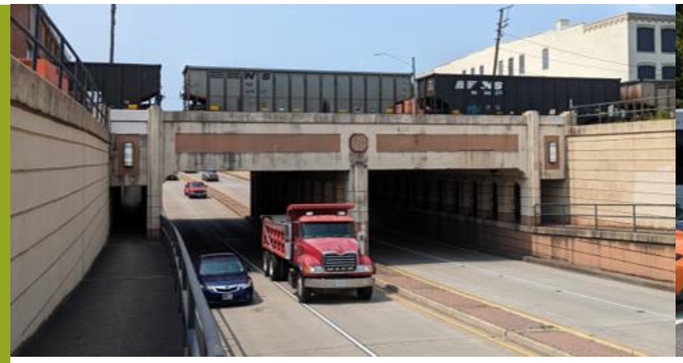

PROJECT PIPELINE

Monticello Avenue / St. Paul's Boulevard Corridor

HR-23-06

Final Report

DRPT Virginia Department of Rail and Public Transportation

Office of INTERMODAL Planning and Investment

VDOT Virginia Department of Transportation

PROJECT PIPELINE

Project Pipeline – Hampton Roads

Monticello Avenue / St. Paul's Boulevard Corridor

July 2024

Prepared for

Office of INTERMODAL Planning and Investment

VDOT Virginia Department of Transportation

DRPT Virginia Department of Rail and Public Transportation

Prepared by

Kimley»Horn

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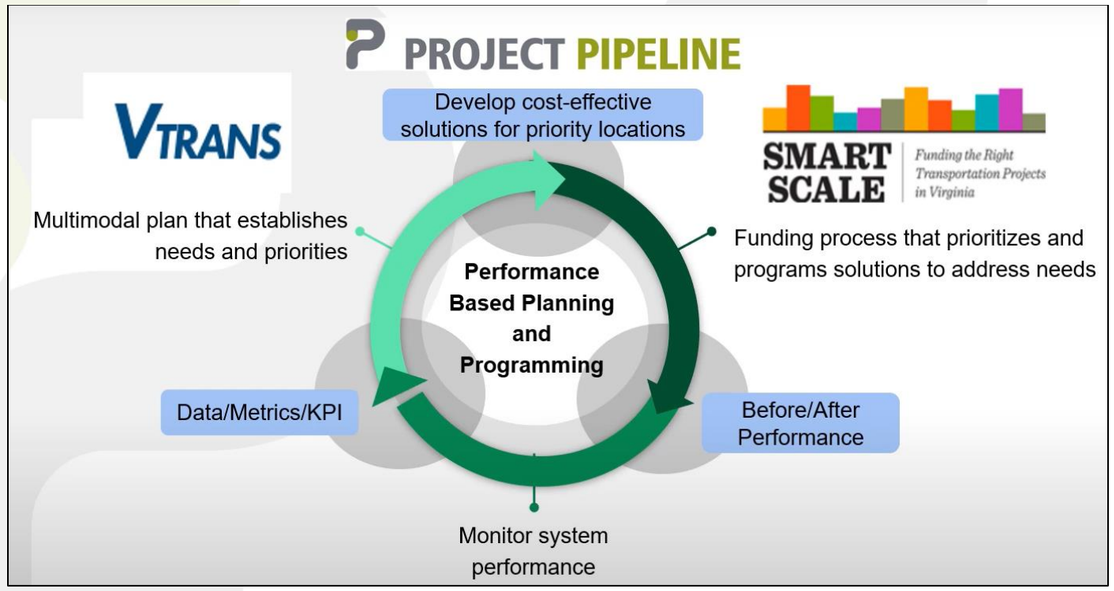
1 Needs Evaluation & Diagnosis

1.1 Introduction

Multimodal Project Pipeline (Project Pipeline) is a performance-based planning program to identify cost-effective solutions to multimodal transportation needs in Virginia. Through this planning process, projects and solutions may be considered for funding through programs, including SMART SCALE, revenue sharing, interstate funding, and others. Visit the Project Pipeline webpage for additional information: vaprojectpipeline.org.

This study focuses on concepts targeting identified needs including congestion mitigation, safety improvements, pedestrian and bicycle access, transit access, and transportation demand management (TDM). The objectives of Project Pipeline are shown below in **Figure 1**.

Figure 1: Project Pipeline Objectives

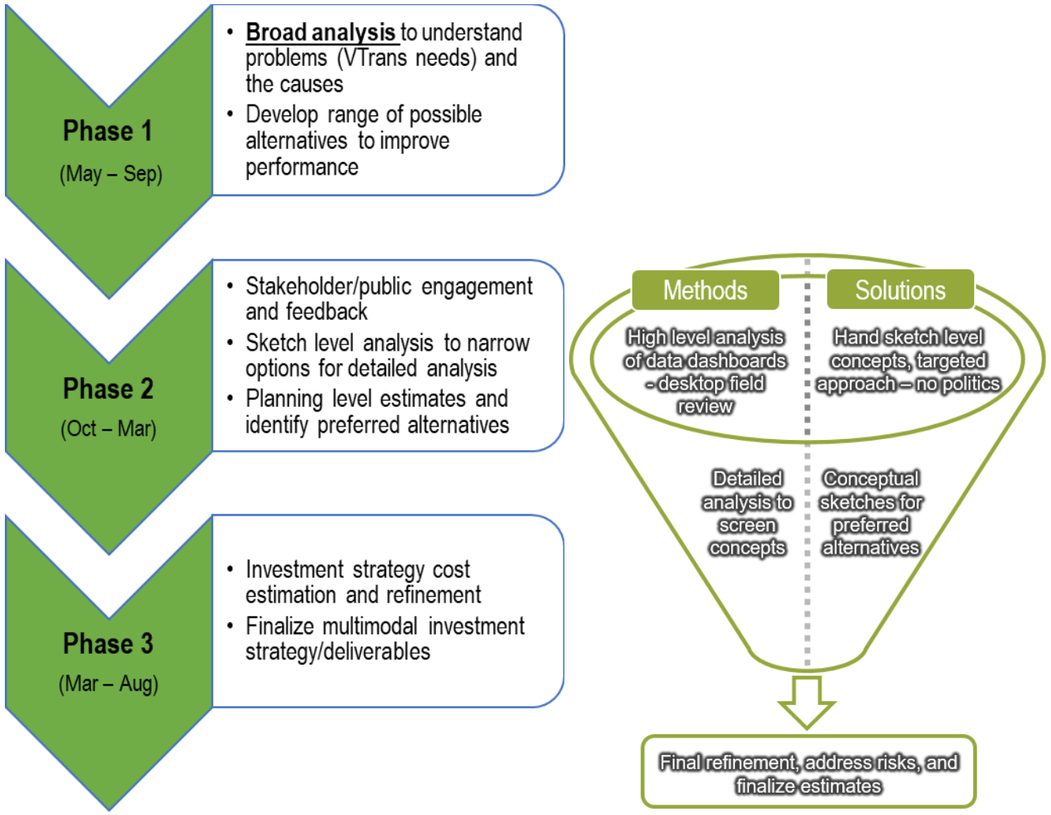


1.2 Methodology

The Project Pipeline study process consists of three phases, further detailed in **Figure 2**.

- **Phase 1:** Problem Diagnosis and Alternative Brainstorming
- **Phase 2:** Alternative Evaluation and Sketch-Level Analysis
- **Phase 3:** Investment Strategy and Cost Estimate

Figure 2: Study Phase Methods and Solutions



1.3 Study Background

A study work group (SWG) was formed for this Project Pipeline Study to capture input from local stakeholders and shape the development of potential improvements. The SWG provided local and institutional knowledge of the corridor, reviewed study methodologies, provided input on key assumptions, and reviewed and approved proposed improvements developed through the study process. The SWG included members representing the following organizations:

- Virginia Department of Transportation (VDOT)
- Office of Intermodal Planning and Investment (OIPI)
- City of Norfolk
- Hampton Roads Transportation Planning Organization (HRTPO)
- Department of Rail and Public Transportation (DRPT)
- Kimley-Horn

The study area limits along the Monticello Avenue and St. Paul's Boulevard corridor extend between Church Street in the north and East Charlotte Street/Wood Street in the south. The study corridor is approximately 1.6 miles in length with 12 signalized intersections and 12 unsignalized intersections, as shown in **Figure 3**. Monticello Avenue is generally a four-lane undivided roadway; center left-turn lanes are provided between 21st Street and Virginia Beach Boulevard. St. Paul's Boulevard is generally a six-lane, median-divided roadway within the study area. The corridor is classified as an "Other Principal Arterial" and has a 30-mph posted speed limit within the study area.

The study corridor is in the southwestern part of the City of Norfolk, Virginia and traverses the east side of the Downtown, Ghent, and Park Place neighborhoods. The corridor primarily serves commercial development, with numerous minor street connections to residential areas. The Coca-Cola Bottling Company, Onelife Fitness, Doumar's, Chick-fil-A, Hampton Roads Transit, Wyndham Garden Hotel, Norfolk Scope Arena, Chrysler Hall, and various other commercial developments are notable traffic generators along the corridor. St. Paul's Boulevard connects to I-264 and the Berkley Bridge—common commuter routes—just south of the study area, and Monticello Avenue connects to U.S. Route 460 (Church Street/Granby Street) to the north. Hampton Roads Transit (HRT) bus Routes 001, 003, and 961 have multiple bus stops along the study corridor. In addition, HRT operates the Downtown Norfolk Transit Center located adjacent to St. Paul's Boulevard just south of the study corridor limits and a Tide light rail stop along Monticello Avenue just west of the south end of the study corridor.

The study team collected data including intersection turning movement counts, pedestrian and bicycle counts, traffic signal timings, and transit ridership data along the corridor.

A framework document was developed prior to commencing the study which outlined the study methods and assumptions. The signed framework document is provided in **Appendix A**. A kickoff meeting with the SWG was held on June 9, 2023. The materials can be found in **Appendix A**.

1.4 VTrans Needs

Project Pipeline follows a performance-based planning approach to identify solutions that address VTrans Mid-Term needs. VTrans Mid-Term needs were identified from a data-informed process and were used as a primary source for selecting Project Pipeline study corridors. **Table 1** outlines the VTrans needs along the Monticello Avenue / St. Paul's Boulevard corridor.

Table 1: Monticello Avenue / St. Paul's Boulevard VTrans Needs

VTrans 2019 Mid-Term Need	Priority
Bicycle Access	Very High
Capacity Preservation	None
Congestion Mitigation	Very High
IEDA (UDA) Access	None
Pedestrian Access	Very High
Safety Improvement	Very High
Pedestrian Safety Improvement	High
Reliability	None
Rail On-time Performance	None
Transit Access	Very High
Transit Access for Equity Emphasis Areas	None
Transportation Demand Management	Very High

The Monticello Avenue / St. Paul's Boulevard corridor was selected as a Project Pipeline study location due to the presence of overlapping VTrans needs. The project team took the following steps to confirm and evaluate the VTrans needs identified in the study area.

- Reviewed the Project Pipeline data dashboard to identify issues and transportation trends in the study area
- Conducted a field review of the corridor to observe issues and document existing conditions
- Collected traffic counts at the study area intersections
- Reviewed relevant studies and plans near the corridor to inform the alternatives development
- Conducted detailed existing and no-build conditions traffic operations analyses using Synchro and SimTraffic
- Assessed existing transit service and multimodal infrastructure

Figure 3: Project Study Area

1.5 High-Level Needs Diagnosis

The data dashboard was developed by OIPI and VDOT to centralize data collection and leverage big data sources to streamline VTrans needs and problem diagnosis across all Project Pipeline studies as well as identifying the core issues and patterns identified in the framework document. The data dashboard contains performance measures including VDOT crash data, travel time index data, level of travel time reliability (LOTTR) data, and speed data for each Project Pipeline study area. The analysis results are summarized in the Phase 1 Executive Summary in **Appendix B**. The study team reviewed the dashboard performance measures to validate the presence of VTrans needs and identify the most effective improvements within the study corridor.

1.5.1 Operations and Access Needs

The study area has a Very High Congestion Mitigation VTrans need based on the Travel Time Index (TTI) and the proportion of travel happening during excessively congested conditions. The greatest impact to TTI occurs on southbound St. Paul's Boulevard. Specifically, traffic conditions outside the study area at the I-264 ramp intersections with St. Paul's Boulevard cause congestion to propagate upstream on southbound St. Paul's Boulevard within the study area. The TTI data for the study corridor reflect directional travel patterns to I-264 where the greatest impact to TTI occurs on southbound St. Paul's Boulevard during the PM peak. The corridor operates more than 10 mph below the speed limit during the PM peak. Minor congestion also occurs at the signalized intersections with Brambleton Avenue, Virginia Beach Boulevard, Princess Anne Road, 21st Street, 26th Street, and 27th Street. The evening peak hour typical traffic trend from Google Maps is shown in **Figure 4**. **Figure 5** includes additional details from the operations needs diagnosis.

Based on input from the City of Norfolk and field observations, there is frequent congestion at the northern end of the corridor due to train crossings at the Monticello Avenue underpass just north of 22nd Street. This grade-separated crossing is operated by Norfolk Southern Railroad, and although it does not block traffic on Monticello Avenue, it does block parallel facilities at Church Street, Granby Street, Llewellyn Avenue, and Colonial Avenue, which causes traffic diversions onto Monticello Avenue between 20th Street and 27th Street during multiple times per day train crossings. Although less frequent, trains can sometimes stop on the tracks and block crossings for up to an hour.

The study area also has Very High Bicycle Access and Pedestrian Access VTrans needs due to the presence of transit and proximity to activity zones with a high density of residential and commercial land uses. Parallel and intersecting bicycle facilities currently exist along Princess Anne Road, Llewellyn Avenue, Church Street, 26th Street, and 27th Street. The study corridor offers opportunity for additional bicycle connectivity across St. Paul's Boulevard on Olney Road. The City of Norfolk *Bicycle and Pedestrian Strategic Plan* identifies this Olney Road connection and a priority shared lane along Granby Street rather than on Monticello Avenue / St. Paul's Boulevard. However, the *Multimodal Transportation Master Plan* indicates a bicycle/scooter, transit, and pedestrian emphasis along Monticello Avenue / St. Paul's Boulevard south of Princess Anne Road and a transit and pedestrian emphasis north of Princess Anne Road. Sidewalks are currently provided along both sides of the Monticello Avenue / St. Paul's Boulevard corridor, but pedestrian curb ramps do not exist at every intersection. A summary of the existing multimodal transportation access along the corridor is shown in **Figure 6**. **Figure 7** summarizes the high-level operations needs along the corridor.

Figure 4: Evening Peak Hour Google Traffic Trend

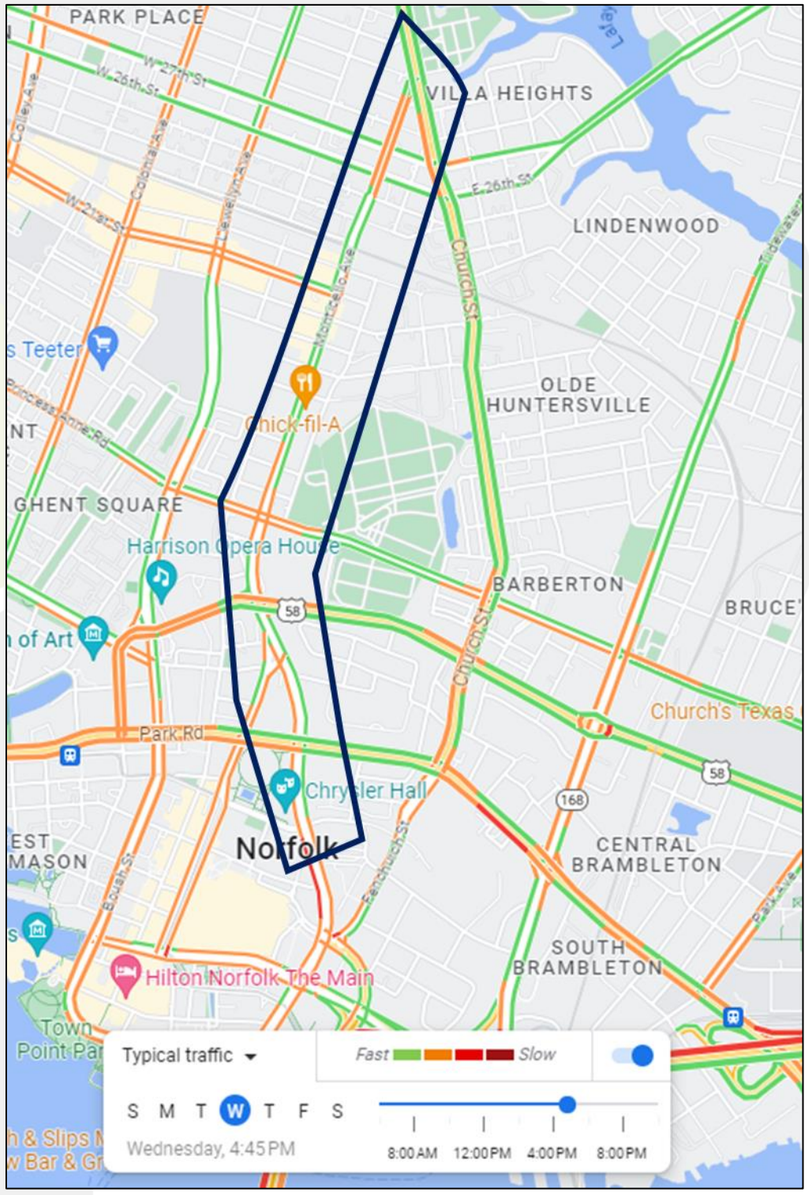


Figure 5: High-Level Operations Needs Summary

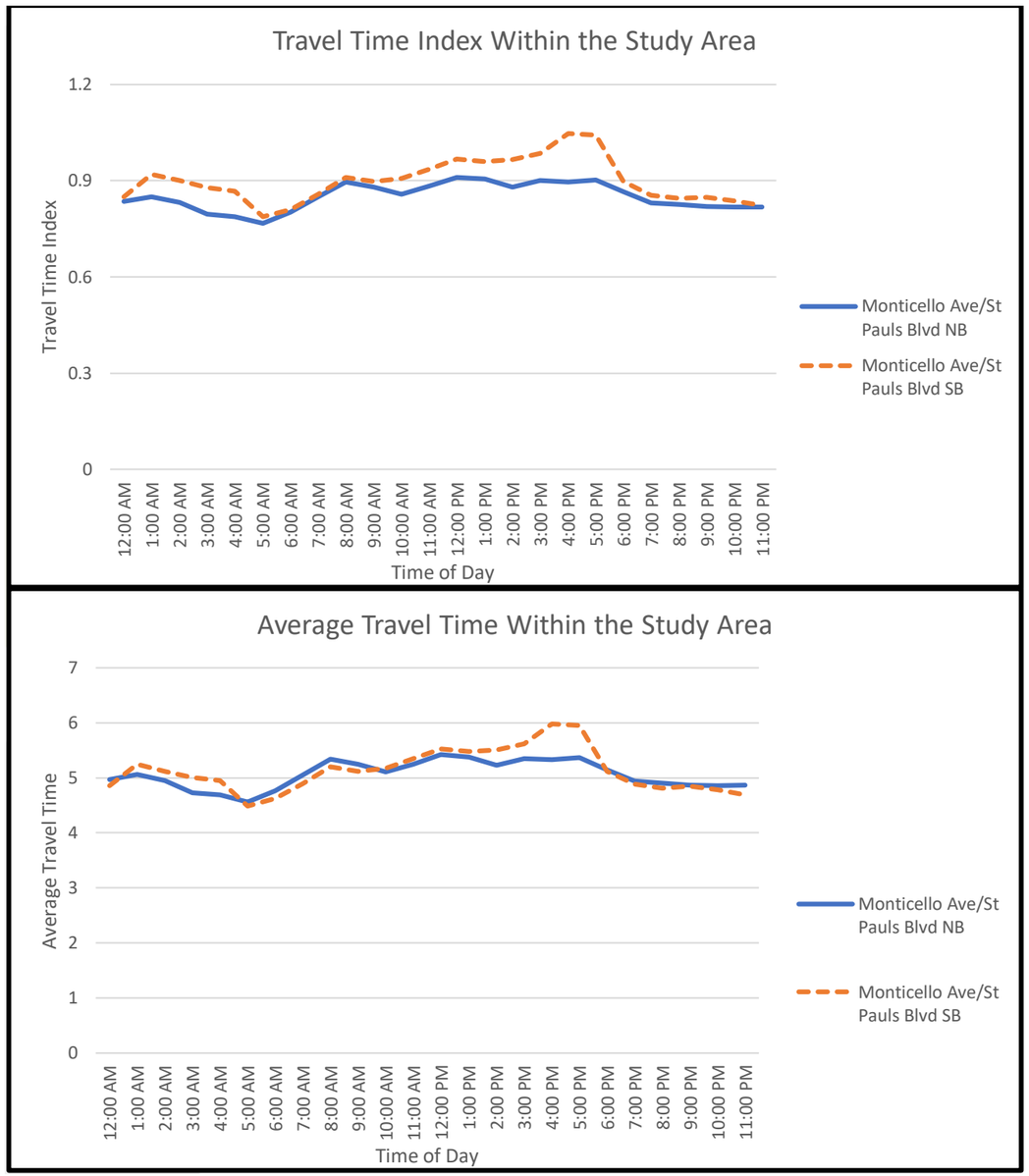


Figure 6: Multimodal Transportation Access Summary

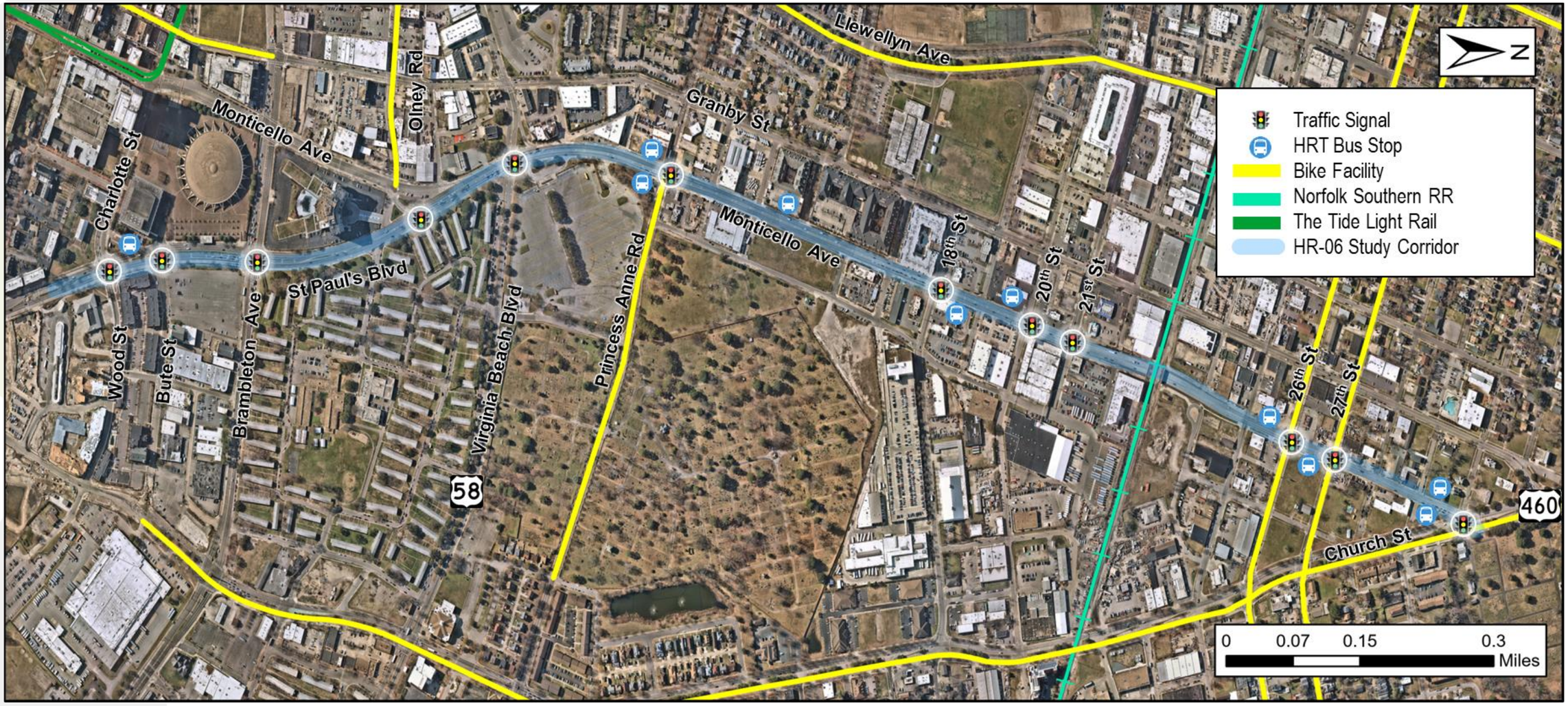
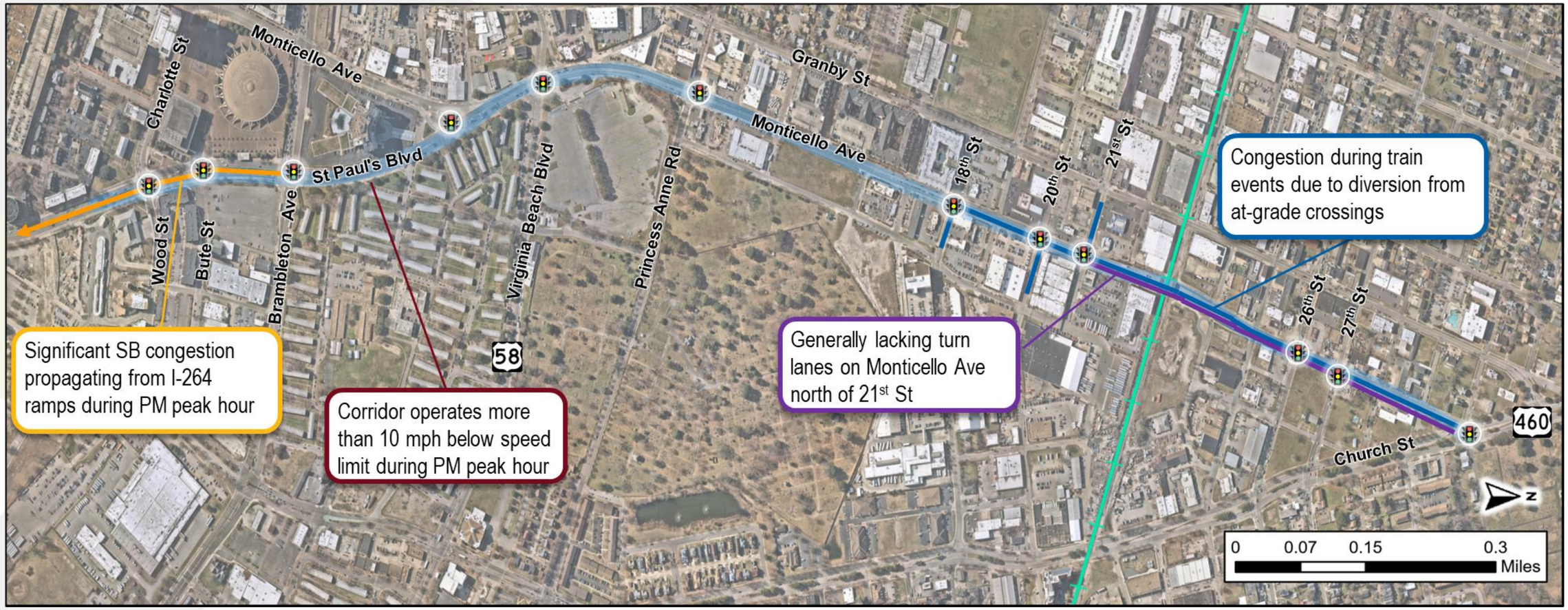


Figure 7: Existing Operational Needs Summary



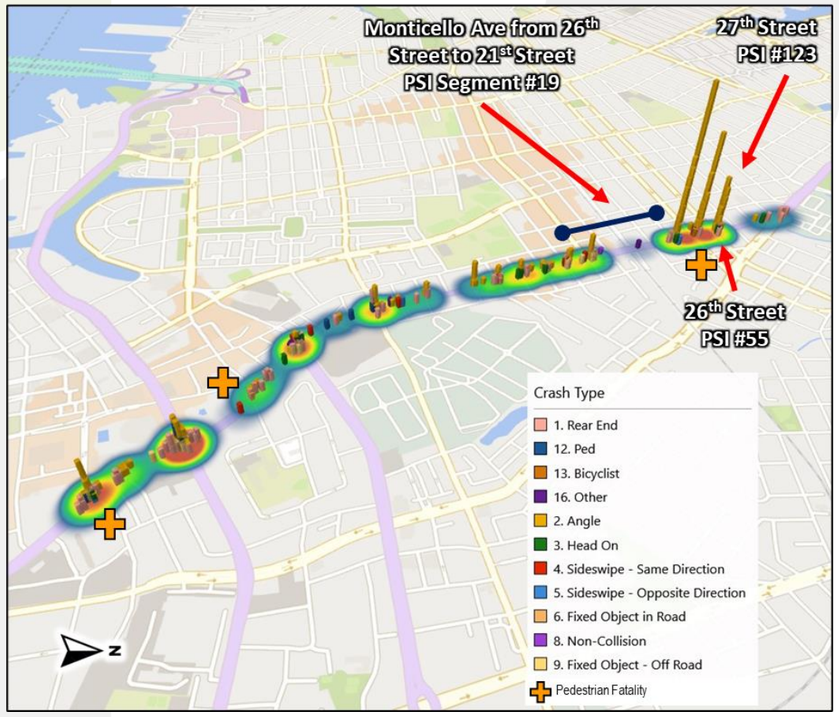
1.5.2 Safety and Reliability Needs

The study corridor has Very High Statewide Safety Improvement and High Pedestrian Safety Improvement VTrans needs. The study team reviewed the VDOT crash data from 2018-2022 to identify high-level crash trends in the study corridor.

In total, 392 crashes were reported along the study corridor including three fatalities, 133 injury crashes, and 256 crashes involving property damage only (PDO). **Figure 8** includes additional details from the corridorwide crash analysis.

Monticello Avenue is a VDOT Pedestrian Safety Action Plan (PSAP) priority corridor and is listed in the statewide top 1% of corridors. There were seven collisions involving pedestrians between 2018 and 2022 within the study corridor, two of which were fatalities. The fatalities occurred at the 9th Street and Charlotte Street intersections.

Figure 8: Corridor Crash Summary



1.5.3 Transit and Transportation Demand Management Needs

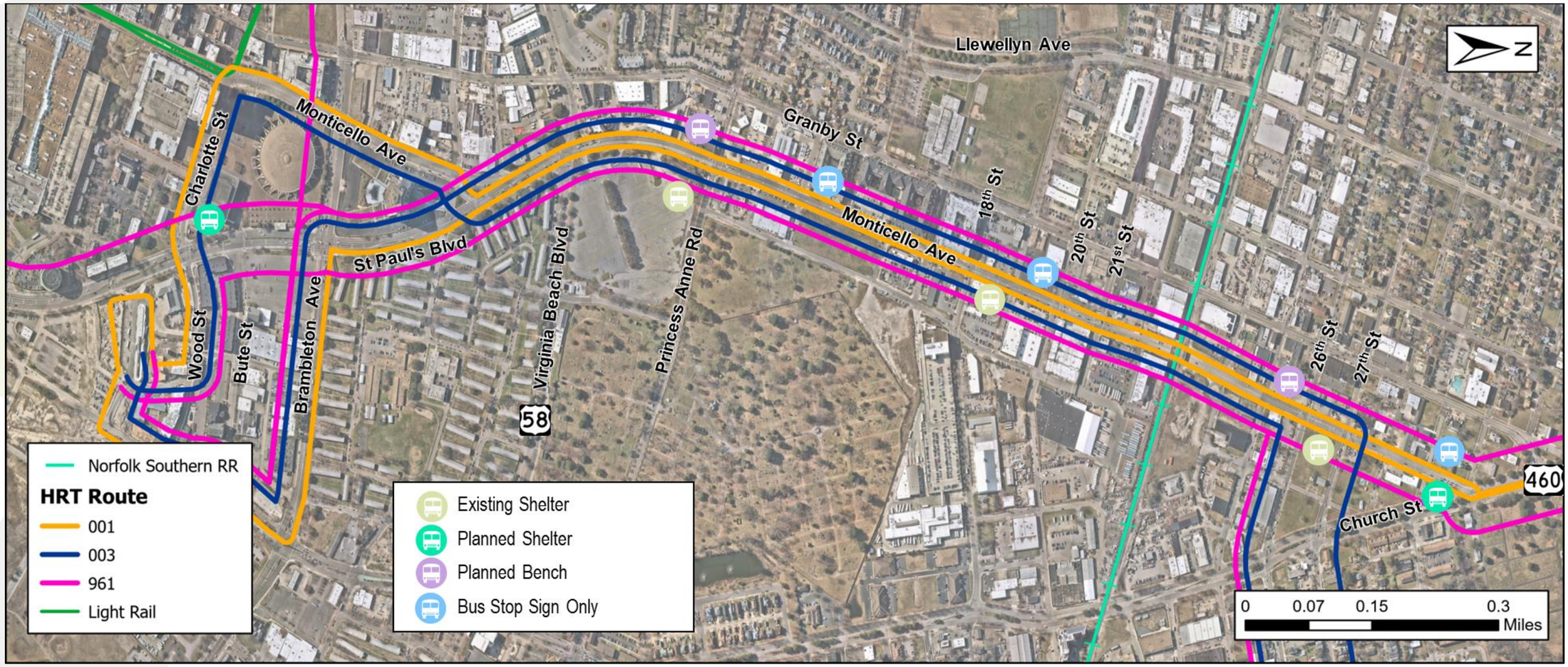
The study corridor has a Very High Transit Access VTrans need. The study team reviewed existing Hampton Roads Transit (HRT) bus services in the study corridor. There are 10 bus stops located along the study corridor that serve the following HRT bus routes, which are currently operating on 30- to 60-minute frequencies:

- Route 1 – Downtown Norfolk Transit Center / Pembroke East
- Route 3 – Downtown Norfolk Transit Center / Navy Exchange Mall
- Route 961 – Newport News Shipbuilding / Hampton / Norfolk

Figure 9 illustrates the existing bus stop locations and indicates existing or planned bus stop amenities as provided by HRT. Due to right-of-way constraints, some high-activity bus stops are not currently planned for shelter installation. During a meeting on July 5, 2023, HRT staff indicated that that they are beginning to develop a new Transit Service Plan and emphasized that the Monticello Avenue / St. Paul's Boulevard corridor will always serve transit.

The study corridor also has a Very High Transportation Demand Management (TDM) VTrans need. This VTrans need informed the development of potential TDM improvements.

Figure 9: High-Level Transit Access Needs Diagnosis Summary



1.5.4 Environmental Justice

The Screening Tool for Equity Analysis of Projects (STEAP) tool is a web application that permits rapid screening of potential project locations anywhere in the United States to support the analyses of Title VI, environmental justice, and other socioeconomic data. It provides estimates of socioeconomic characteristics of the resident population surrounding a project location, based on the latest American Community Survey (2016-2020) and on the 2020 Decennial Census Redistricting data. An equity analysis project profile report for the study area was generated by selecting the study corridor and applying a half-mile buffer. The STEAP analysis study area is shown in **Figure 10**.

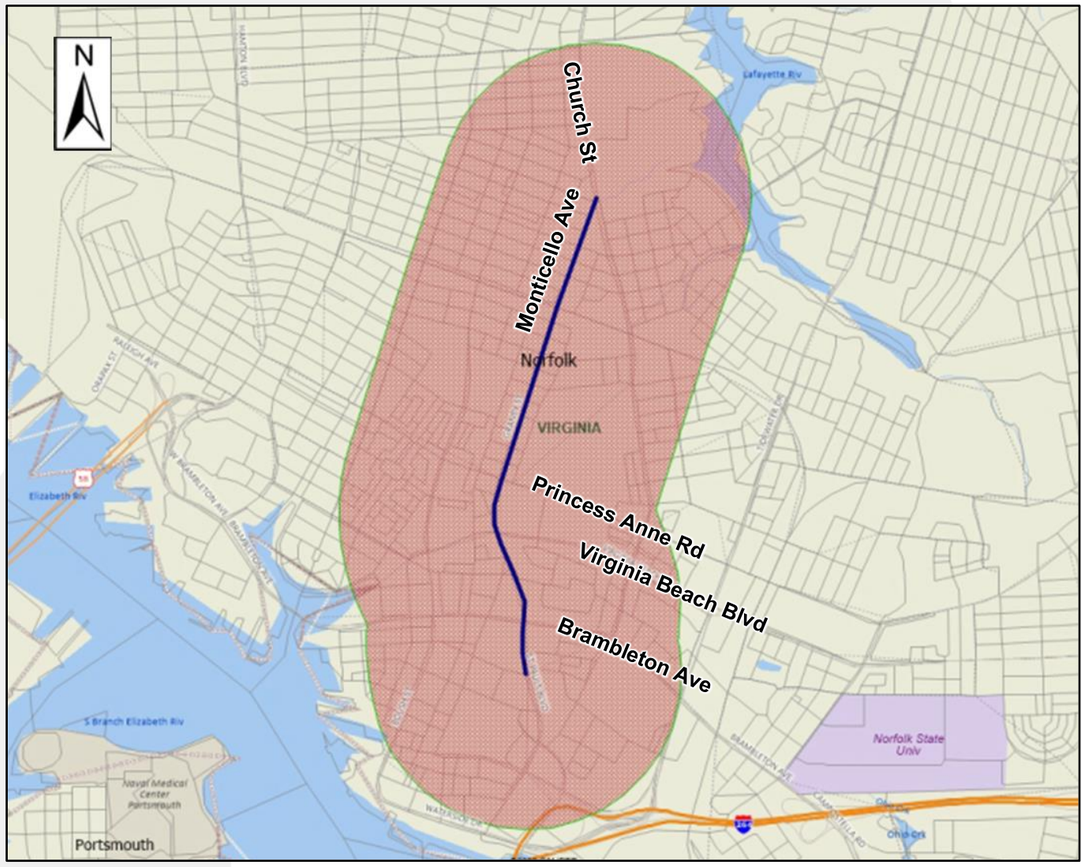


Figure 10: STEAP Analysis Study Area

The results show that 55% of the population within the study area is black, compared to 19% in Virginia. Overall, 64% of the study area population is minority, listing their racial status as a race other than white alone. Within the study area, 10% of the population is reported to have limited English proficiency, and 32% of the population is considered low-income or in poverty. Additionally, 22% of households do not own a vehicle and 12% of households report no internet connection. Based on this data, there are low-income and minority populations that should be considered when developing and screening transportation improvement concepts.

1.6 Detailed Needs Validation

The study team performed additional traffic operations, safety, and transit analyses to quantify the existing and anticipated needs in the study area. Results from these analyses were used as a baseline when comparing the conditions of proposed improvements to the existing and anticipated no-build conditions.

1.6.1 Existing Conditions Traffic Operations and Safety Analysis

The study team conducted a multifaceted analysis of the existing conditions in the study corridor, which included reviewing previous studies, conducting a safety analysis, conducting a preliminary field review, analyzing traffic operations using Synchro and SimTraffic, and reviewing pedestrian, bicycle, rail crossing, and transit activity. The results of the existing conditions analysis were presented to the Study Work Group during a Technical Team Workshop on July 26, 2023. The presentation is provided for reference in **Appendix C**.

Relevant Studies, Plans, and Projects

Information for the following studies, plans, and projects was collected and reviewed to identify previous or ongoing recommendations in and adjacent to the study area.

- Multimodal Transportation Master Plan (City of Norfolk)
  - Study corridor south of Princess Anne Road – bicycle/scooter, transit, and pedestrian emphasis
  - Study corridor north of Princess Anne Road – transit and pedestrian emphasis
- Midtown Plan (City of Norfolk)
  - Key Design Principle for Midtown Vision – reinforce and develop high quality pedestrian connectivity

- St. Paul's Area Transformation (City of Norfolk)
  - Transformation of area just south and east of study corridor (design and construction ongoing)
  - Removal of transit center traffic signal at St. Paul's Boulevard (just south of Charlotte Street) and installation of new traffic signal at new intersection with Freemason Street
- LED Street Light Conversion (City of Norfolk)
  - Segments of corridor slated for conversion between August 2023 and August 2024
- Pedestrian accommodations and Countdown Signals (City of Norfolk)
  - Monticello Avenue & Church Street – new pedestrian push buttons, countdown signal heads, and crosswalk markings
  - Monticello Avenue & 18th Street – new ADA ramps, pedestrian push buttons, countdown signal heads, and crosswalk markings

Safety Analysis

A safety analysis was conducted using crash data from the VDOT Crash Database over a five-year period (January 1, 2018 – December 31, 2022). In total, 392 crashes were reported in the study area with three fatalities, 133 injury crashes, and 256 PDO crashes. Most crashes in the study area were either angle (69%) or rear-end (16%) crashes. Summaries of crashes in the study area by severity and type are shown in **Table 2** and **Table 3**, respectively. **Appendix C** includes a detailed crash summary for the study area.

All intersection and roadway segments within the VDOT linear referencing system (LRS) are evaluated annually for the potential for safety improvement (PSI) based on the Highway Safety Manual (HSM) methodology by VDOT. The crash frequency, severity of crashes, volume, and length of segment are contributing factors in the predictive analysis. Crash predictions, based on the safety performance function (SPF) crash data files, are made for intersection and segments. The top 100 intersections and 100 miles of segments are published by VDOT for each district on an annual basis. VDOT also identifies Targeted Safety Need (TSN) locations, which are intersections or segments that have been identified as PSI locations for three or more of the last five years. The study team also identified "hot spots" based on crash history. Detailed intersection hot spot crash maps are shown in **Figure 11** through **Figure 15**.

Monticello Avenue from 26th Street to 21st Street is listed as a PSI segment at rank #19 for the Hampton Roads District. In VDOT's Pedestrian Safety Action plan, Monticello Avenue is listed in rank #2 for the top 1% of corridors needing pedestrian safety improvements.

Table 2: Study Area Crashes by Crash Severity

Intersection	# of Crashes – K	# of Crashes – A	# of Crashes – B	# of Crashes – C	# of Crashes – PDO	Total
Monticello Avenue & Church Street	0	0	1	0	4	**5**
Monticello Avenue & 29th Street	0	0	0	0	1	**1**
Monticello Avenue & 27th Street	0	0	11	1	23	**35**
Monticello Avenue & 26th Street	1	1	18	4	28	**52**
Monticello Avenue & 25th Street	0	3	24	3	35	**65**
Monticello Avenue & 21st Street	0	0	3	0	11	**14**
Monticello Avenue & 20th Street	0	1	2	2	9	**14**
Monticello Avenue & 19th Street	0	0	1	0	8	**9**
Monticello Avenue & 18th Street	0	0	1	0	15	**16**
Monticello Avenue & 17th Street	0	0	3	0	5	**8**
Monticello Avenue & 16th Street	0	0	0	0	6	**6**
Monticello Avenue & 14th Street	0	0	1	0	5	**6**
Monticello Avenue & 13th Street	0	0	2	0	2	**4**
Monticello Avenue & Princess Anne Road	0	1	7	3	9	**20**
Monticello Avenue & 11th Street	0	0	1	0	2	**3**
Monticello Avenue & 9th Street	1	0	0	0	0	**1**
Monticello Avenue & Virginia Beach Boulevard	0	1	5	1	19	**26**
Monticello Avenue & St. Paul's Boulevard	0	0	1	0	4	**5**
St. Paul's Boulevard & Olney Road	0	0	2	0	5	**7**
St. Paul's Boulevard & Brambleton Avenue	0	1	16	2	36	**55**
St. Paul's Boulevard & Bute Street	0	0	3	0	7	**10**
St. Paul's Boulevard & Charlotte Street/Wood Street	1	0	5	2	21	**29**
Rest of Corridor	0	0	1	0	1	**1**
Total	**3 (1%)**	**8 (2%)**	**107 (27%)**	**18 (5%)**	**256 (65%)**	**392**

Table 3: Study Area Crashes by Crash Type

Intersection	# of Crashes – Rear-End	# of Crashes – Angle	# of Crashes – Fixed Object-Off Road	# of Crashes – Sideswipe	# of Crashes – Pedestrian	# of Crashes – Other*	Total
Monticello Avenue & Church Street	4	0	0	0	0	1	**5**
Monticello Avenue & 29th Street	0	1	0	0	0	0	**1**
Monticello Avenue & 27th Street	2	32	0	0	0	1	**35**
Monticello Avenue & 26th Street	1	49	0	0	0	2	**52**
Monticello Avenue & 25th Street	2	60	1	1	0	1	**65**
Monticello Avenue & 21st Street	2	5	4	1	0	2	**14**
Monticello Avenue & 20th Street	2	10	1	1	0	0	**14**
Monticello Avenue & 19th Street	1	6	0	1	0	1	**9**
Monticello Avenue & 18th Street	3	11	0	0	0	2	**16**
Monticello Avenue & 17th Street	3	4	0	1	0	0	**8**
Monticello Avenue & 16th Street	0	6	0	0	0	0	**6**
Monticello Avenue & 14th Street	3	3	0	0	0	0	**6**
Monticello Avenue & 13th Street	0	2	0	2	0	0	**4**
Monticello Avenue & Princess Anne Road	6	12	0	0	1	1	**20**
Monticello Avenue & 11th Street	1	1	0	0	1	0	**3**
Monticello Avenue & 9th Street	0	0	0	0	1	0	**1**
Monticello Avenue & Virginia Beach Boulevard	4	10	3	3	1	5	**26**
Monticello Avenue & St. Paul's Boulevard	4	1	0	0	0	0	**5**
St. Paul's Boulevard & Olney Road	2	3	0	2	0	0	**7**
St. Paul's Boulevard & Brambleton Avenue	15	29	6	1	2	2	**55**
St. Paul's Boulevard & Bute Street	3	7	0	0	0	0	**10**
St. Paul's Boulevard & Charlotte Street/Wood Street	5	19	1	1	1	2	**29**
Rest of Corridor	4	0	0	0	0	1	**1**
Total	**63 (16%)**	**271 (69%)**	**16 (5%)**	**14 (4%)**	**7 (2%)**	**14 (4%)**	**392**

**Other includes Head On, Fixed Object in Road, Non-Collision, and Bicyclist collisions*

In addition, the Monticello Avenue intersections with 27th Street and 26th Street are ranked #123 and #55 on the district PSI intersection list, respectfully. The 26th Street and 27th Street corridors are one-way pairs operating as key minor arterials serving heavy east-west traffic movements in southwest Norfolk. These intersections account for more than 22% of the total collisions within the study area. More than 90% of the collisions at these intersections are angle crashes, primarily caused by red light running.

More than 15% of the crashes in the study corridor (65 crashes) occurred at the intersection of Monticello Avenue and 25th Street. Of these, 92% were angle collisions that were primarily attributed to vehicles attempting to travel eastbound and westbound across Monticello Avenue despite current signs restricting the eastbound and westbound approaches to right-turn only from 8 AM to 7 PM on weekdays. Additionally, this intersection is a part of the #19 PSI District Segment.

The study team identified the intersection of St. Paul's Boulevard and Brambleton Avenue intersection as a crash hot spot with a total of 55 crashes. Of these, 29 (53%) were angle crashes, a significant portion of which involved red light running. Additionally, there were 15 rear-end collisions which occurred on all approaches.

Another hot spot was identified at the intersection of St. Paul's Boulevard and Charlotte Street / Wood Street, which experienced a total of 29 crashes. There were 19 angle crashes (66%) at this intersection, and many occurred during the permissive northbound left-turn movement. Red light running was also a significant contributing factor. There was one pedestrian fatality at this intersection involving a hit and run with the vehicle heading in the southbound direction.

Figure 11: Monticello Avenue and 25th Street Crash Map

Figure 12: Monticello Avenue and 26th Street Crash Map

Figure 13: Monticello Avenue and 27th Street Crash Map

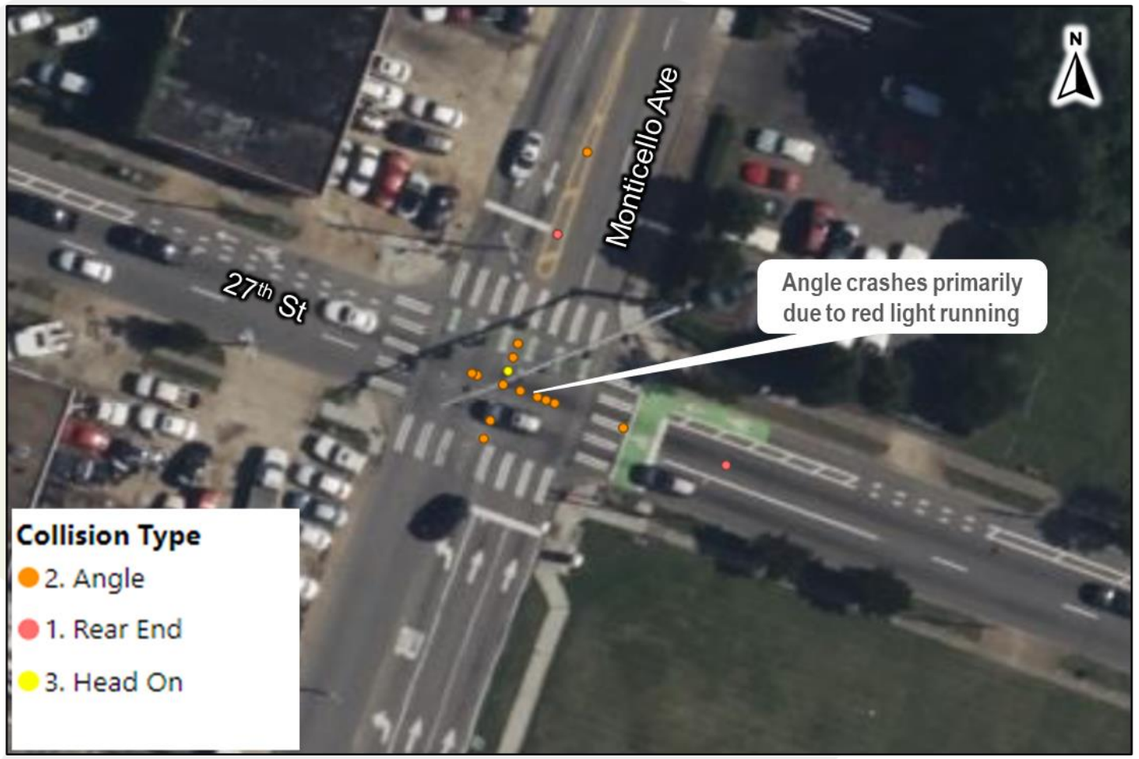


Figure 14: St. Paul's Boulevard and Brambleton Avenue Crash Map

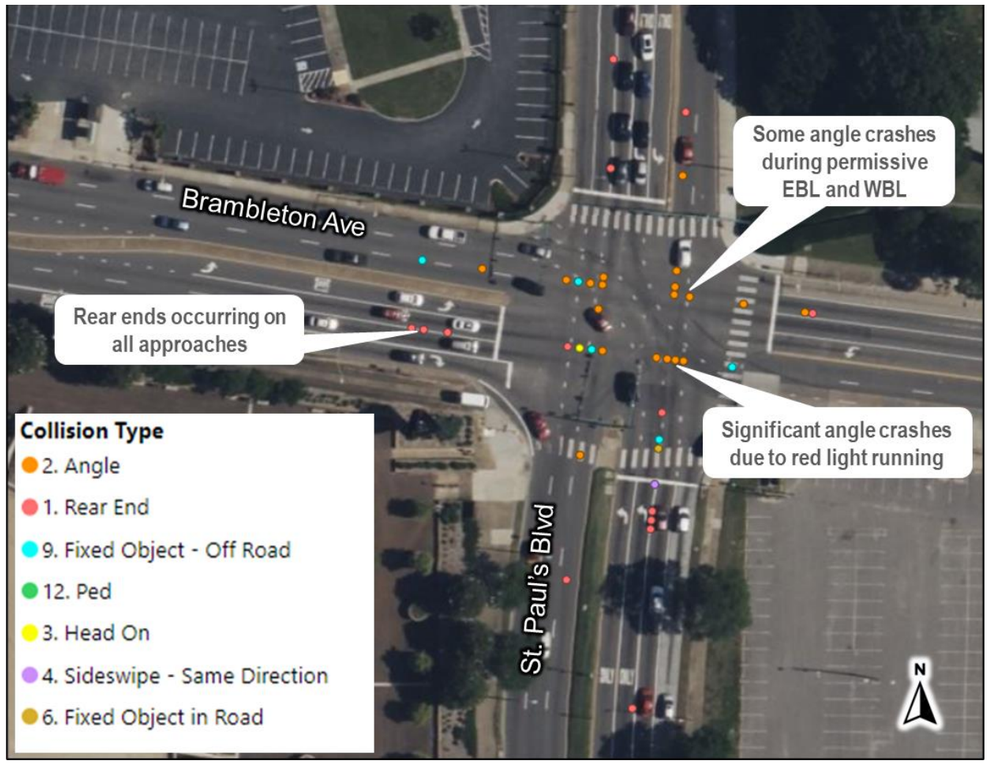
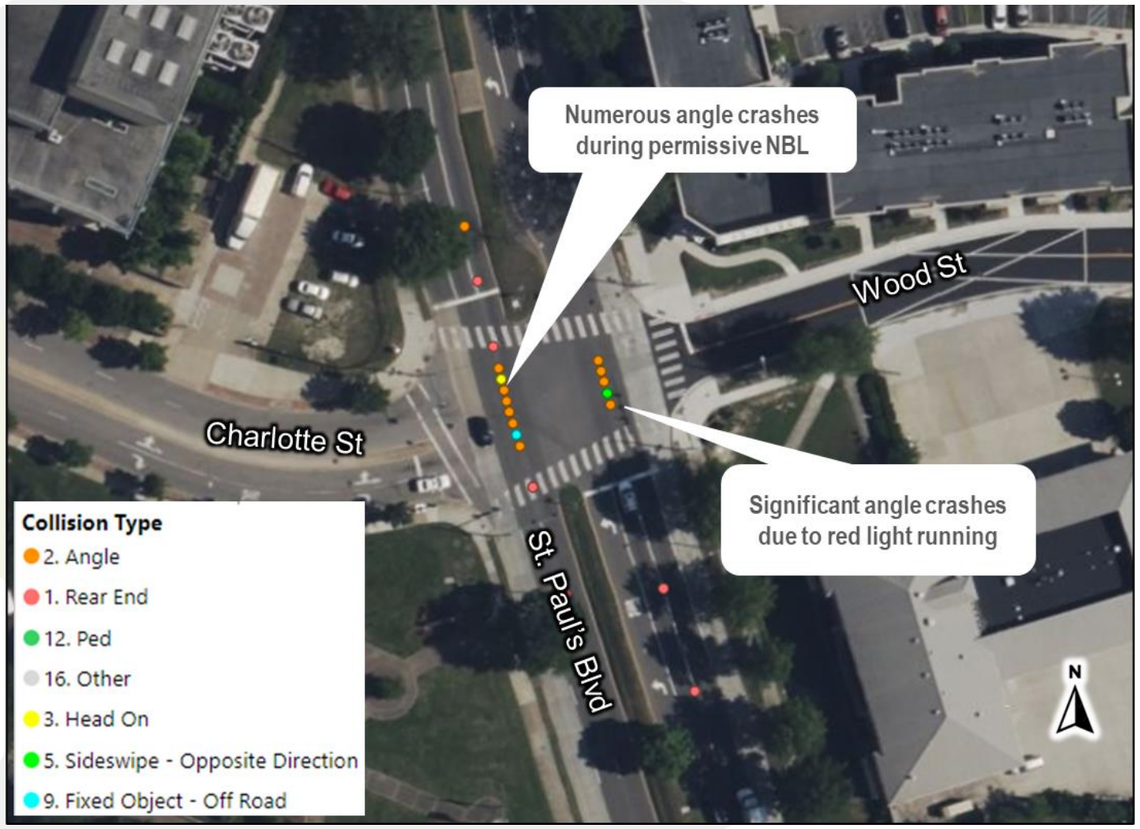


Figure 15: St. Paul's Boulevard and Charlotte Street / Wood Street Crash Map



Field Review Observations

A preliminary field review of the study area was conducted on Tuesday, June 6, 2023 and Wednesday, June 7, 2023 to verify existing conditions, confirm traffic control devices and lane configurations, and observe peak hour traffic conditions and driver behavior. The following observations were made during the field review.

Monticello Avenue at 27th Street

- The northbound left-turn queue was observed to extend beyond its storage during the PM peak period, but the lagging protected left-turn phase was observed to clear all queued vehicles.

Monticello Avenue at 25th Street

- Motorists did not obey signs restricting vehicles from turning left or traveling through from eastbound or westbound 25th Street. This frequently resulted in vehicles making unsafe turns using minimal gaps, causing mainline traffic to brake to avoid collisions.

Monticello Avenue at 19th Street

- The southbound left-turn lane is used by vehicles turning into the midblock Onelife Fitness driveway, which creates additional congestion in the middle of the block rather than queuing vehicles at the intersection. The southbound left-turn queue did at times exceed available storage, extending into the northbound left-turn lane at 20th Street.

Monticello Avenue at Norfolk Southern Railroad Underpass

- The study team observed a train blocking the at-grade crossings at Church Street and Granby Street for approximately one hour during the AM peak period. This substantially impacted operations along the northern end of the corridor, resulting in northbound congestion on Church Street as well as much longer delays and queues on side street approaches at both signalized and unsignalized intersections.

General Observations

- Minor congestion and queuing observed during AM and PM peak periods at signalized intersections with Princess Anne Road, Virginia Beach Boulevard, Brambleton Avenue, and Charlotte Street.
- Significant southbound congestion observed during PM peak period propagating from I-264 ramp intersections south of the study corridor with queues extending up to Brambleton Avenue in the inside lane.

Bicycle and Pedestrian Needs

The study team reviewed existing pedestrian accommodations within the study area during field observations. **Figure 16** shows several observed pedestrian facility deficiencies evident in the corridor. **Figure 17** and **Figure 18** provide a graphical representation of pedestrian and bicycle access and safety needs in the study area.

Figure 16: Existing Pedestrian Conditions

Figure 17: Pedestrian and Bicycle Access and Safety Needs Summary (1)

Figure 18: Pedestrian and Bicycle Access and Safety Needs Summary (2)

Transit Data Analysis

HRT provided 2019 and 2023 boarding and alighting activity data for the HRT bus stops along the study corridor, which is summarized in **Table 4**. Stops with higher activity levels are identified in **bold** font. Bus shelters are currently in place for bus stops on the northbound side with the highest activity. However, the southbound bus stops at 19th Street and Princess Anne Road have been identified by HRT as not having sufficient right-of-way for a bus shelter. A bench is planned for the southbound stops at 25th Street and Princess Anne Road.

Table 4: HRT Bus Stop Boarding and Alighting Activity Data

Stop ID	Stop Description	Direction	2019 Boarding	2019 Alighting	2019 Activity	2023 Boarding	2023 Alighting	2023 Activity
0003	St. Paul's & Charlotte	SB	1.4	27.0	28.4	0.1	5.5	5.6
0013	**Monticello & Princess Anne**	**NB**	**106.8**	**27.2**	**134.0**	**54.8**	**8.4**	**63.2**
0015	**Monticello & 18th Street**	**NB**	**168.4**	**97.4**	**265.8**	**81.7**	**40.0**	**121.7**
0018	Monticello & 29th Street	NB	13.9	17.9	31.8	5.3	7.9	13.2
0186	Monticello & 29th Street	SB	14.7	19.5	34.2	4.0	10.1	14.1
0188	**Monticello & 25th Street**	**SB**	**62.4**	**59.6**	**122.0**	**25.3**	**34.4**	**59.7**
0189	**Monticello & 19th Street**	**SB**	**76.8**	**120.6**	**197.4**	**36.5**	**86.6**	**123.1**
0191	Monticello & 15th Street	SB	1.4	3.2	4.6	1.4	6.1	7.5
0192	**Monticello & Princess Anne**	**SB**	**24.1**	**95.9**	**120.0**	**8.2**	**45.2**	**53.4**

Rail Crossing Data Analysis

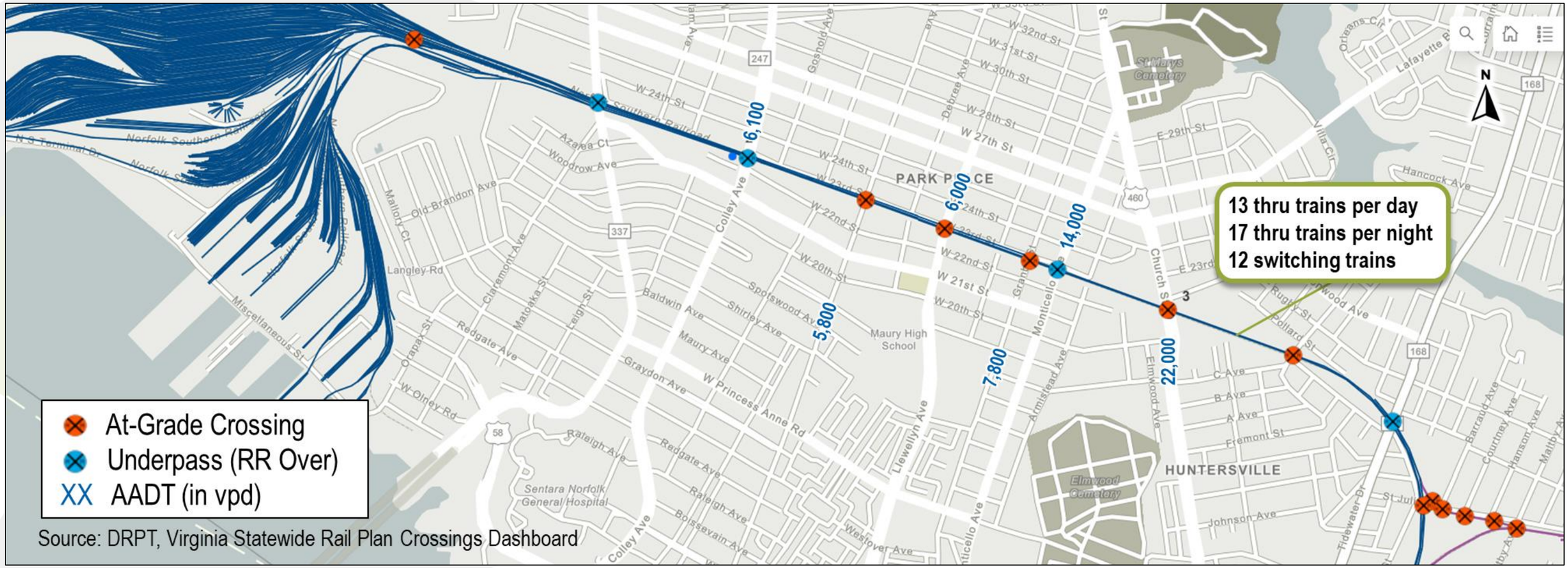
There is frequent congestion at the northern end of the corridor due to train crossings at the Monticello Avenue underpass just north of 22nd Street. This grade separated crossing is operated by Norfolk Southern Railroad and serves the Lambert's Point Yard located approximately one mile to the west. At-grade crossings occur at the adjacent parallel roadways of Church Street, Granby Street, Llewellyn Avenue, and Colonial Avenue. **Figure 19** illustrates the crossing locations and the annual average daily traffic (AADT) volume on each facility based on VDOT data.

As shown, Monticello Avenue carries an AADT volume of 14,000 vehicles per day (vpd) near the rail crossing while Church Street carries an AADT volume of 22,000 vpd, or nearly 60% more traffic than Monticello Avenue. Due to the at-grade crossing on Church Street with approximately 30 daily trains, the traffic from this higher volume roadway typically diverts to Monticello Avenue, causing congestion during the frequent train crossing events. In addition, **Table 5** summarizes available data from the Federal Railroad Administration (FRA) blocked crossings database. The incidents reported in the database can be reported by first responders, the traveling public, or other stakeholders, and do not necessarily provide a representative sample. However, based on the available data, reports of blocked crossings near the study area have increased, with nearly as many reports in the first three months of 2023 as in all of 2022.

Table 5: FRA Blocked Crossings Data

Crossing	2021	2022	2023 (Jan-Mar)	Total
Colonial Avenue	11	18	16	45
Llewellyn Avenue	4	7	8	19
Granby Street	1	11	5	17
Church Street	6	13	8	27
Total	**22**	**49**	**37**	**108**

Figure 19: Norfolk Southern Rail Crossings



1.6.2 Synchro and SimTraffic Analysis

The study team conducted a traffic operations analysis to evaluate the overall performance of the study corridor under existing (2023) AM and PM peak hour conditions. Existing conditions were modeled using Synchro 11 and SimTraffic 11.

The existing AM and PM Synchro models were developed based on the existing roadway geometry and collected traffic count data. In addition, due to the coordinated traffic signal network near the study area, adjacent traffic signals were included in the Synchro models using data available from a recently completed City of Norfolk Citywide Signal Retiming project. Inputs and analysis methodologies were consistent with the VDOT *Traffic Operations and Safety Analysis Manual (TOSAM),* Version 2.0. SimTraffic analysis results and the corresponding Calibration Memo will be incorporated in a future submittal.

Existing speed limits, lane configurations, and storage lengths are shown in **Figure 20**, **Figure 21**, and **Figure 22**.

Traffic Data

Vehicular turning movement, pedestrian, and bicycle count data was collected at the 24 study intersections on Tuesday, May 23, 2023; Wednesday, May 24, 2023, Tuesday, May 30, 2023, and Wednesday July 19, 2023. Twelve-hour collection periods were performed for signalized intersections while eight-hour collection periods were performed for the unsignalized intersections. **Appendix C** includes the raw collected data. The AM and PM peak hours were determined to be 7:45 AM to 8:45 AM and 4:30 PM to 5:30 PM.

Due to traffic data being collected on different days and some counts being affected by train crossings and cruise traffic, volume balancing was required. The study team balanced up when balancing traffic volumes. Due to some differences between travel patterns for intersections collected on different days, in some cases, volumes differed between intersections by more than 10%. The resulting balanced volumes were used as the existing volumes that form the basis of this study and are shown **Figure 23**, **Figure 24**, and **Figure 25**. Heavy vehicle percentages and peak hour factors are shown in **Figure 25**, **Figure 27**, and **Figure 28**.

Level of Service (LOS) Criteria

The intersection Level of Service (LOS) is a qualitative measure that describes a driver's perception of the operating conditions. LOS ratings range from A to F. LOS A indicates little or no congestion, and LOS F indicates severe congestion, unstable traffic flow, and/or stop-and-go conditions.

Table 6 summarizes the LOS corresponding to the delay at unsignalized and signalized intersections as specified in the HCM. The delay criteria for LOS differs slightly for unsignalized and signalized intersections due to driver expectations and behavior. For signalized intersections, LOS is calculated as the lost travel time caused by vehicles waiting at a traffic signal. For unsignalized intersections, LOS is calculated by determining the number of gaps that are available in the conflicting traffic stream, since the LOS analysis assumes that the traffic on the mainline is not affected by the traffic on the side street.

Table 6: Level of Service Criteria

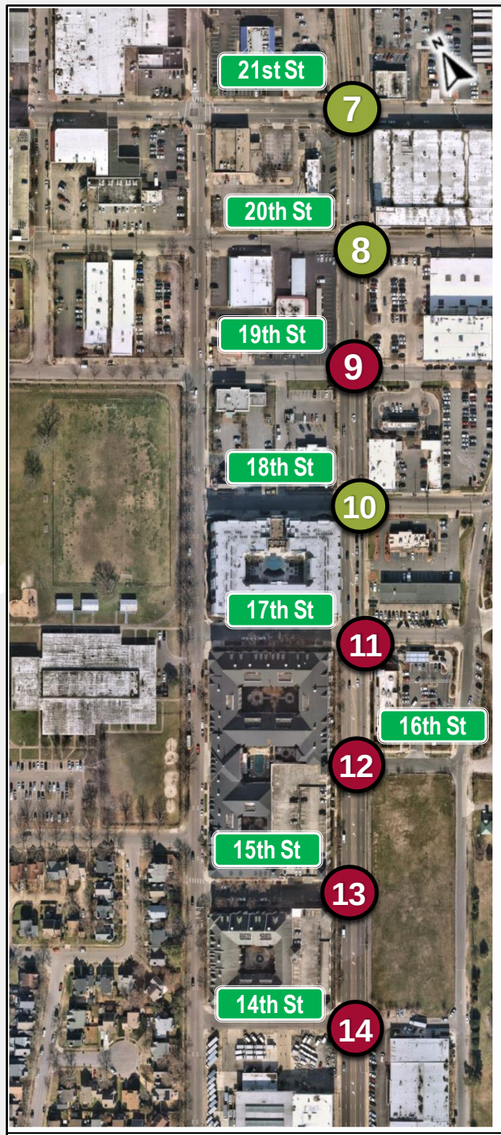
Level of Service	Control Delay (seconds/vehicle) - Signalized Intersection	Control Delay (seconds/vehicle) - Unsignalized Intersection
A	≤ 10.0	≤ 10.0
B	> 10.0 to 20.0	> 10.0 to 15.0
C	> 20.0 to 35.0	> 15.0 to 25.0
D	> 35.0 to 55.0	> 25.0 to 35.0
E	> 55.0 to 80.0	> 35.0 to 50.0
F	≥ 80.0	≥ 50.0

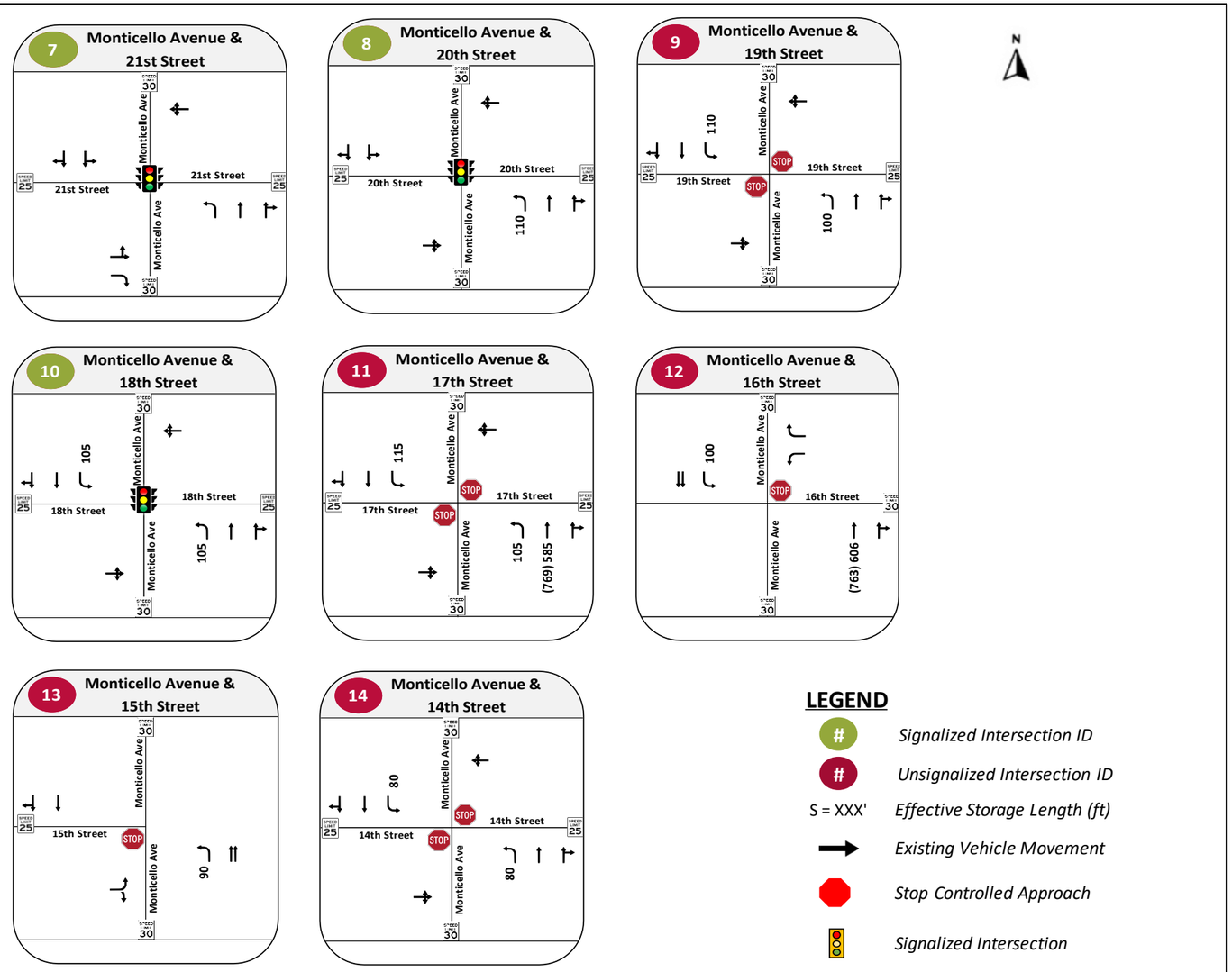
Figure 20: Existing Lane Configurations and Speed Limits (1)

HR-06 Monticello Avenue/St Pauls Boulevard

PROJECT PIPELINE

Figure 21: Existing Lane Configurations and Speed Limits (2)

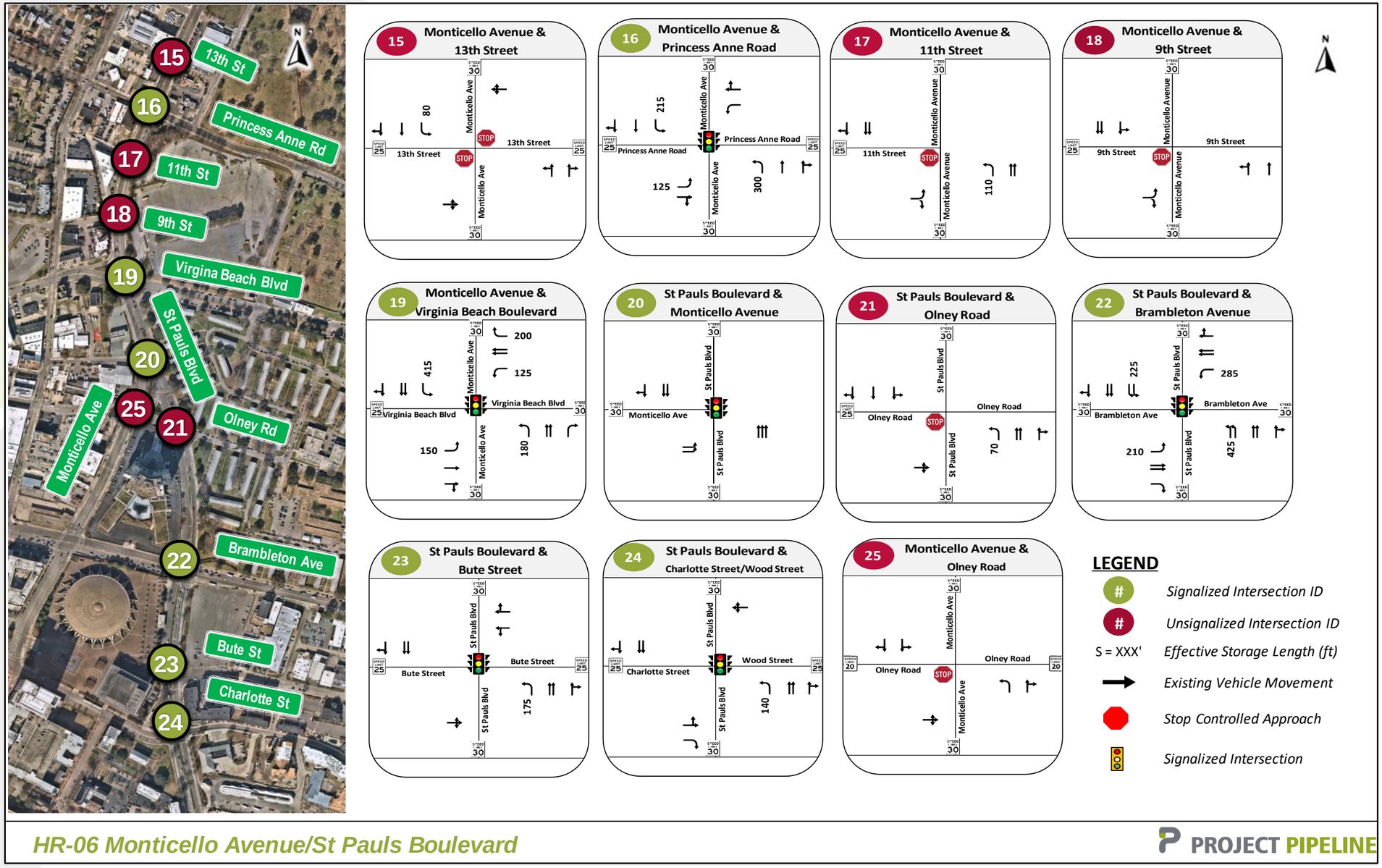




HR-06 Monticello Avenue/St Pauls Boulevard

PROJECT PIPELINE

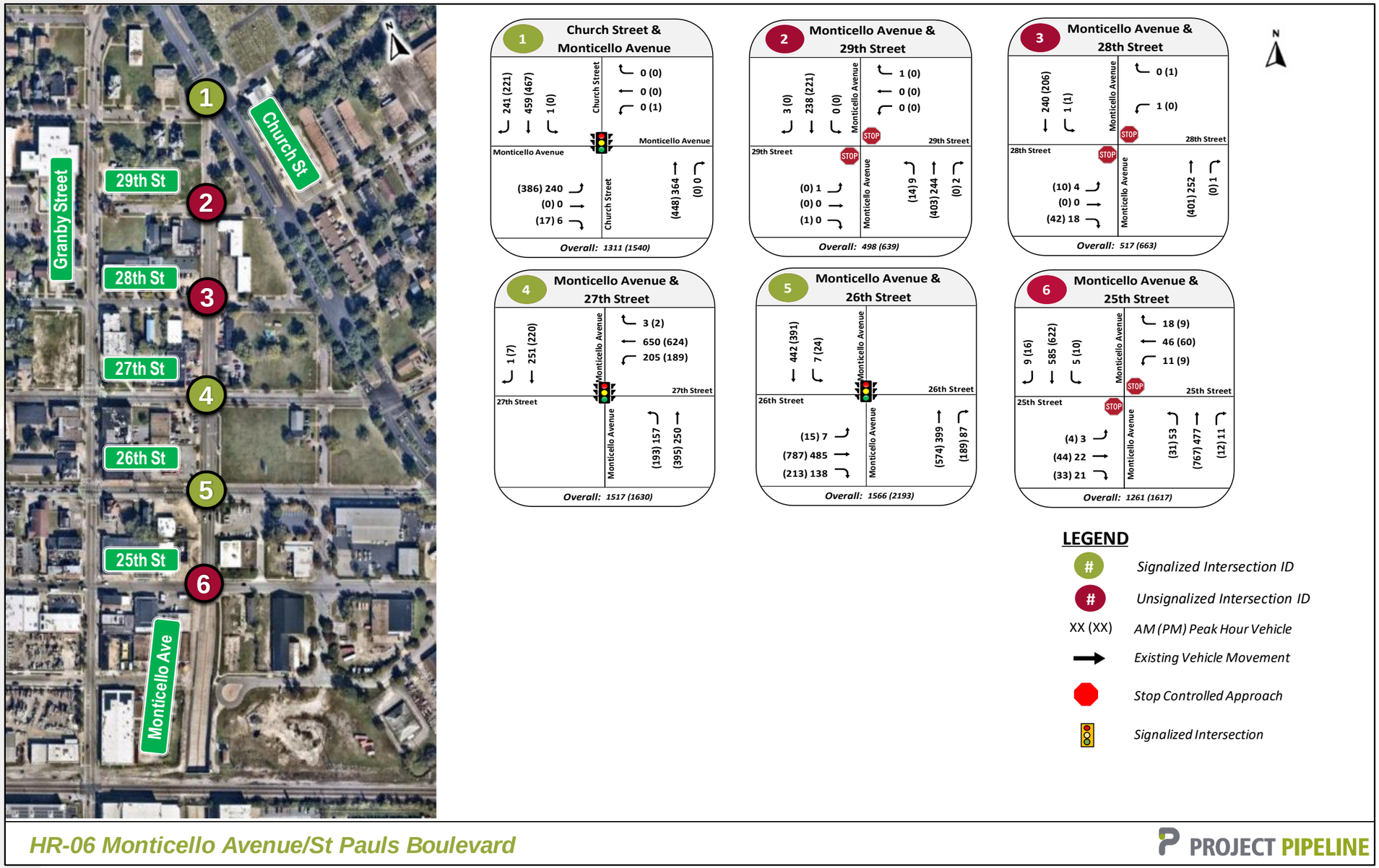
Figure 22: Existing Lane Configurations and Speed Limits (3)



HR-06 Monticello Avenue/St Pauls Boulevard

PROJECT PIPELINE

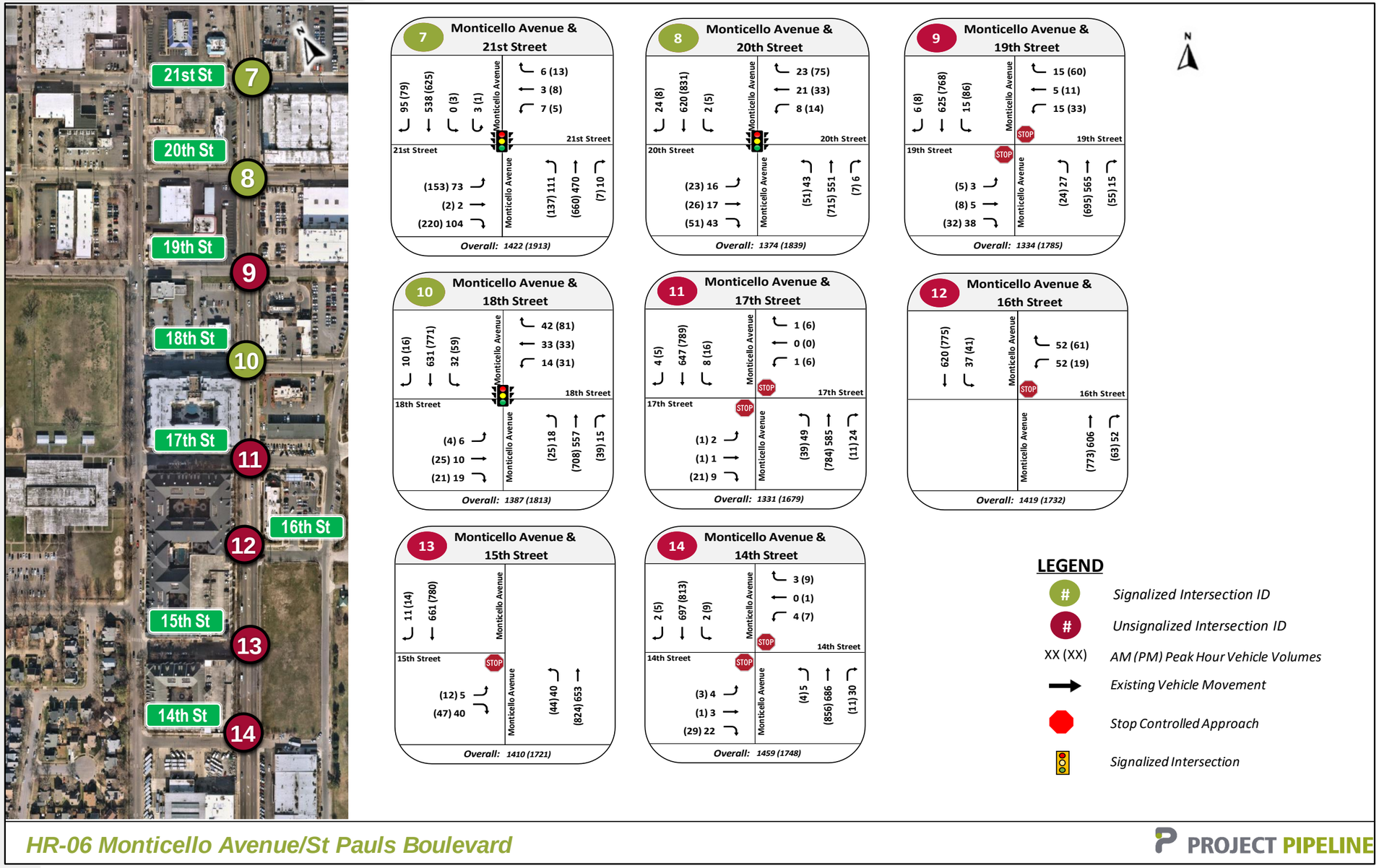
Figure 23: 2023 Existing Peak Hour Volumes (1)



HR-06 Monticello Avenue/St Pauls Boulevard

PROJECT PIPELINE

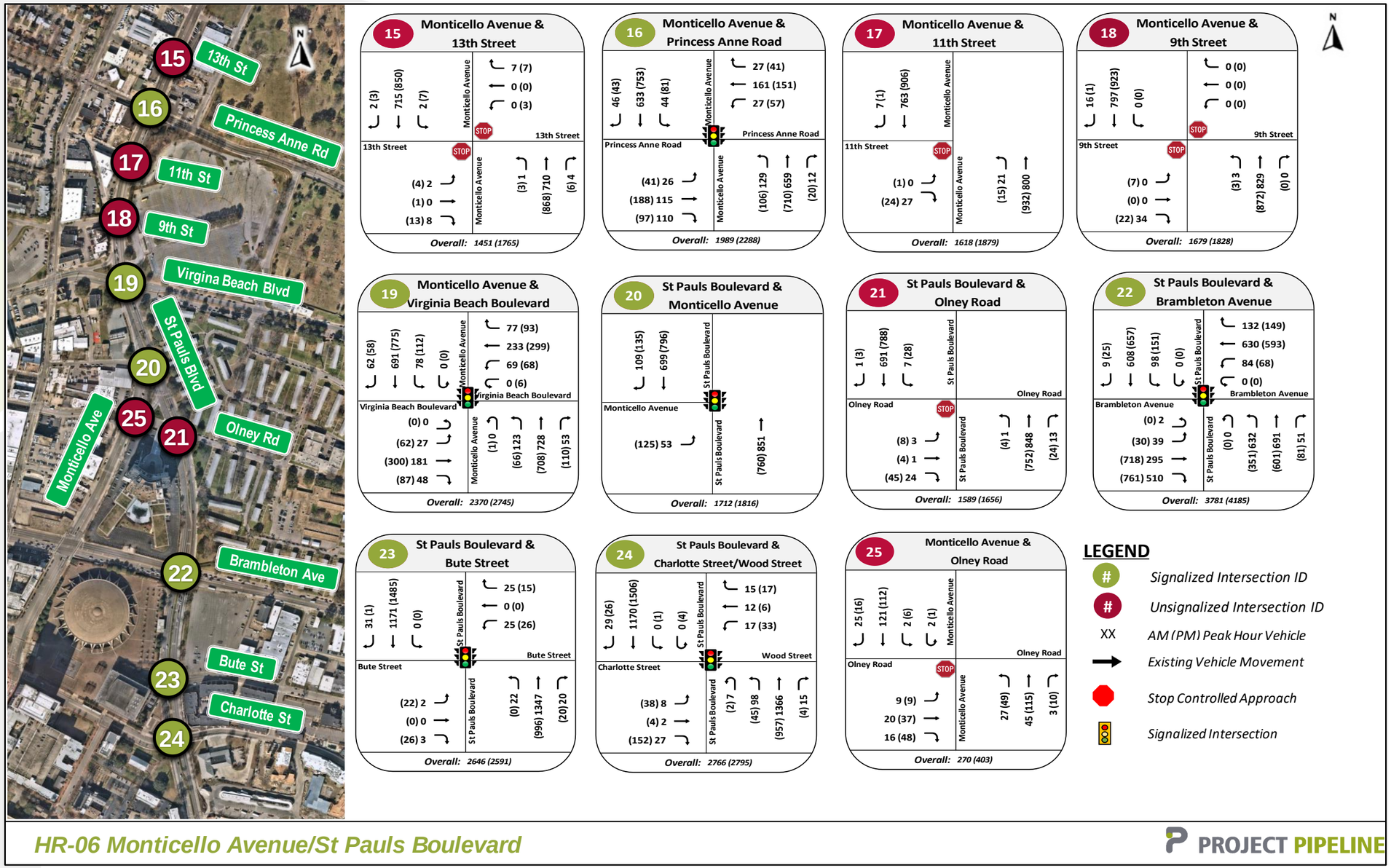
Figure 24: 2023 Existing Peak Hour Volumes (2)



HR-06 Monticello Avenue/St Pauls Boulevard

PROJECT PIPELINE

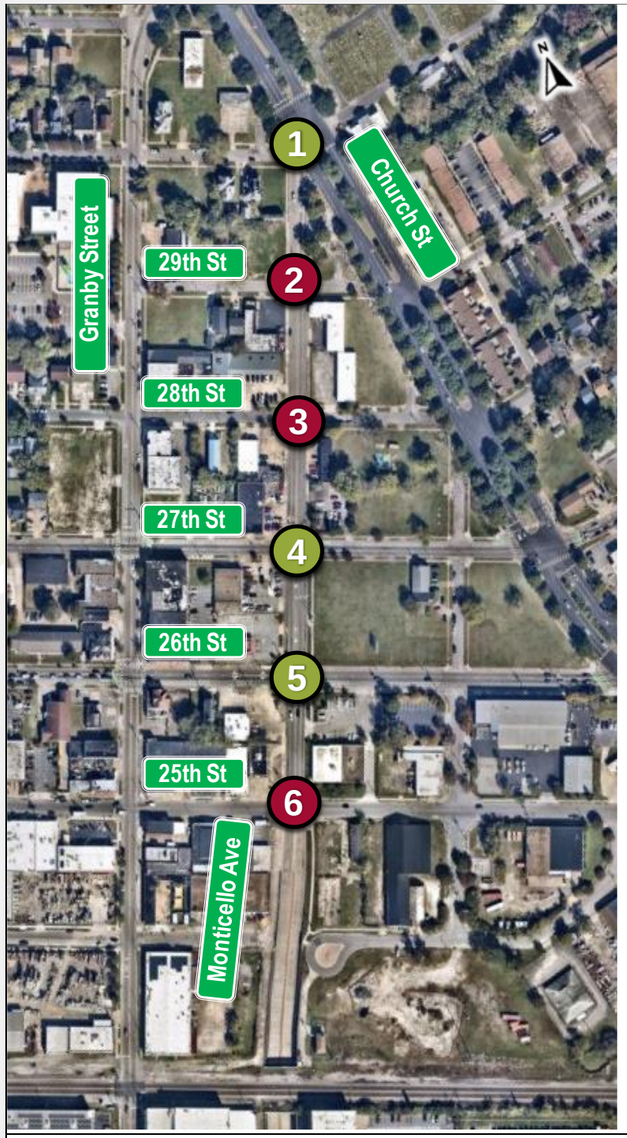
Figure 25: 2023 Existing Peak Hour Volumes (3)

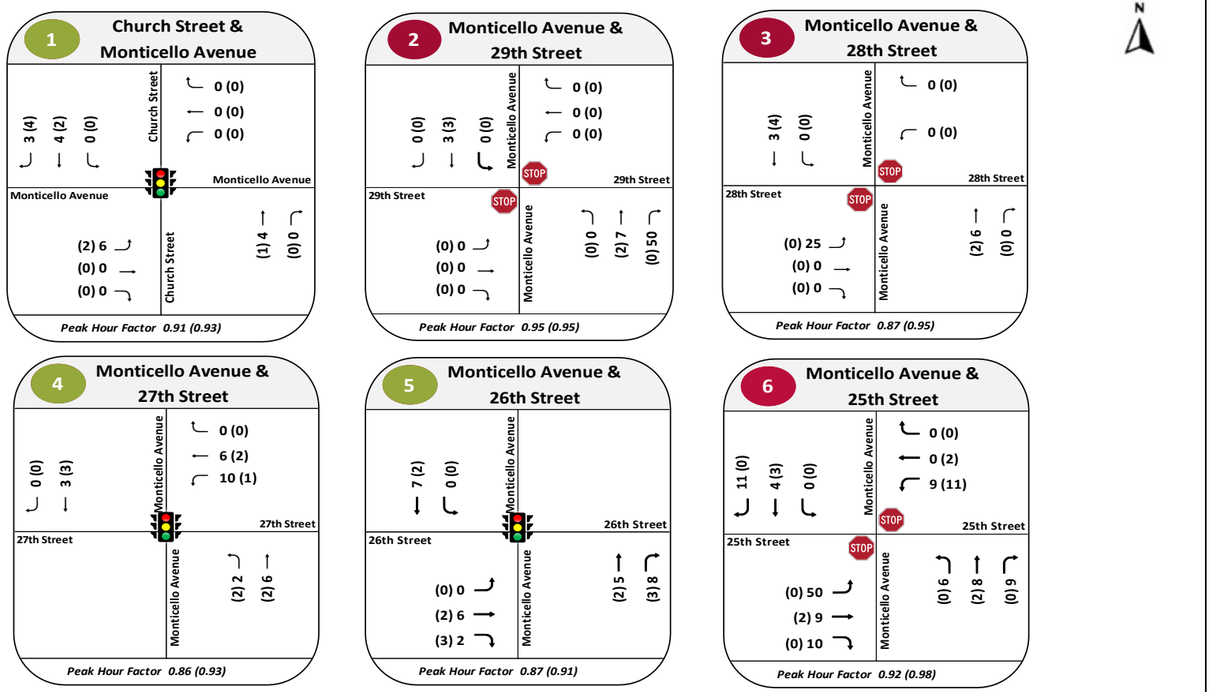


HR-06 Monticello Avenue/St Pauls Boulevard

PROJECT PIPELINE

Figure 26: 2023 Existing Heavy Vehicle Percentages and Peak Hour Factors (1)





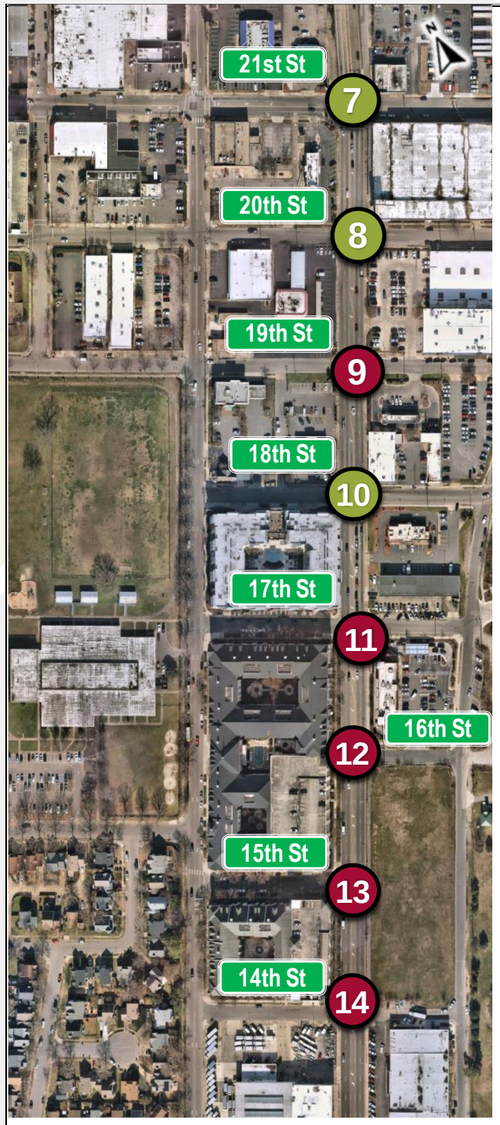
LEGEND

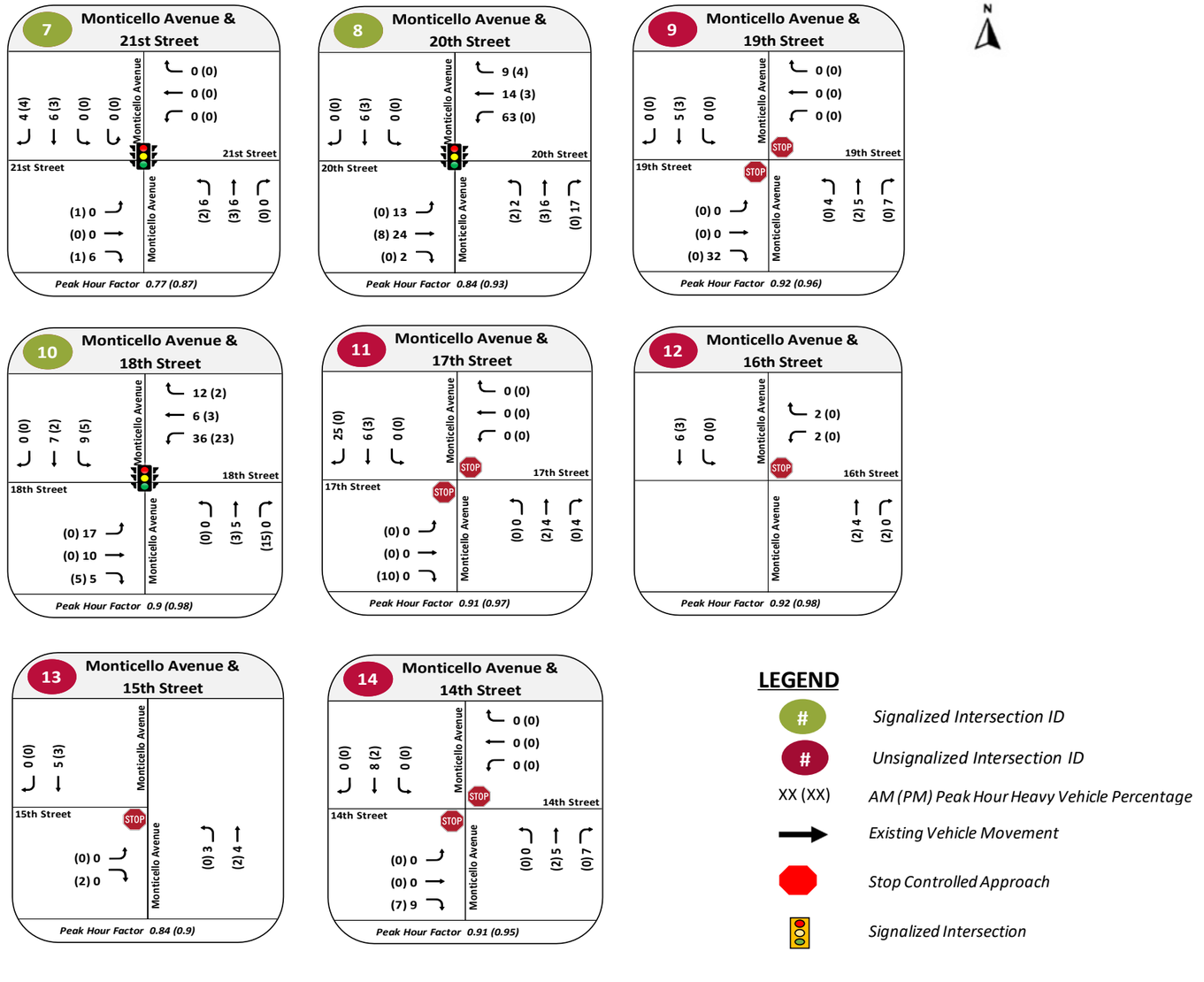
- # — *Signalized Intersection ID*
- # — *Unsignalized Intersection ID*
- XX (XX) — *AM (PM) Peak Hour Heavy Vehicle Percentage*
- *Existing Vehicle Movement*
- *Stop Controlled Approach*
- *Signalized Intersection*

HR-06 Monticello Avenue/St Pauls Boulevard

PROJECT PIPELINE

Figure 27: 2023 Existing Heavy Vehicle Percentages and Peak Hour Factors (2)

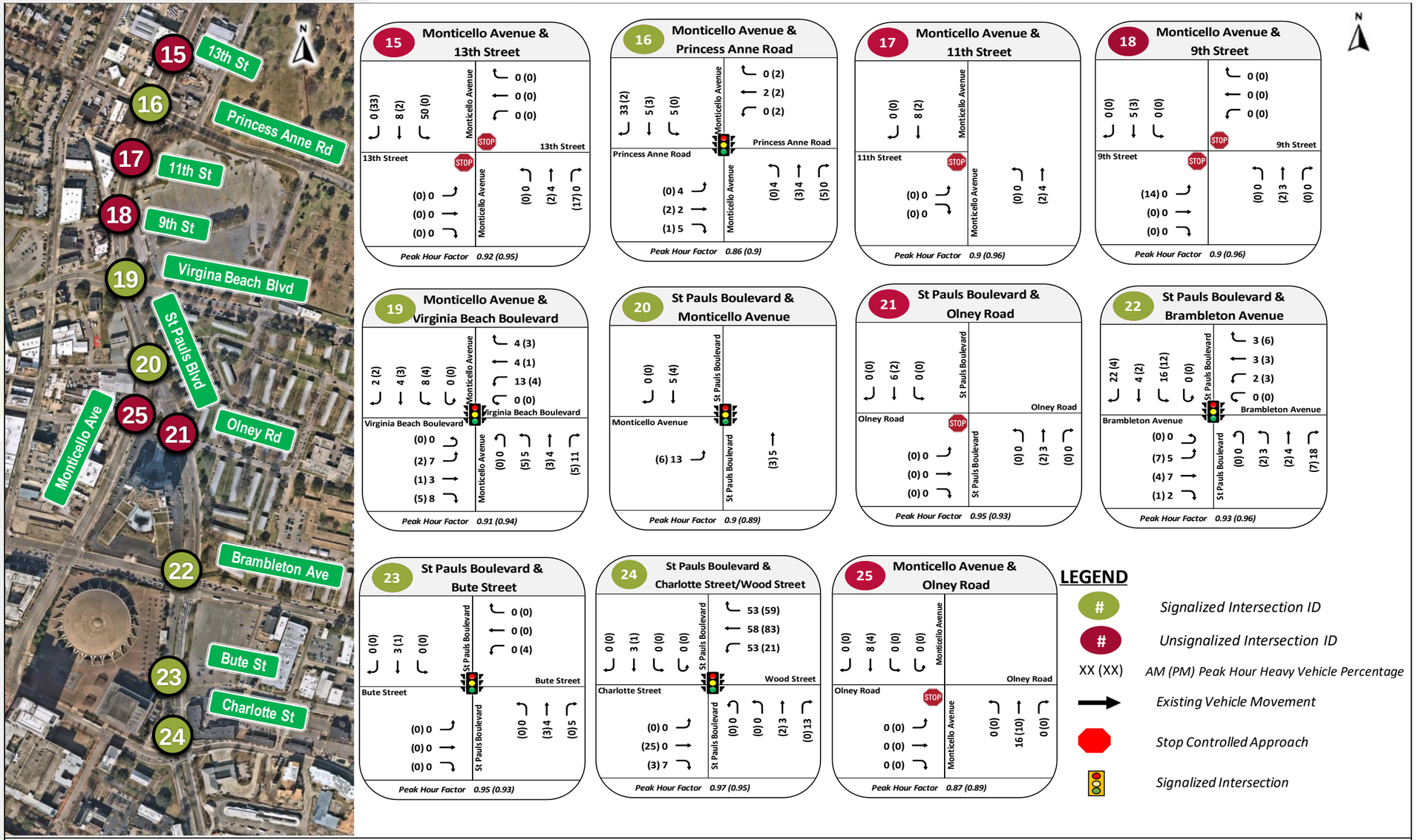




HR-06 Monticello Avenue/St Pauls Boulevard

PROJECT PIPELINE

Figure 28: 2023 Existing Heavy Vehicle Percentages and Peak Hour Factors (3)



HR-06 Monticello Avenue/St Pauls Boulevard

PROJECT PIPELINE

Traffic Analysis Results

Due to the previously noted differences in overall observed traffic operations along the Monticello Avenue and St. Paul's Boulevard within the study area, different measures of effectiveness were selected for these two segments. Control delay (seconds per vehicle) and 95th percentile queue lengths were used for the segment on Monticello Avenue. For the segment on St. Paul's Boulevard, control delay (seconds per vehicle) and maximum queue length (feet) from SimTraffic were selected as measures of effectiveness to quantitatively report the performance at each study intersection. The Highway Capacity Manual (HCM) 2000 methodology was selected to analyze the twelve signalized intersections and twelve unsignalized intersections in the study area.

Ten simulations were completed for both the AM and PM SimTraffic models. Synchro results for the existing condition models and additional analysis details are included in **Table 7**. The Synchro 95th percentile queue and SimTraffic maximum queue lengths for the existing conditions models are included in **Table 8**.

Under existing conditions, almost all signalized intersections operate at an overall LOS C or better during both peak hours, except for St. Paul's Boulevard and Brambleton Avenue, which operates just over the LOS D threshold during the AM peak hour. Almost all unsignalized approaches operate at LOS C or better except for the eastbound and westbound 25th Street approaches that operate at LOS D and LOS F, respectively, during the PM peak hour, which caused by vehicles not abiding by the left-turn restriction in effect during the time periods analyzed. Specific movements at the study intersections also experience significant queuing during both peak periods.

The following trends were observed under existing conditions.

AM Peak Hour

- The highest signalized approach delay occurred on the eastbound approach at the 21st Street at Monticello Avenue intersection (71.4 seconds).
- The highest unsignalized minor street delay occurred on the westbound approach of the 25th Street at Monticello Avenue (30.8 seconds) intersection, which was due to vehicles not abiding by the "right-turn only" restriction.
- The northbound shared through/right-turn lane queues at the 26th Street at Monticello Avenue intersection extend 191 feet, which almost reaches 25th Street.
- The longest queue at the Virginia Beach Boulevard at Monticello Avenue intersection occurred on the northbound approach (346 feet).
- The northbound left-turn queues at the Brambleton Avenue at St. Paul's Boulevard intersection extend 368 feet, almost exceeding the available storage length.

PM Peak Hour

- The highest signalized approach delay occurred on the eastbound approach at the Monticello Avenue at Church Street intersection (56.6 seconds).
- The highest unsignalized minor street delay occurred on the westbound approach of the 25th Street at Monticello Avenue (49.1 seconds) intersection, which was due to vehicles not abiding by the "right-turn only" restriction.
- The northbound shared through/right-turn lane queues at the 26th Street at Monticello Avenue intersection extend 340 feet, extending past 25th Street.
- The longest queue at the Princess Anne Road at Monticello Avenue intersection occurred on the southbound approach (387 feet).
- Southbound queues along St. Paul's Boulevard propagate upstream from the I-264 ramps south of the study area at the St. Paul's Boulevard and City Hall Avenue and Market Street intersections. This impact is evident in the reported queue lengths for the southbound through movements at Brambleton Avenue (359 feet), Bute Street (364 feet), Charlotte Street / Wood Street (301 feet).

1.6.3 Phase 1 Public Outreach

The Phase 1 Public Input survey was open from September 6, 2023 to September 20, 2023 to collect feedback on existing traffic, safety, transit, and bicycle and pedestrian issues within the study area. The online survey had 362 participates with 651 comments. Participants ranked pedestrian safety and accessibility, reduced traffic congestion, and corridor safety/intersection safety as the three most important issues in the study area. Insufficient/missing crosswalks and pedestrian signal timings and speeding/aggressive driving were identified as the greatest safety concerns. Detailed results from the Phase 1 public outreach are in **Appendix C**.

Common themes among written comments included the following:

- Review intersection alignments and traffic signal timings
- Bike lanes (for and against)
- Flooding and drainage issues exist within the study area
- Desire for streetscape improvements
- Access management issues
- Need enforcement for red light running
- Need additional crosswalks at multiple intersections

Table 7: 2023 Existing Conditions Peak Hour Control Delay and LOS

Intersection Number and Description		Type of Control	Lane Group	Eastbound				Westbound				Northbound				Southbound				Overall	
				AM		PM		AM		PM		AM		PM		AM		PM			
				Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	AM	PM
1	Monticello Avenue at Church Street			Monticello Avenue				Cemetery				Church Street				Church Street				Intersection	
		Signalized	Left	52.0	D	57.8	E	0.0	A	46.8	A					3.4	A	0.0	A	Delay	Delay
			Through									6.3	A	2.5	A	3.6	A	2.7	A	12.8	16.4
			Right	28.7	C	30.4	C									0.5	A	0.4	A	LOS	LOS
			Approach	51.4	D	56.6	E	0.0	A	46.8	D	6.3	A	2.5	A	2.5	A	2.0	A	B	B
2	29th Street at Monticello Avenue			29th Street				29th Street				Monticello Avenue				Monticello Avenue				Intersection	
		Unsignalized	Left	11.5	B	8.9	A	8.9	A	0.0	A	0.6	A	0.6	A	0.0	A	0.0	A	Delay	Delay
			Through									0.0	A	0.0	A	0.0	A	0.0	A	-	-
			Right																	LOS	LOS
			Approach	11.5	B	8.9	A	8.9	A	0.0	A	0.3	A	0.3	A	0.0	A	0.0	A	-	-
3	28th Street at Monticello Avenue			28th Street				28th Street				Monticello Avenue				Monticello Avenue				Intersection	
		Unsignalized	Left	9.6	A	9.5	A	11.5	B	13.5	B	0.0	A	0.0	A	0.1	A	0.1	A	Delay	Delay
			Through									0.0	A	0.0	A	0.0	A	0.0	A	-	-
			Right																	LOS	LOS
			Approach	9.6	A	9.5	A	11.5	B	13.5	B	0.0	A	0.0	A	0.0	A	0.0	A	-	-
4	27th Street at Monticello Avenue			27th Street				27th Street				Monticello Avenue				Monticello Avenue				Intersection	
		Signalized	Left					9.8	A	9.1	A	5.7	A	2.9	A					Delay	Delay
			Through									1.4	A	1.5	A	17.7	B	24.8	C	9.3	8.7
			Right																	LOS	LOS
			Approach					9.8	A	9.1	A	3.1	A	2.0	A	17.7	B	24.8	C	A	A
5	26th Street at Monticello Avenue			26th Street				26th Street				Monticello Avenue				Monticello Avenue				Intersection	
		Signalized	Left													14.6	B	24.1	C	Delay	Delay
			Through	8.4	A	11.3	B					23.5	C	41.7	D	12.6	B	13.4	B	14.3	22.4
			Right																	LOS	LOS
			Approach	8.4	A	11.3	B					23.5	C	41.7	D	12.6	B	14.0	B	B	C
6	25th Street at Monticello Avenue			25th Street				25th Street				Monticello Avenue				Monticello Avenue				Intersection	
		Unsignalized	Left	22.3	C	30.8	D	30.8	D	49.1	E	2.1	A	1.0	A	0.2	A	0.4	A	Delay	Delay
			Through																	-	-
			Right									0.0	A	0.0	A	0.0	A	0.0	A	LOS	LOS
			Approach	22.3	C	30.8	D	30.8	D	49.1	E	1.1	A	0.5	A	0.1	A	0.2	A	-	-

Table 7: 2023 Existing Conditions Peak Hour Control Delay and LOS (cont.)

Intersection Number and Description		Type of Control	Lane Group	Eastbound				Westbound				Northbound				Southbound				Overall	
				AM		PM		AM		PM		AM		PM		AM		PM			
				Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	AM	PM
7	21st Street at Monticello Avenue			21st Street				21st Street				Monticello Avenue				Monticello Avenue				Intersection	
		Signalized	Left	38.6	D	43.7	D	30.6	C	27.5	C	46.5	D	41.7	D	11.1	B	15.6	B	Delay	Delay
			Through									2.9	A	6.2	A					18.9	19.5
			Right	95.3	F	40.6	D													LOS	LOS
			Approach	71.4	E	41.9	D	30.6	C	27.5	C	11.1	B	12.3	B	11.1	B	15.6	B	B	B
8	20th Street at Monticello Avenue			20th Street				20th Street				Monticello Avenue				Monticello Avenue				Intersection	
		Signalized	Left	27.8	C	33.6	C	28.2	C	35.9	D	4.8	A	4.3	A	4.5	A	4.1	A	Delay	Delay
			Through									4.1	A	3.3	A					6.5	7.5
			Right																	LOS	LOS
			Approach	27.8	C	33.6	C	28.2	C	35.9	D	4.2	A	3.4	A	4.5	A	4.1	A	A	A
9	19th Street at Monticello Avenue			19th Street				19th Street				Monticello Avenue				Monticello Avenue				Intersection	
		Unsignalized	Left	10.9	B	14.2	B	12.5	B	17.1	C	8.6	A	8.9	A	8.5	A	9.2	A	Delay	Delay
			Through									0.0	A	0.0	A	0.0	A	0.0	A	-	-
			Right																	LOS	LOS
			Approach	10.9	B	14.2	B	12.5	B	17.1	C	0.4	A	0.3	A	0.2	A	0.9	A	-	-
10	18th Street at Monticello Avenue			18th Street				18th Street				Monticello Avenue				Monticello Avenue				Intersection	
		Signalized	Left	26.3	C	31.4	C	27.8	C	34.9	C	11.1	B	10.3	B	2.7	A	3.2	A	Delay	Delay
			Through									13.6	B	12.9	B	2.7	A	3.0	A	9.5	10.5
			Right																	LOS	LOS
			Approach	26.3	C	31.4	C	27.8	C	34.9	C	13.6	B	12.8	B	2.7	A	3.0	A	A	B
11	17th Street at Monticello Avenue			17th Street				17th Street				Monticello Avenue				Monticello Avenue				Intersection	
		Unsignalized	Left	14.1	B	13.0	B	18.1	C	24.4	C	9.0	A	9.3	A	9.1	A	9.6	A	Delay	Delay
			Through									0.0	A	0.0	A	0.0	A	0.0	A	-	-
			Right																	LOS	LOS
			Approach	14.1	B	13.0	B	18.1	C	24.4	C	0.7	A	0.4	A	0.1	A	0.2	A	-	-
12	16th Street at Monticello Avenue			16th Street				16th Street				Monticello Avenue				Monticello Avenue				Intersection	
		Unsignalized	Left					14.8	B	11.7	B					0.0	A	0.0	A	Delay	Delay
			Through									0.0	A	0.0	A					-	-
			Right																	LOS	LOS
			Approach					14.8	B	11.7	B	0.0	A	0.0	A	0.5	A	0.5	A	-	-
13	15th Street at Monticello Avenue			15th Street				15th Street				Monticello Avenue				Monticello Avenue				Intersection	
		Unsignalized	Left	11.4	B	12.2	B					0.0	A	0.0	A					Delay	Delay
			Through									0.0	A	0.0	A	0.0	A	0.0	A	-	-
			Right													0.0	A	0.0	A	LOS	LOS
			Approach	11.4	B	12.2	B					0.6	A	0.5	A	0.0	A	0.0	A	-	-

Table 7: 2023 Existing Conditions Peak Hour Control Delay and LOS (cont.)

Intersection Number and Description		Type of Control	Lane Group	Eastbound				Westbound				Northbound				Southbound				Overall	
				AM		PM		AM		PM		AM		PM		AM		PM			
				Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	AM	PM
14	14th Street at Monticello Avenue			14th Street				14th Street				Monticello Avenue				Monticello Avenue				Intersection	
		Unsignalized	Left	12.5	B	12.6	B	11.7	B	12.2	B	9.4	A	9.6	A	8.8	A	9.0	A	Delay	Delay
			Through									0.0	A	0.0	A	0.0	A	0.0	A	-	-
			Right																	LOS	LOS
			Approach	12.5	B	12.6	B	11.7	B	12.2	B	0.1	A	0.0	A	0.0	A	0.1	A	-	-
15	13th Street at Monticello Avenue			13th Street				13th Street				Monticello Avenue				Monticello Avenue				Intersection	
		Unsignalized	Left	11.8	B	13.4	B	9.0	A	10.9	B	0.0	A	0.1	A	0.0	A	0.0	A	Delay	Delay
			Through																	-	-
			Right									0.0	A	0.0	A					LOS	LOS
			Approach	11.8	B	13.4	B	9.0	A	10.9	B	0.0	A	0.1	A	0.0	A	0.1	A	-	-
16	Princess Anne Road at Monticello Avenue			Princess Anne Road				Princess Anne Road				Monticello Avenue				Monticello Avenue				Intersection	
		Signalized	Left	17.4	B	11.8	B	25.3	C	19.2	B	31.6	C	42.4	D	18.7	B	24.8	C	Delay	Delay
			Through	21.9	C	15.7	B	29.0	C	21.4	C	11.7	B	16.2	B	30.1	C	37.8	D	22.5	25.6
			Right																	LOS	LOS
			Approach	21.5	C	15.2	B	28.6	C	20.9	C	14.9	B	19.5	B	29.4	C	36.6	D	C	C
17	11th Street at Monticello Avenue			11th Street				11th Street				Monticello Avenue				Monticello Avenue				Intersection	
		Unsignalized	Left	10.2	B	9.1	A					9.8	A	8.4	A					Delay	Delay
			Through									0.0	A	0.0	A	0.0	A	0.0	A	-	-
			Right																	LOS	LOS
			Approach	10.2	B	9.1	A					0.2	A	0.1	A	0.0	A	0.0	A	-	-
18	9th Street at Monticello Avenue			9th Street				9th Street				Monticello Avenue				Monticello Avenue				Intersection	
		Unsignalized	Left	10.5	B	10.2	B					0.1	A	0.1	A					Delay	Delay
			Through									0.0	A	0.0	A	0.0	A	0.0	A	-	-
			Right																	LOS	LOS
			Approach	10.5	B	10.2	B					0.0	A	0.0	A	0.0	A	0.0	A	-	-
19	Virginia Beach Boulevard at Monticello Avenue			Virginia Beach Boulevard				Virginia Beach Boulevard				Monticello Avenue				Monticello Avenue				Intersection	
		Signalized	Left	18.2	B	18.2	B	14.5	B	15.0	B	12.8	B	23.4	C	13.8	B	27.4	C	Delay	Delay
			Through	23.6	C	29.3	C	23.0	C	22.9	C	29.4	C	38.8	D	16.7	B	27.6	C	24.9	34.8
			Right					116.7	F	89.8	F	22.0	C	105.8	F					LOS	LOS
			Approach	23.0	C	27.8	C	40.5	D	35.0	C	26.7	C	46.0	D	16.4	B	27.6	C	C	C

Table 7: 2023 Existing Conditions Peak Hour Control Delay and LOS (cont.)

Intersection Number and Description		Type of Control	Lane Group	Eastbound				Westbound				Northbound				Southbound				Overall	
				AM		PM		AM		PM		AM		PM		AM		PM			
				Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	AM	PM
20	Monticello Avenue at St. Paul's Boulevard			Monticello Avenue				Monticello Avenue				St. Paul's Boulevard				St. Paul's Boulevard				Intersection	
		Signalized	Left	47.3	D	34.1	C													Delay	Delay
			Through									3.6	A	1.3	A	3.1	A	2.7	A	4.9	4.4
			Right																	LOS	LOS
			Approach									3.6	A	1.3	A	3.1	A	2.7	A	A	A
21	Olney Road at St. Paul's Boulevard			Olney Road				Olney Road				St. Paul's Boulevard				St. Paul's Boulevard				Intersection	
		Unsignalized	Left									0.0	A	0.0	A	0.4	A	1.4	A	Delay	Delay
			Through	10.4	B	11.4	B					0.0	A	0.0	A	0.0	A	0.0	A	-	-
			Right									0.0	A	0.0	A					LOS	LOS
			Approach	10.4	B	11.4	B					0.0	A	0.0	A	0.1	A	0.4	A	-	-
22	Brambleton Avenue at St. Paul's Boulevard			Brambleton Avenue				Brambleton Avenue				St. Paul's Boulevard				St. Paul's Boulevard				Intersection	
		Signalized	Left	44.7	D	14.8	B	10.1	B	13.2	B	55.5	E	47.8	D	51.0	D	30.3	C	Delay	Delay
			Through	55.8	E	19.6	B	20.0	B	18.7	B	21.8	C	29.2	C	40.9	D	29.5	C	35.5	24.8
			Right	36.1	D	17.0	B													LOS	LOS
			Approach	43.4	D	18.2	B	19.0	B	18.3	B	37.3	D	35.5	D	42.3	D	29.7	C	D	C
23	Bute Street at St. Paul's Boulevard			Bute Street				Bute Street				St. Paul's Boulevard				St. Paul's Boulevard				Intersection	
		Signalized	Left	33.0	C	35.7	D	33.2	C	35.4	D	3.8	A	0.0	A					Delay	Delay
			Through									3.2	A	3.1	A	10.9	B	11.0	B	7.3	8.8
			Right																	LOS	LOS
			Approach	33.0	C	35.7	D	33.2	C	35.4	D	3.2	A	3.1	A	10.9	B	11.0	B	A	A
24	Charlotte Street/ Wood Street at St. Paul's Boulevard			Charlotte Street				Wood Street				St. Paul's Boulevard				St. Paul's Boulevard				Intersection	
		Signalized	Left	37.2	D	39.0	D	28.0	C	28.4	C	15.7	B	16.7	B	5.8	A	8.0	A	Delay	Delay
			Through									13.9	B	12.2	B					11.0	12.1
			Right	37.1	D	38.2	D													LOS	LOS
			Approach	37.1	D	38.4	D	28.0	C	28.4	C	14.0	B	12.4	B	5.8	A	8.0	A	B	B
25	Monticello Avenue at Olney Road*			Olney Road*				Olney Road*				Monticello Avenue*				Monticello Avenue*				Intersection	
		Unsignalized	Left																	Delay	Delay
			Through																		
			Right																	LOS	LOS
			Approach																		

- Denotes the overall intersection is stop controlled and no level of service or delay is reported

* HCM 2000 Unsignalized does not support 5-legged intersections

Table 8: 2023 Existing Conditions Peak Hour Queue Results

Intersection Number and Description		Type of Control	Lane Group	Maximum Queue							
				Eastbound		Westbound		Northbound		Southbound	
				AM	PM	AM	PM	AM	PM	AM	PM
1	Monticello Avenue at Church Street			Monticello Avenue		Cemetery		Church Street		Church Street	
		Signalized	Left	123	126	0	6			m0	0
			Through					142	27	31	16
			Right	0	0					1	1
2	29th Street at Monticello Avenue			29th Street		29th Street		Monticello Avenue		Monticello Avenue	
		Unsignalized	Left	0	0	0	0	1	1	0	0
			Through					0	0	0	0
			Right								
3	28th Street at Monticello Avenue			28th Street		28th Street		Monticello Avenue		Monticello Avenue	
		Unsignalized	Left	3	5	0	1	0	0	0	0
			Through					0	0	0	0
			Right								
4	27th Street at Monticello Avenue			27th Street		27th Street		Monticello Avenue		Monticello Avenue	
		Signalized	Left			111	111	35	m8		
			Through							107	112
			Right								
5	26th Street at Monticello Avenue			26th Street		26th Street		Monticello Avenue		Monticello Avenue	
		Signalized	Left	63	126					m5	m17
			Through					191	340	95	96
			Right								
6	25th Street at Monticello Avenue			25th Street		25th Street		Monticello Avenue		Monticello Avenue	
		Unsignalized	Left	18	41	41	61	5	2	0	1
			Through								
			Right					0	0	0	0
7	21st Street at Monticello Avenue			21st Street		21st Street		Monticello Avenue		Monticello Avenue	
		Signalized	Left	92	179	22	28	121	145	80	143
			Through					35	93		
			Right	60	155						
8	20th Street at Monticello Avenue			20th Street		20th Street		Monticello Avenue		Monticello Avenue	
		Signalized	Left	51	79	57	127	12	12	41	61
			Through					49	55		
			Right								

Table 8: 2023 Existing Conditions Peak Hour Queue Results (cont.)

	Intersection Number and Description	Type of Control	Lane Group	Maximum Queue							
				Eastbound		Westbound		Northbound		Southbound	
				AM	PM	AM	PM	AM	PM	AM	PM
9	19th Street at Monticello Avenue			19th Street		19th Street		Monticello Avenue		Monticello Avenue	
		Unsignalized	Left	6	9	6	26	2	2	1	8
			Through					0	0	0	0
			Right								
10	18th Street at Monticello Avenue			18th Street		18th Street		Monticello Avenue		Monticello Avenue	
		Signalized	Left	33	46	65	106	17	20	m6	10
			Through					145	175	37	46
			Right								
11	17th Street at Monticello Avenue			17th Street		17th Street		Monticello Avenue		Monticello Avenue	
		Unsignalized	Left	2	4	1	5	5	4	1	2
			Through					0	0	0	0
			Right								
12	16th Street at Monticello Avenue			16th Street		16th Street		Monticello Avenue		Monticello Avenue	
		Unsignalized	Left			23	11			0	0
			Through					0	0		
			Right								
13	15th Street at Monticello Avenue			15th Street		15th Street		Monticello Avenue		Monticello Avenue	
		Unsignalized	Left	7	10			0	0		
			Through							0	0
			Right								
14	14th Street at Monticello Avenue			14th Street		14th Street		Monticello Avenue		Monticello Avenue	
		Unsignalized	Left	5	6	1	3	0	0	0	1
			Through					0	0	0	0
			Right								
15	13th Street at Monticello Avenue			13th Street		13th Street		Monticello Avenue		Monticello Avenue	
		Unsignalized	Left	2	3	1	1	0	0	0	0
			Through								
			Right					0	0		
16	Princess Anne Road at Monticello Avenue			Princess Anne Road		Princess Anne Road		Monticello Avenue		Monticello Avenue	
		Signalized	Left	m14	m15	m23	m30	107	107	35	66
			Through	57	63	100	80	129	146	293	387
			Right								

Table 8: 2023 Existing Conditions Peak Hour Queue Results (cont.)

Intersection Number and Description		Type of Control	Lane Group	Maximum Queue							
				Eastbound		Westbound		Northbound		Southbound	
				AM	PM	AM	PM	AM	PM	AM	PM
17	11th Street at Monticello Avenue			11th Street		11th Street		Monticello Avenue		Monticello Avenue	
		Unsignalized	Left	3	2			2	1		
			Through							0	0
			Right								
18	9th Street at Monticello Avenue			9th Street		9th Street		Monticello Avenue		Monticello Avenue	
		Unsignalized	Left	4	3			0	0		
			Through							0	0
			Right								
19	Virginia Beach Boulevard at Monticello Avenue			Virginia Beach Boulevard		Virginia Beach Boulevard		Monticello Avenue		Monticello Avenue	
		Signalized	Left	52	142	98	94	180	180	88	145
			Through	127	215	136	138	346	341	199	229
			Right			46	56	0	0		
20	Monticello Avenue at St. Paul's Boulevard			Monticello Avenue		Monticello Avenue		St. Paul's Boulevard		St. Paul's Boulevard	
		Signalized	Left	85	99						
			Through					143	74	105	97
			Right								
21	Olney Road at St. Paul's Boulevard			Olney Road		Olney Road		St. Paul's Boulevard		St. Paul's Boulevard	
		Unsignalized	Left	26	49			2	10	50	100
			Through					69	2	11	69
			Right					3	10		
22	Brambleton Avenue at St. Paul's Boulevard			Brambleton Avenue		Brambleton Avenue		St. Paul's Boulevard		St. Paul's Boulevard	
		Signalized	Left	115	66	70	106	368	221	197	224
			Through	200	220	224	283	271	327	256	359
			Right	348	281						
23	Bute Street at St. Paul's Boulevard			Bute Street		Bute Street		St. Paul's Boulevard		St. Paul's Boulevard	
		Signalized	Left	30	92	60	66	56	19		
			Through					171	118	204	364
			Right								
24	Charlotte Street/ Wood Street at St. Paul's Boulevard			Charlotte Street		Wood Street		St. Paul's Boulevard		St. Paul's Boulevard	
		Signalized	Left	33	87	149	155	140	134	265	301
			Through					383	219		
			Right	47	153						

Table 8: 2023 Existing Conditions Peak Hour Queue Results (cont.)

Intersection Number and Description		Type of Control	Lane Group	Maximum Queue							
				Eastbound		Westbound		Northbound		Southbound	
				AM	PM	AM	PM	AM	PM	AM	PM
				Olney Road		Olney Road		Monticello Avenue		Monticello Avenue	
25	Monticello Avenue at Olney Road	Unsignalized	Left	46	53			26	58	7	63
			Through					3	66		
			Right								

1.6.4 No-Build Conditions Traffic Operations Analysis

No-Build 2045 Volume Development

Traffic operational analyses were conducted to evaluate the overall study corridor performance under No-Build (2045) AM and PM peak hour conditions. The intent of the No-Build conditions analyses is to provide a general understanding of the baseline future traffic conditions as a starting point for developing improvement concepts.

The following sources were reviewed to determine the growth rates to apply to existing traffic volumes to forecast future (2045) traffic volumes.

- **Hampton Roads Regional Travel Demand Model (TDM)**
  Outputs from the Hampton Roads Regional TDM, which included base year data from 2017 and future year data from 2045, were adjusted using NCHRP-765 methodologies that incorporate project-specific and VDOT project traffic count data to calibrate future volume projections. Using the adjusted future year (2045) TDM output and existing available count data, linear growth rates for the study area were developed.
- **Historical traffic count data**
  Historical traffic count data were sourced primarily from official VDOT historical AADT counts. Significant development and regression trends between years were identified, outliers were removed, and a linear regression analysis was performed to produce linear growth rates for segments throughout the study area.
- **Socioeconomic data**
  Population and employment data from traffic analysis zones (TAZ) in the 2017-2045 Hampton Roads Regional TDM were reviewed and compared to the linear traffic growth rates developed with the 2017-2045 Hampton Roads Regional TDM.

Table 9 and **Figure 29** present the recommended linear growth rates within the study area. Traffic forecasting growth rate development was presented in a stakeholder meeting on July 21, 2023, and the full presentation is included in **Appendix D**. **Figure 30** to **Figure 32** summarize the 2045 No Build peak hour traffic volumes.

Table 9: Linear Traffic Growth Rate Development Summary

ID	Segment	Historical Linear Growth Rate	Projected TDM Linear Growth Rate	Recommended Linear Growth Rate
1	Monticello Ave. south of Church St.	-0.29%	0.07%	0.50%
2	Monticello Ave. south of 21st St.	-0.48%	-0.14%	0.50%
3	Monticello Ave. south of Virginia Beach Blvd.	-0.34%	0.00%	0.50%
4	St. Paul's Blvd. south of Monticello Ave.	-0.64%	0.00%	0.50%
5	St. Paul's Blvd. south of Brambleton Ave.	-1.67%	-0.15%	0.50%

Figure 29: Study Area Linear Traffic Growth Rate Segment IDs

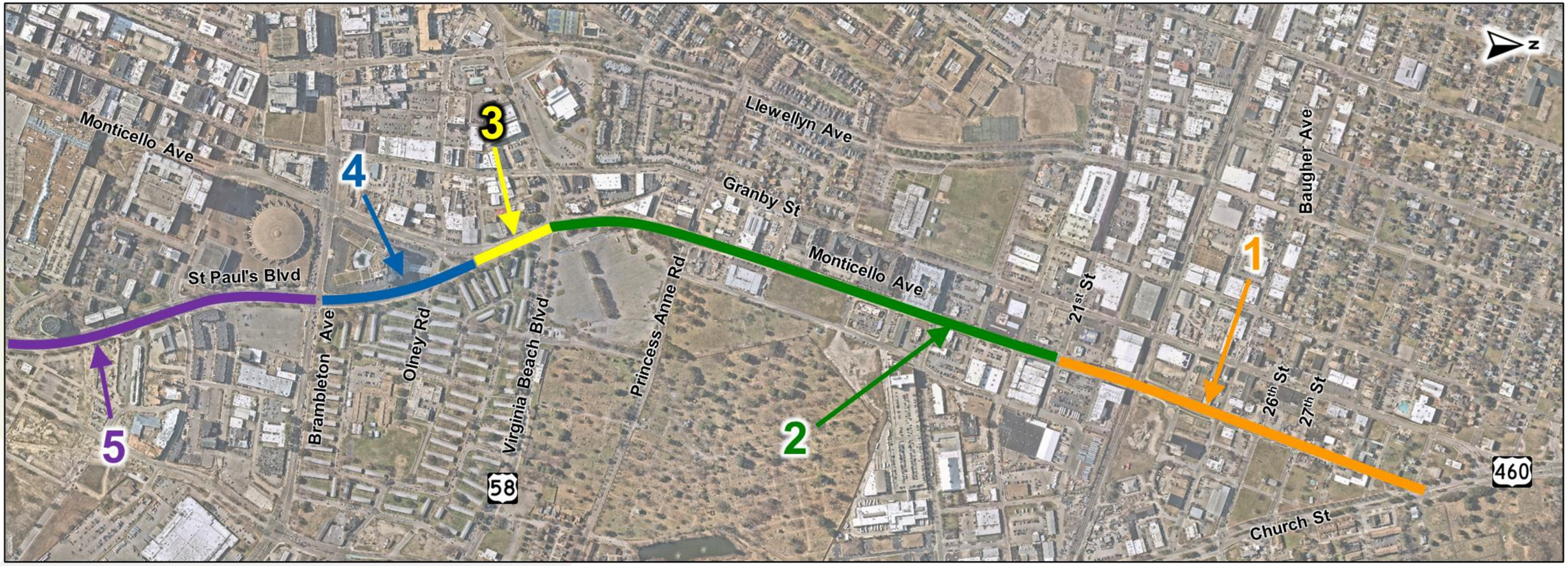
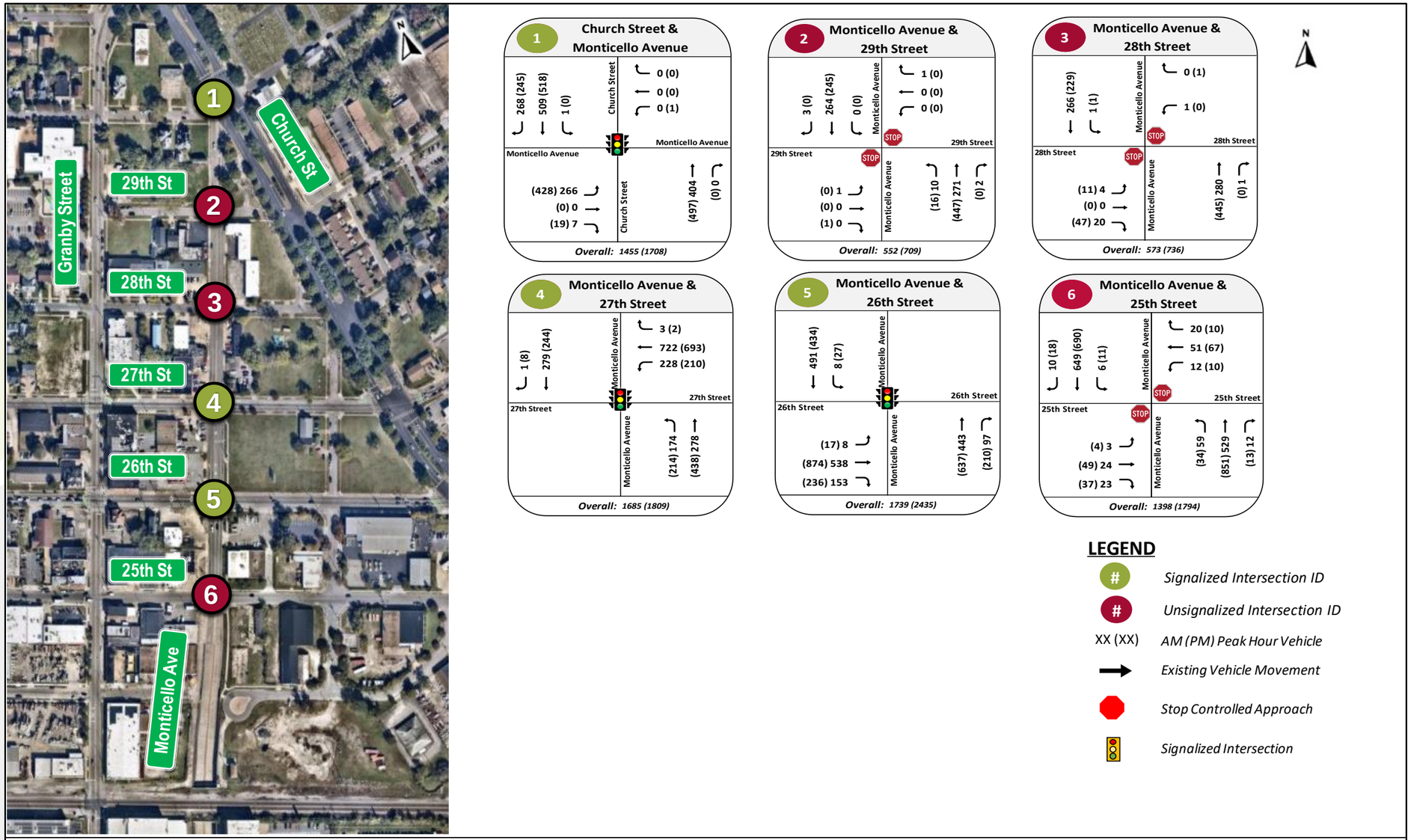


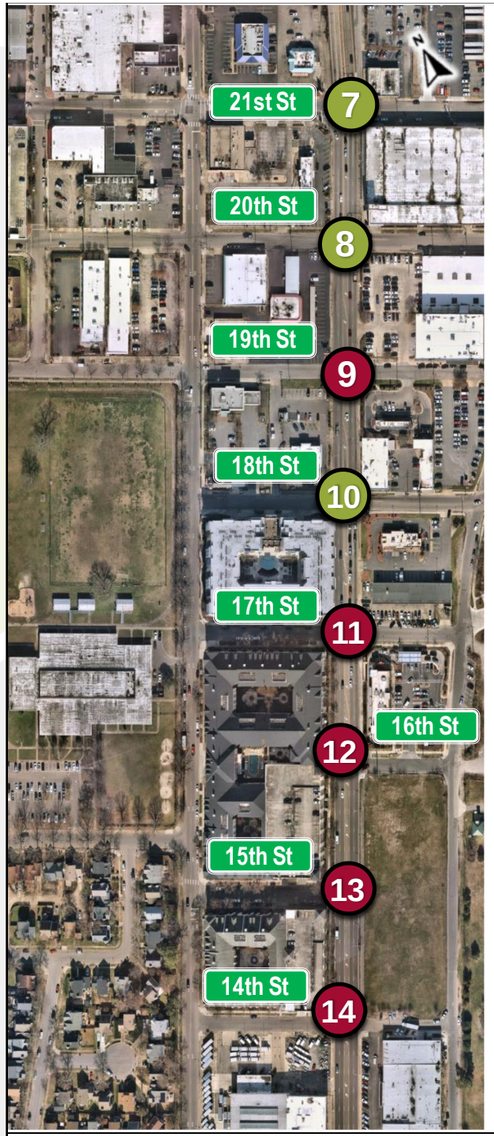
Figure 30: 2045 No-Build Peak Hour Volumes (1)

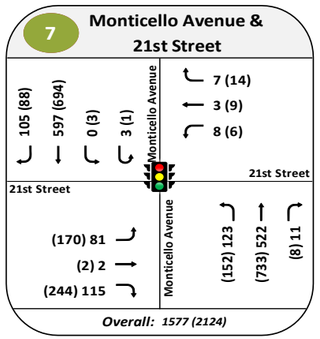


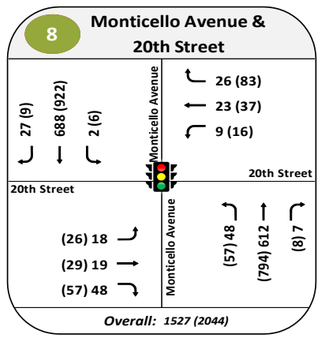
HR-06 Monticello Avenue/St Pauls Boulevard

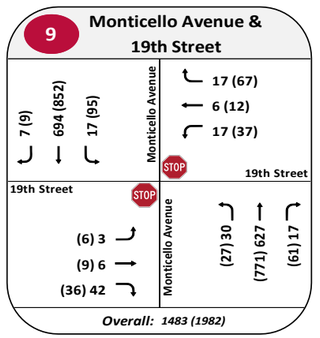
PROJECT PIPELINE

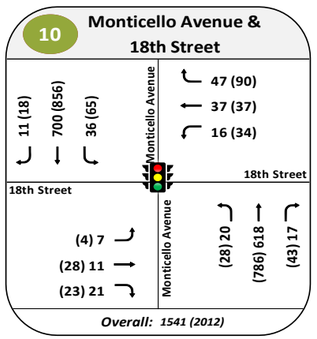
Figure 31: 2045 No-Build Peak Hour Volumes (2)

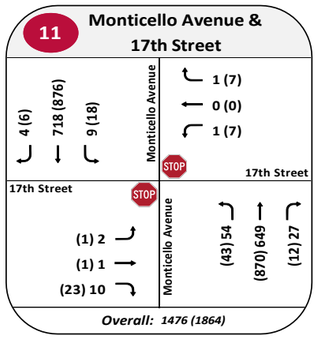


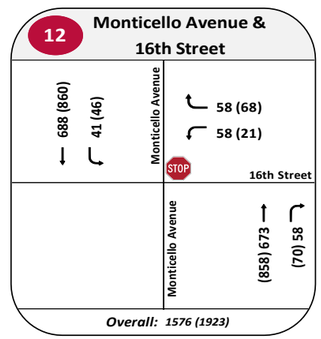


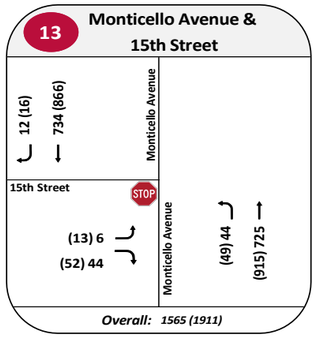


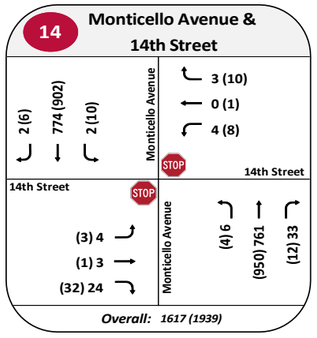












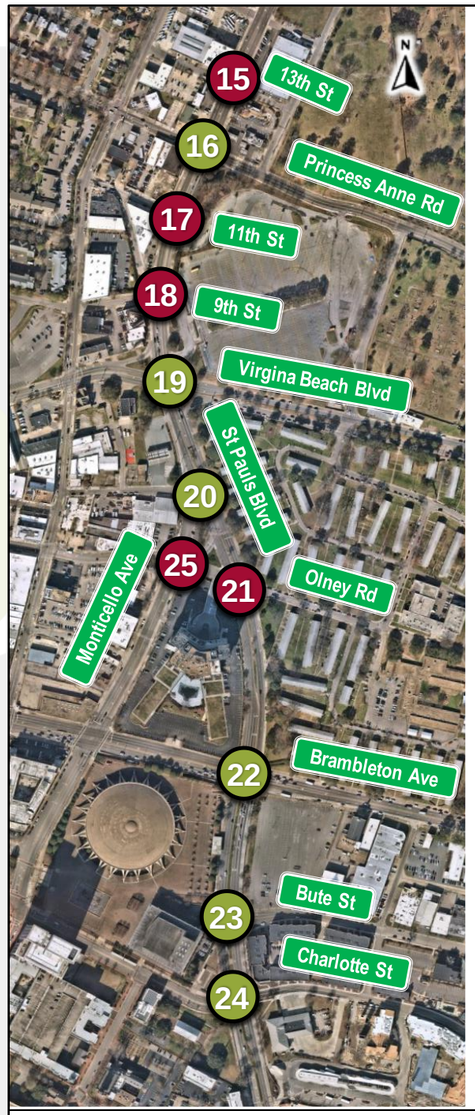
LEGEND

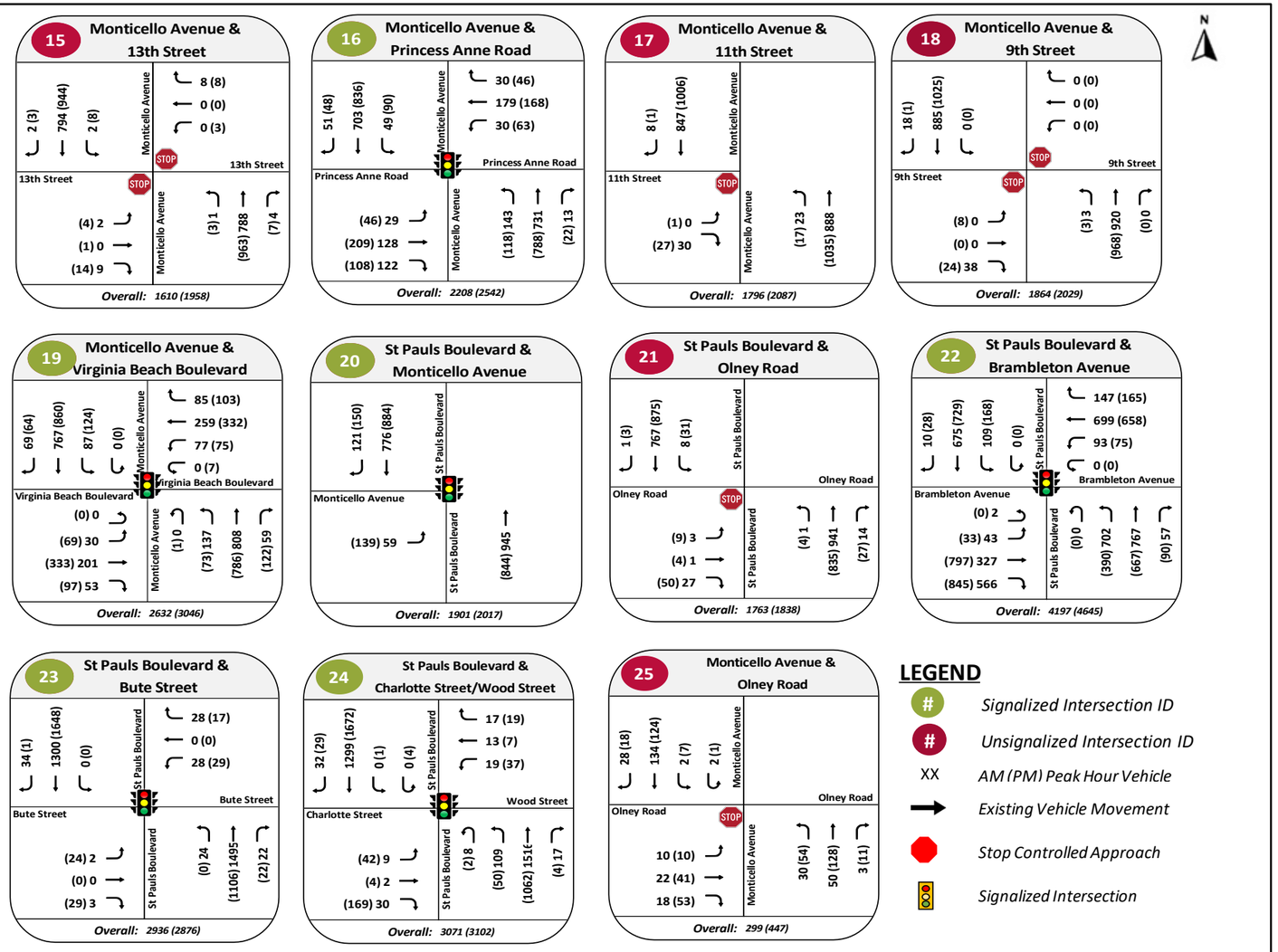
- # — *Signalized Intersection ID*
- # — *Unsignalized Intersection ID*
- XX (XX) — *AM (PM) Peak Hour Vehicle Volumes*
- *Existing Vehicle Movement*
- *Stop Controlled Approach*
- *Signalized Intersection*

HR-06 Monticello Avenue/St Pauls Boulevard

PROJECT PIPELINE

Figure 32: 2045 No-Build Peak Hour Volumes (3)





HR-06 Monticello Avenue/St Pauls Boulevard

PROJECT PIPELINE

Funded Improvements

Based on a review of previous studies and discussions with the City of Norfolk, the following improvements are funded within the study area.

- St. Paul's Area Transportation
  - Transformation of area just south and east of study corridor
  - Removal of Transit Center traffic signal at St. Paul's Boulevard (just south of Charlotte Street) and installation of a new traffic signal at a new Freemason Street intersection
- LED Street Light Conversion
  - Segments of corridor slated for conversion between August 2023 and August 2024
- Pedestrian Accommodations and Countdown Signals
  - Monticello Avenue & Church Street – new pedestrian push buttons, countdown signal heads, and crosswalk markings
  - Monticello Avenue & 18th Street – new ADA ramps, pedestrian push buttons, countdown signal heads, and crosswalk markings

Synchro and SimTraffic Analysis

Traffic operations analyses were conducted to evaluate overall study intersection performance under No-Build (2045) AM and PM peak hour conditions. The intent of No-Build conditions analyses was to provide a general understanding of the baseline future traffic conditions as a starting point for developing improvement alternatives. No-Build conditions were modeled using Synchro 11 and SimTraffic 11 for all study area intersections.

The existing conditions Synchro models were used to develop the No-Build models for the AM and PM peak hour conditions. The models were updated with the projected 2045 No-Build traffic volumes and the previously identified funded improvements. Traffic signal cycle lengths were assumed to be consistent with existing conditions, while splits and offsets were optimized. No-Build inputs and analysis methodologies were applied consistently with *TOSAM*.

Ten simulations were conducted for both the AM and PM No-Build SimTraffic models. As described in **Section 1.6.2**, control delay (seconds per vehicle) and either Synchro 95th percentile or SimTraffic maximum queue lengths (feet) were selected as measures of effectiveness to quantitatively report the performance of each study intersection. The full Synchro and SimTraffic reports are included in **Appendix D** and shown in **Table 10** and **Table 11**.

Similar trends in delay, LOS, and queuing were observed under No-Build conditions as were observed in Existing conditions. Under No-Build conditions, all signalized intersections operated at LOS C or better in both AM and PM peak hours. All unsignalized approaches operate at LOS C or better except for eastbound and westbound 25th Street which operates at LOS D and E during the AM peak hour.

The following trends were observed under No-Build conditions.

AM Peak Hour

- The highest signalized approach delay occurred on the eastbound approach at the Monticello Avenue at Church Street intersection (51.8 seconds).
- The highest unsignalized minor street delay occurred on the westbound approach at the 25th Street at Monticello Avenue intersection (44.1 seconds), which was due to vehicles not abiding by the right-turn only restriction.
- The northbound shared through/right-turn lane queues at the intersection of 26th Street at Monticello Avenue extends 206 feet, close to reaching 25th Street.
- The northbound left-turn queues at the Brambleton Avenue at St. Paul's Boulevard intersection extend 408 feet, exceeding the available storage length.
- The longest queue at the Charlotte Street/Wood Street at St. Paul's Boulevard intersection occurred on the northbound approach (567 feet).

PM Peak Hour

- The highest signalized approach delay occurred on the eastbound approach at the Monticello Avenue at Church Street intersection (54.4 seconds).
- The highest unsignalized minor street delay occurred on the westbound approach of the 25th Street at Monticello Avenue (65.3 seconds) intersection, which was due to vehicles not abiding by the right-turn only restriction.
- The northbound shared through/right-turn lane queues at the 26th Street at Monticello Avenue intersection extends 387 feet, extending through 25th Street.
- The longest queue at the Brambleton Avenue at St. Paul's Boulevard intersection occurred on the southbound approach (716 feet).

Table 10: 2045 No-Build Conditions Peak Hour Control Delay and LOS

Intersection Number and Description		Type of Control	Lane Group	Eastbound				Westbound				Northbound				Southbound				Overall	
				AM		PM		AM		PM		AM		PM		AM		PM			
				Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	AM	PM
1	Monticello Avenue at Church Street			Monticello Avenue				Cemetery				Church Street				Church Street				Intersection	
		Signalized	Left	52.5	D	55.5	E	0.0	A	46.8	D					3.6	A	0.0	A	Delay	Delay
			Through									7.2	A	4.4	A	3.7	A	2.0	A	13.1	17.1
			Right	28.3	C	29.5	C									0.5	A	7.0	A	LOS	LOS
			Approach	51.8	D	54.4	D	0.0	A	46.8	D	7.2	A	4.4	A	2.6	A	3.6	A	B	B
2	29th Street at Monticello Avenue			29th Street				29th Street				Monticello Avenue				Monticello Avenue				Intersection	
		Unsignalized	Left	11.8	B	9.0	A	8.8	A	0.0	A	0.6	A	0.6	A	0.0	A	0.0	A	Delay	Delay
			Through									0.0	A	0.0	A	0.0	A	0.0	A	-	-
			Right																	LOS	LOS
			Approach	11.8	B	9.0	A	8.8	A	0.0	A	0.3	A	0.3	A	0.0	A	0.0	A	-	-
3	28th Street at Monticello Avenue			28th Street				28th Street				Monticello Avenue				Monticello Avenue				Intersection	
		Unsignalized	Left	9.6	A	9.7	A	11.7	B	14.1	B	0.0	A	0.0	A	0.1	A	0.1	A	Delay	Delay
			Through									0.0	A	0.0	A	0.0	A	0.0	A	-	-
			Right																	LOS	LOS
			Approach	9.6	A	9.7	A	11.7	B	14.1	B	0.0	A	0.0	A	0.0	A	0.0	A	-	-
4	27th Street at Monticello Avenue			27th Street				27th Street				Monticello Avenue				Monticello Avenue				Intersection	
		Signalized	Left					8.9	A	9.1	A	5.8	A	3.3	A					Delay	Delay
			Through									1.3	A	1.4	A	17.5	B	24.6	C	8.8	8.7
			Right																	LOS	LOS
			Approach					8.9	A	9.1	A	3.0	A	2.0	A	17.5	B	24.6	C	A	A
5	26th Street at Monticello Avenue			26th Street				26th Street				Monticello Avenue				Monticello Avenue				Intersection	
		Signalized	Left	8.1	A	12.7	B									14.4	B	27.6	C	Delay	Delay
			Through									21.0	C	45.9	D	12.5	B	13.2	B	13.4	24.5
			Right																	LOS	LOS
			Approach	8.1	A	12.7	B					21.0	C	45.9	D	12.5	B	14.0	B	B	C
6	25th Street at Monticello Avenue			25th Street				25th Street				Monticello Avenue				Monticello Avenue				Intersection	
		Unsignalized	Left	28.0	D	37.2	E	44.1	E	65.3	F	2.3	A	1.1	A	0.2	A	0.5	A	Delay	Delay
			Through																	-	-
			Right									0.0	A	0.0	A	0.0	A	0.0	A	LOS	LOS
			Approach	28.0	D	37.2	E	44.1	E	65.3	F	1.2	A	0.5	A	0.1	A	0.2	A	-	-

Table 10: 2045 No-Build Conditions Peak Hour Control Delay and LOS (cont.)

Intersection Number and Description		Type of Control	Lane Group	Eastbound				Westbound				Northbound				Southbound				Overall	
				AM		PM		AM		PM		AM		PM		AM		PM			
				Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	AM	PM
7	21st Street at Monticello Avenue			21st Street				21st Street				Monticello Avenue				Monticello Avenue				Intersection	
		Signalized	Left	60.2	E	40.7	D	28.9	C	27.6	C	45.7	D	44.6	D	11.1	B	16.2	B	Delay	Delay
			Through									3.3	A	6.1	A					13.5	20.9
			Right	4.6	A	51.5	D													LOS	LOS
			Approach	27.9	C	47.0	D	28.9	C	27.6	C	11.3	B	12.6	B	11.1	B	16.2	B	B	C
8	20th Street at Monticello Avenue			20th Street				20th Street				Monticello Avenue				Monticello Avenue				Intersection	
		Signalized	Left	27.9	C	32.2	C	28.2	C	34.3	C	4.4	A	5.3	A	3.2	A	6.9	A	Delay	Delay
			Through									3.7	A	3.8	A					5.8	8.9
			Right																	LOS	LOS
			Approach	27.9	C	32.2	C	28.2	C	34.3	C	3.7	A	3.9	A	3.2	A	6.9	A	A	A
9	19th Street at Monticello Avenue			19th Street				19th Street				Monticello Avenue				Monticello Avenue				Intersection	
		Unsignalized	Left	11.7	B	15.3	C	13.7	B	18.7	C	8.8	A	9.1	A	8.6	A	9.5	A	Delay	Delay
			Through									0.0	A	0.0	A	0.0	A	0.0	A	-	-
			Right																	LOS	LOS
			Approach	11.7	B	15.3	C	13.7	B	18.7	C	0.4	A	0.3	A	0.2	A	0.9	A	-	-
10	18th Street at Monticello Avenue			18th Street				18th Street				Monticello Avenue				Monticello Avenue				Intersection	
		Unsignalized	Left	26.4	C	30.7	C	28.1	C	34.7	C	11.3	B	11.0	B	2.2	A	3.5	A	Delay	Delay
			Through									14.0	B	14.1	B	2.1	A	3.2	A	9.4	11.1
			Right																	LOS	LOS
			Approach	26.4	C	30.7	C	28.1	C	34.7	C	13.9	B	14.0	B	2.1	A	3.2	A	A	B
11	17th Street at Monticello Avenue			17th Street				17th Street				Monticello Avenue				Monticello Avenue				Intersection	
		Signalized	Left	15.0	B	13.9	B	20.4	C	30.3	D	9.3	A	9.6	A	9.3	A	10.0	A	Delay	Delay
			Through									0.0	A	0.0	A	0.0	A	0.0	A	-	-
			Right																	LOS	LOS
			Approach	15.0	B	13.9	B	20.4	C	30.3	D	0.7	A	0.4	A	0.1	A	0.2	A	-	-
12	16th Street at Monticello Avenue			16th Street				16th Street				Monticello Avenue				Monticello Avenue				Intersection	
		Signalized	Left					14.9	B	12.2	B					0.0	A	0.0	A	Delay	Delay
			Through									0.0	A	0.0	A					-	-
			Right																	LOS	LOS
			Approach					14.9	B	12.2	B	0.0	A	0.0	A	0.5	A	0.5	A	-	-

Table 10: 2045 No-Build Conditions Peak Hour Control Delay and LOS (cont.)

Intersection Number and Description		Type of Control	Lane Group	Eastbound				Westbound				Northbound				Southbound				Overall	
				AM		PM		AM		PM		AM		PM		AM		PM			
				Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	AM	PM
13	15th Street at Monticello Avenue			15th Street				15th Street				Monticello Avenue				Monticello Avenue				Intersection	
		Unsignalized	Left	11.2	B	12.3	B					0.0	A	0.0	A					Delay	Delay
			Through									0.0	A	0.0	A	0.0	A	0.0	A	-	-
			Right													0.0	A	0.0	A	LOS	LOS
			Approach	11.2	B	12.3	B					0.5	A	0.5	A	0.0	A	0.0	A	-	-
14	14th Street at Monticello Avenue			14th Street				14th Street				Monticello Avenue				Monticello Avenue				Intersection	
		Unsignalized	Left	12.8	B	12.6	B	12.1	B	12.5	B	9.6	A	9.9	A	9.0	A	9.3	A	Delay	Delay
			Through									0.0	A	0.0	A	0.0	A	0.0	A	-	-
			Right																	LOS	LOS
			Approach	12.8	B	12.6	B	12.1	B	12.5	B	0.1	A	0.0	A	0.0	A	0.1	A	-	-
15	13th Street at Monticello Avenue			13th Street				13th Street				Monticello Avenue				Monticello Avenue				Intersection	
		Unsignalized	Left	12.3	B	14.2	B	9.0	A	11.2	B	0.0	A	0.1	A	0.0	A	0.0	A	Delay	Delay
			Through																	-	-
			Right									0.0	A	0.0	A					LOS	LOS
			Approach	12.3	B	14.2	B	9.0	A	11.2	B	0.0	A	0.1	A	0.0	A	0.1	A	-	-
16	Princess Anne Road at Monticello Avenue			Princess Anne Road				Princess Anne Road				Monticello Avenue				Monticello Avenue				Intersection	
		Signalized	Left	26.1	C	15.1	B	34.2	C	12.7	B	28.8	C	49.5	D	19.9	B	26.6	C	Delay	Delay
			Through	30.6	C	19.1	B	40.1	D	13.8	B	3.6	A	11.8	B	32.6	C	40.2	D	22.7	25.1
			Right																	LOS	LOS
			Approach	30.1	C	18.6	B	39.4	D	13.5	B	7.6	A	16.6	B	31.8	C	38.9	D	C	C
17	11th Street at Monticello Avenue			11th Street				11th Street				Monticello Avenue				Monticello Avenue				Intersection	
		Signalized	Left	9.0	A	9.3	A					8.6	A	8.3	A					Delay	Delay
			Through									0.0	A	0.0	A	0.0	A	0.0	A	-	-
			Right																	LOS	LOS
			Approach	9.0	A	9.3	A					0.2	A	0.1	A	0.0	A	0.0	A	-	-
18	9th Street at Monticello Avenue			9th Street				9th Street				Monticello Avenue				Monticello Avenue				Intersection	
		Unsignalized	Left	8.7	A	9.9	A					0.1	A	0.1	A					Delay	Delay
			Through									0.0	A	0.0	A	0.0	A	0.0	A	-	-
			Right																	LOS	LOS
			Approach	8.7	A	9.9	A					0.0	A	0.0	A	0.0	A	0.0	A	-	-

Table 10: 2045 No-Build Conditions Peak Hour Control Delay and LOS (cont.)

Intersection Number and Description		Type of Control	Lane Group	Eastbound				Westbound				Northbound				Southbound				Overall	
				AM		PM		AM		PM		AM		PM		AM		PM			
				Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	AM	PM
19	Virginia Beach Boulevard at Monticello Avenue			Virginia Beach Boulevard				Virginia Beach Boulevard				Monticello Avenue				Monticello Avenue				Intersection	
		Signalized	Left	18.2	B	19.0	B	25.8	C	17.2	B	10.4	B	19.5	B	26.1	C	30.7	C	Delay	Delay
			Through	22.4	C	26.0	C	29.9	C	28.0	C	11.6	B	37.4	D	20.7	C	21.8	C	19.2	28.5
			Right					33.1	C	30.3	C	22.1	C	47.3	D					LOS	LOS
			Approach	22.0	C	25.0	C	29.8	C	26.7	C	12.1	B	37.3	D	21.2	C	22.8	C	B	C
20	Monticello Avenue at St. Paul's Boulevard			Monticello Avenue				Monticello Avenue				St. Paul's Boulevard				St. Paul's Boulevard				Intersection	
		Unsignalized	Left	45.7	D	34.3	C													Delay	Delay
			Through									2.5	A	1.1	A	4.1	A	2.2	A	4.6	4.1
			Right																	LOS	LOS
			Approach									2.5	A	1.1	A	4.1	A	2.2	A	A	A
21	Olney Road at St. Paul's Boulevard			Olney Road				Olney Road				St. Paul's Boulevard				St. Paul's Boulevard				Intersection	
		Unsignalized	Left	10.6	B	11.9	B					0.0	A	0.0	A	0.5	A	1.5	A	Delay	Delay
			Through									0.0	A	0.0	A	0.0	A	0.0	A	-	-
			Right									0.0	A	0.0	A					LOS	LOS
			Approach	10.6	B	11.9	B					0.0	A	0.0	A	0.1	A	0.4	A	-	-
22	Brambleton Avenue at St. Paul's Boulevard			Brambleton Avenue				Brambleton Avenue				St. Paul's Boulevard				St. Paul's Boulevard				Intersection	
		Unsignalized	Left	37.9	D	15.0	B	9.7	A	16.7	B	48.8	D	45.8	D	52.4	D	30.3	C	Delay	Delay
			Through	45.4	D	21.9	C	18.6	B	21.0	C	24.3	C	29.5	C	47.8	D	29.4	C	32.3	27.0
			Right	17.3	B	25.1	C													LOS	LOS
			Approach	28.1	C	23.4	C	17.7	B	20.7	C	35.6	D	35.0	C	48.4	D	29.5	C	C	C
23	Bute Street at St. Paul's Boulevard			Bute Street				Bute Street				St. Paul's Boulevard				St. Paul's Boulevard				Intersection	
		Signalized	Left	33.0	C	35.0	C	33.2	C	34.7	C	1.7	A	0.0	A					Delay	Delay
			Through									1.3	A	3.4	A	6.6	A	11.3	B	4.3	9.0
			Right																	LOS	LOS
			Approach	33.0	C	35.0	C	33.2	C	34.7	C	1.3	A	3.4	A	6.6	A	11.3	B	A	A
24	Charlotte Street/ Wood Street at St. Paul's Boulevard			Charlotte Street				Wood Street				St. Paul's Boulevard				St. Paul's Boulevard				Intersection	
		Signalized	Left	41.4	D	44.2	D	31.1	C	31.7	C	15.6	B	17.1	B	5.9	A	4.2	A	Delay	Delay
			Through									12.3	B	10.6	B					10.3	9.9
			Right	41.1	D	42.5	D													LOS	LOS
			Approach	41.2	D	42.9	D	31.1	C	31.7	C	12.6	B	10.9	B	5.9	A	4.2	A	B	A

Table 10: 2045 No-Build Conditions Peak Hour Control Delay and LOS (cont.)

Intersection Number and Description		Type of Control	Lane Group	Eastbound				Westbound				Northbound				Southbound				Overall	
				AM		PM		AM		PM		AM		PM		AM		PM			
				Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	AM	PM
25	Monticello Avenue at Olney Road*			Olney Road*				Olney Road*				Monticello Avenue*				Monticello Avenue*				Intersection	
		Unsignalized	Left																	Delay	Delay
			Through																		
			Right																	LOS	LOS
			Approach																		

- Denotes the overall intersection is stop controlled and no level of service or delay is reported

* HCM 2000 Unsignalized does not support 5-legged intersections

Table 11: 2045 No-Build Conditions Peak Hour Queue Results

Intersection Number and Description		Type of Control	Lane Group	Maximum Queue							
				Eastbound		Westbound		Northbound		Southbound	
				AM	PM	AM	PM	AM	PM	AM	PM
1	Monticello Avenue at Church Street			Monticello Avenue		Cemetery		Church Street		Church Street	
		Signalized	Left	133	89	0	6			m0	0
			Through					156	56	34	60
			Right	0	0					1	13
2	29th Street at Monticello Avenue			29th Street		29th Street		Monticello Avenue		Monticello Avenue	
		Unsignalized	Left	0	0	0	0	1	1	0	0
			Through					0	0	0	0
			Right								
3	28th Street at Monticello Avenue			28th Street		28th Street		Monticello Avenue		Monticello Avenue	
		Unsignalized	Left	3	6	0	1	0	0	0	0
			Through					0	0	0	0
			Right								
4	27th Street at Monticello Avenue			27th Street		27th Street		Monticello Avenue		Monticello Avenue	
		Signalized	Left			109	113	45	m8		
			Through							117	122
			Right								
5	26th Street at Monticello Avenue			26th Street		26th Street		Monticello Avenue		Monticello Avenue	
		Signalized	Left	60	151			0		m6	m19
			Through					206	387	103	105
			Right								
6	25th Street at Monticello Avenue			25th Street		25th Street		Monticello Avenue		Monticello Avenue	
		Unsignalized	Left	25	55	62	83	5	3	1	1
			Through					0	0	0	0
			Right								
7	21st Street at Monticello Avenue			21st Street		21st Street		Monticello Avenue		Monticello Avenue	
		Signalized	Left	105	m186	25	31	134	164	78	355
			Through					41	96		
			Right	3	200						
8	20th Street at Monticello Avenue			20th Street		20th Street		Monticello Avenue		Monticello Avenue	
		Signalized	Left	58	85	62	136	12	14	41	82
			Through					47	63		
			Right								

Table 11: 2045 No-Build Conditions Peak Hour Queue Results (cont.)

Intersection Number and Description		Type of Control	Lane Group	Maximum Queue							
				Eastbound		Westbound		Northbound		Southbound	
				AM	PM	AM	PM	AM	PM	AM	PM
9	19th Street at Monticello Avenue			19th Street		19th Street		Monticello Avenue		Monticello Avenue	
		Unsignalized	Left	8	11	8	33	3	2	1	9
			Through					0	0	0	0
			Right								
10	18th Street at Monticello Avenue			18th Street		18th Street		Monticello Avenue		Monticello Avenue	
		Signalized	Left	35	49	70	118	19	23	m5	m10
			Through					160	205	35	52
			Right								
11	17th Street at Monticello Avenue			17th Street		17th Street		Monticello Avenue		Monticello Avenue	
		Unsignalized	Left	3	5	1	7	5	4	1	2
			Through					0	0	0	0
			Right								
12	16th Street at Monticello Avenue			16th Street		16th Street		Monticello Avenue		Monticello Avenue	
		Unsignalized	Left			25	13			0	0
			Through					0	0		
			Right								
13	15th Street at Monticello Avenue			15th Street		15th Street		Monticello Avenue		Monticello Avenue	
		Unsignalized	Left	7	11			0	0		
			Through							0	0
			Right								
14	14th Street at Monticello Avenue			14th Street		14th Street		Monticello Avenue		Monticello Avenue	
		Unsignalized	Left	5	6	1	3	1	0	0	1
			Through					0	0	0	0
			Right								
15	13th Street at Monticello Avenue			13th Street		13th Street		Monticello Avenue		Monticello Avenue	
		Unsignalized	Left	2	4	1	1	0	0	0	0
			Through					0	0		
			Right								
16	Princess Anne Road at Monticello Avenue			Princess Anne Road		Princess Anne Road		Monticello Avenue		Monticello Avenue	
		Signalized	Left	m25	m20	m35	m27	91	m115	38	71
			Through	128	97	155	81	33	100	336	430
			Right								

Table 11: 2045 No-Build Conditions Peak Hour Queue Results (cont.)

Intersection Number and Description		Type of Control	Lane Group	Maximum Queue							
				Eastbound		Westbound		Northbound		Southbound	
				AM	PM	AM	PM	AM	PM	AM	PM
17	11th Street at Monticello Avenue			11th Street		11th Street		Monticello Avenue		Monticello Avenue	
		Unsignalized	Left					2	1		
			Through	3	3					0	0
			Right								
18	9th Street at Monticello Avenue			9th Street		9th Street		Monticello Avenue		Monticello Avenue	
		Unsignalized	Left					0	0		
			Through	3	3					0	0
			Right								
19	Virginia Beach Boulevard at Monticello Avenue			Virginia Beach Boulevard		Virginia Beach Boulevard		Monticello Avenue		Monticello Avenue	
		Signalized	Left	47	106	98	113	142	180	110	214
			Through	107	177	116	152	171	354	221	282
			Right			60	43	0	0		
20	Monticello Avenue at St. Paul's Boulevard			Monticello Avenue		Monticello Avenue		St. Paul's Boulevard		St. Paul's Boulevard	
		Signalized	Left	103	106						
			Through					119	74	120	325
			Right								
21	Olney Road at St. Paul's Boulevard			Olney Road		Olney Road		St. Paul's Boulevard		St. Paul's Boulevard	
		Unsignalized	Left					2	10	62	131
			Through	28	101			1	3	25	123
			Right					2	16		
22	Brambleton Avenue at St. Paul's Boulevard			Brambleton Avenue		Brambleton Avenue		St. Paul's Boulevard		St. Paul's Boulevard	
		Signalized	Left	101	75	92	117	408	225	185	225
			Through	183	440	235	313	343	406	252	716
			Right	259	529						
23	Bute Street at St. Paul's Boulevard			Bute Street		Bute Street		St. Paul's Boulevard		St. Paul's Boulevard	
		Signalized	Left					71	38		
			Through	28	111	69	96	188	144	193	502
			Right								
24	Charlotte Street/ Wood Street at St. Paul's Boulevard			Charlotte Street		Wood Street		St. Paul's Boulevard		St. Paul's Boulevard	
		Signalized	Left	39	91	155	190	140	139	245	316
			Through					567	300		
			Right	48	244						

Table 11: 2045 No-Build Conditions Peak Hour Queue Results (cont.)

Intersection Number and Description		Type of Control	Lane Group	Maximum Queue							
				Eastbound		Westbound		Northbound		Southbound	
				AM	PM	AM	PM	AM	PM	AM	PM
				Olney Road*		Olney Road*		Monticello Avenue*		Monticello Avenue*	
25	Monticello Avenue at Olney Road	Unsignalized	Left	45	120	0		29	57	15	338
			Through					12	97		
			Right								

2 Alternatives Development & Refinement

The study team developed concepts along the Monticello Avenue / St. Paul's Boulevard corridor to enhance multimodal access and address safety and operational deficiencies in the study area.

The study team screened concepts based on anticipated safety benefits, operational performance, multimodal access, constructability, estimated costs, and input from the SWG. A SWG meeting was held on January 8, 2024 to review the preliminary concepts. The meeting materials can be found in **Appendix E**. The study team selected five concepts to present to the public and gather feedback, as well as seven types of corridorwide improvements.

2.1 Phase 1 Alternative Development

The study team developed preliminary concepts in parallel with the highest-level needs diagnosis efforts documented in **Chapter 1.5**. The proposed Phase 1 concepts were developed to meet the following criteria:

- Improve operations and capacity at study intersections
- Mitigate safety issues for all users along the study corridor
- Enhance pedestrian and transit access along the study corridor

The following sections describe the process used to develop Phase 1 concepts encompassing various categories of needs.

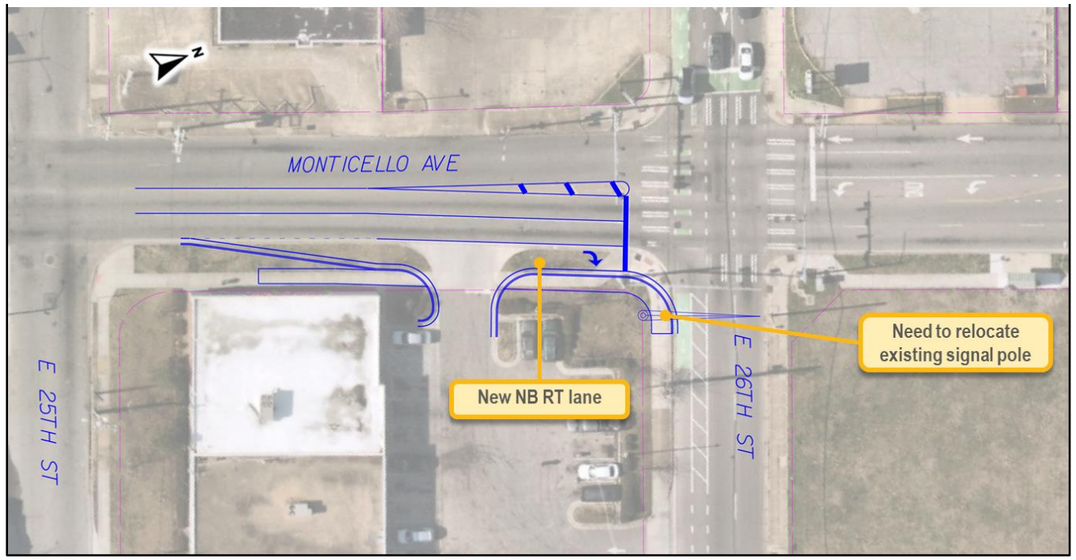
2.1.1 Concepts Addressing Traffic Operations Needs

Several concepts were developed to address congestion and operations needs along the corridor. These concepts are further described below.

Monticello Avenue & 26th Street Intersection – Northbound Right-Turn Lane

Figure 33 shows a concept to add capacity at the 26th Street intersection by constructing a new northbound right-turn lane. The existing traffic signal pole on the southeast corner would need to be relocated, and it is anticipated that commercial entrance to the Advance Auto Parts would be maintained.

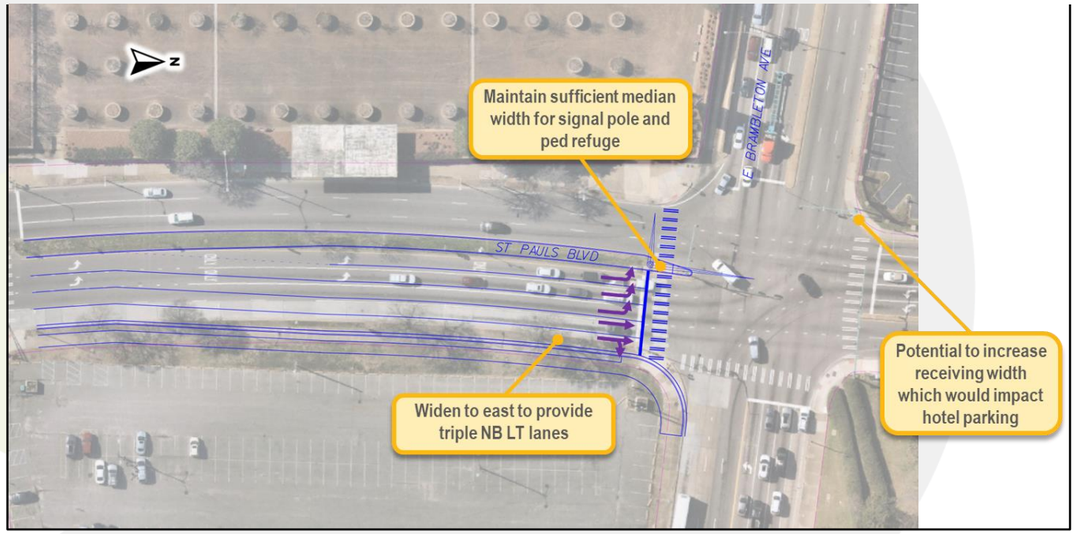
Figure 33: Phase 1 Concept – 26th Street Northbound Right-Turn Lane



St. Paul's Boulevard & Brambleton Avenue Intersection – Northbound Triple Left-Turn Lanes

Figure 34 shows a concept to widen St. Paul's Boulevard to the east in order to provide triple northbound left-turn lanes. The existing signal pole in the northbound median would need to be relocated, and the northwest corner would need to be evaluated for potential widening to receive the triple left-turn lanes.

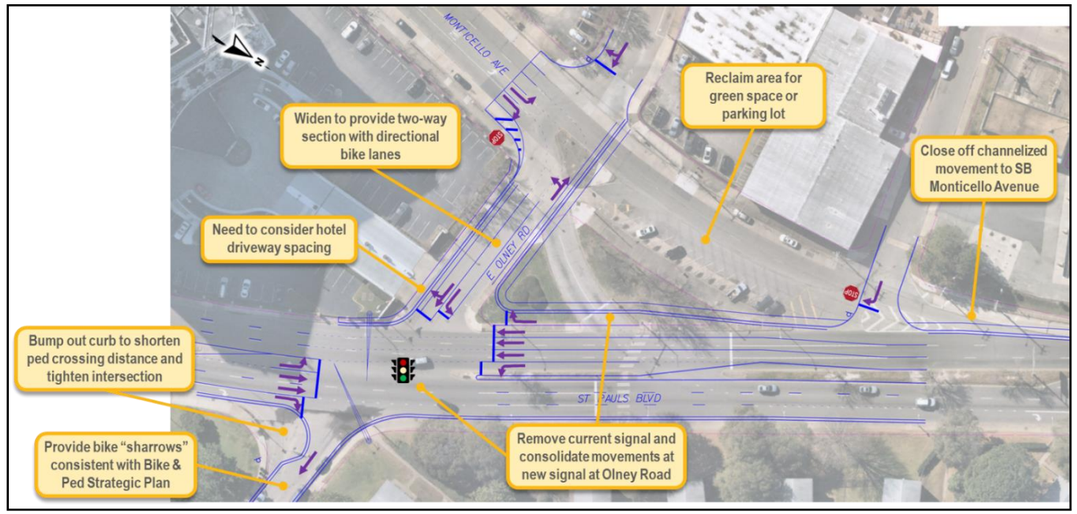
Figure 34: Phase 1 Concept – Brambleton Avenue Northbound Triple Left-Turn Lanes



St. Paul's Boulevard and Monticello Avenue at Olney Road Reconfiguration

Figure 42 shows a reconfiguration concept for the "triangle" area formed by St. Paul's Boulevard, Monticello Avenue, and Olney Road. The existing signal would be removed, and the movements would be consolidated at a new signal at Olney Road. Olney Road would be widened between Monticello Avenue and St. Paul's Boulevard to provide a two-way section with directional bike lanes. The channelized movements heading southbound on Monticello Avenue would be removed, and the area would be reclaimed for green space or a parking lot. The curb along East Olney Road would be bumped out to shorten the pedestrian crossing distance and tighten the intersection. One challenge of this concept would be the spacing between the new signal and the hotel driveway along Olney Road.

Figure 35: Phase 1 Concept – St. Paul's Boulevard & Monticello Avenue at Olney Road Reconfiguration



Rail Crossing Improvements

Figure 36 shows a concept for rail crossing improvements to address congestion on Monticello Avenue related to at-grade railroad crossings on adjacent corridors. The improvements include installing detection to enable modified traffic signal timing plans during train events and installing advanced warning signs for active trains along Church Street. A long-term improvement would include the construction of a grade-separated crossing at Church Street.

Figure 36: Phase 1 Concept – Rail Crossing Improvements

2.1.2 Concepts Addressing Safety Needs

Concepts addressing safety included the following corridorwide improvements:

- Install stop bars on all stop-controlled intersection approaches
- Modify all protected-permissive left-turn phases (five-section signal heads) to flashing yellow arrow (FYA)
- Install backplates on all traffic signal heads

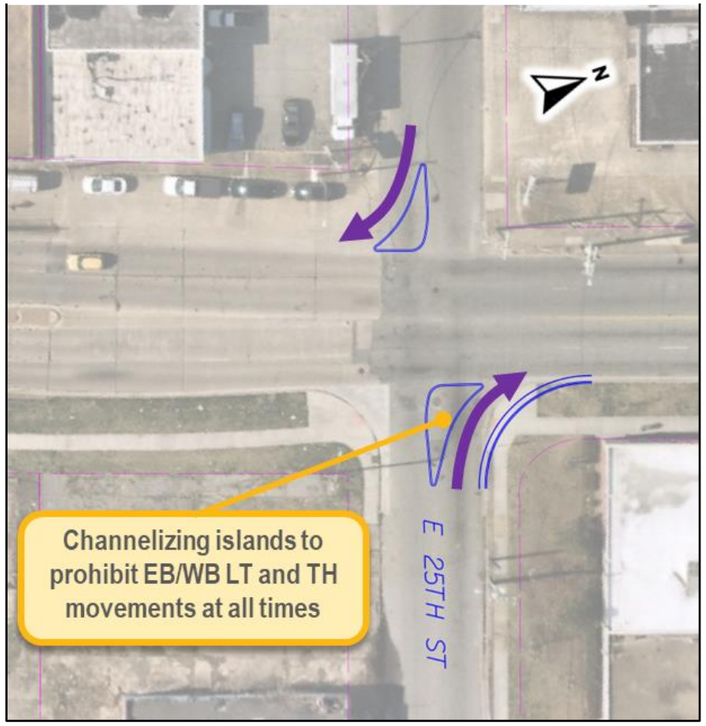
In addition, concepts were proposed at two signalized intersections to address high number of angle crashes. At the Brambleton Avenue intersection, the eastbound and westbound left-turn phases would be modified to protected only. The northbound left-turn phase at Charlotte Street/Wood Street would also be modified to protected only, and southbound left-turn movements would be prohibited due to the lack of a turn lane.

Finally, two alternatives were presented for the 25th Street intersection to address the high number of angle crashes caused by eastbound and westbound vehicles making left-turn and through movements that are currently prohibited by signage for most of the day.

Monticello Avenue & 25th Street Intersection – Channelizing Islands Alternative

Figure 37 shows a concept sketch for the first alternative at the 25th Street intersection that would include the construction of channelizing islands on the eastbound and westbound approaches to prohibit vehicles from turning left or traveling straight across Monticello Avenue.

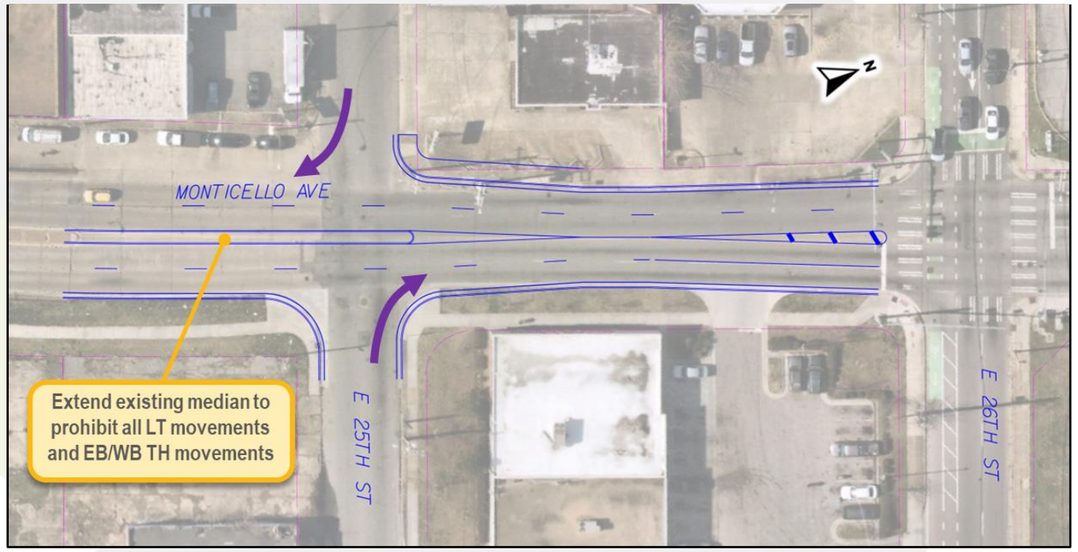
Figure 37: Phase 1 Concept – 25th Street Channelizing Islands Alternative



Monticello Avenue & 25th Street Intersection – Median Extension Alternative

Figure 38 shows a concept sketch for the second alternative at the 25th Street intersection that would include the extension of the existing median from the railroad underpass through the intersection, which would prohibit all left-turn and through movements to and from 25th Street.

Figure 38: Phase 1 Concept – 25th Street Median Extension Alternative



2.1.3 Concepts Addressing Pedestrian Access and Safety Needs

Concepts addressing pedestrian access and safety included the following corridorwide improvements:

- Install ADA-compliant curb ramps
- Upgrade existing sidewalks to be ADA compliant
- Refresh existing crosswalk markings and consistently use high-visibility crosswalks
- Install pedestrian signal heads and push buttons for all crossings at signalized intersections
- Install new sidewalk and marked crosswalks to complete gaps in pedestrian network
- Implement access management strategies such as consolidating or closing driveways

2.1.4 Concepts Addressing Transit Access Needs

Concepts addressing transit access included providing an additional bus stop with a shelter on northbound St. Paul's Boulevard between Brambleton Avenue and Virginia Beach Boulevard to serve Young Terrace. Corridorwide improvements included installing ADA loading pads at bus stops and evaluating long-term opportunities to provide bus shelters.

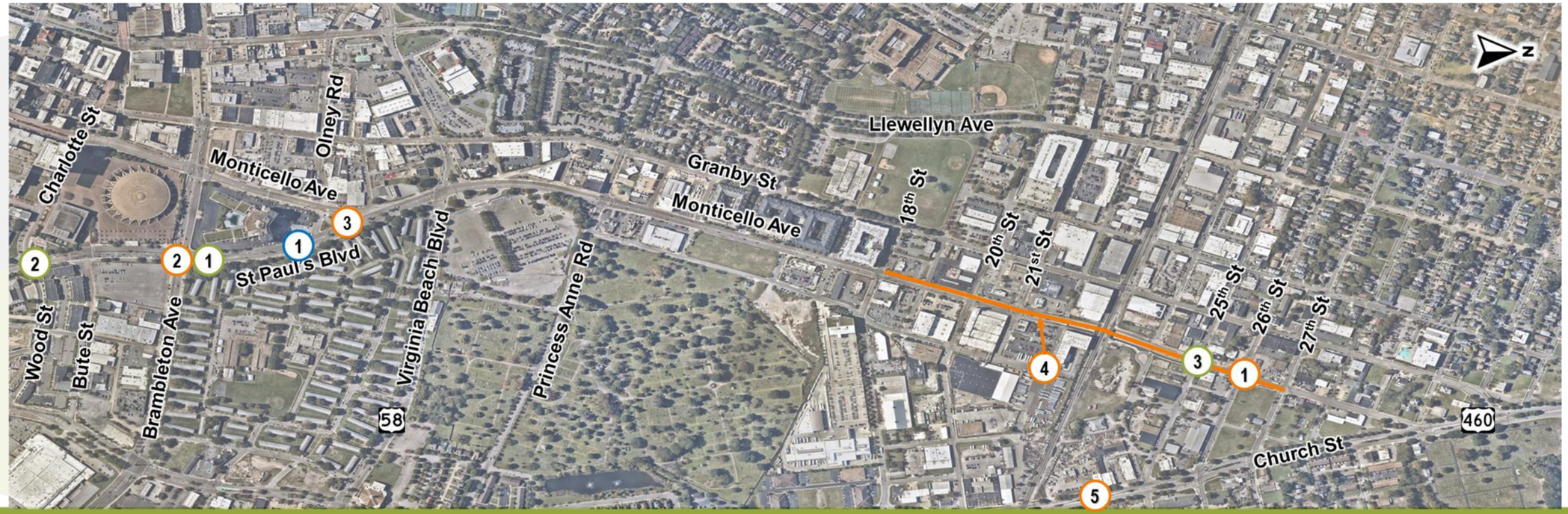
2.1.5 Phase 1 Alternatives Summary

Table 12 includes a refined list of the concepts considered in Phase 1 and the associated needs addressed. **Figure 39** shows the preliminary concepts graphically categorized by the needs addressed by each concept. The study team discussed further details of the Phase 1 improvement concepts during the Phase 1 brainstorming meeting held with the SWG on July 26, 2023.

Table 12: Phase 1 Concepts and Anticipated Needs Addressed

Need	Concept	Need	Concept
Transit Access/TDM Need	Rail crossing	Safety Need	Northbound right-turn lane
	Corridorwide bus shelter/stop improvements		Olney Road concept
			Protected only left-turn phasing
Operations and Access Need	Triple left-turn lanes at Brambleton Ave		Channelizing islands
		Pedestrian and Bicycle Need	Corridorwide pedestrian improvements

Figure 39: Phase 1 Scoping Level Improvement Concepts



Proposed Solutions to Evaluate in Phase 2

Operations Improvements

1. Construct northbound right-turn lane at 26th Street
2. Widen northbound Brambleton Avenue approach to provide 3 left-turn lanes
3. Realign intersection of St. Paul's Boulevard and Monticello Avenue to consolidate movements at Olney Road
4. Install detection to enable modified signal timing plans during train events
5. Install advance warning signs for active trains along Church Street

Pedestrian and Bicycle Improvements:

- Install ADA-compliant curb ramps
- Bring existing sidewalks up to ADA compliance
- Refresh existing crosswalk markings and consistently use high-visibility crosswalks
- Install pedestrian signal heads and push buttons for all crossings at signalized intersections
- Install new sidewalk and marked crosswalks to complete gaps
- Implement access management

Safety Improvements

1. Modify eastbound and westbound left-turn phases to protected only at Brambleton Avenue
2. Modify northbound left-turn phase to protected only and prohibit southbound left-turn at Charlotte/Wood Street
3. Extend median at 25th Street to prohibit eastbound and westbound left-turn and through movements

- Modify all 5-section signal heads to flashing yellow arrow (FYA)
- Install stop bars on all stop-controlled approaches
- Install backplates on all signal heads

Transit Improvements

1. Provide additional bus stop with shelter on northbound St. Paul's Boulevard between Brambleton Avenue and Virginia Beach Boulevard to serve Young Terrace

- Install ADA loading pads at bus stops
- Evaluate long-term opportunities to provide bus shelters

- Denotes corridorwide improvement

2.2 Phase 2 Concept Analysis and Refinement

A SWG meeting was held on January 8, 2024 to share the draft concept sketches and gather feedback on the concepts. The study team then conducted a screening-level traffic operations analysis using Synchro 11 as well as a screening-level safety analysis. An additional SWG meeting was held on February 13, 2024 to review the revised concepts and share the concept screening results in advance of public outreach. During the concept screening results meeting, the study team discussed each concept based on potential impacts to safety, traffic operations, cost, and right-of-way impacts. Both presentations, along with the detailed concept benefits, are included in **Appendix E**.

2.2.1 Phase 2 Concept Analysis

Some of the Phase 2 concepts remained unchanged from Phase 1 while others were further refined. In addition, several new concepts were introduced by the SWG for consideration in Phase 2. The following report sections include the details for each concept analyzed.

Monticello Avenue & 25th Street Intersection – Channelizing Islands Alternative

This concept would include the construction of channelizing islands on the eastbound and westbound approaches to prohibit vehicles from turning left or traveling straight across Monticello Avenue. **Figure 40** presents a conceptual sketch of the alternative.

Monticello Avenue & 25th Street Intersection – Median Extension Alternative

This concept would extend the existing median from the railroad underpass through the intersection to prohibit all left-turn movements to and from 25th Street. **Figure 41** presents a conceptual sketch of the alternative.

Figure 40: Phase 2 Concept – 25th Street Channelizing Islands Alternative

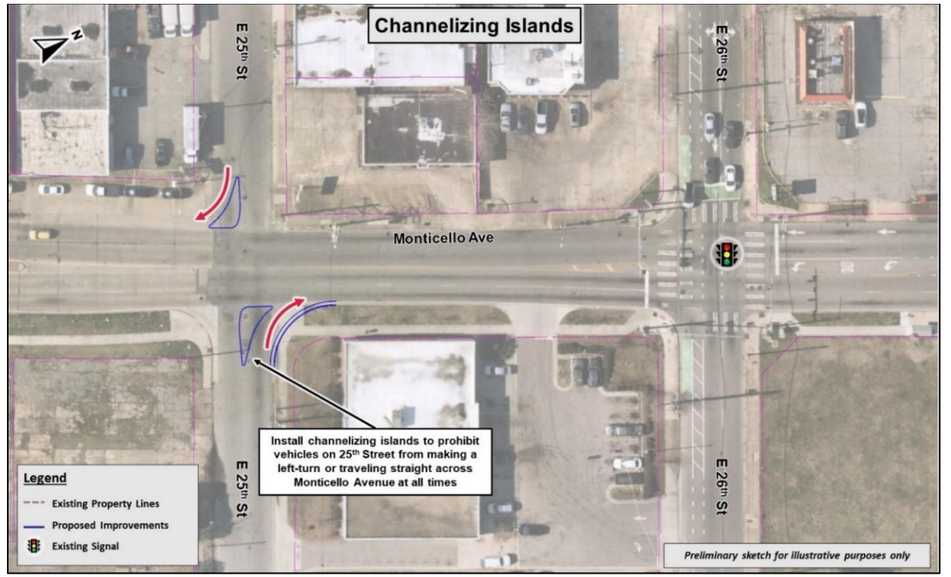
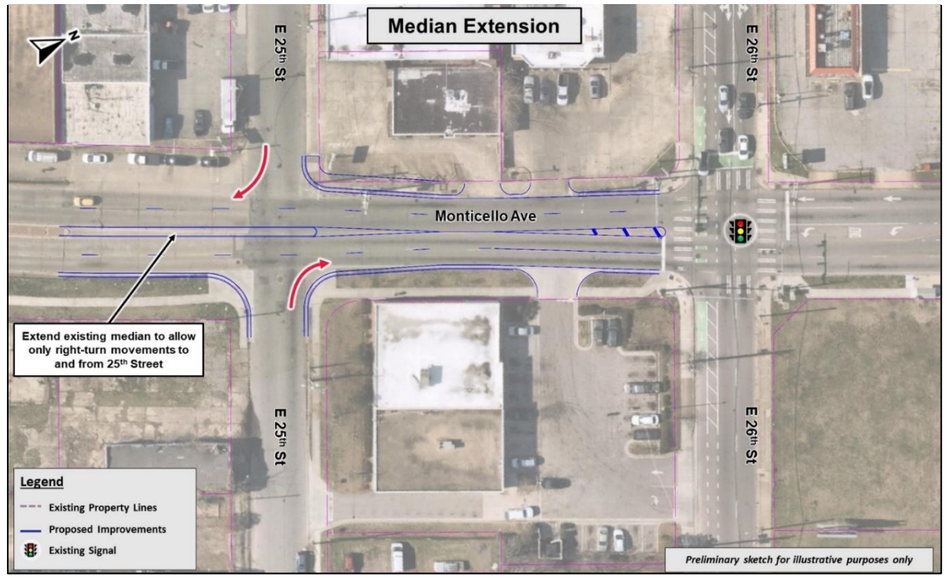


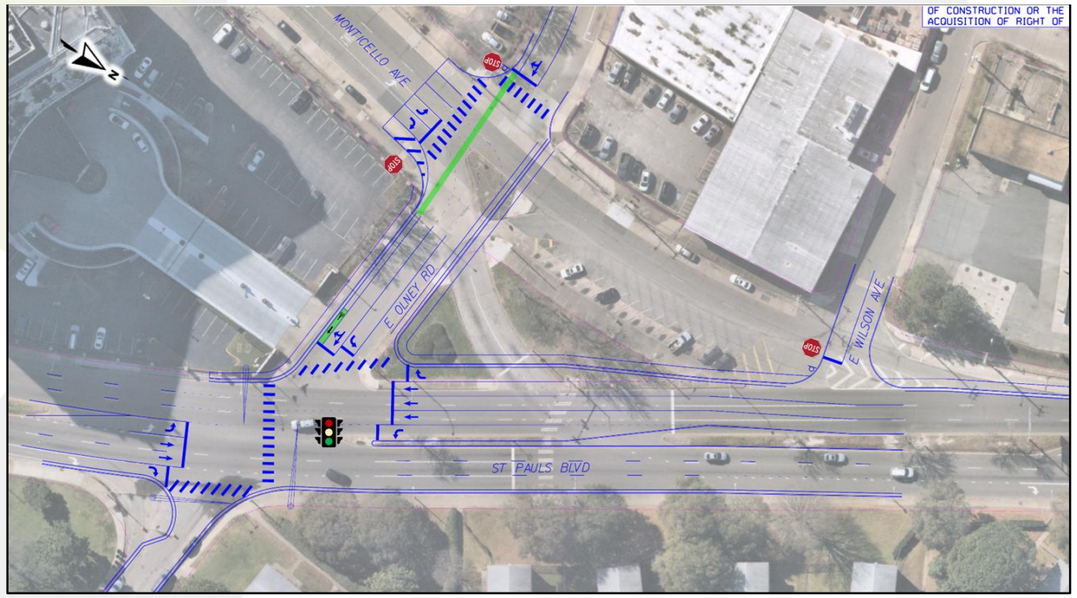
Figure 41: Phase 2 Concept – 25th Street Median Extension Alternative



St. Paul's Boulevard and Monticello Avenue at Olney Road Reconfiguration – Existing Olney Alignment Alternative

This concept would remove the existing traffic signal and consolidate movements at a new traffic signal at Olney Road. Olney Road would be widened between Monticello Avenue and St. Paul's Boulevard to provide a two-way section with directional bike lanes. The channelized movements heading southbound on Monticello Avenue would be removed, and the area would be reclaimed for green space or a parking lot. The curb along East Olney Road would be bumped out to shorten the pedestrian crossing distance and tighten the intersection. One challenge of this concept would be the spacing between the new traffic signal and the hotel commercial entrance on Olney Road. **Figure 42** presents a conceptual sketch of the alternative.

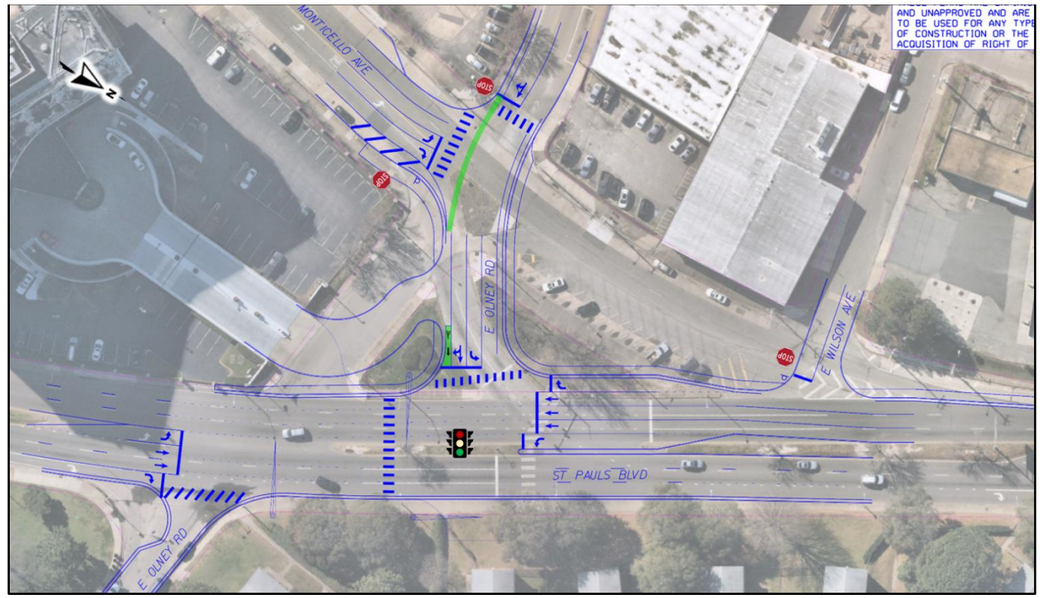
Figure 42: Phase 2 Concept – St. Paul's Boulevard & Monticello Avenue at Olney Road Reconfiguration – Existing Olney Alignment



St. Paul's Boulevard and Monticello Avenue at Olney Road Reconfiguration – Alternate Olney Alignment Alternative

Like the first alternative, this concept would remove the existing traffic signal and consolidate movements at a new traffic signal at Olney Road. For this alternative, Olney Road would be realigned to create a new 90 degree intersection with St. Paul's Boulevard. The hotel driveway would also be realigned to maintain access and create additional space between the driveway and St. Paul's Boulevard. In the long term, this alternative would allow for further realignment of Olney Road with the future redevelopment of Young Terrace. **Figure 43** presents a conceptual sketch of the alternative.

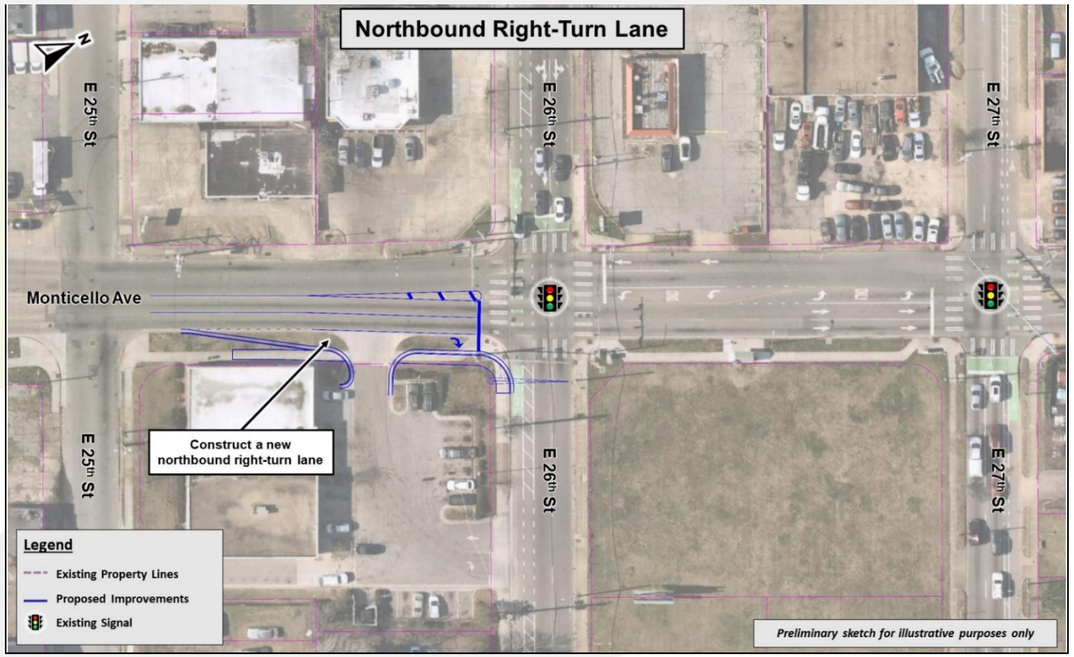
Figure 43: Phase 2 Concept – St. Paul's Boulevard & Monticello Avenue at Olney Road Reconfiguration – Alternate Olney Alignment



Monticello Avenue & 26th Street Intersection – Northbound Right-Turn Lane

This concept would add capacity to the 26th Street intersection by constructing a new northbound right-turn lane. The existing traffic signal pole on the southeast corner would be relocated and it is anticipated that access to the Advance Auto Parts would be maintained. **Figure 44** presents a conceptual sketch of the alternative.

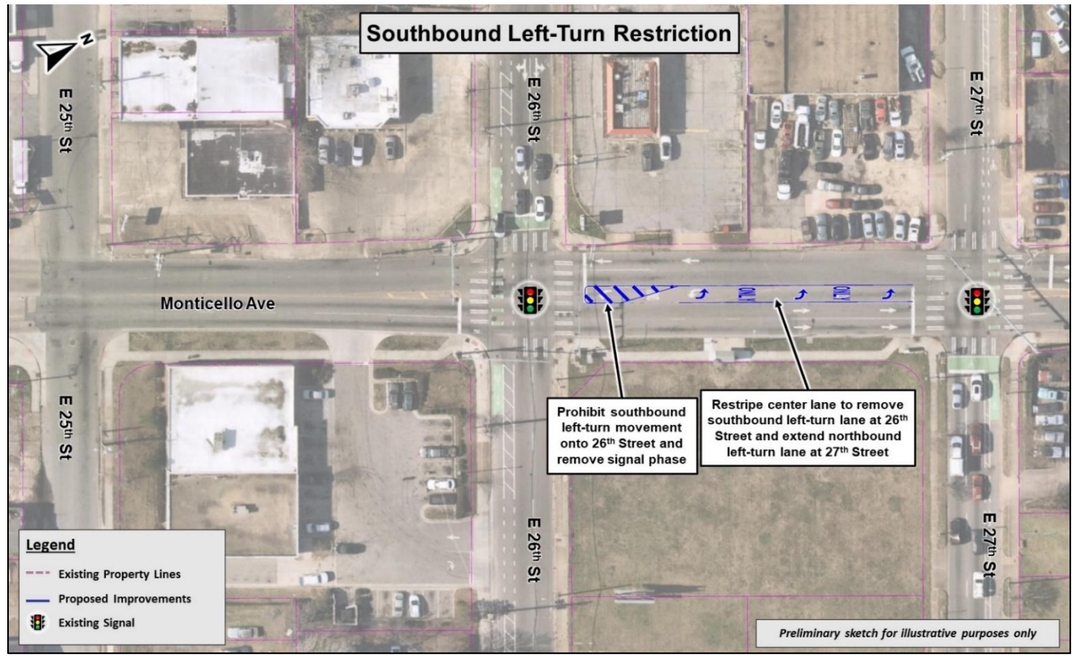
Figure 44: Phase 2 Concept – 26th Street Northbound Right-Turn Lane



Monticello Avenue & 26th Street Intersection – Southbound Left-Turn Restriction

This concept would restripe the center lane between 26th Street and 27th Street to remove the southbound left-turn lane at 26th Street and extend the storage length for the northbound left-turn lane at 27th Street. This would improve capacity at the 26th Street intersection by prohibiting the southbound left turns, removing the protected southbound left-turn phase, and reallocating left-turn phase time to the northbound approach. This concept could be implemented with or without the northbound right-turn lane concept. **Figure 45** presents a conceptual sketch of the alternative.

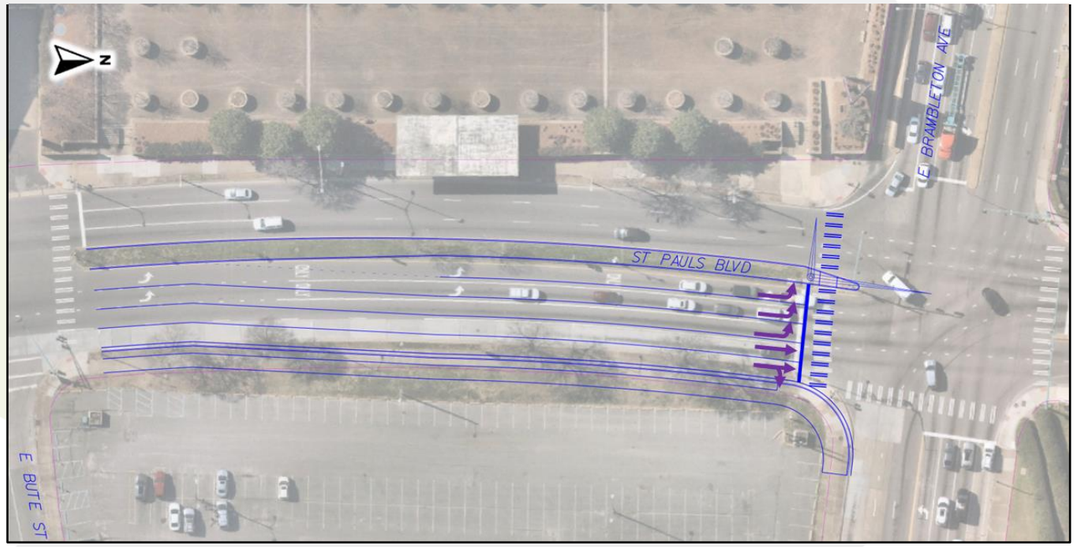
Figure 45: Phase 2 Concept – 26th Street Southbound Left-Turn Restriction



St. Paul's Boulevard & Brambleton Avenue Intersection – Northbound Triple Left-Turn Lanes

This concept would widen St. Paul's Boulevard to the east to provide triple northbound left-turn lanes. The existing traffic signal pole in the northbound median would need to be relocated and the northwest quadrant would need to be evaluated for potential widening to receive the triple left-turn lanes. A conceptual sketch of the alternative is show in **Figure 46**.

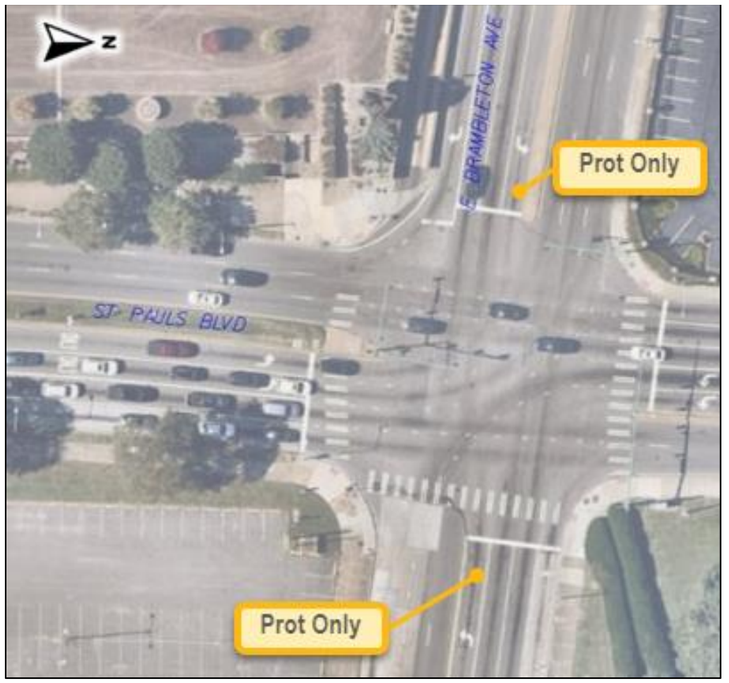
Figure 46: Phase 2 Concept – Brambleton Avenue Northbound Triple Left-Turn Lanes



St. Paul's Boulevard & Brambleton Avenue Intersection – Eastbound/Westbound Protected Only Left-Turn Phases

This concept would modify the eastbound and westbound left-turn phases to protected only, which would reduce conflicts by eliminating the permissive movement and provide flexibility to modify phase sequence (lead-lag) for improved progression along Brambleton Avenue. The left-turn movements are identified in **Figure 47**.

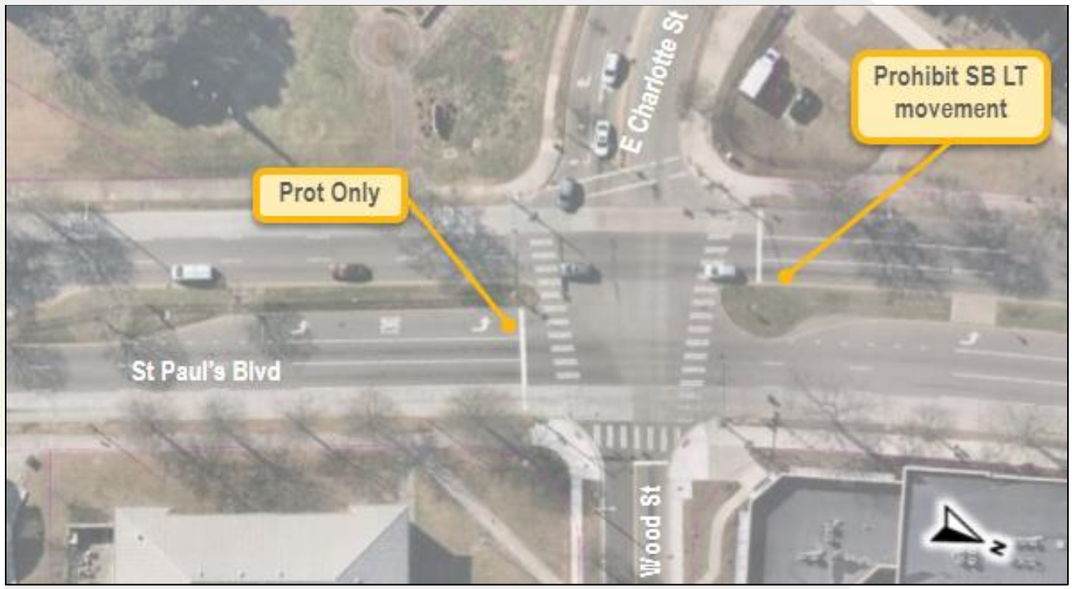
Figure 47: Phase 2 Concept – Brambleton Ave Eastbound/Westbound Protected Only Left-Turn Phases



St. Paul's Boulevard & Charlotte Street/Wood Street Intersection – Left-Turn Modifications

This concept would modify the northbound left-turn phase to protected only and prohibit southbound left-turn movements by installing a no-left turn sign. This concept would reduce conflicts by eliminating the permissive movement and provide flexibility to modify phase sequence (lead-lag) for improved progression along St. Paul's Boulevard. The left-turn movements are identified in **Figure 48**.

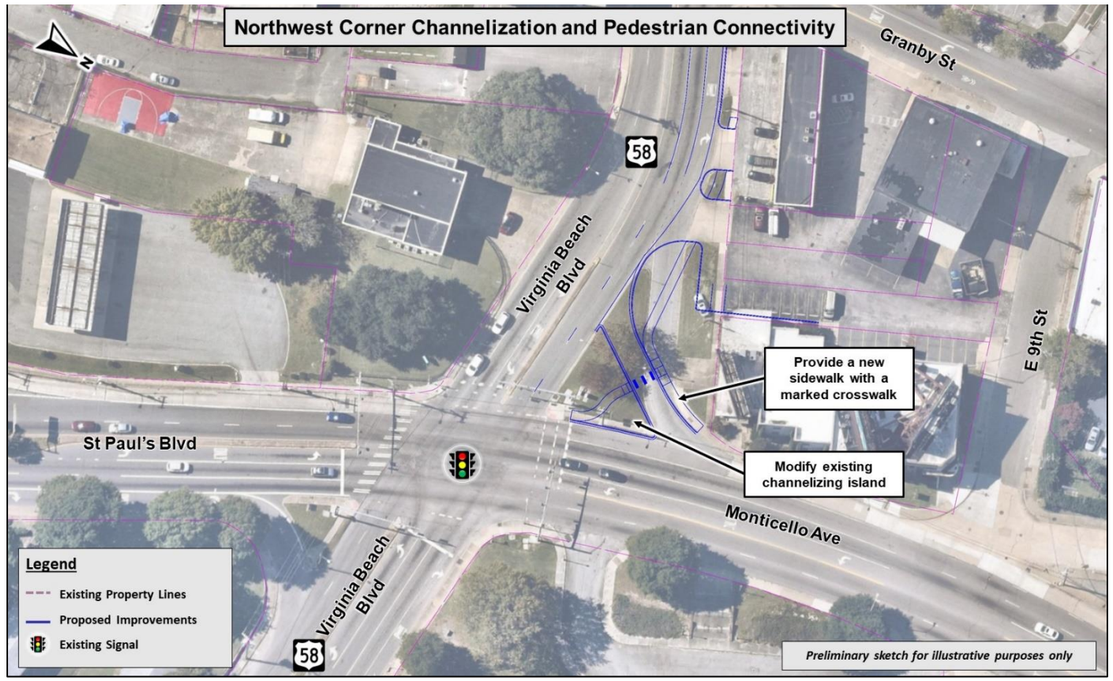
Figure 48: Phase 2 Concept – Charlotte Street/Wood Street Left-Turn Modifications



Monticello Avenue & Virginia Beach Boulevard Intersection – Northwest Quadrant Channelization & Pedestrian Access

This concept would modify the existing channelizing island in the northwest quadrant of the intersection to increase the angle at which the southbound right-turn lane intersects with westbound Virginia Beach Boulevard. New sidewalks would be provided on the northwest corner with a new marked crosswalk across the channelized southbound right-turn lane. A conceptual sketch of the alternative is shown in **Figure 49**.

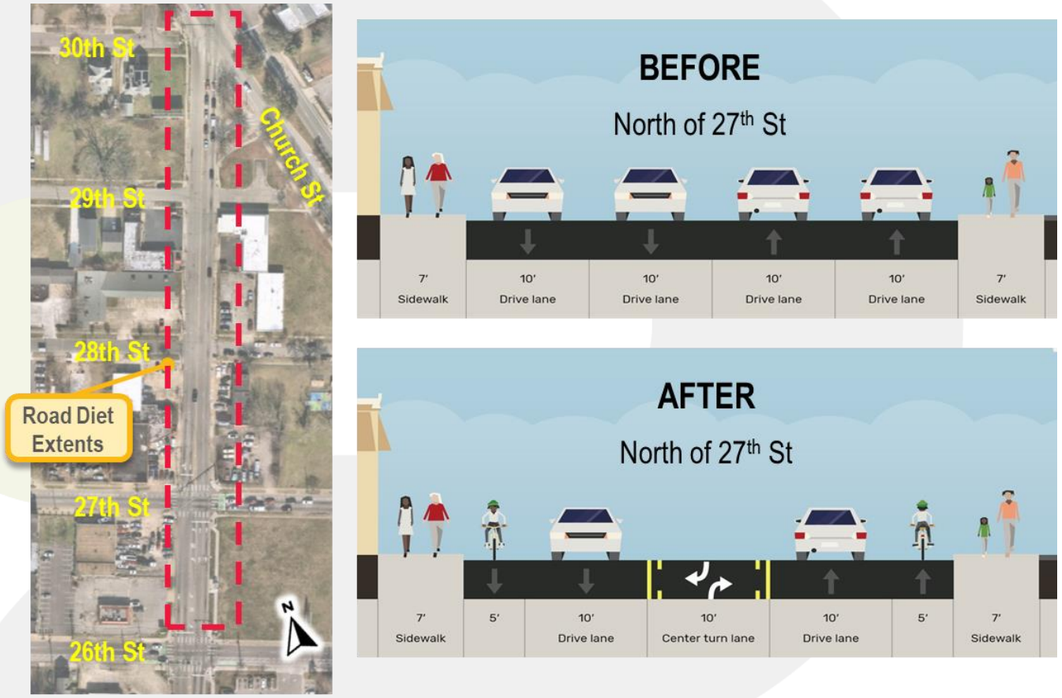
Figure 49: Phase 2 Concept – Virginia Beach Boulevard NW Corner Channelization & Pedestrian Connectivity



Monticello Avenue from 27th Street to Church Street – Potential Road Diet

This concept would implement a potential road diet along Monticello Avenue between 27th Street and Church Street to provide one travel lane in each direction, one center left-turn lane, and designated bike lanes in each direction. **Figure 50** presents a conceptual sketch of the alternative.

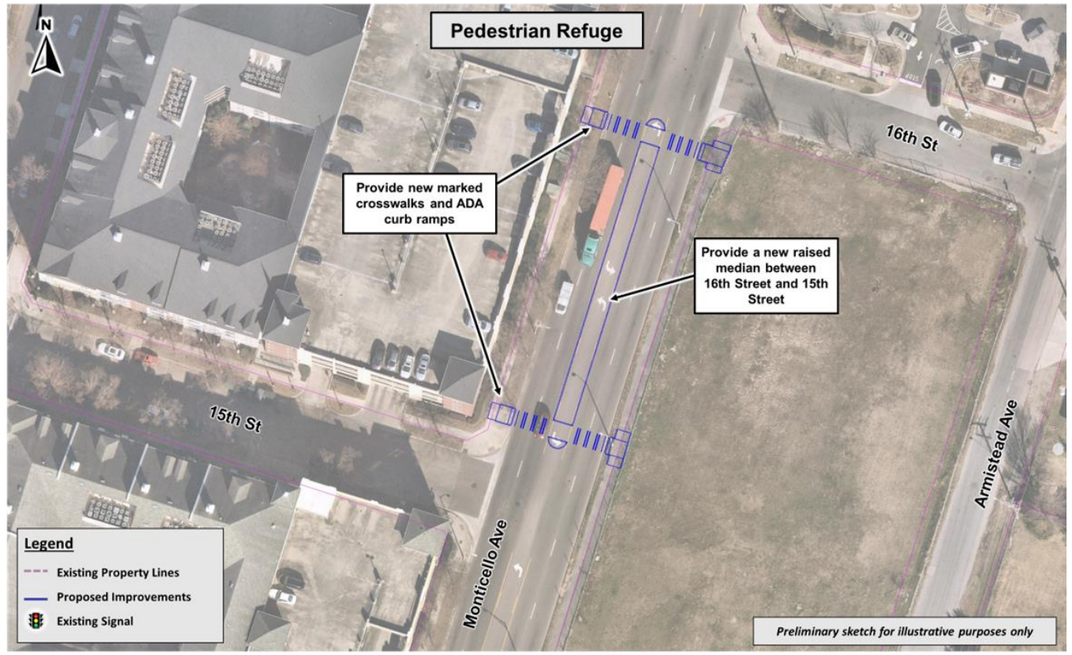
Figure 50: Phase 2 Concept – Monticello Avenue Potential Road Diet



Monticello Avenue at 15th Street and 16th Street – Median Pedestrian Islands

This concept would construct a new raised median with marked crosswalks and ADA curb ramps between 15th Street and 16th Street. **Figure 51** presents a conceptual sketch of the alternative.

Figure 51: Phase 2 Concept – 15th Street & 16th Street Median Pedestrian Islands



Corridorwide Improvements – Signing, Marking, and Signal Improvements and Pedestrian and Transit Infrastructure Improvements

Corridorwide improvements for signing, marking, and traffic signals consist of the following:

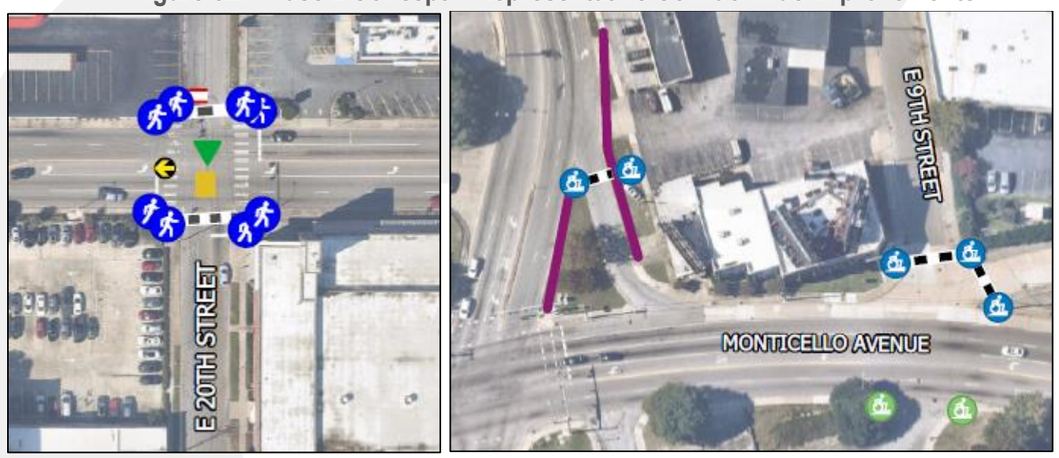
- Install detection to enable modified traffic signal timing plans during train events
- Modifying all protected-permissive left-turn phases (five-section signal heads) to flashing yellow arrows (FYA)
- Install stop bars on all stop-controlled intersection approaches
- Install backplates on all traffic signal heads
- Refresh existing crosswalk markings and consistently use high-visibility crosswalks
- Install pedestrian signal heads and push buttons for all crossings at signalized intersections
- Install new marked crosswalks to complete gaps in pedestrian connectivity

Corridorwide improvements for pedestrian and transit infrastructure consist of the following:

- Install ADA-compliant curb ramps
- Bring existing sidewalks up to ADA compliance
- Install new sidewalk to complete gaps in pedestrian connectivity
- Provide additional bus stop with shelter on northbound St. Paul's Boulevard between Brambleton Avenue and Virginia Beach Boulevard to serve Young Terrace
- Install ADA loading pads at bus stops
- Evaluate long-term opportunities to provide bus shelters

Figure 52 presents representative examples of corridorwide improvements.

Figure 52: Phase 2 Concept – Representative Corridorwide Improvements



Anticipated Crash Reduction for Alternatives

The study team reviewed crash modification factors (CMFs) to determine the potential safety benefits for each concept. CMFs were selected from the approved list of CMFs applied during the VDOT SMART SCALE safety scoring process, and where not available, the Virginia State Preferred CMF list or CMF Clearinghouse. The CMF resulting in the highest anticipated crash reduction was applied to fatal and injury crashes within the influence area of each intersection or roadway segment as applicable, as shown in **Table 13.**

2.2.2 Phase 2 Concept Screening Summary

The primary goal of the Phase 2 concept development effort was to prepare a refined set of concepts to present to the public and solicit feedback. The study team compared all concepts for all improvement types and locations across several metrics including cost, safety, access management, right-of-way impacts, and challenges and considerations to determine the refined list of concepts to present to the public, as shown in **Table 14**. In addition, the study team used the iCAP screening tool to compare two different alternatives at the intersection of Monticello Avenue and 25th Street due to the proposed intersection reconfiguration. The iCAP Stage 2 results are shown in **Table 15** and **Table 16.**

Table 13: Crash Modification Factors (CMFs) and Crash Reduction Summary

Intersection / Location	Improvement	CMF Name	CMF	Annual Crash Reduction (Fatality + Injury Crashes)
Monticello Avenue & 25th Street	Channelizing islands	Convert two-way stop control to unsignalized RCUT	0.37	3.8
	Median extension	Add median or close median opening	0.40	3.6
Monticello Avenue, St Paul's Boulevard & Olney Road	Existing Olney alignment	Convert stop control to traffic signal Add turn lane	0.65 0.97	0.30
	Alternate Olney alignment	Convert stop control to traffic signal Reduce intersection skew Add turn lane	0.65 0.87 0.97	0.36
Monticello Avenue & 26th Street	Northbound right-turn lane	Change number of approaches with right-turn lane	0.96	0.19
	Southbound left-turn restriction	Extend turn lane (at 27th Street) Prohibit left-turn movement and remove traffic signal phase	0.85 *	0.36 *
St. Paul's Boulevard & Brambleton Avenue	Northbound triple left-turn lanes	Add turn lane	0.97	0.11
	Eastbound/Westbound protected only left-turn phases	Change from permitted/protected left-turn to protected on major approach	0.01	2.4
St. Paul's Boulevard & Charlotte Street/Wood Street	Left-turn modifications	Change from permitted/protected left-turn to protected on major approach	0.01	1.2
Monticello Avenue & Virginia Beach Boulevard	Channelization and pedestrian access	Add new sidewalk Improve angle of merging traffic	0.12 ***	0** ***
Monticello Avenue from 27th Street to Church Street	Road diet (4U to 3T)	Road Diet	0.71	2.4
Corridorwide Improvements	Signing, marking, and traffic signal improvements Pedestrian and transit infrastructure improvements	Change from protected/permissive left-turn to Flashing Yellow Arrow Install retroreflective backplates Convert standard crosswalk pavement marking to high visibility crosswalk Install countdown PED timer (ped crashes only) Add pedestrian signal heads (all other crashes)	0.81 0.85 0.63 0.30 0.85	9.0
Monticello Avenue at 15th Street to 16th Street	Median pedestrian islands	Install raised pedestrian crossing	0.70	0**

*No CMF for the improvement exists; however, the improvement would reduce the number of conflicts from 13 to 9, which would result in additional crash reduction beyond what is shown
**No recent pedestrian crashes documented
***No CMF for the improvement exists; however, it provides an improved angle for merging and enhanced sight distance and removes merging vehicles from the functional area of the Granby Street intersection

Table 14: Concept Screening Summary

Category	Concept	Estimated Cost	Annual Crash Reduction	Access Management	ROW Impacts	Qualitative Benefits	Challenges and Considerations	Advance to Public Engagement
Capacity Improvement Concepts	**26th St – NBRT Lane**	$800k – $1.0 M	< 1 crash	None	Medium	Improved operations Traffic flow benefits	Longer ped crossing Property impacts	Yes
	Brambleton Ave – Triple NBLT Lanes	$2.3 M - $2.8 M	< 1 crash	None	Medium	Some increased capacity	Property impacts Design	No (screened out)
Safety Improvement Concepts	**25th St – Channelizing Islands**	$200k - $300K	3.8 crashes	None	None	Improved safety Improved operations	Design	Yes
	25th St – Median Extension	$900k – $1.1 M	3.6 crashes	None	Low	Improved safety Improved operations	Property impacts	Yes
	Monticello Ave, St. Paul's Blvd, & Olney Rd – Existing Alignment	$3.0 M - $5.0 M	<1	Medium	None	Improved safety Improved pedestrian and bicycle connectivity	Access Impacts Design	No (screened out)
	Monticello Ave, St. Paul's Blvd, & Olney Rd – Alternate Alignment	$5.8 M - $7.3 M	<1	Medium	Low	Improved safety Improved pedestrian and bicycle connectivity	Access Impacts Design	No (screened out)
	26th St – SBLT Restriction **27th St – Extend NBLT Lane**	<$15k	Conflict reduction (13 to 9)	Medium	None	Improved safety Improved operations	Access impacts	Yes
	Brambleton Ave – Protected Only EBLT/WBLT Phases	$450k - $600k	2 crashes	None	None	Improved safety Improved operations	Potential structural impacts	No (signal modification)
	Charlotte St / Wood St –Protected Only NBLT Phase / **SBLT Restriction**	$125k – $200k	1 crash	Low	None	Improved safety Improved operations	Potential structural impacts Fire and rescue	No (signal modification)
Bike/Pedestrian Access Improvement Concepts	**Virginia Beach Blvd – NW Quadrant Channelization and Pedestrian Access**	$600k - $800k	*No recent bike/ped crashes documented in NW quadrant*	Low	None	Improved safety Improved pedestrian connectivity	Property impacts Traffic signal cabinet	Yes
	Monticello Ave – Road Diet from 27th St to Church St	*TBD*	*TBD*	Low	None	Bicycle connectivity Improved safety Traffic calming	Operational impacts Design	No (screened out)
	15th St and 16th St – Median Pedestrian Islands	*$400k - $500k*	*No recent bike/ped crashes documented*	None	None	Improved pedestrian access Improved pedestrian safety Traffic calming	Conflicts with vehicles exiting Chick-fil-A	No (new concept)
Corridorwide Improvement Concepts	**Signing, Marking, and Signal Improvements**	$1.3 M - $1.5 M	9 crashes	None	Low	Improved safety Improved operations	Potential structural impacts Potential ROW impacts	Yes
	Pedestrian and Transit Infrastructure Improvements	$750k - $1.0 M	*TBD*	None	Low	Improved pedestrian access Improved transit access	ADA Potential ROW impacts	Yes

Table 15: iCAP Stage 2 Results – Monticello Avenue & 25th Street Intersection (AM Peak Hour)

Stage 2: Alternatives Assessment Performance Matrix

MOE 1: *Control Delay* **MOE 2:** *95th Percentile Queue Length*

Alternative	Traffic Operations Metric			Pedestrian Metric Score	Safety Metric		Stage 2 Cost Metric		Total Stage 2 Score	Preferred Alternative?
	MOE 1 Score	MOE 2 Score	Total Score		Annual F+I Crash Reduction	Score	VJuST-C Cost Estimate	Score		
Right-In Right-Out and Left-In	0.6		0.6	0.5	3.78	1.0	$ 250,000	1.0	6.3 out of 8	**Yes: Fewer anticipated ROW and utility imapacts. Directly addresses the safety and operational issues.**
Right-In Right-Out Only	1.0		1.0	0.5	3.60	1.0	$ 1,000,000	0.3	6.8 out of 8	No: Potential ROW and utility conflicts are anticipated to negatively impacts construction feasibility and project costs.
					0.00	0.0		0.0		
					1.80	0.0		0.0		
					0.90	0.0		0.0		
Metric Weighting	3			1	3		1			

Page 2 of 2

Table 16: iCAP Stage 2 Results – Monticello Avenue & 25th Street Intersection (PM Peak Hour)

Stage 2: Alternatives Assessment Performance Matrix

MOE 1: *Control Delay* **MOE 2:** *95th Percentile Queue Length*

Alternative	Traffic Operations Metric			Pedestrian Metric Score	Safety Metric		Stage 2 Cost Metric		Total Stage 2 Score	Preferred Alternative?
	MOE 1 Score	MOE 2 Score	Total Score		Annual F+I Crash Reduction	Score	VJuST-C Cost Estimate	Score		
Right-In Right-Out and Left-In	0.8		0.8	0.5	3.78	1.0	$ 250,000	1.0	6.9 out of 8	**Yes: Fewer anticipated ROW and utility imapacts. Directly addresses the safety and operational issues.**
Right-In Right-Out Only	1.0		1.0	0.5	3.60	1.0	$ 1,000,000	0.3	6.8 out of 8	No: Potential ROW and utility conflicts are anticipated to negatively impacts construction feasibility and project costs.
					0.00	0.0		0.0		
					1.80	0.0		0.0		
					0.90	0.0		0.0		
Metric Weighting	3			1	3		1			

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3 Public & Stakeholder Outreach & Feedback

The Project Pipeline process involved targeted outreach and stakeholder input for the alternative concepts in the study area that the SWG agreed to advance to public engagement (see **Table 14**). The study team developed concept sketches, prepared presentation materials, and created a public survey to meet the public engagement needs for this study. Certain corridorwide improvements, such as bringing existing sidewalks up to ADA compliance, were not presented to the public as they are maintenance-related activities. In addition, concepts to convert existing left-turn signal phases to protected only were not presented to the public since they are straightforward traffic signal modifications for safety purposes.

3.1 Stakeholder Coordination

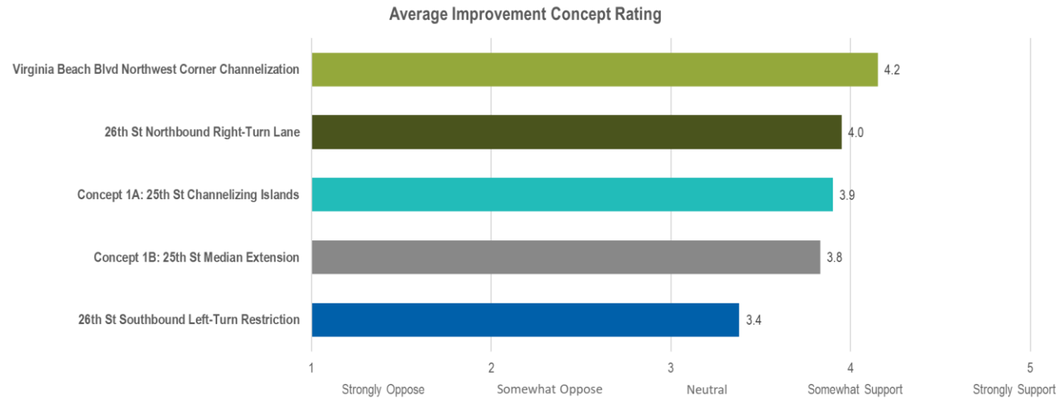
Stakeholder engagement is a key part in making the recommendations of the study successful from more than a traffic operations standpoint. The stakeholders provide regional and local knowledge about the study area and help guide the study direction. The project stakeholders identified in **Section 1.3** were involved in all steps of the Project Pipeline process and assisted in the decision-making process by identifying which concepts to advance to public engagement.

3.2 Public Involvement

A PublicInput survey was available from March 11 to March 25, 2024 to collect feedback on the potential improvements within the study corridor. While the study was available and advertised online, on Thursday March 21, the study team conducted a pedestrian survey along the study corridor during the peak periods of pedestrian travel. The study team asked passing pedestrians the PublicInput survey questions while also providing a QR code for potential responses to be captured online. There were 505 participants, the majority of whom live in the City of Norfolk. The survey provided the study team with an understanding of how the public viewed each concept before selecting preferred concepts. **Figure 53** summarizes the average ranking for each concept presented in the survey. A rating of 5.0 represents a strongly supported concept, and a rating of 1.0 represents a strongly opposed concept.

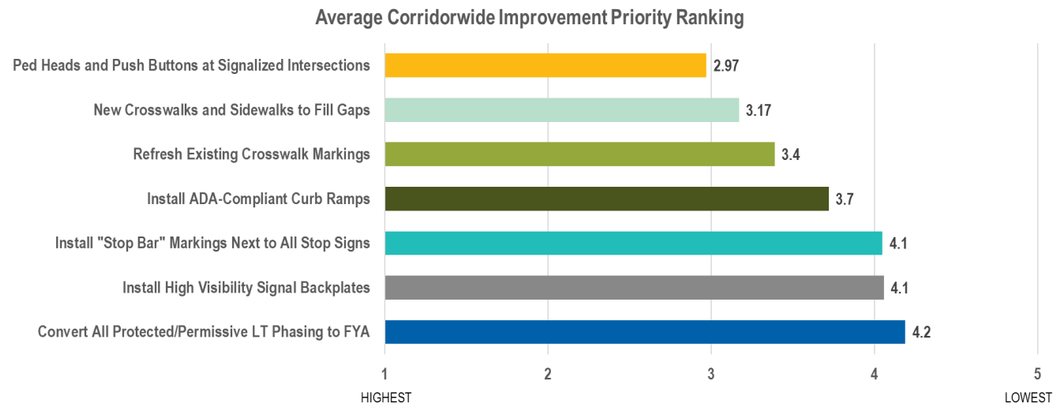
The survey results indicated the strongest support for the Virginia Beach Boulevard Northwest Corner Channelization (4.2 out of 5). The concepts for the 26th Street Northbound Right-Turn Lane (4.0 out of 5.0), the 25th Street channelizing islands (3.9 out of 5.0), and the 25th Street median extension (3.8 out of 5.0) followed closely behind. The survey results indicated the lowest average rating for the 26th Street southbound left-turn restriction (3.4 out of 5.0).

Figure 53: Public Engagement – Average Rating of Concepts



The PublicInput survey was also used to ask participants to rank several corridorwide improvements by order of priority; the results are shown in **Figure 54**. The highest priorities were converting protected-permissive left-turn phases to FYA, installing high visibility signal backplates, and installing stop bar pavement markings next to stop signs.

Figure 54: Public Engagement – Average Corridorwide Improvement Priority Ranking



Kimley-Horn presented the PublicInput survey results to the study work group on March 28, 2024. During this meeting, the study team and SWG discussed potential funding sources and options for packaging concepts together to advance to the development of a set of preferred alternatives. After reviewing the PublicInput survey results and further discussing the concepts, the SWG decided to move forward with combining multiple concepts into a single preferred alternative to be comprised of four different projects. **Appendix E** includes presentation materials from the Preferred Alternatives meeting and the Phase 2 Executive Summary.

4 Preferred Alternative & Investment Strategy

Phase 3 of the study included a detailed design, cost estimate, risk assessment, and further operations assessment of the selected preferred alternative.

4.1 Preferred Alternative Selection

During the Preferred Alternatives meeting with the SWG on March 28, 2024, Kimley-Horn presented a set of concepts to advance to the development of a preferred alternative as outlined in **Section 2.2**. After reviewing the PublicInput survey results and further discussing the concepts, the SWG decided to move forward with combining multiple concepts into a single preferred alternative to be comprised of four different projects.

4.2 Preferred Alternative Refinement

The following projects were selected as the combined preferred alternative. During Phase 3, the designs were further refined in coordination with the SWG as a result of the field review conducted on May 21, 2024 and the Risk Evaluation meeting held on June 11, 2024. Each preferred alternative project and the Phase 3 design refinements are detailed below.

Project 1 — Intersection Improvements
This project consists of several intersection improvements along the corridor that will enhance pedestrian safety and connectivity as well as improve vehicular safety and help mitigate congestion, particularly during train crossing events. The following improvements as described in **Section 2.2** are proposed with this project:

- Monticello Avenue & 26th Street intersection – northbound right-turn lane
- Monticello Avenue & 25th Street intersection – channelizing islands
- Monticello Avenue & Virginia Beach Boulevard intersection – northwest quadrant channelization and pedestrian access

During Phase 3, the Project 1 design was refined to provide pedestrian accommodations across the proposed channelizing islands at 25th Street, adjust the location of the proposed crosswalk across the southbound right-turn lane at Virginia Beach Boulevard, and to bring pedestrian crossings up to current ADA standards at each intersection.

Project 2 — Left-Turn Signal Modifications
This project consists of left-turn signal modifications at two intersections to enhance vehicular and pedestrian safety and provide operational flexibility. The following improvements as described in **Section 2.2** are proposed with this project:

- St. Paul's Boulevard & Brambleton Avenue intersection – eastbound/westbound protected only left-turn phases
- St. Paul's Boulevard & Charlotte Street/Wood Street intersection – northbound protected only left-turn phase and southbound left-turn prohibition

Signal poles and mast arms will be replaced as required for each intersection. During Phase 3, the Project 2 design was refined to realign the pedestrian crossing and provide a new median refuge on the north leg of the Charlotte Street/Wood Street intersection and to construct a new pedestrian crossing on the west leg of the Brambleton Avenue intersection.

Project 3 — Median Pedestrian Islands
This project proposes the construction of a new raised median along Monticello Avenue between 16th Street and 15th Street with new marked crosswalks at each intersection to enhance pedestrian safety and connectivity. During Phase 3, the Project 3 design was refined to include a rectangular rapid flashing beacon (RRFB) at each crosswalk based on VDOT guidance.

Project 4 — Corridorwide Safety and Access Improvements
This project proposes systemic improvements throughout the corridor to enhance vehicular and pedestrian safety, improve operations and traffic flow, and improve pedestrian and transit access and connectivity. As described in **Section 2.2** this includes signing, marking, and traffic signal improvements as well as pedestrian and transit infrastructure improvements: **Figure 55** through **Figure 58** present the refined planning-level sketches for each of the preferred alternative projects. Summary sheets for each preferred alternative project detailing the needs addressed, public feedback, and benefits of the project are provided in **Appendix F**

Figure 55: Preferred Alternative Project 1 Concept

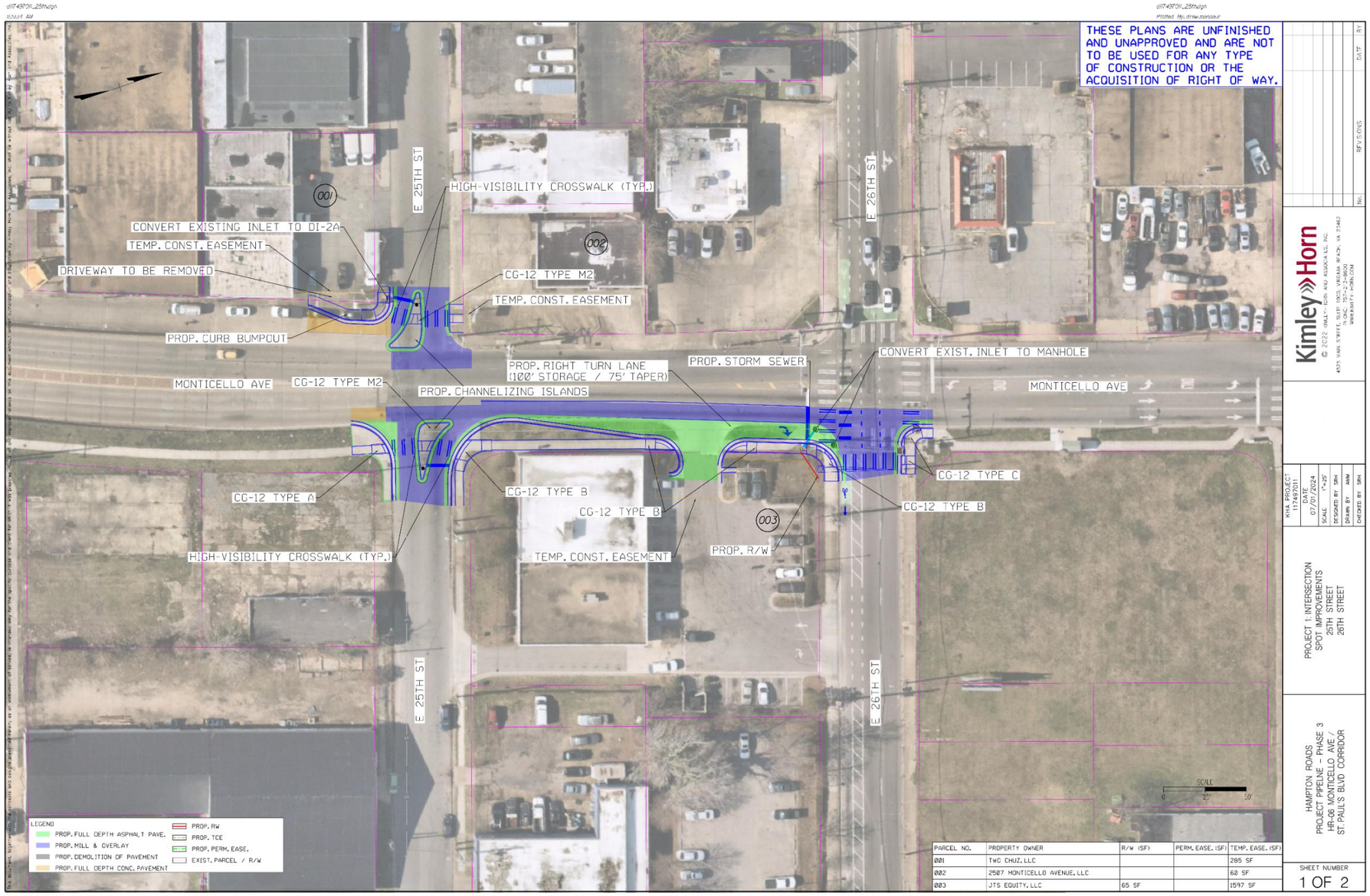


Figure 55: Preferred Alternative Project 1 Concept (Sheet 2 of 2)

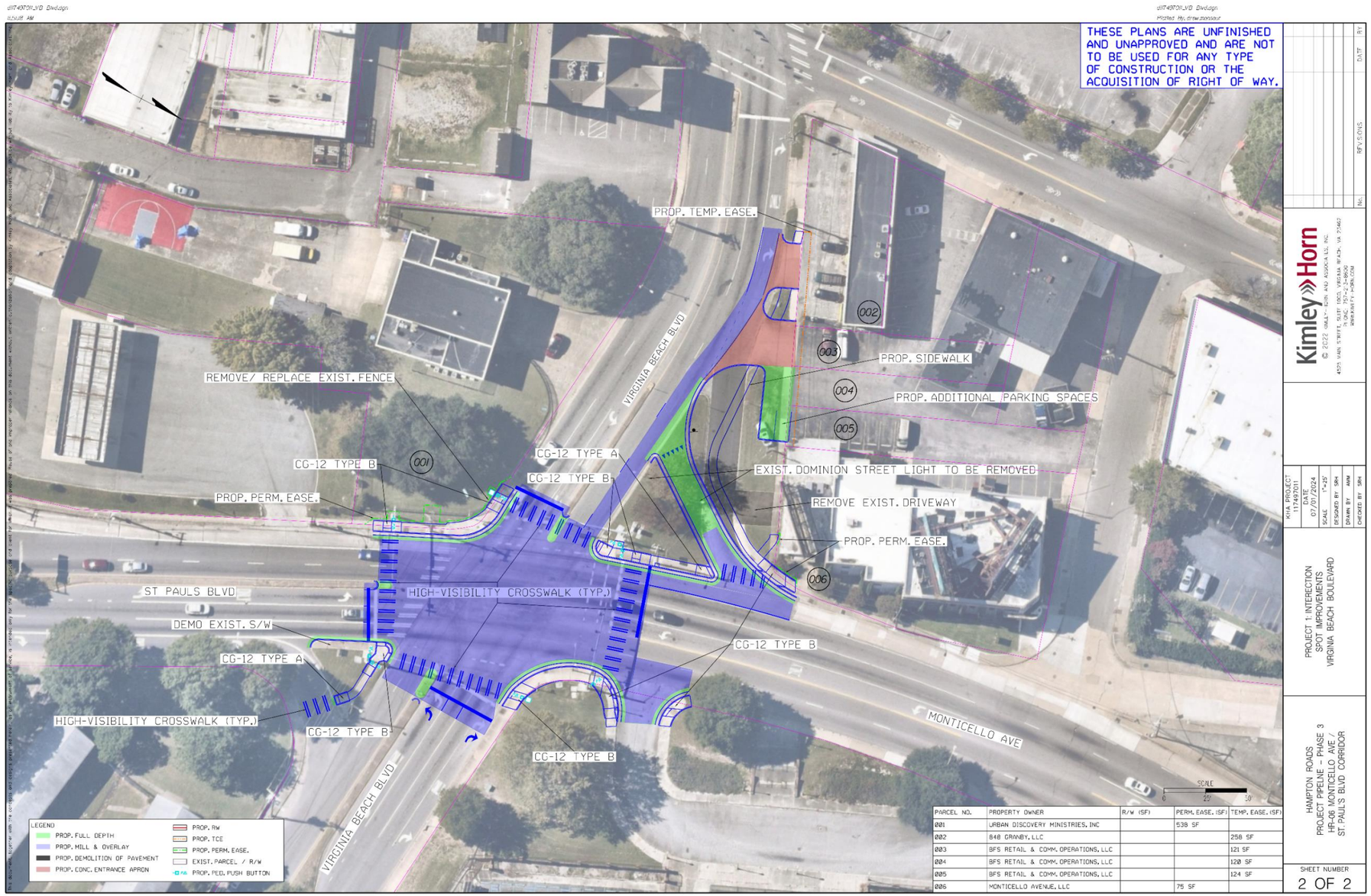


Figure 56: Preferred Alternative Project 2 Concept

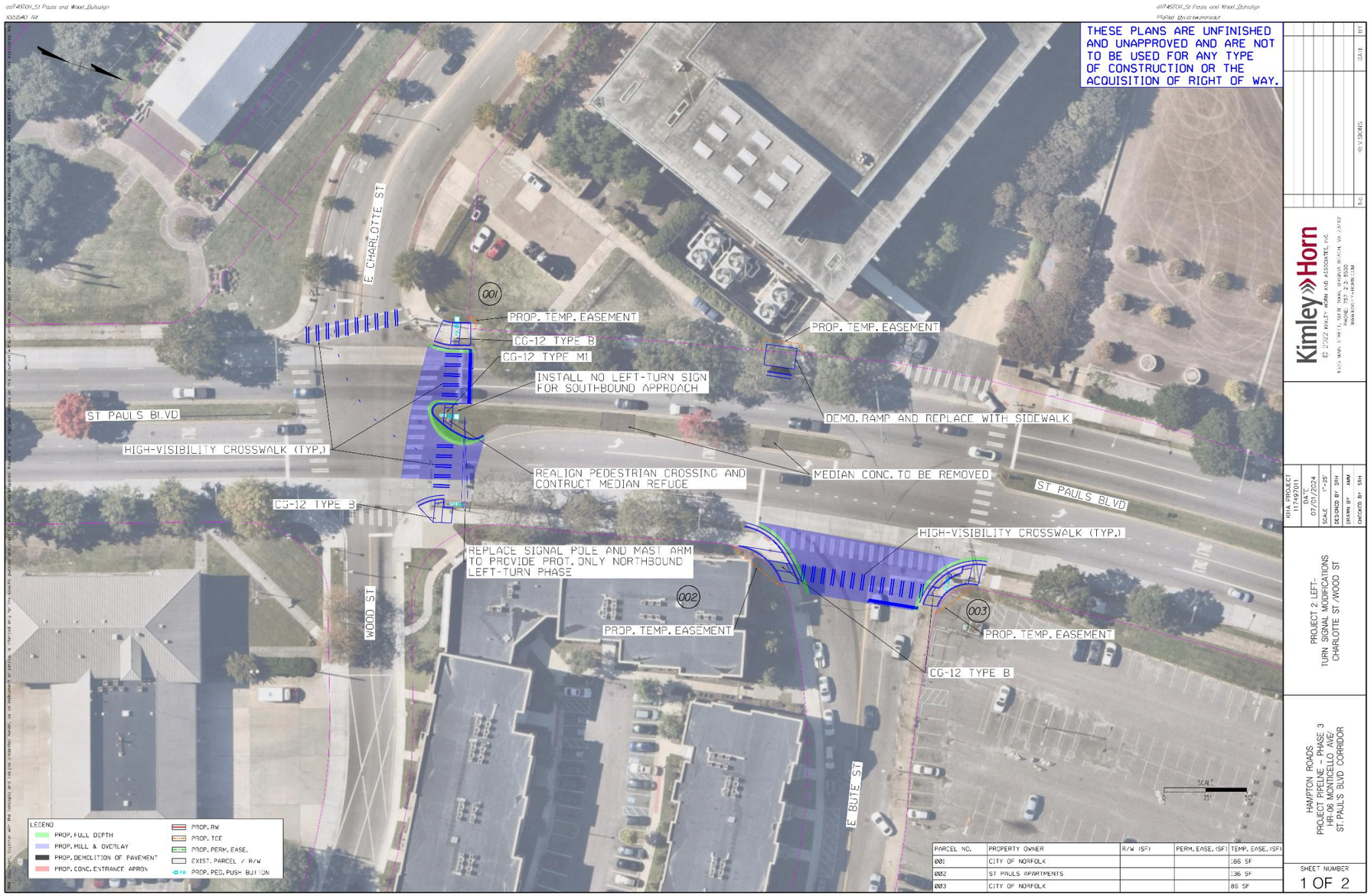


Figure 56: Preferred Alternative Project 2 Concept (Sheet 2 of 2)

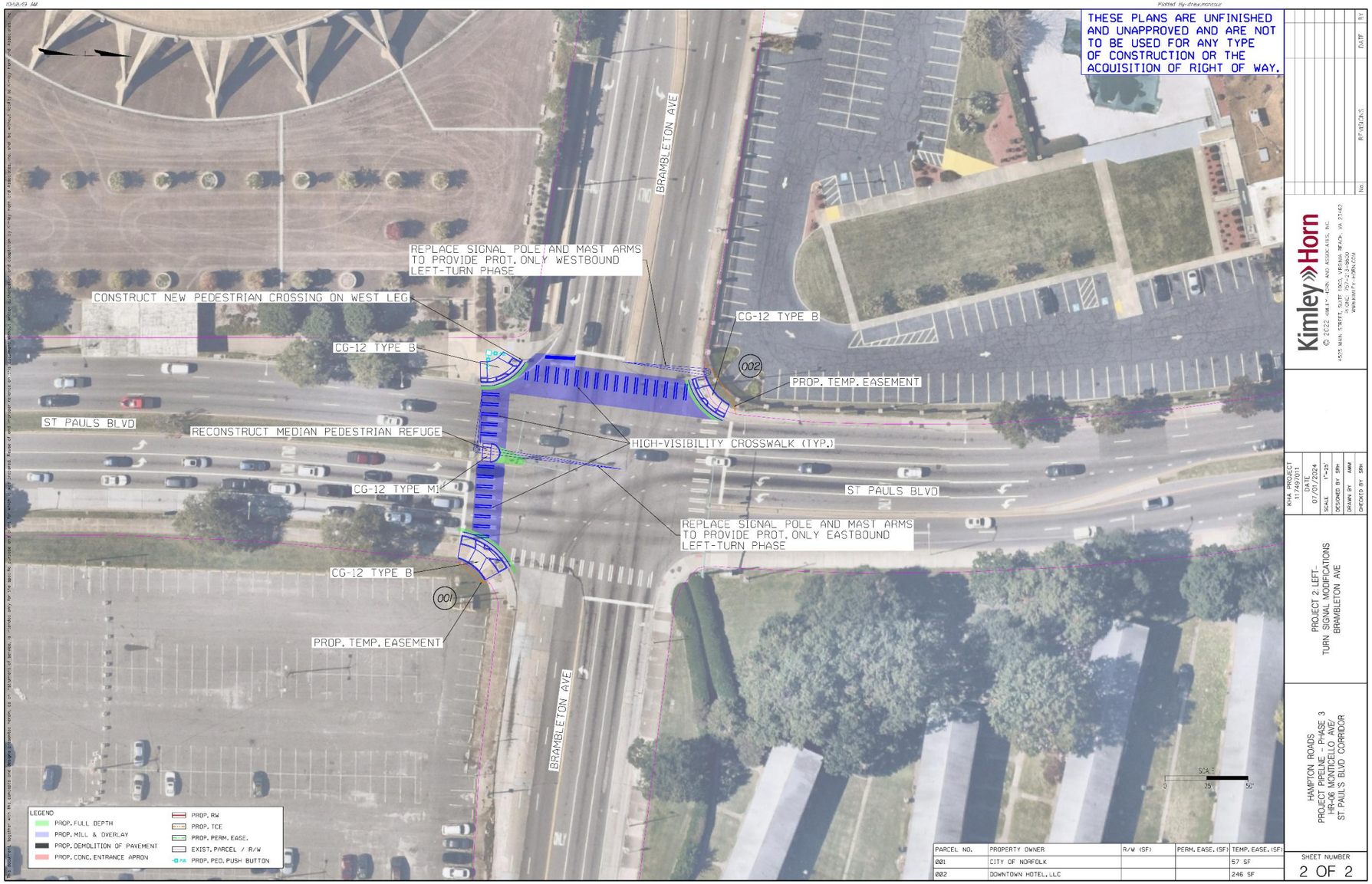


Figure 57: Preferred Alternative Project 3 Concept

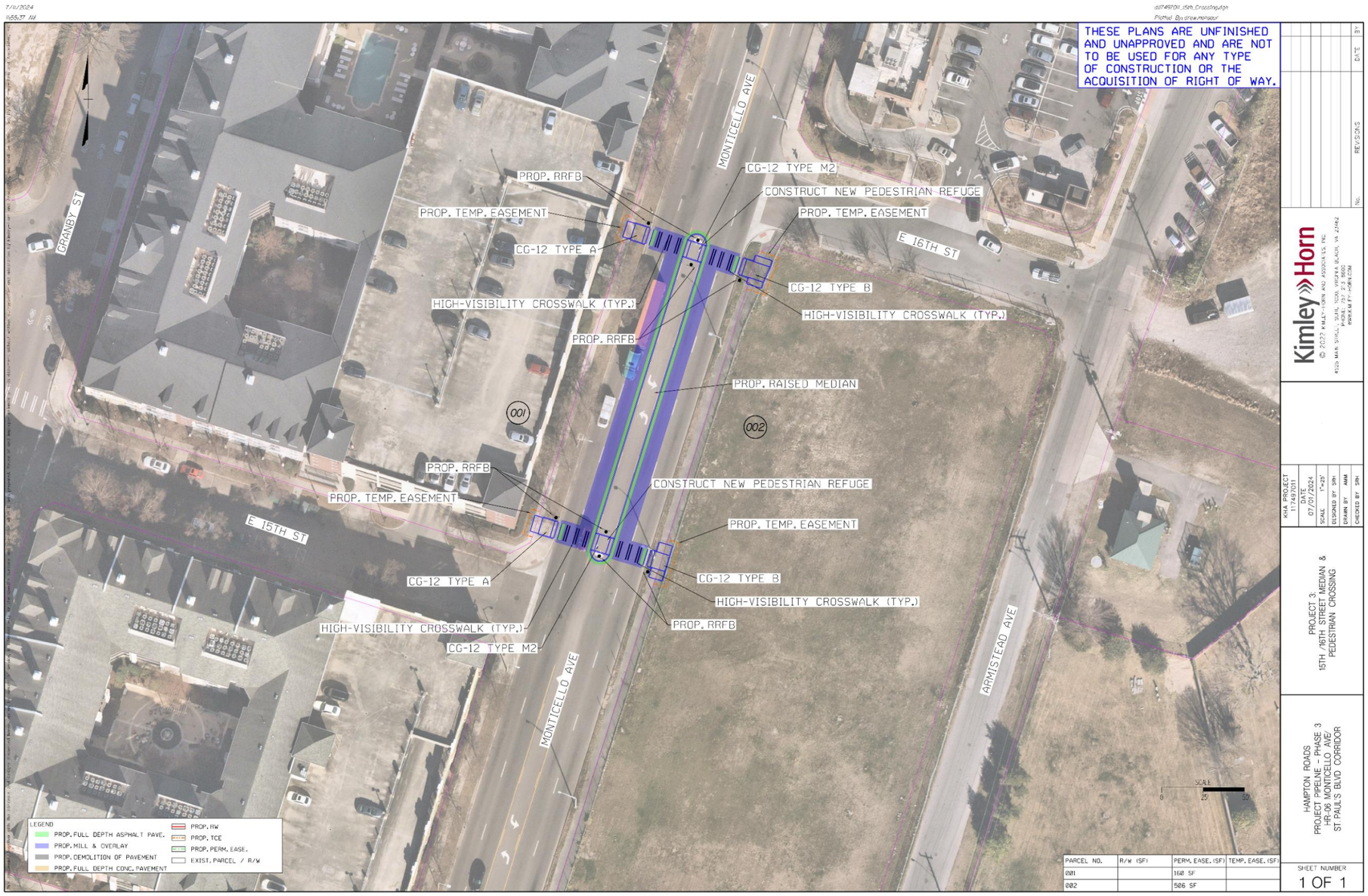


Figure 58: Preferred Alternative Project 4 Concept

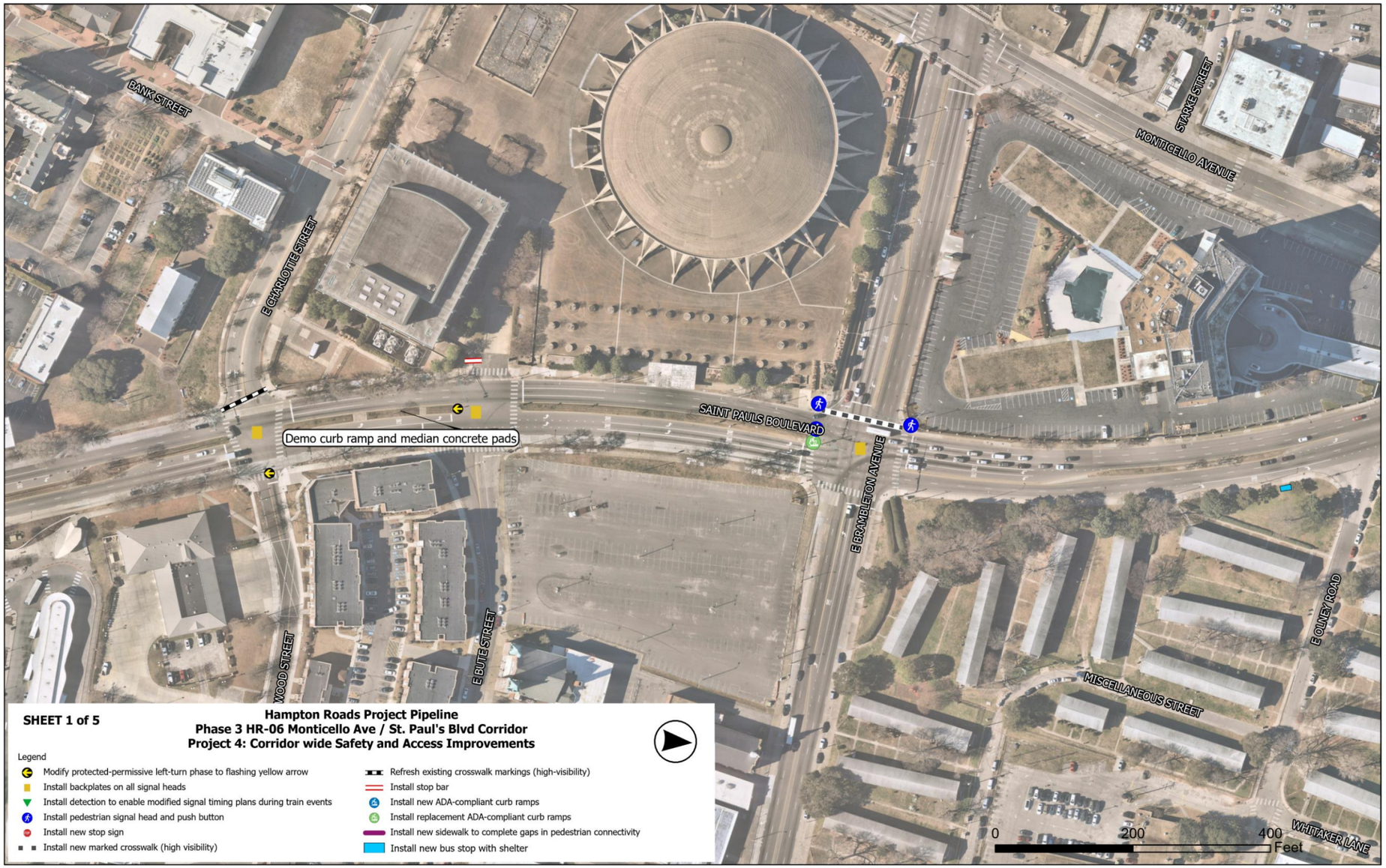


Figure 58: Preferred Alternative Project 4 Concept (Sheet 2 of 5)

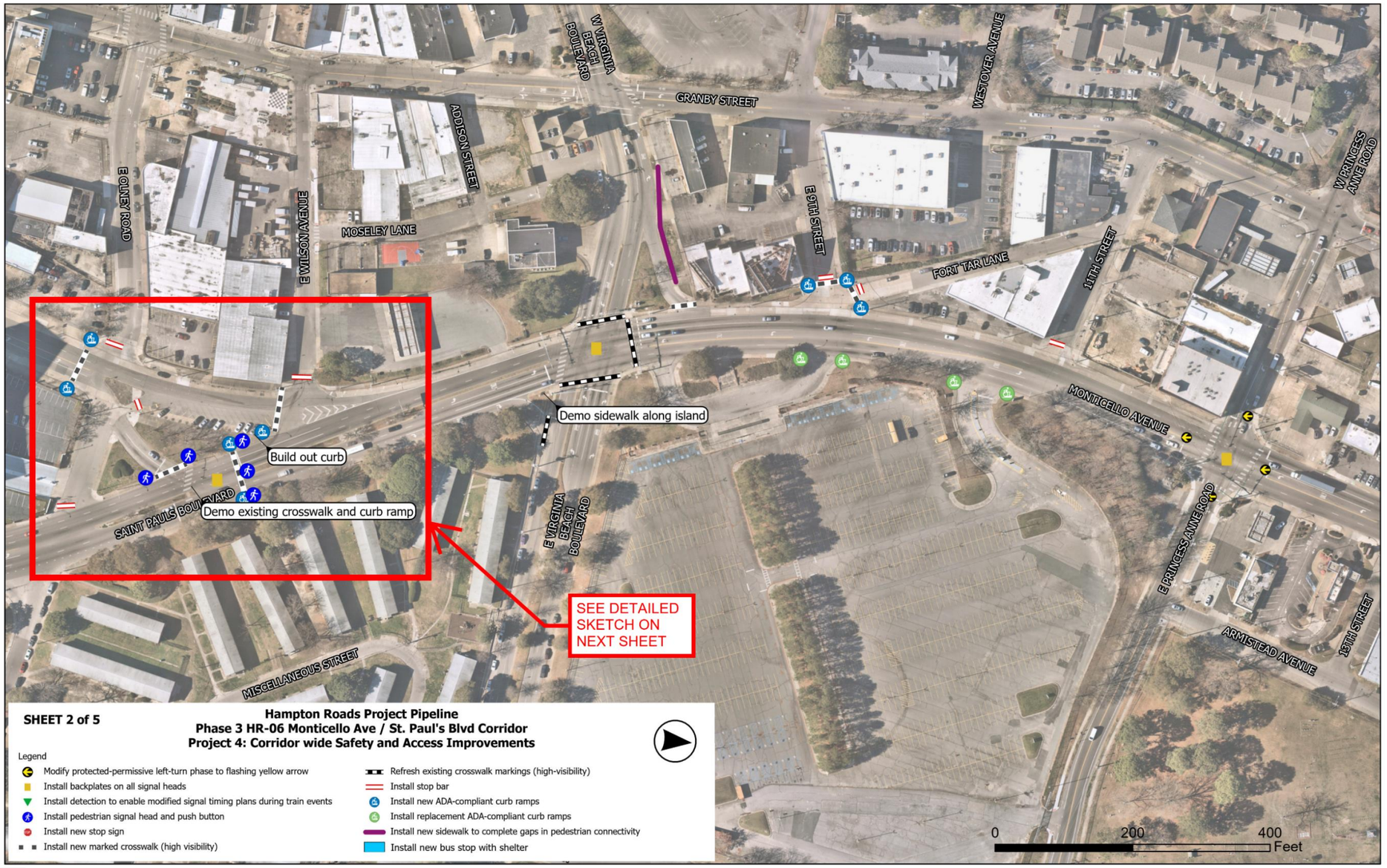


Figure 58: Preferred Alternative Project 4 Concept (Sheet 2A of 5)

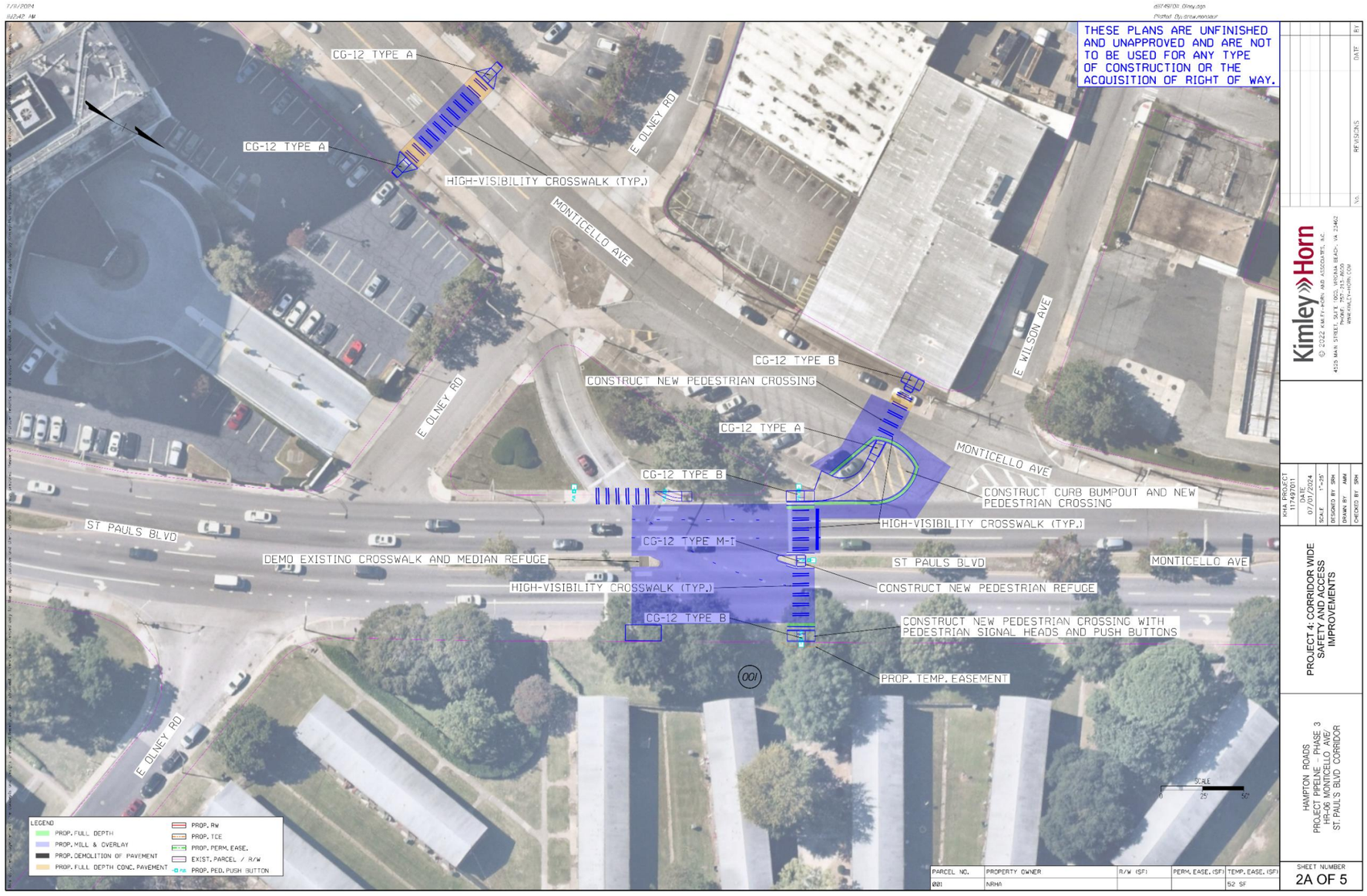


Figure 58: Preferred Alternative Project 4 Concept (Sheet 3 of 5)

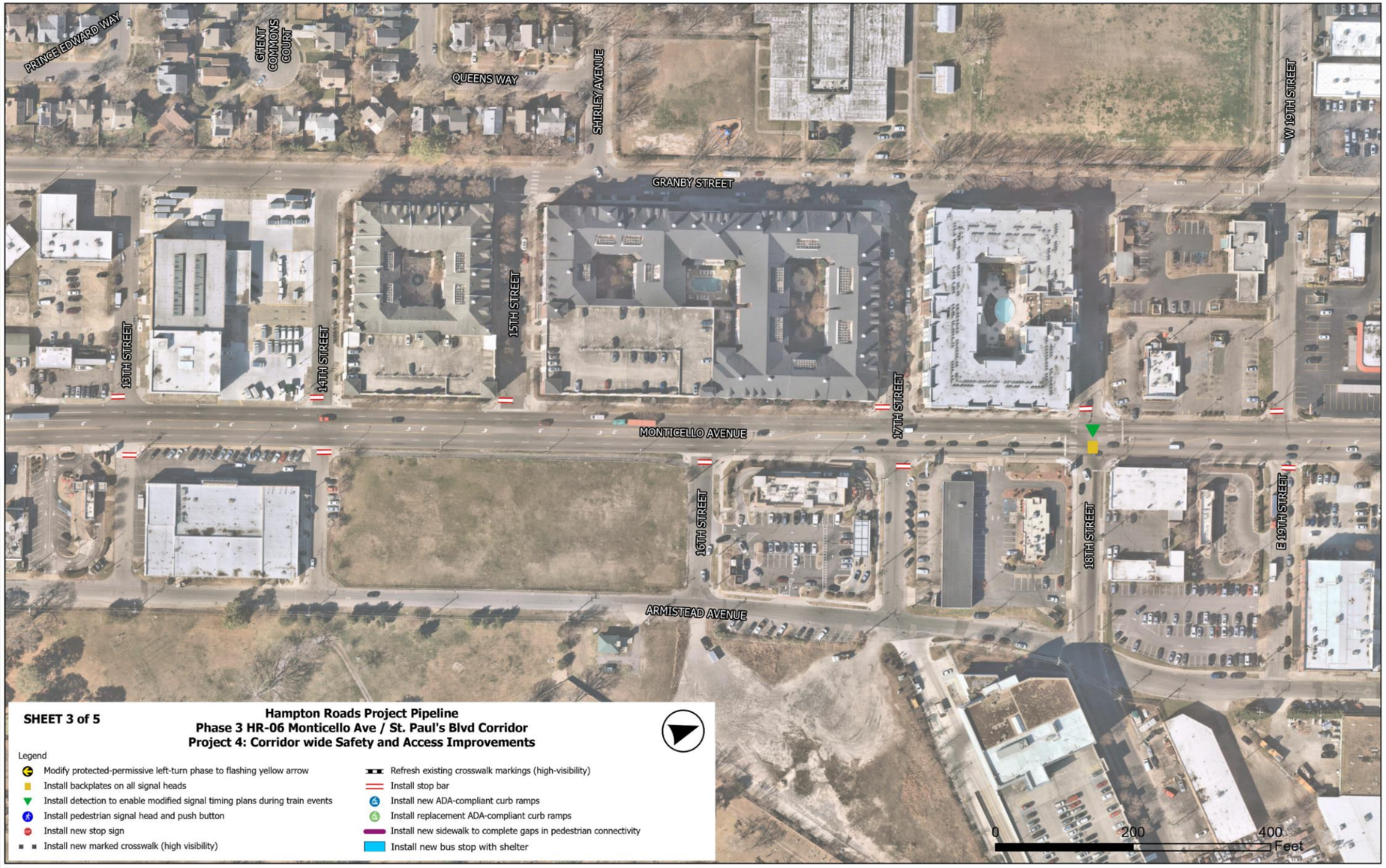


Figure 58: Preferred Alternative Project 4 Concept (Sheet 4 of 5)

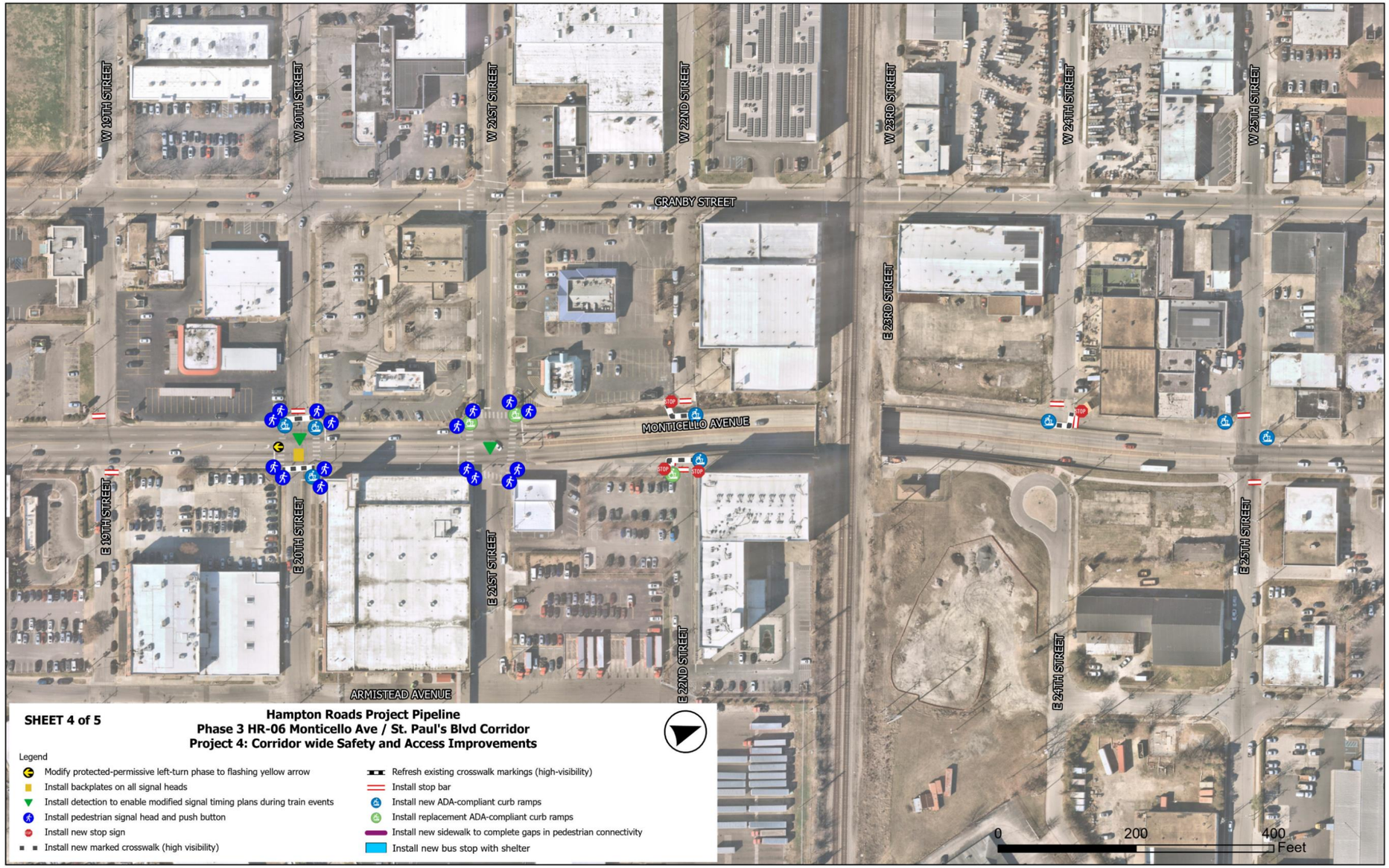


Figure 58: Preferred Alternative Project 4 Concept (Sheet 5 of 5)

4.3 Operational Analysis

Once the preferred alternative was selected, the study team conducted Synchro and SimTraffic analyses to quantify the anticipated future traffic operations under Build conditions.

Synchro/SimTraffic models for 2045 Build conditions were developed for two different scenarios to separately evaluate the performance of the study area intersections under the preferred alternative Project 1 and Project 2 improvements. Traffic signal cycle lengths were assumed to be consistent with No-Build conditions, while splits and offsets were optimized.

For the 2045 Build models with Project 1 improvements, eastbound and westbound through and left-turn traffic volumes at 25th Street were rerouted to 26th Street and 27th Street based on the proposed modifications to access at 25th Street.

Ten simulation runs were conducted for the AM and PM peak hours for both 2045 Build scenario SimTraffic models.

Scenario 1 Results: Preferred Alternative Project 1 – Intersection Improvements

The Synchro and SimTraffic results for the Preferred Alternative Project 1 improvements are provided in **Table 17** and **Table 18**. In addition, MOE comparisons between No-Build and Build conditions for the improved intersections are provided in **Table 19** and **Table 20**. The full Synchro and SimTraffic reports are provided in **Appendix F**.

Delay, LOS, and queuing were observed to be very similar to No-Build conditions with all signalized intersections operating at overall LOS C or better during both the AM and PM peak hours. At the Monticello Avenue and 26th Street intersection, the addition of the northbound right-turn lane reduces the northbound approach queue by more than 30 feet during the AM peak hour and by more than 100 feet during the PM peak hour due to the additional capacity. The eastbound and westbound approach delays at the Monticello Avenue and 25th Street intersection are anticipated to be reduced by 18-55 seconds depending on the direction and peak hour due to the physical prohibition of through and left-turn movements.

Scenario 2 Results: Preferred Alternative Project 2 – Left-Turn Signal Modifications

The Synchro and SimTraffic results for the Preferred Alternative Project 2 improvements are provided in **Table 21** through **Table 22**. In addition, MOE comparisons between No-Build and Build conditions for the improved intersections are provided in **Table 23** and **Table 24**. The full Synchro and SimTraffic reports are provided in **Appendix F**.

Delay, LOS, and queuing were observed to be very similar to No-Build conditions with all signalized intersections operating at overall LOS C or better during both the AM and PM peak hours. At the Brambleton Avenue and St. Paul's Boulevard intersection, the safety improvement to modify the eastbound and westbound left-turn phases to protected only generally results in an increase in delay for those movements, the most significant of which is an increase from approximately 10 seconds to 53 seconds of delay for the westbound left-turn movement during the AM peak hour. Because eastbound and westbound left-turn vehicles are no longer able to make a permissive left-turn movement, the delay for these movements is primarily a function of the signal's cycle length. However, the modification does provide additional operational flexibility to utilize lead-lag phase sequencing which results in improved progression for the eastbound left-turn movement during the AM peak hour with a slight decrease in delay of approximately 7 seconds. Eastbound and westbound approach delay increases ranged from only 2-6 seconds. Queues on the eastbound and westbound approaches are anticipated to be similar to No-Build conditions (within +/- 75 feet).

Similarly, the delay for the northbound left-turn movement at the St. Paul's Boulevard and Charlotte Street/Wood Street intersection is anticipated to increase by approximately 40 seconds during each peak hour due to the modification to protected only operation. However, the northbound approach delay is expected to increase by only 2-3 seconds. Queues at the intersection are anticipated to be similar between No-Build and Build conditions.

Table 17: 2045 Preferred Alternative Project 1 Control Delay and LOS Results

Intersection Number and Description		Type of Control	Lane Group	Eastbound				Westbound				Northbound				Southbound				Overall	
				AM		PM		AM		PM		AM		PM		AM		PM			
				Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	AM	PM
1	Monticello Avenue at Church Street			Monticello Avenue				Monticello Avenue				Church Street				Church Street				Intersection	
		Signalized	Left	53.3	D	55.2	E	0.0	A	46.8	D					3.6	A	0.0	A	Delay	Delay
			Through									7.2	A	4.4	A	3.7	A	2.0	A	13.3	17.1
			Right	28.3	C	29.5	C									0.5	A	7.0	A	LOS	LOS
			Approach	52.6	D	54.1	D	0.0	A	46.8	D	7.2	A	4.4	A	2.6	A	3.6	A	B	B
2	29th Street at Monticello Avenue			29th Street				29th Street				Monticello Avenue				Monticello Avenue				Intersection	
		Unsignalized	Left	11.8	B	9.0	A	8.8	A	0.0	A	0.6	A	0.6	A	0.0	A	0.0	A	Delay	Delay
			Through									0.0	A	0.0	A	0.0	A	0.0	A	-	-
			Right																	LOS	LOS
			Approach	11.8	B	9.0	A	8.8	A	0.0	A	0.3	A	0.3	A	0.0	A	0.0	A	-	-
3	28th Street at Monticello Avenue			28th Street				28th Street				Monticello Avenue				Monticello Avenue				Intersection	
		Unsignalized	Left	9.6	A	9.7	A	11.7	B	14.1	B	0.0	A	0.0	A	0.1	A	0.1	A	Delay	Delay
			Through									0.0	A	0.0	A	0.0	A	0.0	A	-	-
			Right																	LOS	LOS
			Approach	9.6	A	9.7	A	11.7	B	14.1	B	0.0	A	0.0	A	0.0	A	0.0	A	-	-
4	27th Street at Monticello Avenue			27th Street				27th Street				Monticello Avenue				Monticello Avenue				Intersection	
		Signalized	Left					9.8	A	9.3	A	6.9	A	6.3	A					Delay	Delay
			Through									0.8	A	1.0	A	17.5	B	24.6	C	9.3	9.1
			Right																	LOS	LOS
			Approach					9.8	A	9.3	A	3.2	A	2.7	A	17.5	B	24.6	C	A	A
5	26th Street at Monticello Avenue			26th Street				26th Street				Monticello Avenue				Monticello Avenue				Intersection	
		Signalized	Left	8.9	A	14.7	B									13.2	B	18.1	B	Delay	Delay
			Through									19.6	B	38.5	D	12.8	B	13.1	B	13.2	24.1
			Right									18.7	B	56.9	E					LOS	LOS
			Approach	8.9	A	14.7	B					19.4	B	43.1	D	12.8	B	13.4	B	B	C
6	25th Street at Monticello Avenue			25th Street				25th Street				Monticello Avenue				Monticello Avenue				Intersection	
		Unsignalized	Left									2.3	A	1.1	A	0.2	A	0.4	A	Delay	Delay
			Through																	-	-
			Right	9.3	A	9.6	A	10.3	B	10.5	B	0.0	A	0.0	A	0.0	A	0.0	A	LOS	LOS
			Approach	9.3	A	9.6	A	10.3	B	10.5	B	1.2	A	0.5	A	0.1	A	0.2	A	-	-

Table 17: 2045 Preferred Alternative Project 1 Control Delay and LOS Results (cont.)

Intersection Number and Description		Type of Control	Lane Group	Eastbound				Westbound				Northbound				Southbound				Overall	
				AM		PM		AM		PM		AM		PM		AM		PM			
				Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	AM	PM
7	21st Street at Monticello Avenue	21st Street						21st Street				Monticello Avenue				Monticello Avenue				Intersection	
		Signalized	Left	60.2	E	40.7	D	28.9	C	27.6	C	45.7	D	44.6	D	10.9	B	15.9	B	Delay	Delay
			Through									3.3	A	6.1	A					13.4	20.8
			Right	4.6	A	51.5	D													LOS	LOS
			Approach	27.9	C	47.0	D	28.9	C	27.6	C	11.3	B	12.6	B	10.9	B	15.9	B	B	C
8	20th Street at Monticello Avenue	20th Street						20th Street				Monticello Avenue				Monticello Avenue				Intersection	
		Signalized	Left	27.9	C	32.2	C	28.2	C	34.3	C	4.4	A	5.3	A	3.2	A	6.9	A	Delay	Delay
			Through									3.7	A	3.8	A					5.8	8.8
			Right																	LOS	LOS
			Approach	27.9	C	32.2	C	28.2	C	34.3	C	3.7	A	3.9	A	3.2	A	6.9	A	A	A
9	19th Street at Monticello Avenue	19th Street						19th Street				Monticello Avenue				Monticello Avenue				Intersection	
		Unsignalized	Left	11.7	B	15.3	C	13.7	B	18.7	C	8.8	A	9.1	A	8.6	A	9.5	A	Delay	Delay
			Through									0.0	A	0.0	A	0.0	A	0.0	A	-	-
			Right																	LOS	LOS
			Approach	11.7	B	15.3	C	13.7	B	18.7	C	0.4	A	0.3	A	0.2	A	0.9	A	-	-
10	18th Street at Monticello Avenue	18th Street						18th Street				Monticello Avenue				Monticello Avenue				Intersection	
		Signalized	Left	26.4	C	30.7	C	28.1	C	34.7	C	11.3	B	11.0	B	2.1	A	3.5	A	Delay	Delay
			Through									14.0	B	14.1	B	2.0	A	3.1	A	9.4	11.1
			Right																	LOS	LOS
			Approach	26.4	C	30.7	C	28.1	C	34.7	C	13.9	B	14.0	B	2.1	A	3.2	A	A	B
11	17th Street at Monticello Avenue	17th Street						17th Street				Monticello Avenue				Monticello Avenue				Intersection	
		Unsignalized	Left	15.0	B	13.9	B	20.4	C	30.3	D	9.3	A	9.6	A	9.3	A	10.0	A	Delay	Delay
			Through									0.0	A	0.0	A	0.0	A	0.0	A	-	-
			Right																	LOS	LOS
			Approach	15.0	B	13.9	B	20.4	C	30.3	D	0.7	A	0.4	A	0.1	A	0.2	A	-	-
12	16th Street at Monticello Avenue	16th Street						16th Street				Monticello Avenue				Monticello Avenue				Intersection	
		Unsignalized	Left					14.9	B	12.2	B					9.0	A	9.4	A	Delay	Delay
			Through									0.0	A	0.0	A	0.0	A	0.0	A	-	-
			Right																	LOS	LOS
			Approach					14.9	B	12.2	B	0.0	A	0.0	A	0.5	A	0.5	A	-	-

Table 17: 2045 Preferred Alternative Project 1 Control Delay and LOS Results (cont.)

Intersection Number and Description		Type of Control	Lane Group	Eastbound				Westbound				Northbound				Southbound				Overall	
				AM		PM		AM		PM		AM		PM		AM		PM			
				Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	AM	PM
13	15th Street at Monticello Avenue			15th Street				15th Street				Monticello Avenue				Monticello Avenue				Intersection	
		Unsignalized	Left	11.2	B	12.3	B					9.6	A	10.1	B					Delay	Delay
			Through									0.0	A	0.0	A	0.0	A	0.0	A	-	-
			Right													0.0	A	0.0	A	LOS	LOS
			Approach	11.2	B	12.3	B					0.5	A	0.5	A	0.0	A	0.0	A	-	-
14	14th Street at Monticello Avenue			14th Street				14th Street				Monticello Avenue				Monticello Avenue				Intersection	
		Unsignalized	Left	12.8	B	12.6	B	12.1	B	12.5	B	9.6	A	9.9	A	9.0	A	9.3	A	Delay	Delay
			Through									0.0	A	0.0	A	0.0	A	0.0	A	-	-
			Right																	LOS	LOS
			Approach	12.8	B	12.6	B	12.1	B	12.5	B	0.1	A	0.0	A	0.0	A	0.1	A	-	-
15	13th Street at Monticello Avenue			13th Street				13th Street				Monticello Avenue				Monticello Avenue				Intersection	
		Unsignalized	Left	12.3	B	14.2	B	9.0	A	11.2	B	0.0	A	0.1	A	0.0	A	0.0	A	Delay	Delay
			Through																	-	-
			Right									0.0	A	0.0	A					LOS	LOS
			Approach	12.3	B	14.2	B	9.0	A	11.2	B	0.0	A	0.1	A	0.0	A	0.1	A	-	-
16	Princess Anne Road at Monticello Avenue			Princess Anne Road				Princess Anne Road				Monticello Avenue				Monticello Avenue				Intersection	
		Signalized	Left	26.1	C	15.1	B	34.2	C	13.5	B	28.8	C	49.4	D	19.9	B	26.6	C	Delay	Delay
			Through	30.6	C	19.1	B	40.1	D	14.3	B	3.6	A	10.9	B	32.6	C	40.2	D	22.7	24.9
			Right																	LOS	LOS
			Approach	30.1	C	18.6	B	39.4	D	14.1	B	7.6	A	15.8	B	31.8	C	38.9	D	C	C
17	11th Street at Monticello Avenue			11th Street				11th Street				Monticello Avenue				Monticello Avenue				Intersection	
		Unsignalized	Left	9.0	A	9.3	A					8.6	A	8.3	A					Delay	Delay
			Through									0.0	A	0.0	A	0.0	A	0.0	A	-	-
			Right																	LOS	LOS
			Approach	9.0	A	9.3	A					0.2	A	0.1	A	0.0	A	0.0	A	-	-
18	9th Street at Monticello Avenue			9th Street				9th Street				Monticello Avenue				Monticello Avenue				Intersection	
		Unsignalized	Left	8.7	A	9.9	A					0.1	A	0.1	A					Delay	Delay
			Through									0.0	A	0.0	A	0.0	A	0.0	A	-	-
			Right																	LOS	LOS
			Approach	8.7	A	9.9	A					0.0	A	0.0	A	0.0	A	0.0	A	-	-

Table 17: 2045 Preferred Alternative Project 1 Control Delay and LOS Results (cont.)

Intersection Number and Description		Type of Control	Lane Group	Eastbound				Westbound				Northbound				Southbound				Overall	
				AM		PM		AM		PM		AM		PM		AM		PM			
				Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	AM	PM
19	Virginia Beach Boulevard at Monticello Avenue			Virginia Beach Boulevard				Virginia Beach Boulevard				Monticello Avenue				Monticello Avenue				Intersection	
		Signalized	Left	18.2	B	19.0	B	25.8	C	16.7	B	10.4	B	19.5	B	26.1	C	30.6	C	Delay	Delay
			Through	22.4	C	26.0	C	29.9	C	25.6	C	11.6	B	36.9	D	20.7	C	21.8	C	19.2	28.1
			Right					33.1	C	30.3	C	22.1	C	47.5	D					LOS	LOS
			Approach	22.0	C	25.0	C	29.8	C	25.1	C	12.1	B	36.9	D	21.2	C	22.8	C	B	C
20	Monticello Avenue at St. Paul's Boulevard			Monticello Avenue				Monticello Avenue				St. Paul's Boulevard				St. Paul's Boulevard				Intersection	
		Signalized	Left	45.7	D	34.2	C													Delay	Delay
			Through									2.5	A	0.9	A	4.1	A	2.1	A	4.6	4.0
			Right																	LOS	LOS
			Approach									2.5	A	0.9	A	4.1	A	2.1	A	A	A
21	Olney Road at St. Paul's Boulevard			Olney Road				Olney Road				St. Paul's Boulevard				St. Paul's Boulevard				Intersection	
		Unsignalized	Left	10.4	B	14.1	B					0.0	A	0.0	A	0.5	A	1.7	A	Delay	Delay
			Through									0.0	A	0.0	A	0.0	A	0.0	A	-	-
			Right									0.0	A	0.0	A					LOS	LOS
			Approach	10.4	B	14.1	B					0.0	A	0.0	A	0.1	A	0.5	A	-	-
22	Brambleton Avenue at St. Paul's Boulevard			Brambleton Avenue				Brambleton Avenue				St. Paul's Boulevard				St. Paul's Boulevard				Intersection	
		Signalized	Left	37.9	D	15.0	B	9.7	A	17.1	B	48.8	D	45.8	D	52.4	D	30.4	C	Delay	Delay
			Through	45.4	D	21.9	C	18.6	B	21.6	C	24.3	C	29.5	C	47.8	D	29.7	C	32.3	27.1
			Right	17.3	B	25.1	C													LOS	LOS
			Approach	28.1	C	23.4	C	17.7	B	21.2	C	35.6	D	35.0	C	48.4	D	29.8	C	C	C
23	Bute Street at St. Paul's Boulevard			Bute Street				Bute Street				St. Paul's Boulevard				St. Paul's Boulevard				Intersection	
		Signalized	Left	33.0	C	35.0	C	33.2	C	34.7	C	1.7	A	0.0	A					Delay	Delay
			Through									1.3	A	3.4	A	6.6	A	11.3	B	4.3	9.0
			Right																	LOS	LOS
			Approach	33.0	C	35.0	C	33.2	C	34.7	C	1.3	A	3.4	A	6.6	A	11.3	B	A	A
24	Charlotte Street/ Wood Street at St. Paul's Boulevard			Charlotte Street				Wood Street				St. Paul's Boulevard				St. Paul's Boulevard				Intersection	
		Signalized	Left	41.4	D	44.2	D	31.1	C	31.7	C	15.6	B	17.1	B	5.9	A	4.2	A	Delay	Delay
			Through									12.3	B	10.6	B					10.3	9.9
			Right	41.1	D	42.5	D													LOS	LOS
			Approach	41.2	D	42.9	D	31.1	C	31.7	C	12.6	B	10.9	B	5.9	A	4.2	A	B	A

Table 17: 2045 Preferred Alternative Project 1 Control Delay and LOS Results (cont.)

Intersection Number and Description		Type of Control	Lane Group	Eastbound				Westbound				Northbound				Southbound				Overall	
				AM		PM		AM		PM		AM		PM		AM		PM			
				Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	AM	PM
25	Monticello Avenue at Olney Road			Olney Road*				Olney Road*				Monticello Avenue*				Monticello Avenue*				Intersection	
		Unsignalized	Left																	Delay	Delay
			Through																		
			Right																	LOS	LOS
			Approach																		

- Denotes the overall intersection is stop controlled and no level of service or delay is reported

* HCM 2000 Unsignalized does not support 5-legged intersections

Table 18: 2045 Preferred Alternative Project 1 Queue Results

Intersection Number and Description		Type of Control	Lane Group	Maximum Queue							
				Eastbound		Westbound		Northbound		Southbound	
				AM	PM	AM	PM	AM	PM	AM	PM
1	Monticello Avenue at Church Street	Monticello Avenue				Cemetery		Church Street		Church Street	
		Signalized	Left	133	55	0	6			m0	0
			Through					156	56	34	58
			Right	0	0					1	13
2	29th Street at Monticello Avenue	29th Street				29th Street		Monticello Avenue		Monticello Avenue	
		Unsignalized	Left	0	0	0	0	1	1	0	0
			Through					0	0	0	0
			Right								
3	28th Street at Monticello Avenue	28th Street				28th Street		Monticello Avenue		Monticello Avenue	
		Unsignalized	Left	3	6	0	1	0	0	0	0
			Through					0	0	0	0
			Right								
4	27th Street at Monticello Avenue	27th Street				27th Street		Monticello Avenue		Monticello Avenue	
		Signalized	Left			115	115	72	m64		
			Through							117	122
			Right								
5	26th Street at Monticello Avenue	26th Street				26th Street		Monticello Avenue		Monticello Avenue	
		Signalized	Left	71	173					m5	m17
			Through					173	286	108	110
			Right					17	89		
6	25th Street at Monticello Avenue	25th Street				25th Street		Monticello Avenue		Monticello Avenue	
		Unsignalized	Left	0	0	0	0	5	3	1	1
			Through								
			Right					0	0	0	0
7	21st Street at Monticello Avenue	21st Street				21st Street		Monticello Avenue		Monticello Avenue	
		Signalized	Left	105	m186	25	31	134	164	75	m303
			Through					41	96		
			Right	3	200						
8	20th Street at Monticello Avenue	20th Street				20th Street		Monticello Avenue		Monticello Avenue	
		Signalized	Left	58	85	62	136	12	14	41	82
			Through					47	63		
			Right								

Table 18: 2045 Preferred Alternative Project 1 Queue Results (cont.)

Intersection Number and Description		Type of Control	Lane Group	Maximum Queue							
				Eastbound		Westbound		Northbound		Southbound	
				AM	PM	AM	PM	AM	PM	AM	PM
9	19th Street at Monticello Avenue			19th Street		19th Street		Monticello Avenue		Monticello Avenue	
		Unsignalized	Left	8	11	8	33	3	2	1	9
			Through					0	0	0	0
			Right								
10	18th Street at Monticello Avenue			18th Street		18th Street		Monticello Avenue		Monticello Avenue	
		Signalized	Left	35	49	70	118	19	23	m5	m10
			Through					160	205	34	52
			Right								
11	17th Street at Monticello Avenue			17th Street		17th Street		Monticello Avenue		Monticello Avenue	
		Unsignalized	Left	3	5	1	7	5	4	1	2
			Through					0	0	0	0
			Right								
12	16th Street at Monticello Avenue			16th Street		16th Street		Monticello Avenue		Monticello Avenue	
		Unsignalized	Left			25	13			4	4
			Through					0	0		
			Right								
13	15th Street at Monticello Avenue			15th Street		15th Street		Monticello Avenue		Monticello Avenue	
		Unsignalized	Left	7	11			5	6		
			Through							0	0
			Right								
14	14th Street at Monticello Avenue			14th Street		14th Street		Monticello Avenue		Monticello Avenue	
		Unsignalized	Left	5	6	1	3	1	0	0	1
			Through					0	0	0	0
			Right								
15	13th Street at Monticello Avenue			13th Street		13th Street		Monticello Avenue		Monticello Avenue	
		Unsignalized	Left	2	4	1	1	0	0	0	0
			Through					0	0		
			Right								
16	Princess Anne Road at Monticello Avenue			Princess Anne Road		Princess Anne Road		Monticello Avenue		Monticello Avenue	
		Signalized	Left	m25	m20	m35	m28	91	m114	38	71
			Through	128	97	155	81	33	95	336	430
			Right								

Table 18: 2045 Preferred Alternative Project 1 Queue Results (cont.)

Intersection Number and Description		Type of Control	Lane Group	Maximum Queue							
				Eastbound		Westbound		Northbound		Southbound	
				AM	PM	AM	PM	AM	PM	AM	PM
17	11th Street at Monticello Avenue			11th Street		11th Street		Monticello Avenue		Monticello Avenue	
		Unsignalized	Left	3	3			2	1		
			Through							0	0
			Right								
18	9th Street at Monticello Avenue			9th Street		9th Street		Monticello Avenue		Monticello Avenue	
		Unsignalized	Left	3	3			0	0		
			Through							0	0
			Right								
19	Virginia Beach Boulevard at Monticello Avenue			Virginia Beach Boulevard		Virginia Beach Boulevard		Monticello Avenue		Monticello Avenue	
		Signalized	Left	51	126	98	119	147	180	118	244
			Through	100	233	125	242	201	358	250	294
			Right			72	74	0	38		
20	Monticello Avenue at St. Paul's Boulevard			Monticello Avenue		Monticello Avenue		St. Paul's Boulevard		St. Paul's Boulevard	
		Signalized	Left	90	108						
			Through					117	80	120	364
			Right								
21	Olney Road at St. Paul's Boulevard			Olney Road		Olney Road		St. Paul's Boulevard		St. Paul's Boulevard	
		Unsignalized	Left	23	110			1	10	51	131
			Through					5	1	4	134
			Right					8	15		
22	Brambleton Avenue at St. Paul's Boulevard			Brambleton Avenue		Brambleton Avenue		St. Paul's Boulevard		St. Paul's Boulevard	
		Signalized	Left	98	77	97	134	409	233	194	225
			Through	177	490	227	327	348	402	237	712
			Right	261	537						
23	Bute Street at St. Paul's Boulevard			Bute Street		Bute Street		St. Paul's Boulevard		St. Paul's Boulevard	
		Signalized	Left	32	99	71	113	63	21		
			Through					131	146	174	506
			Right								
24	Charlotte Street/ Wood Street at St. Paul's Boulevard			Charlotte Street		Wood Street		St. Paul's Boulevard		St. Paul's Boulevard	
		Signalized	Left	38	108	148	196	140	139	216	316
			Through					588	323		
			Right	56	249						

Table 18: 2045 Preferred Alternative Project 1 Queue Results (cont.)

Intersection Number and Description		Type of Control	Lane Group	Maximum Queue							
				Eastbound		Westbound		Northbound		Southbound	
				AM	PM	AM	PM	AM	PM	AM	PM
25	Monticello Avenue at Olney Road			Olney Road*		Olney Road*		Monticello Avenue*		Monticello Avenue*	
		Unsignalized	Left	53	106			34	67	10	305
			Through					0	81		
			Right								

Table 19: 2045 Preferred Alternative Project 1 No-Build to Build Delay and LOS Comparison

Intersection Number and Description	Type of Control	Lane Group	Eastbound				Westbound				Northbound				Southbound				Overall	
			No-Build		Build		No-Build		Build		No-Build		Build		No-Build		Build			
			Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	No-Build	Build
AM Peak																				
#5: 26th Street at Monticello Avenue			26th Street				26th Street				Monticello Avenue				Monticello Avenue				Intersection	
	Signalized	Left	8.1	A	8.9	A									14.4	B	13.2	B	Delay	Delay
		Through									21.0	C	19.6	B	12.5	B	12.8	B	13.4	13.2
		Right											18.7	B					LOS	LOS
		Approach	8.1	A	8.9	A					21.0	C	19.4	B	12.5	B	12.8	B	B	B
#6: 25th Street at Monticello Avenue			25th Street				25th Street				Monticello Avenue				Monticello Avenue				Intersection	
	Unsignalized	Left	28.0	D			44.1	E			2.3	A	2.3	A	0.2	A	0.2	A	Delay	Delay
		Through																	-	-
		Right			9.3	A			10.3	B	0.0	A	0.0	A	0.0	A	0	A	LOS	LOS
		Approach	28.0	D	9.3	A	44.1	E	10.3	B	1.2	A	1.2	A	0.1	A	0.1	A	-	-
#19: Virginia Beach Boulevard at Monticello Avenue			Virginia Beach Boulevard				Virginia Beach Boulevard				Monticello Avenue				Monticello Avenue				Intersection	
	Signalized	Left	18.2	B	18.2	B	25.8	C	25.8	C	10.4	B	10.4	B	26.1	C	26.1	C	Delay	Delay
		Through	22.4	C	22.4	C	29.9	C	29.9	C	11.6	B	11.6	B	20.7	C	20.7	C	19.2	19.2
		Right					33.1	C	33.1	C	22.1	C	22.1	C					LOS	LOS
		Approach	22.0	C	22.0	C	29.8	C	29.8	C	12.1	B	12.1	B	21.2	C	21.2	C	B	B
PM Peak																				
#5: 26th Street at Monticello Avenue			26th Street				26th Street				Monticello Avenue				Monticello Avenue				Intersection	
	Signalized	Left	12.7	B	14.7	B									27.6	C	18.1	B	Delay	Delay
		Through									45.9	D	38.5	D	13.2	B	13.1	B	24.5	24.1
		Right											56.9	E					LOS	LOS
		Approach	12.7	B	14.7	B					45.9	D	43.1	D	14.0	B	13.4	B	C	C
#6: 25th Street at Monticello Avenue			25th Street				25th Street				Monticello Avenue				Monticello Avenue				Intersection	
	Unsignalized	Left	37.2	E			65.3	F			1.1	A	1.1	A	0.5	A	0.4	A	Delay	Delay
		Through																	-	-
		Right			9.6	A			10.5	B	0.0	A	0.0	A	0.0	A	0.0	A	LOS	LOS
		Approach	37.2	E	9.6	A	65.3	F	10.5	B	0.5	A	0.5	A	0.2	A	0.2	A	-	-
#19: Virginia Beach Boulevard at Monticello Avenue			Virginia Beach Boulevard				Virginia Beach Boulevard				Monticello Avenue				Monticello Avenue				Intersection	
	Signalized	Left	19.0	B	19.0	B	17.2	B	16.7	B	19.5	B	19.5	B	30.7	C	30.6	C	Delay	Delay
		Through	26.0	C	26.0	C	28.0	C	25.6	C	37.4	D	36.9	D	21.8	C	21.8	C	28.5	28.1
		Right					30.3	C	30.3	C	47.3	D	47.5	D					LOS	LOS
		Approach	25.0	C	25.0	C	26.7	C	25.1	C	37.3	D	36.9	D	22.8	C	22.8	C	C	C

Table 20: 2045 Preferred Alternative Project 1 No-Build to Build Queue Comparison

Intersection Number and Description	Type of Control	Lane Group	Maximum Queue							
			Eastbound		Westbound		Northbound		Southbound	
			No-Build	Build	No-Build	Build	No-Build	Build	No-Build	Build
AM Peak Hour										
#5: 26th Street at Monticello Avenue			26th Street		26th Street		Monticello Avenue		Monticello Avenue	
	Signalized	Left	60	71					m6	m5
		Through					206	173	103	108
		Right						17		
#6: 25th Street at Monticello Avenue			25th Street		25th Street		Monticello Avenue		Monticello Avenue	
	Unsignalized	Left	25		62		5	5	1	1
		Through								
		Right					0	0	0	0
#19: Virginia Beach Boulevard at Monticello Avenue			Virginia Beach Boulevard		Virginia Beach Boulevard		Monticello Avenue		Monticello Avenue	
	Signalized	Left	47	51	98	98	142	147	110	118
		Through	107	100	116	125	171	201	221	250
		Right			60	72	0	0		
PM Peak Hour										
#5: 26th Street at Monticello Avenue			26th Street		26th Street		Monticello Avenue		Monticello Avenue	
	Signalized	Left	151	173					m19	m17
		Through					387	286	105	110
		Right						89		
#6: 25th Street at Monticello Avenue			25th Street		25th Street		Monticello Avenue		Monticello Avenue	
	Unsignalized	Left	55		83		3	3	1	1
		Through								
		Right					0	0	0	0
#19: Virginia Beach Boulevard at Monticello Avenue			Virginia Beach Boulevard		Virginia Beach Boulevard		Monticello Avenue		Monticello Avenue	
	Signalized	Left	106	126	113	119	180	180	214	244
		Through	177	233	152	242	354	358	282	294
		Right			43	74	0	38		

Table 21: 2045 Preferred Alternative Project 2 Control Delay and LOS Results

Intersection Number and Description		Type of Control	Lane Group	Eastbound				Westbound				Northbound				Southbound				Overall	
				AM		PM		AM		PM		AM		PM		AM		PM			
				Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	AM	PM
1	Monticello Avenue at Church Street			Monticello Avenue				Cemetery				Church Street				Church Street				Intersection	
		Signalized	Left	52.5	D	55.5	E	0.0	A	46.8	D					3.6	A	0.0	A	Delay	Delay
			Through									7.2	A	4.4	A	3.7	A	2.0	A	13.1	17.1
			Right	28.3	C	29.5	C									0.5	A	7.0	A	LOS	LOS
			Approach	51.8	D	54.4	D	0.0	A	46.8	D	7.2	A	4.4	A	2.6	A	3.6	A	B	B
2	29th Street at Monticello Avenue			29th Street				29th Street				Monticello Avenue				Monticello Avenue				Intersection	
		Unsignalized	Left	11.8	B	9.0	A	8.8	A	0.0	A	0.6	A	0.6	A	0.0	A	0.0	A	Delay	Delay
			Through									0.0	A	0.0	A	0.0	A	0.0	A	-	-
			Right																	LOS	LOS
			Approach	11.8	B	9.0	A	8.8	A	0.0	A	0.3	A	0.3	A	0.0	A	0.0	A	-	-
3	28th Street at Monticello Avenue			28th Street				28th Street				Monticello Avenue				Monticello Avenue				Intersection	
		Unsignalized	Left	9.6	A	9.7	A	11.7	B	14.1	B	0.0	A	0.0	A	0.1	A	0.1	A	Delay	Delay
			Through									0.0	A	0.0	A	0.0	A	0.0	A	-	-
			Right																	LOS	LOS
			Approach	9.6	A	9.7	A	11.7	B	14.1	B	0.0	A	0.0	A	0.0	A	0.0	A	-	-
4	27th Street at Monticello Avenue			27th Street				27th Street				Monticello Avenue				Monticello Avenue				Intersection	
		Signalized	Left					8.9	A	9.1	A	5.8	A	3.3	A					Delay	Delay
			Through									1.3	A	1.4	A	17.5	B	24.6	C	8.8	8.7
			Right																	LOS	LOS
			Approach					8.9	A	9.1	A	3.0	A	2.0	A	17.5	B	24.6	C	A	A
5	26th Street at Monticello Avenue			26th Street				26th Street				Monticello Avenue				Monticello Avenue				Intersection	
		Signalized	Left	8.1	A	12.7	B									14.4	B	27.6	C	Delay	Delay
			Through									21.0	C	45.9	D	12.5	B	13.2	B	13.4	24.5
			Right																	LOS	LOS
			Approach	8.1	A	12.7	B					21.0	C	45.9	D	12.5	B	14.0	B	B	C
6	25th Street at Monticello Avenue			25th Street				25th Street				Monticello Avenue				Monticello Avenue				Intersection	
		Unsignalized	Left	28.0	D	37.2	E	44.1	E	65.3	F	2.3	A	1.1	A	0.2	A	0.5	A	Delay	Delay
			Through																	-	-
			Right									0.0	A	0.0	A	0.0	A	0.0	A	LOS	LOS
			Approach	28.0	D	37.2	E	44.1	E	65.3	F	1.2	A	0.5	A	0.1	A	0.2	A	-	-

Table 21: 2045 Preferred Alternative Project 2 Control Delay and LOS Results (cont.)

Intersection Number and Description		Type of Control	Lane Group	Eastbound				Westbound				Northbound				Southbound				Overall	
				AM		PM		AM		PM		AM		PM		AM		PM			
				Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	AM	PM
7	21st Street at Monticello Avenue			21st Street				21st Street				Monticello Avenue				Monticello Avenue				Intersection	
		Signalized	Left	60.2	E	40.7	D	28.9	C	27.6	C	45.7	D	44.6	D	11.1	B	16.2	B	Delay	Delay
			Through									3.3	A	6.1	A					13.5	20.9
			Right	4.6	A	51.5	D													LOS	LOS
			Approach	27.9	C	47.0	D	28.9	C	27.6	C	11.3	B	12.6	B	11.1	B	16.2	B	B	C
8	20th Street at Monticello Avenue			20th Street				20th Street				Monticello Avenue				Monticello Avenue				Intersection	
		Signalized	Left	27.9	C	32.2	C	28.2	C	34.3	C	4.4	A	5.3	A	3.2	A	6.9	A	Delay	Delay
			Through									3.7	A	3.8	A					5.8	8.9
			Right																	LOS	LOS
			Approach	27.9	C	32.2	C	28.2	C	34.3	C	3.7	A	3.9	A	3.2	A	6.9	A	A	A
9	19th Street at Monticello Avenue			19th Street				19th Street				Monticello Avenue				Monticello Avenue				Intersection	
		Unsignalized	Left	11.7	B	15.3	C	13.7	B	18.7	C	8.8	A	9.1	A	8.6	A	9.5	A	Delay	Delay
			Through									0.0	A	0.0	A	0.0	A	0.0	A	-	-
			Right																	LOS	LOS
			Approach	11.7	B	15.3	C	13.7	B	18.7	C	0.4	A	0.3	A	0.2	A	0.9	A	-	-
10	18th Street at Monticello Avenue			18th Street				18th Street				Monticello Avenue				Monticello Avenue				Intersection	
		Signalized	Left	26.4	C	30.7	C	28.1	C	34.7	C	11.3	B	11.0	B	2.2	A	3.5	A	Delay	Delay
			Through									14.0	B	14.1	B	2.1	A	3.2	A	9.4	11.1
			Right																	LOS	LOS
			Approach	26.4	C	30.7	C	28.1	C	34.7	C	13.9	B	14.0	B	2.1	A	3.2	A	A	B
11	17th Street at Monticello Avenue			17th Street				17th Street				Monticello Avenue				Monticello Avenue				Intersection	
		Unsignalized	Left	15.0	B	13.9	B	20.4	C	30.3	D	9.3	A	9.6	A	9.3	A	10.0	A	Delay	Delay
			Through									0.0	A	0.0	A	0.0	A	0.0	A	-	-
			Right																	LOS	LOS
			Approach	15.0	B	13.9	B	20.4	C	30.3	D	0.7	A	0.4	A	0.1	A	0.2	A	-	-
12	16th Street at Monticello Avenue			16th Street				16th Street				Monticello Avenue				Monticello Avenue				Intersection	
		Unsignalized	Left					14.9	B	12.2	B					9.0	A	9.4	A	Delay	Delay
			Through									0.0	A	0.0	A	0.0	A	0.0	A	-	-
			Right																	LOS	LOS
			Approach					14.9	B	12.2	B	0.0	A	0.0	A	0.5	A	0.5	A	-	-

Table 21: 2045 Preferred Alternative Project 2 Control Delay and LOS Results (cont.)

Intersection Number and Description		Type of Control	Lane Group	Eastbound				Westbound				Northbound				Southbound				Overall	
				AM		PM		AM		PM		AM		PM		AM		PM			
				Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	AM	PM
13	15th Street at Monticello Avenue			15th Street				15th Street				Monticello Avenue				Monticello Avenue				Intersection	
		Unsignalized	Left	11.2	B	12.3	B					9.6	A	10.1	B					Delay	Delay
			Through									0.0	A	0.0	A	0.0	A	0.0	A	-	-
			Right													0.0	A	0.0	A	LOS	LOS
			Approach	11.2	B	12.3	B					0.5	A	0.5	A	0.0	A	0.0	A	-	-
14	14th Street at Monticello Avenue			14th Street				14th Street				Monticello Avenue				Monticello Avenue				Intersection	
		Unsignalized	Left	12.8	B	12.6	B	12.1	B	12.5	B	9.6	A	9.9	A	9.0	A	9.3	A	Delay	Delay
			Through									0.0	A	0.0	A	0.0	A	0.0	A	-	-
			Right																	LOS	LOS
			Approach	12.8	B	12.6	B	12.1	B	12.5	B	0.1	A	0.0	A	0.0	A	0.1	A	-	-
15	13th Street at Monticello Avenue			13th Street				13th Street				Monticello Avenue				Monticello Avenue				Intersection	
		Unsignalized	Left	12.3	B	14.2	B	9.0	A	11.2	B	0.0	A	0.1	A	0.0	A	0.0	A	Delay	Delay
			Through																	-	-
			Right									0.0	A	0.0	A					LOS	LOS
			Approach	12.3	B	14.2	B	9.0	A	11.2	B	0.0	A	0.1	A	0.0	A	0.1	A	-	-
16	Princess Anne Road at Monticello Avenue			Princess Anne Road				Princess Anne Road				Monticello Avenue				Monticello Avenue				Intersection	
		Signalized	Left	26.1	C	15.1	B	33.9	C	13.6	B	28.8	C	49.4	D	19.9	B	26.6	C	Delay	Delay
			Through	30.6	C	19.1	B	40.1	D	14.3	B	3.6	A	10.9	B	32.6	C	40.2	D	22.7	24.9
			Right																	LOS	LOS
			Approach	30.1	C	18.6	B	39.3	D	14.2	B	7.7	A	15.8	B	31.8	C	38.9	D	C	C
17	11th Street at Monticello Avenue			11th Street				11th Street				Monticello Avenue				Monticello Avenue				Intersection	
		Unsignalized	Left	9.0	A	9.3	A					8.6	A	8.3	A					Delay	Delay
			Through									0.0	A	0.0	A	0.0	A	0.0	A	-	-
			Right																	LOS	LOS
			Approach	9.0	A	9.3	A					0.2	A	0.1	A	0.0	A	0.0	A	-	-
18	9th Street at Monticello Avenue			9th Street				9th Street				Monticello Avenue				Monticello Avenue				Intersection	
		Unsignalized	Left	8.7	A	9.9	A					0.1	A	0.1	A					Delay	Delay
			Through									0.0	A	0.0	A	0.0	A	0.0	A	-	-
			Right																	LOS	LOS
			Approach	8.7	A	9.9	A					0.0	A	0.0	A	0.0	A	0.0	A	-	-

Table 21: 2045 Preferred Alternative Project 2 Control Delay and LOS Results (cont.)

Intersection Number and Description		Type of Control	Lane Group	Eastbound				Westbound				Northbound				Southbound				Overall	
				AM		PM		AM		PM		AM		PM		AM		PM			
				Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	AM	PM
19	Virginia Beach Boulevard at Monticello Avenue			Virginia Beach Boulevard				Virginia Beach Boulevard				Monticello Avenue				Monticello Avenue				Intersection	
		Signalized	Left	18.3	B	18.9	B	25.3	C	16.7	B	13.5	B	19.5	B	26.1	C	30.6	C	Delay	Delay
			Through	22.4	C	25.9	C	29.5	C	25.6	C	14.0	B	37.4	D	20.7	C	21.8	C	20.0	28.4
			Right					33.1	C	30.3	C	22.1	C	50.6	D					LOS	LOS
			Approach	22.0	C	25.0	C	29.4	C	25.2	C	14.4	B	37.7	D	21.2	C	22.8	C	B	C
20	Monticello Avenue at St. Paul's Boulevard			Monticello Avenue				Monticello Avenue				St. Paul's Boulevard				St. Paul's Boulevard				Intersection	
		Signalized	Left	40.2	D	34.2	C													Delay	Delay
			Through									1.0	A	2.3	A	4.2	A	2.1	A	3.7	4.6
			Right																	LOS	LOS
			Approach									1.0	A	2.3	A	4.2	A	2.1	A	A	A
21	Olney Road at St. Paul's Boulevard			Olney Road				Olney Road				St. Paul's Boulevard				St. Paul's Boulevard				Intersection	
		Unsignalized	Left	10.4	B	14.1	B					0.0	A	0.0	A	0.5	A	1.7	A	Delay	Delay
			Through									0.0	A	0.0	A	0.0	A	0.0	A	-	-
			Right									0.0	A	0.0	A					LOS	LOS
			Approach	10.4	B	14.1	B					0.0	A	0.0	A	0.1	A	0.5	A	-	-
22	Brambleton Avenue at St. Paul's Boulevard			Brambleton Avenue				Brambleton Avenue				St. Paul's Boulevard				St. Paul's Boulevard				Intersection	
		Signalized	Left	30.7	C	33.7	C	53.2	D	53.6	D	48.8	D	45.9	D	52.4	D	30.4	C	Delay	Delay
			Through	13.2	B	18.9	B	20.5	C	18.1	B	24.3	C	29.5	C	47.8	D	29.7	C	30.6	27.9
			Right	14.0	B	31.8	C													LOS	LOS
			Approach	14.5	B	25.7	C	23.8	C	21.1	C	35.6	D	35.1	D	48.4	D	29.8	C	C	C
23	Bute Street at St. Paul's Boulevard			Bute Street				Bute Street				St. Paul's Boulevard				St. Paul's Boulevard				Intersection	
		Signalized	Left	33.0	C	35.0	C	33.2	C	34.7	C	1.7	A	0.0	A					Delay	Delay
			Through									1.3	A	3.4	A	13.1	B	11.9	B	7.3	9.3
			Right																	LOS	LOS
			Approach	33.0	C	35.0	C	33.2	C	34.7	C	1.3	A	3.4	A	13.1	B	11.9	B	A	A
24	Charlotte Street/ Wood Street at St. Paul's Boulevard			Charlotte Street				Wood Street				St. Paul's Boulevard				St. Paul's Boulevard				Intersection	
		Signalized	Left	41.4	D	44.2	D	31.1	C	31.7	C	56.3	E	56.6	E					Delay	Delay
			Through									12.3	B	10.6	B	6.3	A	3.4	A	12.1	10.1
			Right	41.1	D	42.5	D													LOS	LOS
			Approach	41.2	D	42.9	D	31.1	C	31.7	C	15.4	B	12.8	B	6.3	A	3.4	A	B	B

Table 21: 2045 Preferred Alternative Project 2 Control Delay and LOS Results (cont.)

Intersection Number and Description		Type of Control	Lane Group	Eastbound				Westbound				Northbound				Southbound				Overall	
				AM		PM		AM		PM		AM		PM		AM		PM			
				Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	AM	PM
25	Monticello Avenue at Olney Road			Olney Road*				Olney Road*				Monticello Avenue*				Monticello Avenue*				Intersection	
		Unsignalized	Left																	Delay	Delay
			Through																		
			Right																	LOS	LOS
			Approach																		

- Denotes the overall intersection is stop controlled and no level of service or delay is reported

* HCM 2000 Unsignalized does not support 5-legged intersections

Table 22: 2045 Preferred Alternative Project 2 Queue Results

Intersection Number and Description		Type of Control	Lane Group	Maximum Queue							
				Eastbound		Westbound		Northbound		Southbound	
				AM	PM	AM	PM	AM	PM	AM	PM
1	Monticello Avenue at Church Street			Monticello Avenue		Cemetery		Church Street		Church Street	
		Signalized	Left	133	89	0	6			m0	0
			Through					156	56	34	60
			Right	0	0					1	13
2	29th Street at Monticello Avenue			29th Street		29th Street		Monticello Avenue		Monticello Avenue	
		Unsignalized	Left	0	0	0	0	1	1	0	0
			Through					0	0	0	0
			Right								
3	28th Street at Monticello Avenue			28th Street		28th Street		Monticello Avenue		Monticello Avenue	
		Unsignalized	Left	3	6	0	1	0	0	0	0
			Through					0	0	0	0
			Right								
4	27th Street at Monticello Avenue			27th Street		27th Street		Monticello Avenue		Monticello Avenue	
		Signalized	Left			109	113	45	m8		
			Through							117	122
			Right								
5	26th Street at Monticello Avenue			26th Street		26th Street		Monticello Avenue		Monticello Avenue	
		Signalized	Left	60	151					m6	m19
			Through					206	387	103	105
			Right								
6	25th Street at Monticello Avenue			25th Street		25th Street		Monticello Avenue		Monticello Avenue	
		Unsignalized	Left	25	55	62	83	5	3	1	1
			Through					0	0	0	0
			Right								
7	21st Street at Monticello Avenue			21st Street		21st Street		Monticello Avenue		Monticello Avenue	
		Signalized	Left	105	m186	25	31	134	164	78	355
			Through					41	96		
			Right	3	200						
8	20th Street at Monticello Avenue			20th Street		20th Street		Monticello Avenue		Monticello Avenue	
		Signalized	Left	58	85	62	136	12	14	41	82
			Through					47	63		
			Right								

Table 22: 2045 Preferred Alternative Project 2 Queue Results (cont.)

Intersection Number and Description		Type of Control	Lane Group	Maximum Queue							
				Eastbound		Westbound		Northbound		Southbound	
				AM	PM	AM	PM	AM	PM	AM	PM
9	19th Street at Monticello Avenue			19th Street		19th Street		Monticello Avenue		Monticello Avenue	
		Unsignalized	Left	8	11	8	33	3	2	1	9
			Through					0	0	0	0
			Right								
10	18th Street at Monticello Avenue			18th Street		18th Street		Monticello Avenue		Monticello Avenue	
		Signalized	Left	35	49	70	118	19	23	m5	m10
			Through					160	205	35	52
			Right								
11	17th Street at Monticello Avenue			17th Street		17th Street		Monticello Avenue		Monticello Avenue	
		Unsignalized	Left	3	5	1	7	5	4	1	2
			Through					0	0	0	0
			Right								
12	16th Street at Monticello Avenue			16th Street		16th Street		Monticello Avenue		Monticello Avenue	
		Unsignalized	Left			25	13			4	4
			Through					0	0		
			Right								
13	15th Street at Monticello Avenue			15th Street		15th Street		Monticello Avenue		Monticello Avenue	
		Unsignalized	Left	7	11			5	6		
			Through							0	0
			Right								
14	14th Street at Monticello Avenue			14th Street		14th Street		Monticello Avenue		Monticello Avenue	
		Unsignalized	Left	5	6	1	3	1	0	0	1
			Through					0	0	0	0
			Right								
15	13th Street at Monticello Avenue			13th Street		13th Street		Monticello Avenue		Monticello Avenue	
		Unsignalized	Left	2	4	1	1	0	0	0	0
			Through					0	0		
			Right								
16	Princess Anne Road at Monticello Avenue			Princess Anne Road		Princess Anne Road		Monticello Avenue		Monticello Avenue	
		Signalized	Left	m25	m20	m35	m28	91	m114	38	71
			Through	128	97	155	81	33	96	336	430
			Right								

Table 22: 2045 Preferred Alternative Project 2 Queue Results (cont.)

Intersection Number and Description		Type of Control	Lane Group	Maximum Queue							
				Eastbound		Westbound		Northbound		Southbound	
				AM	PM	AM	PM	AM	PM	AM	PM
17	11th Street at Monticello Avenue			11th Street		11th Street		Monticello Avenue		Monticello Avenue	
		Unsignalized	Left	3	3			2	1		
			Through							0	0
			Right								
18	9th Street at Monticello Avenue			9th Street		9th Street		Monticello Avenue		Monticello Avenue	
		Unsignalized	Left	3	3			0	0		
			Through							0	0
			Right								
19	Virginia Beach Boulevard at Monticello Avenue			Virginia Beach Boulevard		Virginia Beach Boulevard		Monticello Avenue		Monticello Avenue	
		Signalized	Left	57	93	105	109	157	180	128	170
			Through	100	157	122	191	183	352	228	247
			Right			80	84	0	21		
20	Monticello Avenue at St. Paul's Boulevard			Monticello Avenue		Monticello Avenue		St. Paul's Boulevard		St. Paul's Boulevard	
		Signalized	Left	89	106						
			Through					115	114	125	250
			Right								
21	Olney Road at St. Paul's Boulevard			Olney Road		Olney Road		St. Paul's Boulevard		St. Paul's Boulevard	
		Unsignalized	Left	22	82			1	8	70	111
			Through					9	69	21	97
			Right					2	42		
22	Brambleton Avenue at St. Paul's Boulevard			Brambleton Avenue		Brambleton Avenue		St. Paul's Boulevard		St. Paul's Boulevard	
		Signalized	Left	104	99	168	164	411	240	187	205
			Through	146	475	197	274	340	389	282	609
			Right	250	532						
23	Bute Street at St. Paul's Boulevard			Bute Street		Bute Street		St. Paul's Boulevard		St. Paul's Boulevard	
		Signalized	Left	30	100	68	101	59	46		
			Through					140	142	201	502
			Right								
24	Charlotte Street/ Wood Street at St. Paul's Boulevard			Charlotte Street		Wood Street		St. Paul's Boulevard		St. Paul's Boulevard	
		Signalized	Left	40	94	149	205	140	140	202	319
			Through					568	348		
			Right	56	270						

Table 22: 2045 Preferred Alternative Project 2 Queue Results (cont.)

Intersection Number and Description		Type of Control	Lane Group	Maximum Queue							
				Eastbound		Westbound		Northbound		Southbound	
				AM	PM	AM	PM	AM	PM	AM	PM
25	Monticello Avenue at Olney Road			Olney Road*		Olney Road*		Monticello Avenue*		Monticello Avenue*	
		Unsignalized	Left	43	91			36	59	2	172
			Through					5	85		
			Right								

Table 23: 2045 Preferred Alternative Project 2 No-Build to Build Delay and LOS Comparison

	Type of Control	Lane Group	Eastbound				Westbound				Northbound				Southbound				Overall	
			No-Build		Build		No-Build		Build		No-Build		Build		No-Build		Build			
			Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	No-Build	Build
AM Peak																				
#22: Brambleton Avenue at St. Paul's Boulevard			Brambleton Avenue				Brambleton Avenue				St. Paul's Boulevard				St. Paul's Boulevard				Intersection	
	Signalized	Left	37.9	D	30.7	C	9.7	A	53.2	D	48.8	D	48.8	D	52.4	D	52.4	D	Delay	Delay
		Through	45.4	D	13.2	B	18.6	B	20.5	C	24.3	C	24.3	C	47.8	D	47.8	D	32.3	30.6
		Right	17.3	B	14.0	B													LOS	LOS
		Approach	28.1	C	14.5	B	17.7	B	23.8	C	35.6	D	35.6	D	48.4	D	48.4	D	C	C
#24: Charlotte Street/ Wood Street at St. Paul's Boulevard			Charlotte Street				Wood Street				St. Paul's Boulevard				St. Paul's Boulevard				Intersection	
	Signalized	Left	41.4	D	41.4	D	31.1	C	31.1	C	15.6	B	56.3	E	5.9	A			Delay	Delay
		Through									12.3	B	12.3	B			6.3	A	10.3	12.1
		Right	41.1	D	41.1	D													LOS	LOS
		Approach	41.2	D	41.2	D	31.1	C	31.1	C	12.6	B	15.4	B	5.9	A	6.3	A	B	B
PM Peak																				
#22: Brambleton Avenue at St. Paul's Boulevard			Brambleton Avenue				Brambleton Avenue				St. Paul's Boulevard				St. Paul's Boulevard				Intersection	
	Signalized	Left	15.0	B	33.7	C	16.7	B	53.6	D	45.8	D	45.9	D	30.3	C	30.4	C	Delay	Delay
		Through	21.9	C	18.9	B	21.0	C	18.1	B	29.5	C	29.5	C	29.4	C	29.7	C	27.0	27.9
		Right	25.1	C	31.8	C													LOS	LOS
		Approach	23.4	C	25.7	C	20.7	C	21.1	C	35.0	C	35.1	D	29.5	C	29.8	C	C	C
#24: Charlotte Street/ Wood Street at St. Paul's Boulevard			Charlotte Street				Wood Street				St. Paul's Boulevard				St. Paul's Boulevard				Intersection	
	Signalized	Left	44.2	D	44.2	D	31.7	C	31.7	C	17.1	B	56.6	E	4.2	A			Delay	Delay
		Through									10.6	B	10.6	B			3.4	A	9.9	10.1
		Right	42.5	D	42.5	D													LOS	LOS
		Approach	42.9	D	42.9	D	31.7	C	31.7	C	10.9	B	12.8	B	4.2	A	3.4	A	A	B

Table 24: 2045 Preferred Alternative Project 2 No-Build to Build Queue Comparison

Intersection Number and Description	Type of Control	Lane Group	Maximum Queue							
			Eastbound		Westbound		Northbound		Southbound	
			No Build	Build	No Build	Build	No Build	Build	No Build	Build
AM Peak Hour										
#22: Brambleton Avenue at St. Paul's Boulevard			Brambleton Avenue		Brambleton Avenue		St. Paul's Boulevard		St. Paul's Boulevard	
	Signalized	Left	101	104	92	168	408	411	185	187
		Through	183	146	235	197	343	340	252	282
		Right	259	250						
#24: Charlotte Street/ Wood Street at St. Paul's Boulevard			Charlotte Street		Wood Street		St. Paul's Boulevard		St. Paul's Boulevard	
	Signalized	Left	39	40	155	149	140	140	245	202
		Through					567	568		
		Right	48	56						
PM Peak Hour										
#22: Brambleton Avenue at St. Paul's Boulevard			Brambleton Avenue		Brambleton Avenue		St. Paul's Boulevard		St. Paul's Boulevard	
	Signalized	Left	75	99	117	164	225	240	225	205
		Through	440	475	313	274	406	389	716	609
		Right	529	532						
#24: Charlotte Street/ Wood Street at St. Paul's Boulevard			Charlotte Street		Wood Street		St. Paul's Boulevard		St. Paul's Boulevard	
	Signalized	Left	91	94	190	205	139	140	316	319
		Through					300	348		
		Right	244	270						

4.4 Cost Estimates

Appendix F includes a Basis of Design Memo detailing the established project design criteria, field review notes, risk assessment, and assumptions made during the design effort for Preferred Alternative Project 1 (Intersection Improvements).

An engineer's preliminary opinion of probable cost was created for construction costs, right-of-way acquisition costs, and utility relocation costs for each of the preferred alternative projects. These cost opinions established the project budget, in FY2024 dollars, as shown in **Table 25**. Given the systemic nature of the corridorwide improvements, right-of-way acquisition and utility relocation costs have not been established for Project 4 as part of the sketch-level design. Detailed cost estimates for each project are included in **Appendix F**.

Table 25: HR-23-06 Preferred Alternative Budget (FY2024)

Phase Description	Project 1	Project 2	Project 3	Project 4
Preliminary Engineering	$ 460,000	$ 480,000	$ 120,000	$ 470,000
Right-of-Way Acquisition (includes Utility Relocations)	$ 790,000	$ 150,000	$ 150,000	TBD
Construction	$3,050,000	$3,220,000	$ 760,000	$3,180,000
Total	**$4,300,000**	**$3,850,000**	**$1,030,000**	**$3,650,000**

4.5 Schedule Estimates

Estimated schedules were developed for each of the preferred alternative projects. **Table 26** summarizes the projected timeframes for the preliminary engineering (PE), right-of-way (RW), and construction (CN) phases.

Table 26: HR-23-06 Preferred Alternative Estimated Schedule Duration (Months)

Phase Description	Project 1	Project 2	Project 3	Project 4
Preliminary Engineering	28	28	28	24
Right-of-Way Acquisition (includes Utility Relocations)	16	10	10	9
Construction	31	28	22	28
Total	**75**	**66**	**60**	**61**

4.6 Project Risks

All projects have risks; however, some projects may have more significant risks than others due to technical complexity, funding, financing, and stakeholder acceptance. Risk management generally involves the process of anticipating what risks a project may face, mitigating them to the extent reasonably possible, and having a plan to react to them if and when they occur. This is recognized in VDOT guidance regarding the analysis of and mitigation of risks.

The following is a list the most notable potential issues that may affect project development, risks faced by the project, and risk mitigation strategies to be applied to manage and minimize risks throughout project development. **Appendix F** includes the risk analysis matrix for Project 1 which details the risk assessment and mitigation strategy.

Risk/Issue: Roadway Design

The ability to retrofit curb ramps and crosswalks in accordance with current design standards is constrained by existing drainage, traffic signal, public utility, and franchise utility infrastructure. Detailed design of the pedestrian facility improvements may require costly relocation of equipment.

Risk/Issue: Right-of-Way

Existing and proposed sidewalks and traffic signal equipment may be located on private property according to GIS information utilized in the conceptual design. Additional right-of-way and permanent and temporary easements may be necessary to construct the proposed improvements.

Risk/Issue: Environmental

Based on the desktop environmental review, the study area may be located within northern long-eared bat (NLEB) year-round preservation area; however, there is minimal tree clearing anticipated based on the proposed improvements. Time of year restrictions will govern when trees can be cleared, and a minimum of two replacement trees will be required for every tree removed.

Rise/Issue: Utilities

There are numerous aerial and underground utilities present throughout the proposed corridor improvements that will either limit the locations of curb ramps and traffic signal improvements or will require costly relocation.

Risk/Issue: Geotechnical

Multiple pavement types are present within the corridor including areas of concrete, asphalt, and asphalt over concrete within the same intersection area. Areas of cracked concrete and asphalt were noted during field review that will require rehabilitation or replacement in conjunction with the project improvements. There is potential for unsuitable subgrade soils that will require undercut and backfill

under any new pavement or sidewalk areas and are currently unidentified without formal geotechnical investigations.

Risk/Issue: Construction

The current construction market across Virginia and in the Hampton Roads area is constrained due to a number of large, ongoing construction projects. This creates a challenging labor market and increased pressures on the material supply chain that will impact the cost and schedule of the proposed improvements. Given the nature of the corridor, allowable work hours may limit the Contractor's daily production rate or require night work operations which will extend the project duration and increase construction costs.

4.7 Possible Funding Sources

The primary goal of Project Pipeline is to identify a preferred alternative that can address issues identified within the Commonwealth of Virginia as identified via VTrans needs and then prepare the selected projects for potential funding sources. The primary intended funding source for projects developed through the Project Pipeline process is Virginia's SMART SCALE funding. SMART SCALE is a process that helps Virginia meet its most critical transportation needs using limited tax dollars. It evaluates potential transportation projects based on key factors like how they improve safety, reduce congestion, increase accessibility, contribute to economic development, promote efficient land use, and affect the environment. The anticipated benefits are calculated, and the projects are scored and ranked. This information is used by the Commonwealth Transportation Board to help guide and inform their project selection decisions.

The City of Norfolk has elected to submit the preferred alternative "Project 1" for Round 6 of SMART SCALE funding. This project includes the following improvements:

- Constructing a northbound right-turn lane at the intersection of Monticello Avenue and 26th Street
- Constructing channelizing islands on the eastbound and westbound approaches of 25th Street at Monticello Avenue to physically prevent through and left-turn movements
- Modifying the existing channelizing island in the northwest quadrant of the Monticello Avenue and Virginia Beach Boulevard intersection to improve the angle of the southbound right-turn slip lane and to construct new sidewalk with a new marked crosswalk

The preferred alternative documentation prepared through this Project Pipeline study also can be leveraged to apply for funding from other sources such as Transportation Alternatives (TA), Safe Routes to School (SRTS), Revenue Sharing, Highway Safety Improvements Program (HSIP), Congestion Mitigation and Air Quality (CMAQ), and future rounds of SMART SCALE. The preferred alternative projects not submitted for SMART SCALE funding during this round (i.e., Projects 2, 3, and 4), may be packaged for applications for these grant programs as well as local funding sources.