

# **PROJECT PIPELINE**

**HR-23-09: Route 17 (George  
Washington Memorial Highway)**

**York County  
Phase 3 Report**



# Project Pipeline – Hampton Roads

## HR-23-09 Route 17 (George Washington Highway) – Cook Road to Denbigh Boulevard | July 2024



## Table of Contents

1	Needs Evaluation & Diagnosis .....	5
1.1	Introduction .....	5
1.2	Methodology .....	5
1.3	Study Background .....	6
1.3.1	Study Area .....	6
1.3.2	Related Plans and Other Initiatives .....	7
1.4	VTrans Needs .....	8
1.5	High-Level Needs Diagnosis .....	8
1.5.1	Operations and Access Needs .....	8
1.5.2	Safety Needs .....	10
1.5.3	Transit and Transportation Demand Management Needs .....	18
1.5.4	Environmental Justice .....	22
1.6	Detailed Needs Validation .....	22
1.6.1	Additional Safety Review .....	22
1.6.2	Phase 1 Field Review .....	27
1.6.3	Existing Conditions Traffic Operations Analysis .....	31
1.6.4	No-Build Conditions Traffic Operations Analysis .....	43
1.6.5	Phase 1 Public Outreach .....	52
2	Alternatives Development & Refinement .....	53
2.1	Phase 1 Alternative Development .....	53
2.1.1	Alternatives Addressing Traffic Operations and Safety Needs .....	53
2.1.2	Alternatives Addressing Bicycle and Pedestrian Access and Safety .....	56
2.1.3	Phase 1 Alternatives Summary .....	56
2.2	Phase 2 Alternatives Analysis and Refinement .....	59
2.2.1	Tier 1 Screening .....	59
2.2.2	Concepts Advanced to Tier 2 Screening .....	60
2.2.3	Tier 2 Screening Results .....	69
2.2.4	Other Potential Improvements .....	74

3	Public & Stakeholder Outreach & Feedback .....	76
3.1	Stakeholder Coordination .....	76
3.2	Public Involvement .....	76
4	Preferred Alternative & Investment Strategy .....	78
4.1	Selection of the Preferred Alternative .....	78
4.2	Operational Analysis .....	82
4.3	Phase 3 Planning-Level Sketches and Cost Estimates .....	87
4.4	Schedule Estimates .....	87
4.5	Project Risks .....	87
4.6	Possible Funding Sources .....	87

## List of Figures

Figure 1:	Project Pipeline Objectives .....	5
Figure 2:	Study Phase Methods and Solution .....	5
Figure 3:	Project Study Area .....	7
Figure 4:	2019 Average Annual Daily Traffic Volumes (vehicles per day) .....	9
Figure 5:	2021 Average Annual Daily Traffic Volumes (vehicles per day) .....	10
Figure 6:	Average Travel Time Index and Average Travel Time Per Hour .....	10
Figure 7:	Potential for Safety Improvement (PSI) Locations (2016-2020) .....	11
Figure 8:	Route 17 Sidewalks and Sidewalk Gaps .....	12
Figure 9:	Study Area Crashes by Collision Type (1/1/2015-3/31/2023) .....	13
Figure 10:	Study Area Crashes by Crash Severity (1/1/2015-3/31/2022) .....	13
Figure 11:	Fatal Crash Diagram (1/6/2023, 7:22 AM) .....	14
Figure 12:	Severe Injury Crash Locations by Collision Type (1/1/2015-3/31/2023) .....	14
Figure 13:	Intersection Crashes by Collision Type (2018-2022) .....	16
Figure 14:	VDOT Park-and-Ride Locations .....	18
Figure 15:	Proposed WATA Route 17 Bus Demonstration Service .....	19
Figure 16:	Proposed New HRT MAX Commuter Bus Service .....	19
Figure 17:	2010 Population Density in York County, James City County, and City of Williamsburg .....	20
Figure 18:	Transit Dependence Index in York County, James City County, and City of Williamsburg .....	21

Figure 19: Transit Dependence Index Percentage in York County, James City County, and City of Williamsburg.....	21	Figure 46: Phase 1 Scoping Level Improvement Alternatives.....	58
Figure 20: Pedestrian Crashes in the HR09 Study Area 1/1/2015-6/30/2023.....	23	Figure 47: Results of the Tier 1 Screening of Potential Concepts.....	59
Figure 21: Pedestrian Waiting to Cross Route 17 at McDonald’s/Starbucks Entrance Photo looking south from north of the Fort Eustis Boulevard intersection.....	23	Figure 48: Phase 2 Alternative – Route 17 at Cook Road – New Left Turn Lane.....	60
Figure 22: Crash Diagram of Vehicle-Bicycle Crash.....	24	Figure 49: Phase 2 Alternative – Route 17 at Cook Road – Thru-Cut.....	61
Figure 23: Collision Diagram – Route 17 at Cook Road/York Warwick Drive.....	25	Figure 50: Phase 2 Alternative – Route 17 at Cook Road – Partial Median U-Turn.....	61
Figure 24: Collision Diagram – Route 17 at Battle Road/Clairmont Way.....	25	Figure 51: Phase 2 Alternative – Route 17 at Cook Road – Restricted Crossing U-Turn.....	62
Figure 25: Collision Diagram – Route 17 at Colonial Harbor Entrance.....	26	Figure 52: Phase 2 Alternative – Route 17 at Battle Road – New Left Turn Lane.....	62
Figure 26: Collision Diagram – Route 17 at Fort Eustis Boulevard.....	26	Figure 53: Phase 2 Alternative – Route 17 at Battle Road – Thru-Cut.....	63
Figure 27: Collision Diagram – Route 17 at Old York-Hampton Highway/Faulkner Road.....	27	Figure 54: Phase 2 Alternative – Route 17 at Battle Road – Full Median U-Turn.....	63
Figure 28: Photo of Lack of Deceleration Lanes and Poor Roadside Conditions.....	28	Figure 55: Phase 2 Alternative – Route 17 at Battle Road – Partial Median U-Turn.....	64
Figure 29: Northbound Route 17 Queuing at Cook Road/York Warwick Drive in PM Peak Period.....	28	Figure 56: Phase 2 Alternative – Route 17 at Battle Road – Restricted Crossing U-Turn.....	64
Figure 30: Congestion and Queuing at the McDonald’s and Starbucks Entrance North of Fort Eustis Boulevard.....	29	Figure 57: Phase 2 Alternative – Route 17 at Fort Eustis Boulevard – Restriped Lanes.....	65
Figure 31: Aerial Photo of the Intersection of Route 17 at Old York-Hampton Highway/Faulkner Rd...	30	Figure 58: Phase 2 Alternative – Route 17 at Fort Eustis Boulevard – Eastbound Approach Widening.....	66
Figure 32: Aerial Photo of Route 17 at Terrebonne Road.....	30	Figure 59: Phase 2 Alternative – Route 17 at Fort Eustis Boulevard – Quadrant Roadway.....	66
Figure 33: Three-Car Rear End Crash During Phase 1 Field Review.....	30	Figure 60: Phase 2 Alternative – Route 17 at Fort Eustis Boulevard – Partial Displaced Left Turn.....	67
Figure 34: 2023 Existing Peak Hour Vehicle Volumes (1).....	33	Figure 61: Phase 2 Alternative – Route 17 at Old York-Hampton Highway – New Faulkner Road Alignment.....	67
Figure 35: 2023 Existing Peak Hour Vehicle Volumes (2).....	34	Figure 62: Phase 2 Alternative – Route 17 at Old York-Hampton Highway – Continuous Green-T.....	68
Figure 36: 2023 Existing Heavy Vehicle Percentages and Peak Hour Factors (1).....	35	Figure 63: Phase 2 Alternative – Route 17 at Old York-Hampton Highway – Partial Median U-Turn...	68
Figure 37: 2023 Existing Heavy Vehicle Percentages and Peak Hour Factors (2).....	36	Figure 64: Phase 2 Alternative – Route 17 at Old York-Hampton Highway – Thru-Cut.....	69
Figure 38: INRIX Speed Data for Route 17 between Siege Lane and Goosley Road.....	37	Figure 65: iCAP Stage 2 Results – AM Peak Hour – Route 17 and Cook Road/York Warwick Drive...	70
Figure 39: Background Traffic Growth Rates.....	43	Figure 66: iCAP Stage 2 Results – PM Peak Hour – Route 17 and Cook Road/York Warwick Drive...	70
Figure 40: 2045 No-Build Peak Hour Volumes (1).....	44	Figure 67: iCAP Stage 2 Results – AM Peak Hour – Route 17 at Battle Road/Clairmont Way.....	71
Figure 41: 2045 No-Build Peak Hour Volumes (2).....	45	Figure 68: iCAP Stage 2 Results – PM Peak Hour – Route 17 at Battle Road/Clairmont Way.....	71
Figure 42: iCAP Stage 1 Results – PM Peak Hour – Route 17 and Cook Road/York Warwick Drive...	54	Figure 69: iCAP Stage 2 Results – AM Peak Hour – Route 17 at Fort Eustis Boulevard.....	72
Figure 43: iCAP Stage 1 Results – PM Peak Hour – Route 17 and Battle Road/Clairmont Way.....	54	Figure 70: iCAP Stage 2 Results – PM Peak Hour – Route 17 at Fort Eustis Boulevard.....	72
Figure 44: iCAP Stage 1 Results – PM Peak Hour – Route 17 and Fort Eustis Boulevard.....	55	Figure 71: iCAP Stage 2 Results – AM Peak Hour – Route 17 at Old York-Hampton Highway/Faulkner Road.....	73
Figure 45: iCAP Stage 1 Results – PM Peak Hour – Route 17 and Old York-Hampton Highway/Faulkner Road.....	55	Figure 72: iCAP Stage 2 Results – PM Peak Hour – Route 17 at Old York-Hampton Highway/Faulkner Road.....	73



Figure 73: Public Engagement – Average Rating of Alternatives – Route 17 at Cook Road/York Warwick Drive.....	76
Figure 74: Public Engagement – Average Rating of Alternatives – Route 17 at Battle Road/Clairmont Way .....	76
Figure 75: Public Engagement – Average Rating of Alternatives – Route 17 at Fort Eustis Boulevard .....	77
Figure 76: Public Engagement – Average Rating of Alternatives – Route 17 at Old York-Hampton Highway.....	77
Figure 77: Refined Phase 2 Alternative – Route 17 at Cook Road – Thru-Cut with Southbound Left Turn Prohibition .....	79
Figure 78: Phase 2 Preferred Alternative – Route 17 at Cook Road – Thru-Cut with Southbound Left Turn Prohibition .....	80
Figure 79: Phase 2 Preferred Alternative – Route 17 at Fort Eustis Boulevard – Eastbound Approach Widening.....	81
Figure 80: Phase 3 Sketch – Route 17 at Cook Road – Thru-Cut with Southbound Left Turn Prohibition .....	88
Figure 81: Phase 3 Sketch – Route 17 at Fort Eustis Boulevard – Eastbound Approach Widening.....	89

Table 15: 2045 No-Build Conditions Peak Hour Maximum Queue (2).....	51
Table 16: Phase 1 Alternatives and Anticipated Needs Addressed – Route 17 and Cook Road/York Warwick Drive.....	56
Table 17: Phase 1 Alternatives and Anticipated Needs Addressed – Route 17 and Battle Road/Clairmont Way.....	56
Table 18: Phase 1 Alternatives and Anticipated Needs Addressed – Route 17 and Fort Eustis Boulevard .....	57
Table 19: Phase 1 Alternatives and Anticipated Needs Addressed – Route 17 and Old York-Hampton Highway/ Faulkner Road .....	57
Table 20: 2045 Build Conditions Peak Hour and LOS (1) .....	83
Table 21: 2045 Build Conditions Peak Hour and LOS (2) .....	84
Table 22: 2045 Build Conditions Peak Hour Maximum Queue (1) .....	85
Table 23: 2045 Build Conditions Peak Hour Maximum Queue (2) .....	86
Table 24: HR-09 Phase 3 Cost Estimates (FY2024 Dollars) .....	87
Table 25: HR-09 Phase 3 Schedule Estimate .....	87

## List of Tables

Table 1: Route 17 VTrans Needs .....	8
Table 2: Route 17 2019 and 2021 AADT Volumes .....	9
Table 3: Study Area Crashes by Crash Severity .....	17
Table 4: Study Area Crashes by Collision Type.....	17
Table 5: Key Equity Statistics.....	22
Table 6: Intersection Turning Movement Count Data Collection Locations and Dates .....	31
Table 7: LOS and Delay .....	37
Table 8: 2023 Existing Conditions Peak Hour Control Delay and LOS (1) .....	39
Table 9: 2023 Existing Conditions Peak Hour Control Delay and LOS (2) .....	40
Table 10: 2023 Existing Conditions Peak Hour Maximum Queue (1).....	41
Table 11: 2023 Existing Conditions Peak Hour Maximum Queue (2) .....	42
Table 12: 2045 No-Build Conditions Peak Hour and LOS (1).....	48
Table 13: 2045 No-Build Conditions Peak Hour and LOS (2).....	49
Table 14: 2045 No-Build Conditions Peak Hour Maximum Queue (1).....	50

## Appendices

Appendix A: Framework Document

Appendix B: Phase 1 Summary Sheet

Appendix C: Equity Analysis Results (FHWA STEAP Tool Project Profile Report)

Appendix D: SimTraffic Calibration Memo

Appendix E: Raw Traffic Data

Appendix F: Synchro and SimTraffic Output Reports

Appendix G: Phase 1 Public Input Survey Results

Appendix H: VJuST Outputs

Appendix I: Study Work Group Meeting Presentations

Appendix J: Phase 2 Public Input Survey Results

Appendix K: Phase 2 Preferred Alternatives Executive Summary Sheets

Appendix L: Phase 3 Preferred Alternative Sketches, Basis of Design Memo, and Detailed Cost Estimate

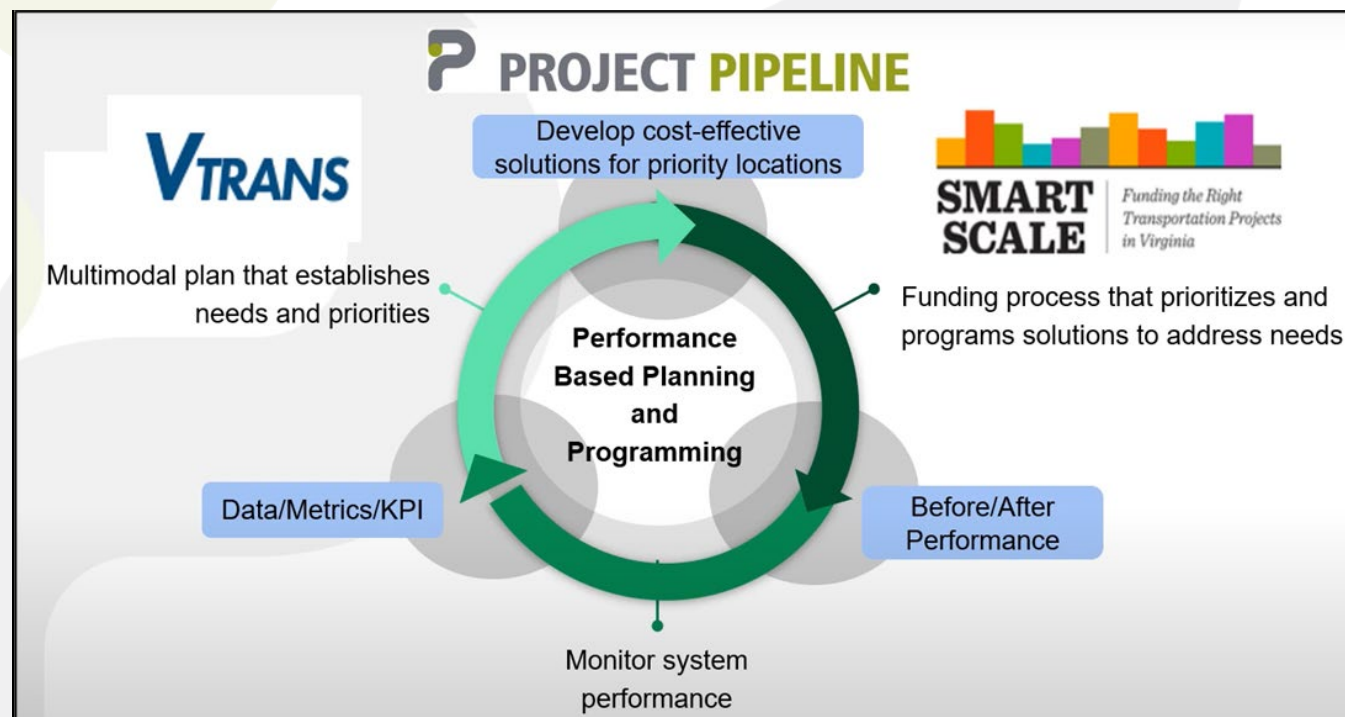
# 1 Needs Evaluation & Diagnosis

## 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](http://vaprojectpipeline.org).

This study is entitled HR-23-09 –Route 17 (George Washington Memorial Highway) and will be referred to as the Study in this report. This study focuses on concepts targeting identified needs including improving safety and access for pedestrians and bicyclists, transit access, motorist safety, and congestion mitigation. The objectives of Project Pipeline are shown below in Figure 1.

Figure 1: Project Pipeline Objectives

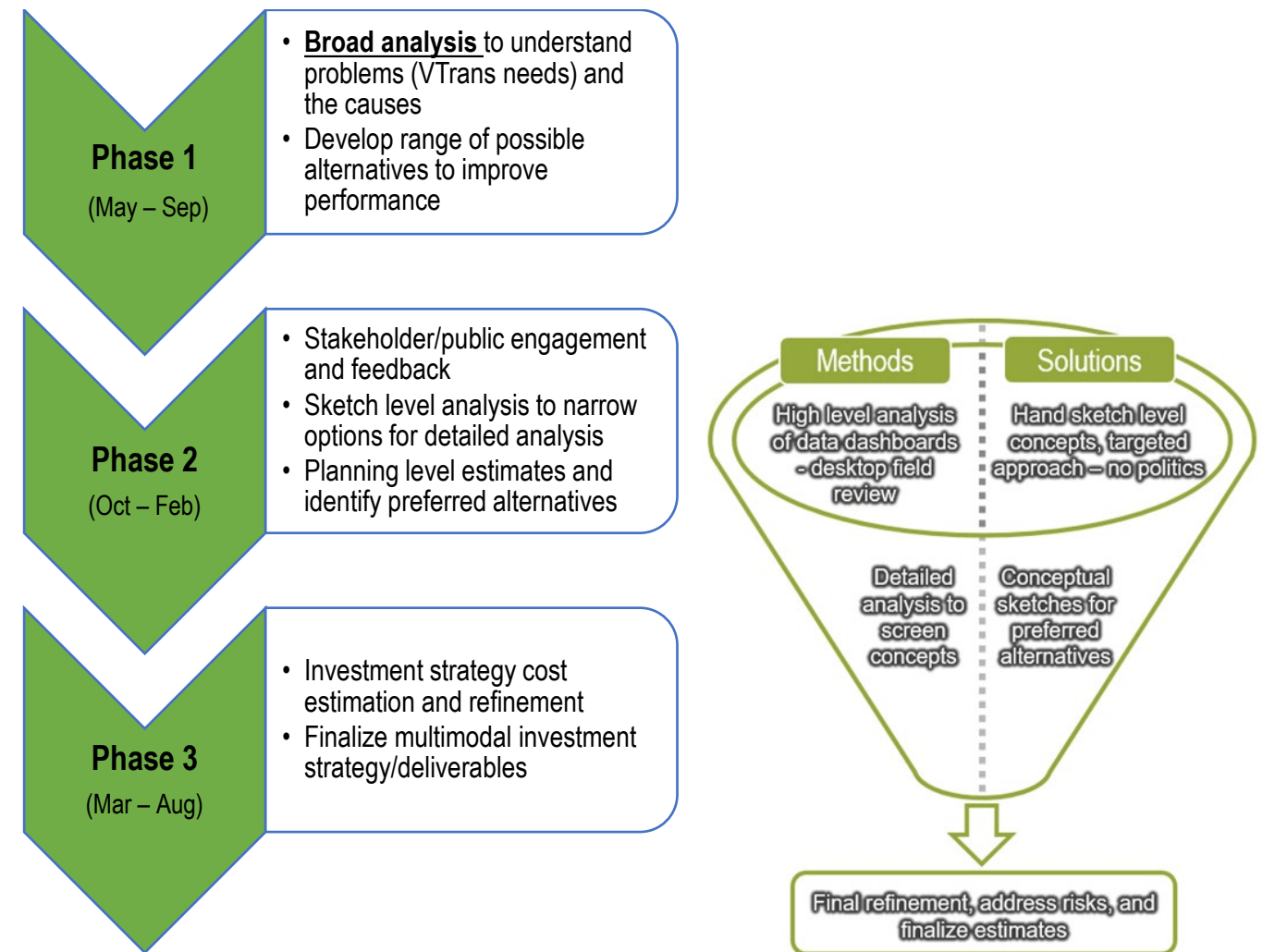


## 1.2 Methodology

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

- **Phase I:** Problem Diagnosis and Alternative Brainstorming
- **Phase II:** Alternative Evaluation and Sketch-Level Analysis
- **Phase III:** 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 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 for the HR09 Project Pipeline study included representatives from:

- Virginia Department of Transportation (VDOT)
- Office of Intermodal Planning and Investment (OIPI)
- York County
- Hampton Roads Transportation Planning Organization (HRTPO)
- Williamsburg Area Transit Authority (WATA)
- Department of Rail and Public Transportation (DRPT)

### 1.3.1 Study Area

The study area includes the roughly two-mile segment of Route 17 (George Washington Memorial Highway) in York County from Denbigh Boulevard/Goodwin Neck Road to Cook Road/York Warwick Drive. The study area is shown in **Figure 3**.

There are five signalized intersections within the study area:

1. Route 17 at Denbigh Boulevard/Goodwin Neck Road
2. Route 17 at Old York-Hampton Highway/Faulkner Road
3. Route 17 at Fort Eustis Boulevard
4. Route 17 at Clairmont Way/Battle Road
5. Route 17 at Cook Road/York Warwick Drive.

Route 17 in the study area is functionally classified as an “Other Principal Arterial” and has a posted speed limit of 50 mph through most of the study area. The posted speed limit is 55 mph north of Cook Road, and 45 mph approaching Denbigh Boulevard. Route 17 generally has two through lanes in each direction separated by a grassy median that transitions to turn lanes at intersections. The exception is the northbound segment from the Patriots Square shopping center to Fort Eustis Boulevard, which has three through lanes. The third lane turns into an exclusive right turn lane at the intersection of Fort Eustis Boulevard.

The study area segment of Route 17 is part of the Coastal Corridor – a Corridor of Statewide Significance as designated in VTrans, Virginia’s statewide transportation plan. Route 17 serves as an alternative to I-95 and I-64 between Fredericksburg and Hampton Roads. It is a key corridor for freight movement to the Port of Virginia facilities in Hampton Road and Rappahannock River navigation channels. It also serves local communities.

The study team collected data including traffic counts, traffic signal timings, and pedestrian and bicycle counts to assist with the transportation analysis in the study area.

A framework document was developed prior to starting the study that outlined study needs, methods, and assumptions. The framework document is the foundation upon which this study was based, which was signed by the agencies in the study work group. This document is included in **Appendix A**.

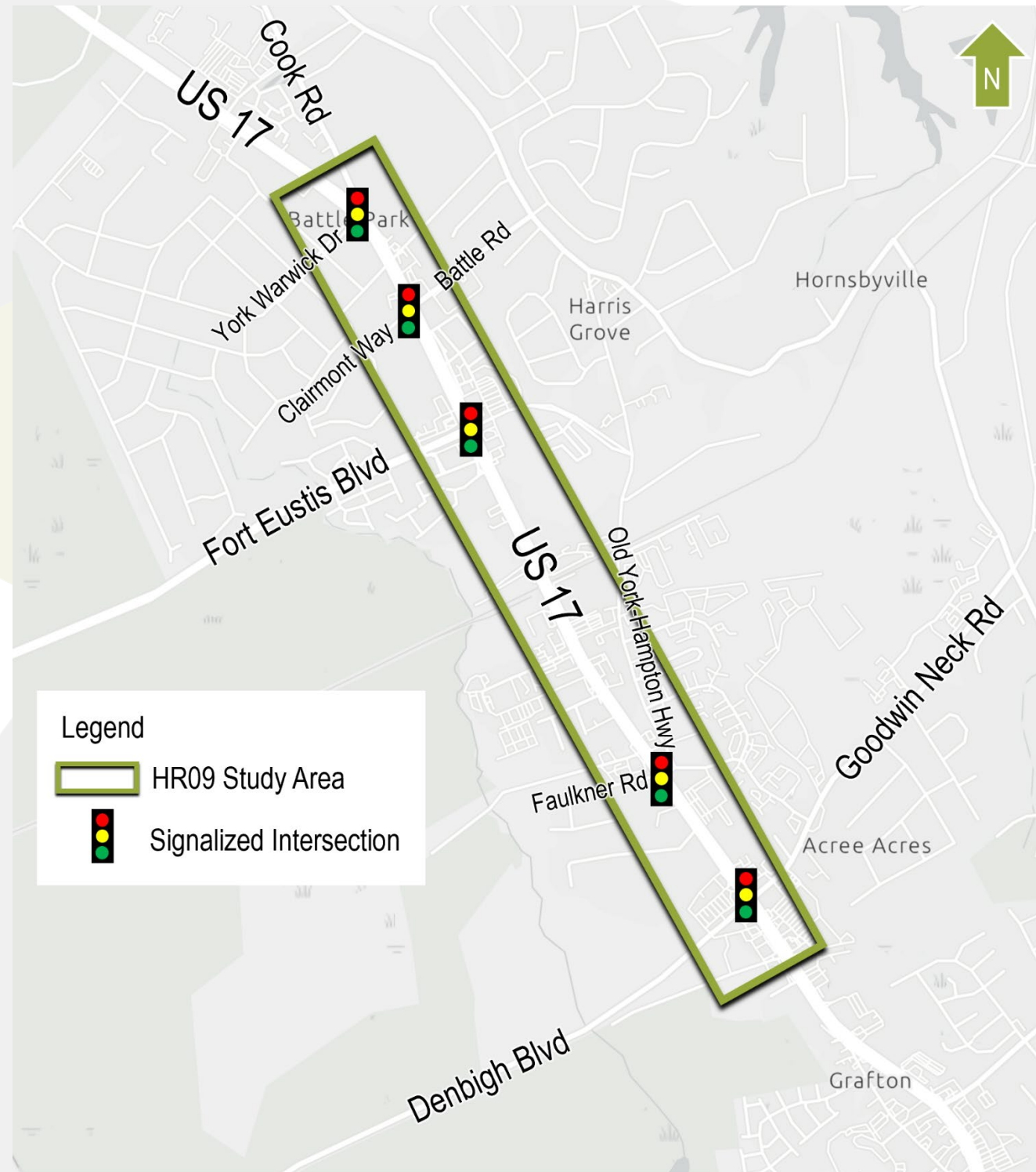
North of the HR09 study area, Route 17 is a high-speed limited access highway through natural area wetlands, connecting to Yorktown and Gloucester County over the York River. The study area segment is a key commuter corridor for people who live in Gloucester County and commute south to jobs in Newport News and further south in the Hampton Roads region.

As Route 17 approaches the study area from the north, the land use context changes. York High School and residential communities are set back from the roadway with entrances. There are other community uses like Yorktown Elementary School, Edgehill Community Center, and a church located along or off of Route 17. Within the study area, commercial uses front Route 17 with residential communities or natural areas located behind them.

As explained in **Section 1.4**, the study area has highly ranked VTrans needs, including capacity preservation, safety improvement, transportation demand management, and congestion mitigation.



Figure 3: Project Study Area



### 1.3.2 Related Plans and Other Initiatives

While this study was being conducted, several other related planning, development, and transportation improvement activities were occurring, including the following:

- The **Route 17 Widening project** is a VDOT project to widen Route 17 from two lanes to three lanes in each direction starting at the southern end of the HR09 study area just north of Denbigh Boulevard south to just north of Wolf Trap Road (Route 630). This project is currently in design. Construction is estimated to begin in 2027.
- **Yorktown Crescent** – a new 29.2-acre development at the southwest quadrant of Fort Eustis Boulevard at Route 17, behind Wendy’s and Arby’s. This development is expected to include a major chain grocery store and outparcels with fast food in addition to townhomes and multi-family apartments. The York County Board of Supervisors voted to approve the amendment of the development master plan on January 16, 2024.
- **WATA Bus Demonstration Project** – WATA has planned a new bus route to provide service along 11 miles of Route 17 from the York-Poquoson Courthouse in Yorktown to the Walmart at the intersection of Route 17 and Victory Boulevard. This new bus service would run through the entire length of the HR09 study area, with several proposed stops in the study area. WATA secured funding for a 3-year demonstration of the service but has held back implementation due to staffing challenges.
- **I-64/Denbigh Boulevard Interchange Project** – A new interchange on I-64 is being planned at Denbigh Boulevard in response to safety concerns at the existing I-64 interchanges with Fort Eustis Boulevard and Jefferson Avenue. FHWA approved an Interchange Justification Report that was prepared in May 2021. The new interchange will be constructed in two phases. Phase 1 will include westbound I-64 on- and off-ramp improvements at Denbigh Boulevard, and it is included in the HRTPO’s Transportation Improvement Program (TIP) (UPC 119217), with construction currently scheduled to begin in 2028. Phase 2 will construct the eastbound I-64 access ramps and widen the Denbigh Boulevard Bridge over I-64. Phase 2 is expected to start construction in 2030 and be completed in 2034.
- **HRT MAX Commuter Bus Service from Gloucester to Newport News** – HRT is planning a new MAX express bus route from the park-and-ride in Gloucester to the Newport News shipyard. HRT is seeking funding for the purchase of two buses in the HRTPO TIP (UPC 115871). This service would run along Route 17 within the HR09 study area, but it is unclear if the service would include a bus stop in the study area.

## 1.4 VTrans Needs

Project Pipeline focuses on solutions to the identified VTrans Mid-Term needs with a performance-based planning approach. The VTrans Mid-Term needs were identified from a data-informed process to guide Virginia’s transportation future. The VTrans needs and corresponding priorities for the HR09 Route 17 Project Pipeline study are outlined in **Table 1**.

**Table 1: Route 17 VTrans Needs**

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

The Route 17 corridor was identified as a Project Pipeline study location due to the presence of these 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, multimodal infrastructure, and the suitability for additional transit service within the 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, speed data, and StreetLight data for each study area. The results of this analysis are summarized in the Phase 1 Executive Summary in **Appendix B**.

The study team reviewed the dashboard performance measures in addition to other sources to validate the presence of VTrans needs and identify the most effective improvements within the study area.

### 1.5.1 Operations and Access Needs

The VTrans Mid-Term needs in the HR09 study area include Very High Capacity Preservation needs and Medium Congestion Mitigation needs.

- The VTrans needs analysis identified Capacity Preservation needs on roadway segments that are:
  - within a Regional Network or along a Corridor of Statewide Significance, and
  - included in VDOT’s Arterial Preservation Network.
- The VTrans needs analysis for Capacity Preservation needs also considered the Average Annual Daily Traffic (AADT) volumes and the Travel Time Index (TTI). TTI is the ratio of the travel time during the peak period to the time required to make the same trip at reference (a.k.a. typical) speeds. A higher number indicates more congestion.
- The VTrans needs analysis identified Congestion Mitigation needs on roadway segments where the average weekday and weekend day TTI is greater than 1.5 for at least one hour, or 1.3 for at least three hours.

The HR09 study team examined the AADT data from VDOT and the average travel time and TTI data from INRIX to understand the capacity preservation and congestion mitigation needs in more detail.



### Average Annual Daily Traffic Volumes

VDOT's AADT data includes two segments within the HR09 study area, listed in **Table 2**.

**Table 2: Route 17 2019 and 2021 AADT Volumes**

Road Segment	2019 AADT (vehicles per day)	2021 AADT (vehicles per day)
Route 17 from Cook Road/York Warwick Drive to Fort Eustis Boulevard	26,000	24,000
Route 17 from Fort Eustis Boulevard to Denbigh Boulevard/Goodwin Neck Road	34,000	32,000

The 2019 AADT volumes for Route 17 and the cross-streets for which data is available are shown in **Figure 4**. The 2021 AADT volumes are shown in **Figure 5**.

### Average Travel Time and Travel Time Index Data

The INRIX data for the study corridor reveals that the average travel time in the southbound direction is generally consistent from 7 AM to 7 PM with no remarkable peaks.

- The average southbound travel time on Route 17 through the HR09 study corridor from 7 AM to 7PM is between 3.6 and 4.0 minutes.
- The highest average travel time and highest TTI in the southbound direction occurs in the 2:00 PM hour, with an average travel time of 4.0 minutes and 1.09 TTI.
- The average travel time from 7 PM to 7 AM varies from 3.5 minutes in the 7:00 PM hour to 2.8 minutes in the 4:00 AM hour.

In the northbound direction, there is a small increase in average travel time in the 4:00 PM hour that corresponds to a small increase in TTI at the same time.

- The average northbound travel time on Route 17 through the HR09 study corridor from 7 AM to 7 PM is between 3.6 and 4.0 minutes.
- The highest average travel time and highest TTI in the northbound direction occurs in the 4:00 PM hour, with an average travel time of 4.2 minutes and 1.09 TTI.
- The average travel time from 7 PM to 7 AM is consistently 3.4 to 3.5 minutes.

**Figure 4: 2019 Average Annual Daily Traffic Volumes (vehicles per day)**

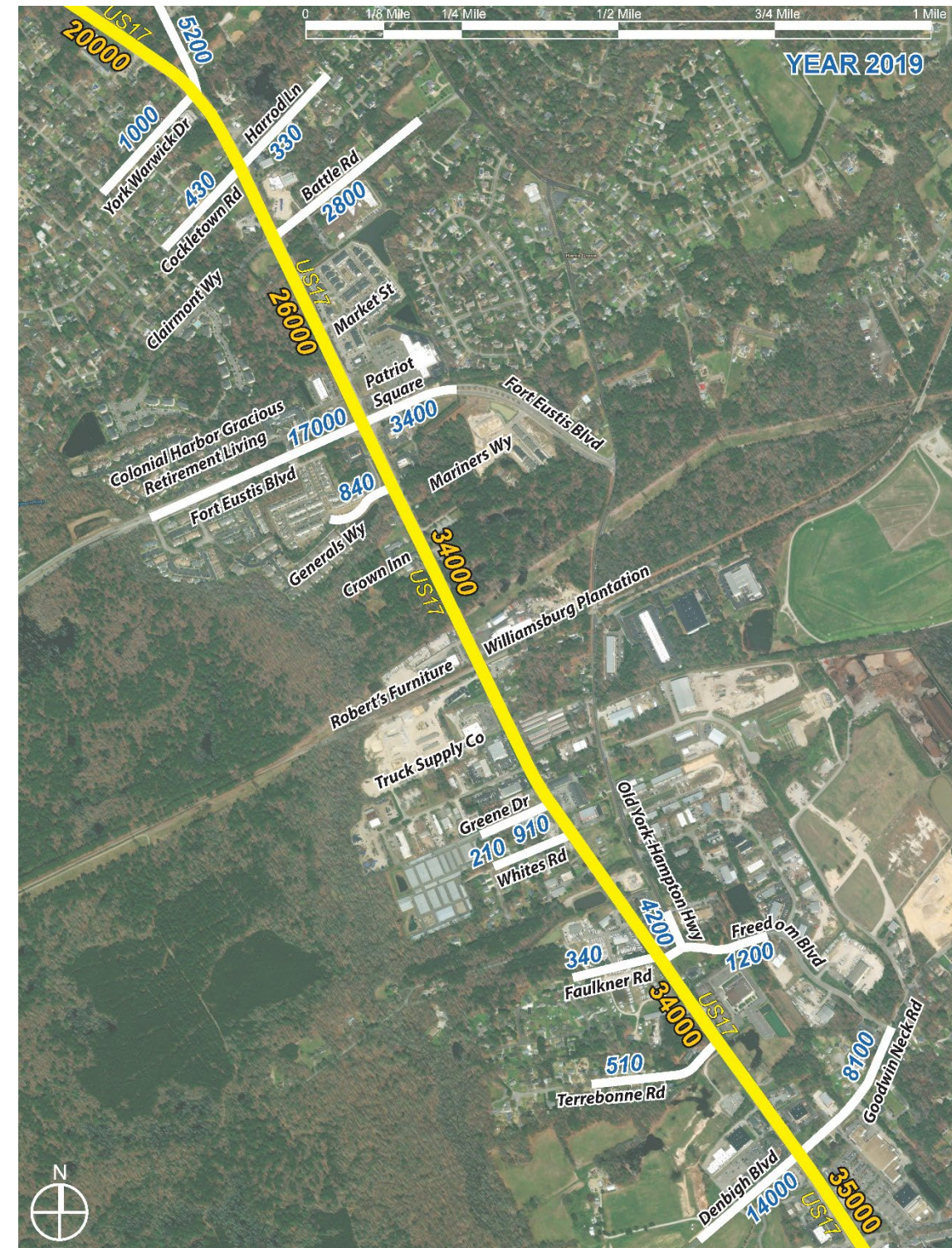




Figure 5: 2021 Average Annual Daily Traffic Volumes (vehicles per day)

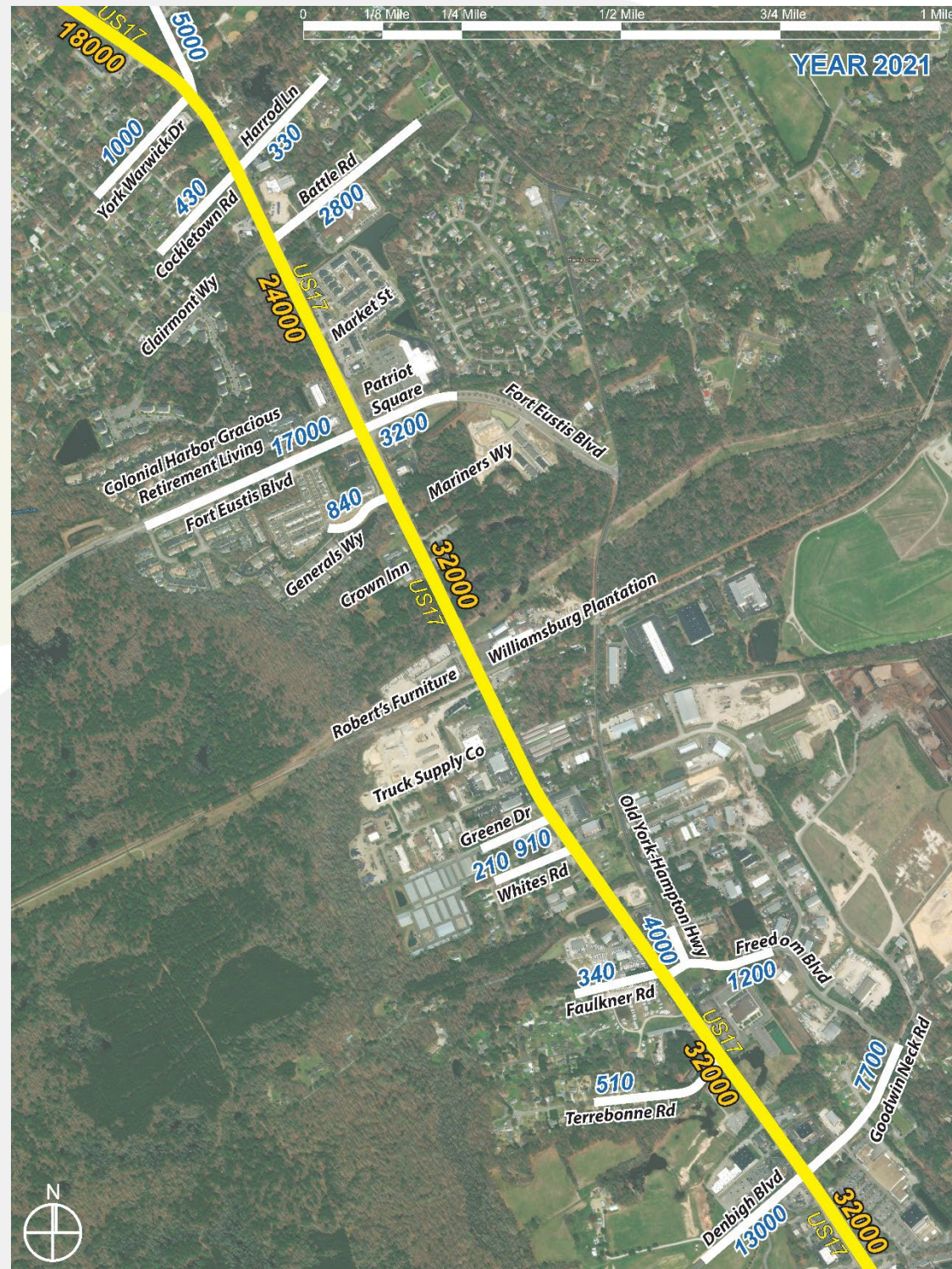
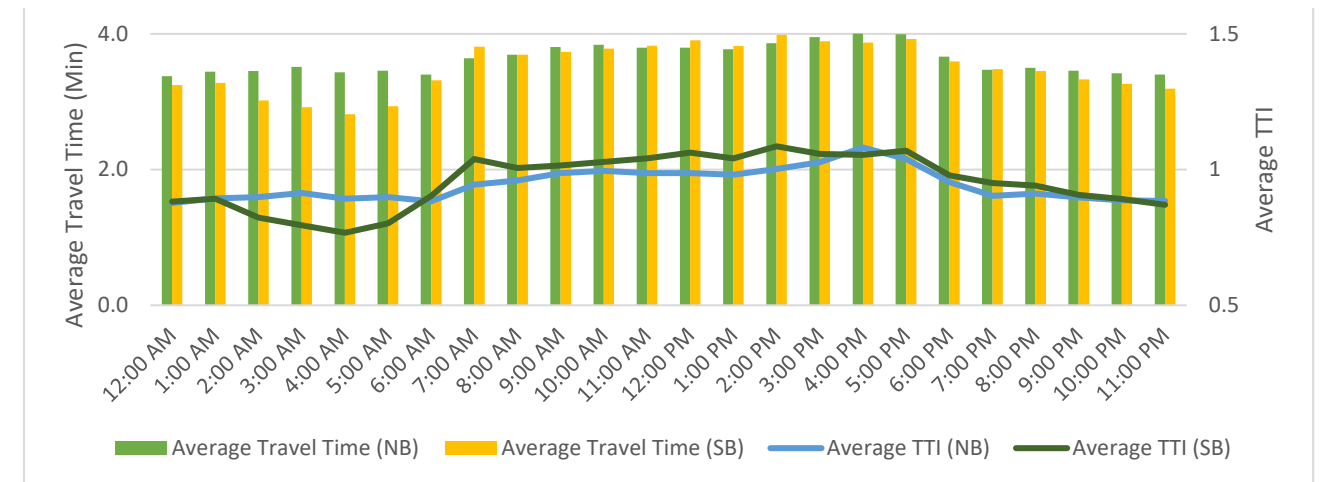


Figure 6 shows the average travel time and average TTI for each hour of the day. This data is for an average of Tuesdays, Wednesdays, and Thursdays.

Figure 6: Average Travel Time Index and Average Travel Time Per Hour



The traffic operations were further explored in a preliminary microsimulation analysis using Synchro and SimTraffic. The microsimulation analysis results are further explained in Section 1.6.3 and Section 1.6.4.

### 1.5.2 Safety Needs

The VTrans Mid-Term needs in the HR09 study area include Very High Safety Improvement needs. These needs were identified through the statewide data-driven needs analysis process in VTrans.

- The VTrans needs analysis identified Safety Improvement needs in areas with a higher calculated risk of crashes based on roadway characteristics and observed crash data. This analysis is based on the VDOT Traffic Operations Division's Potential for Safety Improvement (PSI) analysis.

The study team examined the PSI analysis and VDOT crash data to identify high-level crash trends in the study corridor.

#### Locations with Potential for Safety Improvement

PSI is a calculation that determines if the observed crash frequency exceeds the expected crash frequency on a road with similar characteristics and traffic volumes. PSI is the best available measure for understanding whether crashes at an intersection are higher or lower than expected.



VDOT publishes a ranking of intersections and road segments with PSI for each VDOT District. The PSI rankings used in this study use 2016-2020 crash data. The lower the ranking, the higher the PSI. For example, the #1 ranked intersection with PSI has the highest potential for safety improvement, meaning the observed crash frequency is higher than the crash frequency that would be expected for an intersection with similar traffic volumes and characteristics.

Figure 7 shows the locations of segments and intersections in the HR09 study area that have PSI and the PSI rankings.

- Nearly the entire Route 17 study corridor is within a PSI segment. The only segment of Route 17 within the study corridor that does not lie within a PSI segment is between Greene Drive and Old York-Hampton Highway/ Faulkner Road.
- Both segments of Fort Eustis Boulevard on either side of Route 17 lie within a PSI segment.
- Three of the five signalized intersections in the HR09 study corridor are PSI intersections.

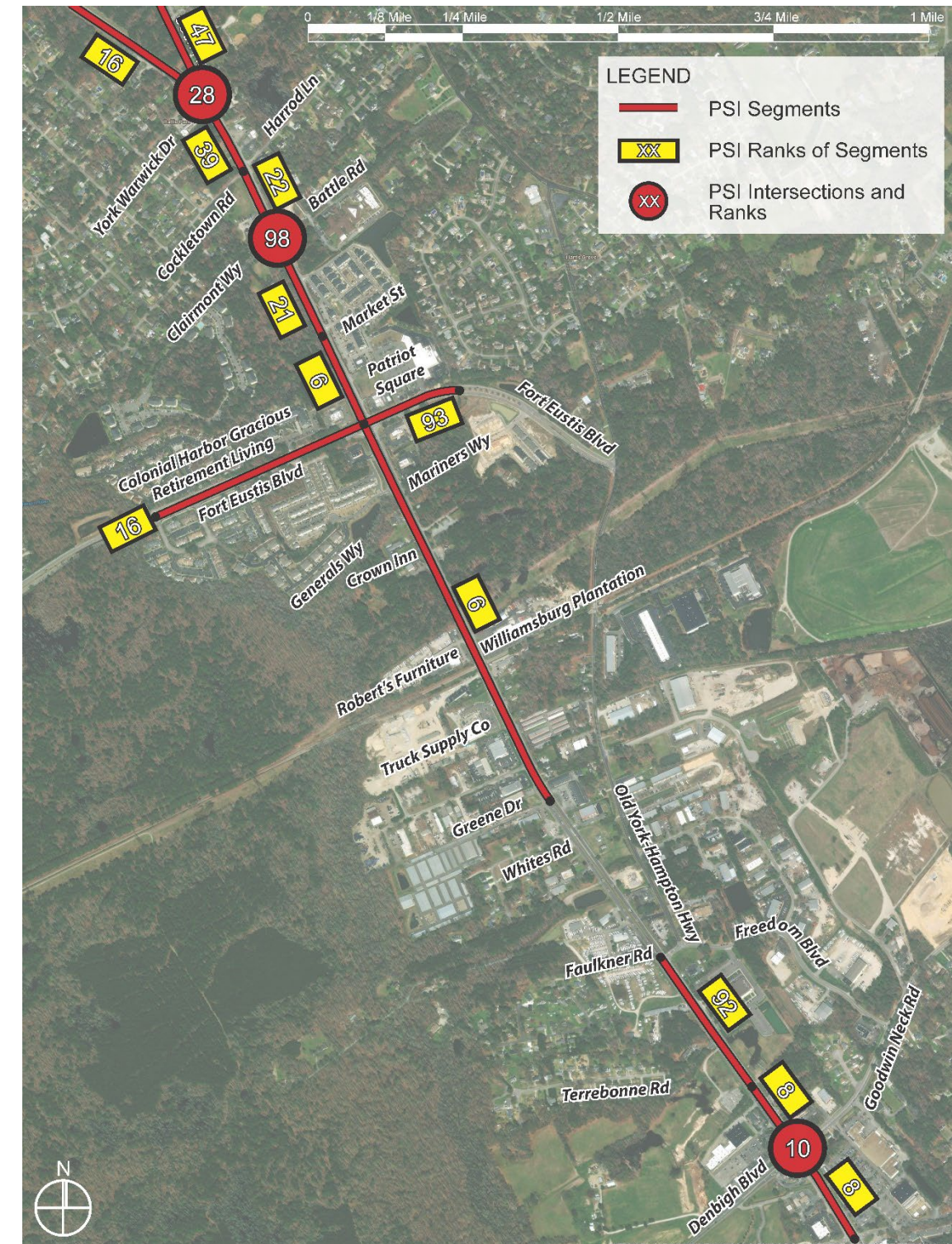
The intersections with PSI in the HR09 study area are:

- Route 17 at Denbigh Boulevard/Goodwin Neck Road (Intersection PSI Rank #10)
- Route 17 at Cook Road/York Warwick Drive (Intersection PSI Rank #28)
- Route 17 at Clairmont Way/Battle Road (Intersection PSI Rank #98)

The segments with PSI in the HR09 study area are:

- Route 17 from Market Street to Greene Drive (Segment PSI Rank #6)
- Route 17 from Terrebonne Road to Denbigh Boulevard/Goodwin Neck Road (Segment PSI Rank #8)
- Route 17 from Clairmont Way/Battle Road to Market Street (Segment PSI Rank #21)
- Route 17 from Harrod Lane to Clairmont Way/Battle Road (Segment PSI Rank #22)
- Route 17 from Cook Road/York Warwick Drive to Harrod Lane (Segment PSI Rank #39)
- Route 17 from Old York-Hampton Highway/Faulkner Road to Terrebonne Road (Segment PSI Rank #92)

Figure 7: Potential for Safety Improvement (PSI) Locations (2016-2020)





Although not technically within the HR09 study area, it is worth noting that the following roadway segments adjacent to the study area also have PSI:

- Route 17 from Denbigh Boulevard/Goodwin Neck Road to Brick Church Road (Segment PSI Rank #8)
- Route 17 from Harris Grove Lane to Cook Road/York Warwick Drive (Segment PSI Rank #16)
- Fort Eustis Boulevard from Crepe Myrtle Drive to Route 17 (Segment PSI Rank #16)
- Cook Road from Falcon Road to Route 17 (Segment PSI Rank #47)
- Fort Eustis Boulevard from Route 17 to ~800 feet east of Route 17 (Segment PSI Rank #93)

### Pedestrian and Bicycle Access and Safety Needs

The VTrans Mid-Term needs in the HR09 study area include:

- Low Pedestrian Access needs
- Low Bicycle Access needs

These needs were identified through the statewide data-driven needs analysis process in VTrans.

- The VTrans needs analysis identified Pedestrian Access needs in areas within walking distance of VTrans Activity Centers. VTrans Activity Centers are “areas of regional importance that have a high density of economic and social activity” and are associated with the VTrans Regional Travel Market.
- The VTrans needs analysis identified Bicycle Access needs in areas within biking distance of VTrans Activity Centers.

The HR09 study team examined and validated the pedestrian and bicycle access and safety needs in the study area using crash data, data from VDOT’s Pedestrian Safety Action Plan (PSAP) map viewer, and on-site observations.

As shown in **Figure 8**, sidewalks currently exist on the northbound (east) side of Route 17 from Fort Eustis Boulevard to the library just north of Battle Road. There are currently no marked crosswalks across Route 17. VDOT awarded Revenue Sharing funds to York County for a project to extend the existing sidewalk further north to the existing asphalt path near York High School. This project will also include two crosswalks across Route 17 – one at Cook Road/York Warwick Drive, and another at Harrod Lane.

There are no bike lanes or facilities for bicyclists on Route 17 in the HR09 study area. There is an existing bike lane on Old York-Hampton Highway, which varies in width. The Regional Bikeways Plan

shows a proposed multi-use path along Freedom Boulevard to connect to Goodwin Neck Road, providing a parallel bicycle facility as an alternative to biking on Route 17.

**Figure 8: Route 17 Sidewalks and Sidewalk Gaps**



### VDOT Pedestrian Safety Action Plan Priority Corridor

Route 17 throughout York County is listed as a statewide top 5% PSAP priority corridor based on 2014-2018 data. The top 5% PSAP priority corridors are not as highly ranked in importance as the top 1% PSAP priority corridors.

### VDOT Crash Data Analysis: Examining Crashes from 1/1/2015 to 3/31/2023

The study team examined crash data that was provided through the Project Pipeline PowerBI Dashboard. This data included crash data from the VDOT Crash Database from January 1, 2015, through March 31, 2023. This includes the full five years of pre-pandemic crash data as well as the crash data during the COVID-19 pandemic.

In total, 614 crashes were reported along the HR09 Route 17 study corridor within the 1/1/2015-3/31/2023 period. 180 of these crashes resulted in injury, about 1 in 3. **Figures 9 and 10** show the crash types and crash severities, respectively. Rear-end crashes account for 59 percent of all crashes. Angle crashes account for 25 percent, and fixed-object off-road crashes account for 6 percent of all crashes.

The crash data indicates 13 percent of crashes were reported as involving speeding. It is possible more crashes involved speeding, but this was not identified in the crash report. 33 percent of all severe injury crashes were reported as speed-related. The one fatal crash in the study corridor was reported as speed-related.

12 deer collisions were reported within the 1/1/2015-3/31/2023 period, representing 2 percent of all crashes. The deer collisions occurred throughout the study corridor and were concentrated near the railroad tracks.

There was one fatal crash that occurred in the study area. It occurred at the entrance to the Starbucks and McDonald's on the southbound approach of the intersection with Fort Eustis Boulevard, on Friday January 6, 2023, at 7:22 AM. It was an angle crash involving three vehicles. The crash data indicates it was reported as speed-related, it involved a senior driver, and one or more of the people involved in the crash was not wearing their safety belt. **Figure 11** shows the diagram of this fatal crash.

**Figure 12** shows the location of severe injury crashes along the study corridor. The severe injury crashes tend to be concentrated at the locations of the signalized intersections, with the exception of Old York-Hampton Highway/Faulkner Rd, and at the railroad crossing.

Figure 9: Study Area Crashes by Collision Type (1/1/2015-3/31/2023)

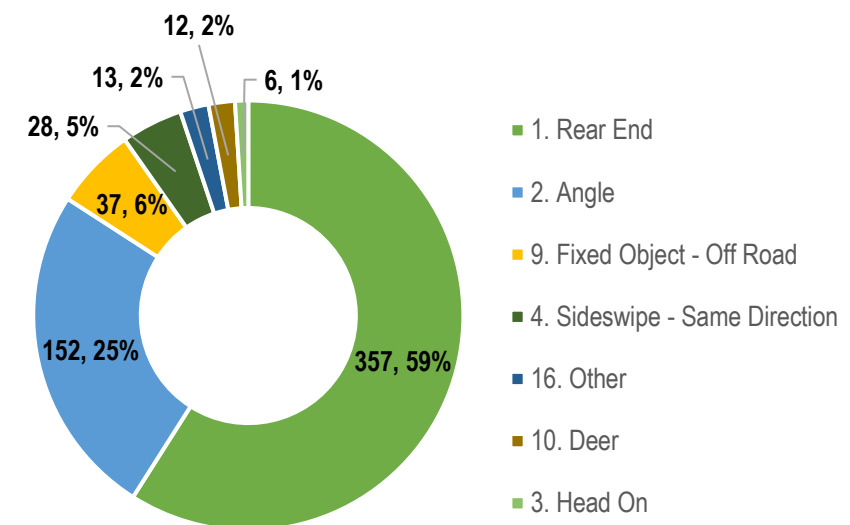


Figure 10: Study Area Crashes by Crash Severity (1/1/2015-3/31/2022)

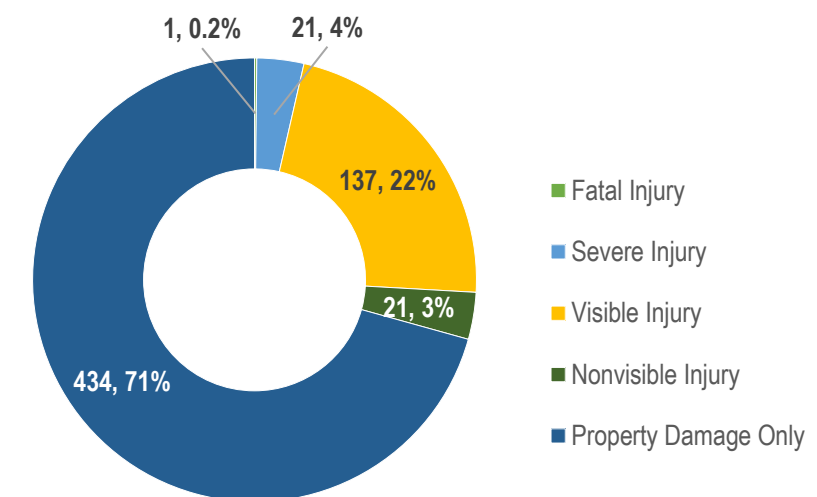




Figure 11: Fatal Crash Diagram (1/6/2023, 7:22 AM)

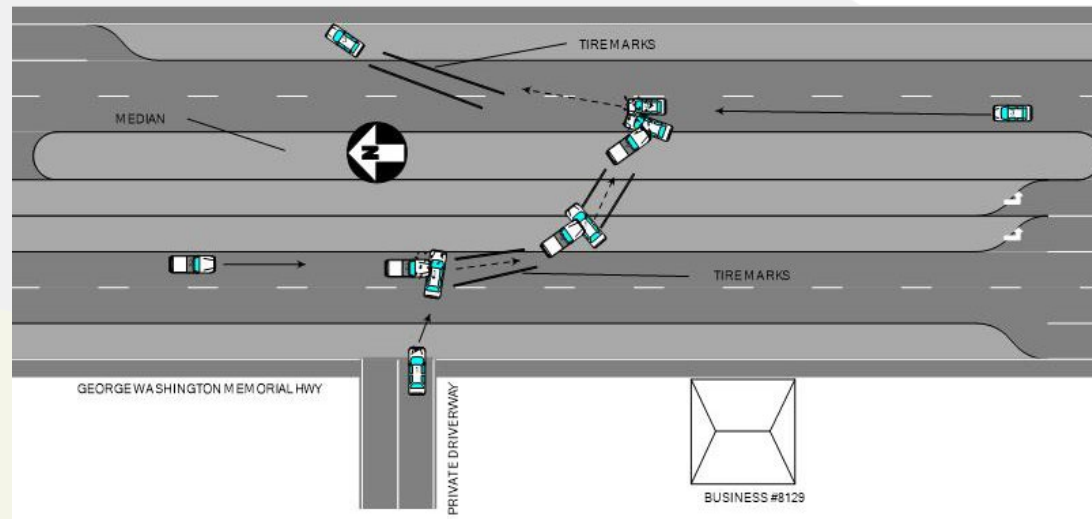
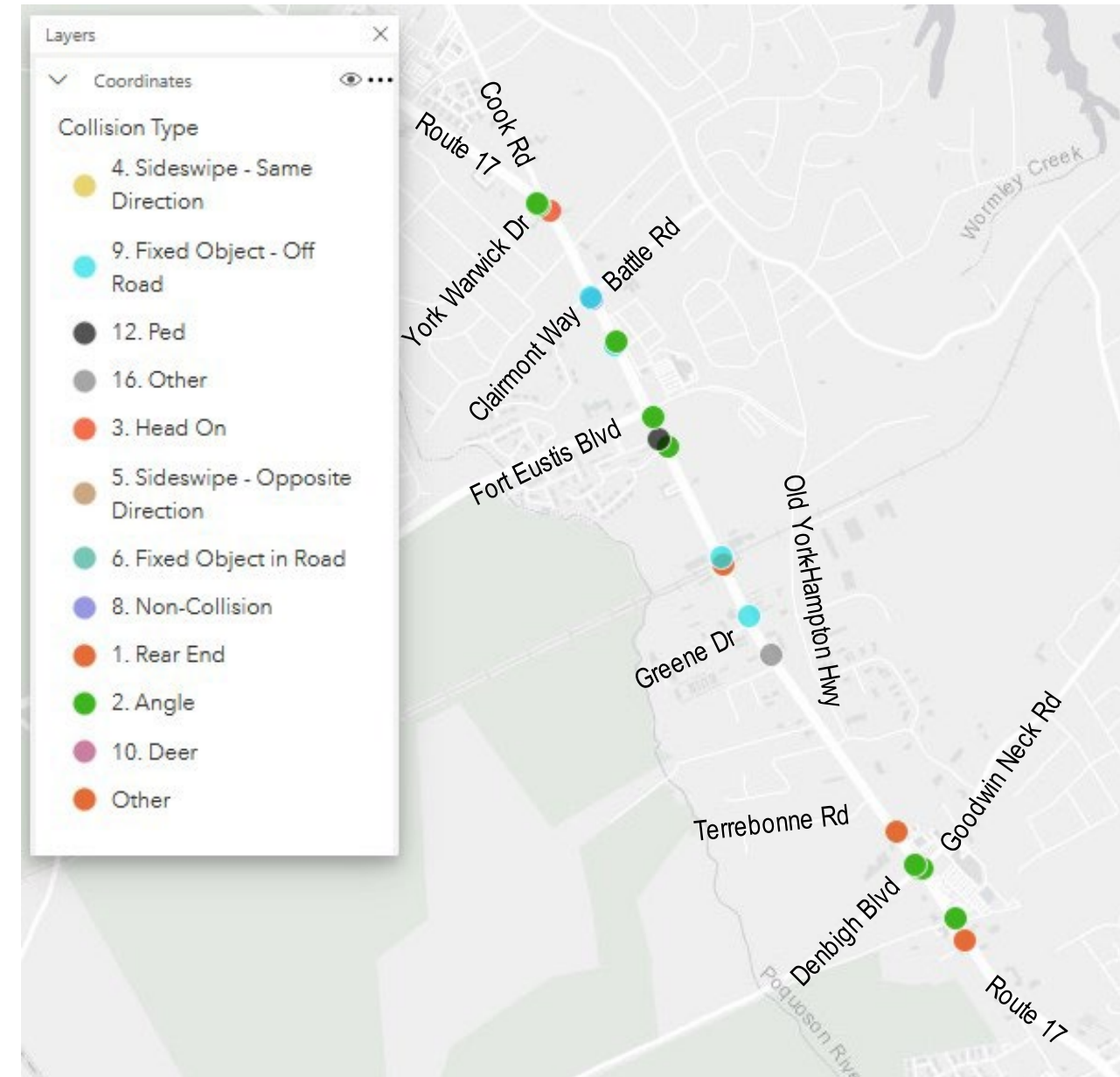


Figure 12: Severe Injury Crash Locations by Collision Type (1/1/2015-3/31/2023)





### Five-Year VDOT Crash Data Analysis: Examining Crashes from 1/1/2018 to 12/31/2022

The study team examined the last five years of crash data in more detail (1/1/2018-12/31/2022). The study team assigned crashes to the intersections and median openings to obtain a better understanding of the crash patterns at each intersection.

Crashes were attributed to an intersection or median opening if they were within:

- 250 feet of the intersection in the upstream direction,
- the length of the turn lane (including those within the through lanes) in the upstream direction, or
- 100 feet of the intersection in the downstream direction.

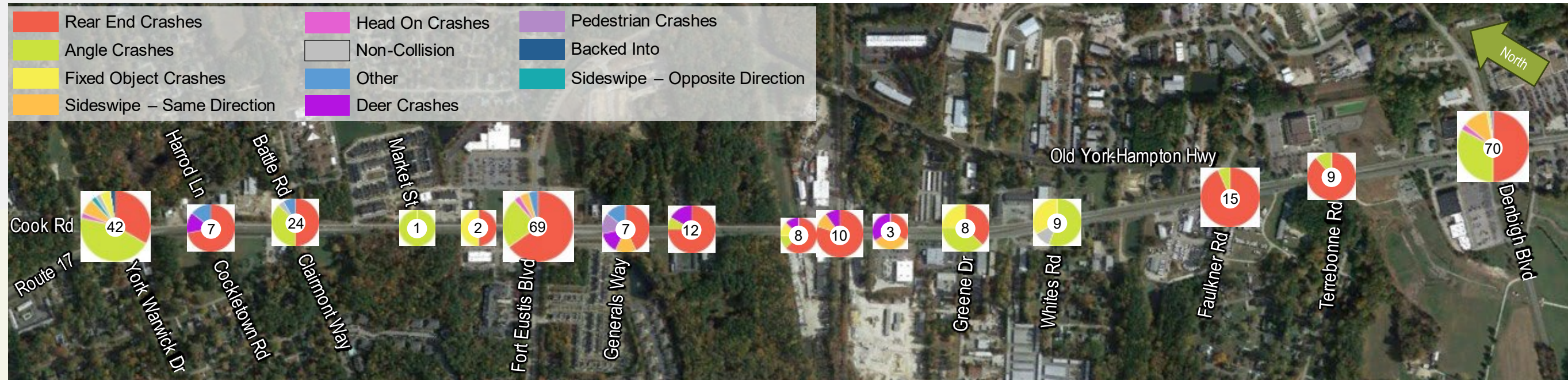
**Figure 13** shows the number of crashes at each intersection, as well as the distribution of crashes by collision type across the study corridor.

The intersections with the highest number of crashes over the five-year crash period (2018-2022) were:

- Route 17 at Denbigh Boulevard/Goodwin Neck Road: 70 crashes
- Route 17 at Fort Eustis Boulevard: 69 crashes
- Route 17 at Cook Road/York Warwick Drive: 42 crashes

**Table 3** shows the number of crashes by collision type at each intersection or median opening. **Table 4** shows the number of crashes by crash severity at each intersection or median opening.

Figure 13: Intersection Crashes by Collision Type (2018-2022)



The examination of the crashes at intersections and median openings as well as review of select available FR300 crash reports revealed the following crash trends within the 2018-2022 five-year analysis period:

- 82 percent of injury crashes were rear-end or angle crashes
- Roughly half (52 percent) of injury crashes occurred at an intersection
- Of the injury crashes that occurred at an intersection, 58 percent were angle crashes and 27 were rear-end crashes.
- Of the injury crashes that did not occur at an intersection, 73 percent were rear-end crashes.

This analysis underscores the importance of addressing angle crashes at intersections and rear-end crashes along the segments between intersections.

Other crash trends identified include:

- Multiple crashes at the railroad crossing were related to stopped school buses.
- Crash reports for angle crashes at the intersections of Route 17 with Cook Road/York Warwick Drive, Clairmont Way/Battle Road, and Denbigh Boulevard/Goodwin Neck Road frequently cited vehicles turning left on the flashing yellow arrow.
- Crash reports for fixed object – off road crashes cited utility poles, trees, and ditches.

**Table 3: Study Area Crashes by Crash Severity – Number of Crashes (2018-2022)**

Intersection with Route 17	K	A	B	C	PDO	Total
Cook Rd/York Warwick Dr	0	3	10	2	27	42
Harrod Ln	0	0	1	0	6	7
Clairmont Way/Battle Rd	0	1	8	1	14	24
Market St	0	1	0	0	0	1
Patriots Square	0	0	0	0	2	2
Fort Eustis Blvd	0	1	14	2	52	69
Generals Way/Mariners Way	0	1	2	0	4	7
Crown Inn	0	0	1	0	11	12
Roberts Furniture/Hart Building	0	0	2	0	6	8
Railroad Crossing	0	0	3	0	7	10
Tractor Supply Co Driveway	0	0	2	0	1	3
Greene Dr	0	0	0	0	8	8
Whites Rd	0	0	1	0	8	9
Old York-Hampton Hwy/Faulkner Rd	0	0	7	0	8	15
Terrebonne Rd	0	0	1	0	8	9
Denbigh Blvd/Goodwin Neck Rd	0	2	15	1	52	70
Rest of Corridor	0	2	8	0	32	42
<b>Total</b>	<b>0</b>	<b>11</b>	<b>75</b>	<b>6</b>	<b>246</b>	<b>338</b>

**Table 4: Study Area Crashes by Collision Type – Number of Crashes (2018-2022)**

Intersection with Route 17	Rear End	Angle	Fixed Object – Off Road	Sideswipe	Deer	Other	Total
Cook Rd/York Warwick Dr	14	19	2	4	0	3	42
Harrod Ln	5	0	0	0	1	1	7
Clairmont Way/Battle Rd	12	9	0	0	0	3	24
Market St	0	1	0	0	0	0	1
Patriots Square	1	0	1	0	0	0	2
Fort Eustis Blvd	45	16	0	3	0	5	69
Generals Way/Mariners Way	3	0	0	1	1	2	7
Crown Inn	9	1	0	0	2	0	12
Roberts Furniture/Hart Building	5	1	1	0	1	0	8
Railroad Crossing	8	0	0	1	1	0	10
Tractor Supply Co Driveway	1	0	0	1	1	0	3
Greene Dr	3	3	2	0	0	0	8
Whites Rd	0	5	3	0	0	1	9
Old York-Hampton Hwy/Faulkner Rd	14	1	0	0	0	0	15
Terrebonne Rd	8	1	0	0	0	0	9
Denbigh Blvd/Goodwin Neck Rd	35	23	1	8	0	3	70
Rest of Corridor	28	2	7	0	0	5	42
<b>Total</b>	<b>191</b>	<b>82</b>	<b>17</b>	<b>18</b>	<b>7</b>	<b>23</b>	<b>338</b>



### 1.5.3 Transit and Transportation Demand Management Needs

The VTrans Mid-Term needs in the HR09 study area include:

- Very High Transportation Demand Management (TDM) needs
- Low Transit Access needs

These needs were identified through the statewide data-driven needs analysis process in VTrans.

- The VTrans needs analysis identified TDM needs in locations where TDM strategies can be beneficial to reduce vehicle miles traveled. Roadway segments along non-limited access facilities along a Corridor of Statewide Significance are identified as those with need for:
  - New or expanded park-and-ride facilities,
  - Rail and public transportation services and facilities,
  - Bicycle and pedestrian facilities, and
  - Expansion and coordination of commuter assistance programs services.
- The VTrans needs analysis identified Transit Access needs in VTrans Activity Centers where fewer workers can access the Activity Center within 45 minutes by transit than by automobile.

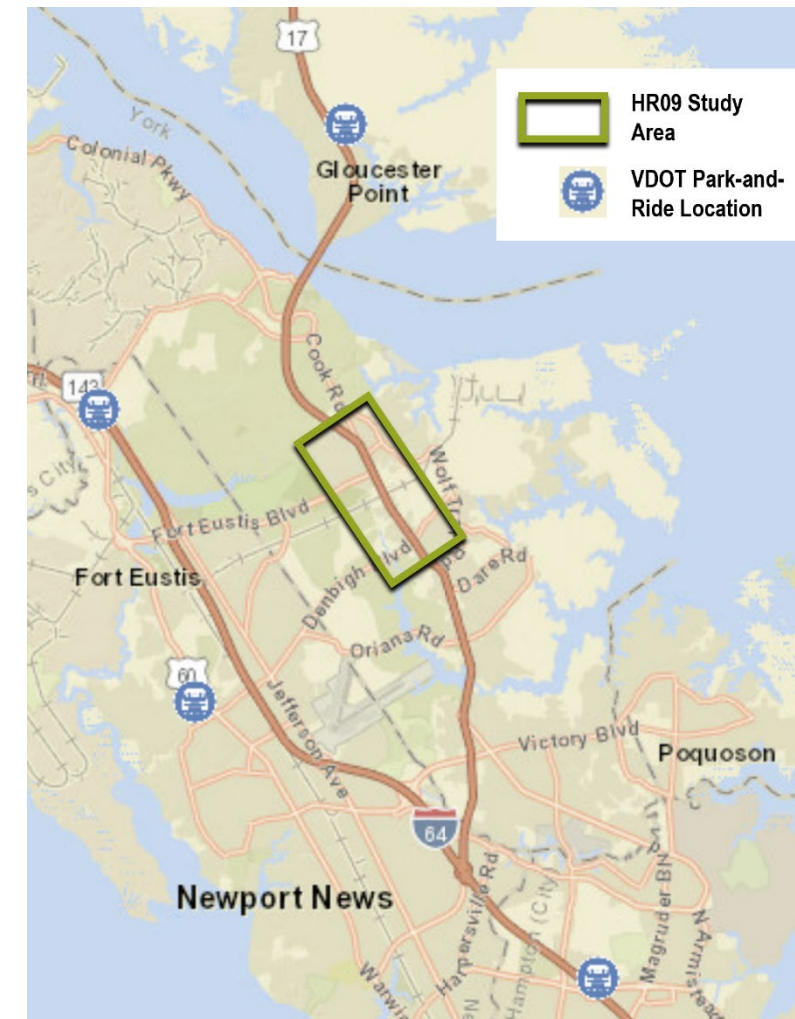
#### Existing Transit and TDM Services

The HR09 study area does not currently have any fixed route or on-demand bus service. Neither Hampton Roads Transit (HRT) nor Williamsburg Area Transit Authority (WATA) currently provide bus transit service.

TRAFFIX is a TDM program run by HRT that provides commuter services to employers and military installations including assistance in forming carpools and vanpools, introducing telework options, implementing parking management plans, offering guaranteed rides for commuters experiencing unexpected emergencies and a ride-matching and rewards program to provide discounts to popular area businesses for commuters who log their ride-sharing trips.

There are several park-and-ride facilities outside of the HR09 study area, as shown in **Figure 14** that can serve to intercept trips.

Figure 14: VDOT Park-and-Ride Locations



#### Planned Transit and TDM Services

As shown in **Figure 15** and mentioned previously in **Section 1.3.2**, WATA is planning a new bus route to serve the Route 17 corridor from the York-Poquoson Courthouse in Yorktown to the Walmart at the intersection of Route 17 and Victory Boulevard, and this would include several stops in the HR09 study corridor. WATA is planning to implement the service initially through a demonstration project to test demand for the service. Implementation has been delayed due to WATA staffing challenges.



Figure 15: Proposed WATA Route 17 Bus Demonstration Service



HRT is planning to begin a new MAX commuter bus service (Route 975) between the Gloucester park-and-ride at the intersection of Route 216 (Guinea Road) and York Crossing and the Newport News Shipyard. The new MAX route is planned to operate three trips in the AM peak and three trips in the PM peak. According to HRT's Transit Strategic Plan FY 2023 – FY 2032, this service is planned to begin in FY 2026. **Figure 16** shows the proposed alignment of the new Route 975 service.

Figure 16: Proposed New HRT MAX Commuter Bus Service

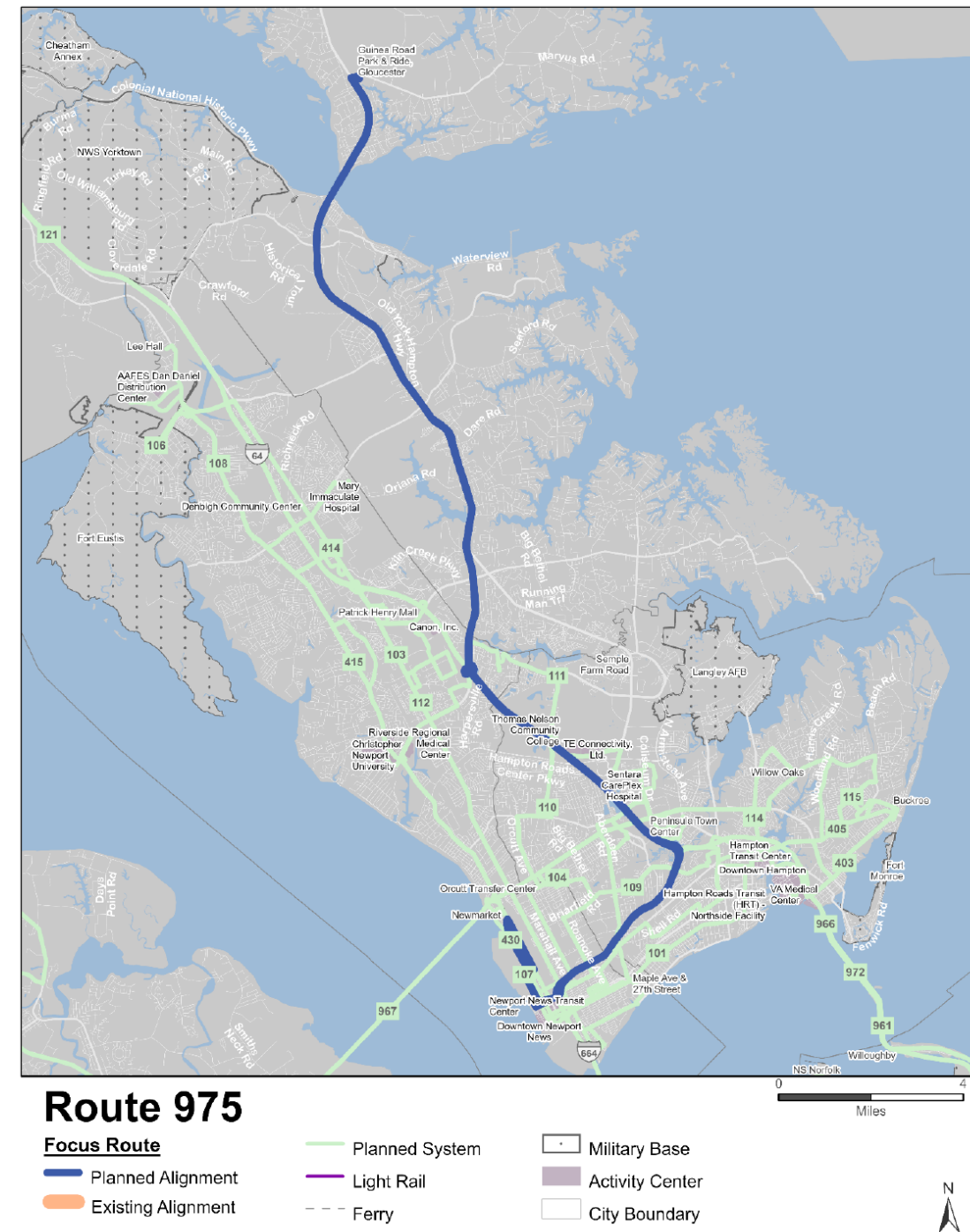


Image Source: HRT Transit Strategic Plan FY 2023 – FY 2032

## Transit Propensity

The study team reviewed the demographics and land use analysis from the WATA's most recent Transit Development Plan (TDP) (adopted in 2016) to examine the propensity for further transit services along and near the HR09 study area.

### Population Density

**Figure 17** shows the 2010 population density of Census block groups within the Williamsburg area, including the City of Williamsburg, York County, and James City County. As indicated in the WATA TDP, a general rule of thumb is that areas with population densities above 2,000 persons per square mile may be able to sustain frequent daily fixed route bus service. Areas with population densities below 2,000 persons per square mile are usually better suited for deviated fixed-route, flex schedule, or dial-a-ride service. The Census block groups within the HR09 Project Pipeline study area are all less than 2,000 persons per square mile.

### Transit Dependence

**Figure 18** shows a map of how different Census block groups within the Williamsburg area rank in terms of the Transit Dependence Index (TDI). TDI measures five factors:

- Population density
- Zero-vehicle households
- Elderly populations
- Youth populations
- Below-poverty populations

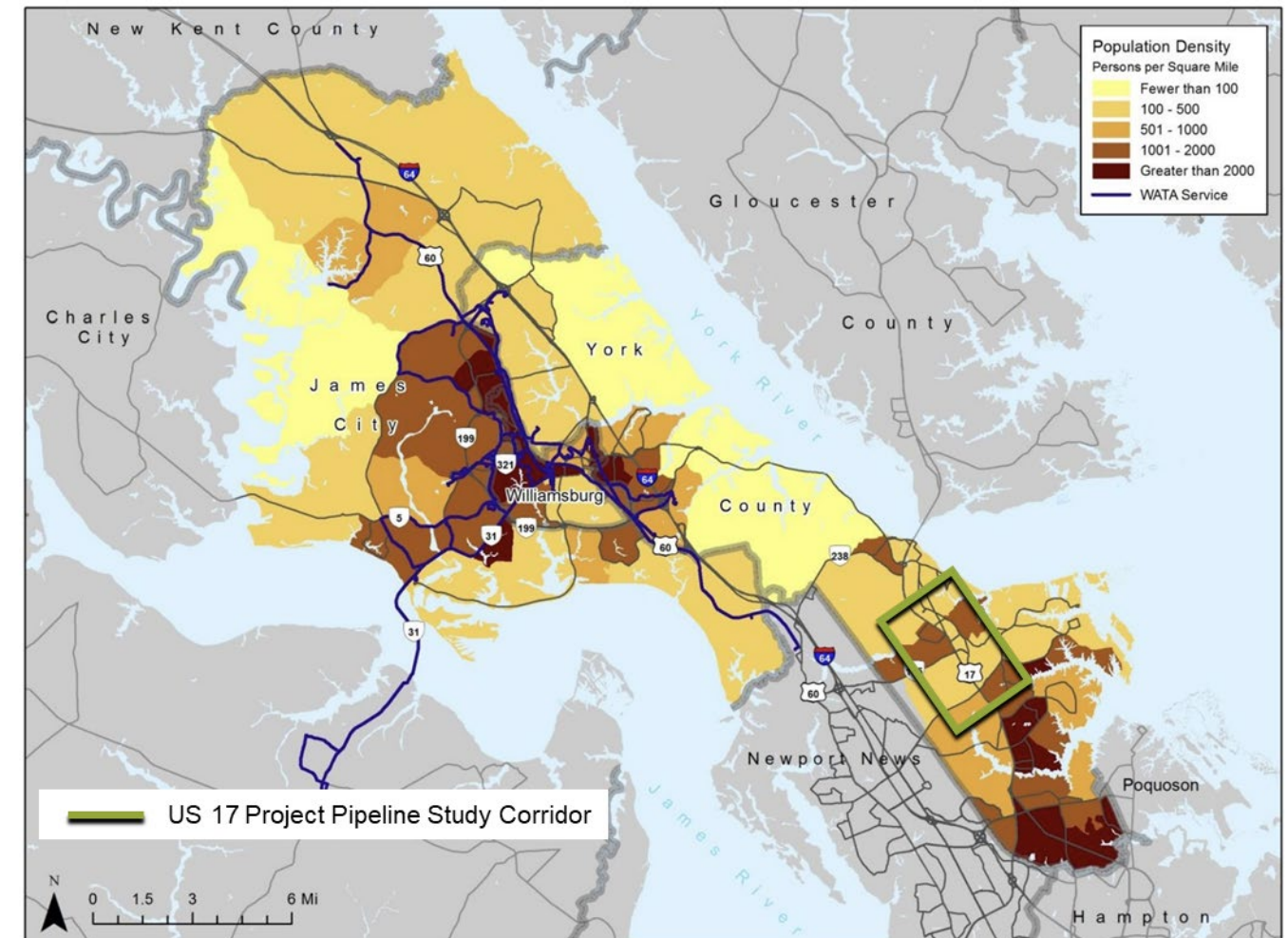
The Census block groups within the HR09 Project Pipeline study area all rank as low or very low TDI.

**Figure 19** shows a map of the Transit Dependence Index Percentage (TDIP). The TDIP is similar to TDI, except it removes the population density factor, thus eliminating Census block groups that register solely because of their population density. The Census block groups within the HR09 Project Pipeline study area all rank as low or very low TDIP.

### Transit Propensity Conclusions

Based on these results, the study team concluded that the demographic and land use analysis does not identify the HR09 Project Pipeline study area as a high or moderate need for transit service. The planned WATA Route 17 bus demonstration project and the new HRT MAX route will provide ample opportunity to test demand for and success of fixed route transit service.

**Figure 17: 2010 Population Density in York County, James City County, and City of Williamsburg**



Source: US Census, 2010

Image Source: WATA Transit Development Plan (2016)



Figure 18: Transit Dependence Index in York County, James City County, and City of Williamsburg

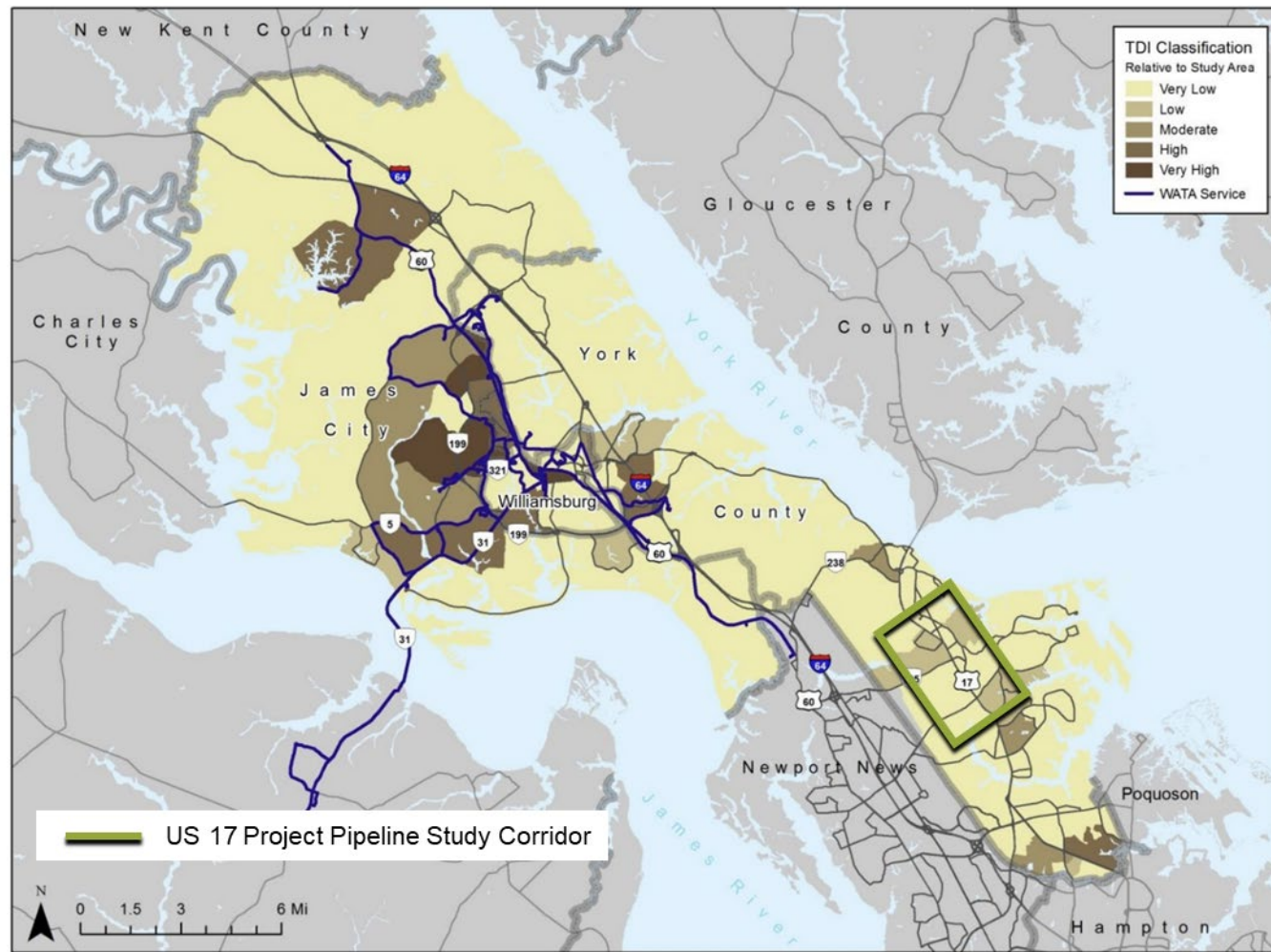


Image Source: WATA Transit Development Plan (2016)

Figure 19: Transit Dependence Index Percentage in York County, James City County, and City of Williamsburg

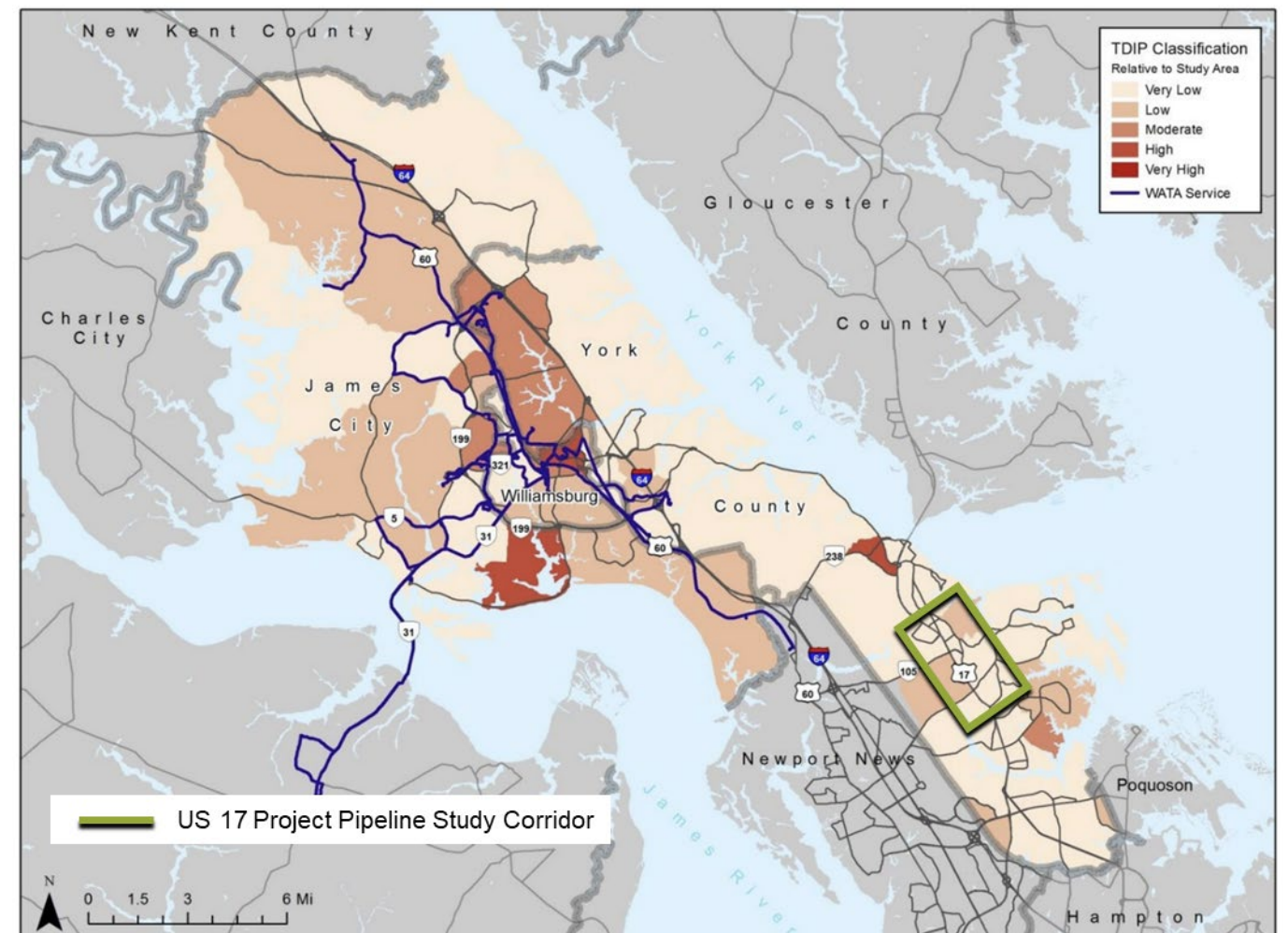


Image Source: WATA Transit Development Plan (2016)

### 1.5.4 Environmental Justice

The Federal Highway Administration (FHWA) developed the Screening Tool for Equity Analysis of Projects (STEAP). The STEAP tool provides estimates of the socioeconomic characteristics of the resident population surrounding a project location based on the latest American Community Survey 2016-2020 Five Year data. The tool generates an equity analysis project profile report.

The HR09 study team performed an analysis of socioeconomic characteristics and environmental justice issues by running the STEAP tool for the area within a half-mile buffer of the HR09 study corridor. Notable statistics from the equity analysis are provided in **Table 5**, which compares these statistics for the HR09 study area to those of York County, VA, and the state of Virginia as a whole. **Appendix C** provides the full STEAP-generated equity analysis project profile report.

**Table 5: Key Equity Statistics**

*FHWA STEAP Analysis, Data from ACS 2016-2020 Five Year Estimates*

Equity Statistic	Half-Mile HR09 Study Area Buffer	York County, VA	Virginia Statewide
Percent of Population: Black	9%	13%	19%
Percent of Population: Hispanic Origin	2%	7%	10%
Percent of Population: Age 65+	24%	16%	15%
Percent of Households: Income < \$15,000	5%	5%	8%
Percent of Households: Income \$75,000+	58%	62%	51%
Percent of Households: Zero Vehicles	2%	3%	6%
Percent of Households: One Vehicle	27%	21%	30%
Percent of Population: Non-English at Home	7%	11%	16%
Percent of Population 18+: Veterans	21%	19%	10%
Percent of Population (Civilian Non-Inst): People with Disabilities	21%	15%	15%
Percent of Households: No Internet Connection	9%	6%	11%

### 1.6 Detailed Needs Validation

#### 1.6.1 Additional Safety Review

In addition to the safety analyses performed for the high-level needs diagnosis described in **Section 1.5**, the study team examined several safety aspects in greater detail, including pedestrian and bicycle crashes and activity, and crash patterns at five select locations, as described in the following sections.

#### Pedestrian Crashes

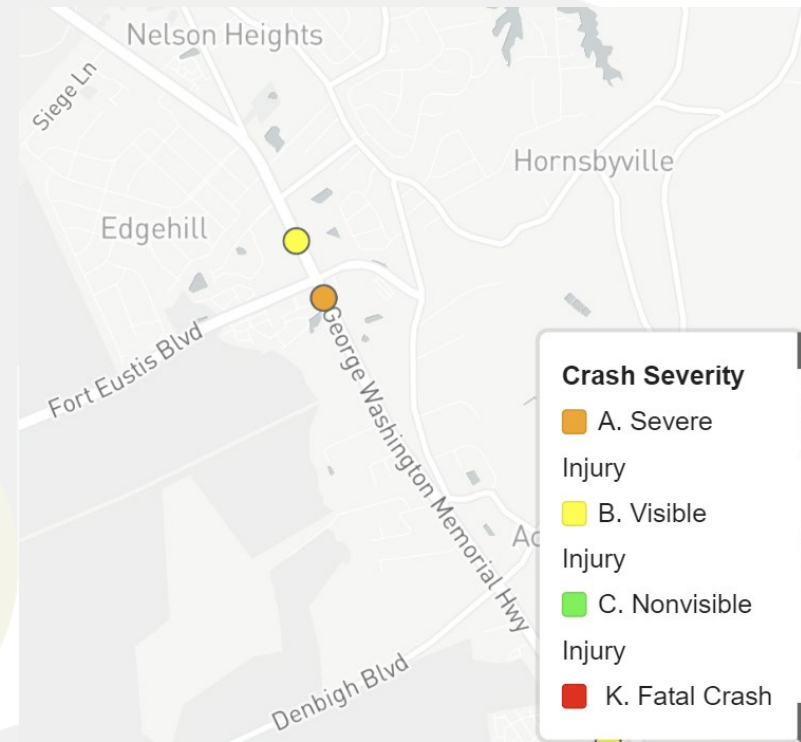
One pedestrian crash occurred on Route 17 within the HR09 study area between 1/1/2015 and 3/31/2023. It occurred just south of the Fort Eustis Boulevard intersection, at the Mariners Way entrance in front of the Arby's on Tuesday January 26, 2021, at 7:30 PM. A vehicle traveling southbound struck a pedestrian who was walking northbound on Route 17 in the right southbound lane. This crash was reported as a hit-and-run involving alcohol and distracted behavior. This crash resulted in a severe incapacitating injury to the pedestrian.

The study team re-examined VDOT's PowerBI Crash Map and discovered another pedestrian crash recently occurred on Friday June 2, 2023, at 10:48 AM, at the intersection of Route 17 and Market Street, north of Fort Eustis Boulevard. A pedestrian was walking on the grass on the west side of Route 17 and was struck by a 4"X4" piece of wood sticking out from the flatbed trailer of a single-unit truck. The pedestrian sustained visible injuries.

The location of these two pedestrian crashes is shown in **Figure 20**.



**Figure 20: Pedestrian Crashes in the HR09 Study Area 1/1/2015-6/30/2023**



**Observed Pedestrian Activity**

During the May 31, 2023, site visit, the study team observed pedestrians crossing Route 17 in the locations approximately 200 to 300 feet back from the Fort Eustis Boulevard intersection, in both north and south directions. The study team also observed pedestrians walking on the existing sidewalk, as well as in the right northbound travel lane south of the Fort Eustis Boulevard intersection.

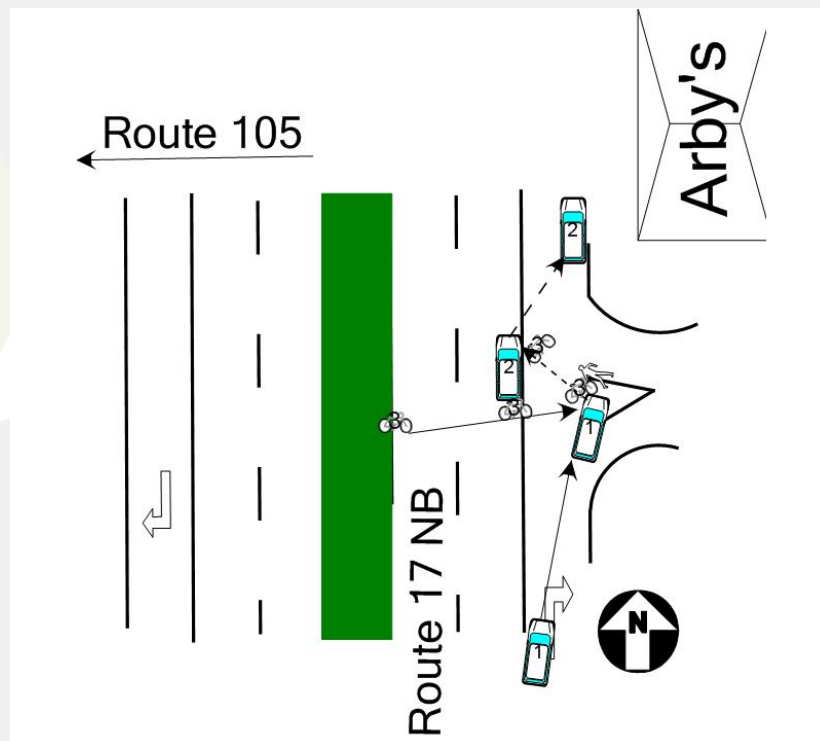
**Figure 21: Pedestrian Waiting to Cross Route 17 at McDonald's/Starbucks Entrance**  
Photo looking south from north of the Fort Eustis Boulevard intersection.



## Bicycle Crashes

One bicycle crash occurred on Route 17 within the HR09 study area between 1/1/2015 and 3/31/2023. It occurred just south of the Fort Eustis Boulevard intersection, at the Mariners Way entrance. It occurred on Friday April 15, 2016, at 3:59 PM. A bicyclist was crossing Route 17 mid-block in front of Arby's. A vehicle traveling northbound was turning right into the Mariners Way entrance, and struck the bicyclist, who then struck another northbound vehicle stopped in traffic. The crash diagram is provided in **Figure 22**.

*Figure 22: Crash Diagram of Vehicle-Bicycle Crash*



## Observed Bicycle Activity

During the May 31, 2023, Phase 1 field review, the study team observed one bicyclist in the corridor, who came from Fort Eustis Boulevard from the east. The bicyclist turned left and proceeded south along Route 17. This activity was observed around 4:30 PM.

## Collision Diagrams

The study team reviewed the FR300 reports for crashes within the 2018-2022 five-year crash analysis period at five locations:

- Route 17 at Cook Road/York Warwick Drive
- Route 17 at Battle Road/Clairmont Way
- Route 17 at Colonial Harbor (entrance service McDonald's and Starbucks just north of Fort Eustis Boulevard)
- Route 17 at Fort Eustis Boulevard
- Route 17 at Old York-Hampton Highway/Faulkner Road

The study team prepared collision diagrams showing the location, collision type, and severity of crashes at these locations. The collision diagrams are provided in **Figure 23** through **Figure 27**.

Figure 23: Collision Diagram – Route 17 at Cook Road/York Warwick Drive

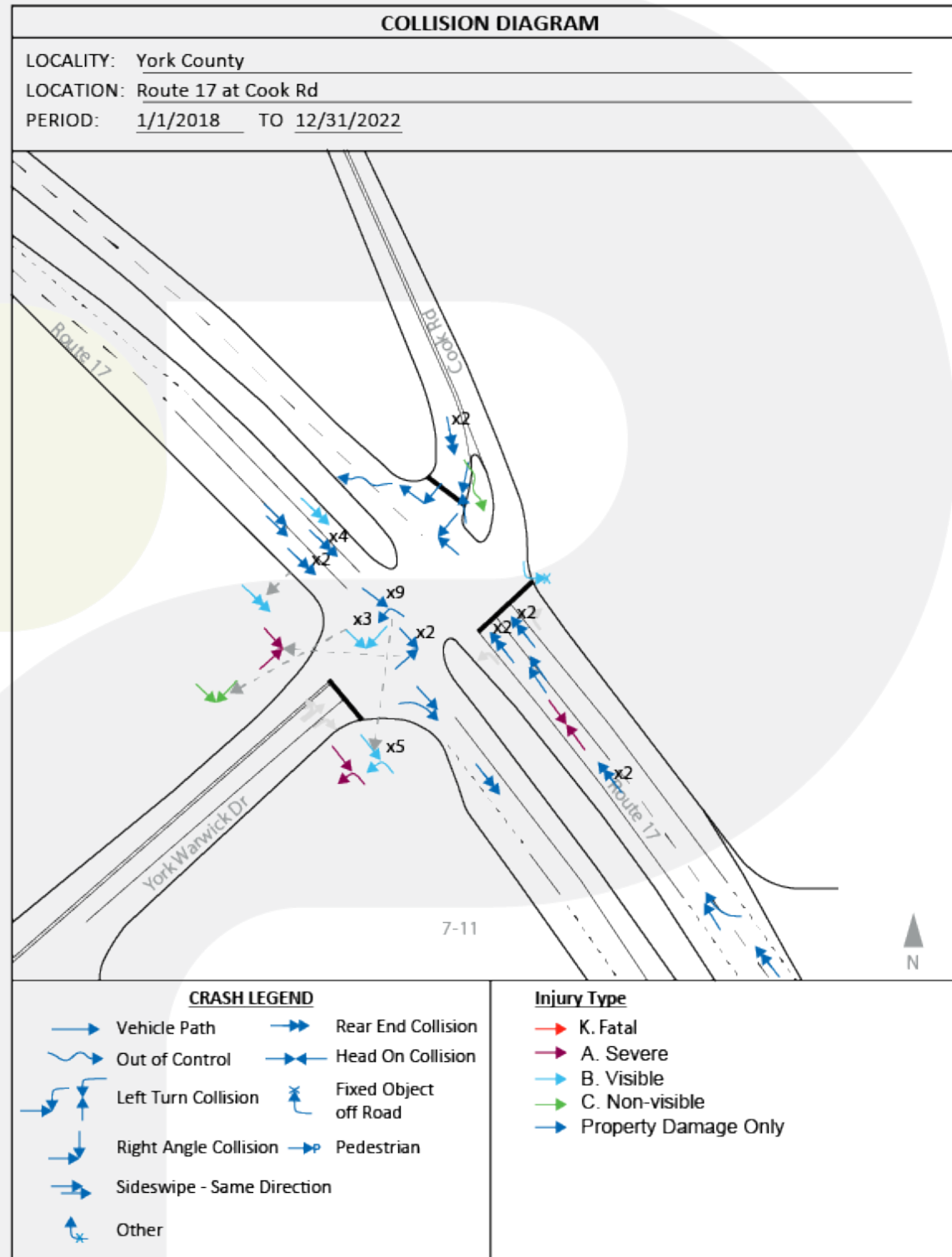


Figure 24: Collision Diagram – Route 17 at Battle Road/Clairmont Way

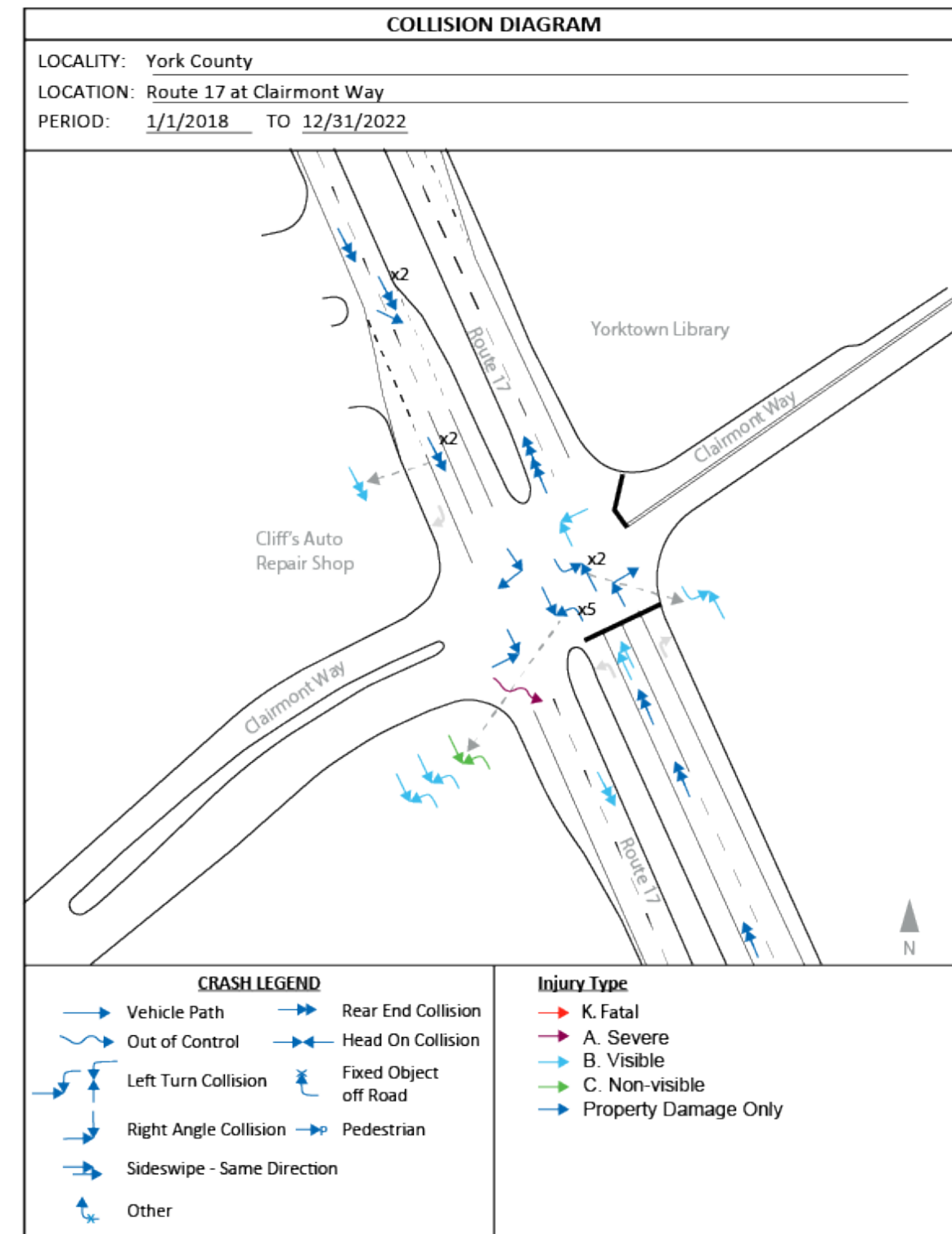




Figure 25: Collision Diagram – Route 17 at Colonial Harbor Entrance

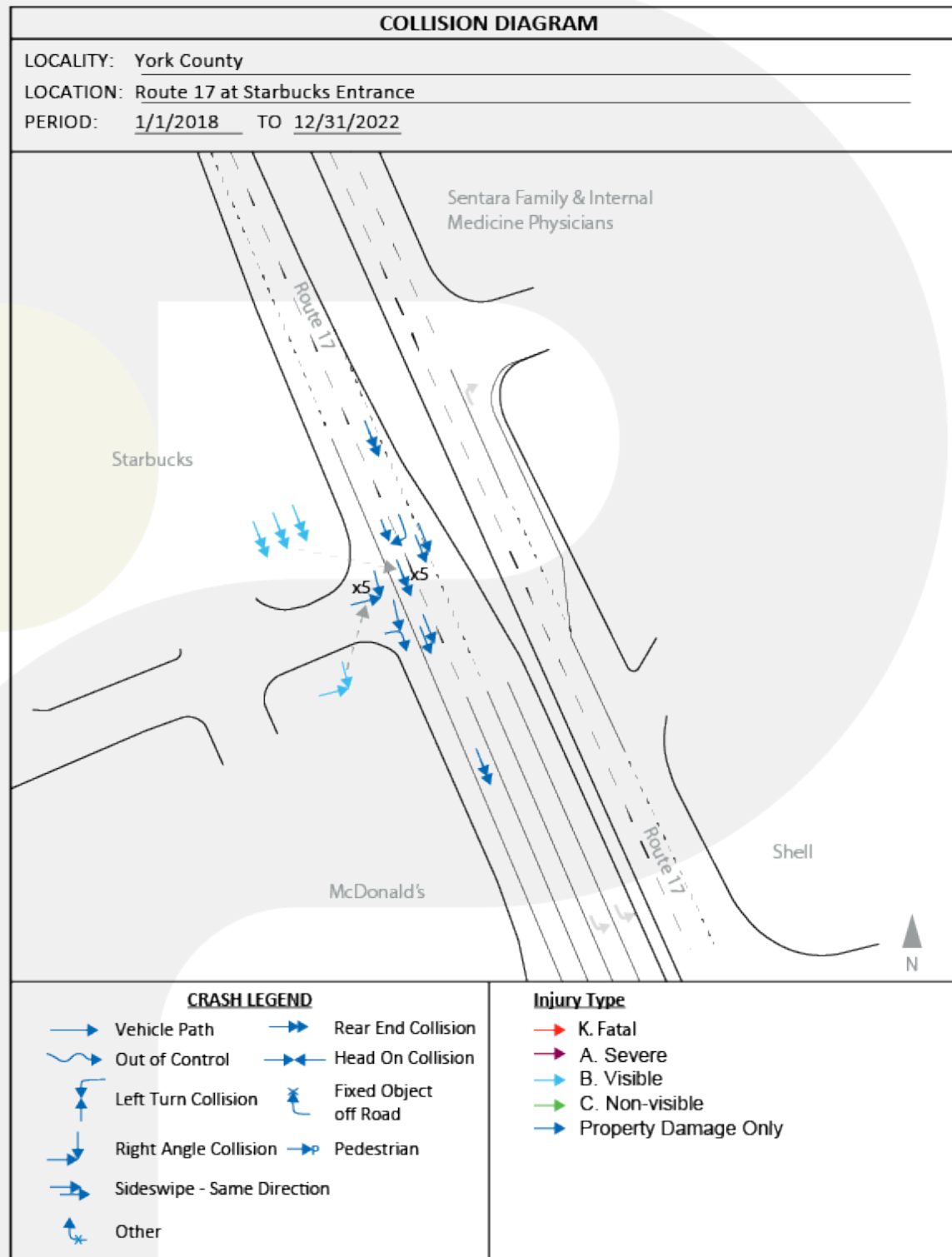


Figure 26: Collision Diagram – Route 17 at Fort Eustis Boulevard

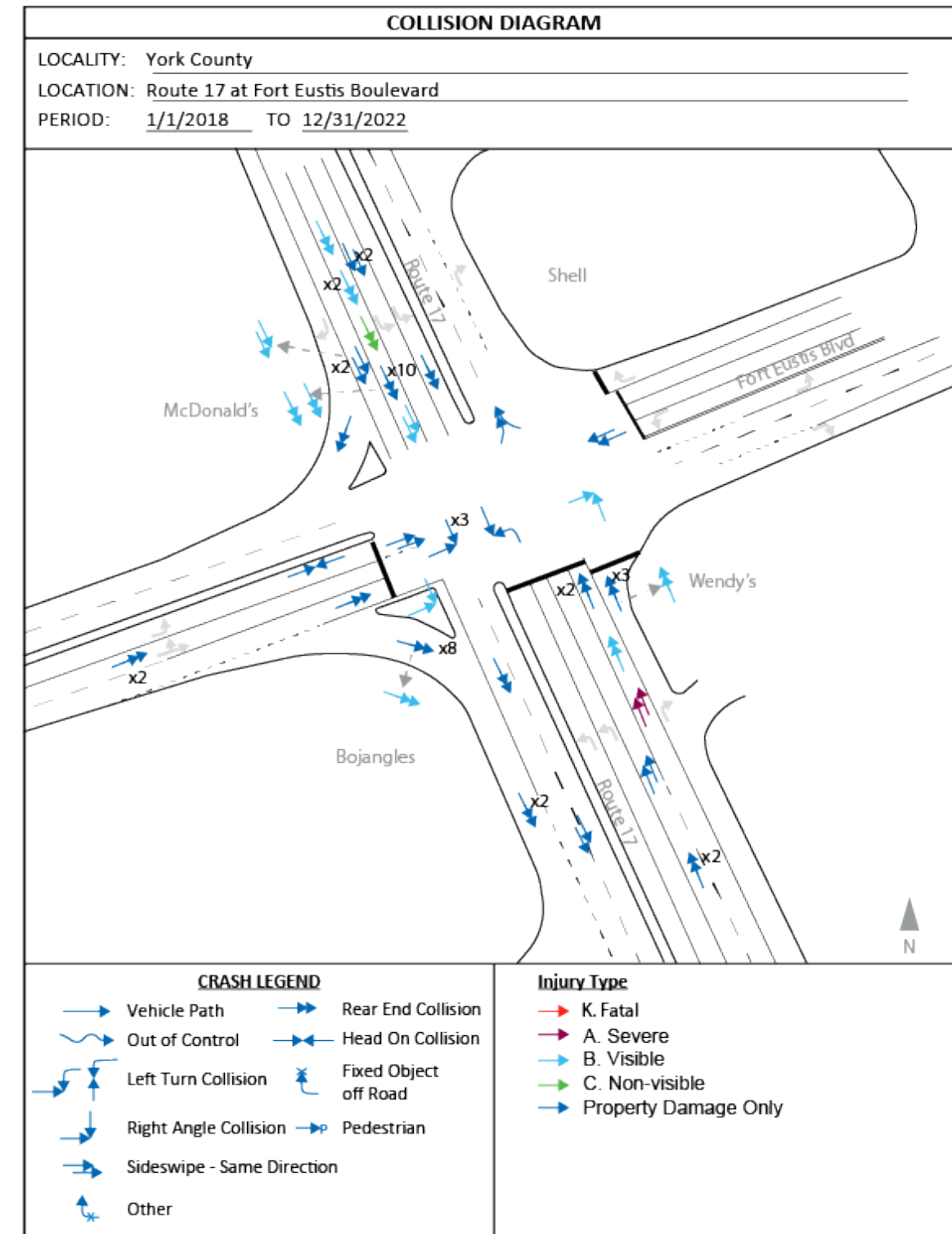
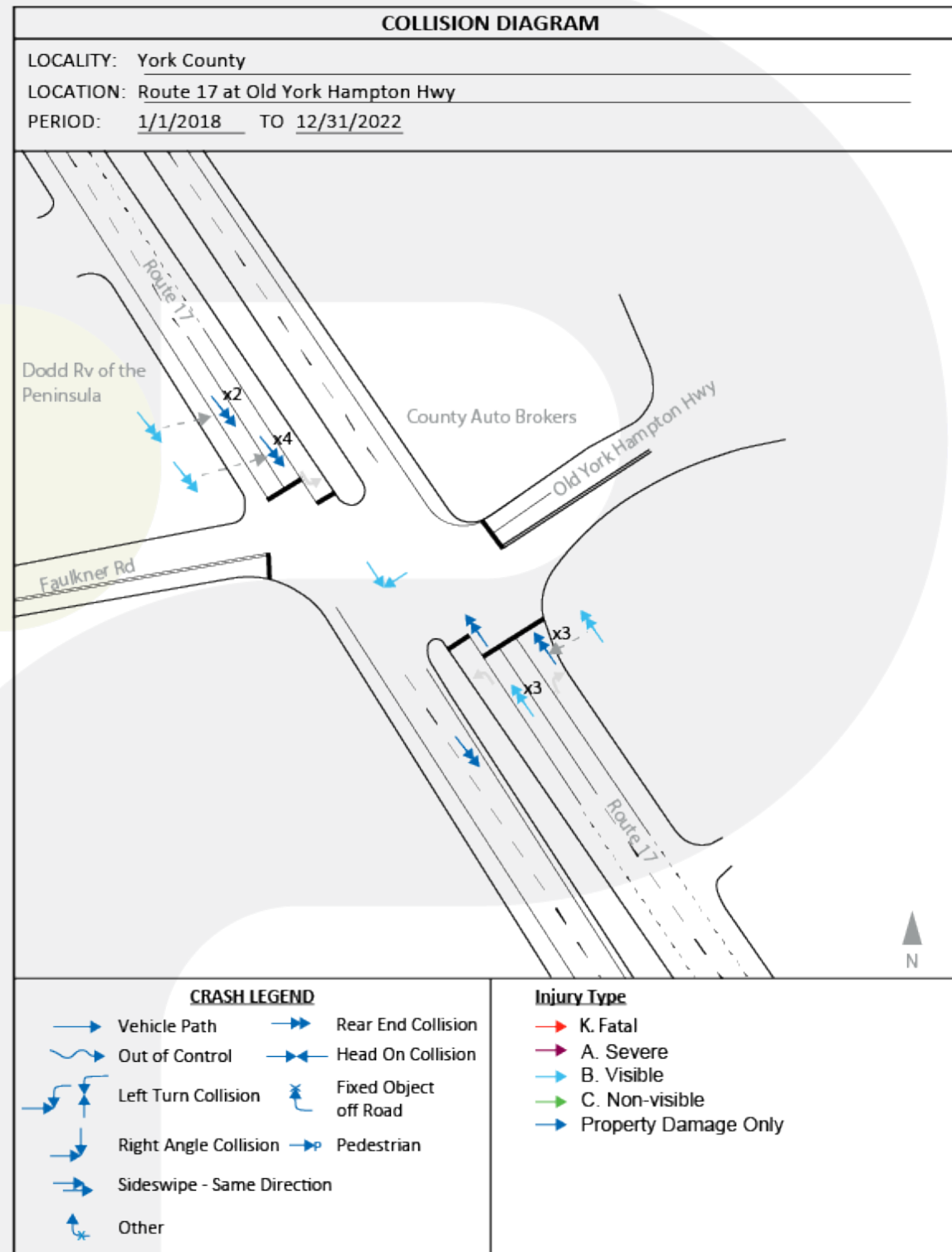


Figure 27: Collision Diagram – Route 17 at Old York-Hampton Highway/Faulkner Road



### 1.6.2 Phase 1 Field Review

The Phase 1 field review of the study area was conducted on May 31, 2023, to verify existing conditions, confirm traffic control devices, and observe peak hour traffic conditions, driver behavior, and pedestrian and bicycle activity. The study team noted the locations of the 50 mph and 45 mph posted speed limit signs and confirmed the lane configurations and markings shown in Google Earth aerial imagery.

The study team noted the following general observations during the field review.

- When coming from the north from Gloucester or Yorktown, Route 17 has a posted speed limit of 55 mph. After leaving Yorktown, the land use is natural area wetlands. There are no buildings and no access points. The road feels like a high-speed interstate highway. As drivers continue south into the HR09 study corridor, trees line the roadside, and land uses are generally set far back from the road, which maintains drivers' expectations to continue at high speeds. As drivers approach the intersection of Cook Road/York Warwick Drive, there are flashing signal warning signs, and the speed limit changes from 55 mph to 50 mph.
- Speeding appears to be common throughout the study corridor. Although speed data was not collected, the study team drove the corridor and observed many drivers driving much faster than the 50 mph posted speed limit.
- In several portions of the study corridor, access points are spaced closely together. The VDOT Road Design Manual Appendix F indicates a minimum of 495 feet between partial access entrances for principal arterials with a design speed of 50 mph or higher. Some portions of the Route 17 study corridor have entrances spaced 200 feet apart or closer.
- Some access points do not have right turn lanes for decelerating.



*Figure 28: Photo of Lack of Deceleration Lanes and Poor Roadside Conditions*



Observations for specific intersections and segments within the HR09 study area are provided below.

*Route 17 at Cook Road/York Warwick Drive*

- This intersection has split phasing, which gives less green time to the north/south through movements on Route 17, which are heavy especially during peak times.
- Queues on Route 17 were heavy during peak times. The study team observed 31 vehicles amongst the two through lanes in queue in the southbound direction and 26 northbound vehicles amongst the two through lanes in queue in the northbound direction in the PM peak period.
- If the signal phasing was changed to run the side-street left turns concurrently, it could give more green time to the Route 17 through movements and decrease queue lengths.

*Figure 29: Northbound Route 17 Queuing at Cook Road/York Warwick Drive in PM Peak Period*



*Route 17 at Clairmont Way/Battle Road*

- This intersection has split phasing, which gives less green time to the north/south through movements on Route 17, which are heavy especially during peak times.
- This intersection experienced similar heavy queuing on Route 17 as at Cook Road/York Warwick Drive.

*Route 17 at Fort Eustis Boulevard*

- The intersection of Route 17 and Fort Eustis Boulevard experienced heavy southbound queuing in the AM peak period. Southbound queues extended past the tree line beyond the commercial building, beyond visibility.



- The study team observed heavy queuing in the southbound, northbound, and eastbound directions in the PM peak period. The eastbound queues blocked the Colonial Harbor retirement living entrance.
- The entrance along southbound Route 17 that serves McDonald's and the commercial building with Starbucks and several other businesses experienced several issues. It is located approximately 300 feet north of the Fort Eustis Boulevard intersection. Route 17 southbound traffic backed up from the traffic signal at Fort Eustis Boulevard and blocked this entrance. Vehicles exiting McDonald's or Starbucks waited until the queue cleared with the southbound green phase. The queue often stacked back up again before vehicles can exit, and there was not enough space to pull forward, blocking the right turn lane, as shown in **Figure 30**. This entrance is the location of the fatal crash described previously in **Section 1.5.2**.
- At approximately 8:00 AM, the study team noted several school buses at this intersection that came from all directions.
- Throughout the day, the study team observed several pedestrians crossing Route 17 several hundred feet back from the intersection, both north and south of the intersection. Pedestrians crossed Route 17 at the Starbucks entrance north of the intersection, and in front of Arby's south of the intersection.

**Figure 30: Congestion and Queuing at the McDonald's and Starbucks Entrance North of Fort Eustis Boulevard**



#### *Route 17 between Fort Eustis Boulevard and Old York-Hampton Highway*

- There are no traffic signals in this 1-mile segment.
- Entrances often lack deceleration lanes. Where deceleration lanes are present, they are often too narrow or too short.
- Some entrances are spaced too closely together and do not meet VDOT's access spacing standards.

#### *Route 17 at Old York-Hampton Highway/Faulkner Road*

- In the middle of the AM and PM peak hour, queues on Old York-Hampton Highway backed up beyond the bend, blocking the intersection of Old York-Hampton Highway and Freedom Boulevard.
- Freedom Boulevard traffic counts were not collected. The study team observed very light traffic on Freedom Boulevard.
- All queues in the AM and PM peak hours at this intersection cleared within one cycle length.
- The Faulkner Road approach is slightly offset from the intersection.
- This intersection has split phasing.

#### *Route 17 at Terrebonne Road*

- The southbound queue from the intersection of Route 17 at Denbigh Boulevard/Goodwin Neck Road backed up to this intersection. Drivers did not obey the DO NOT BLOCK INTERSECTION markings and blocked Terrebonne Road.
- Terrebonne Road is offset from the median opening.
- The entrance to the power station is immediately adjacent to Terrebonne Road.
- Left turns from Terrebonne Road to go north on Route 17 are allowed, but this movement feels awkward from the geometry of the intersection, and difficult because of heavy, high-speed southbound Route 17 traffic.

#### *Route 17 at Denbigh Boulevard/Goodwin Neck Road*

- This intersection will be widened to three northbound through lanes and three southbound through lanes with the Route 17 Widening project, as described previously in **Section 1.3.2**. It was not included for data collection or detailed queue length observations.
- The study team generally noted the southbound queues extended back beyond Terrebonne Road in both AM and PM peak periods.



Figure 31: Aerial Photo of the Intersection of Route 17 at Old York-Hampton Highway/Faulkner Rd

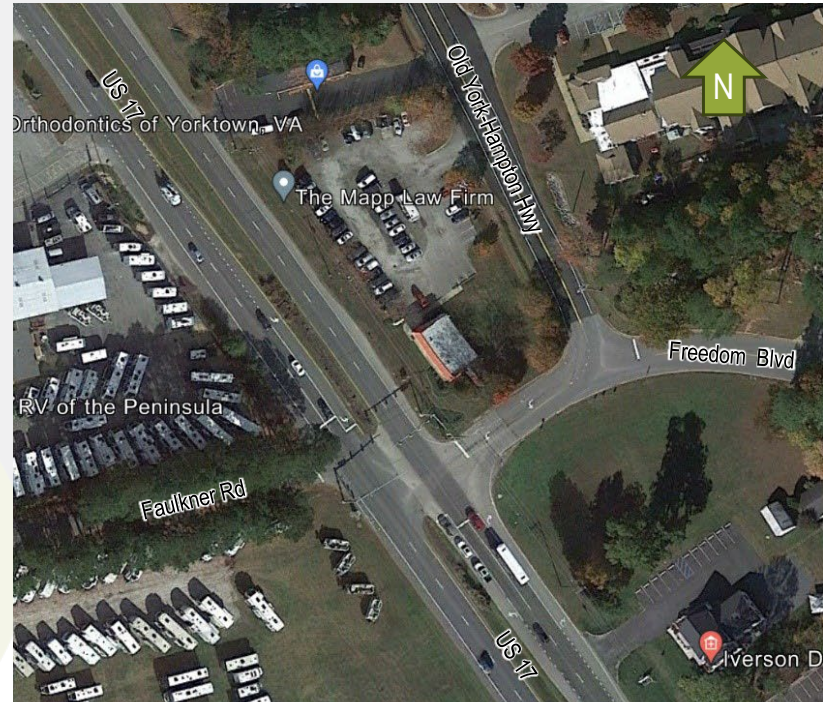


Figure 32: Aerial Photo of Route 17 at Terrebonne Road



The study team also observed evidence of two crashes occurring the day of the site visit.

- A three-vehicle rear-end crash occurred on the southbound approach of Route 17 at Fort Eustis Boulevard. The red SUV and blue car were stopped at a red light. The white SUV did not stop, and rear-ended the blue car, pushing it into the red SUV. This crash resulted in property damage only.
- The study team observed evidence of a vehicle hitting a deer on southbound Route 17 between Fort Eustis Boulevard and Old York-Hampton Highway.

Figure 33: Three-Car Rear End Crash During Phase 1 Field Review





### 1.6.3 Existing Conditions Traffic Operations Analysis

The HR09 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. Inputs and analysis methodologies were consistent with the VDOT Traffic Operations and Safety Analysis Manual (TOSAM), Version 2.0. **Appendix D** includes the SimTraffic Calibration Memo detailing the refinements made to the Synchro and SimTraffic models to reflect observed conditions. Ten simulations were conducted for both the AM and PM models. The VDOT *Sample Size Determination Tool* was used to confirm the number of SimTraffic model runs necessary.

#### Traffic Data Collection

12-hour turning movement counts (6 AM to 6 PM) were collected at 12 intersections within the study corridor. These intersections are listed in **Table 6** from south to north. Counts at 9 intersections were collected on Wednesday May 31, 2023. Counts at the remaining 3 intersections were collected on Wednesday June 14, 2023. Raw traffic data can be found in **Appendix E**.

**Table 6: Intersection Turning Movement Count Data Collection Locations and Dates**

ID	Intersection	Type	Date of Data Collection
1	Route 17 at Old York-Hampton Hwy/Faulkner Rd	Signalized	5/31/2023
2	Route 17 at Whites Rd	Unsignalized	5/31/2023
3	Route 17 at Green Dr	Unsignalized	5/31/2023
4	Route 17 at Tractor Supply Company entrance	Unsignalized	5/31/2023
5	Route 17 at Roberts Furniture/Hart Building	Unsignalized	6/14/2023
6	Route 17 at Generals Way/Mariners Way	Unsignalized	5/31/2023
7	Route 17 at Fort Eustis Blvd	Signalized	5/31/2023
8	Route 17 at Colonial Harbor entrance	Unsignalized	6/14/2023
9	Route 17 at Patriots Square entrance	Unsignalized	5/31/2023
10	Route 17 at Market Street	Unsignalized	5/31/2023
11	Route 17 at Clairmont Way/Battle Rd	Signalized	6/14/2023
12	Route 17 at Cook Rd/York Warwick Dr	Signalized	5/31/2023

As mentioned previously, counts were not collected at the intersection of Route 17 and Denbigh Boulevard/Goodwin Neck Road because this intersection is part of the Route 17 Widening project. The study team used previously collected turning movement counts for this intersection that were taken on May 1, 2018.

48-hour tube counts were collected beginning at 12:00AM on Wednesday May 31, 2023, and concluding at 11:59PM on Thursday June 1, 2023, to obtain 15-minute counts of southbound and northbound vehicles on Route 17 at two locations:

- North of the Fort Eustis Boulevard intersection, just north of the entrance to Patriots Square shopping center
- South of the Fort Eustis Boulevard intersection, between the Bojangles entrance and Mariners Way (Arby's entrance)

A review of the count data revealed that traffic volumes along the study corridor peaked from 7:00-8:00 AM and from 4:30-5:30 PM. The study team balanced the collected turning movement counts and used the balanced volumes to develop the Synchro/SimTraffic model. The balanced volumes that were used as the existing volumes and formed the basis of this study are shown in **Figure 34** and **Figure 35**. Heavy vehicle percentages and peak hour factors are included in **Figure 36** and **Figure 37**.

Notable findings from the traffic volumes are provided below:

- The intersections of Route 17 at Fort Eustis Boulevard and Route 17 at Denbigh Boulevard/Goodwin Neck Road have the highest overall volumes with 3,552 and 3,528 entering vehicles in the AM peak hour and 4,388 and 4,329 entering vehicles in the PM peak hour.
- Route 17 southbound through volumes are slightly higher in the AM peak hour than in the PM peak hour. The difference between AM and PM volumes in the southbound direction is highest at the northernmost intersection (Cook Road/York Warwick Drive), where the southbound AM peak hour through volume is 1,386 vehicles, and the PM peak hour volume is 872 vehicles. The difference between the southbound AM and PM peak hour through volumes decreases to the south. At the Old York-Hampton Highway intersection, the PM peak hour southbound through volume (1,525 vehicles) is slightly higher than the AM peak hour volume (1,428 vehicles).
- Route 17 northbound through volumes are significantly higher in the PM peak hour than in the AM peak hour. At the unsignalized intersections between Clairmont Way/Battle Road and Fort Eustis Boulevard, the PM peak hour northbound volumes are around 1,900 vehicles, and the AM peak hour volumes are around 1,100 vehicles.
- At the Route 17 and Fort Eustis Boulevard intersection, there are two reciprocal pairs of heavy turning movements:
  - The southbound right turn has 435 vehicles in the AM peak hour, and the reciprocal eastbound left turn has 584 vehicles in the PM peak hour.



- The northbound left turn has 323 vehicles in the AM peak hour, and the reciprocal eastbound right turn has 469 vehicles in the PM peak hour.
- Other turning movements with peak hour volumes above 200 vehicles include:
  - Route 17 at Cook Road/York Warwick Drive:
    - Westbound left turn: 208 vehicles in the PM peak hour
  - Route 17 at Denbigh Boulevard/Goodwin Neck Road:
    - Eastbound left turn: 239 vehicles in the AM peak hour and 431 vehicles in the PM peak hour
    - Southbound right turn: 335 vehicles in the AM peak hour and 287 vehicles in the PM peak hour.

Figure 34: 2023 Existing Peak Hour Vehicle Volumes (1)

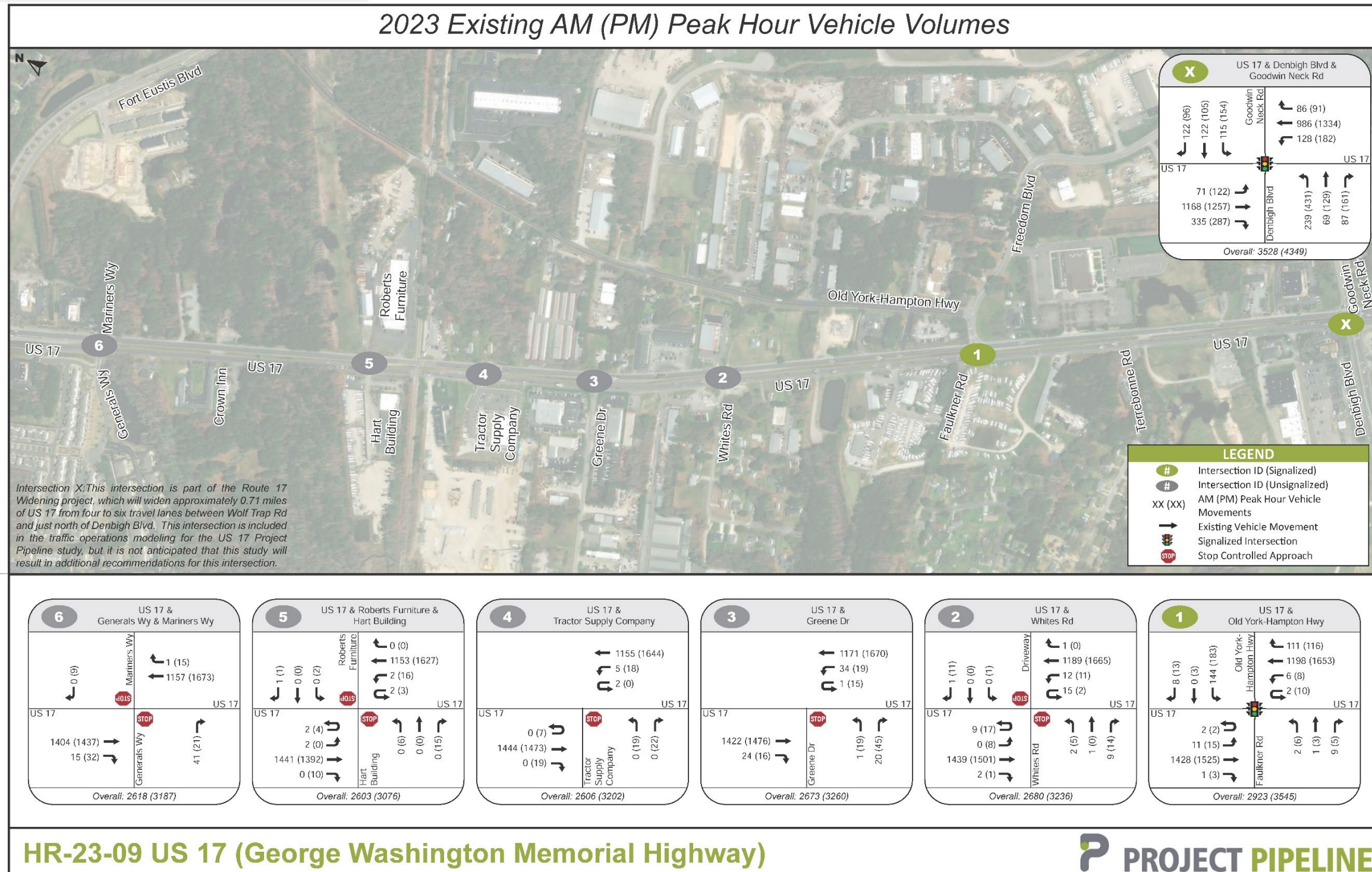




Figure 35: 2023 Existing Peak Hour Vehicle Volumes (2)

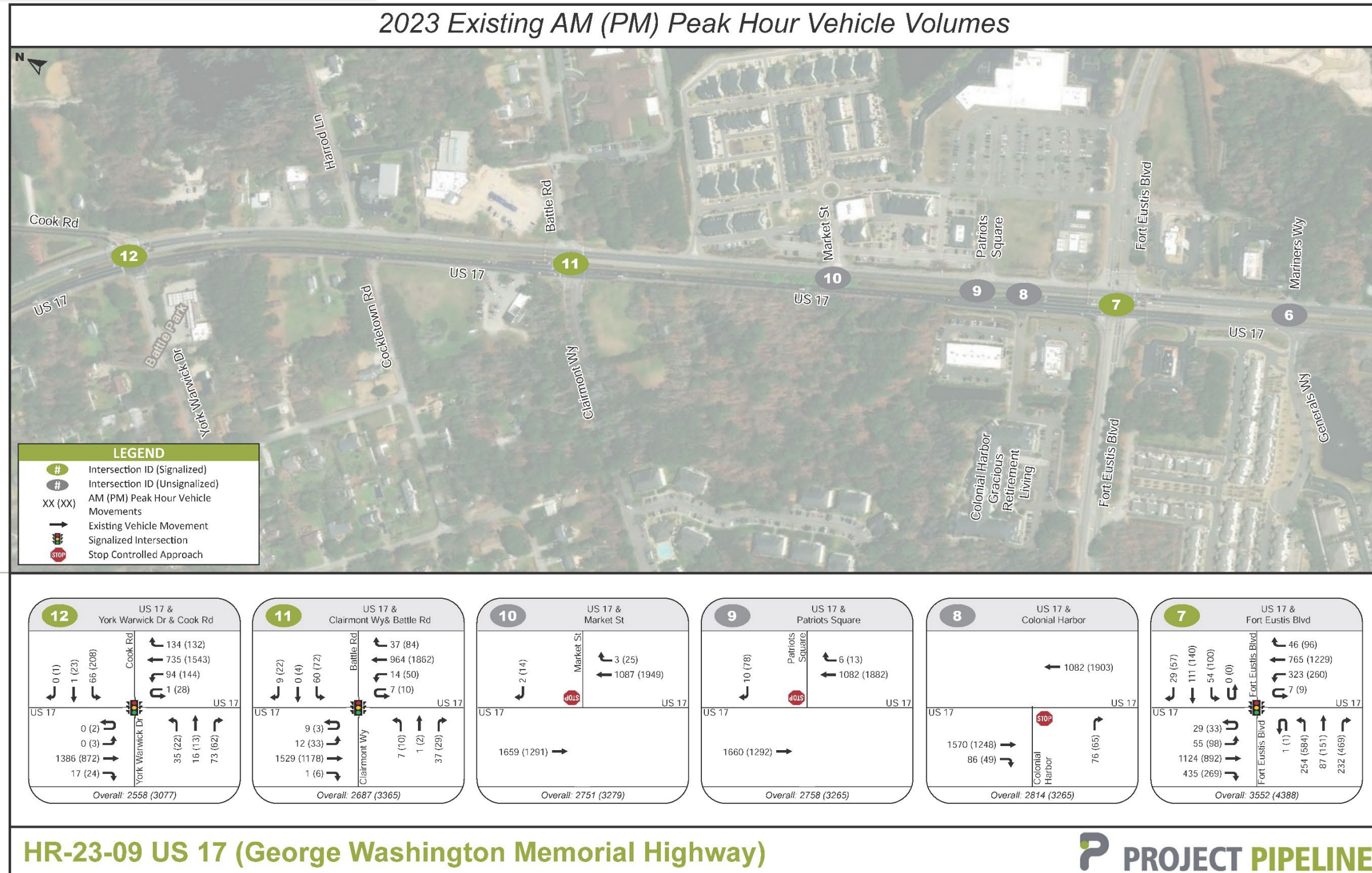




Figure 36: 2023 Existing Heavy Vehicle Percentages and Peak Hour Factors (1)

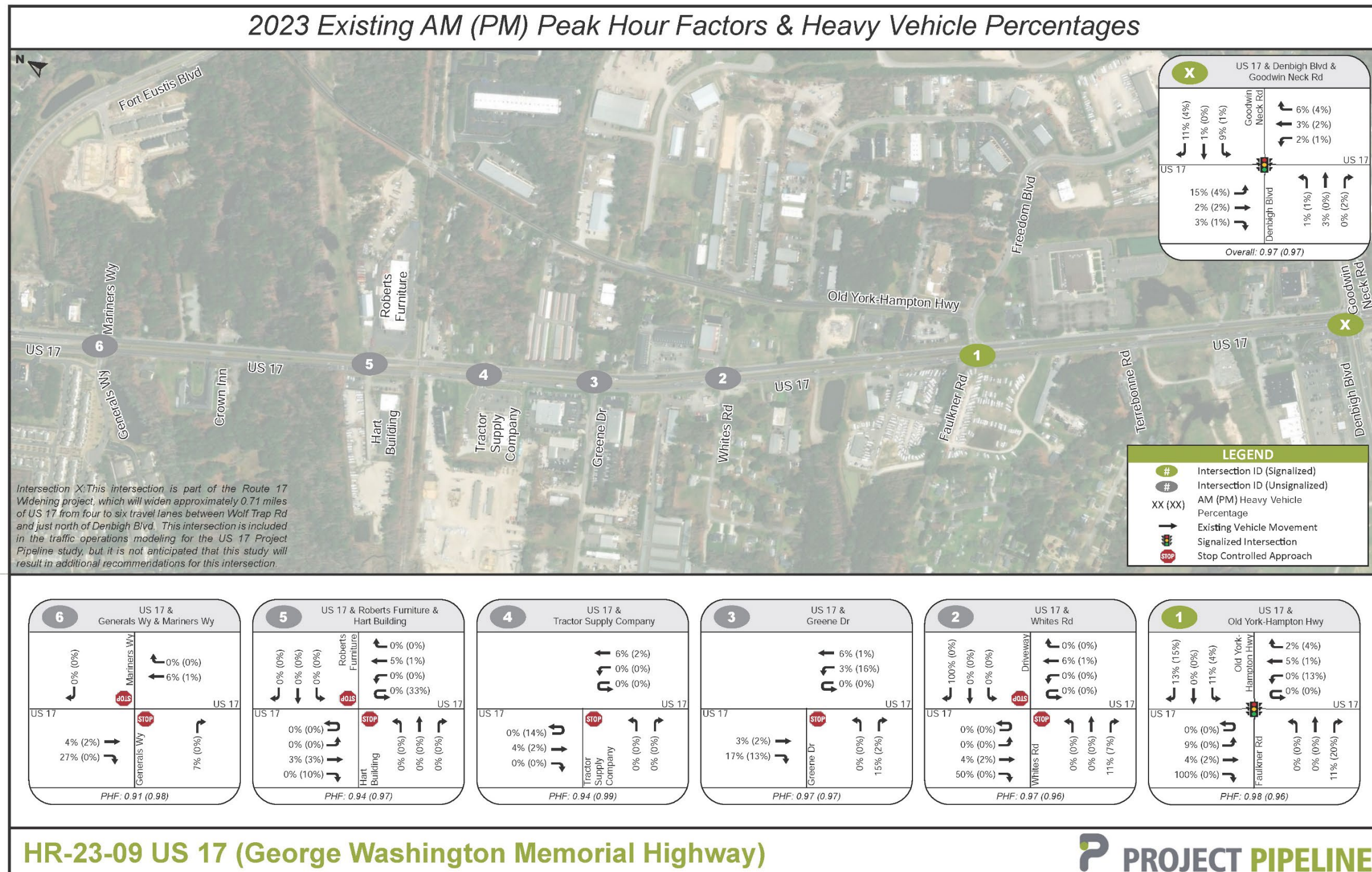
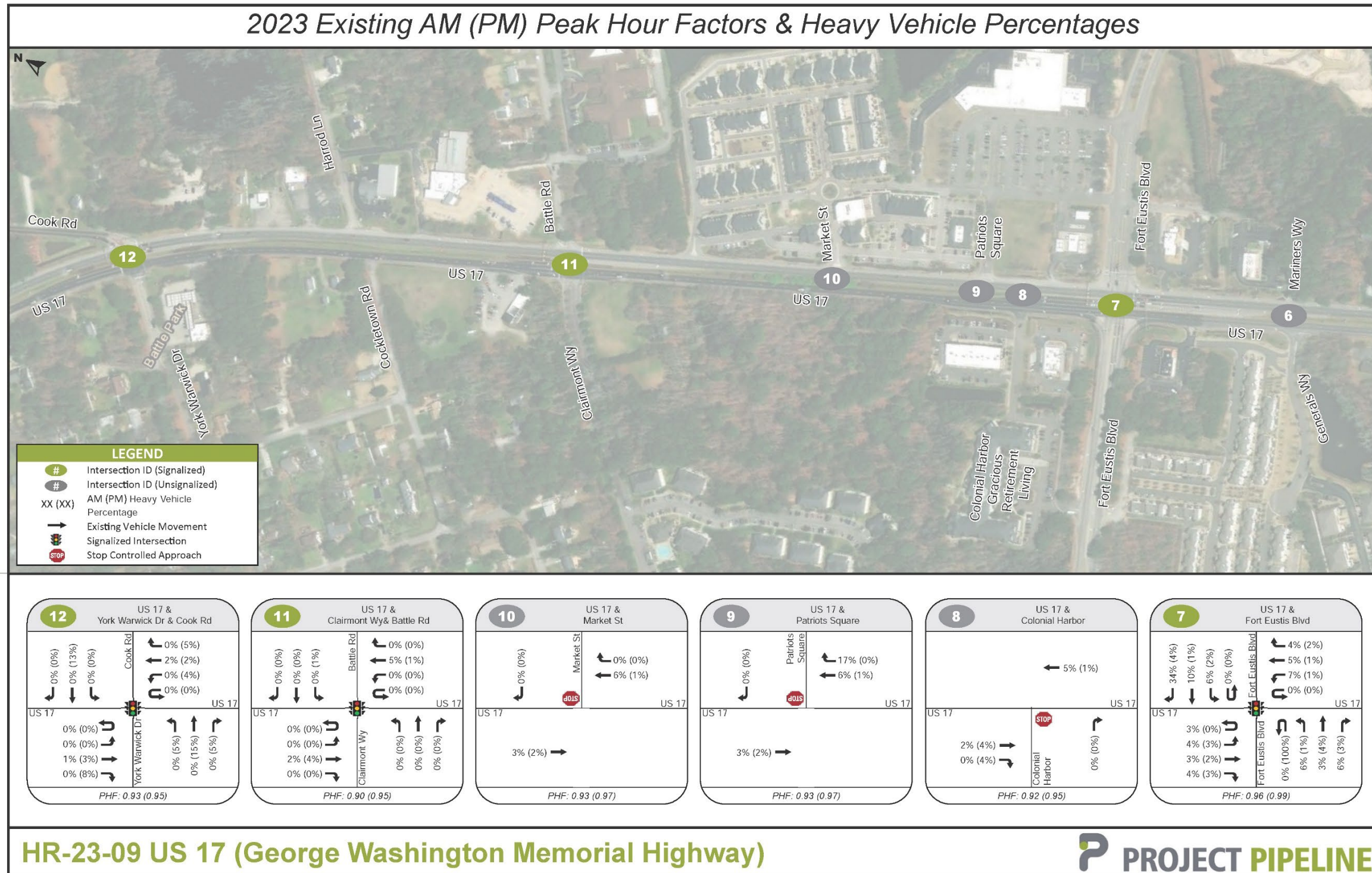




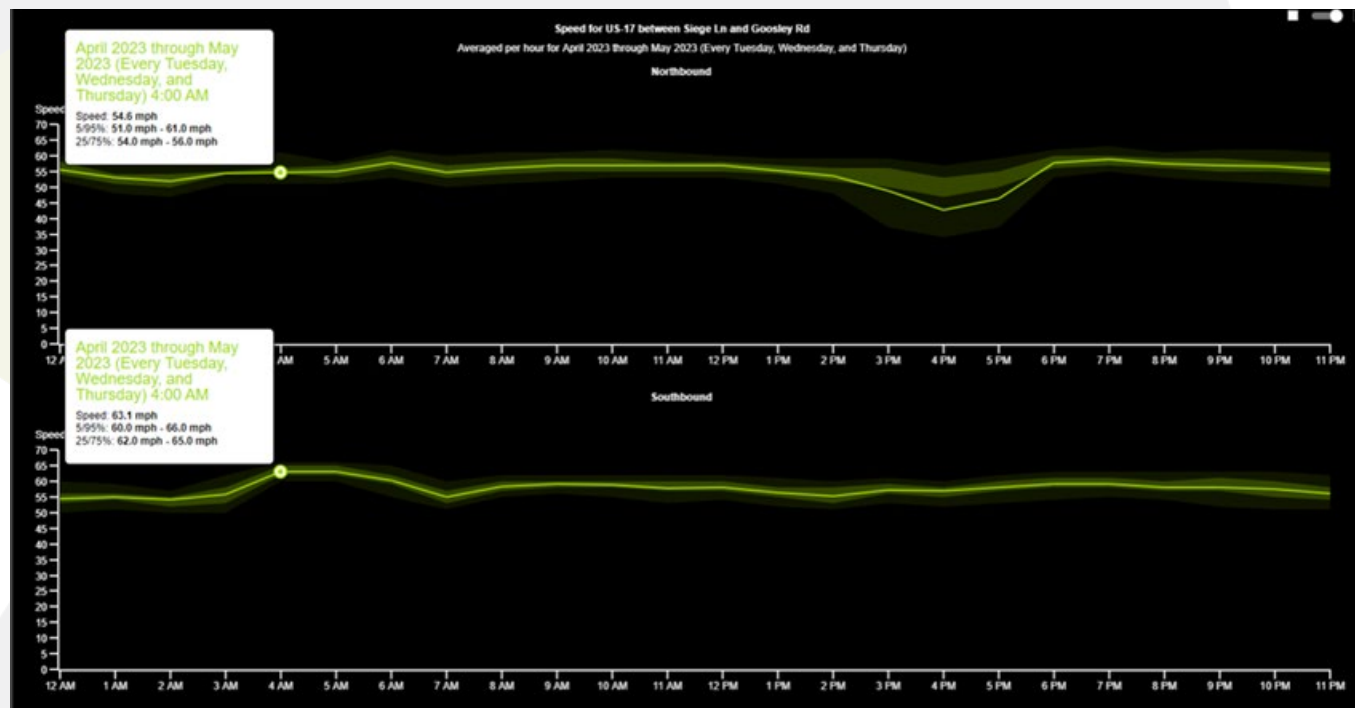
Figure 37: 2023 Existing Heavy Vehicle Percentages and Peak Hour Factors (2)



### Free-Flow Speed

The study team examined INRIX average speed data for the segment of Route 17 between Siege Lane and Goosley Road to determine free-flow speeds for the study corridor. The section of Route 17 between Siege Lane and Goosley Road is north of Cook Road and is uninterrupted by traffic signals. The data shows northbound and southbound 75th to 95th percentile speeds of about 60 mph, as shown in **Figure 38**. The study team used this data in the calibration of the existing conditions Synchro and SimTraffic models, which also validated the observations from the Phase 1 field review that most vehicles traveled faster than the 50 mph speed limit when not delayed by congestion.

Figure 38: INRIX Speed Data for Route 17 between Siege Lane and Goosley Road



### Model Outputs

Traffic operations model results are reported as control delay (seconds per vehicle), level of service (LOS), and maximum queue length (feet). The HCM 2000 methodology was used to analyze all signalized intersections and the HCM 6<sup>th</sup> Edition methodology was used to analyze the unsignalized intersections. Control delay and LOS are reported from the Synchro analysis. Maximum queue length is reported from SimTraffic. In some instances, the Synchro analysis reported inaccurate control delay and LOS for right turns at signalized intersections in exclusive right turn lanes. In these select instances, control delay and LOS are reported from SimTraffic.

### Level of Service

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 7** 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 available gaps 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 7: LOS and Delay

Level of Service	Signalized Intersection Control Delay (seconds per vehicle)	Unsignalized Intersection Control Delay (seconds per vehicle)
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



## Existing Conditions Traffic Operations Analysis Results

The control delay and LOS results from the Synchro analysis of existing conditions are provided in **Table 8** and **Table 9**. The maximum queue results from the SimTraffic analysis are provided in **Table 10** and **Table 11**. The full Synchro and SimTraffic reports are included in **Appendix F**.

Findings from the existing conditions traffic analysis are summarized below:

- Four of the five signalized intersections operate at LOS D or better overall in both AM and PM peak hours:
  - Route 17 at Cook Road/York Warwick Drive
  - Route 17 at Clairmont Way/Battle Road
  - Route 17 at Fort Eustis Boulevard
  - Route 17 at Old York-Hampton Highway/Faulkner Road
- The signalized intersection of Denbigh Boulevard/Goodwin Neck Road operates at overall LOS D in the AM peak hour and LOS E in the PM peak hour. Eastbound and westbound approaches operate at LOS E or F in both peak hours. Both northbound and southbound Route 17 approaches operate at LOS D in the PM peak hour. Demand is exceeding capacity on most approaches. Through queues block turn lanes on all four approaches in the PM peak hour, and on three approaches in the AM peak hour.
- The southbound Route 17 queue at Fort Eustis Boulevard extends over 100 feet past Market Street in the AM peak hour. This queue frequently blocks the Colonial Harbor entrance serving McDonald's and Starbucks, as observed in the Phase 1 field visit. The analysis shows the eastbound Colonial Harbor entrance queue extends beyond the 328-foot link length 33 percent of the AM peak hour, blocking the Starbucks and McDonald's parcel entrances. The southbound Route 17 queue also blocks the Colonial Harbor entrance in the PM peak hour, although it is not quite as long as in the AM peak hour.
- Select movements at the intersection of Route 17 and Fort Eustis Blvd operate at LOS E or F in one or both peak hours, including the eastbound left turn, all movements on the westbound approach, and the southbound left turn.
- Queues on southbound Route 17 at Generals Way are the result of vehicles slowing down at the weaving section in front of the Bojangle's. It was not observed that this weaving movement interfered with traffic operations at the upstream intersection of Route 17 at Fort Eustis Boulevard.
- At the intersection of Route 17 and Old York-Hampton Highway, the westbound Old York-Hampton Highway queue extends past and blocks the intersection with Freedom Boulevard, which is located approximately 150 feet from the Route 17 intersection. However, the intersection appeared to function without any major operational issues during the Phase 1 field review observations. The queue fully cleared in each cycle observed.
- Also at the intersection of Route 17 and Old York-Hampton Highway, the northbound and southbound Route 17 maximum queues in the PM peak hour extend beyond the turn lanes, blocking vehicles from entering the turn lanes.
- At the intersection of Route 17 and Cook Road/York Warwick Drive, through movements on Route 17 operate at LOS C or better in both peak hours. Side-street movements and the northbound left turns generally operate at LOS E in both peak hours. Maximum queues for the northbound left turn and northbound right turn extend to the end of the turn lane, but do not spill back into the through lane.
- Side-street movements at the intersection of Route 17 and Battle Road/Clairmont Way operate at LOS E. Side-street volumes are relatively low. Turning volumes are less than 100 vehicles per hour on the westbound Battle Road approach and less than 50 vehicles per hour on the eastbound Clairmont Way approach. This intersection operates at overall LOS C in the AM peak hour and LOS B in the PM peak hour. The southbound Route 17 simulated maximum queue in the AM peak hour extends to nearly 450 feet but does not affect operations.
- Side-street approaches operate at LOS E at the following unsignalized intersections.
  - At the intersection of Route 17 and Roberts Furniture/Hart Building, the westbound approach operates at LOS E in the PM peak hour. The volume on the westbound approach volumes is 21 vehicles in the PM peak hour.
  - At the intersection of Route 17 at Tractor Supply Co, the eastbound left turn operates at LOS E.

Table 8: 2023 Existing Conditions Peak Hour Control Delay and LOS (1)

Intersection Number and Description	Type of Control	Lane Group	Eastbound				Westbound				Northbound				Southbound				Overall		
			AM		PM		AM		PM		AM		PM		AM		PM		AM	PM	
			Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	
12	Route 17 and Cook Rd/ York Warwick Dr	Signalized	York Warwick Drive				Cook Rd				Route 17				Route 17				Intersection		
			Left	56.6	E	64.0	E	56.6	E	66.8	E	57.2	E	73.4	E	‡	‡	22.1	C	Delay	Delay
			Through									1.6	A	29.3	C					21.8	35.1
			Right	53.4	D	61.4	E					3.6	A	1.6'	A	27.1	C	31.7	C	LOS	LOS
		Approach	54.7	D	62.3	E	56.6	E	66.8	E	7.4	A	31.4	C	27.1	C	31.7	C	C	D	
11	Route 17 and Clairmont Way/ Battle Rd	Signalized	Clairmont Way				Battle Rd				Route 17				Route 17				Intersection		
			Left									22.4	C	11.9	B	16.7	B	50.9	D	Delay	Delay
			Through	55.7	E	63.4	E	56.3	E	68.1	E	22.2	C	24.8	C	30.2	C	7.1	A	28.0	20.0
			Right									8.6	A	11.0	B	8.4	A	10.9	B	LOS	LOS
		Approach	55.7	E	63.4	E	56.3	E	68.1	E	21.7	C	23.8	C	30.0	C	8.4	A	C	B	
10	Route 17 and Market St	Unsignalized	Market St				Route 17				Route 17				Intersection						
			Left									†	†	†	†	†	†	†	†	-	-
			Through									14.2	B	23.5	C	†	†	†	†	LOS	LOS
			Right									14.2	B	23.5	C	0.0	A	0.0	A	0.0	A
		Approach																			
9	Route 17 and Patriots Square	Unsignalized	Patriots Square				Route 17				Route 17				Intersection						
			Left									†	†	†	†	†	†	†	†	-	-
			Through									13.0	B	25.3	D	†	†	†	†	LOS	LOS
			Right									13.0	B	25.3	D	0.0	A	0.0	A	0.0	A
		Approach																			
8	Route 17 and Colonial Harbor	Unsignalized	Colonial Harbor				Route 17				Route 17				Intersection						
			Left									†	†	†	†	†	†	†	†	-	-
			Through																	LOS	LOS
			Right	27.0	D	18.2	C					0.0	A	0.0	A	0.0	A	0.0	A	-	-
		Approach	27.0	D	18.2	C															
7	Route 17 and Fort Eustis Blvd	Signalized	Fort Eustis Blvd				Fort Eustis Blvd				Route 17				Route 17				Intersection		
			Left	60.9	E	77.2	E	54.9	D	90.8	F	40.4	D	33.0	C	63.2	E	65.1	E	Delay	Delay
			Through	51.2*	D	51.7*	D	54.7	D	62.1	E	9.1	A	16.1	B	28.5	C	54.7	D	29.7	40.9
			Right	47.4	D	51.1	D	52.1	D	58.4	E	15.1	B	21.0	C	15.9	B	2.0'	A	LOS	LOS
		Approach	51.8	D	57.7	E	54.4	D	71.1	E	18.4	B	19.3	B	26.9	C	44.8	D	C	D	
6	Route 17 and Generals Way/ Mariners Way	Unsignalized	Generals Way				Mariners Way				Route 17				Route 17				Intersection		
			Left									†	†	†	†	†	†	†	†	-	-
			Through																	LOS	LOS
			Right	17.5	C	15.4	C	†	†	19.2	C	†	†	†	†	†	†	†	†	†	†
		Approach	17.5	C	15.4	C	0.0	A	19.2	C	0.0	A	0.0	A	0.0	A	0.0	A	-	-	

† Synchro does not provide level of service or delay for movements with no conflicting volumes.

‡ Movement volume is zero.

\* Lane group contains a shared left/through movement.

\*\* Movement is a U-turn only, not a left turn.

' Delay reported from SimTraffic. Synchro reported unrealistically high delay.



Table 9: 2023 Existing Conditions Peak Hour Control Delay and LOS (2)

Intersection Number and Description	Type of Control	Lane Group	Eastbound				Westbound				Northbound				Southbound				Overall	
			AM		PM		AM		PM		AM		PM		AM		PM		AM	PM
			Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
5 Route 17 and Roberts Furniture/ Hart Building	Unsignalized	Hart Building		Roberts Furniture		Route 17				Route 17				Intersection						
		Left	‡	‡	25.6	D	13.2	B	45.0	E	21.2	C	16.8	C	15.7	C	35.0	D	Delay	Delay
		Through	†	†							†	†	†	†	†	†	†	†	-	-
		Right	†	†							†	†	†	†	†	†	†	†	LOS	LOS
		Approach	0.0	A	25.6	D	13.2	B	45.0	E	0.1	A	0.2	A	0.0	A	0.1	A	-	-
4 Route 17 and Tractor Supply Co	Unsignalized	Tractor Supply Co				Route 17				Route 17				Intersection						
		Left	†	†	43.3	E					17.9	C	13.3	B	†	†	40.7**	E	Delay	Delay
		Through	†	†							†	†	†	†	†	†	†	†	-	-
		Right	†	†	15.6	C									†	†	†	†	LOS	LOS
		Approach	0.0	A	28.4	D					0.1	A	0.1	A	0.0	A	0.2	A	-	-
3 Route 17 and Greene Dr	Unsignalized	Greene Dr				Route 17				Route 17				Intersection						
		Left	17.5	C	32.0	D					14.4	B	25.8	D					Delay	Delay
		Through	†	†							†	†	†	†	†	†	†	†	-	-
		Right	17.5	C	32.0	D									†	†	†	†	LOS	LOS
		Approach	17.5	C	32.0	D					0.4	A	0.5	A	0.0	A	0.0	A	-	-
2 Route 17 and Whites Rd	Unsignalized	Whites Rd		Driveway		Route 17				Route 17				Intersection						
		Left					19.0	C	17.5	C	23.2	C	16.6	C	20.5	C	36.0	E	Delay	Delay
		Through	24.3	C	29.1	D					†	†	†	†	†	†	†	†	-	-
		Right	†	†							†	†	†	†	†	†	†	†	LOS	LOS
		Approach	24.3	C	29.1	D	19.0	C	17.5	C	0.5	A	0.1	A	0.1	A	0.6	A	-	-
1 Route 17 and Old York Hampton Hwy/Faulkner Rd	Signalized	Faulkner Rd		Old York Hampton Hwy		Route 17				Route 17				Intersection						
		Left					61.1	E	74.3	E	75.8	E	47.8	D	72.9	E	83.5	F	Delay	Delay
		Through	58.3	E	67.2	E					25.7	C	11.7	B	14.2	B	8.7	A	21.4	14.6
		Right					45.7	D	50.5	D	1.0'	A	13.0	B					LOS	LOS
		Approach	58.3	E	67.2	E	60.3	E	72.4	E	23.9	C	12.2	B	14.7	B	9.5	A	C	B
X Route 17 and Denbigh Blvd/ Goodwin Neck Rd	Signalized	Denbigh Blvd		Goodwin Neck Rd		Route 17				Route 17				Intersection						
		Left	67.8	E	163.2	F	64.7	E	79.5	E	27.1	C	62.3	E	23.2	C	43.7	D	Delay	Delay
		Through	67.9*	E	163.8*	F	73.4*	E	79.5*	E	30.6	C	52.3	D	50.4	D	53.4	D	41.7	65.5
		Right	46.9	D	50.3	D	49.4	D	55.4	E	20.6	C	24.2	C	11.8'	B	12.0'	B	LOS	LOS
		Approach	63.2	E	138.2	F	62.7	E	73.0	E	29.5	C	51.9	D	41.0	D	45.6	D	D	E

† Synchro does not provide level of service or delay for movements with no conflicting volumes.

‡ Movement volume is zero.

\* Lane group contains a shared left/through movement.

\*\* Movement is a U-turn only, not a left turn.

' Delay reported from SimTraffic. Synchro reported unrealistically high delay.

Table 10: 2023 Existing Conditions Peak Hour Maximum Queue (1)

Intersection Number and Description	Type of Control	Lane Group	Maximum Queue (feet)								
			Eastbound		Westbound		Northbound		Southbound		
			AM	PM	AM	PM	AM	PM	AM	PM	
12	Route 17 and Cook Rd/ York Warwick Dr	Signalized	York Warwick Dr		Cook Rd		Route 17		Route 17		
			Left	120	92	126	312	154	** (1%)	‡ ** (11%)	** (2%)
			Through	114	84			126	417	556	318
Right	18	** (7%)									
11	Route 17 and Clairmont Way/ Battle Rd	Signalized	Clairmont Way		Battle Rd		Route 17		Route 17		
			Left	73	96	143	176	48	87	** (8%)	** (1%)
			Through					240	334	449	190
Right					18	52	* (10%)	** (1%)			
10	Route 17 and Market St	Unsignalized	Market St		Route 17		Route 17		Route 17		
			Left								
			Through					+	+	112	+
Right	0	0			+	+					
9	Route 17 and Patriots Square	Unsignalized	Patriots Square		Route 17		Route 17		Route 17		
			Left								
			Through					+	+	^(1%)	218
Right	30	64			+	+					
8	Route 17 and Colonial Harbor	Unsignalized	Colonial Harbor		Route 17		Route 17		Route 17		
			Left								
			Through	^(33%)	132			+	+	^(18%)	^(15%)
Right											
7	Route 17 and Fort Eustis Blvd	Signalized	Fort Eustis Blvd		Fort Eustis Blvd		Route 17		Route 17		
			Left	184	335	106	186	246	176	** (26%)	** (20%)
			Through	207°	372°	129	150	267	342	^(29%)	^(24%)
Right	14	** (2%)	66	85	42	61	** (29%)	** (24%)			
6	Route 17 and Generals Way/ Mariners Way	Unsignalized	Generals Way		Mariners Way		Route 17		Route 17		
			Left								
			Through					+	2	322	417
Right	78	52	‡	0	+	+	49	277			

† No queue reported. Movement does not have conflicting volumes.

‡ Movement volume is zero.

\*(X%) Maximum queue extends full length of storage bay for X% of the analysis period.

\*\* (Y%) Queue in lane adjacent to storage bay extends beyond end of storage bay for Y% of the analysis period.

^(Z%) Maximum queue extends back to the upstream intersection for Z% of the analysis period.

° Lane group contains a shared left/through movement.



Table 11: 2023 Existing Conditions Peak Hour Maximum Queue (2)

Intersection Number and Description	Type of Control	Lane Group	Maximum Queue (feet)								
			Eastbound		Westbound		Northbound		Southbound		
			AM	PM	AM	PM	AM	PM	AM	PM	
5	Route 17 and Roberts Furniture/ Hart Building	Unsignalized	Hart Building		Roberts Furniture		Route 17		Route 17		
			Left	‡	69	12	27	21	41	22	24
			Through	†				†	†	†	†
4	Route 17 and Tractor Supply Co	Unsignalized	Tractor Supply Co				Route 17		Route 17		
			Left	‡	^(5%)			33	49	‡	38
			Through					†	†	†	†
3	Route 17 and Greene Dr	Unsignalized	Greene Dr				Route 17		Route 17		
			Left	72	426			56	71		
			Through					†	†	†	†
2	Route 17 and Whites Rd	Unsignalized	Whites Rd		Driveway		Route 17		Route 17		
			Left					59	31	21	48
			Through	54	52	0	0	†	†	†	†
1	Route 17 and Old York Hampton Hwy/ Faulkner Rd	Signalized	Faulkner Rd		Old York-Hampton Hwy		Route 17		Route 17		
			Left			^(14%)	^(26%)	58	** (5%)	44	** (5%)
			Through	39	46	** (14%)	** (26%)	292	354	226	415
X	Route 17 and Denbigh Blvd/ Goodwin Neck Rd	Signalized	Denbigh Blvd		Goodwin Neck Rd		Route 17		Route 17		
			Left	243	*(2%)*(67%)	*(1%)*(34%)	*(1%)*(20%)	190	** (17%)	** (38%)	** (36%)
			Through	282°	^(48%)°	463°	377°	396	^(4%)	1286	1228
			Right	133	*(2%)*(67%)	** (34%)	** (20%)	** (6%)	** (40%)	*(2%)*(25%)	*(1%)*(25%)

† No queue reported. Movement does not have conflicting volumes.

‡ Movement volume is zero.

\*(X%) Maximum queue extends full length of storage bay for X% of the analysis period.

\*\* (Y%) Queue in lane adjacent to storage bay extends beyond end of storage bay for Y% of the analysis period.

^(Z%) Maximum queue extends back to the upstream intersection for Z% of the analysis period.

° Lane group contains a shared left/through movement.

### 1.6.4 No-Build Conditions Traffic Operations Analysis

Traffic operational analyses were conducted to evaluate the overall performance of the study corridor 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.

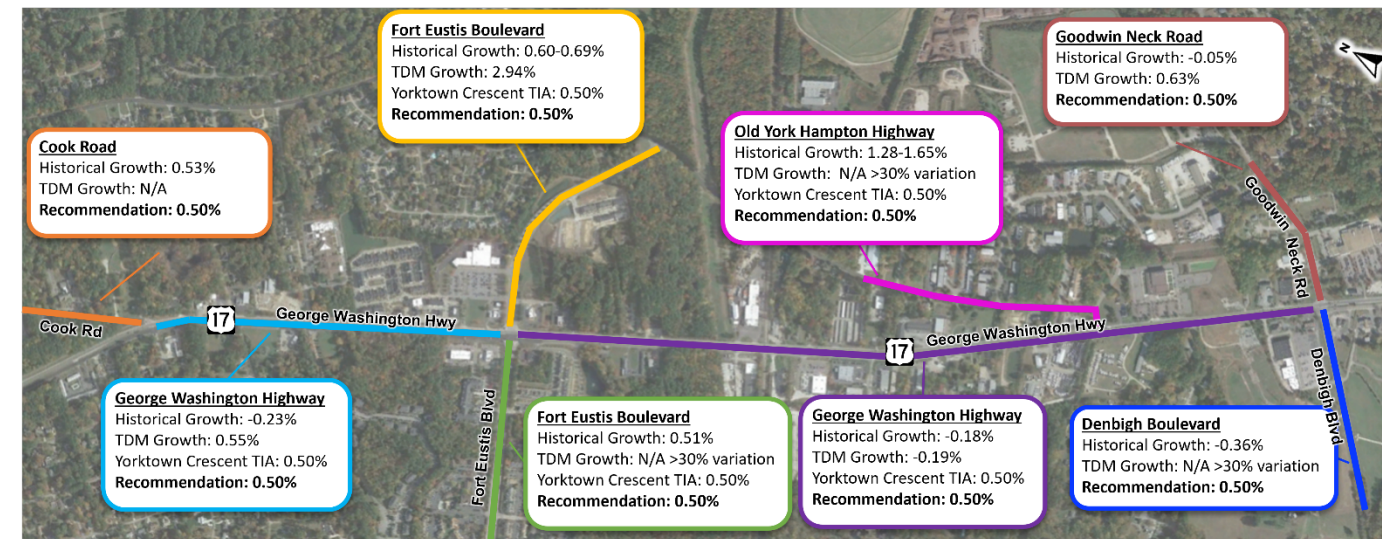
#### No-Build 2045 Volume Development

The following sources were reviewed to determine the background growth rates to apply to existing 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 annual average daily traffic (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.
- Previous study**  
 Growth rates from the Yorktown Crescent Traffic Impact Analysis (September 2023) were reviewed and compared to the other sources.

**Figure 39** presents the recommended linear background growth rates and the growth rates determined from historical volumes, the HRTPO TDM, and the Yorktown Crescent Traffic Impact Analysis. The study team recommended and VDOT approved a 0.5% per year linear growth rate as a background growth rate for all roads and road segments in the study area.

Figure 39: Background Traffic Growth Rates



The study team applied the 0.5% background growth rate to the existing (2023) volumes. The study team added the Yorktown Crescent development trips and the other pending development trips from the Yorktown Crescent Traffic Impact Analysis. **Figure 40** and **Figure 41** show the 2045 No-Build peak hour volumes.

The potential future Yorktown Crescent development is expected to generate over 12,000 new vehicle trips per day, including over 800 vehicle trips in the PM peak hour. Development volumes were added in accordance with the Yorktown Crescent Traffic Impact Analysis, which included over 570 vehicles at the intersection of Route 17 and Fort Eustis Boulevard in the PM peak hour. Additional turning movement volumes were also added, per the Yorktown Crescent TIA to Mariners Way and a new entrance south of Mariners Way in front of the Crown Inn. Development volumes were carried through on Route 17 through the entirety of the HR09 study area.



Figure 40: 2045 No-Build Peak Hour Volumes (1)

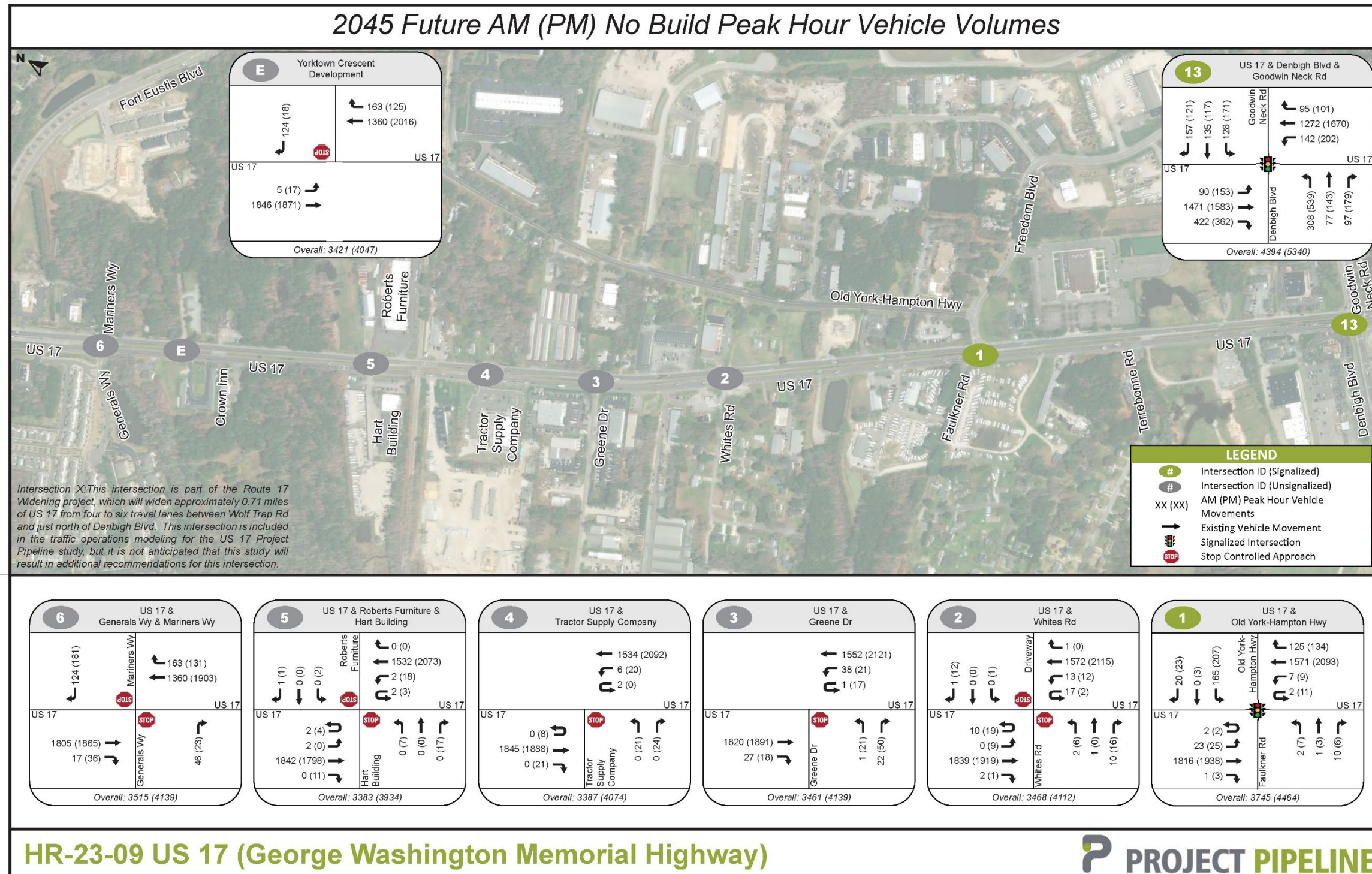
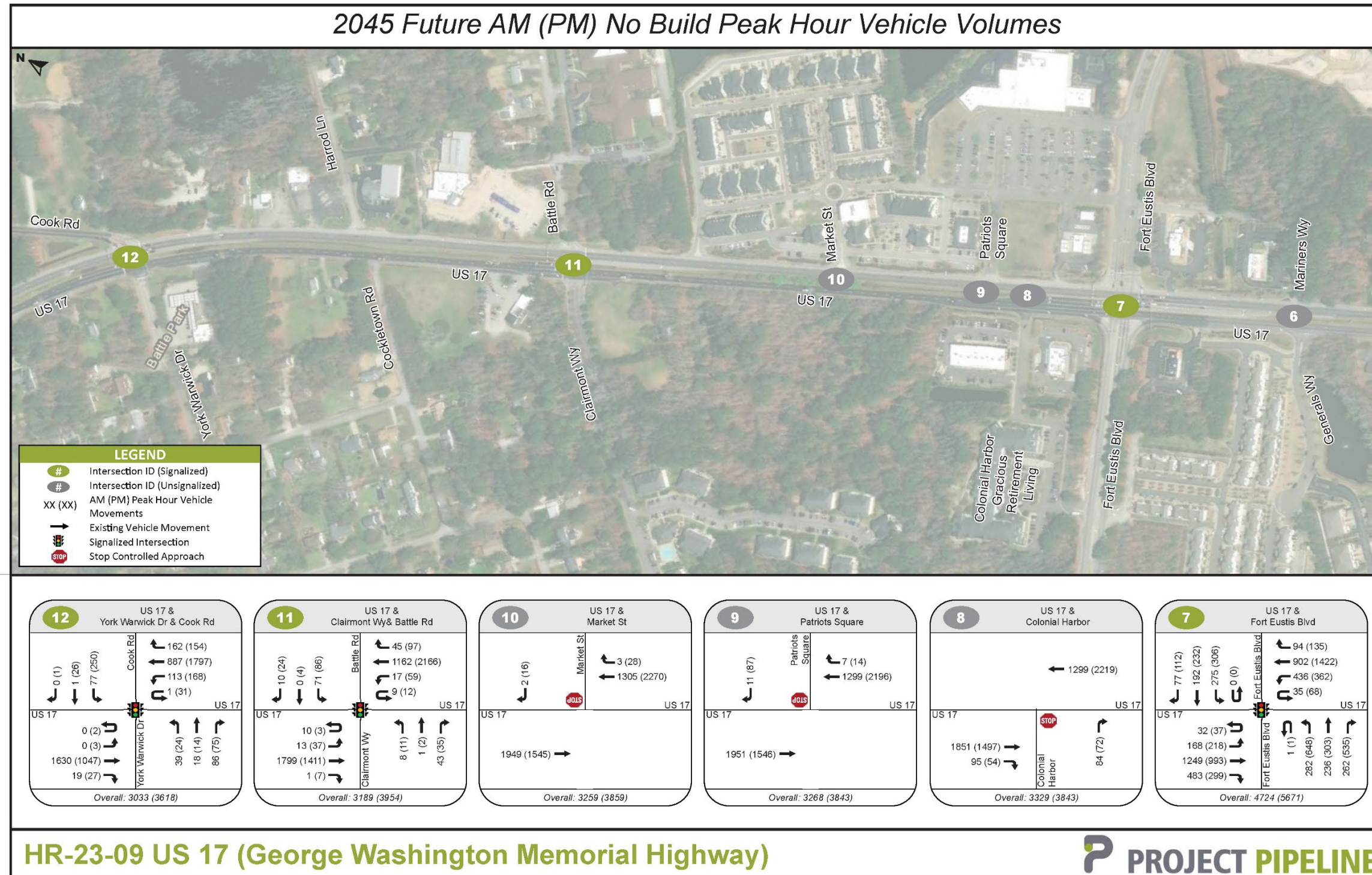




Figure 41: 2045 No-Build Peak Hour Volumes (2)





## No-Build Synchro and SimTraffic Model Development

No-Build conditions were modeled using Synchro 11 and SimTraffic 11 for the entire study area. The existing conditions Synchro models were used as a basis 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 anticipated roadway improvements, which include:

- Widening of Route 17 at the intersection with Denbigh Boulevard/Goodwin Neck Road from two lanes to three lanes in each direction. The widening project limits begin approximately 500 feet to the north of Denbigh Boulevard. The intersection of Route 17 and Denbigh Boulevard/Goodwin Neck Road is the only intersection in the HR-09 study area that is affected by this widening project. The remainder of Route 17 in the HR-09 study area remains two lanes in each direction.
- Restriping the eastbound and westbound approaches of Fort Eustis Boulevard as indicated in the Yorktown Crescent Traffic Impact Analysis.
- Constructing a new entrance with a directional median opening off of Route 17 to the Yorktown Crescent development as proposed in the Yorktown Crescent Traffic Impact Analysis. This new entrance is located approximately 150 feet north of the existing median opening in front of the Crown Inn. The new directional median will allow left turns from southbound Route 17 while restricting outbound (i.e. westbound) left turns.

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 Version 2.0.

## No-Build Results Traffic Operations Analysis Results

Ten simulations were conducted for both the AM and PM No-Build SimTraffic models. The same measures of effectiveness of control delay (seconds per vehicle), LOS, and maximum queue lengths (feet) as in the existing conditions were selected to quantitatively report the performance of each study intersection. The full Synchro and SimTraffic reports are included in **Appendix F** and shown in **Table 12** through **Table 15**.

Findings from the No-Build traffic analysis are summarized below:

- Three of the five signalized intersections continue to operate at LOS D or better overall in both AM and PM peak hours:
  - Route 17 at Cook Road/York Warwick Drive
  - Route 17 at Clairmont Way/Battle Road
  - Route 17 at Old York-Hampton Highway/Faulkner Road

- The widening of Route 17 at the signalized intersection of Denbigh Boulevard/Goodwin Neck Road allows the intersection to continue to operate at overall LOS D in the AM peak hour and LOS E in the PM peak hour despite the increases in traffic volumes. In the PM peak hour, delays decrease on Route 17 southbound and Denbigh Boulevard eastbound, while delays increase on Route 17 northbound and Goodwin Neck Road westbound. Despite the increase in capacity from the widening to three lanes, demand exceeds capacity on most approaches. Maximum queues extend to the upstream intersection or the edge of the link length in both peak hours in the westbound and northbound approaches, and in the PM peak hour in the eastbound approach.
- Operations at the intersection of Route 17 and Fort Eustis Boulevard worsen. The overall intersection degrades from LOS C to LOS D in the AM peak hour and from LOS D to LOS F in the PM peak hour. The additional trips from the Yorktown Crescent development place further strain on the intersection's capacity, especially in the westbound direction, which operates at LOS F in both peak hours. The average control delay for the intersection overall in the PM peak hour doubles, increasing from 41 seconds to 82 seconds.
- The southbound Route 17 approach continues to back up from the Fort Eustis Boulevard intersection with increasing frequency and longer queues. In existing conditions, the maximum southbound queue in the AM peak hour backs up from Fort Eustis Boulevard to 112 feet north of Market Street. In No-Build conditions, the maximum southbound AM peak hour queue extends back past Cook Road. The southbound queue blocks the Colonial Harbor entrance 18% of the analysis period in existing AM conditions. In No Build, it blocks the entrance 50% of the analysis period.
- The eastbound Colonial Harbor entrance queue extends beyond the 328-foot link length 33 percent of the AM peak hour in existing conditions. This increases to 93 percent in No Build conditions. This queue also extends beyond the link length 24 percent of the PM peak hour in No Build conditions. The southbound queues make it nearly impossible for vehicles to exit this entrance.
- Queues on southbound Route 17 at Generals Way resulting from the weaving section in front of Bojangle's increase and begin to interfere with operations at the Fort Eustis Boulevard intersection.
- At the intersection of Route 17 and Old York-Hampton Highway, the westbound Old York-Hampton Highway queue extends past and blocks the intersection with Freedom Boulevard with increasing frequency.

- At the intersection of Route 17 and Cook Road/York Warwick Drive, movements on Route 17 operate at LOS D or better in both peak hours. Delays for southbound through vehicles increase by 22 seconds in the PM peak hour from LOS C to LOS D, while delays for northbound vehicles decrease. Delays on side-street movements generally increase, some increasing to LOS F. Southbound queues extend past the 1,700-foot link length in 14 percent of the AM peak hour, underscoring the need for more efficient signal operations to more efficiently process the demand on Route 17.
- At the intersection of Route 17 and Battle Road/Clairmont Way, delays on the low-volume westbound Battle Road approach double to over 2 minutes in the PM peak hour, while delays for other movements decrease. The intersection continues to operate at overall LOS C or better in both peak hours. The southbound Route 17 queue continues to back up at this intersection due to increased demand.
- Side-street approaches at the unsignalized intersections in the southern portion of the corridor continue to degrade as volume increases on Route 17 make it increasingly difficult to find a gap. Control delays at these low-volume approaches increase as it becomes increasingly difficult to find gaps. This is especially true in the PM peak hour at the following intersections:
  - Route 17 at Roberts Furniture/Hart Building
  - Route 17 at Tractor Supply Co.
  - Route 17 at Greene Drive
  - Route 17 at Whites Road
- Delays for the left turns from Route 17 also increase at the unsignalized intersections, as gaps in oncoming traffic become increasingly rare.



Table 12: 2045 No-Build Conditions Peak Hour and LOS (1)

Intersection Number and Description	Type of Control	Lane Group	Eastbound				Westbound				Northbound				Southbound				Overall	
			AM		PM		AM		PM		AM		PM		AM		PM		AM	PM
			Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS		
12	Signalized	York Warwick Drive		Cook Rd		Route 17				Route 17				Intersection						
		Left	98.9	F	80.1	F	69.0	E	95.6	F	43.5	D	30.7	C	‡	‡	28.6	C	Delay	Delay
		Through									5.5	A	7.5	A	31.5	C	46.6	D	26.1	28.8
		Right	55.4	E	62.9	E					9.6	A	1.3	A					LOS	LOS
		Approach	72.7	E	68.6	E	69.0	E	95.6	F	9.8	A	9.2	A	31.5	C	46.5	D	C	C
11	Signalized	Clairmont Way		Battle Rd		Route 17				Route 17				Intersection						
		Left									15.1	B	7.2	A	2.0	A	24.3	C	Delay	Delay
		Through	57.0	E	65.4	E	55.3	E	136.5	F	3.9	A	17.6	B	4.3	A	3.3	A	6.5	16.2
		Right									8.1	A	8.9	A	7.9	A	9.4	A	LOS	LOS
		Approach	57.0	E	65.4	E	55.3	E	136.5	F	4.3	A	16.9	B	4.3	A	3.9	A	A	B
10	Unsignalized	Market St		Route 17				Route 17				Intersection								
		Left									‡	‡	‡	‡	‡	‡	‡	‡	-	-
		Through									16.0	C	29.7	D	‡	‡	‡	‡	LOS	LOS
		Right									16.0	C	29.7	D	0.0	A	0.0	A	-	-
		Approach								0.0	A	0.0	A	0.0	A	0.0	A	-	-	
9	Unsignalized	Patriots Square		Route 17				Route 17				Intersection								
		Left									‡	‡	‡	‡	‡	‡	‡	‡	-	-
		Through									14.6	B	36.9	E	‡	‡	‡	‡	LOS	LOS
		Right									14.6	B	36.9	E	0.0	A	0.0	A	-	-
		Approach								0.0	A	0.0	A	0.0	A	0.0	A	-	-	
8	Unsignalized	Colonial Harbor		Route 17				Route 17				Intersection								
		Left									‡	‡	‡	‡	‡	‡	‡	‡	-	-
		Through									‡	‡	‡	‡	‡	‡	‡	‡	LOS	LOS
		Right	39.7	E	22.7	C					0.0	A	0.0	A	0.0	A	0.0	A	-	-
		Approach	39.7	E	22.7	C												-	-	
7	Signalized	Fort Eustis Blvd		Fort Eustis Blvd		Route 17				Route 17				Intersection						
		Left	52.6	D	75.2	E	111.7	F	135.1	F	89.6	F	74.8	E	36.9	D	84.2	F	Delay	Delay
		Through	109.4	F	66.7	E	94.2	F	113.6	F	32.3	C	71.2	E	47.6	D	39.7	D	52.8	77.8
		Right	47.5	D	166.2	F	48.2	D	54.3	D	22.2	C	26.0	C	11.9	B	48.3	D	LOS	LOS
		Approach	68.1	E	106.2	F	92.6	F	109.1	F	50.0	D	68.9	E	37.6	D	48.7	D	D	E
6	Unsignalized	Generals Way		Mariners Way		Route 17				Route 17				Intersection						
		Left									‡	‡	‡	‡	‡	‡	‡	‡	-	-
		Through									‡	‡	‡	‡	‡	‡	‡	‡	LOS	LOS
		Right	23.9	C	20.0	C	25.0	C	71.8	F	‡	‡	‡	‡	‡	‡	‡	‡	-	-
		Approach	23.9	C	20.0	C	25.0	C	71.8	F	0.0	A	0.0	A	0.0	A	0.0	A	-	-

† Synchro does not provide level of service or delay for movements with no conflicting volumes.  
‡ Movement volume is zero.  
\* Lane group contains a shared left/through movement.  
\*\* Movement is a U-turn only, not a left turn.

Table 13: 2045 No-Build Conditions Peak Hour and LOS (2)

Intersection Number and Description	Type of Control	Lane Group	Eastbound				Westbound				Northbound				Southbound				Overall		
			AM		PM		AM		PM		AM		PM		AM		PM		AM	PM	
			Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS			
5	Route 17 and Roberts Furniture/ Hart Building	Unsignalized	Hart Building				Roberts Furniture				Route 17				Route 17				Intersection		
			Left	‡	‡	44.7	E	16.1	C	86.9	F	34.2	D	25.3	D	23.4	C	67.2	F	Delay	Delay
			Through	‡	‡							†	†	†	†	†	†	†	†	-	-
			Right	‡	‡							†	†	†	†	†	†	†	†	LOS	LOS
		Approach	0.0	A	44.7	E	16.1	C	86.9	F	0.1	A	0.3	A	0.1	A	0.1	A	-	-	
4	Route 17 and Tractor Supply Co	Unsignalized	Tractor Supply Co								Route 17				Route 17				Intersection		
			Left	†	†	83.5	F					26.3	D	17.4	C	‡	‡	84.8**	F	Delay	Delay
			Through									†	†	†	†	†	†	†	†	-	-
			Right	†	†	20.1	C									†	†	†	†	LOS	LOS
		Approach	0.0	A	49.7	E				0.1	A	0.2	A	0.0	A	0.4	A	-	-		
3	Route 17 and Greene Dr	Unsignalized	Greene Dr								Route 17				Route 17				Intersection		
			Left	23.4	C	85.3	F					19.7	C	55.6	F					Delay	Delay
			Through									†	†	†	†	†	†	†	†	-	-
			Right	23.4	C	85.3	F									†	†	†	†	LOS	LOS
		Approach	23.4	C	85.3	F				0.5	A	1.0	A	0.0	A	0.0	A	-	-		
2	Route 17 and Whites Rd	Unsignalized	Whites Rd				Driveway				Route 17				Route 17				Intersection		
			Left									43.2	E	24.2	C	34.3	D	87.7	F	Delay	Delay
			Through	39.1	E	53.2	F	25.6	D	23.2	C	†	†	†	†	†	†	†	†	-	-
			Right	39.1	E	53.2	F	25.6	D	23.2	C	†	†	†	†	†	†	†	†	LOS	LOS
		Approach	39.1	E	53.2	F	25.6	D	23.2	C	0.8	A	0.2	A	0.2	A	1.3	A	-	-	
1	Route 17 and Old York Hampton Hwy/ Faulkner Rd	Signalized	Faulkner Rd				Old York Hampton Hwy				Route 17				Route 17				Intersection		
			Left					89.6	F	117.1	F	269.3	F	102.4	F	77.9	E	68.9	E	Delay	Delay
			Through	59.0	E	70.2	E	47.0	D	51.9	D	7.7	A	14.4	B	21.1	C	26.3	C	19.0	25.0
			Right									0.2	A	0.0	A					LOS	LOS
		Approach	59.0	E	70.2	E	85.1	F	109.8	F	8.5	A	14.3	B	21.8	C	26.9	C	B	C	
X	Route 17 and Denbigh Blvd/ Goodwin Neck Rd	Signalized	Denbigh Blvd				Goodwin Neck Rd				Route 17				Route 17				Intersection		
			Left	79.6	E	104.2	F	42.5	D	55.3	E	35.1	D	69.6	E	39.3	D	72.6	E	Delay	Delay
			Through	79.6*	E	98.8*	F	79.4	E	129.6	E	39.1	D	64.0	E	35.0	C	40.7	D	42.7	63.1
			Right	45.6	D	43.9	D					27.2	C	30.2	C	28.0	C	54.9	D	LOS	LOS
		Approach	72.8	E	89.5	F	68.2	E	98.6	F	38.0	D	62.9	E	33.7	C	45.5	D	D	E	
E	Route 17 and new Yorktown Crescent entrance	Unsignalized					New Driveway				Route 17				Route 17				Intersection		
			Left													14.6	B	23.8	C	Delay	Delay
			Through									†	†	†	†	†	†	†	†	-	-
			Right					17.5	C	24.1	C	†	†	†	†					LOS	LOS
		Approach				17.5	C	24.1	C	0.0	A	0.0	A	0.0	A	0.2	A	-	-		

† Synchro does not provide level of service or delay for movements with no conflicting volumes.

‡ Movement volume is zero.

\* Lane group contains a shared left/through movement.

\*\* Movement is a U-turn only, not a left turn.



Table 14: 2045 No-Build Conditions Peak Hour Maximum Queue (1)

Intersection Number and Description		Type of Control	Lane Group	Maximum Queue (feet)							
				Eastbound		Westbound		Northbound		Southbound	
				AM	PM	AM	PM	AM	PM	AM	PM
12	Route 17 and Cook Rd/ York Warwick Dr	Signalized	Left	York Warwick Dr		Cook Rd		Route 17		Route 17	
			Through	125	115	162	398	159	228	‡ **(42%)	** (6%)
			Right	111	94			142	181	^(14%)	381
11	Route 17 and Clairmont Way/ Battle Rd	Signalized	Left	Clairmont Way		Battle Rd		Route 17		Route 17	
			Through	102	89	189	314	80	100	** (40%)	** (2%)
			Right					14	27	^(1%)	208
10	Route 17 and Market St	Unsignalized	Left	Market St		Route 17		Route 17		Route 17	
			Through					†	†	^(8%)	404
			Right			0 0		†	†		
9	Route 17 and Patriots Square	Unsignalized	Left	Patriots Square		Route 17		Route 17		Route 17	
			Through					†	†	^(37%)	^(12%)
			Right			35 72		†	†		
8	Route 17 and Colonial Harbor	Unsignalized	Left	Colonial Harbor		Route 17		Route 17		Route 17	
			Through					†	†	^(50%)	^(35%)
			Right	^(93%)	^(39%)						
7	Route 17 and Fort Eustis Blvd	Signalized	Left	Fort Eustis Blvd		Fort Eustis Blvd		Route 17		Route 17	
			Through	** (2%) ^ (1%) *(18%)** (54%) ^ (39%)	** (1%)** (14%)	** (1%)** (9%)	381	** (1%)	** (49%)	*(4%)** (41%)	
			Right	^(3%)	^(58%)	399°	342°	397	^(1%)	^(51%)	^(42%)
6	Route 17 and Generals Way/ Mariners Way	Unsignalized	Left	Generals Way		Mariners Way		Route 17		Route 17	
			Through					†	11	415	506
			Right	83	55	0	0	14	2	66	485

† No queue reported. Movement does not have conflicting volumes.

‡ Movement volume is zero.

\*(X%) Maximum queue extends full length of storage bay for X% of the analysis period.

\*\* (Y%) Queue in lane adjacent to storage bay extends beyond end of storage bay for Y% of the analysis period.

^(Z%) Maximum queue extends back to the upstream intersection for Z% of the analysis period.

° Lane group contains a shared left/through movement.

Table 15: 2045 No-Build Conditions Peak Hour Maximum Queue (2)

Intersection Number and Description	Type of Control	Lane Group	Maximum Queue (feet)								
			Eastbound		Westbound		Northbound		Southbound		
			AM	PM	AM	PM	AM	PM	AM	PM	
5	Route 17 and Roberts Furniture/ Hart Building	Unsignalized	Hart Building		Roberts Furniture		Route 17		Route 17		
			Left	‡	60	14	30	21	60	24	27
			Through	†				†	†	†	†
4	Route 17 and Tractor Supply Co	Unsignalized	Tractor Supply Co				Route 17		Route 17		
			Left	‡	99			30	45	‡	34
			Through	†				†	†	†	†
3	Route 17 and Greene Dr	Unsignalized	Greene Dr				Route 17		Route 17		
			Left	69	622			76	77		
			Through	†				†	†	†	†
2	Route 17 and Whites Rd	Unsignalized	Whites Rd		Driveway		Route 17		Route 17		
			Left			0	0	50	28	17	51
			Through	62	150			†	†	†	†
1	Route 17 and Old York Hampton Hwy/Faulkner Rd	Signalized	Faulkner Rd		Old York-Hampton Hwy		Route 17		Route 17		
			Left			*(42%)^(4%)	*(58%)^(11%)	43	66	59	** (4%)
			Through	41	47	** (42%)	** (58%)	214	165	178	410
X	Route 17 and Denbigh Blvd/ Goodwin Neck Rd	Signalized	Denbigh Blvd		Goodwin Neck Rd		Route 17		Route 17		
			Left	311	*(1)**(39%)	*(1)**(53%)	*(1)**(50%)	*(1)**(80%)	*(1)**(77%)	267	** (1%)
			Through	346°	^(13%)°	^(5%)	^(5%)	^(68%)	^(88%)	378	453
E	Route 17 and new Yorktown Crescent entrance	Unsignalized	New Driveway		Route 17		Route 17		Route 17		
			Left							31	52
			Through			59	44	†	†	†	†

† No queue reported. Movement does not have conflicting volumes.

‡ Movement volume is zero.

\*(X%) Maximum queue extends full length of storage bay for X% of the analysis period.

\*\* (Y%) Queue in lane adjacent to storage bay extends beyond end of storage bay for Y% of the analysis period.

^(Z%) Maximum queue extends back to the upstream intersection for Z% of the analysis period.

° Lane group contains a shared left/through movement.



### 1.6.5 Phase 1 Public Outreach

The goal of public outreach during Phase 1 of the HR09 Project Pipeline study was to solicit public feedback on existing conditions, including the public's priorities and perceptions of the corridor, and inform the public of the study efforts and goals.

Public outreach during Phase 1 consisted of an online survey using PublicInput.com. This survey listed the needs identified for Route 17 and asked the public if they agree with these needs. The survey also asked the public to rank the most important issues and identify other issues along the study corridor not already identified.

The survey was open for public responses from September 6, 2023, through September 20, 2023. A total of 602 people responded to the survey and provided 889 individual comments in addition to answering the survey questions.

Participants ranked reducing traffic congestion and corridor safety/intersection safety as the two most important issues along the study area. Speeding/aggressive driving and running red lights were identified as the greatest safety issues. The full survey responses including all comments are provided in **Appendix G**.

Common themes from the written comments included:

- Need to widen to 3 lanes each direction.
- Speeding cited as a top issue needing to be addressed.
- Sidewalks and pedestrian crossings across Route 17 are needed. Separate off-road bicycle paths are needed.
- Traffic signals need to be better coordinated.
- Drivers frequently run red lights. Close calls with left turns on flashing yellow arrows.
- Plant more trees and vegetation to make the road more aesthetically pleasing. Preserve the rural charm of York County.
- Lack of right turn lanes for business entrance access.
- Left turn lanes at intersections are not long enough.
- Poor pavement condition. Roadway needs to be repaved.
- Poor drainage and flooding, especially near the railroad tracks.
- Streetlights are burnt out.

## 2 Alternatives Development & Refinement

The study team developed alternative concepts along Route 17 to enhance multimodal access and address safety and geometric deficiencies in the study area.

The study team screened the alternatives based on anticipated safety benefits, operational performance, multimodal access, constructability, and input from the SWG.

The Phase 2 alternatives were presented to the public in an online survey. Based on the results from the Phase 2 screening and the online survey, the SWG identified a preferred alternative for moving into Phase 3. The online survey results and selection of the preferred alternative are documented in **Chapter 3**.

### 2.1 Phase 1 Alternative Development

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

- Improve operations at intersections in the study area, thereby increasing and preserving capacity at key congestion hot-spots along the corridor
- Mitigate safety issues at signalized intersections by reducing conflict points, especially for movements with identified crash patterns
- Enhance pedestrian access throughout the study area by providing crosswalks and sidewalks at key locations

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

#### 2.1.1 Alternatives Addressing Traffic Operations and Safety Needs

The study team examined each intersection and identified potential concepts both at specific intersections and for the corridor as a whole. The study team conducted a high-level traffic operations and safety analysis of the four signalized intersections in the study corridor following the Virginia Intersection and Interchange Control Assessment Program (iCAP) process.

The Virginia Junction Screening Tool (VJuST) and iCAP tools, which are used to screen intersection and interchange alternatives based on impacts to traffic operations, pedestrian accommodations, safety, and cost; were used to develop initial alternatives, including innovative intersection configurations, to improve traffic operations and address safety issues identified in **Chapter 1**.

The following potential concepts were identified and considered through the iCAP Stage 1 assessment. Concepts marked with an asterisk(\*) are innovative intersection configurations explained in more detail on VDOT's Innovative Intersections webpage: [https://virginiadot.org/info/innovative\\_intersections\\_and\\_interchanges/virginia\\_icap.asp](https://virginiadot.org/info/innovative_intersections_and_interchanges/virginia_icap.asp). Descriptions, illustrations, and examples of these kinds of intersections are provided in the link above.

The iCAP Stage 1 results for the PM peak hour for all alternatives analyzed are provided in **Figures 42** through **45**. VJuST outputs are provided in **Appendix H**.

#### *Route 17 at Cook Road/York Warwick Drive*

- Conventional intersection with unsplit side-street phasing
- Median U-Turn\*
- Restricted Crossing U-Turn\*
- Thru-Cut\*

#### *Route 17 at Clairmont Way/Battle Road*

- Conventional intersection with unsplit side-street phasing
- Median U-Turn\*
- Partial Median U-Turn\*
- Restricted Crossing U-Turn\*
- Thru-Cut\*

#### *Route 17 at Fort Eustis Boulevard*

- Conventional intersection with unsplit side-street phasing, additional eastbound approach lane, and additional full-width exclusive eastbound left and right turn lanes.
- Center Turn Overpass\*
- Partial Displaced Left Turn\* displacing the southbound and northbound Route 17 left turns
- Quadrant Roadway\* in the northwest quadrant behind the Colonial Harbor retirement apartments
- Thru-Cut\*
- Eastbound Left Turn Overpass – a new ramp in the median and above the intersection allowing eastbound left turns from Fort Eustis Blvd to northbound Route 17 to go up and over the intersection, and merge back in from the median north of the intersection.



Route 17 at Old York-Hampton Highway/Faulkner Road

- Conventional intersection with unsplit side-street phasing and realigned Faulkner Road approach to align directly with intersection.
- Continuous Green-T\*
- Median U-Turn\*
- Restricted Crossing U-Turn\*
- Thru-Cut\*

Corridor-wide Improvements

- Review of posted speed limit and consideration of lowering speed limit
- Review of access spacing and compliance with VDOT access spacing standards
- Analysis of turn lanes, including deceleration lanes for entrances

Alternative concepts were not developed for the intersection of Route 17 at Denbigh Boulevard/ Goodwin Neck Road because of the Route 17 Widening Project already in design at this intersection

Figure 42: iCAP Stage 1 Results – PM Peak Hour – Route 17 and Cook Road/York Warwick Drive

Metric Weighting (Based on Purpose and Need)		Traffic Operations		Pedestrian		Safety		Stage 1 Cost		Total Possible Score
		Traffic Operations Weight		Pedestrian Weight		Safety Weight		Stage 1 Cost Weight		
		2		1		3		1		
Alternatives		VJuST Maximum V/C Ratio	Traffic Operations Metric MOE Score	VJuST Accommodation Compared to Conventional	Traffic Operations Metric MOE Score	VJuST Weighted Total Conflict Points	Safety Metric MOE Score	VJuST Planning Level Cost Category	Stage 1 Cost Metric MOE Score	Total Stage 1 Score
Existing	Conventional	0.72	--	0	--	48	--		--	
Alternative 1^	Conventional w/ unsplit side-street phasing	0.70	1.0	0	0.5	48	0.0	\$\$	1.0	3.5 out of 7
Alternative 2^	Median U-Turn NB-SB	0.83	0.0	+	1.0	20	1.0	\$\$	1.0	5.0 out of 7
Alternative 3^	Restricted Crossing U-Turn NB-SB	0.75	0.0	0	0.5	20	1.0	\$\$	1.0	4.5 out of 7
Alternative 4^	Thru-Cut	0.71	0.5	0	0.5	28	0.7	\$\$	1.0	4.6 out of 7

^Alternative carried forward to Stage 2

Figure 43: iCAP Stage 1 Results – PM Peak Hour – Route 17 and Battle Road/Clairmont Way

Metric Weighting (Based on Purpose and Need)		Traffic Operations		Pedestrian		Safety		Stage 1 Cost		Total Possible Score
		Traffic Operations Weight		Pedestrian Weight		Safety Weight		Stage 1 Cost Weight		
		2		1		3		1		
Alternatives		VJuST Maximum V/C Ratio	Traffic Operations Metric MOE Score	VJuST Accommodation Compared to Conventional	Traffic Operations Metric MOE Score	VJuST Weighted Total Conflict Points	Safety Metric MOE Score	VJuST Planning Level Cost Category	Stage 1 Cost Metric MOE Score	Total Stage 1 Score
Existing	Conventional	0.78	--	0	--	48	--		--	
Alternative 1^	Conventional w/ unsplit side-street phasing	0.78	0.0	0	0.5	48	0.0	\$\$	1.0	1.5 out of 7
Alternative 2^	Median U-Turn NB-SB	0.74	1.0	+	1.0	20	1.0	\$\$	1.0	7.0 out of 7
Alternative 3^	Partial Median U-Turn NB-SB	0.78	0.0	+	1.0	28	0.7	\$\$	1.0	4.1 out of 7
Alternative 4^	Restricted Crossing U-Turn NB-SB	0.76	0.5	0	0.5	20	1.0	\$\$	1.0	5.5 out of 7
Alternative 5^	Thru-Cut	0.76	0.5	0	0.5	28	0.7	\$\$	1.0	4.6 out of 7

^Alternative carried forward to Stage 2

Figure 44: iCAP Stage 1 Results – PM Peak Hour – Route 17 and Fort Eustis Boulevard

Metric Weighting (Based on Purpose and Need)		Traffic Operations		Pedestrian		Safety		Stage 1 Cost		Total Possible Score
		Traffic Operations Weight		Pedestrian Weight		Safety Weight		Stage 1 Cost Weight		
		2		1		3		1		
Alternatives		VJuST Maximum V/C Ratio	Traffic Operations Metric MOE Score	VJuST Accommodation Compared to Conventional	Traffic Operations Metric MOE Score	VJuST Weighted Total Conflict Points	Safety Metric MOE Score	VJuST Planning Level Cost Category	Stage 1 Cost Metric MOE Score	Total Stage 1 Score
Existing	Conventional	0.81	--	0	--	48	--		--	
Alternative 1^	Conventional w/ EB approach widening	0.78	0.1	0	0.5	48	0.0	\$\$	1.0	1.7 out of 7
Alternative 2^	Center Turn Overpass	0.51	1.0	+	1.0	32	0.8	\$\$\$\$	0.5	5.9 out of 7
Alternative 3^	Partial Displaced Left Turn NB-SB	0.76	0.2	-	0.0	44	0.2	\$\$\$	0.7	1.7 out of 7
Alternative 4^	Quadrant Roadway N-W	0.70	0.4	0	0.5	40	0.4	\$\$\$	0.7	3.2 out of 7
Alternative 5^	Thru-Cut	0.80	0.0	0	0.5	28	1.0	\$\$	1.0	4.5 out of 7
Alternative 6^	Eastbound Left Turn Overpass	0.61	0.7	+	1.0	37	0.5	\$\$\$\$	0.5	4.7 out of 7

^Alternative carried forward to Stage 2

Figure 45: iCAP Stage 1 Results – PM Peak Hour – Route 17 and Old York-Hampton Highway/Faulkner Road

Metric Weighting (Based on Purpose and Need)		Traffic Operations		Pedestrian		Safety		Stage 1 Cost		Total Possible Score
		Traffic Operations Weight		Pedestrian Weight		Safety Weight		Stage 1 Cost Weight		
		2		1		3		1		
Alternatives		VJuST Maximum V/C Ratio	Traffic Operations Metric MOE Score	VJuST Accommodation Compared to Conventional	Traffic Operations Metric MOE Score	VJuST Weighted Total Conflict Points	Safety Metric MOE Score	VJuST Planning Level Cost Category	Stage 1 Cost Metric MOE Score	Total Stage 1 Score
Existing	Conventional	0.74	--	0	--	48	--		--	
Alternative 1^	Conventional w/ unsplit side-street phasing	0.74	0.0	0	0.5	48	0.0	\$	1.0	1.5 out of 7
Alternative 2^	Continuous Green-T	0.73	1.0	-	0.0	12	1.0	\$\$	0.5	5.5 out of 7
Alternative 3^	Median U-Turn NB-SB	0.73	1.0	+	1.0	20	0.8	\$\$	0.5	5.9 out of 7
Alternative 4^	Restricted Crossing U-Turn NB-SB	0.81	0.0	0	0.5	20	0.8	\$\$	0.5	3.4 out of 7
Alternative 5^	Thru-Cut	0.73	1.0	0	0.5	28	0.6	\$\$	0.5	4.8 out of 7



## 2.1.2 Alternatives Addressing Bicycle and Pedestrian Access and Safety

Alternatives addressing pedestrian access and safety included:

- Installing marked crosswalks across Route 17 and adding pedestrian signals at signalized intersections
- ADA ramp compliance review
- Adding sidewalks to complete the sidewalk network

The concepts that proposed innovative intersections benefit bicycles and pedestrians due to the reduction of signal phases. A reduction of signal phases allows for the possibility of median refuge islands and shortens the distance bicycles and pedestrians must traverse through the intersection.

As mentioned in Section 1.5.2, the Regional Bikeways Plan shows a proposed multi-use path along Freedom Boulevard to connect to Goodwin Neck Road, providing a parallel bicycle facility as an alternative to biking on Route 17.

## 2.1.3 Phase 1 Alternatives Summary

Tables 16 through 19 shows the list of the alternatives considered in Phase 1 and the associated needs addressed by the alternative. Figure 46 shows the preliminary alternatives graphically categorized by the needs addressed by the alternative.

The study team discussed further details of the Phase 1 improvement alternatives during the Phase 1 Brainstorming meeting held with the SWG on August 8, 2023. The meeting materials can be found in Appendix I.

The VJuST screening in the iCAP Stage 1 assessment showed a Safety Metric MOE Score of zero for the conventional alternatives because there would be no reduction in conflict points. However, the intention of these alternatives is to improve intersection operations overall, reducing queue lengths, and potentially reducing rear-end collisions, where were a prevalent crash type at the signalized intersections. Although Tables 16 through 19 show the conventional alternatives do not address the safety needs at these intersections, there could be a safety benefit to these alternatives.

Similarly, some of the alternatives showed the same or a higher V/C ratio in the VJuST screening than the conventional. Tables 16 through 19 show these alternatives as not addressing the congestion need. However, these alternatives were carried forward for more detailed analysis in Phase 2 because the high-level VJuST screening did not account for the Yorktown Crescent development volumes or additional laneage adjustments that could potentially result in better operations.

Table 16: Phase 1 Alternatives and Anticipated Needs Addressed – Route 17 and Cook Road/York Warwick Drive

Improvement	Safety Need	Congestion Need	Pedestrian Need	Bike Need
Conventional w/ unsplit side-street phasing	○	●	●	●
Median U-Turn	●	○	●	●
Restricted Crossing U-Turn	●	○	●	●
Thru-Cut	●	●	●	●

Legend | ● Need exists and is addressed      ○ Need exists and is not addressed      If no circle is present, need is not present

Table 17: Phase 1 Alternatives and Anticipated Needs Addressed – Route 17 and Battle Road/Clairmont Way

Improvement	Safety Need	Congestion Need	Pedestrian Need	Bike Need
Conventional w/ unsplit side-street phasing	○	○	●	●
Median U-Turn	●	●	●	●
Partial Median U-Turn	●	○	●	●
Restricted Crossing U-Turn	●	●	●	●
Thru-Cut	●	●	●	●

Legend | ● Need exists and is addressed      ○ Need exists and is not addressed      If no circle is present, need is not present

Table 18: Phase 1 Alternatives and Anticipated Needs Addressed – Route 17 and Fort Eustis Boulevard

Improvement	Safety Need	Congestion Need	Pedestrian Need	Bike Need
Conventional w/ EB approach widening	○	●	●	●
Center Turn Overpass	●	●	●	●
Partial Displaced Left Turn	●	●	●	●
Quadrant Roadway	●	●	●	●
Thru-Cut	●	○	●	●
Eastbound Left Turn Overpass	●	●	●	●

**Legend** | ● Need exists and is addressed    ○ Need exists and is not addressed    If no circle is present, need is not present

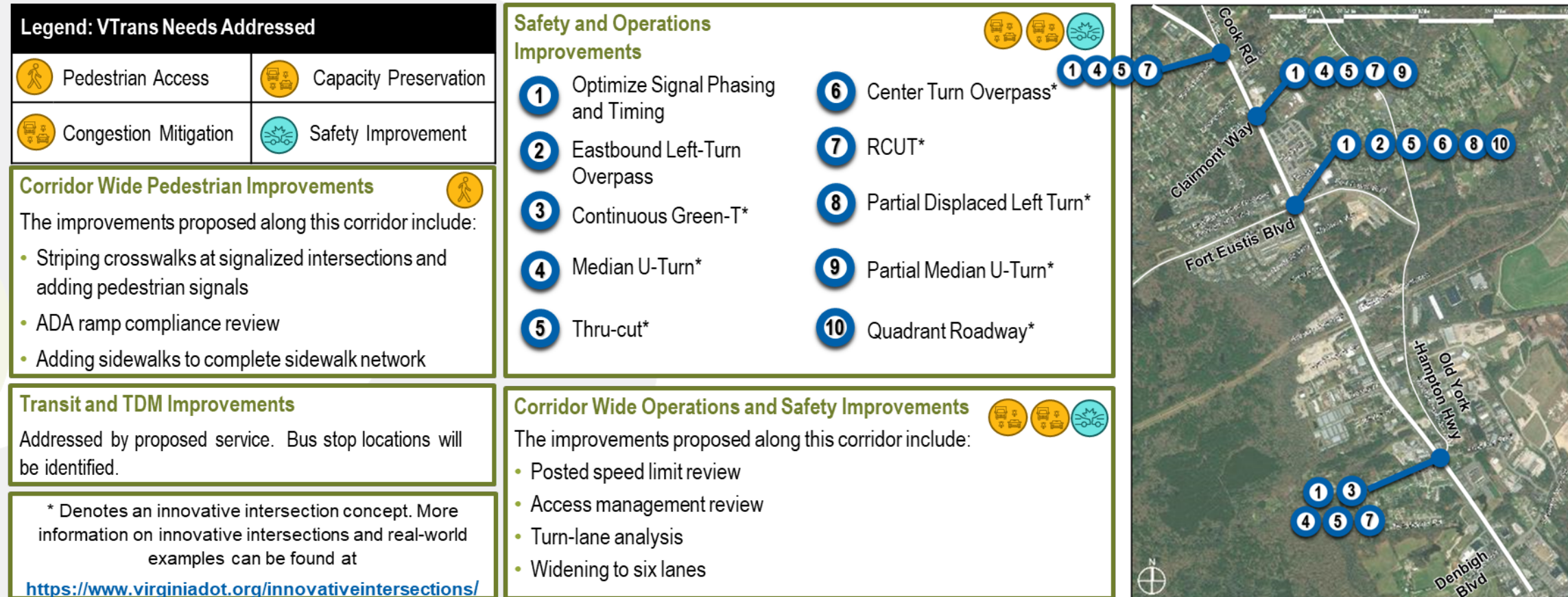
Table 19: Phase 1 Alternatives and Anticipated Needs Addressed – Route 17 and Old York-Hampton Highway/ Faulkner Road

Improvement	Safety Need	Congestion Need	Pedestrian Need	Bike Need
Conventional w/ unsplit side-street phasing	○	○	●	●
Continuous Green-T	●	●	○	●
Median U-Turn	●	●	●	●
Restricted Crossing U-Turn	●	○	●	●
Thru-Cut	●	●	●	●

**Legend** | ● Need exists and is addressed    ○ Need exists and is not addressed    If no circle is present, need is not present



Figure 46: Phase 1 Scoping Level Improvement Alternatives



## 2.2 Phase 2 Alternatives Analysis and Refinement

The study team conducted a two-tier screening of the 20 potential concepts for the four signalized intersections selected for further examination in Phase 1.

### 2.2.1 Tier 1 Screening

In the Tier 1 screening, the study team performed a closer examination of high-level feasibility to narrow down the list of possible options. The Tier 1 screening examined turning movement volumes, including additional projected trips from the Yorktown Crescent development, intersection crashes, and the potential for property impacts.

Figure 47 shows the results of the Tier 1 screening, which eliminated two of the 20 potential concepts, and set aside another two potential concepts. The study team presented the results of the Tier 1 screening at the January 11, 2024, SWG meeting. More information on the Tier 1 screening can be found in the meeting presentation, included in **Appendix I**.

Sixteen of the 20 potential concepts at the four signalized intersections advanced to the Tier 2 screening. The next section describes the 16 concepts advanced to the Tier 2 screening in more detail.

Figure 47: Results of the Tier 1 Screening of Potential Concepts

Safety and Operations Improvements	
1 Optimize Signal Phasing and Timing	6 Center Turn Overpass*
2 Eastbound Left-Turn Overpass	7 RCUT*
3 Continuous Green-T*	8 Partial Displaced Left Turn*
4 Median U-Turn*	9 Partial Median U-Turn*
5 Thru-cut*	10 Quadrant Roadway*

\* Denotes an innovative intersection concept. More information on innovative intersections and real-world examples can be found at <https://www.virginia.gov/innovativeintersections/>

- ✗ Eliminate alternative
- ✘ Set aside alternative (grade separation)
- ✓ Advance to Tier 2 screening





## 2.2.2 Concepts Advanced to Tier 2 Screening

Sixteen potential alternative concepts were selected to advance to the Tier 2 screening. This section describes each concept.

Many of the potential concepts involve innovative intersection configurations that restrict certain turning movements to reduce crash potential, increase capacity, and improve traffic operations. These potential concepts are marked with an asterisk (\*). More information about how these configurations work, including descriptions, illustrations, and examples are available on VDOT's Innovative Intersections webpage:

[https://virginiadot.org/info/innovative\\_intersections\\_and\\_interchanges/virginia\\_icap.asp](https://virginiadot.org/info/innovative_intersections_and_interchanges/virginia_icap.asp).

### Route 17 at Cook Road/York Warwick Drive

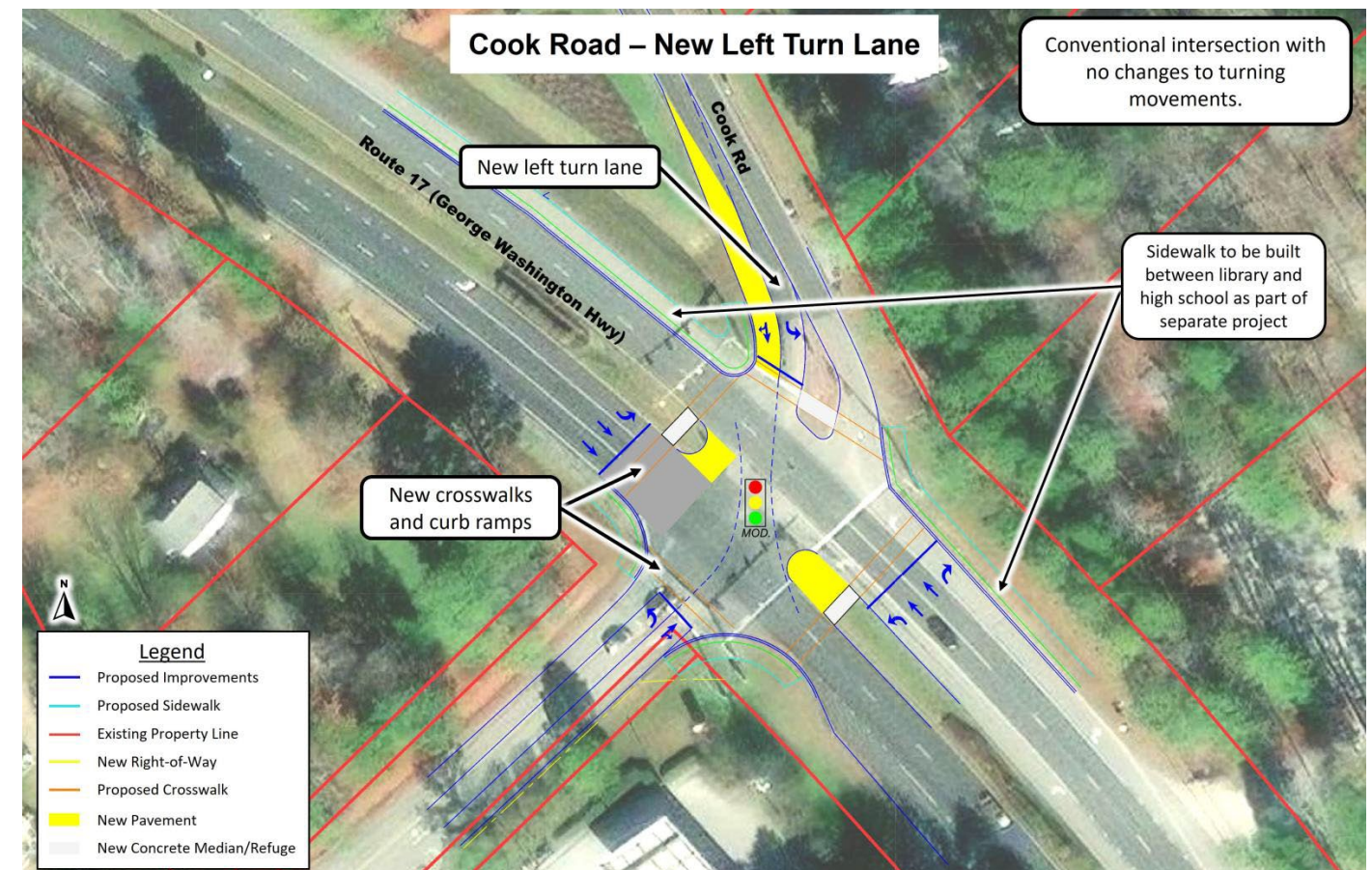
As described previously in various sections in **Chapter 1**, this intersection has an intersection PSI ranking of 28, with 42 crashes over the five-year crash analysis period, 15 of which resulted in injury. 33 of the 42 crashes were rear end or angle crashes. Queues on Route 17 at this intersection were heavy during peak times. This is the first traffic signal on southbound Route 17 for two miles, and average vehicle speeds are 10 mph or more over the 50 mph posted speed limit. Vehicle speeds often contribute to crash severity.

Four potential concepts were advanced to the Tier 2 screening for this intersection. All four concepts show sidewalk along the east side of Route 17 and a crosswalk across the Cook Road approach. This sidewalk and the crosswalk across Cook Road will be constructed as a separate project.

### Concept 1: New Left Turn Lane

This concept retains a conventional intersection with no rerouted movements. It adds a left turn lane along the westbound Cook Road approach, which allows the side-street left turns to run concurrently, removing the split phasing. This concept, like all the other concepts at this intersection, adds crosswalks and curb ramps across all intersection legs. **Figure 48** presents a conceptual sketch of the alternative.

**Figure 48: Phase 2 Alternative – Route 17 at Cook Road – New Left Turn Lane**



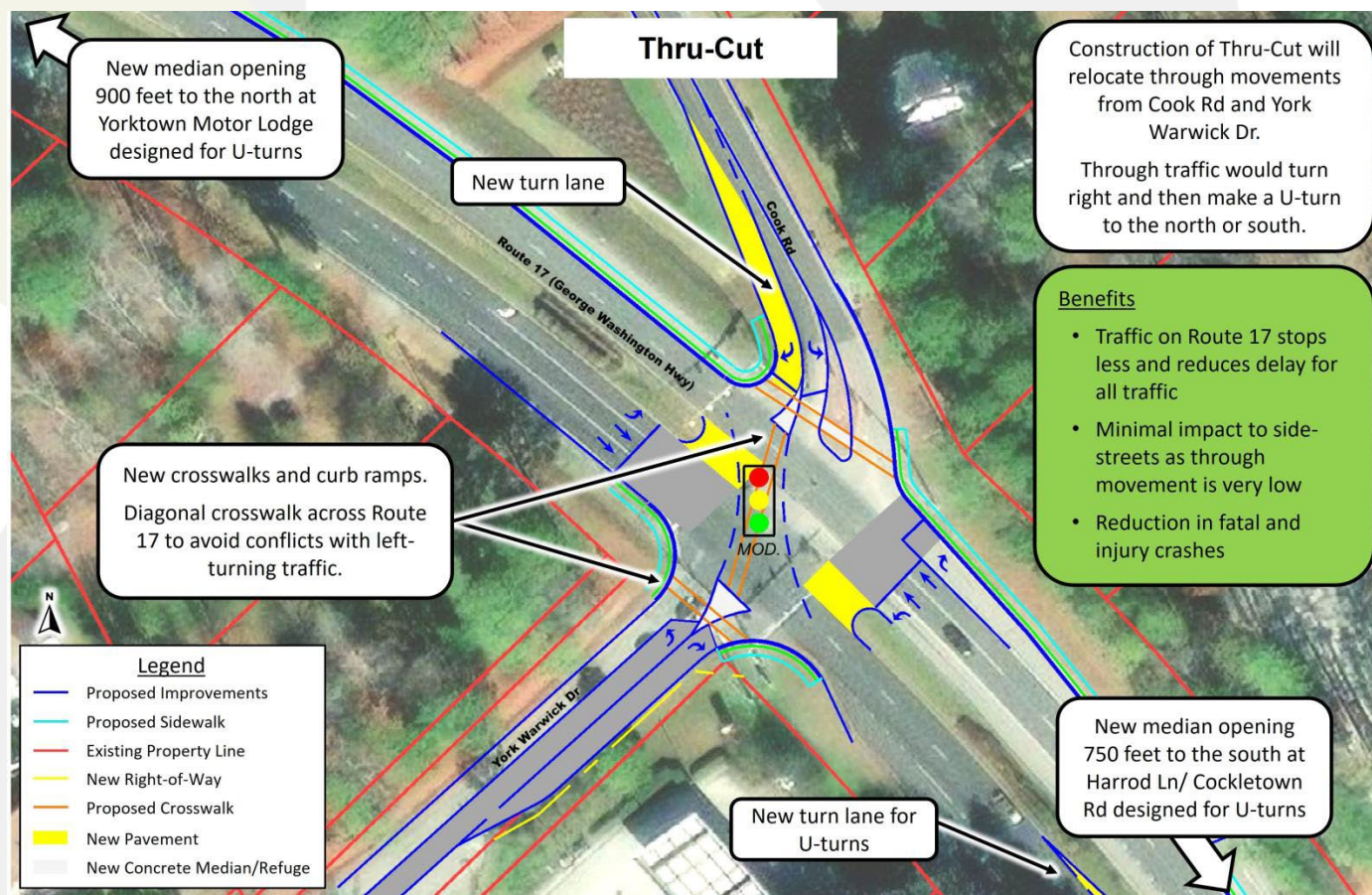


**Concept 2: Thru-Cut\***

This concept modifies the side-street approaches so that side-street traffic can turn left or right but cannot go straight through. Today there are fewer than 40 vehicles going straight through from the side-streets (this includes vehicles from both side-streets) in the AM or PM peak hour, and this movement is not expected to increase past 40 vehicles per hour in 2045.

Side-street traffic wanting to go straight through can make a right turn, proceed to a median opening downstream, and make a U-turn. This concept involves creating two new median openings to accommodate U-turns. Both median openings would be unsignalized. Crosswalks would be provided across the intersection. Crosswalks could be provided on a diagonal as shown in **Figure 49** to avoid conflicting with the side-street left turns, creating an efficient 2-phase signal.

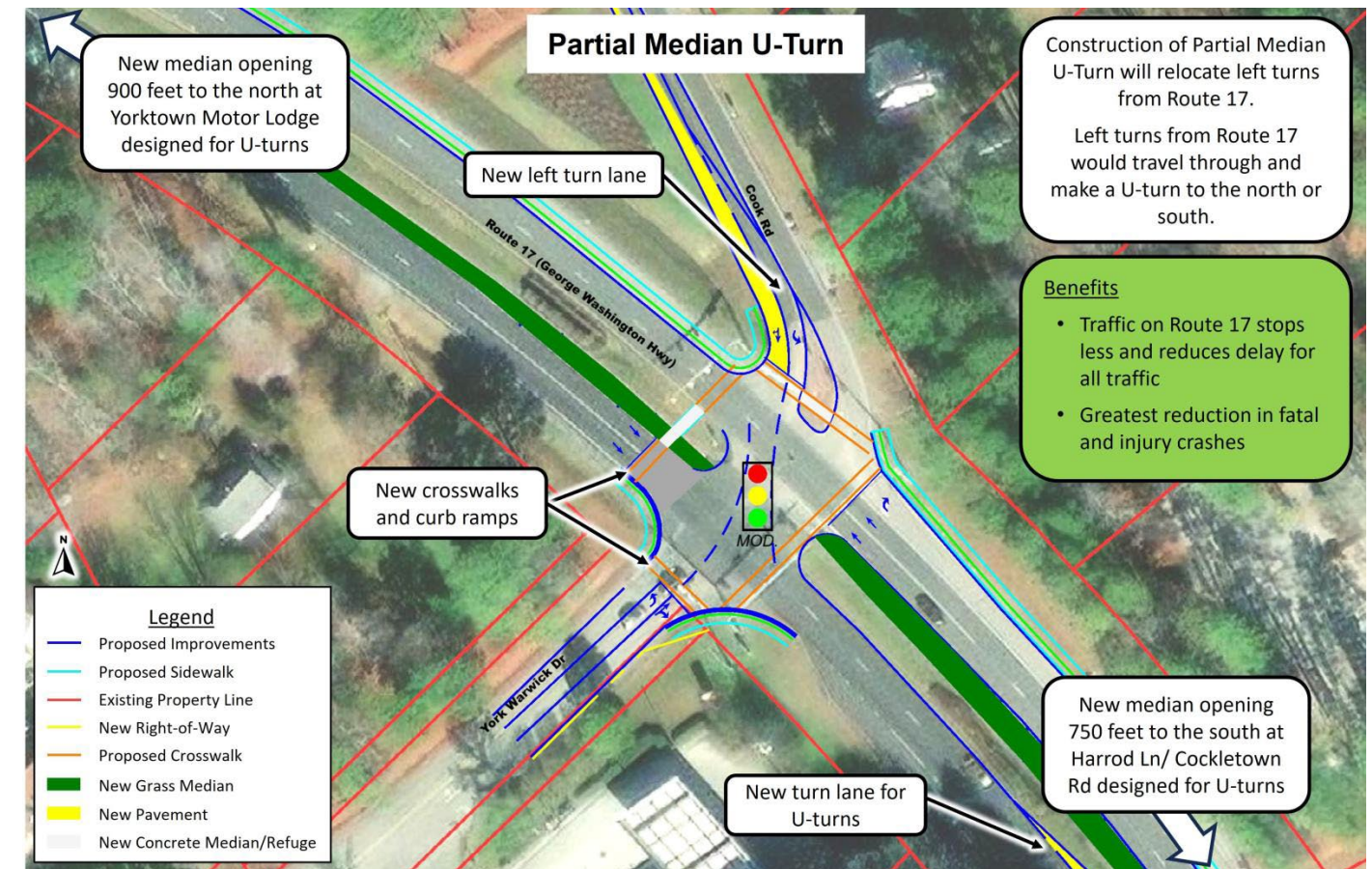
**Figure 49: Phase 2 Alternative – Route 17 at Cook Road – Thru-Cut**



**Concept 3: Partial Median U-Turn\***

This concept reroutes left turns from Route 17 to two new median openings downstream to make a U-turn. The new median openings would be at the same locations as proposed in Concept 2: Thru-Cut. The new median opening to the north would be signalized. Crosswalks across all intersection legs would be provided. **Figure 50** presents a conceptual sketch of the alternative.

**Figure 50: Phase 2 Alternative – Route 17 at Cook Road – Partial Median U-Turn**

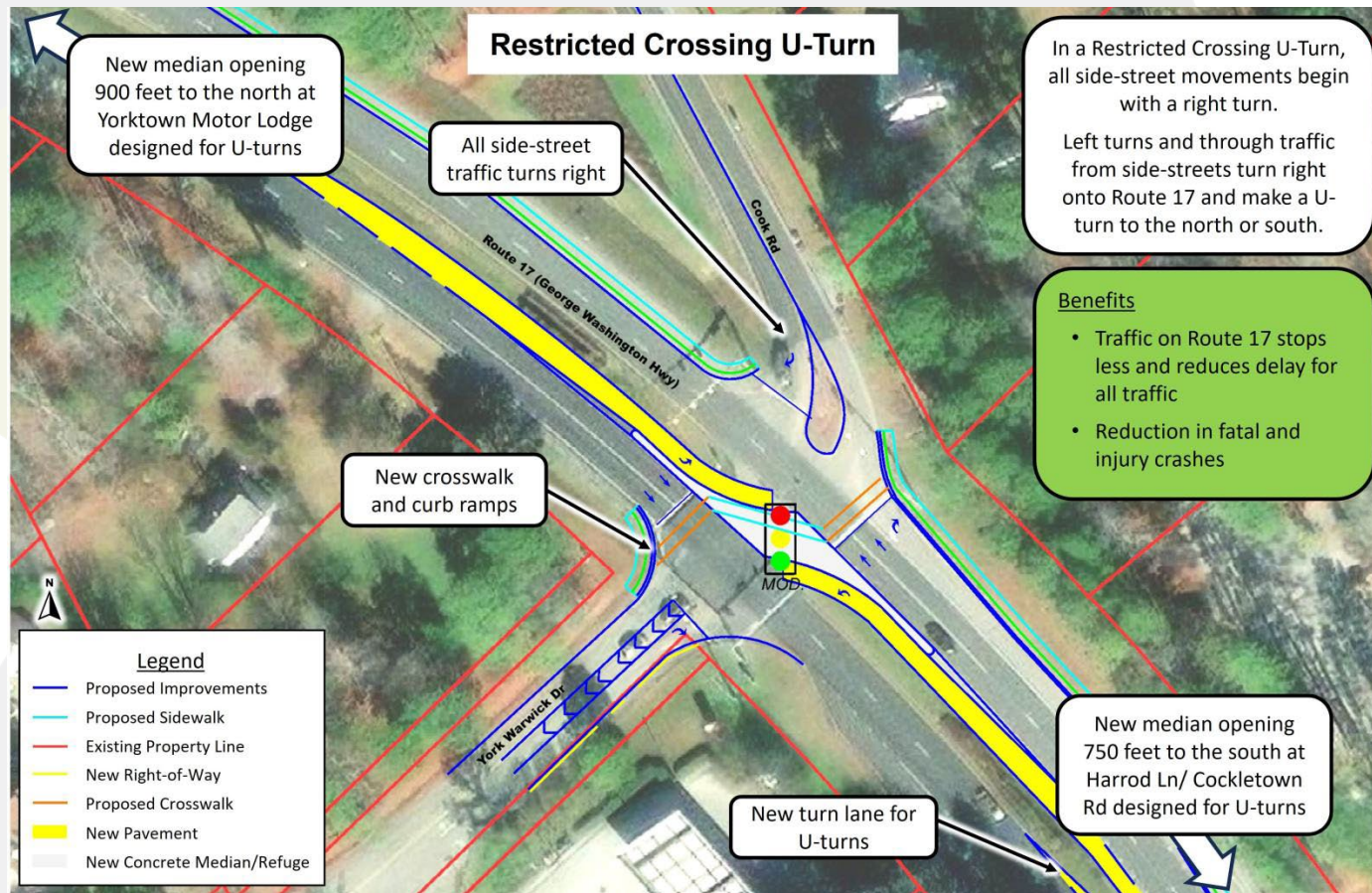




**Concept 4: Restricted Crossing U-Turn\***

This concept converts the intersection into a Restricted Crossing U-Turn (RCUT), where all side-street traffic movements begin with a right turn. Vehicles can complete a left turn from the side-street or go straight across by turning right, proceeding to a median opening, and making a U-turn. The new median openings would be at the same locations as proposed in Concept 2: Thru-Cut. The new median opening to the north would be signalized. **Figure 51** presents a conceptual sketch of the alternative.

*Figure 51: Phase 2 Alternative – Route 17 at Cook Road – Restricted Crossing U-Turn*



**Route 17 at Battle Road/Clairmont Way**

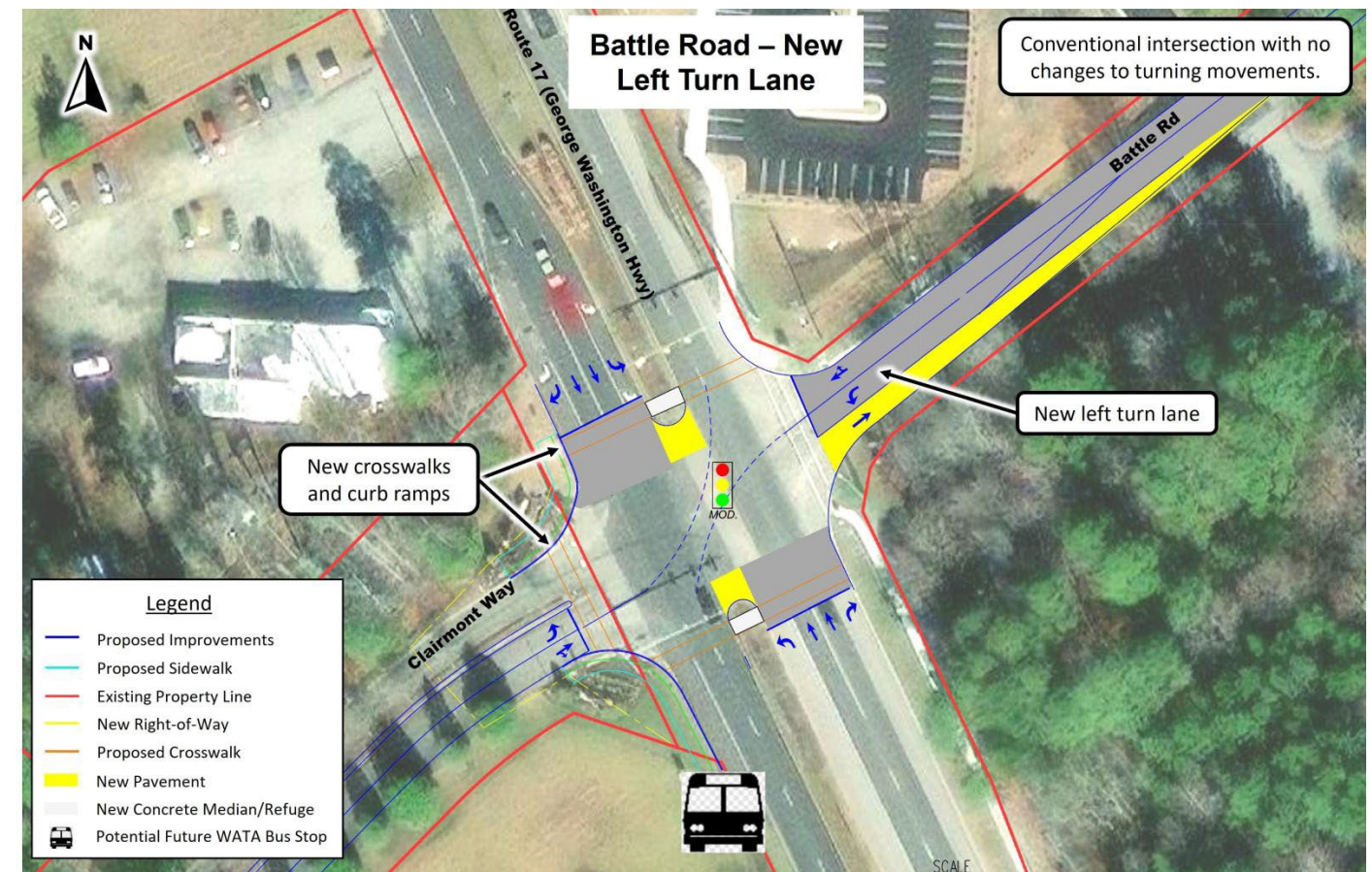
As described previously in various sections in **Chapter 1**, this intersection has an intersection PSI ranking of 98, with 24 crashes over the five-year crash analysis period, 10 of which resulted in injury. 21 of the 24 crashes were rear end or angle crashes. Traffic volumes on Route 17 are generally the same as at the Cook Road/York Warwick Drive intersection. Side-street volumes are not as heavy, and queues are not as long at this intersection. Speeding appears to be common throughout the study corridor, including at this intersection.

Five potential concepts were advanced to the Tier 2 screening for this intersection. All five concepts include installing crosswalks across Route 17, adding curb ramps, and adding sidewalk from the curb ramp at the southwest intersection corner to a potential future WATA bus stop.

**Concept 1: New Left Turn Lane**

This concept retains a conventional intersection with no rerouted movements. It adds a left turn lane along the westbound Battle Road approach, which allows the side-street left turns to run concurrently, removing the split phasing. **Figure 52** presents a conceptual sketch of the alternative.

*Figure 52: Phase 2 Alternative – Route 17 at Battle Road – New Left Turn Lane*



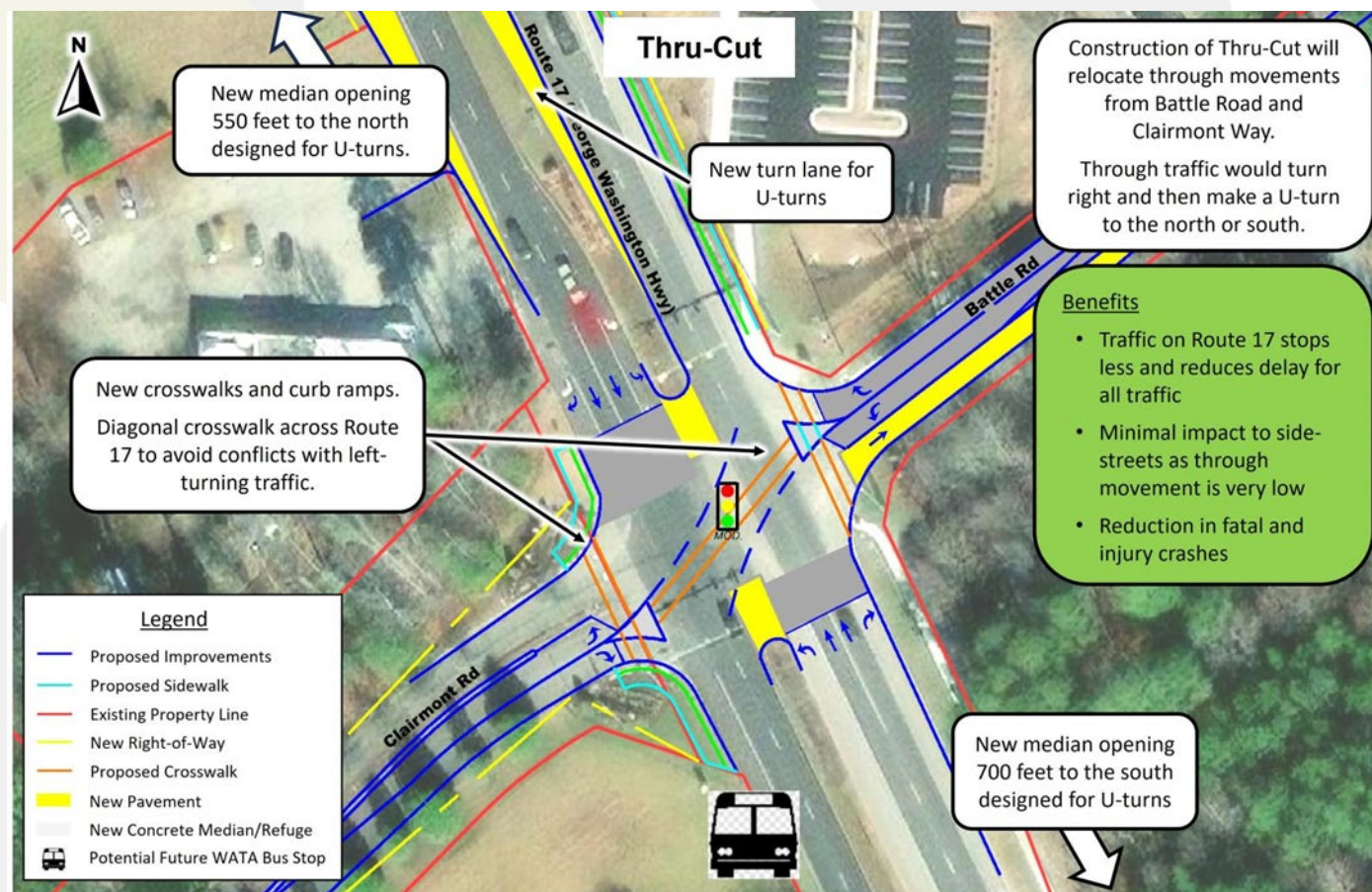


**Concept 2: Thru-Cut\***

This concept modifies the side-street approaches so that side-street traffic can turn left or right but cannot go straight through. Today there are six or fewer vehicles going straight through from the side-streets (this includes vehicles from both side-streets) in the AM or PM peak hour, and this movement is not expected to increase in 2045.

Side-street traffic wanting to go straight through can make a right turn, proceed to a median opening downstream, and make a U-turn. This concept involves creating two new median openings to accommodate U-turns. Both median openings would be unsignalized. Crosswalks would be provided across the intersection. Crosswalks could be provided on a diagonal as shown in **Figure 53** to avoid conflicting with the side-street left turns, creating an efficient 2-phase signal.

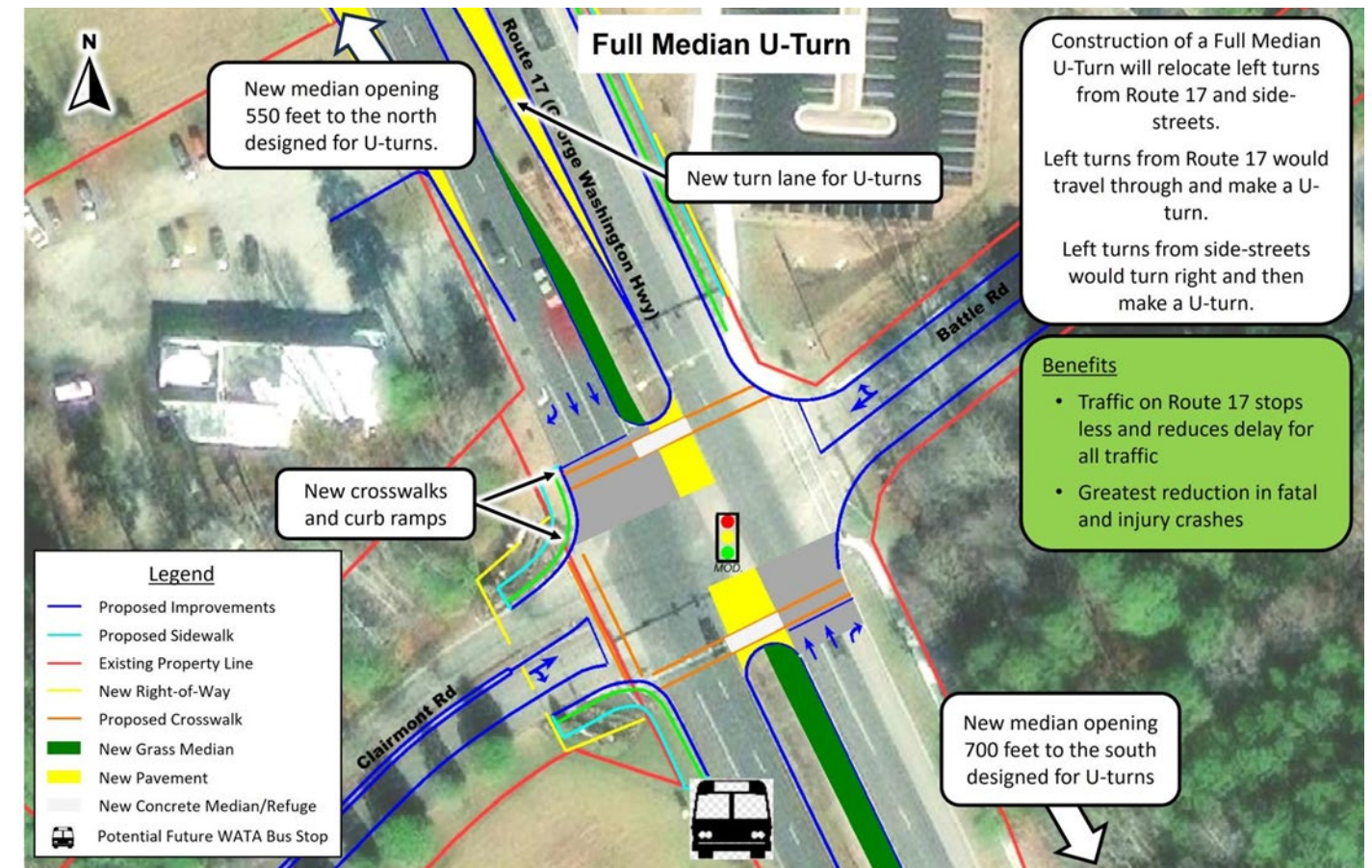
**Figure 53: Phase 2 Alternative – Route 17 at Battle Road – Thru-Cut**



**Concept 3: Full Median U-Turn\***

This concept reroutes left turns from Route 17 to two new median openings downstream to make a U-turn. It also reroutes left turns from the side-streets. The new median openings would be at the same locations as proposed in Concept 2: Thru-Cut. Crosswalks across all intersection legs would be provided. **Figure 54** presents a conceptual sketch of the alternative.

**Figure 54: Phase 2 Alternative – Route 17 at Battle Road – Full Median U-Turn**

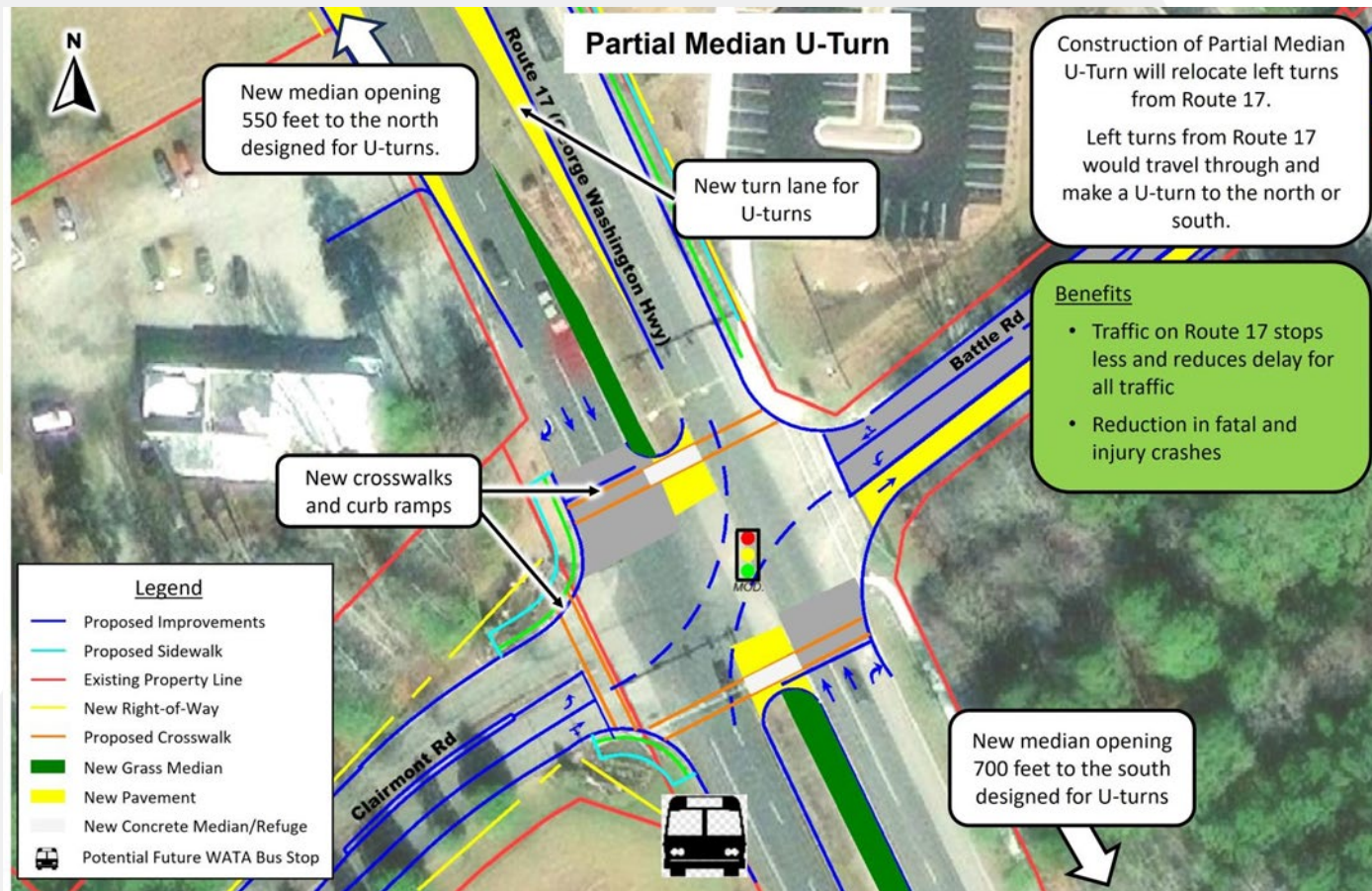




**Concept 4: Partial Median U-Turn\***

This concept is the same as Concept 3: Full Median U-turn, except it allows left turns from the side-streets. Left turns from Route 17 would be rerouted to two new median openings downstream to make a U-turn. The new median openings would be at the same locations as proposed in Concepts 2 and 3. Crosswalks across all intersection legs would be provided. **Figure 55** presents a conceptual sketch of the alternative.

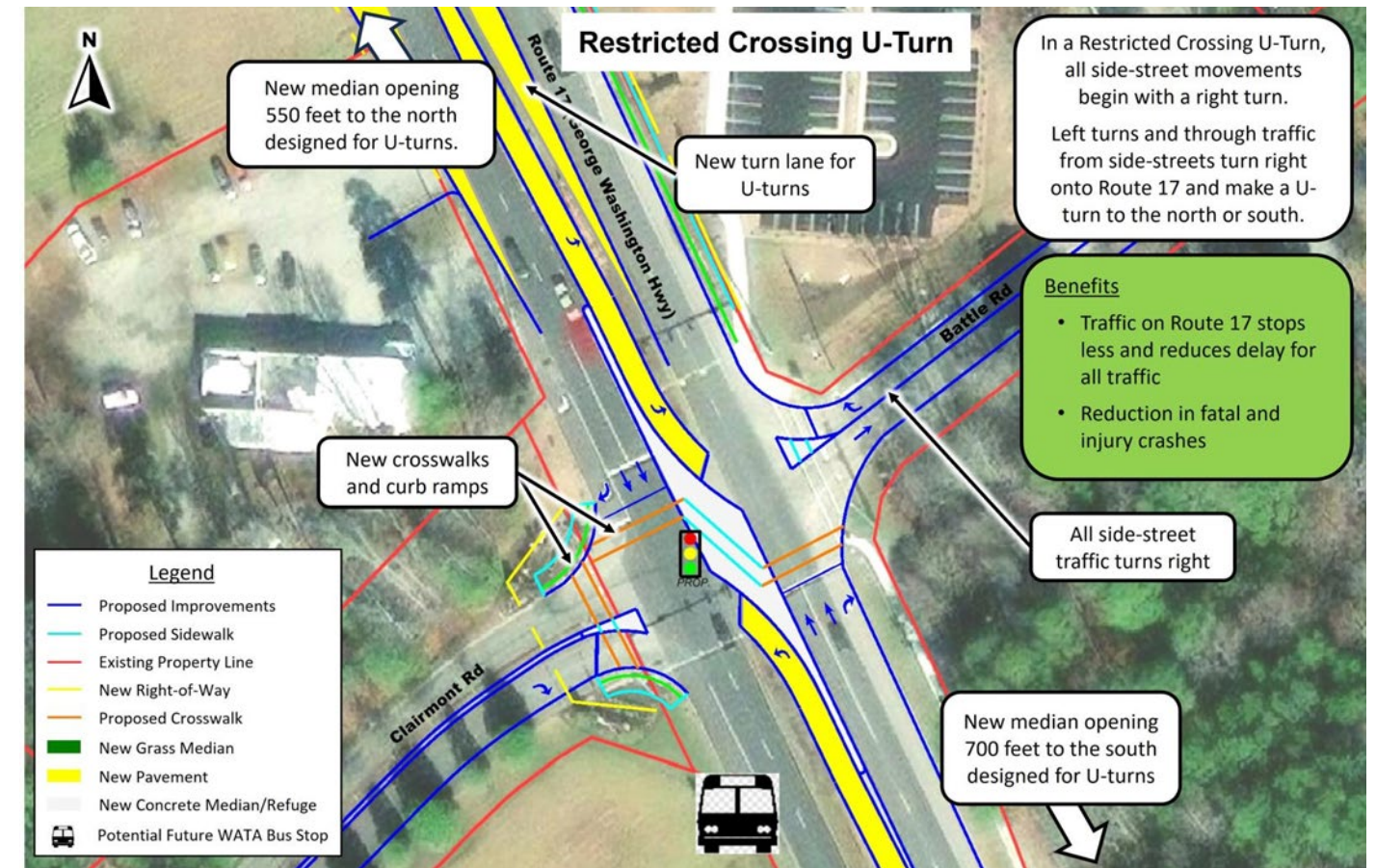
*Figure 55: Phase 2 Alternative – Route 17 at Battle Road – Partial Median U-Turn*



**Concept 5: Restricted Crossing U-Turn\***

This concept converts the intersection into a Restricted Crossing U-Turn (RCUT), where all side-street traffic movements begin with a right turn. Vehicles can complete a left turn from the side-street or go straight across by turning right, proceeding to a median opening, and making a U-turn. The new median openings would be at the same locations as proposed in Concepts 2, 3, and 4. **Figure 56** presents a conceptual sketch of the alternative.

*Figure 56: Phase 2 Alternative – Route 17 at Battle Road – Restricted Crossing U-Turn*





### Route 17 at Fort Eustis Boulevard

The intersection of Route 17 at Fort Eustis Boulevard has the highest volumes in the study corridor. Through volumes on Route 17 exceed 2,000 vehicles per hour (sum of both directions) in the PM peak hour today, and are expected to exceed 2,400 vehicles per hour by 2045. In addition to these heavy through volumes on Route 17, the eastbound left turn from Fort Eustis Boulevard serves nearly 600 vehicles in the PM peak hour today, and that volume is expected to reach nearly 650 vehicles in the PM peak hour by 2045. The northbound left turn from Route 17 serves over 320 vehicles in the peak hour today, and that volume is expected to increase to nearly 440 vehicles by 2045.

The potential future Yorktown Crescent development is expected to generate over 12,000 new vehicle trips per day, including over 800 vehicle trips in the PM peak hour. Over 570 vehicles are expected to be added to the intersection of Route 17 and Fort Eustis Boulevard in the PM peak hour, further exacerbating capacity issues.

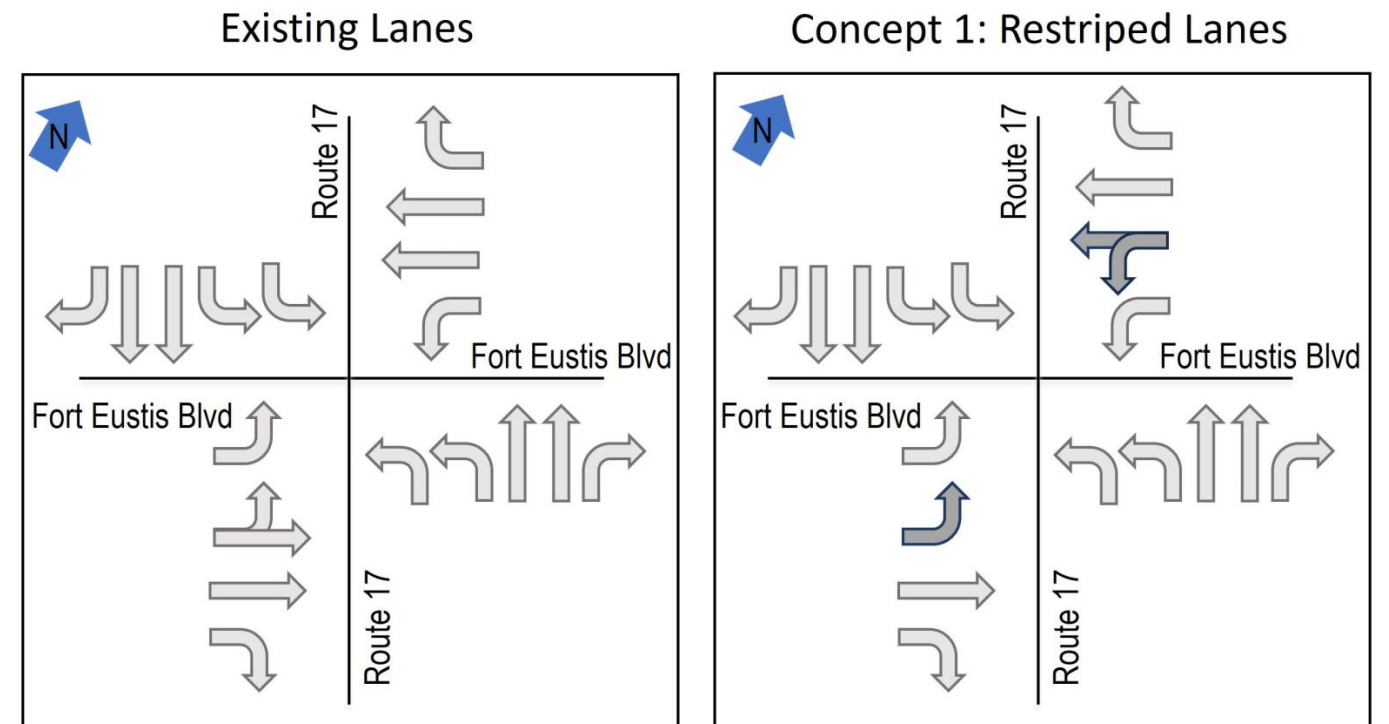
Two pedestrian crashes occurred in proximity to this intersection between January 1, 2015, and June 30, 2023, both resulting in injury. Pedestrians were observed during the Phase 1 site visit crossing Route 17 both just north and south of the Fort Eustis Boulevard intersection.

Four potential concepts were evaluated in the Tier 2 screening, including three that advanced from the Tier 1 screening. A fourth potential concept was added - the proposed lane changes from the Yorktown Crescent Traffic Impact Analysis recommendations.

### Concept 1: Restriped Lanes

This concept retains a conventional intersection with no rerouted movements. It does not include any roadway widening or crosswalk improvements. This concept makes two minor changes to the lane configurations on the Fort Eustis Boulevard approaches. It changes the eastbound shared left turn/through lane into a left turn-only lane. It changes one of the westbound through lanes to a shared left turn/through lane. This concept does not provide crosswalks, sidewalks, or any other pedestrian features. **Figure 57** presents a diagram showing the proposed lane changes in this concept.

*Figure 57: Phase 2 Alternative – Route 17 at Fort Eustis Boulevard – Restriped Lanes*

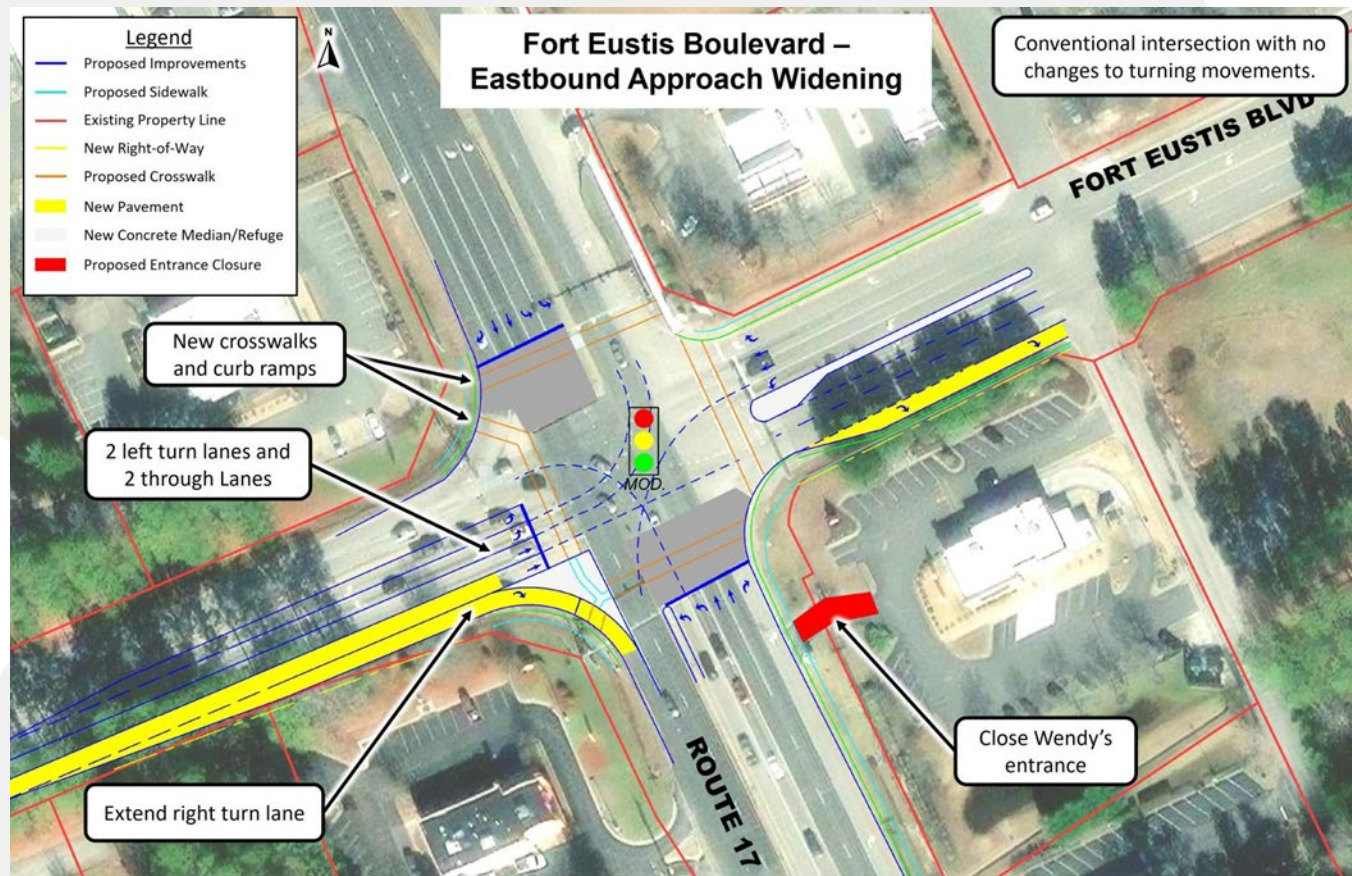




**Concept 2: Eastbound Approach Widening**

This concept retains a conventional intersection with no rerouted movements. It widens the eastbound Fort Eustis Boulevard approach to provide two exclusive left turn lanes, two through lanes, and one channelized right turn lane. It extends the length of the full-width right turn lane to 200 feet plus a 200-ft long taper. This concept adds crosswalks and curb ramps across all intersection legs. It also closes the ingress-only entrance to Wendy's on Route 17 northbound. **Figure 58** presents a conceptual sketch of the alternative.

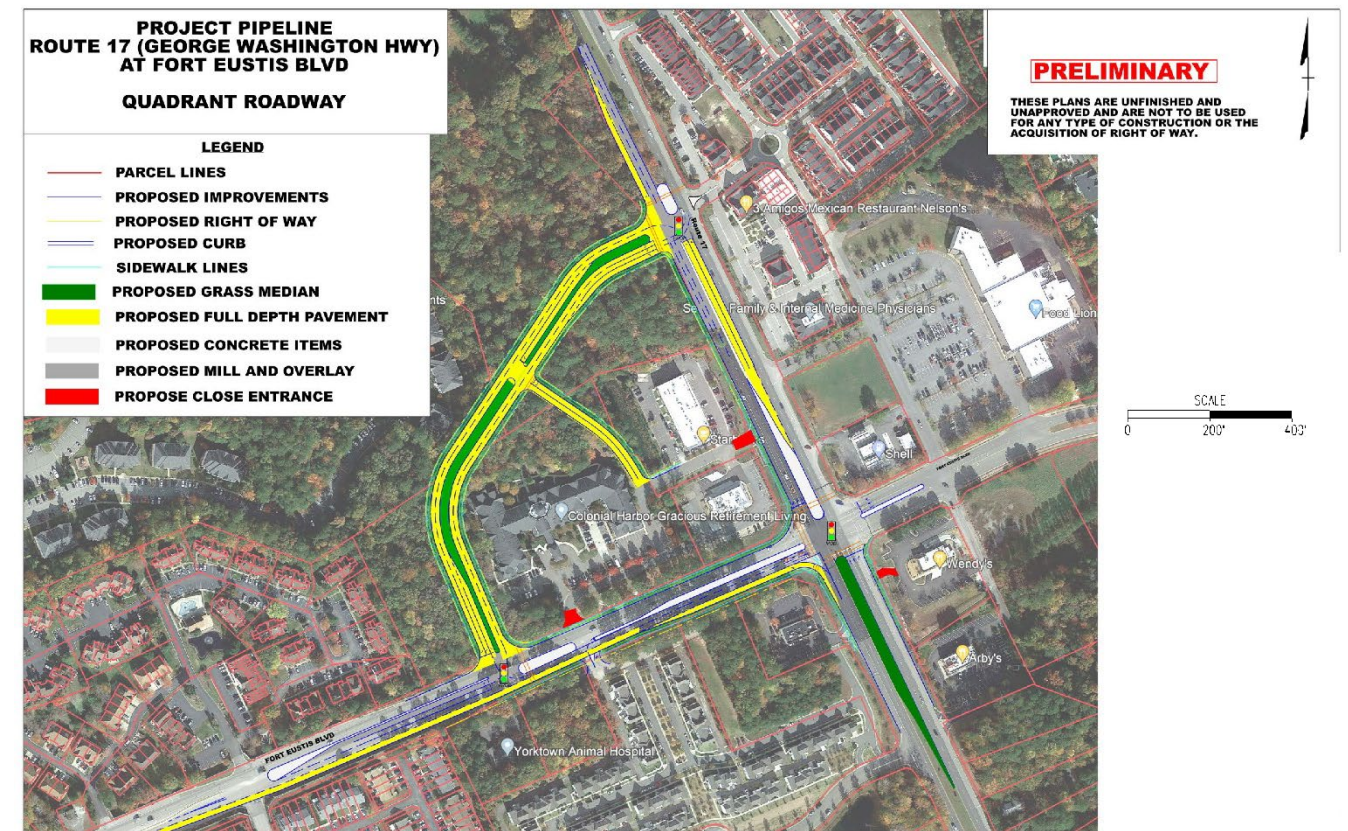
*Figure 58: Phase 2 Alternative – Route 17 at Fort Eustis Boulevard – Eastbound Approach Widening*



**Concept 3: Quadrant Roadway\***

This concept would construct a new roadway on the northwest quadrant of the Route 17 and Fort Eustis Boulevard intersection behind the Colonial Harbor retirement living facility, with a new signaled intersection on Fort Eustis Boulevard and a new signaled intersection on Route 17. Left turns at the original intersection are rerouted to use the new quadrant roadway. The intersections are timed to operate together. **Figure 59** presents a conceptual sketch of the alternative.

*Figure 59: Phase 2 Alternative – Route 17 at Fort Eustis Boulevard – Quadrant Roadway*

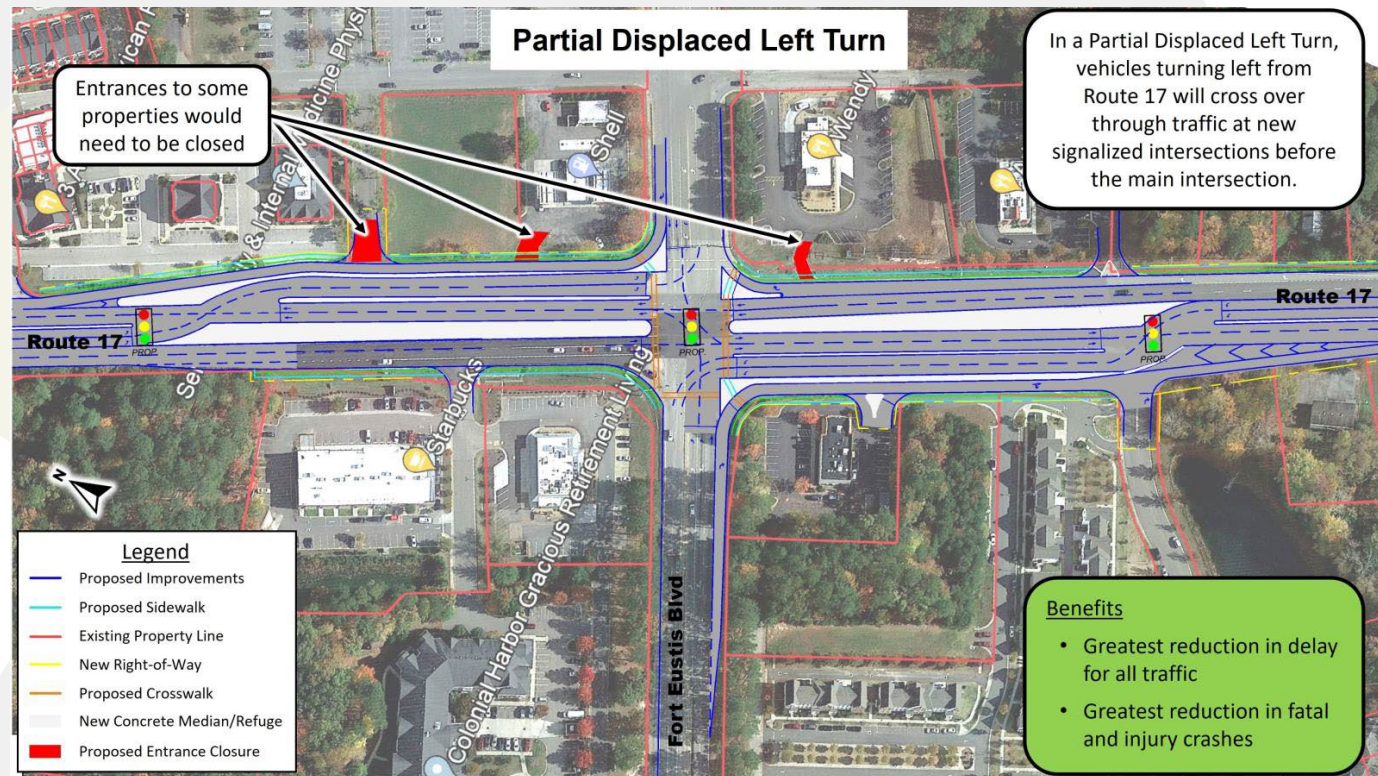




**Concept 4: Partial Displaced Left Turn\***

This concept would create two new signalized intersections on Route 17 to allow left-turning vehicles on Route 17 to cross to the other side of the opposing through traffic in advance of the main intersection. This configuration allows the left turns and the opposing through movements to occur simultaneously. This concept would also include crosswalks across Route 17. It would require additional right-of-way and closing several entrances on Route 17. **Figure 60** presents a conceptual sketch of the alternative.

**Figure 60: Phase 2 Alternative – Route 17 at Fort Eustis Boulevard – Partial Displaced Left Turn**



**Route 17 at Old York-Hampton Highway/Faulkner Road**

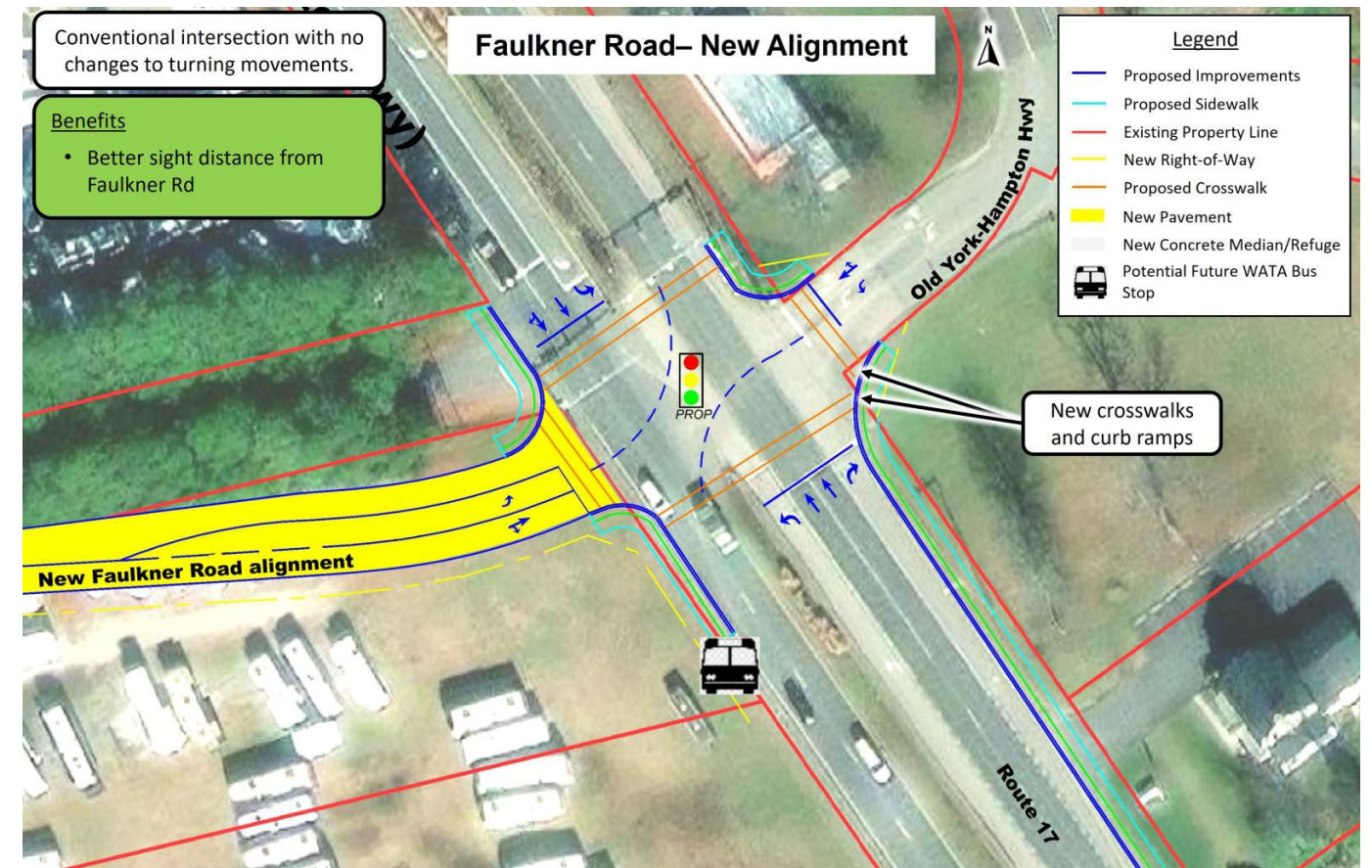
This intersection had 15 crashes over the five year crash period. Fourteen crashes were rear-end collisions on Route 17, and one crash was an angle collision. The Faulkner Road approach is slightly offset from the intersection, and the SWG noted it can be difficult to see oncoming southbound traffic from Faulkner Road.

Four potential concepts were evaluated in the Tier 2 screening. All four concepts would include constructing sidewalk on the west side of Route 17 from the southwest intersection corner to the proposed future WATA bus stop.

**Concept 1: New Faulkner Road Alignment**

This concept retains a conventional intersection with no rerouted movements. It realigns Faulkner Road to intersect Route 17 directly opposite Old York-Hampton Highway. This concept includes crosswalks across all intersection legs and curb ramps. **Figure 61** presents a conceptual sketch of the alternative.

**Figure 61: Phase 2 Alternative – Route 17 at Old York-Hampton Highway – New Faulkner Road Alignment**

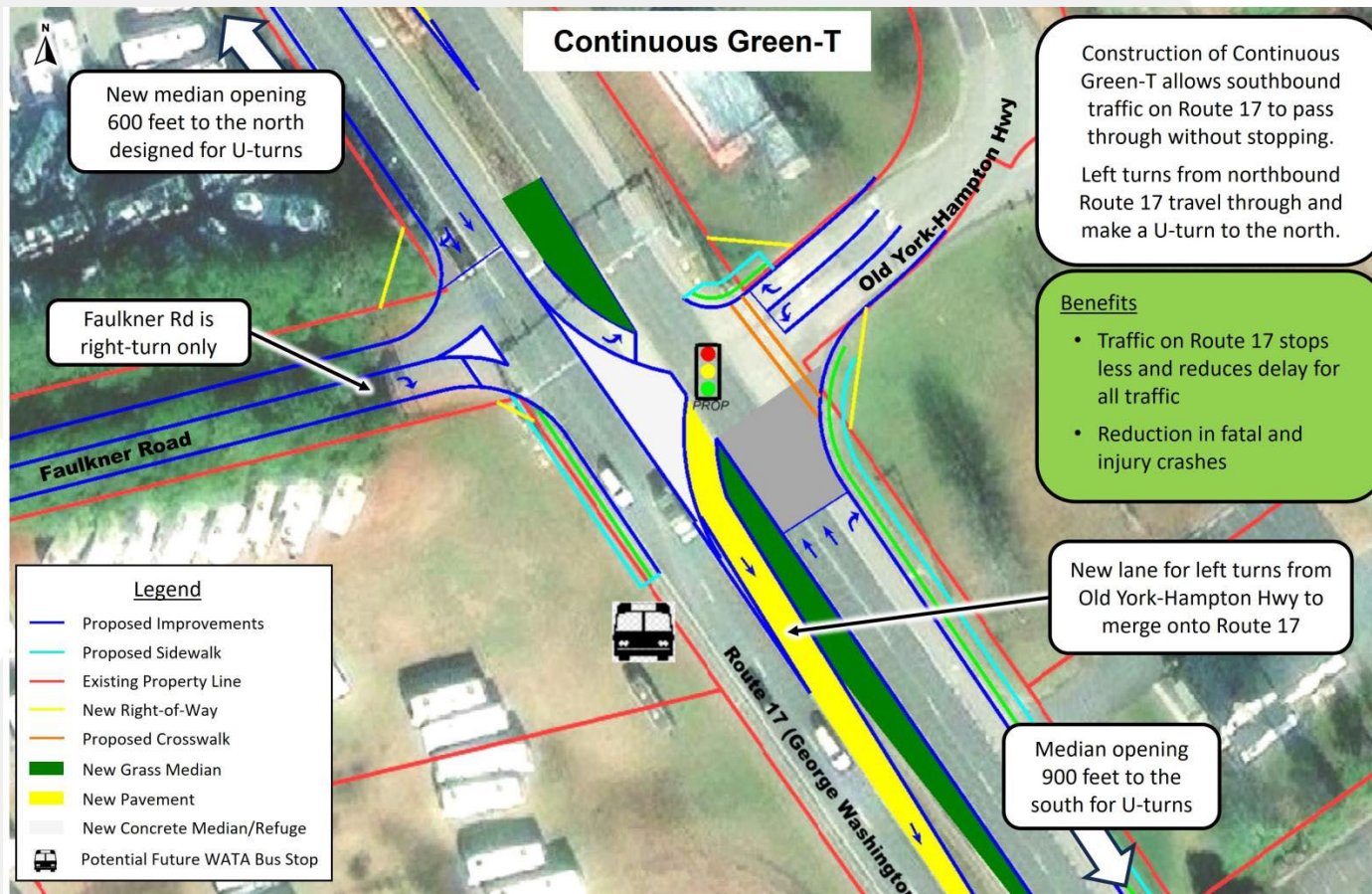




**Concept 2: Continuous Green-T\***

This concept converts the intersection to a Continuous Green-T where southbound Route 17 can pass through the intersection without stopping. Northbound Route 17 would be controlled by a traffic signal. Left turns from Old York-Hampton Highway would use a channelized receiving lane to merge onto southbound Route 17. Faulkner Road would be converted to a right-in/right-out only approach. Crosswalks would not be provided across Route 17 at this location in this concept. **Figure 62** presents a conceptual sketch of the alternative.

Figure 62: Phase 2 Alternative – Route 17 at Old York-Hampton Highway – Continuous Green-T

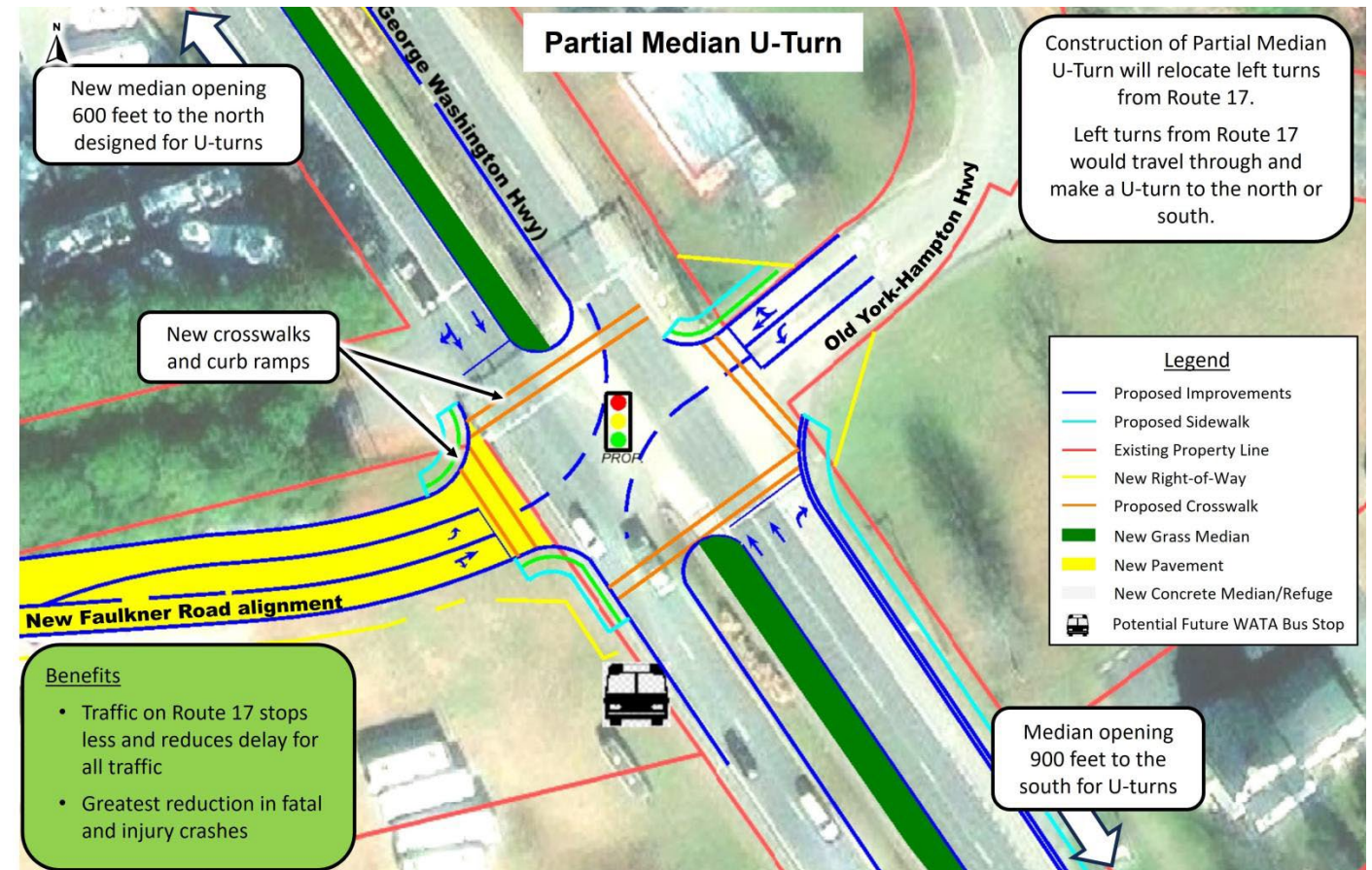


The study team tested a variation of the Continuous Green-T that also prohibited the southbound left turn movement, allowing a more efficient two-phase signal operation. The future 2045 southbound left turn volumes do not exceed 25 vehicles per hour in the peak hours. The screening results showed the southbound left turn prohibition did not further reduce overall intersection control delay in the PM peak hour. In the AM peak hour, it further reduced the overall intersection control delay by 0.7 seconds. The results indicate very little additional benefit from the southbound left turn prohibition. The SWG agreed to not move this variation forward.

**Concept 3: Partial Median U-Turn\***

This concept reroutes left turns from Route 17 to median openings downstream to make a U-turn, including a new median opening 600 feet to the north. The existing median opening at Terrebonne Road would be used for southbound-to-northbound U-turns. Crosswalks across all intersection legs would be provided. This approach includes the realignment of Faulkner Road from Concept 1. **Figure 63** presents a conceptual sketch of the alternative.

Figure 63: Phase 2 Alternative – Route 17 at Old York-Hampton Highway – Partial Median U-Turn

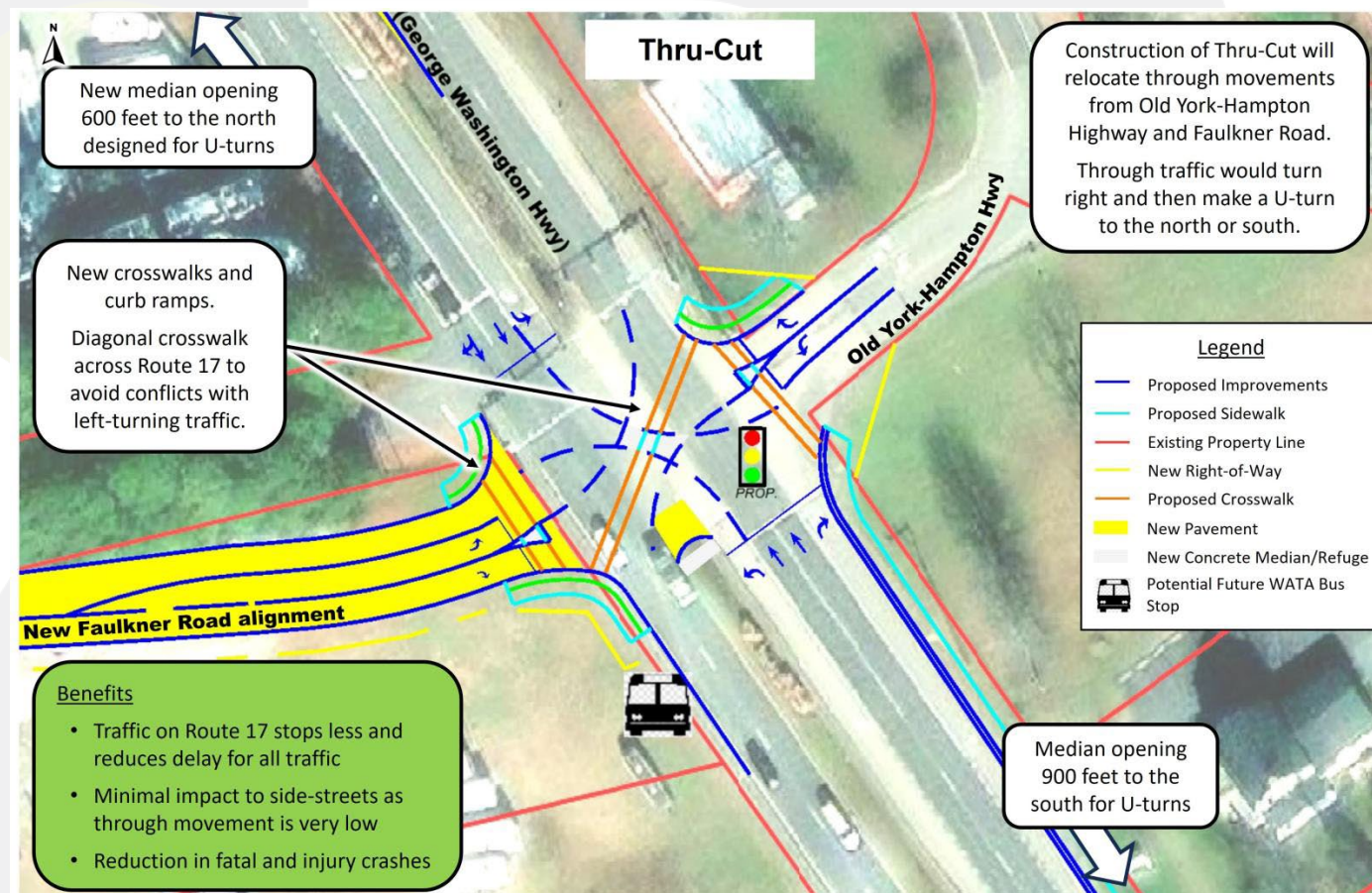




**Concept 4: Thru-Cut\***

This concept modifies the side-street approaches so that side-street traffic can turn left or right but cannot go straight through. Today there are fewer than 10 vehicles going straight through from the side-streets (this includes vehicles from both side-streets) in the AM or PM peak hour, and this movement is not expected to increase past 10 vehicles per hour in 2045. Side-street traffic wanting to go straight through can make a right turn, proceed to a median opening downstream, and make a U-turn. Crosswalks would be provided across the intersection. Crosswalks could be provided on a diagonal, as shown in **Figure 64**, to avoid conflicting with the side-street left turns, creating an efficient 2-phase signal.

**Figure 64: Phase 2 Alternative – Route 17 at Old York-Hampton Highway – Thru-Cut**



**2.2.3 Tier 2 Screening Results**

The study team conducted a Tier 2 screening using the iCAP Stage 2 assessment tool to compare each alternative concept across several metrics including traffic operations, safety, pedestrian and bicycle access, and cost.

One of the traffic operations metrics used in this screening is the change in overall intersection control delay (seconds per vehicle) in the AM and PM peak hours. These are the results of a simplified analysis for high-level screening, as the existing conditions and No Build SimTraffic models were not yet calibrated at the time the screening was conducted. The basis for comparison in this simplified analysis was the existing Synchro model with 2045 future volumes. No geometric improvements were incorporated into the future base year Synchro model for screening comparison.

The safety metrics used in this screening are based on crash modification factors (CMFs). CMFs were selected from the SMART SCALE Planning Level CMF List from Round 5. The CMF resulting in the highest anticipated crash reduction was applied to fatal and injury (F+I) crashes within the influence area of each intersection.

The results of the Tier 2 screening are shown in the iCAP Stage 2 outputs in **Figure 65** through **Figure 72**. The study team presented these results at the February 9, 2024, SWG meeting. More information is available in the meeting presentation, included in **Appendix I**.

The primary goal of this screening was to prepare a refined set of alternatives to present to the public and solicit feedback and select the preferred alternative. All alternatives were selected to be included in the survey except the Quadrant Roadway at the intersection of Route 17 and Fort Eustis Boulevard. This alternative was not selected to be included because York County received an application for a development on the parcel that the quadrant roadway would be located on, and the environmental screening showed a wetland is located in the path of the potential quadrant roadway. The selection of the preferred alternative is explained in **Section 4.1**.



Figure 65: iCAP Stage 2 Results – AM Peak Hour – Route 17 and Cook Road/York Warwick Drive

Metric Weighting (Based on Purpose and Need)	Traffic Operations			Pedestrian	Safety	Stage 2 Cost	Stage 2	
	Traffic Operations Weight			Pedestrian Weight	Safety Weight	Stage 2 Cost Weight	Total Possible Score	
	2			1	3	1	7	
Alternatives	95th Percentile Queue Length	Control Delay	Traffic Operations Metric MOE Score	Pedestrian Metric MOE Score	Safety Metric MOE Score	Stage 2 Cost Metric MOE Score	Stage 2 Total Score	
	No Score Calculated for Queue MOEs	Score						
Conventional		0.4	0.4	0.5	0.6	1.0	4.1 out of 7	<div style="width: 58.6%;"></div>
Thru-Cut		1.0	1.0	0.5	0.3	0.3	3.7 out of 7	<div style="width: 52.9%;"></div>
Partial Median U-Turn NB-SB		1.0	1.0	1.0	1.0	0.3	6.3 out of 7	<div style="width: 90.0%;"></div>
Restricted Crossing U-Turn NB-SB		0.9	0.9	0.5	0.7	0.3	4.7 out of 7	<div style="width: 67.1%;"></div>
Thru-Cut with SB Left Turn Prohibition*		0.9	0.9	1.0	0.3	0.6	4.3 out of 7	<div style="width: 61.4%;"></div>

\*Note: The Thru-Cut with Southbound Left Turn Prohibition alternative was added to the iCAP analysis after the PublicInput survey concluded at the end of Phase 2. The addition of the Thru-Cut with Southbound Left Turn Prohibition alternative is explained in Section 4.1.

Figure 66: iCAP Stage 2 Results – PM Peak Hour – Route 17 and Cook Road/York Warwick Drive

Metric Weighting (Based on Purpose and Need)	Traffic Operations			Pedestrian	Safety	Stage 2 Cost	Stage 2	
	Traffic Operations Weight			Pedestrian Weight	Safety Weight	Stage 2 Cost Weight	Total Possible Score	
	2			1	3	1	7	
Alternatives	95th Percentile Queue Length	Control Delay	Traffic Operations Metric MOE Score	Pedestrian Metric MOE Score	Safety Metric MOE Score	Stage 2 Cost Metric MOE Score	Stage 2 Total Score	
	No Score Calculated for Queue MOEs	Score						
Conventional		0.4	0.4	0.5	0.6	1.0	4.1 out of 7	<div style="width: 58.6%;"></div>
Thru-Cut		0.8	0.8	0.5	0.3	0.3	3.3 out of 7	<div style="width: 47.1%;"></div>
Partial Median U-Turn NB-SB		1.0	1.0	1.0	1.0	0.3	6.3 out of 7	<div style="width: 90.0%;"></div>
Restricted Crossing U-Turn NB-SB		0.7	0.7	0.5	0.7	0.3	4.3 out of 7	<div style="width: 61.4%;"></div>
Thru-Cut with SB Left Turn Prohibition*		0.9	0.9	1.0	0.3	0.6	4.3 out of 7	<div style="width: 61.4%;"></div>

\*Note: The Thru-Cut with Southbound Left Turn Prohibition alternative was added to the iCAP analysis after the PublicInput survey concluded at the end of Phase 2. The addition of the Thru-Cut with Southbound Left Turn Prohibition alternative is explained in Section 4.1.

Figure 67: iCAP Stage 2 Results – AM Peak Hour – Route 17 at Battle Road/Clairmont Way

Metric Weighting (Based on Purpose and Need)	Traffic Operations			Pedestrian	Safety	Stage 2 Cost	Stage 2	
	Traffic Operations Weight			Pedestrian Weight	Safety Weight	Stage 2 Cost Weight	Total Possible Score	
	2			1	3	1	7	
Alternatives	95th Percentile Queue Length	Control Delay	Traffic Operations Metric MOE Score	Pedestrian Metric MOE Score	Safety Metric MOE Score	Stage 2 Cost Metric MOE Score	Stage 2 Total Score	
	No Score Calculated for Queue MOEs	Score						
Conventional		0.3	0.3	0.5	0.6	1.0	3.9 out of 7	<div style="width: 55%;"></div>
Thru-Cut		0.4	0.4	0.5	0.3	0.3	2.5 out of 7	<div style="width: 35%;"></div>
Median U-Turn NB-SB		1.0	1.0	1.0	1.0	0.3	6.3 out of 7	<div style="width: 90%;"></div>
Partial Median U-Turn NB-SB		0.3	0.3	1.0	1.0	0.3	4.9 out of 7	<div style="width: 70%;"></div>
Restricted Crossing U-Turn NB-SB		0.3	0.3	0.5	0.7	0.2	3.4 out of 7	<div style="width: 48%;"></div>

Figure 68: iCAP Stage 2 Results – PM Peak Hour – Route 17 at Battle Road/Clairmont Way

Metric Weighting (Based on Purpose and Need)	Traffic Operations			Pedestrian	Safety	Stage 2 Cost	Stage 2	
	Traffic Operations Weight			Pedestrian Weight	Safety Weight	Stage 2 Cost Weight	Total Possible Score	
	2			1	3	1	7	
Alternatives	95th Percentile Queue Length	Control Delay	Traffic Operations Metric MOE Score	Pedestrian Metric MOE Score	Safety Metric MOE Score	Stage 2 Cost Metric MOE Score	Stage 2 Total Score	
	No Score Calculated for Queue MOEs	Score						
Conventional		0.4	0.4	0.5	0.6	1.0	4.1 out of 7	<div style="width: 58%;"></div>
Thru-Cut		1.0	1.0	0.5	0.3	0.3	3.7 out of 7	<div style="width: 52%;"></div>
Median U-Turn NB-SB		0.7	0.7	1.0	1.0	0.3	5.7 out of 7	<div style="width: 81%;"></div>
Partial Median U-Turn NB-SB		0.5	0.5	1.0	1.0	0.3	5.3 out of 7	<div style="width: 75%;"></div>
Restricted Crossing U-Turn NB-SB		0.6	0.6	0.5	0.7	0.2	4 out of 7	<div style="width: 57%;"></div>



Figure 69: iCAP Stage 2 Results – AM Peak Hour – Route 17 at Fort Eustis Boulevard

Metric Weighting (Based on Purpose and Need)	Traffic Operations			Pedestrian	Safety	Stage 2 Cost	Stage 2	
	Traffic Operations Weight			Pedestrian Weight	Safety Weight	Stage 2 Cost Weight	Total Possible Score	
	2			1	3	1	7	
Alternatives	95th Percentile Queue Length	Control Delay	Traffic Operations Metric MOE Score	Pedestrian Metric MOE Score	Safety Metric MOE Score	Stage 2 Cost Metric MOE Score	Stage 2 Total Score	
	No Score Calculated for Queue MOEs	Score						
Conventional		0.6	0.6	0.5	0.0	1.0	2.7 out of 7	
Conventional		0.7	0.7	0.5	0.2	0.1	2.6 out of 7	
Quadrant Roadway N-W		0.8	0.8	0.5	0.0	0.0	2.1 out of 7	
Partial Displaced Left Turn NB-SB		1.0	1.0	0.0	1.0	0.0	5 out of 7	

Figure 70: iCAP Stage 2 Results – PM Peak Hour – Route 17 at Fort Eustis Boulevard

Metric Weighting (Based on Purpose and Need)	Traffic Operations			Pedestrian	Safety	Stage 2 Cost	Stage 2	
	Traffic Operations Weight			Pedestrian Weight	Safety Weight	Stage 2 Cost Weight	Total Possible Score	
	2			1	3	1	7	
Alternatives	95th Percentile Queue Length	Control Delay	Traffic Operations Metric MOE Score	Pedestrian Metric MOE Score	Safety Metric MOE Score	Stage 2 Cost Metric MOE Score	Stage 2 Total Score	
	No Score Calculated for Queue MOEs	Score						
Conventional		0.6	0.6	0.5	0.0	1.0	2.7 out of 7	
Conventional		0.5	0.5	0.5	0.2	0.1	2.2 out of 7	
Quadrant Roadway N-W		0.6	0.6	0.5	0.0	0.0	1.7 out of 7	
Partial Displaced Left Turn NB-SB		1.0	1.0	0.0	1.0	0.0	5 out of 7	

Figure 71: iCAP Stage 2 Results – AM Peak Hour – Route 17 at Old York-Hampton Highway/Faulkner Road

Metric Weighting (Based on Purpose and Need)	Traffic Operations				Pedestrian	Safety	Stage 2 Cost	Stage 2	
	Traffic Operations Weight				Pedestrian Weight	Safety Weight	Stage 2 Cost Weight	Total Possible Score	
	2				1	3	1	7	
Alternatives	95th Percentile Queue Length		Control Delay		Traffic Operations Metric MOE Score	Pedestrian Metric MOE Score	Safety Metric MOE Score	Stage 2 Cost Metric MOE Score	Stage 2 Total Score
	Are Queues Acceptable?	No Score Calculated for Queue MOEs	Result	Score					
Conventional	Yes		15.7	0.7	0.7	0.5	0.3	1.0	3.8 out of 7
Continuous Green-T	Yes		12.1	0.9	0.9	0.0	0.5	0.3	3.6 out of 7
Partial Median U-Turn NB-SB	Yes		14.0	0.8	0.8	1.0	1.0	0.3	5.9 out of 7
Thru-Cut	Yes		14.9	0.8	0.8	0.5	0.3	0.7	3.7 out of 7

Figure 72: iCAP Stage 2 Results – PM Peak Hour – Route 17 at Old York-Hampton Highway/Faulkner Road

Metric Weighting (Based on Purpose and Need)	Traffic Operations				Pedestrian	Safety	Stage 2 Cost	Stage 2	
	Traffic Operations Weight				Pedestrian Weight	Safety Weight	Stage 2 Cost Weight	Total Possible Score	
	2				1	3	1	7	
Alternatives	95th Percentile Queue Length		Control Delay		Traffic Operations Metric MOE Score	Pedestrian Metric MOE Score	Safety Metric MOE Score	Stage 2 Cost Metric MOE Score	Stage 2 Total Score
	Are Queues Acceptable?	No Score Calculated for Queue MOEs	Result	Score					
Conventional	Yes		26.7	0.5	0.5	0.5	0.3	1.0	3.4 out of 7
Continuous Green-T	Yes		12.8	1.0	1.0	0.0	0.5	0.3	3.8 out of 7
Partial Median U-Turn NB-SB	Yes		16.0	0.8	0.8	1.0	1.0	0.3	5.9 out of 7
Thru-Cut	Yes		15.9	0.8	0.8	0.5	0.3	0.7	3.7 out of 7



## 2.2.4 Other Potential Improvements

In addition to the alternative concepts for the signalized intersections described in previous sections, several other potential improvements were identified.

### Speed Management

As described in **Section 1.5.2** and **Section 1.6.2**, 33 percent of all severe injury crashes in the corridor were reported as speed-related. Speed is a contributing factor to crash severity, and speeding was a top issue identified in the Phase 1 survey comments as needing to be addressed. In the Phase 1 field review, the study team observed speeding to be common throughout the study corridor. Although speed data was not collected, the study team drove the corridor and observed many drivers driving much faster than the 50 mph posted speed limit. Safe speeds is a core principle of the Safe System approach in the Arrive Alive Virginia 2022-2026 Strategic Highway Safety Plan (SHSP), and speeding is an emphasis area in the SHSP.

### Speed Safety Cameras

Speed safety cameras are one of FHWA's proven safety countermeasures, however the Code of Virginia does not allow the use of speed safety cameras except in school zones and work zones. Introducing a speed enforcement camera in the school speed zone at York High School was discussed. This would only be able to be used during school arrival and dismissal times and is further north than the study corridor location.

### Lowering the Posted Speed Limit

Lowering the posted speed limit was discussed as a potential strategy. The Phase 2 survey included a question asking respondents to indicate their level of support for reducing the posted speed limit from 50 mph to 45 mph. Respondents generally opposed reducing the posted speed limit. While respondents generally agreed that many drivers drive too fast, respondents were skeptical that lowering the posted speed limit alone would change behaviors. Some respondents commented that Route 17 is a straight, flat road that is easy to go fast on when not congested, and people will continue to drive too fast unless the speed limit is enforced. Some respondents were concerned that lowering the posted speed limit would be a way for police to generate more revenue from writing tickets. Other respondents did not want the posted speed limit to be lowered because they do not want traffic to go slower.

### Traffic Signal Coordination for Speed Management

Traffic signal coordination can be applied as a speed management tool to allow a platoon of vehicles to progress at a specified speed. However, this strategy may be difficult to optimize both directions, especially given high vehicle speeds.

### Designing for Slower Speeds

Route 17 is a straight, flat road with a shoulder and ditch typical section designed for speeds above 50 mph. North of Cook Road, the nearest traffic signal is more than two miles away. North of York High

School, the surrounding land use is completely undeveloped, with only a few agricultural and utility access points. Although Route 17 is not a designated limited access highway, this section of Route 17 functions essentially as a limited access highway, where drivers feel comfortable driving 60 mph.

In contrast, the land use context of section of Route 17 in the HR09 study area is not rural and is increasingly urbanizing. Some parcels have developed as commercial or industrial uses. Townhome developments have been constructed, and more are expected, including the Yorktown Crescent development. Some undeveloped parcels still remain, but continued future growth and development is expected.

As this section of Route 17 continues to develop, the corridor may need to be redesigned to an urban curb-and-gutter typical section. A complete corridor redesign to slow speeds could include a separated shared-use path and a raised median with landscaping. Introducing these elements into the driver's field of vision creates a sense of enclosure that encourages slower speeds.

### Speed Management Recommendations for Incorporating into Phase 3 Design

While this HR09 Project Pipeline study did not move forward with a complete corridor redesign into Phase 3 design, the team identified several strategies aimed at preventing excessive speeds that will be explored further and incorporated where feasible and appropriate into the preferred alternative that advances to Phase 3, including:

- Rumble strips and speed feedback signs
- Crepe myrtles and landscaping in the median to visually enclose the space
- Curbed medians
- Narrowing lane widths to 11 feet
- Speed-based traffic signal coordination

### Speed Study

It is recommended that a separate speed study be conducted to validate the observations of speed issues and further explore corridor-wide speed management solutions, including the complete corridor redesign.

### Access Management

#### Unsignalized Restricted Crossing U-Turns

As noted in **Sections 1.6.3** and **1.6.4**, it is difficult to turn left from the side-streets in the peak hours in existing conditions at the series of four unsignalized intersections including:

- Route 17 at Roberts Furniture/Hart Building
- Route 17 at Tractor Supply Co
- Route 17 at Greene Drive
- Route 17 at Whites Road

In No-Build conditions, the traffic volumes on Route 17 grow to the point where it becomes extremely difficult during the peak hours to find a gap in both directions to turn left from the side-streets at these intersections.

A series of unsignalized Restricted Crossing U-Turns at these intersections is recommended to reduce angle collisions.

This recommendation was identified after the Phase 2 survey was conducted.

**Backage Road for Alternate Access to Colonial Harbor, Starbucks, and McDonald's**

As mentioned in **Section 2.2.3**, the Quadrant Roadway concept was eliminated from consideration at the intersection of Route 17 and Fort Eustis Boulevard. This was the only concept that provided an alternate access point to Colonial Harbor, McDonald's, and the commercial building with the Starbucks and other businesses. The operational and safety analyses documented in **Chapter 1** demonstrate the deficiencies of this entrance. With alternate access provided, the current entrance on Route 17 could be closed, addressing the safety and operational issues at that location.

The Quadrant Roadway concept was removed from consideration because York County received an application for a development on the parcel the quadrant roadway would be located on and because of concerns about environmental impacts due to the presence of a wetland in the path of the new quadrant roadway. It is recommended that York County pursue a backage road concept in coordination with approval of this development to provide alternate access, with the goal of relocating access to these parcels through the backage road and closing the current entrance on Route 17.



# 3 Public & Stakeholder Outreach & Feedback

The Project Pipeline process involved targeted outreach and stakeholder input for the alternative concepts in the study area. The study team developed concept sketches, prepared presentation materials, and created a public survey to meet the public engagement needs for this study.

## 3.1 Stakeholder Coordination

Stakeholder engagement is a key part in making the recommendations of the study successful from more than a traffic operation standpoint. The stakeholders provide regional and local knowledge about the study area and help guide the study direction. The project stakeholders identified in **Chapter 1.3** were involved in all steps of the Project Pipeline process and assisted in making decisions about which concepts to move forward to public engagement.

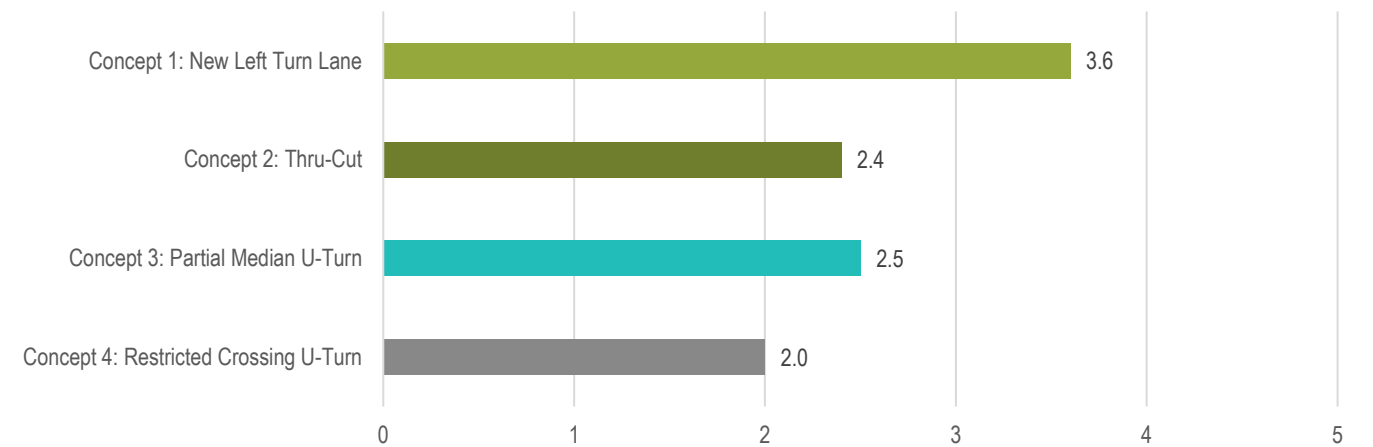
## 3.2 Public Involvement

A PublicInput survey was conducted from March 8 to March 22, 2024, to collect feedback on potential improvements within the study corridor. The survey provided the SWG with an understanding of how the public viewed each concept before selecting a preferred option.

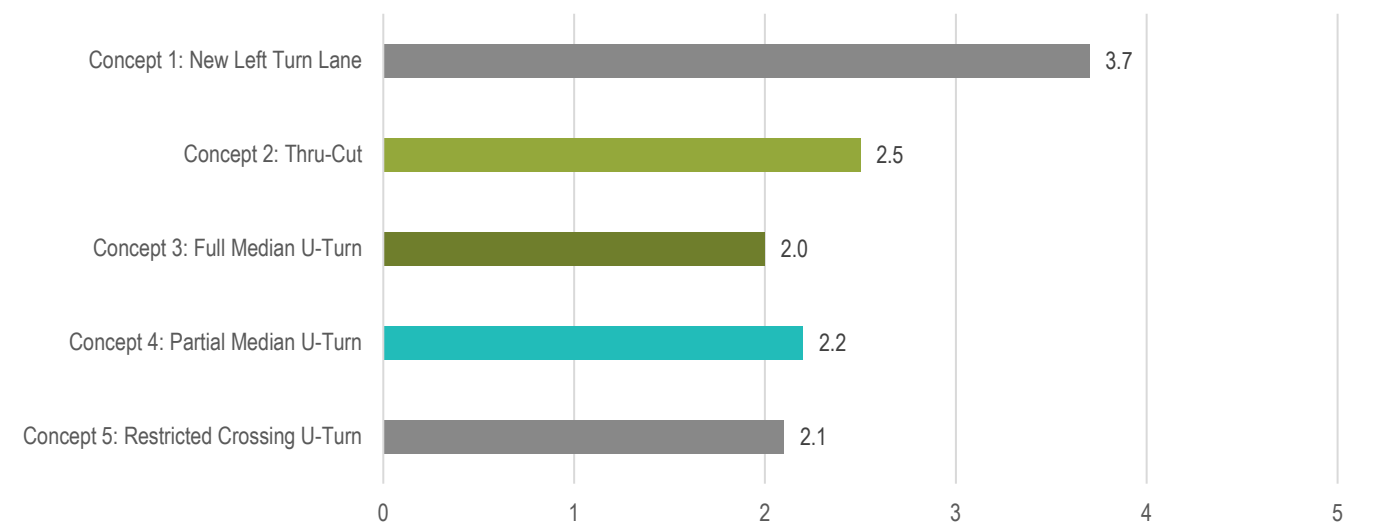
**Figure 73** through **Figure 76** summarize the average ranking for each concept presented in the survey. A rating of 5.0 represents a strongly supported concept and a rating of 1.0 represents a strongly opposed concept.

The SWG reviewed the survey responses in a meeting on March 25, 2024. More details on the public responses to the survey are available in the meeting presentation, included in **Appendix I**. A full list of written comments to the survey is provided in **Appendix J**.

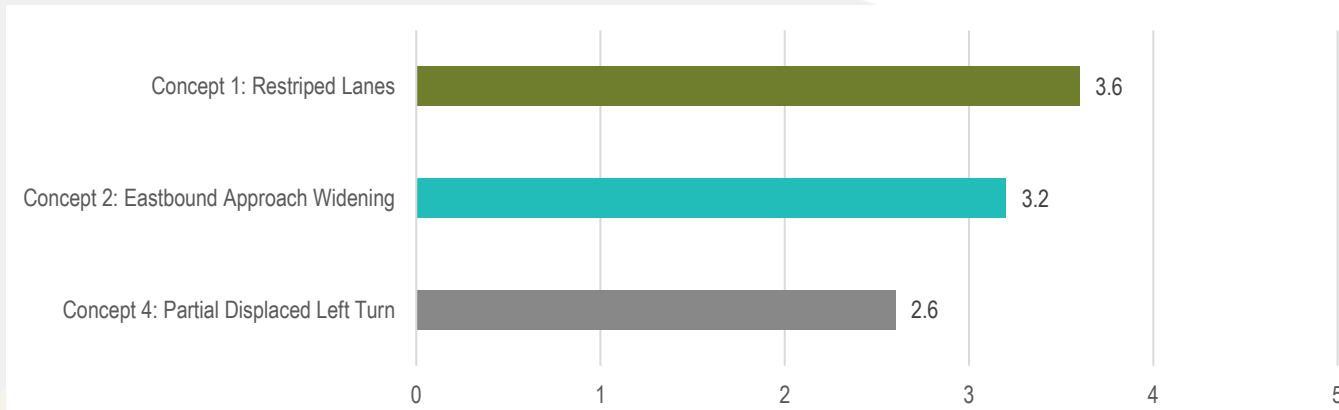
**Figure 73: Public Engagement – Average Rating of Alternatives – Route 17 at Cook Road/York Warwick Drive**



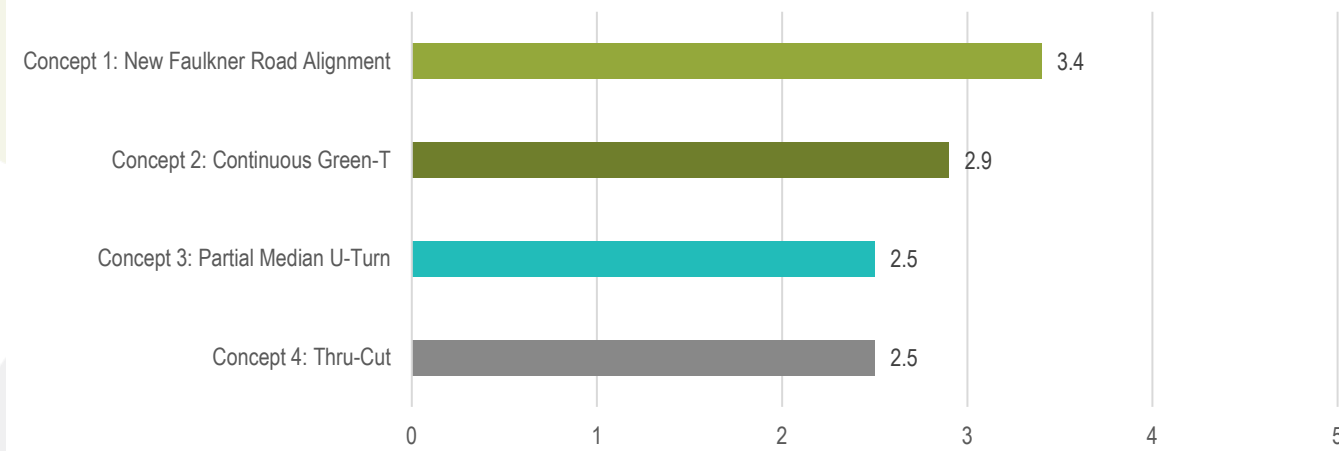
**Figure 74: Public Engagement – Average Rating of Alternatives – Route 17 at Battle Road/Clairmont Way**



**Figure 75: Public Engagement – Average Rating of Alternatives – Route 17 at Fort Eustis Boulevard**



**Figure 76: Public Engagement – Average Rating of Alternatives – Route 17 at Old York-Hampton Highway**





# 4 Preferred Alternative & Investment Strategy

## 4.1 Selection of the Preferred Alternative

The study team presented the survey results to the SWG on March 25, 2024. During this meeting, the study team suggested a set of alternatives to advance towards the development of a preferred alternative. After reviewing the survey results and the screening results documented in **Chapter 2** and further discussing the concepts, the study group decided to move forward with two concepts:

- Partial Median U-Turn at Route 17 and Cook Road/York Warwick Drive, shown previously in **Figure 50** in **Section 2.2.2**
- Eastbound Approach Widening at Route 17 and Fort Eustis Boulevard, shown previously in **Figure 58** in **Section 2.2.2**. In addition to the improvements described previously and shown in **Figure 58**, the preferred alternative will include constructing approximately 550 feet of sidewalk on the west side of Route 17 north of Fort Eustis Boulevard connecting the proposed curb ramp on the northwest quadrant of the intersection to a proposed future WATA bus stop. The sidewalk is not shown in the sketch in **Figure 58** because it was added after the concept was sketched for the Phase 2 survey.

More information from the March 25, 2024 meeting is provided in the meeting presentation in **Appendix I**. On April 1, 2024, York County submitted a SMART SCALE pre-application for the two concepts described above.

On April 25, 2024, VDOT, York County, and the study consultant team met to discuss a refinement to the concept at the intersection of Route 17 and Cook Road/York Warwick Drive. The refined concept - Thru-Cut with Southbound Left Turn Prohibition - is illustrated in **Figure 77**.

The refined concept combines elements of the Partial Median U-turn concept and the Thru-Cut concept shown previously in **Figure 49** in **Section 2.2.2**. It modifies the side-street approaches so that side-street traffic can turn left or right but cannot go straight through. It also prohibits left turns from southbound Route 17 onto Cook Road. Left turns from northbound Route 17 onto York Warwick Drive are not rerouted. The refined concept does not include new median openings or modifications to existing median openings.

In the refined concept, rerouted movements use Falcon Road, which connects Route 17 and Cook Road approximately 0.4 miles north of the intersection of Route 17 and Cook Road/York Warwick Drive.

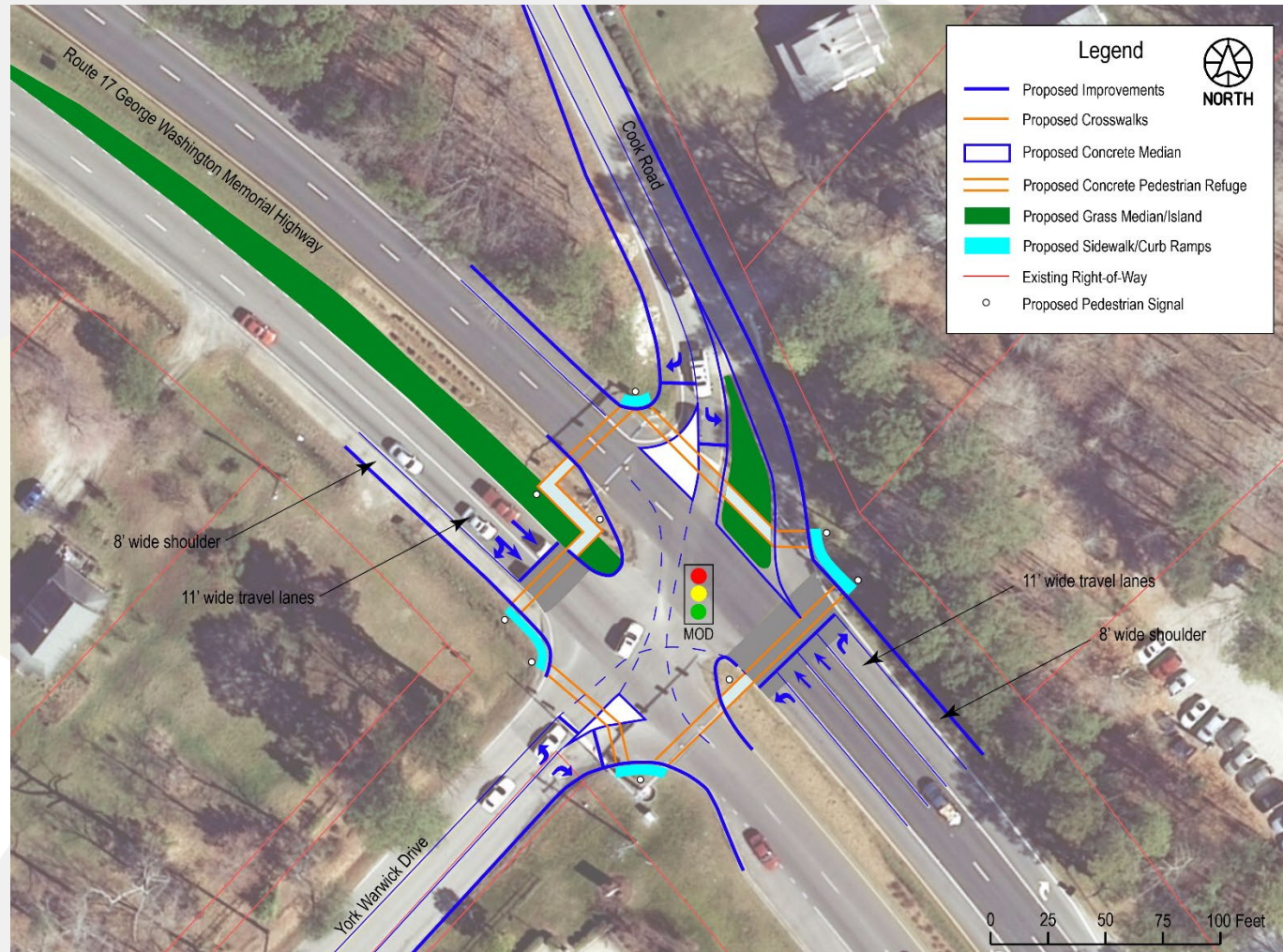
- Vehicles on York Warwick Drive can access Cook Road by turning left from York Warwick Drive onto northbound Route 17 and turning right onto Falcon Road, which intersects with Cook Road.
- Vehicles on Cook Road can access York Warwick Drive by turning onto Falcon Road, turning left onto southbound Route 17, and turning right onto York Warwick Drive.
- Southbound vehicles on Route 17 can access Cook Road by turning left onto Falcon Road, which intersects with Cook Road.

The rerouted movements in the refined concept are all relatively low volume. Today there are fewer than 40 vehicles going straight through from the side-streets (this includes vehicles from both side-streets) in the AM or PM peak hour, and this movement is not expected to increase past 40 vehicles per hour in 2045. Only 10 vehicles made a southbound left turn throughout the 12-hour data collection period, two of which occurred in the PM peak hour. No vehicles made a southbound left turn in the AM peak hour.

The refined concept reduces the number of signal phases, which improves the intersection's operational efficiency and increases intersection capacity, while the number of vehicles that will experience rerouted movements is minimal. It is also a more cost-effective solution because improvements are not needed for downstream U-turns.

The group agreed to move forward with the refined concept as the preferred alternative at the intersection of Route 17 and Cook Road/York Warwick Drive. This concept was added to the iCAP Stage 2 assessment.

**Figure 77: Refined Phase 2 Alternative – Route 17 at Cook Road – Thru-Cut with Southbound Left Turn Prohibition**



**Preferred Alternative**

The preferred alternatives selected at the end of Phase 2 for advancing into Phase 3 design are described below and shown in **Figure 78** and **Figure 79**. **Appendix K** provides higher resolution files of these images.

- Thru-Cut with Southbound Left Turn Prohibition at Route 17 and Cook Road/York Warwick Drive, shown previously in **Figure 77** and described earlier in this section.
- Eastbound Approach Widening at Route 17 and Fort Eustis Boulevard, shown previously in **Figure 58** in **Section 2.2.2**. In addition to the improvements described previously and shown in **Figure 58**, the preferred alternative will include constructing approximately 550 feet of sidewalk on the west side of Route 17 north of Fort Eustis Boulevard connecting the proposed curb ramp on the northwest quadrant of the intersection to a proposed future WATA bus stop. The sidewalk is not shown in the sketch in **Figure 58** because it was added after the concept was sketched for the Phase 2 survey.

Preferred alternatives were identified at the other two signalized intersections. The preferred alternatives at these intersections were not advanced into Phase 3 design. However, they are included in the Synchro and SimTraffic models for analyzing traffic operations for the 2045 Build conditions as described in **Section 4.2**.

- Thru-Cut at Route 17 and Battle Road/Clairmont Way, shown previously in **Figure 53** in **Section 2.2.2**
- Westbound Approach Restriping at Route 17 and Old York-Hampton Highway/Faulkner Road as described earlier in this section.

During the March 25, 2024 meeting, the study work group also requested the study team analyze a new alternative concept at the intersection of Route 17 and Old York-Hampton Highway/Faulkner Road. This new concept retains much of the existing configuration. The only change is to restripe the shared through and right turn lane on the westbound Old York-Hampton Highway approach to a shared left, through, and right turn lane. The existing configuration is one left turn lane and one shared through lane. In the new concept, left turns could be made from either lane.



Figure 78: Phase 2 Preferred Alternative – Route 17 at Cook Road – Thru-Cut with Southbound Left Turn Prohibition

### Project Description

The improvements proposed at this location include:

- 1) **Thru-Cut**
  - Side-street traffic can turn left or right but cannot go straight through.
- 2) **Remove Southbound Left Turns**
  - Replace southbound left turn lane with expanded grass median.
- 3) **Reroute Select Movements to Falcon Road**
  - Rerouted movements use Falcon Road, which connects Route 17 and Cook Road approximately 0.4 miles north of the intersection of Route 17 and Cook Road/York Warwick Drive.
- 4) **Crosswalks and Curb Ramps**
  - New crosswalks and curb ramps at the intersection of Route 17 and Cook Road.

### Project Needs

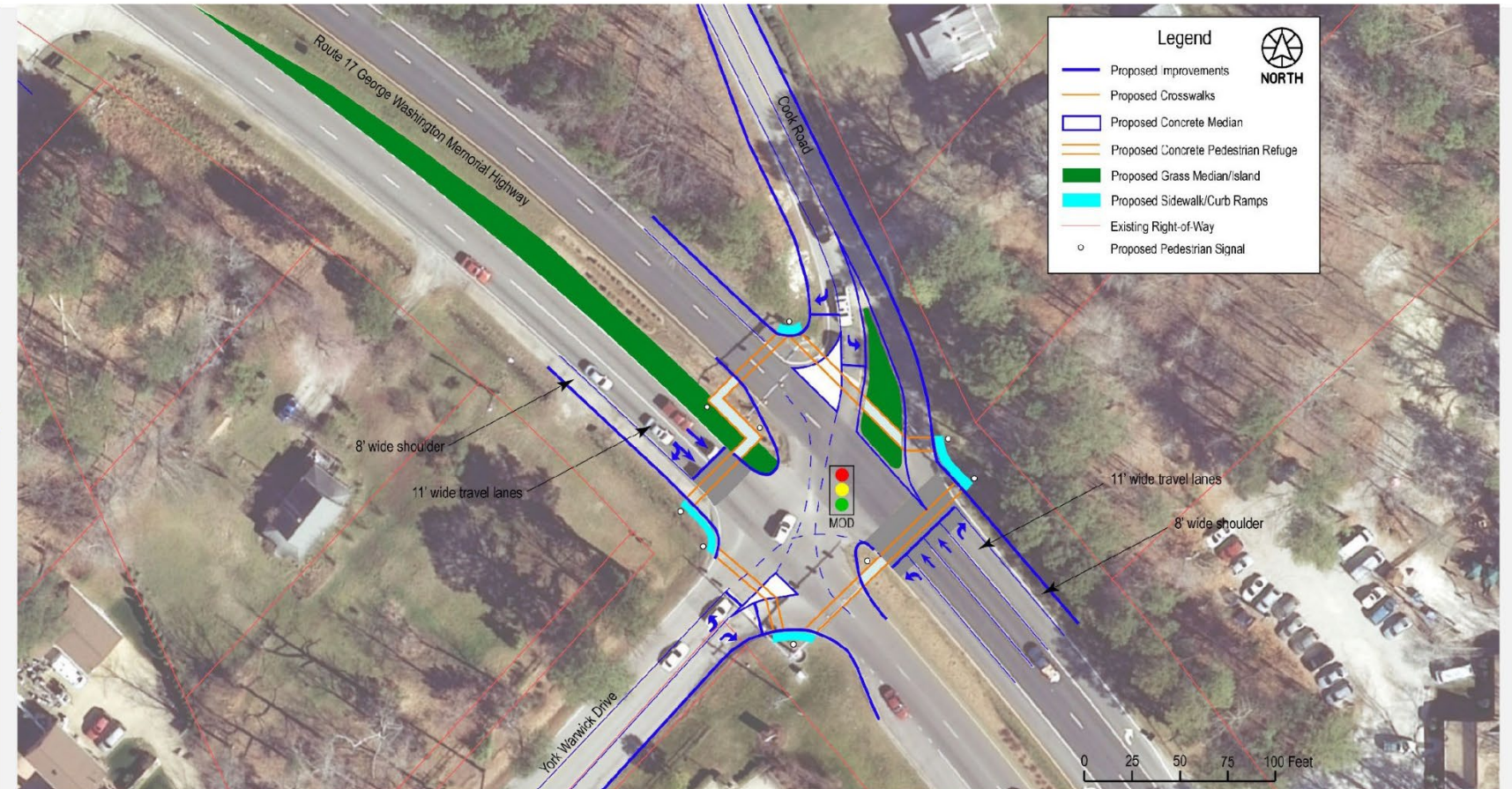
The preferred alternative addresses VTrans needs relating to safety, congestion mitigation, capacity preservation, and pedestrian access.

Needs and Priorities			
 Safety Improvement	Very High	 Pedestrian Access	Low
 Capacity Preservation	Very High	 Bicycle Access	Low
 Congestion Mitigation	Medium	 Transit Access	Low
 Transportation Demand Mgmt.	Very High		

### Project Benefits

The preferred alternative provides the following benefits:

- Reduced fatal and injury crashes along Route 17 at Cook Road
- Reduced congestion and queuing at the intersection of Route 17 and Cook Road
- Improved safety for pedestrians across Route 17 connecting to forthcoming sidewalk along Route 17 to York High School



### Public Input Survey Summary

- The Public Input survey ran between March 8, 2024 and March 22, 2024 (15 days).
- 1,521 participants and 3,068 comments.
- Many respondents expressed concerns with any concept involving U-turns.
- Participants ranked the Partial Median U-Turn the most favorable among the innovative intersection concepts, but the conventional intersection had the highest support overall.
- The Preferred Alternative is a combination of the Thru-Cut and Partial Median U-Turn. It reroutes prohibited movements to use Falcon Road instead of median openings for U-turns, which many survey respondents opposed.

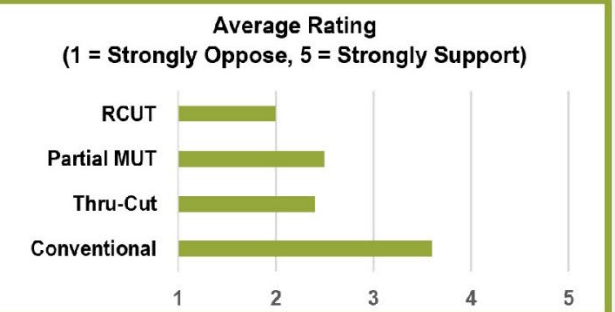




Figure 79: Phase 2 Preferred Alternative – Route 17 at Fort Eustis Boulevard – Eastbound Approach Widening

### Project Description

The improvements proposed at this location include:

- 1) Eastbound Approach Widening**
  - Widen eastbound Fort Eustis Blvd approach at the intersection of Route 17 to 2 exclusive left turn lanes, 2 exclusive through lanes, and 1 exclusive right turn lane.
- 2) Eastbound Right Turn Lane Extension**
  - Extend the eastbound right turn lane to 200 ft of full-width storage and a 200-ft taper.
- 3) Sidewalk, Crosswalks, and Curb Ramps**
  - New crosswalks and curb ramps at the intersection of Route 17 and Fort Eustis Blvd.
  - ~425 feet of new sidewalk along the west side of Route 17 north of Fort Eustis Blvd connecting to a proposed future WATA bus stop (not shown in graphic).
- 4) Wendy's Entrance Closure**
  - Close the ingress-only Wendy's entrance on Route 17, which is within the functional area of the intersection with Fort Eustis Blvd and does not meet VDOT standards.

### Project Needs

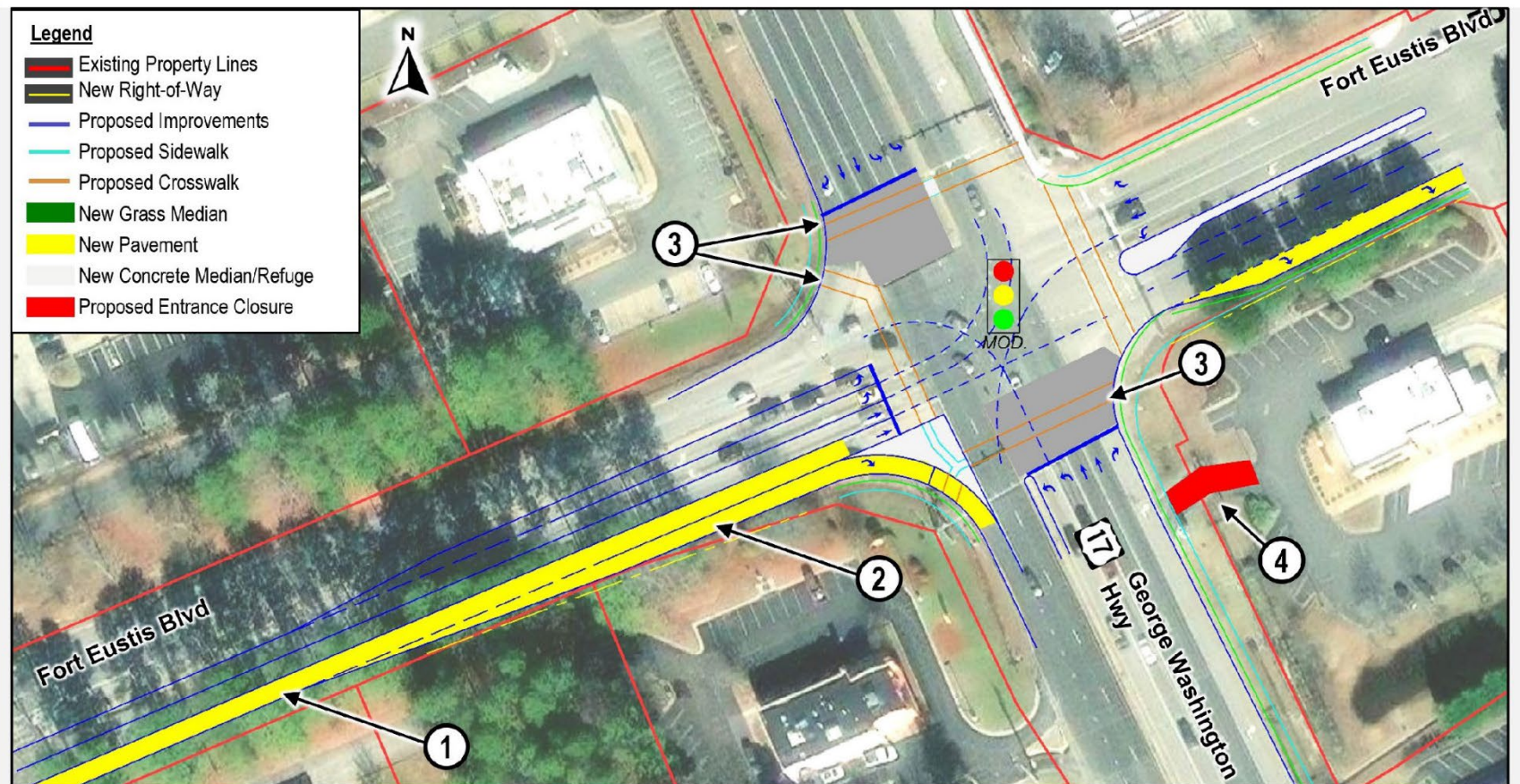
The preferred alternative addresses VTrans needs relating to safety, congestion mitigation, capacity preservation, and pedestrian access.

Needs and Priorities			
Safety Improvement	Very High	Pedestrian Access	Low
Capacity Preservation	Very High	Bicycle Access	Low
Congestion Mitigation	Medium	Transit Access	Low
Transportation Demand Mgmt.	Very High		

### Project Benefits

The preferred alternative provides the following benefits:

- Improved safety for pedestrians across Route 17 connecting to proposed future WATA bus stop and to Yorktown Crescent (future planned mixed-use development)
- Reduced congestion and queuing at the intersection of Route 17 and Fort Eustis Blvd
- Reduced fatal and injury crashes at the intersection of Route 17 at Fort Eustis Blvd



### Public Input Survey Summary

- The Public Input survey ran between March 8, 2024 and March 22, 2024 (15 days).
- 1,521 participants and 3,068 comments.
- Many respondents expressed support for extending the eastbound right turn lane and improving pedestrian safety.
- Participants ranked the Eastbound Approach Widening concept second to the Restripe Lanes concept, which had no additional capacity or pedestrian facilities.

#### Average Rating (1 = Strongly Oppose, 5 = Strongly Support)

Partial DLT	~2.5
Eastbound Approach Widening	~3.5
Restripe Lanes	~4.5

#### Eastbound Approach Widening Concept Ratings

Strongly Support	19%
Somewhat Support	28%
Neutral	25%
Somewhat Oppose	13%
Strongly Oppose	15%



## 4.2 Operational Analysis

Once the preferred alternative was selected, the study team conducted Synchro and SimTraffic analyses to refine the geometry of the preferred alternative and quantify the anticipated future traffic operations. The Build Synchro and SimTraffic models were kept consistent with the No-Build models and include the widening of Route 17 at Denbigh Boulevard and the proposed intersection laneage changes that are proffered as part of the Yorktown Crescent development. Traffic signal cycle lengths were assumed to be consistent with No-Build conditions, while splits and offsets were optimized.

Build conditions analyses were conducted for the AM and PM peak periods. **Table 20** through **Table 23** summarize the control delay and SimTraffic maximum queue lengths measures of effectiveness and compare the Build conditions results against the No-Build conditions models. Traffic operations generally improve in the Build conditions compared to the No Build conditions.

At the intersection of Route 17 and Cook Road/York Warwick Drive, the Thru-Cut with Southbound Left Turn Prohibition reduced control delay on every intersection approach in both AM and PM peak hours, even with the extra distance and resulting travel time of the rerouted movements. The southbound queue was backing up the full length of the segment in the No Build model 14 percent of the AM peak hour, and was nearly 1,700 feet long. In the Build conditions, this queue is cut nearly in half. It is still a long queue of over 800 feet, but the analysis results do not indicate any extending back to the full length of the segment.

At the intersection of Route 17 and Fort Eustis Boulevard, the improvements were focused on adding capacity to the eastbound approach and eliminating the weaving movement in front of the Bojangle's. The Build condition analysis results show a reduction in control delay in the AM peak hour for all approaches. Control delays in the PM peak hour are generally similar in the Build condition compared to No Build. While the eastbound approach widening increased capacity of the approach, the elimination of the free-flow eastbound right turn offsets this increase in capacity and provides safer operations for pedestrian crossings.

The maximum queue results from SimTraffic indicate the improvements provide operational benefits to all approaches in the AM peak hour and to the eastbound approach in the PM peak hour. The eastbound queues that extended back the full length of the eastbound approach in the No Build conditions no longer extend back to the full length in the Build conditions. The queue from the weave in front of the Bojangle's at the Generals Way intersection has been eliminated.

At the intersection of Route 17 and Old York-Hampton Highway/Faulkner Road, the laneage changes provide a small reduction in overall intersection control delay of three seconds in the AM peak hour and five seconds in the PM peak hour.

**Appendix F** includes the full Synchro and SimTraffic results from the Build analysis.

Table 20: 2045 Build Conditions Peak Hour and LOS (1)

Intersection Number and Description	Type of Control	Lane Group	Eastbound				Westbound				Northbound				Southbound				Overall	
			AM		PM		AM		PM		AM		PM		AM		PM		AM	PM
			Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
12	Signalized		York Warwick Drive				Cook Rd				Route 17				Route 17				Intersection	
		Left	51.5	D	45.0	D	57.8	E	64.7	E	31.7	C	38.5	D	34.6	C	48.1	D	Delay	Delay
		Through	84.3	F	77.8	E	58.5	E	129.5	F	2.6	A	2.9	A	21.7	C	32.2	C	17.9	20.2
		Right	49.6	D	44.4	D	‡	‡	44.8	D	1.0	A	0.6	A	21.7	C	32.2	C	LOS	LOS
	Approach	54.5	D	48.7	D	57.8	E	70.7	E	5.3	A	6.1	A	21.7	C	32.2	C	B	C	
11	Signalized		Clairmont Way				Battle Rd				Route 17				Route 17				Intersection	
		Left	51.3	D	57.5	E	63.1	E	77.8	E	10.2	B	2.8	A	1.2	A	25.0	C	Delay	Delay
		Through	92.0	F	109.8	F	73.2	E	111.7	F	1.9	A	5.0	A	2.8	A	2.6	A	6.0	8.2
		Right	51.1	D	57.2	E	52.3	D	58.4	E	5.4	A	0.1	A	5.1	A	5.8	A	LOS	LOS
	Approach	51.9	D	59.5	E	61.8	E	74.9	E	2.2	A	4.7	A	2.7	A	3.2	A	A	A	
10	Unsignalized		Market St				Route 17				Route 17				Intersection					
		Left									†	†	†	†	†	†	†	†	-	-
		Through					16.0	C	29.7	D	†	†	†	†	†	†	†	†	LOS	LOS
		Right					16.0	C	29.7	D	0.0	A	0.0	A	0.0	A	0.0	A	-	-
	Approach																			
9	Unsignalized		Patriots Square				Route 17				Route 17				Intersection					
		Left									†	†	†	†	†	†	†	†	-	-
		Through					14.6	B	36.9	E	†	†	†	†	†	†	†	†	LOS	LOS
		Right					14.6	B	36.9	E	0.0	A	0.0	A	0.0	A	0.0	A	-	-
	Approach																			
8	Unsignalized		Colonial Harbor				Route 17				Route 17				Intersection					
		Left									†	†	†	†	†	†	†	†	-	-
		Through																	LOS	LOS
		Right	39.7	E	22.7	C					0.0	A	0.0	A	0.0	A	0.0	A	-	-
	Approach	39.7	E	22.7	C															
7	Signalized		Fort Eustis Blvd				Fort Eustis Blvd				Route 17				Route 17				Intersection	
		Left	99.2	F	75.2	E	97.2	F	135.1	F	89.6	F	74.8	E	38.8	D	90.6	F	Delay	Delay
		Through	62.7	E	47.5	D	82.5*	F	113.6*	F	28.0	C	71.2	E	30.6	C	45.2	D	46.8	78.1
		Right	52.2	D	166.2	F	47.7	D	54.3	D	19.6	B	26.0	C	9.7	A	50.6	D	LOS	LOS
	Approach	72.4	E	102.3	F	81.7	F	109.1	F	47.2	D	68.9	E	26.2	C	53.7	D	D	E	
6	Unsignalized		Generals Way				Mariners Way				Route 17				Route 17				Intersection	
		Left									†	†	†	†	†	†	†	†	-	-
		Through									†	†	†	†	†	†	†	†	LOS	LOS
		Right	23.9	C	20.0	C	25.0	C	71.8	F	†	†	†	†	†	†	†	†	LOS	LOS
	Approach	23.9	C	20.0	C	25.0	C	71.8	F	0.0	A	0.0	A	0.0	A	0.0	A	-	-	

† Synchro does not provide level of service or delay for movements with no conflicting volumes.  
‡ Movement volume is zero.  
\* Lane group contains a shared left/through movement.  
\*\* Movement is a U-turn only, not a left turn.  
<sup>(1)</sup> Lane group contains a shared left/through/right movement.  
*Delays reported in purple italic font are Experienced Travel Times for movements that have been rerouted.*



Table 21: 2045 Build Conditions Peak Hour and LOS (2)

Intersection Number and Description	Type of Control	Lane Group	Eastbound				Westbound				Northbound				Southbound				Overall		
			AM		PM		AM		PM		AM		PM		AM		PM		AM	PM	
			Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	
5	Route 17 and Roberts Furniture/Hart Building	Unsignalized	Hart Building				Roberts Furniture				Route 17				Route 17				Intersection		
			Left	‡	‡	44.7	E	16.1	C	86.9	F	34.2	D	25.3	D	23.4	C	67.2	F	Delay	Delay
			Through	‡	‡							†	†	†	†	†	†	†	†	-	-
			Right	‡	‡							†	†	†	†	†	†	†	†	LOS	LOS
		Approach	0.0	A	44.7	E	16.1	C	86.9	F	0.1	A	0.3	A	0.1	A	0.1	A	-	-	
4	Route 17 and Tractor Supply Co	Unsignalized	Tractor Supply Co								Route 17				Route 17				Intersection		
			Left	†	†	83.5	F					26.3	D	17.4	C	‡	‡	84.8**	F	Delay	Delay
			Through									†	†	†	†	†	†	†	†	-	-
			Right	†	†	20.1	C									†	†	†	†	LOS	LOS
		Approach	0.0	A	49.7	E				0.1	A	0.2	A	0.0	A	0.4	A	-	-		
3	Route 17 and Greene Dr	Unsignalized	Greene Dr								Route 17				Route 17				Intersection		
			Left	23.4	C	85.3	F					19.7	C	55.6	F					Delay	Delay
			Through									†	†	†	†	†	†	†	†	-	-
			Right	23.4	C	85.3	F									†	†	†	†	LOS	LOS
		Approach	23.4	C	85.3	F				0.5	A	1.0	A	0.0	A	0.0	A	-	-		
2	Route 17 and Whites Rd	Unsignalized	Whites Rd				Driveway				Route 17				Route 17				Intersection		
			Left									43.2	E	24.2	C	34.3	D	87.7	F	Delay	Delay
			Through	39.1	E	53.2	F	25.6	D	23.2	C	†	†	†	†	†	†	†	†	-	-
			Right	39.1	E	53.2	F	25.6	D	23.2	C	†	†	†	†	†	†	†	†	LOS	LOS
		Approach	39.1	E	53.2	F	25.6	D	23.2	C	0.8	A	0.2	A	0.2	A	1.3	A	-	-	
1	Route 17 and Old York Hampton Hwy/Faulkner Rd	Signalized	Faulkner Rd				Old York Hampton Hwy				Route 17				Route 17				Intersection		
			Left					65.9	E	96.7	F	269.3	F	98.1	F	74.2	E	66.7	E	Delay	Delay
			Through	59.0	E	70.2	E	50.1 <sup>(1)</sup>	D	91.7 <sup>(1)</sup>	F	6.9	A	10.4	B	17.9	B	20.4	C	15.8	19.7
			Right	59.0	E	70.2	E	58.2	E	94.2	F	0.1	A	0.0	A					LOS	LOS
		Approach	59.0	E	70.2	E	58.2	E	94.2	F	7.8	A	10.6	B	18.7	B	21.0	C	B	B	
X	Route 17 and Denbigh Blvd/Goodwin Neck Rd	Signalized	Denbigh Blvd				Goodwin Neck Rd				Route 17				Route 17				Intersection		
			Left	79.6	E	104.2	F	42.5	D	55.3	E	35.1	D	69.6	E	38.6	D	76.6	E	Delay	Delay
			Through	79.6*	E	98.8*	F	79.4	E	129.6	E	39.1	D	64.0	E	34.8	C	41.0	D	42.2	63.4
			Right	45.6	D	43.9	D					27.2	C	30.2	C	22.9	C	56.5	E	LOS	LOS
		Approach	72.8	E	89.5	F	68.2	E	98.6	F	38.0	D	62.9	E	32.4	C	46.3	D	D	E	
E	Route 17 and new Yorktown Crescent entrance	Unsignalized					New Driveway				Route 17				Route 17				Intersection		
			Left													14.6	B	23.8	C	Delay	Delay
			Through									†	†	†	†	†	†	†	†	-	-
			Right					17.5	C	24.1	C	†	†	†	†					LOS	LOS
		Approach				17.5	C	24.1	C	0.0	A	0.0	A	0.0	A	0.2	A	-	-		

† Synchro does not provide level of service or delay for movements with no conflicting volumes.

‡ Movement volume is zero.

\* Lane group contains a shared left/through movement.

\*\* Movement is a U-turn only, not a left turn.

<sup>(1)</sup> Lane group contains a shared left/through/right movement.

*Delays reported in purple italic font are Experienced Travel Times for movements that have been rerouted.*

Table 22: 2045 Build Conditions Peak Hour Maximum Queue (1)

Intersection Number and Description	Type of Control	Lane Group	Maximum Queue (feet)							
			Eastbound		Westbound		Northbound		Southbound	
			AM	PM	AM	PM	AM	PM	AM	PM
12 Route 17 and Cook Rd/ York Warwick Dr	Signalized		York Warwick Dr		Cook Rd		Route 17		Route 17	
		Left	125	100	162	360	158	234		
		Through					122	172	847	413
1101 Route 17 and North U-Turn Location	Unsignalized						Route 17		Route 17	
		Left					‡	27		
		Through					†	†	^(1%)	0
11 Route 17 and Clairmont Way/ Battle Rd	Signalized		Clairmont Way		Battle Rd		Route 17		Route 17	
		Left	32	46	130	193	72	116	** (21%)	** (1%)
		Through					107	245	^(5%)	150
1102 Route 17 and South U-Turn Location	Unsignalized						Route 17		Route 17	
		Left							** (20%)	** (5%)
		Through					0	32	^(7%)	242
10 Route 17 and Market St	Unsignalized				Market St		Route 17		Route 17	
		Left					†	†	^(14%)	^(8%)
		Through			0	0	†	†		
9 Route 17 and Patriots Square	Unsignalized				Patriots Square		Route 17		Route 17	
		Left					†	†	^(25%)	^(16%)
		Through			35	76	†	†		
8 Route 17 and Colonial Harbor	Unsignalized		Colonial Harbor				Route 17		Route 17	
		Left					†	†	^(38%)	^(43%)
		Through	^(87%)	^(47%)						
7 Route 17 and Fort Eustis Blvd	Signalized		Fort Eustis Blvd		Fort Eustis Blvd		Route 17		Route 17	
		Left	302	*(1%)*(11%)	*(1%)*(7%)	*(4%)*(14%)	362	** (2%)	** (41%)	*(7%)*(48%)
		Through	251	1262	317°	394°	395	^(1%)	^(41%)	^(48%)
6 Route 17 and Generals Way/ Mariners Way	Unsignalized		Generals Way		Mariners Way		Route 17		Route 17	
		Left								
		Through					20	50	2	0
		Right	101	61	0	0	17	18	0	0

† No queue reported. Movement does not have conflicting volumes.  
‡ Movement volume is zero.  
\*(X%) Maximum queue extends full length of storage bay for X% of the analysis period.  
\*\*(Y%) Queue in lane adjacent to storage bay extends beyond end of storage bay for Y% of the analysis period.  
^(Z%) Maximum queue extends back to the upstream intersection for Z% of the analysis period.  
° Lane group contains a shared left/through movement.



Table 23: 2045 Build Conditions Peak Hour Maximum Queue (2)

Intersection Number and Description		Type of Control	Lane Group	Maximum Queue (feet)								
				Eastbound		Westbound		Northbound		Southbound		
				AM	PM	AM	PM	AM	PM	AM	PM	
5	Route 17 and Roberts Furniture/ Hart Building	Unsignalized	Hart Building				Roberts Furniture		Route 17		Route 17	
			Left	‡	76	21	32	24	56	24	27	
			Through	†				†	†	†	†	
			Right	†				†	†	†	†	
4	Route 17 and Tractor Supply Co	Unsignalized	Tractor Supply Co						Route 17		Route 17	
			Left	‡	^(15%)			33	59	‡	38	
			Through	†				†	†	†	†	
			Right	‡	*(1%)*(52%)				†	†		
3	Route 17 and Greene Dr	Unsignalized	Greene Dr						Route 17		Route 17	
			Left	90	992			76	94			
			Through	†				†	†	†	†	
			Right	90	992				†	†		
2	Route 17 and Whites Rd	Unsignalized	Whites Rd		Driveway		Route 17		Route 17			
			Left			0	0	48	39	25	43	
			Through	118	187			†	†	†	†	
			Right	†				†	†			
1	Route 17 and Old York Hampton Hwy/Faulkner Rd	Signalized	Faulkner Rd		Old York-Hampton Hwy		Route 17		Route 17			
			Left			*(10%)	*(28%)	40	55	70	*(1%)	
			Through	48	42	*(1%)*(10%) <sup>(1)</sup>	*(3%)*(28%) <sup>(1)</sup>	218	160	202	343	
			Right			103	48					
X	Route 17 and Denbigh Blvd/ Goodwin Neck Rd	Signalized	Denbigh Blvd		Goodwin Neck Rd		Route 17		Route 17			
			Left	298	*(1%)*(32%)	*(1%)*(50%)	*(1%)*(60%)	*(1%)*(82%)	*(1%)*(77%)	262	*(1%)	
			Through	393 <sup>°</sup>	^(3%) <sup>°</sup>	^(6%)	^(10%)	^(74%)	^(86%)	440	480	
			Right	*(4%)	*(1%)*(32%)			*(2%)*(82%)	*(1%)*(83%)	*(1%)*(6%)	*(1%)*(7%)	
E	Route 17 and new Yorktown Crescent entrance	Unsignalized	New Driveway				Route 17		Route 17			
			Left						25	54		
			Through					†	†	†	†	
			Right	61	48			†	†			

† No queue reported. Movement does not have conflicting volumes.

‡ Movement volume is zero.

\*(X%) Maximum queue extends full length of storage bay for X% of the analysis period.

\*\*\*(Y%) Queue in lane adjacent to storage bay extends beyond end of storage bay for Y% of the analysis period.

^(Z%) Maximum queue extends back to the upstream intersection for Z% of the analysis period.

<sup>°</sup> Lane group contains a shared left/through movement.

<sup>(1)</sup> Lane group contains a shared left/through/right movement.

### 4.3 Phase 3 Planning-Level Sketches and Cost Estimates

After vetting the potential Phase 2 concepts with the public and finalizing the preferred alternative, the study team proceeded into Phase 3 to examine the preferred alternative in more detail, prepare concept design drawings and planning level cost estimates, and identify potential risks.

The Phase 3 sketches are shown in **Figure 80 and Figure 81**. **Appendix L** includes high resolution images of the Phase 3 sketches, as well as a Basis of Design Memo that details the established project design criteria, field review notes, risk assessment, and assumptions made during the design effort.

An engineer’s preliminary opinion of probable cost was created for construction costs, right of way acquisition costs, and utility relocation costs for the preferred alternative. These cost opinions established the project budget, in FY2024 dollars, as shown in **Table 24**. **Appendix L** includes detailed cost estimates.

**Table 24: HR-09 Phase 3 Cost Estimates (FY2024 Dollars)**

Phase Description	Budget (FY2024)
Preliminary Engineering	\$ 2,519,000
Right of Way and Utility Relocation	\$ 3,000,000
Construction	\$ 9,846,000
CEI	\$ 1,611,000
<b>Total Project Budget</b>	<b>\$ 16,977,000</b>

### 4.4 Schedule Estimates

A schedule estimate was developed for the preferred alternative. **Table 25** summarizes the projected timeframes for the preliminary engineering (PE), right of way (RW), and construction (CN) phases.

**Table 25: HR-09 Phase 3 Schedule Estimate**

Estimated Schedule by Phase (months)	PE	RW	CN	Total
Preferred Concept (all inclusive)	24	15	16	<b>55</b>

### 4.5 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 of 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 L** includes the risk analysis matrix with details on the risk assessment and mitigation strategy.

#### Risk/Issue: Utilities

There were above ground appurtenances observed during the field visit signifying the presence of underground utilities such as fiber optic communication lines, highway advisory radio antennae, light poles, fire hydrants, and water lines identified close to the project limits. The Phase 3 concept has been designed to avoid utility impacts where possible.

#### Risk/Issue: Coordination with other Ongoing Projects

The proposed County sidewalk at Cook Road is at 100% design. The improvements of the preferred alternative have been designed to tie into the sidewalk projects as closely as possible.

#### Risk/Issue: Right of Way

The proposed improvements assume no right-of-way impacts at the Cook Road intersection. The proposed improvements at the Fort Eustis Boulevard intersection will involve acquiring right-of-way on seven parcels.

### 4.6 Possible Funding Sources

York County elected to submit the preferred alternative concepts for the Cook Road and Fort Eustis Boulevard locations for SMART SCALE funding. All remaining funding will come from York County. The sidewalk project will be completed by others and will be funded separately from this project. Other potential funding sources that could be explored for the improvements identified in this study include: later SMART SCALE rounds, HSIP, and federal discretionary grants.



Figure 80: Phase 3 Sketch – Route 17 at Cook Road – Thru-Cut with Southbound Left Turn Prohibition

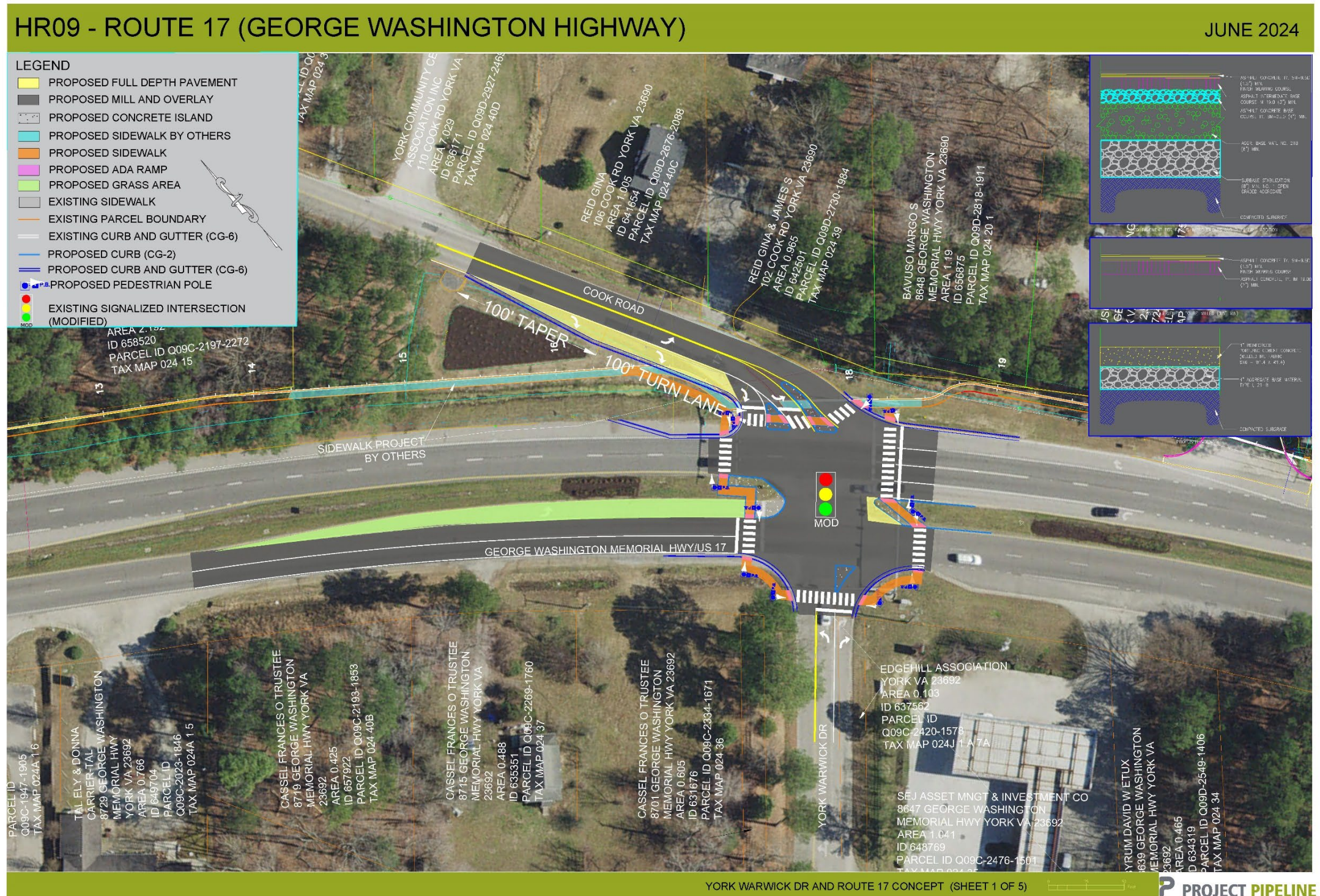




Figure 81: Phase 3 Sketch – Route 17 at Fort Eustis Boulevard – Eastbound Approach Widening

