranked by Implementation Complexity:

- **Crosswalks:** Install zebra crosswalks across Route 17 and Thomas Lane at Olde Forge Drive to connect adjacent developments to Route 17.
  - **Implementation Complexity: LOW**
- **Sidewalks:** Install sidewalks along Olde Forge Drive to connect the adjacent developments' robust sidewalk network to Route 17.
  - **Implementation Complexity: MEDIUM**

Current/Upcoming Construction:

VDOT is planning on realigning the throat of Olde Forge Drive to form a four-way intersection with RV Parkway and Route 17, so any crosswalk and sidewalk improvements should account for this realignment.



GAP #16: QUARLES ROAD

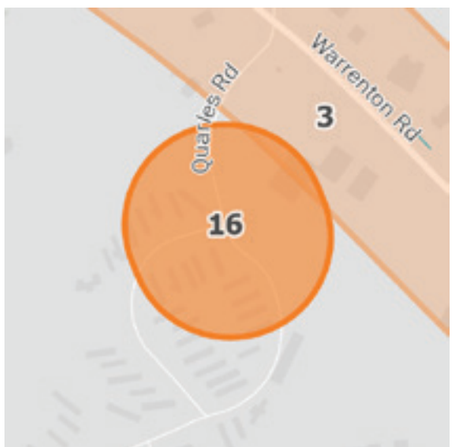
PETROLEUM LANE TO ROUTE 17

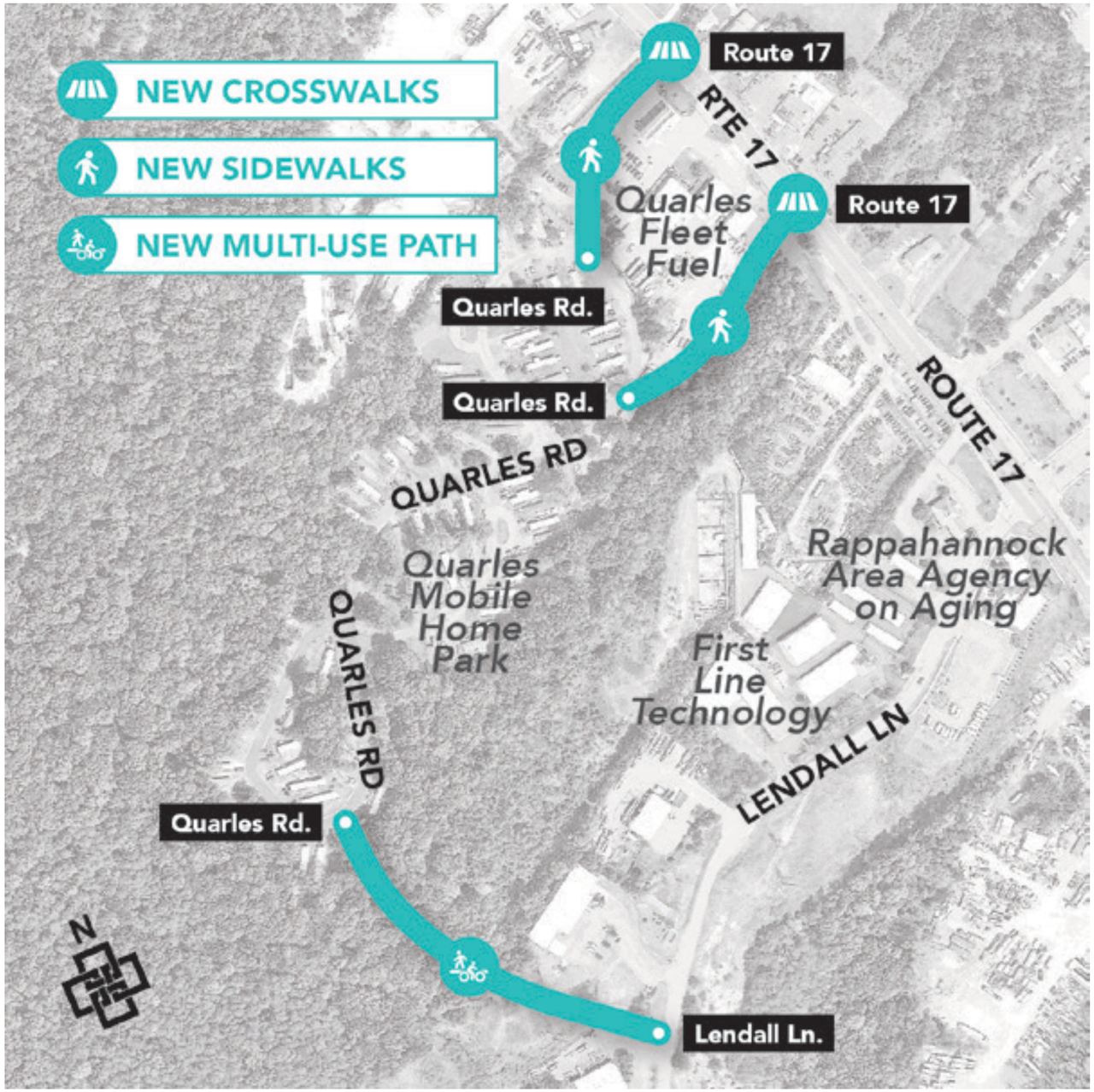
Recommended Improvements Ranked by Implementation Complexity:

- **Crosswalks:** Install zebra crosswalks across Route 17 from Quarles Road.
  - **Implementation Complexity: LOW**
- **Sidewalks:** Install sidewalks along Quarles Road through an existing truck fueling station to facilitate a connection between the low-stress residential network in the adjacent development and Route 17. Depending on which alignment minimizes potential conflicts with truck traffic, the sidewalks could follow Quarles Road (on the north side of the truck fueling station) or they could pass on the south side of the truck fueling station.
  - **Implementation Complexity: MEDIUM**
- **Multi-Use Path:** Install a multi-use path between the southernmost Quarles Road loop and the proposed Lendall Lane improvements (Gap #8).
  - **Implementation Complexity: HIGH**

Current/Upcoming Construction:

None.





GAP #17: CAMBRIDGE STREET/FALMOUTH BRIDGE REPLACEMENT

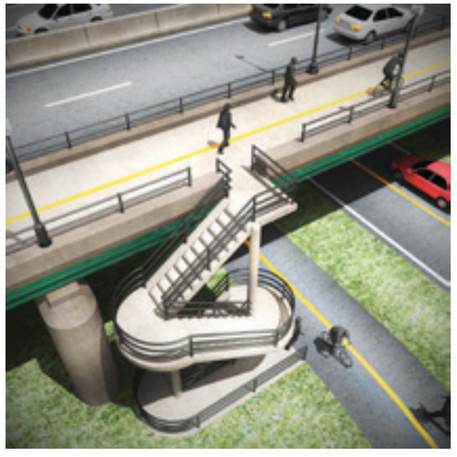
ROUTE 17 TO HANSON AVENUE

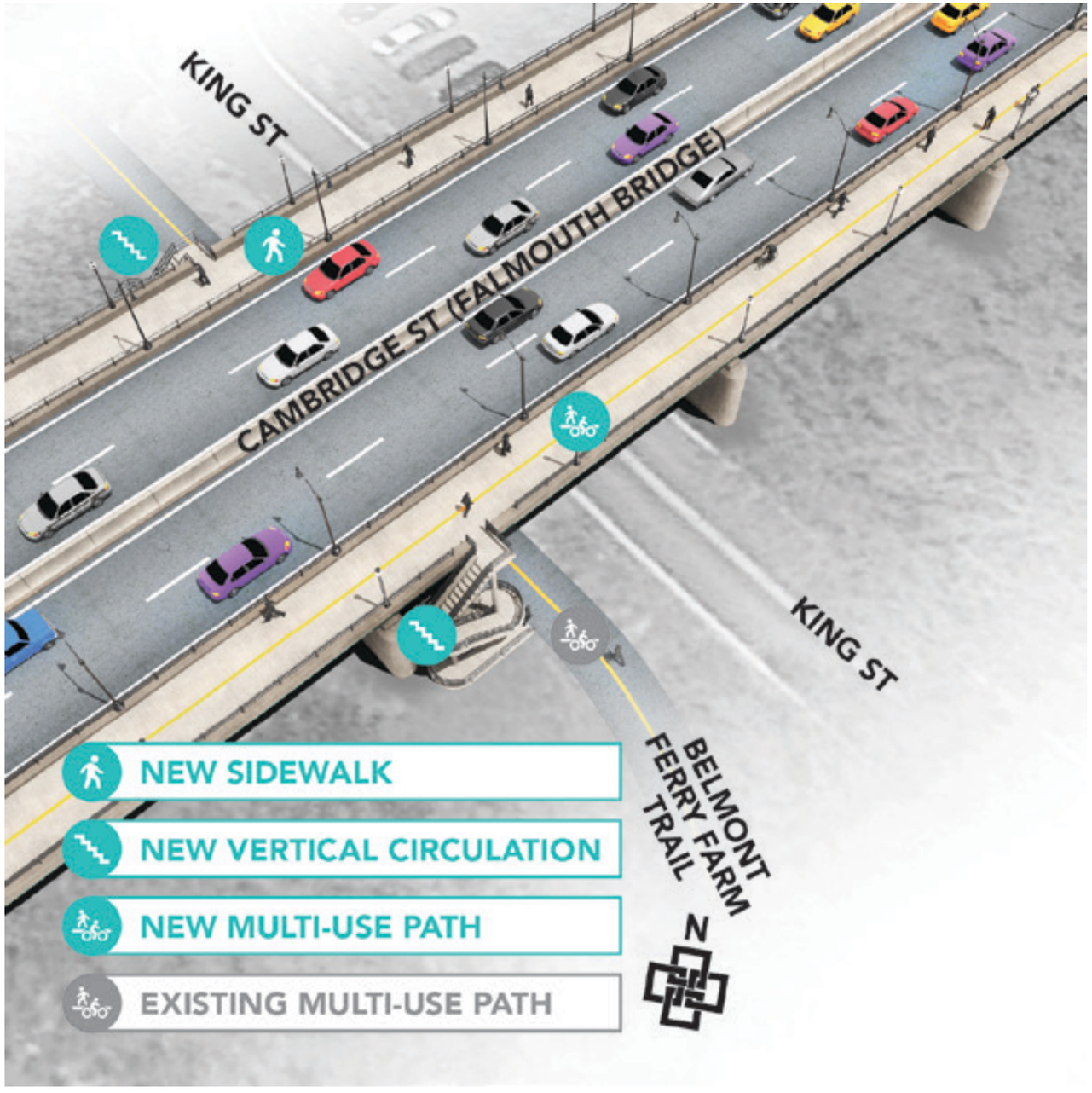
Recommended Improvements Ranked by Implementation Complexity:

- **Sidewalk:** Incorporate a sidewalk into the future Falmouth Bridge replacement to facilitate a safe connection to downtown Fredericksburg.
  - **Implementation Complexity: MEDIUM**
- **Multi-Use Path:** Incorporate a multi-use path into the future Falmouth Bridge replacement to facilitate a safe connection to downtown Fredericksburg, Falmouth Village, and various regional trails.
  - **Implementation Complexity: HIGH**
- **Vertical Circulation:** Install cycling/pedestrian ramps to facilitate connections between the Falmouth Bridge replacement, the Rappahannock River Heritage Trail, and the Belmont-Ferry Farm Trail.
  - **Implementation Complexity: HIGH**

Current/Upcoming Construction:

None.





GAP #18: BEREA CHURCH ROAD

ROUTE 17 TO TRUSLOW ROAD

Recommended Improvements Ranked by Implementation Complexity:

- **Crosswalks:** Install zebra crosswalks at all points where the proposed multi-use path crosses a roadway, as well as at the intersection of Truslow Road and Berea Church Road, to facilitate safe crossings.
  - **Implementation Complexity: LOW**
- **Multi-Use Path:** Install a multi-use path along Berea Church Road from Route 17 to the Truslow Road Trail, which would close the cycling/pedestrian network "loop" west of Route 17.
  - **Implementation Complexity: HIGH**

Current/Upcoming Construction:

VDOT is adding paved shoulders to Berea Church Road; construction is expected to finish in the fall of 2023.

5. GAP PRIORITIZATION AND COSTS

5.1. Prioritization

The study team recognizes that all the proposed improvements in this plan cannot be done at once. To help inform the phasing of investments, a prioritization process was prepared based on metrics established by VTrans, shown in **Table 7:**

- Access to Equity Emphasis Areas
- Prioritization within Pedestrian Access
- Prioritization within Bicycle Access
- Instances of bicycle and pedestrian crashes

Each project was assigned a composite score based and ranked against one another to establish priorities.

5.1.1. METHODOLOGY

The prioritization methodology was based on the approach outlined in the ***Technical Guide for the Identification and Prioritization of the VTrans Mid-Term Needs.*** The document outlines how transportation projects can be prioritized at the statewide and VDOT District levels across a variety of metrics. Not all prioritization metrics are relevant to this study, so the prioritization of projects relied on only four metrics. Each metric scores projects by the severity (e.g., number of crashes, WalkScore™) and magnitude (e.g., population density, roadway class). The measures used include:

- **Access for Equity Emphasis Areas:** Each project was evaluated based on the Equity Emphasis Area (EEA) index value calculated in the VTrans Mid-Term Needs. In cases where a proposed project overlaps multiple census block groups, the highest EEA index score was assigned. The 18 corridors identified in this study scored between 0 and 9.59. No measure of magnitude was utilized in this metric as the EEA index score already accounts for the magnitude of need.
- **Pedestrian Access Need:** Pedestrian access needs are measured by combining the severity of need (defined by WalkScore™ values) and the magnitude of need (defined by the combined population and employment density). Each project is assigned a composite score based on the formula:

  Area-Weighted WalkScore™ x (Area-Weighted Population + Area Weighted Employment Density) x Roadway Class Adjustment Factor[7]

7. Adjustment factors: principal arterials= 7; minor arterials= 3; all other functional classes= 1.

Table 7: Study Prioritization Metrics

Metric	Severity Measure	Magnitude Metric	Data Sources
Access for Equity Emphasis Areas	Maximum equity emphasis score for underlying Census Block Groups	N/A	VTrans 2021
Pedestrian Access Need	Area weighted average WalkScore™	Area weighted average population and employment density; roadway class	WalkScore™, US Census ACS 5-Year Counts, 2019 LEHD, VDOT Roadway Class
Bicycle Access Need	Proximity to activity centers	Area weighted average population and employment density; roadway class	US Census ACS 5-Year Counts, 2019 LEHD, VDOT Roadway Class
Safety Need	Traffic accidents categorized by severity	N/A	Pedestrian Safety Action Plan

- **Bicycle Access Need:** Bicycle access needs are measured by combining the severity of need (defined by proximity to activity centers) and the magnitude of need (defined by the combined population and employment density). Each project is assigned a composite score based on the formula:

  Proximity Score[8] x (Area-Weighted Population + Area Weighted Employment Density) x Roadway Class Adjustment Factor

- **Safety Need:** The safety need is based on the number and severity of crashes within 200 feet of a project. The Pedestrian Safety Action Plan documents five years' worth of crash data. Each safety incident is tagged as: fatal (5), severe injury (4), visible injury (3), non-visible injury (2), and property damage only (1).

Once scores were calculated for each project, the projects were ranked from 0 (lowest scoring project) to 17 (highest scoring project). The rank scores were added together to achieve the final composite score.

5.1.2. FINDINGS AND RESULTS

Results from the gap prioritization in **Table 8** reinforce observations made in the **Existing Conditions Analysis** and **Field Assessment.** Unsurprisingly, the Route 17 interchange with Interstate 95 scored highest, followed by the eastern and western segments of Route 17 itself. Major connecting roadways to Route 17, such as South Gateway Drive and Cambridge Street ranked near the top. The lower ranking projects included non-arterials in lower-density areas.

The gap prioritization results serve as a framework for improving gaps with the highest potential for meaningfully improving cycling and pedestrian access. While the highest-scoring gaps also tend to be the costliest and/or have the highest implementation complexity, they would also yield the greatest benefits for cyclists and pedestrians.

8. Any project within 3 miles of an activity center and within 200 feet of a transit stop receives a 3. All other projects received a 2.5. No project within the study area is more than 3 miles from an existing activity center.

Table 8: Gap Prioritization Results

Gap	Corridor	Extents	Equity	Pedes-trian Access	Bicycle Access	Safety	Final Score	Priority
2	Route 17	Interstate 95 Interchange	14	15	16	16	61	High
1	Route 17	Stafford Lakes Parkway to South Gateway Drive/ Sanford Drive	9	17	17	17	60	High
3	Route 17	Short Street to Cambridge Street	14	16	14	15	59	High
17	Cambridge Street	Route 17 to Hanson Avenue	14	11	11	14	50	High
5	South Gateway Drive	Route 17 to Plantation Drive	7	12	15	13	47	High
15	Olde Forge Drive	Bellows Avenue to Route 17	14	9	9.5	5	37.5	High
16	Quarles Road	Petroleum Lane to Route 17	14	8	9.5	5	36.5	Moderate
18	Berea Church Road	Route 17 to Truslow Road	9	6	13	5	33	Moderate
4	Plantation Drive	Route 17 to Truslow Road	9	10	2	11.5	32.5	Moderate
8	Lendall Lane	Route 17 to Rappahannock River Trail	14	7	6.5	5	32.5	Moderate
9	Rappahannock River Trail	Cambridge Street to Celebrate Virginia Parkway Extension	14	2	6.5	5	27.5	Moderate
14	Celebrate Virginia Parkway and Banks Ford Parkway	Jewett Lane to Route 17	1.5	13	8	5	27.5	Moderate
10	Celebrate Virginia Parkway Extension	New river crossing connecting Southern Gateway to Gordon W. Shelton Boulevard	6	3	12	5	26	Low
13	Connection Near Commerce Parkway	Celebrate Virginia Parkway to Route 17	1.5	14	4	5	24.5	Low
12	Sanford Drive	Celebrate Virginia Parkway to Route 17	1.5	5	4	11.5	22	Low
7	Solomon Drive Extension	Route 17 to Truslow Road	4.5	4	0.5	5	14	Low
6	Truslow Road	Plantation Drive to Solomon Drive Extension	4.5	1	0.5	5	11	Low
11	Celebrate Virginia Parkway	Sanford Drive Intersection	1.5	0	4	5	10.5	Low

5.2. Costs

Improvement costs have been categorized as high, moderate, or low to better understand implementation feasibility, funding and capital needs, and implementation timing. Gaps have been costed by individual recommendation, as well as by total cost of improvements per gap. Note that cost estimations are highly variable and should only be used as a starting point for understanding potential cost implications.

5.2.1. METHODOLOGY

Improvement costs were estimated using the VDOT Transportation and Mobility Planning Division Planning Level Cost Estimates. However, costs are extremely variable depending on right-of-way (ROW) acquisition needs, feasibility studies, construction costs, and economic conditions. To account for this high variability, improvements were costed into categories of low, moderate, or high based on estimated cost relative to each other. For example, relative to the installation of a roundabout, the cost of adding a crosswalk would be low, and the roundabout cost would be high. Assumptions are included in **Table 9.**

Note that these are preliminary planning level cost estimates. No surveying was completed to identify potential additional factors such as utility relocation, specific drainage, topography, or right-of-way acquisitions. To account for project unknowns, the team assigned a high (50 percent) contingency onto the project cost. As proposed projects progress in their planning and design, more precise cost estimates would be developed with lower assumed contingencies.

5.2.2. FINDINGS AND RESULTS

Recommended improvements by gap are listed in **Table 10.**

Key low-cost improvements include installing a multi-use path to facilitate a connection to Sanford Drive (Gap 11), installing sidewalks and a crosswalk across Route 17 at Olde Forge Drive (Gap 15) and Quarles Road (Gap 16), and adding cycling and pedestrian infrastructure along Commerce Parkway (Gap 13). The highest cost improvements most often included intersection signalization, new infrastructure (i.e., roundabouts or bicycle and pedestrian ramps), and installing sidewalks or multi-use paths. All improvements recommended for Gaps 9 and 10, which consist of a multi-use path along and across the Rappahannock River, require high-cost investments.

Table 9: Cost Assumptions

Improvement Type	Cost	
Shared Lane Markings and Signage[9]	$184,000 per mile	Low
Bike Lane	$184,000 per mile	Low
Cycle-Track	$229,000 per mile	Low
Multi-Use Path	$1,800,000 per mile	Moderate
Sidewalk	$1,175,000 per mile	Moderate
Crosswalk	$40,000 per intersection	Low
Signalization	$492,000 per intersection; $70,000 per new pedestrian signal	High
Traffic Calming[10]	$184,000 per mile	Low
Roundabout	$4,500,000 each	High
Vertical Circulation[11]	Varies	High
Additional Factors	**Cost as Percentage**	
Right-of-Way and Utility Costs	57.5% to 80% of construction costs	
Drainage Costs	100% of construction costs (sidewalk only)	
Contingency	50% (total cost)	

9. Costs vary depending on type of signing and markings used as well as the spacing of the markings and signage along the corridor.

10. Costs vary widely depending on method (e.g., curb bump outs are more costly traffic calming measures than low speed limit signs).

11. Improvement costs vary widely depending on specific scenarios but can always be categorized as high cost.

Table 10: Cost by Improvement

Gap	Corridor	Recommended Improvement(s)	Count/Measure	Preliminary Cost Estimate
1	Route 17	Crosswalk	12 intersections	$720,000
		Sidewalk	0.8 miles	$3,948,000
		Signalization	1 intersection; 11 pedestrian signals	$1,893,000
2	Route 17	Crosswalk	1 intersection; one standalone crosswalk	$75,000
		Sidewalk	0.6 miles	$2,961,000
		Signalization	4 pedestrian signals	$420,000
3	Route 17	Crosswalk	4 intersections	$240,000
		Sidewalk	2.3 miles	$11,351,000
		Signalization	1 intersection	$738,000
4	Plantation Drive	Crosswalk	15 intersections	$900,000
		Sidewalk	1.2 miles	$5,446,000
		Multi-Use Path	0.6 miles	$4,054,000
5	South Gateway Drive	Crosswalk	7 intersections	$420,000
		Multi-Use Path	0.6 miles	$2,552,000
		Cycle-Track	0.9 miles	$309,000
6	Truslow Road	Multi-Use Path	1.9 miles	$8,080,000
		Crosswalk	7 intersections	$420,000
7	Solomon Drive Extension	Multi-Use Path	1 mile	$6,757,000
8	Lendall Lane	Sidewalk	0.8 miles	$3,631,000
		Multi-Use Path	0.8 miles	$3,402,000
9	Rappahannock River Trail	Multi-Use Path	3.8 miles	$16,160,000
		Vertical Circulation	2 staircases/ramps	N/A
10	Celebrate Virginia Parkway	Multi-Use Path	1.2 miles	$5,103,000
		Crosswalks	1 intersection	$60,000
		Vertical Circulation	2 staircases/ramps	N/A
11	Celebrate Virginia Parkway	Multi-Use Path	0.2 miles	$851,000
12	Sanford Drive	Shared Lane Markings and Signage	1.2 miles	$331,000
		Sidewalk	0.1 miles	$454,000
		Multi-Use Path	1.1 miles	$4,678,000
		Crosswalk	1 intersection	$60,000
		Traffic Calming	1.1 miles	$304,000

Table 10, Continued: Cost by Improvement

Gap	Corridor	Recommended Improvement(s)	Count/Measure	Preliminary Cost Estimate
13	Connection Near Commerce Parkway	Shared Lane Markings and Signage	0.5 miles	$138,000
		Sidewalk	0.7 miles	$3,177,000
		Crosswalk	2 intersections	$120,000
		Multi-Use Path	0.1 miles	$425,000
14	Celebrate Virginia Parkway and Banks Ford Parkway	Crosswalk	4 intersections	$240,000
		Curb Extension	0.02 miles	$971,000
		Multi-Use Path	0.5 miles	$2,126,000
		Cycle-Track	1 mile	$276,000
		Roundabout	1 roundabout	$10,631,000
		Sidewalk	1 mile	$618,000
		Signalization	1 intersection	$738,000
15	Olde Forge Drive	Crosswalk	1 crosswalk	$60,000
		Sidewalk	0.2 miles	$908,000
16	Quarles Road	Crosswalk	1 intersection	$908,000
		Sidewalk	0.2 miles	$851,000
		Multi-Use Path	0.2 miles	$60,000
17	Cambridge Street	Sidewalk	0.2 miles	$908,000
		Multi-Use Path	0.2 miles	$851,000
		Vertical Circulation	1 staircase/ramp	N/A
18	Berea Church Road	Multi-Use Path	1.5 miles	$6,379,000
		Crosswalk	4 intersections	$240,000

5.2.3. ANTICIPATED COSTS PER GAP

Anticipated costs per gap are provided in **Table 11.** Costs per gap were categorized as low, moderate, or high based on the total anticipated costs of improvements associated with each gap relative to the total cost of all other gaps; a cost of less than $3,000,000 was classified as low, costs between $3,000,000 and $10,000,000 were classified as moderate, and costs exceeding $10,000,000 were classified as high. The priority of each gap, as presented in **Table 8,** is included to understand potential correlations between cost and priority. Additionally, the overall implementation complexity for each gap has been defined.

High implementation complexities are largely driven by intersection signalization or a high volume of improvements required, such as the intersection improvements along Route 17, which includes nearly 50 new crosswalks. Gap 2, which also addresses concerns along Route 17 at the I-95 interchange, has a low total cost of improvements, a high priority, and a moderate implementation complexity.

Table 11: Anticipated Costs Per Gap

Gap	Corridor	Total Cost of Improvements	Priority	Implementation Complexity[12]
1	Route 17	Moderate	High	High
2	Route 17	Moderate	High	Moderate
3	Route 17	High	High	High
4	Plantation Drive	High	High	High
5	South Gateway Drive	Moderate	High	High
6	Truslow Road	Moderate	Moderate	Moderate
7	Solomon Drive Extension	Moderate	Low	Moderate
8	Lendall Lane	Moderate	Low	Moderate
9	Rappahannock River Trail	High	Moderate	High
10	Celebrate Virginia Parkway	Moderate	Low	High
11	Celebrate Virginia Parkway	Low	Moderate	Low
12	Sanford Drive	Moderate	Moderate	High
13	Connection Near Commerce Parkway	Moderate	Low	Moderate
14	Celebrate Virginia Parkway and Banks Ford Parkway	High	Moderate	High
15	Olde Forge Drive	Low	Low	Low
16	Quarles Road	Low	Low	Low
17	Cambridge Street	Low	High	High
18	Berea Church Road	High	Moderate	Moderate

12. Implementation complexity reflects the highest complexity level of ***all*** individual recommendations addressing a gap.

6. CONCLUSION

This bicycle and pedestrian study of the Southern Gateway UDA, a rapidly developing suburban area just outside the City of Fredericksburg, explores how the UDA can better accommodate pedestrians and cyclists. The study identified specific projects that the County and its regional partners can pursue to improve multi-modal transportation in the area, and to support future growth and development.

The study's key takeaways and findings can be summarized as follows:

- **Existing Conditions:** The existing conditions analysis of the Southern Gateway UDA and its surrounding areas included an assessment of resident socio-demographics, travel patterns, and projected growth. The findings identified concentrations of residents and jobs along Route 17 between Banks Ford Parkway and Interstate 95, with limited or disjointed bicycle and pedestrian infrastructure, which in some places was also not adequately maintained. While little dedicated bicycle infrastructure currently exists in the study area, some through streets (e.g., Truslow Road) and streets within most subdivisions provide relatively accommodating conditions for cyclists. Establishing connections between these networks and destinations in and around the study area presents an opportunity to greatly enhance active transportation opportunities for residents and workers.
- **Gap Identification:** Using findings from the study team's existing conditions analysis, the study team identified cycling and pedestrian network gaps that currently serve as barriers to active transportation. The pedestrian and cycling challenges identified in the existing conditions analysis and field assessment culminated in 18 discrete gaps, which were used as a basis and starting point for identifying recommendations and measuring impacts. These gaps were later prioritized for improvements to assist in determining where resources might be dedicated first.
- **Recommended Improvements:** Recommendations were developed using strategies outlined in the **Recommendations Toolbox,** which outlines key industry tools, standards, and best practices for bicycle and pedestrian planning. In most scenarios, several strategies from the toolbox were used together to address a gap, such as the simultaneous addition of crosswalks and sidewalks to connect a corridor to a nearby subdivision. The most common improvements recommended were crosswalks, sidewalks, and multi-use paths, each of which provide benefits for cyclist and pedestrian experiences.
- **Prioritization and Costs:** Many of the lowest cost recommended improvements involve the addition of crosswalks or the installation of sidewalks or multi-use paths. Although multi-use paths and sidewalks are not typically low-cost improvements, the low anticipated costs indicate that the improvements are largely infill infrastructure to connect the area's existing cycling and pedestrian network. Several opportunities with low cost and high priority improvements exist, providing the region with "low hanging fruit." All high-cost gaps, except Gap 2 (Route 17), have priorities of moderate or higher. Since priority was directly related an improvement's impact on the pedestrian experience, the alignment of high cost and moderate-to-high priority gaps reinforces the value and potential impacts of investments in bicycle and pedestrian infrastructure.

With this study, the study team has identified key barriers to cycling and walking within the Southern Gateway UDA. These barriers were formally identified as network gaps, which the study team used to recommended improvements and strategies to address those barriers. The study's findings can be used to guide future growth and development within the Southern Gateway UDA in a way that supports active and multi-modal transportation.

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