PARK AVENUE (US 23) CORRIDOR OPERATIONS AND IMPROVEMENT STUDY

NORTON, VIRGINIA

July 2020

Park Avenue (US 23) Corridor Operations and Improvement Study

Norton, Virginia

July 2020 | Final

Prepared for:

VDOT

Prepared by:

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List of Acronyms

AADT – Annual Average Daily Traffic

AASHTO – American Association of State Highway and Transportation Officials

CEI – Construction Engineering and Inspection

CMAQ – Congestion Mitigation and Air Quality

CMF – Crash Modification Factor

CN – Construction

EPDO – Equivalent Property Damage Only

FHWA – Federal Highway Administration

FI – Fatal and Injury

HCM – Highway Capacity Manual

LOS – Level of Service

MPH – Miles per Hour

MUTCD – Manual on Uniform Traffic Control Devices

PCES – Project Cost Estimating System

PDO – Property Damage Only

PE – Preliminary Engineering

RNS – Roadway Network System

RW – Right-of-way and Utility Relocation

SPS – Statewide Planning System

STARS – Strategically Targeted and Affordable Roadway Solutions

SWG – Study Work Group

STIP – Statewide Transportation Improvement Plan

SYIP – Six-Year Improvement Program

TIP – Transportation Improvement Plan

TMC – Turning Movement Count

TOSAM – Traffic Operations and Safety Analysis Manual

TPO – Transportation Planning Organization

VDOT – Virginia Department of Transportation

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1 INTRODUCTION

1.1 Background and Study Initiation

The Virginia Department of Transportation (VDOT) identified the Park Avenue (US 23) corridor in the City of Norton for study under the Strategically Targeted and Affordable Roadway Solutions (STARS) program. The STARS program uses a data-driven process to identify candidate projects with critical traffic and safety challenges. The Park Avenue corridor ranked highly within the Bristol District with several locations of moderate congestion and high crash frequency. The STARS program then seeks to develop comprehensive, innovative transportation solutions to relieve congestion and resolve safety issues. The goals of STARS studies include:

- Develop innovative, cost-effective solutions
- Evaluate potential solutions more thoroughly
- Identify potential project risks and costs
- Build stakeholder consensus
- Improve readiness for project implementation

This study is entitled the Park Avenue (US 23) Corridor Improvement Study and will be referred to as the Study in this report.

1.2 Purpose of Study

The purpose of this Study was to evaluate existing operational and safety deficiencies along the Park Avenue corridor and to develop potential projects to improve operations and enhance safety. The primary goal of the STARS program is to identify targeted cost-effective improvements that meet project needs and could be programmed into the VDOT Six-Year Improvement Program (SYIP). Consideration was given to the likelihood that recommended improvements would perform favorably in the SMART SCALE project prioritization process or other transportation funding programs. A secondary goal of the project was to develop and implement traffic signal timing plans tailored to existing traffic conditions and make an immediate impact on congestion relief and corridor safety, while funding for infrastructure improvements is programmed for future years. The primary needs for this Study included the following:

- Improve traffic progression and operations on Park Avenue where congestion occurs
- Evaluate safety issues/concerns at intersections with crash patterns
- Evaluate signal timing plans at signalized intersections along Park Avenue
- Evaluate existing traffic signal equipment and identify upgrades to improve communications and operations
- Develop alternatives to improve access management, safety, and operations along Park Avenue
- Improve access/mobility and safety for pedestrians throughout the corridor

Known operational deficiencies in the study area included the following:

- Vehicular progression along Park Avenue from Park Avenue NE (Tipple Hill) to 11th Street
- Control delays and queueing at Park Avenue/Park Avenue NE (Tipple Hill) and Park Avenue/11th Street during the school arrival and dismissal periods
- Control delays at Park Avenue/11th Street due to heavy vehicle traffic along truck route

1.3 Study Work Group

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

- VDOT
- City of Norton
- LENOWISCO Planning District Commission
- Kimley-Horn

1.4 Study Area

The study area limits along Park Avenue extended between Park Avenue NE (Tipple Hill) and 15th Street, Norton Coeburn Road between the US 58/US 23 interchange and Hawthorne Drive, and 11th Street from Park Avenue to Kentucky Avenue. The entire study area totaled approximately 2.8 miles in length. Norton Coeburn Road to the east of Park Avenue NE (Tipple Hill) is a four-lane divided roadway with a 45 mile per hour (MPH) posted speed limit. Park Avenue from Park Avenue NE (Tipple Hill) to 11th Street is a four-lane undivided roadway with on-street parking and a 25 mile per hour posted speed limit. Park Avenue to the west of 11th Street is a two-lane divided roadway with a 25 mile per hour posted speed limit. Park Avenue is functionally classified as a minor arterial. Norton Coeburn Road is classified as a principal arterial.

The study area roadways serve as the primary transportation network for the City of Norton, and it must continue to accommodate a wide array of users with varying trip purposes. The various trip purposes in the study area include, but are not limited to, the following:

- Employment commuting
- Local residential
- Local business access
- Access to schools and hospitals
- Recreational access
- Major highway access (US 58/US 23 Bypass)

The study area for the Park Avenue corridor is shown in *Figure 1*. The following intersections were included in the study area:

1. Norton Coeburn Road at Hawthorne Drive (Signalized) – VDOT Maintained
2. Norton Coeburn Road at Trent Street (Signalized) – VDOT Maintained
3. US 23 (Orby Cantrell Highway) NB Off-Ramp at Norton Coeburn Road (Unsignalized)
4. US 23 (Orby Cantrell Highway) SB Off-Ramp at Norton Coeburn Road (Unsignalized)
5. Park Avenue at Park Avenue NE (Signalized) – City Maintained
6. Park Avenue at Coeburn Avenue (Signalized) – City Maintained
7. Park Avenue at 5th Street (Unsignalized)
8. Park Avenue at 6th Street (Signalized) – City Maintained
9. Park Avenue at 7th Street (Signalized) – City Maintained
10. Park Avenue at 8th Street (Signalized) – City Maintained
11. Park Avenue at 9th Street (Signalized) – City Maintained
12. Park Avenue at 10th Street (Unsignalized)
13. Park Avenue at 11th Street (Signalized) – City Maintained
14. Park Avenue at 12th Street (Unsignalized)
15. Park Avenue at 13th Street (Unsignalized)
16. Park Avenue at 14th Street (Unsignalized)
17. Park Avenue at 15th Street (Unsignalized)
18. 11th Street at Main Avenue (Unsignalized)
19. 11th Street at Kentucky Avenue (Signalized) – City Maintained

Figure 1: Project Study Area

VDOT STARS

Study Area
US 23 (Park Avenue) Corridor Operations and Improvement Study
Norton, VA

FIGURE 1

2 Data Collection and Inventory

A preliminary field review of the study area was conducted on January 28 and 29, 2019 to observe existing geometric conditions, traffic control devices, peak hour traffic conditions, and driver behavior. The traffic volume counts were performed November 13 through November 15, 2018. Existing traffic volume data was collected from a combination of turning movement counts, vehicle speed counts, and vehicle classification tube counts. Additionally, existing signal timing information including signal phase assignments and existing signal timing plans were obtained while in the field for the city-maintained intersections. Roadway Network System (RNS) crash data was obtained from VDOT for the latest available five (5) years (i.e., January 1, 2013 to December 31, 2017). VDOT also provided existing traffic signal timing plans and traffic signal phasing plans for the signals they maintain.

The following sections summarize collected data and field review observations. All assumptions about data collection and processing are based on the direction and guidance provided in the VDOT *Traffic Operations and Safety Analysis Manual* (*TOSAM*).

2.1 Field Review Observations

During the field review, the following was observed:

- Signal timing/coordination of signalized intersections within the study area to include general vehicle progression, queueing, general driver behavior, and pedestrian movements and activity
- Operations of the study area intersections during the AM, Midday, and PM peak hours.
- The lane geometry, signal phasing, approach grades, as well as intersection and roadway segment widths were field measured. Geometric measurements/configurations were also confirmed based on available aerials.
- School peak ingress/egress patterns including the Park Avenue/11th Street intersection and Tipple Hill

Additionally, maximum queues were observed in the field at the intersections of 6th Street, 7th Street, 11th Street and Tipple Hill and used to calibrate the AM and PM peak hour existing conditions Synchro and SimTraffic models.

2.2 Existing Roadway Geometry

The existing roadway geometry in the study area was observed and documented during the field review. *Figure 2* summarizes the existing lane configurations, including the effective storage lengths for left-and right-turn storage bays and posted speed limits, for all study area intersections. A 25 mile per hour (MPH) speed limit was assumed for any road without a posted speed limit. Park Avenue is oriented in an east/west direction and other roads are oriented in a north/south direction for the purposes of this Study.

2.3 Land Use

The existing (2018) land use maps for the City of Norton is provided in *Appendix A*. The total city area of Norton is approximately 7.5 square miles and has an approximate population of 4,000 people per 2010 census data. The land uses within the study area consist primarily of commercial and residential. On either end of downtown, there are major healthcare providers which support the overall region. Downtown serves as the center for professional services and offers various specialty retail shops and restaurants. During the study, a cidery was being constructed within the downtown core, a recommendation as part of the Downtown Revitalization Plan. Additionally, there are two (2) public schools within the study area.

Norton is located near the Jefferson Nation Forest. Additionally, Norton owns and maintains the Flag Rock Recreation Area which is located approximately three miles south of downtown near High Knob. The recreation area includes approximately 25 acres of developed area within an approximate 1,000-acre park. As such, there are many outdoor recreation opportunities offered by the City including hiking, mountain biking, paddling, climbing, fishing, and urban trekking. In 2017, Norton was named a Top Adventure Town by *Blue Ridge Outdoors Magazine*. Norton frequently hosts farmer's markets, outdoor festivals, and outdoor events. Outdoor recreation will continue to be part of the culture and an always improving attraction offered by Norton.

2.4 Traffic Volume Data

Turning movement count (TMC) data was conducted between the AM, Midday, and PM periods of 6:00 AM and 6:00 PM at intersections 1-15 on November 14 or 15, 2018. At intersections 16-19, TMC data was counted between the peak periods of 7:00 AM and 6:00 PM on November 13, 2018. Classification and speed counts were also conducted for seven (7) consecutive days at two (2) locations: at Park Avenue North of Coeburn Avenue and Norton Coeburn Road between Trent Street and Hawthorne Drive. Additionally, 72-hour volumes counts were collected along each of the on and off ramps at the US Route 23/US Route 58 Alt/Norton Coeburn Road interchange. Published annual average daily traffic (AADT) volumes were also reviewed within the study area to verify the accuracy of the collected traffic data.

2.4.1 Speed Counts

Speed counts were collected by lane at two locations described above. The following tables illustrate the information obtained including a statistical summary for each location. The posted speed limit is 25MPH at Tipple Hill where the data was collected and the posted speed limit along Norton Coeburn Road is 45MPH. The highlighted cells indicate where the reported speed exceeds the posted speed limit by five miles per hour or greater. Table 1 and Table 2 illustrate the speed data collected per day separated by various speed thresholds for segments of Park Avenue and Norton Coeburn Road within the study area. Table 3 and Table 4 illustrate the statistical speed summaries for each count location averaged for the weekday.

Table 1: Park Avenue at Tipple Hill Speed Summary Counts

Eastbound Traffic (vehicles per day)	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Average
20 MPH and Under	7	11	5	5	4	5	2	6
25 to 30 MPH	497	537	596	467	447	343	318	458
35 to 40 MPH	4,095	4,383	4,258	4,235	4,442	2,865	2,551	3,833
Over 40 MPH	939	648	769	855	1,277	839	695	860
Total Eastbound	5,538	5,579	5,628	5,562	6,170	4,052	3,566	5,157
Westbound Traffic (vehicles per day)	**Monday**	**Tuesday**	**Wednesday**	**Thursday**	**Friday**	**Saturday**	**Sunday**	**Average**
20 MPH and Under	18	26	14	9	9	1	2	11
25 to 30 MPH	1,487	1,833	1,688	1,720	1,634	849	787	1,428
35 to 40 MPH	3,940	3,948	3973	3,951	4,683	2,931	2,577	3,715
Over 40 MPH	503	346	432	380	564	562	424	459
Total Westbound	5,948	6,153	6,107	6,060	6,890	4,343	3,790	5,613

Table 2: Norton Coeburn Road between Hawthorne Drive and Trent Street Speed Summary Counts

Eastbound Traffic (vehicles per day)	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Average
25 MPH and Under	14	26	28	29	21	3	3	18
30 to 40 MPH	310	333	402	333	353	176	129	291
45 to 50 MPH	3,189	3,405	3,435	3,359	3,410	2,494	1,974	3,038
55 to 60 MPH	1,482	1,344	1,199	1,223	1,749	1,433	1,136	1,367
Over 60 MPH	62	41	35	35	61	79	63	54
Total Eastbound	5,043	5,123	5,071	4,950	5,573	4,182	3,302	4,750
Westbound Traffic (vehicles per day)	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Average
25 MPH and Under	13	18	19	14	16	9	6	14
30 to 40 MPH	426	493	508	507	594	286	214	433
45 to 50 MPH	3,130	3,205	3,215	3,129	3,531	2,575	2021	2,972
55 to 60 MPH	1,157	1,050	1,125	1,021	1,129	950	833	1,038
Over 60 MPH	72	73	72	57	69	89	64	71
Total Westbound	4,785	4,821	4,920	4,714	5,323	3,900	3,132	4,514

Table 3: Park Avenue at Tipple Hill Speed Statistics

	Eastbound	Westbound
Median Speed (MPH)	35.7	33.1
85th Percentile Speed (MPH)	40.3	38.4
Average Speed (MPH)	35.7	33.3

*Posted speed limit is 25 MPH

Table 4: Norton Coeburn Road between Hawthorne Drive and Trent Street Speed Statistics

	Eastbound	Westbound
Median Speed (MPH)	46.0	45.9
85th Percentile Speed (MPH)	52.5	52.2
Average Speed (MPH)	45.5	46.0

*Posted speed limit is 45 MPH

The most notable observations from the speed counts indicate excessive speeds through the Tipple Hill segment of Park Avenue approaching and leaving downtown. The posted speed limit is 25 MPH but the 85th percentile speeds are approximately 40 MPH for the eastbound direction and 38 MPH for the westbound direction which is in excess of 10 MPH higher than the posted speed limit as vehicles approach and leave a downtown area with on-street parking and pedestrian movements.

2.4.2 Classification Counts

Classification counts were collected simultaneously with the speed counts. The following tables summarize the vehicle classification results for each count location.

2.4.3 Peak Hour Determination

A network-wide peak hour was developed for both the AM and PM peak periods. The peak hours for the study area were determined by first reviewing the individual intersection and arterial peak hours. Traffic volumes during each hour were then compared to the traffic volumes during the peak hour at each location. The hours that captured the highest percentage of overall traffic in the network when compared to individual peaks were identified as the peak hours for the Study.

The network-wide peak hours were determined to be 7:45 AM – 8:45 AM and 4:15 PM – 5:15 PM. The peak hour determination summary tables are provided in *Appendix B*.

2.4.4 Heavy Vehicle Percentages and Peak Hour Factors

Heavy vehicle percentages were calculated for each movement at all study area intersections during the AM and PM peak hours. The calculations were based on raw traffic count data.

Intersection wide peak hour factors were calculated at all study area intersections during the peak hours. The calculations were based on raw traffic data.

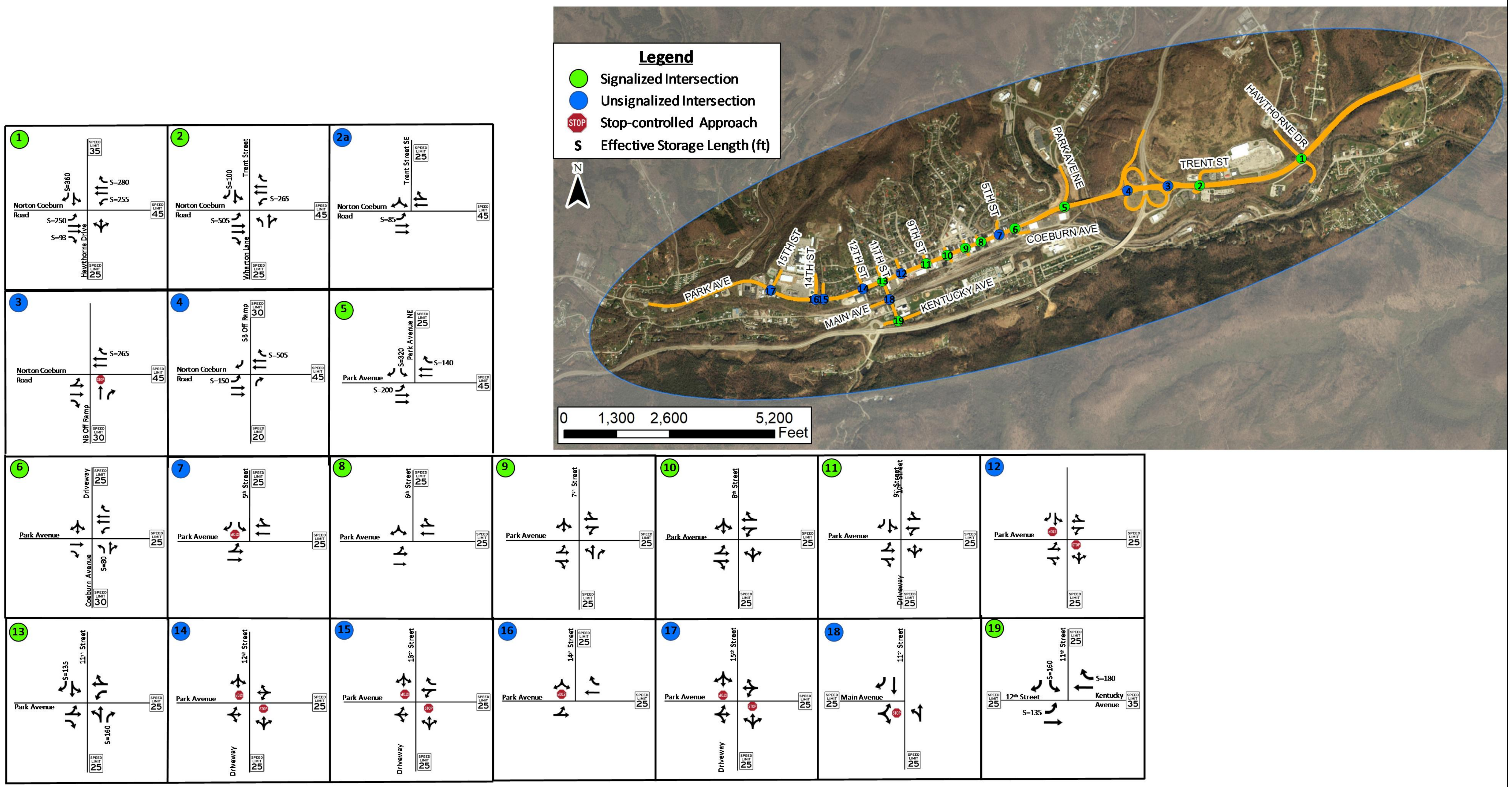
2.4.5 Traffic Volume Balancing

Traffic volumes were balanced, where appropriate, throughout the study area in preparation for the existing conditions operations analyses. Peak hour traffic volumes were balanced between all study area intersections except at locations where imbalances existed due to the presence of significant intersecting roads or driveways between the study area intersections that were counted. Traffic volume imbalances were maintained at the following locations due to the presence of access points:

- Along Park Avenue between 15th Street and 14th Street
- Along 11th Street between Main Avenue and 12th Street/Kentucky Avenue
- Along Norton Coeburn Road between the northbound and southbound ramps
- Norton Coeburn Road between Hawthorne Drive and Trent Street/Wharton Lane

The balanced 2019 AM and PM peak hour traffic volumes in the study area are summarized in *Figure 3* and *Figure 4*, *respectively*.

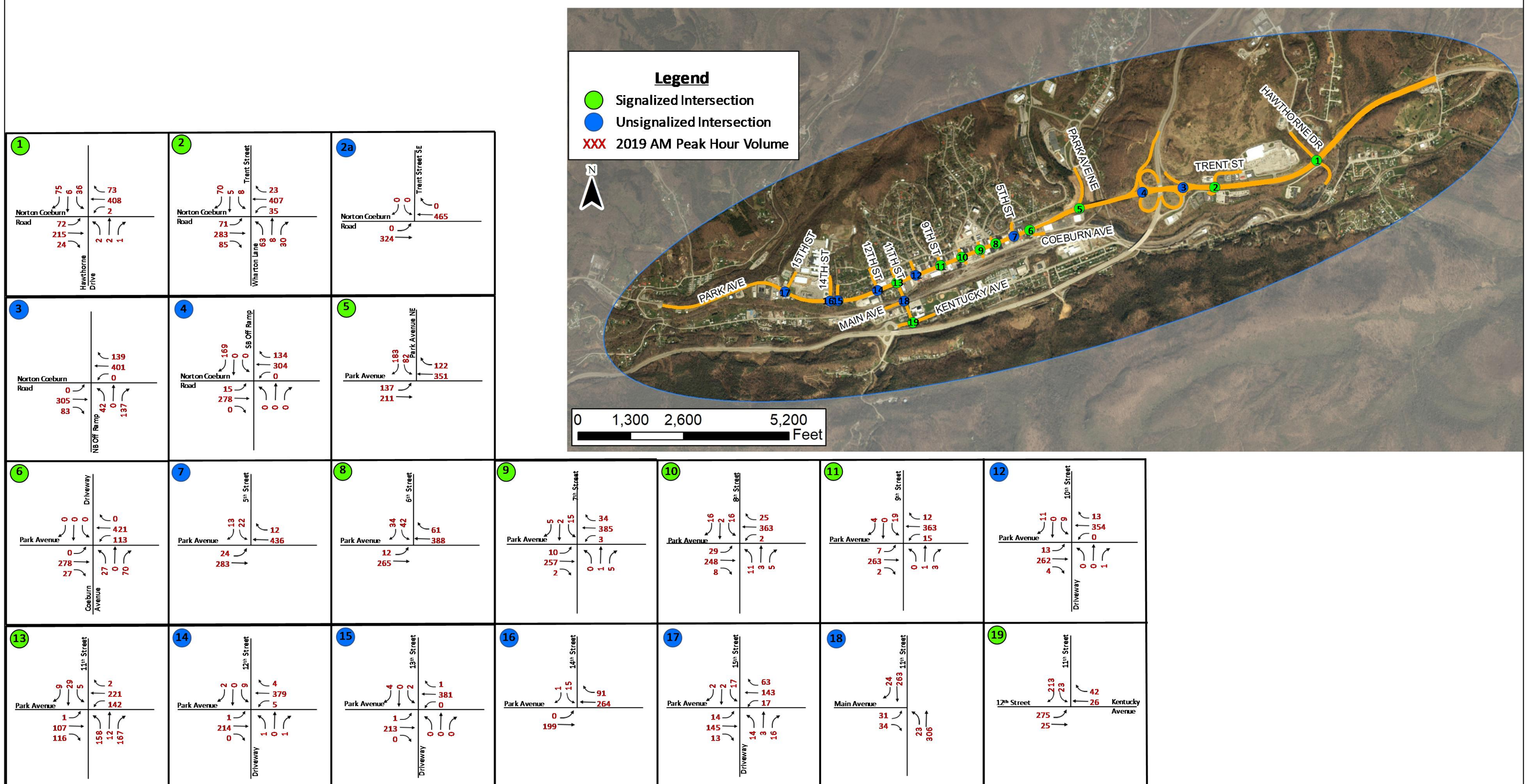
Figure 2: Existing Geometric Configurations



2019 Existing Geometric Conditions
US 23 (Park Avenue) Corridor Operations and Improvement Study
Norton, VA

FIGURE 2

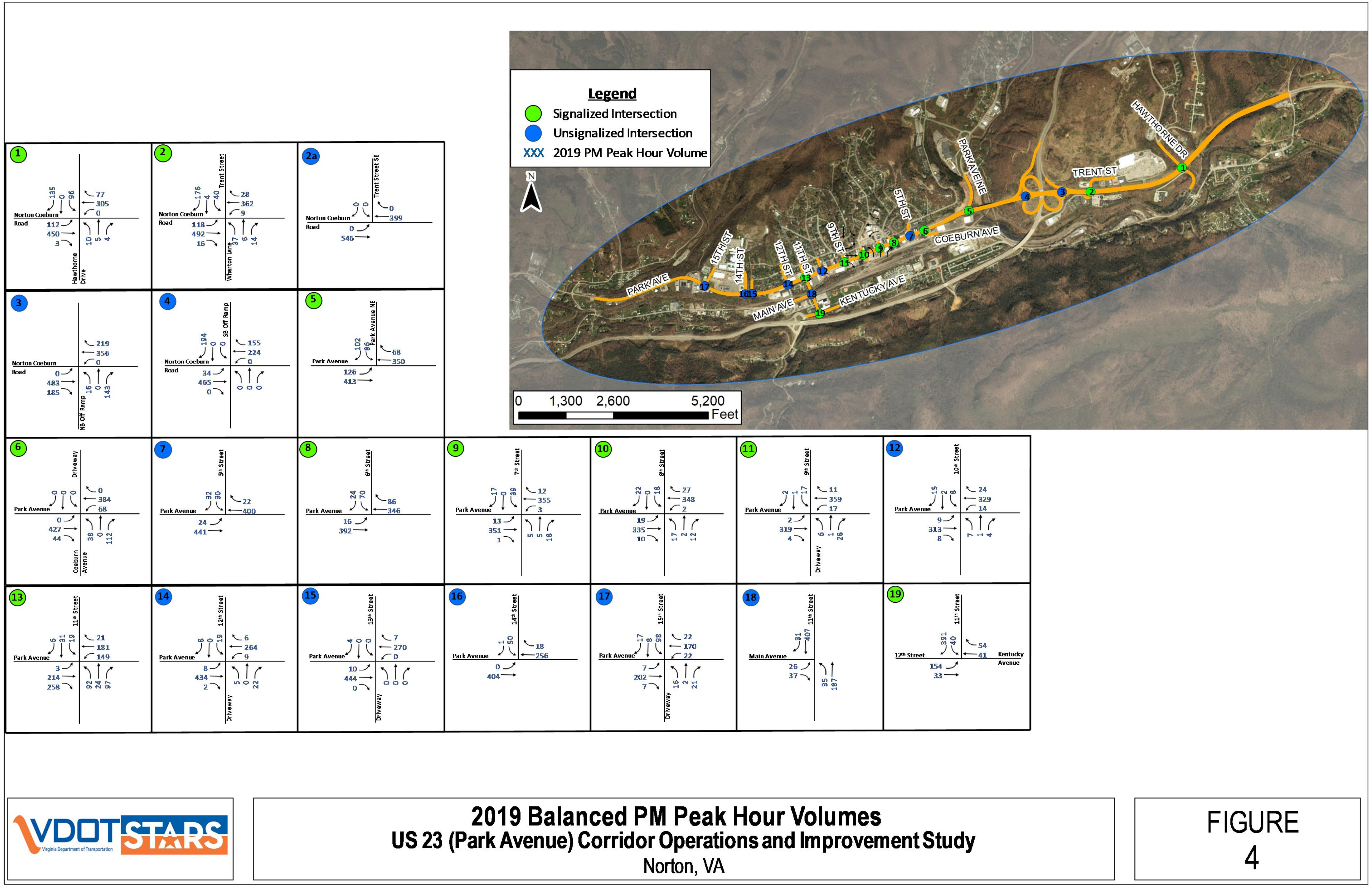
Figure 3: 2019 Existing AM Peak Hour Volumes



2019 Balanced AM Peak Hour Volumes
US 23 (Park Avenue) Corridor Operations and Improvement Study
Norton, VA

FIGURE
3

Figure 4: 2019 Existing PM Peak Hour Volumes



3 Crash Analysis

Crash data for the study area was used to evaluate corridor safety and identify crash patterns. VDOT Roadway Network System (RNS) crash data was obtained for the latest available five (5) years of crash data (January 1, 2013 to December 31, 2017). The following sections provide a summary of the crashes that occurred within the project study area during the five-year period.

3.1 Summary of Study Area Crashes

Over the five-year period, 220 crashes were reported in the study area. Table 5 provides a yearly summary of crashes by crash severity. A total of 113 crashes occurred in the entire study area over the 5-year period. Generally, there was a relatively consistent dispersion of crashes per year as well as by crash severity. During the study process, the City of Norton indicated there have been at least two fatalities within the study area; however, they preceded the analysis. Crash severity is coded using the KABCO scale, which is defined using the following classifications:

- K – Fatal Injury
- A – Suspected Serious Injury
- B – Suspected Minor Injury
- C – Possible Injury
- PDO – Property Damage Only

Table 5: Study Area Crashes by Crash Severity and Year

Year	Total Crashes	K - Fatal Injury*	A - Severe Injury	B - Visible Injury	C - Non-visible Injury	PDO – Property Damage Only
2013	26	0	0	6	1	19
2014	29	0	3	8	1	17
2015	20	0	2	4	1	13
2016	18	0	1	7	2	8
2017	20	0	1	6	1	12
Total	113	0	7	31	6	69

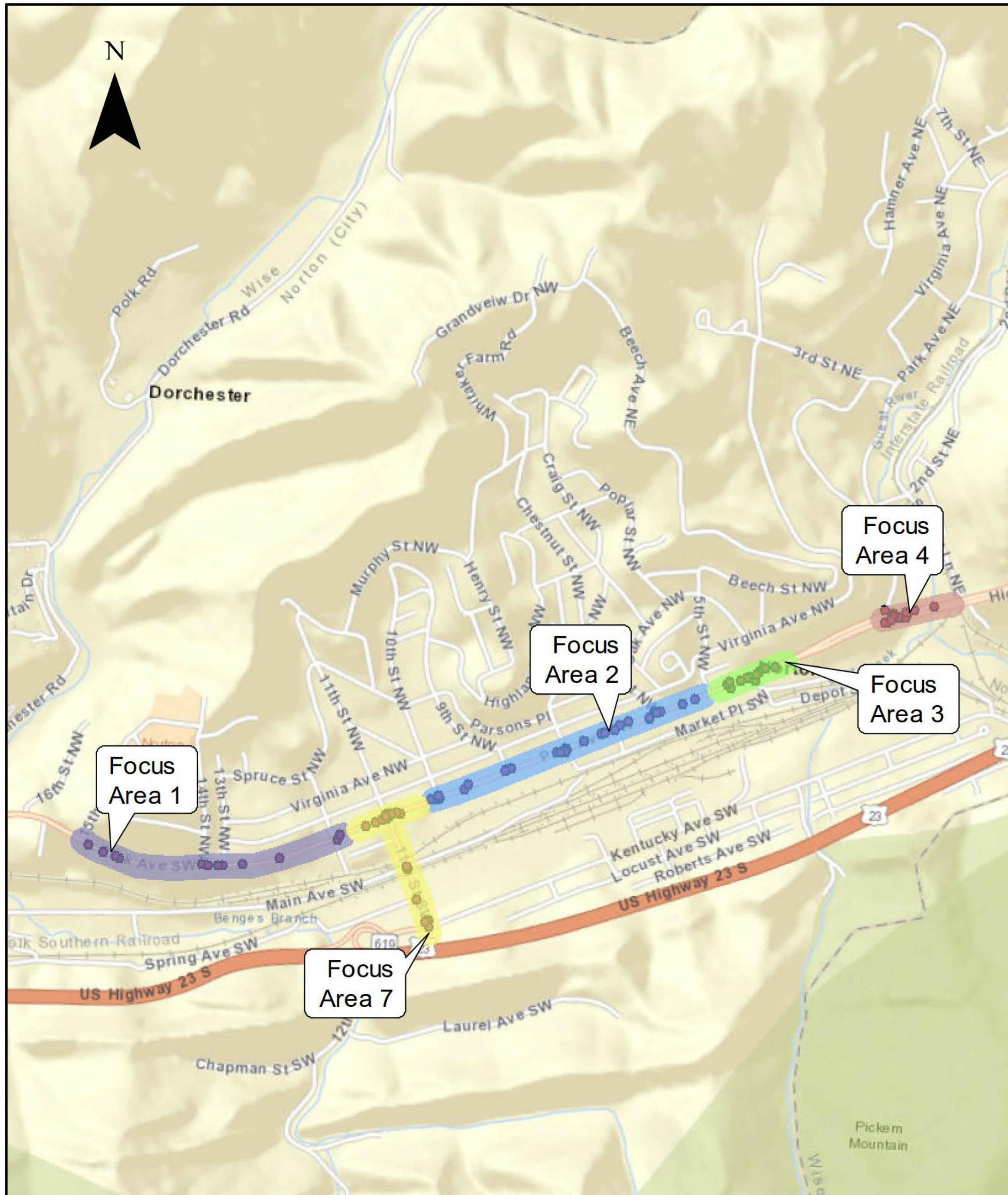
3.2 Crash Analysis by Focus Area

The study area was subdivided into seven focus areas as shown in *Figure 5*. The focus areas were subdivided to better analyze and review crash history and patterns given the changing roadway conditions and segments throughout the study area corridors. The seven focus areas encompass 18 of the study area intersections; 113 crashes were reported in the seven focus areas. Of the reported crashes, there were zero fatal crashes, 44 injury crashes, and 69 crashes involving property damage only (PDO). During the five-year period, Focus Area 2 has the highest number of crashes within the study area with 27 crashes reported. Focus Area 2 is the primary segment within the downtown core area of Norton and includes four closely spaced signalized intersections, pedestrian activity, on-street parking and higher overall activity. While Focus Area 2 has the highest total number of crashes, the crash density is higher at Focus Area 3, 5, 6, and 7 due to a higher rate of crashes along a shorter segment of roadway. Most of those focus areas are limited to a single intersection. Table 6 provides an overall summary of the crash history for each focus area. Table 7 through Table 10 illustrate further breakdown of the crash classifications including by crash type, weather conditions, lighting conditions, and roadway surface conditions. *Figure 6* through *Figure 12* illustrates the breakdown of crashes in each focus area within the study area.

Table 6: Focus Area Crashes by Crash Severity

Focus Area	Total Crashes (2013-2017)	Crash Classifications				
		K - Fatal Injury*	A - Severe Injury	B - Visible Injury	C - Non-visible Injury	PDO – Property Damage Only
Focus Area 1:	13	0	1	3	0	9
Focus Area 2:	27	0	1	7	1	18
Focus Area 3:	8	0	0	3	1	4
Focus Area 4:	13	0	0	2	1	10
Focus Area 5:	21	0	4	7	1	9
Focus Area 6:	13	0	0	6	2	5
Focus Area 7:	18	0	1	3	0	14
Total	113	0	7	31	6	69

Figure 5: Crash Analysis Focus Areas



Focus Area #	Total Crashes (2013-2017)	K - Fatal Injury*	A - Severe Injury	B - Visible Injury	C - Non-visible Injury
		Crashes Resulting in Injury			
Focus Area 1:	13	0	1	3	0
Focus Area 2:	27	0	1	7	1
Focus Area 3:	8	0	0	3	1
Focus Area 4:	13	0	0	2	1
Focus Area 5:	21	0	4	7	1
Focus Area 6:	13	0	0	6	2
Focus Area 7:	18	0	1	3	0
Total	113	0	7	31	6

Focus Area Summary

* There were no fatalities reported between 2013 - 2017

Figure 6: Focus Area 1 Crash Map

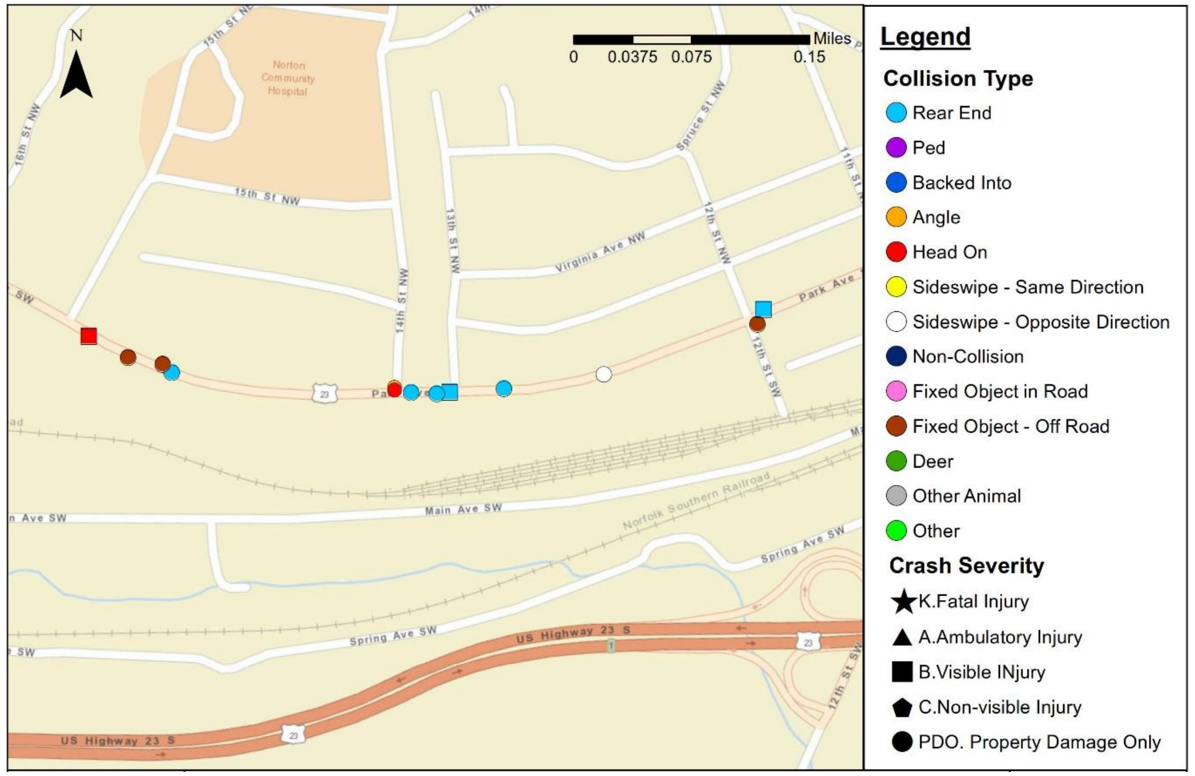


Figure 7: Focus Area 2 Crash Map

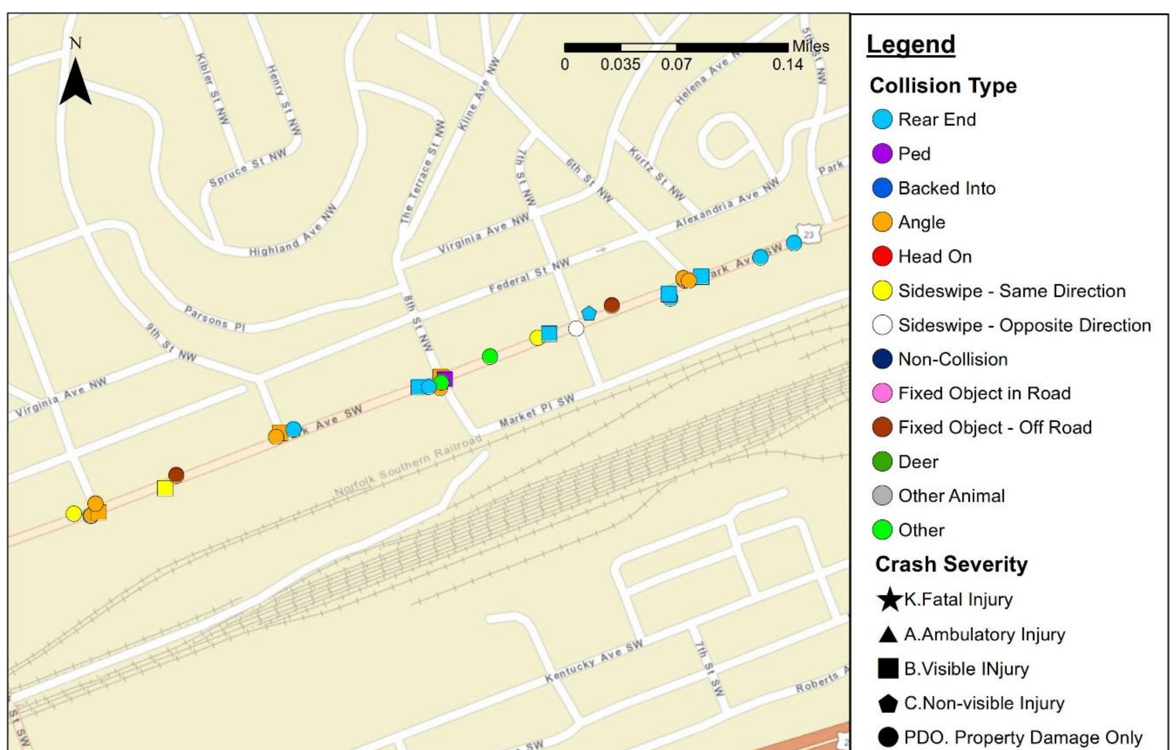


Figure 8: Focus Area 3 Crash Map

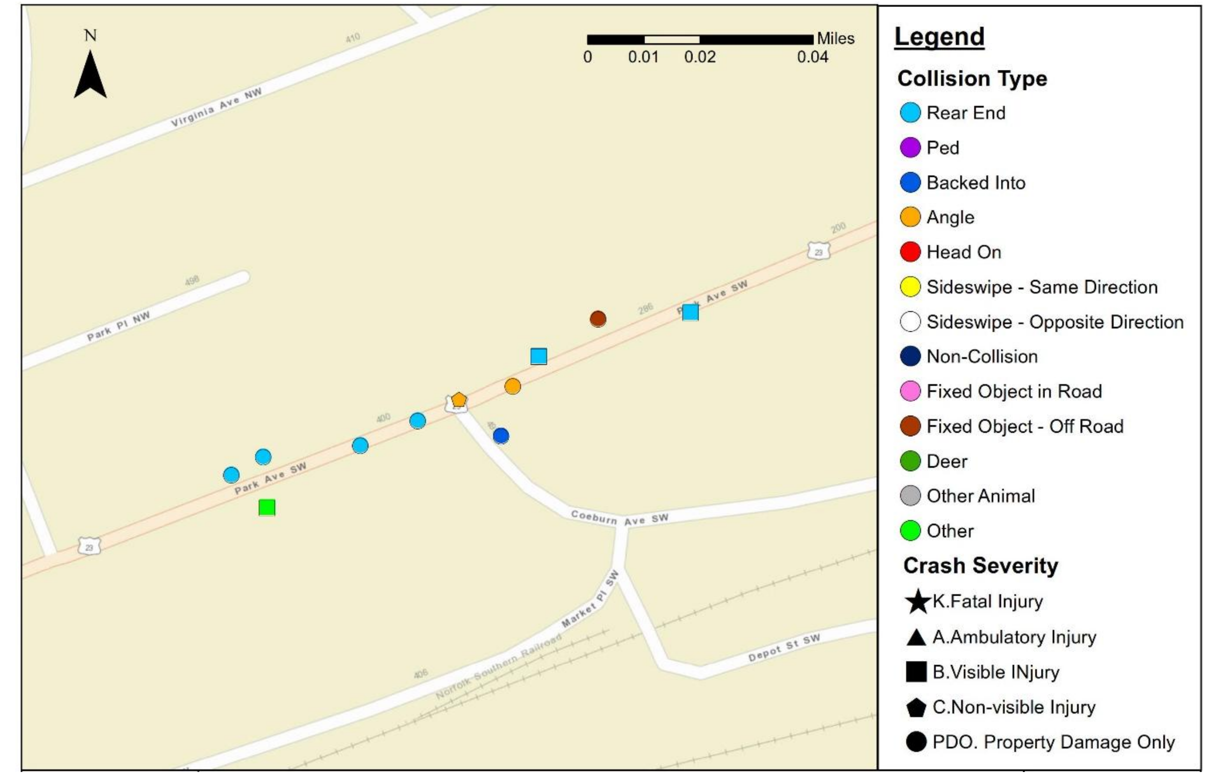


Figure 9: Focus Area 4 Crash Map

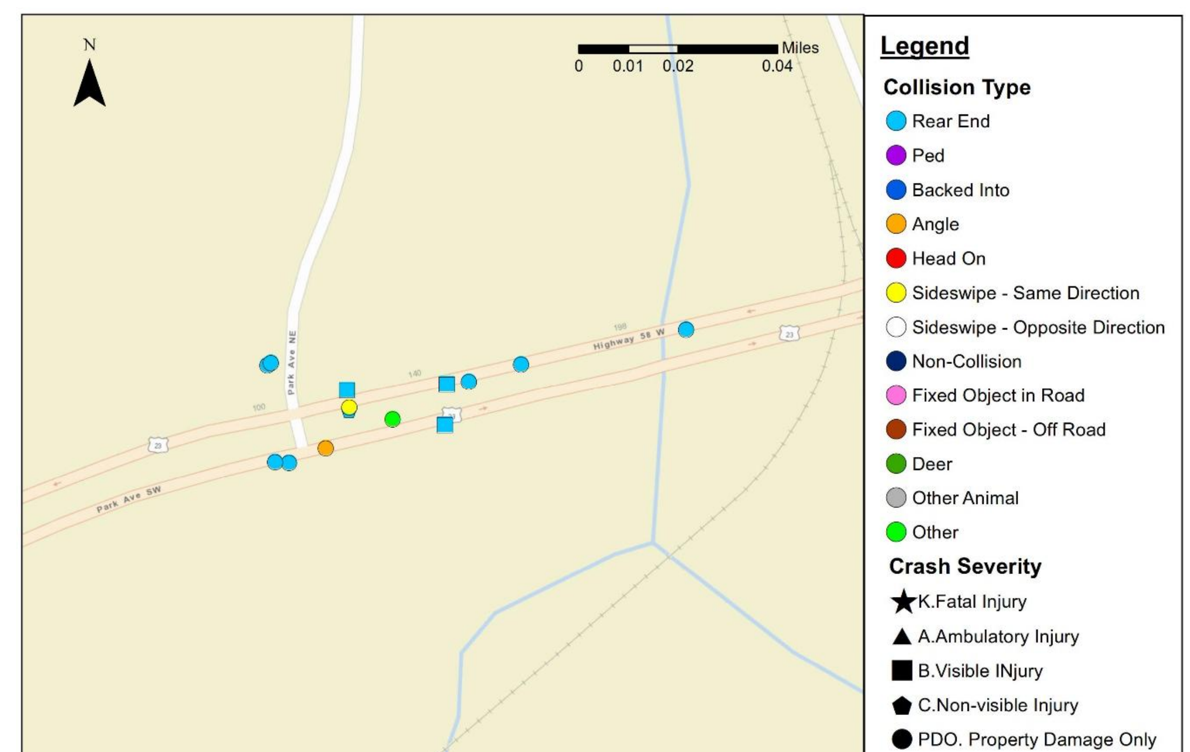


Figure 10: Focus Area 5 Crash Map

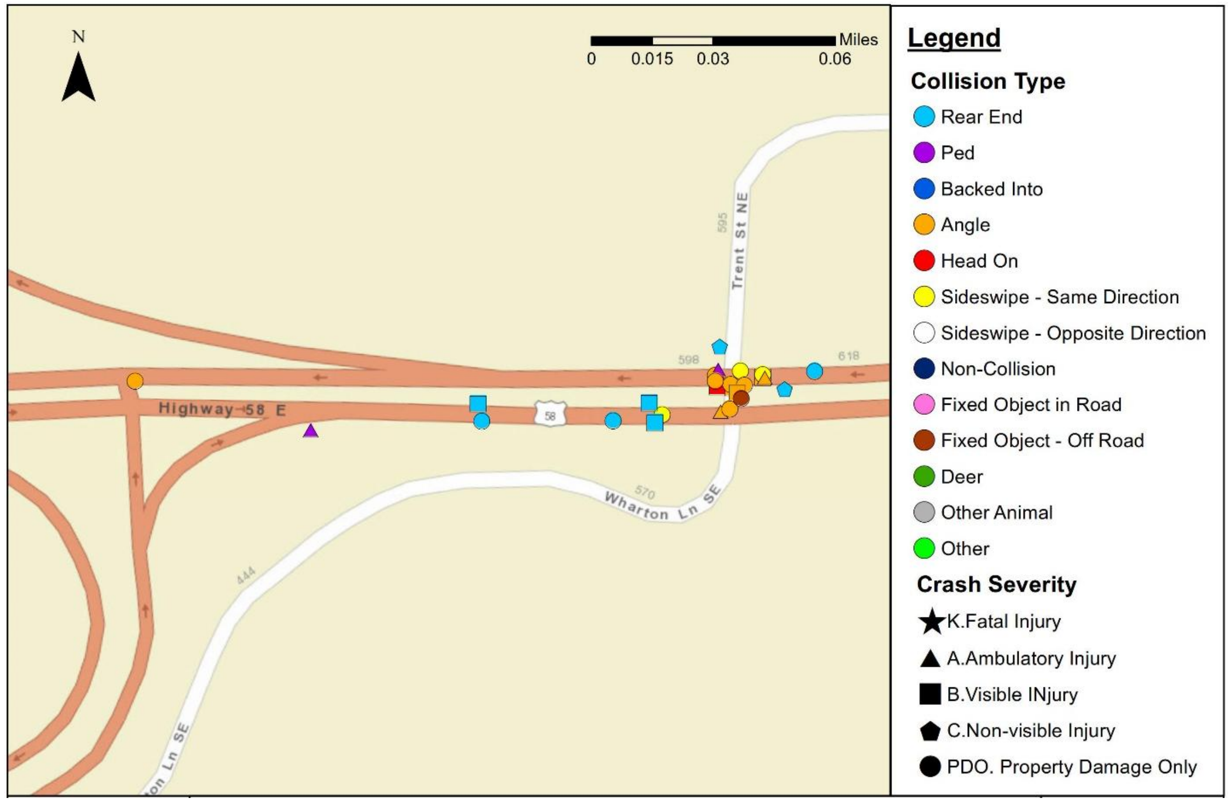


Figure 11: Focus Area 6 Crash Map

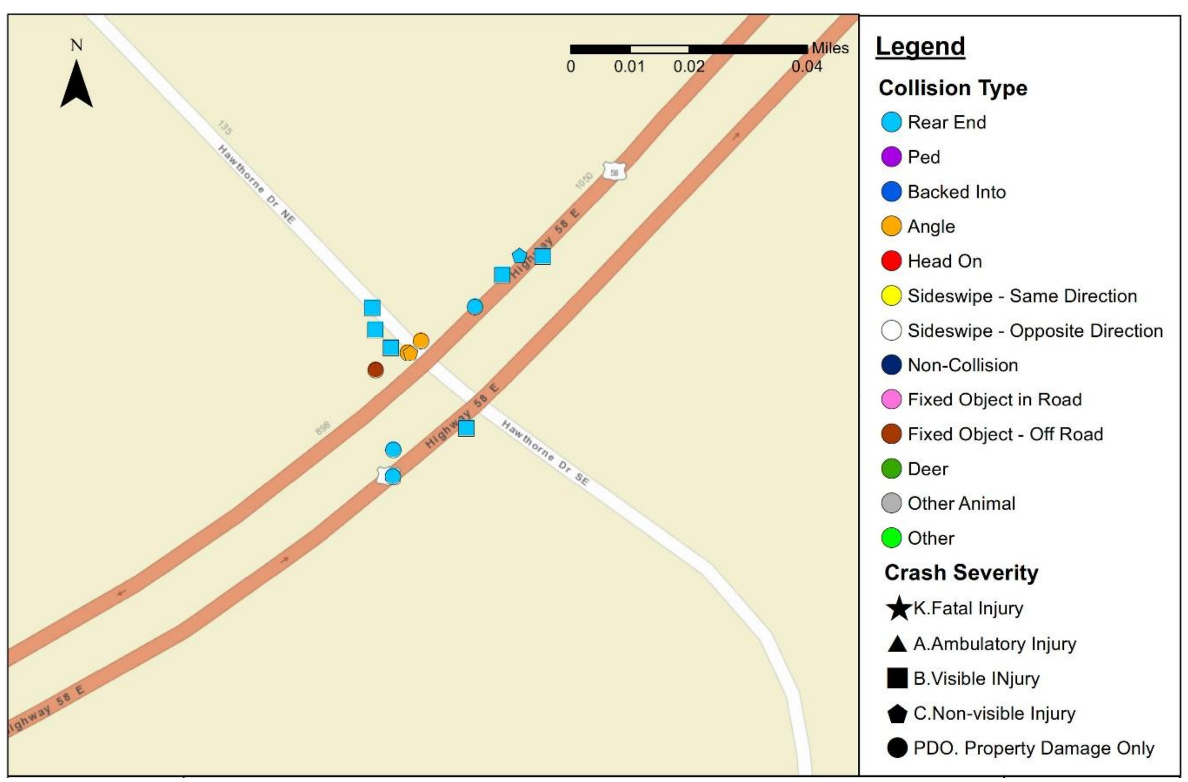
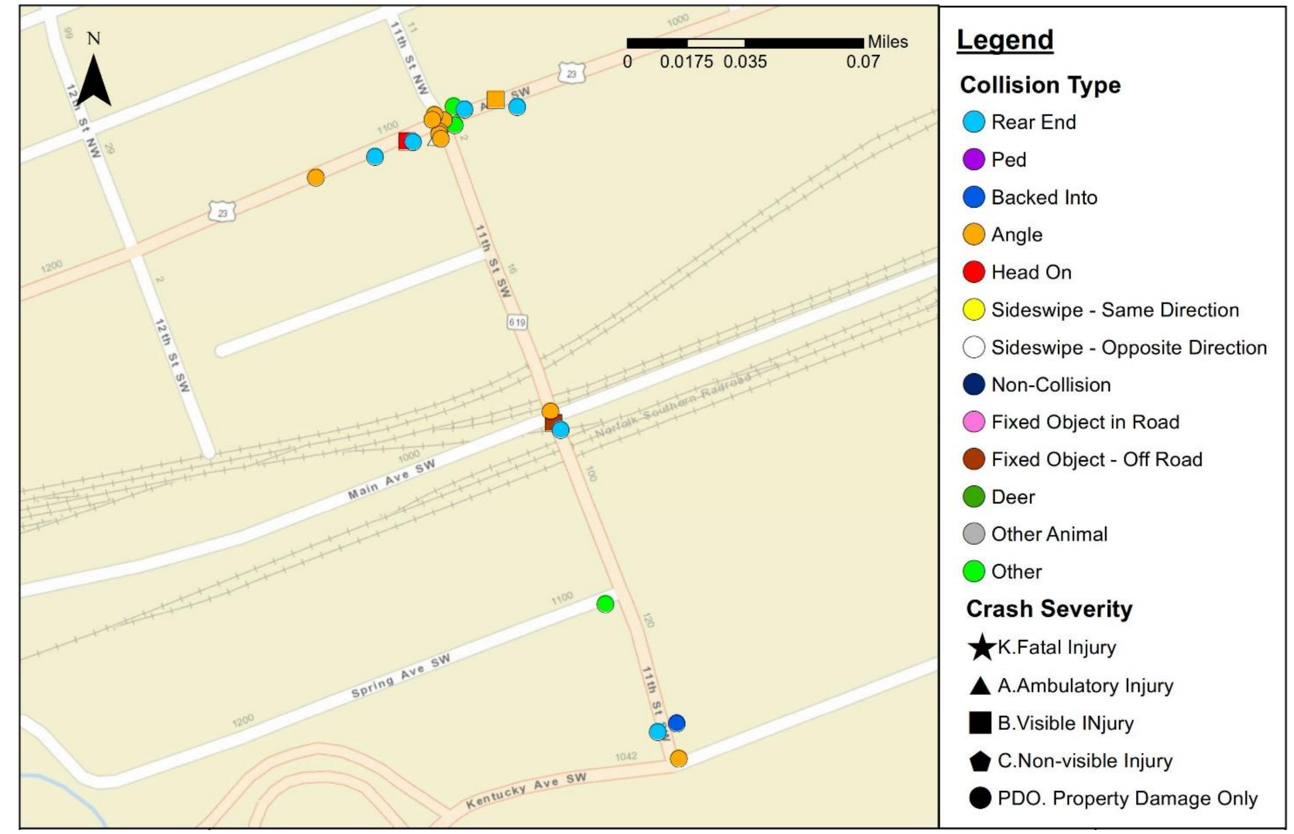


Figure 12: Focus Area 7 Crash Map



A summary of crashes by crash type is shown in Table 7. Rear-end (43 percent) and angle (27 percent) crashes comprise the majority of study area crashes.

Table 7: Study Area Crashes by Crash Type

Collision Type								
Focus Area #	Total Crashes (2013-2017)	Rear End	Angle	Head on	Sideswipe - Same Direction	Fixed Object - Off Road	Pedestrian	Other*
Focus Area 1:	13	6	0	3	0	3	0	1
Focus Area 2:	27	10	9	0	3	2	0	3
Focus Area 3:	8	4	1	0	0	1	0	2
Focus Area 4:	13	10	1	0	1	0	0	1
Focus Area 5:	21	7	9	1	1	1	2	0
Focus Area 6:	13	9	3	0	0	1	0	0
Focus Area 7:	18	3	7	1	1	1	0	5
Total	113	49	30	5	6	9	2	12

*Other includes backed into and sideswipe – opposite direction collisions

Table 8: Crash Summary – Weather Conditions

Weather Conditions					
Focus Area #	Total Crashes (2013-2017)	Clear/Cloudy	Rain	Snow	Other
Focus Area 1:	13	10	2	1	0
Focus Area 2:	27	22	5	0	0
Focus Area 3:	8	4	3	1	0
Focus Area 4:	13	9	1	2	1
Focus Area 5:	21	18	2	1	0
Focus Area 6:	13	13	0	0	0
Focus Area 7:	18	16	1	0	1
Total	113	92	14	5	2

*Other includes fog and mist weather conditions

Table 9: Crash Summary – Lighting Condition

Lighting Condition				
Focus Area #	Total Crashes (2013-2017)	Daylight	Darkness - Road Lighted	Other
Focus Area 1:	13	9	2	2
Focus Area 2:	27	22	4	1
Focus Area 3:	8	6	2	0
Focus Area 4:	13	10	3	0
Focus Area 5:	21	17	3	1
Focus Area 6:	13	12	1	0
Focus Area 7:	18	12	4	2
Total	113	88	19	6

*Other includes dawn, dusk, and darkness – road not lighted conditions

Table 10: Crash Summary – Roadway Surface Condition

Roadway Surface Condition				
Focus Area #	Total Crashes (2013-2017)	Dry	Wet	Other
Focus Area 1:	13	10	2	1
Focus Area 2:	27	22	5	0
Focus Area 3:	8	4	3	1
Focus Area 4:	13	9	3	1
Focus Area 5:	21	18	3	0
Focus Area 6:	13	13	0	0
Focus Area 7:	18	17	1	0
Total	113	93	17	3

*Other includes snowy and icy roadway conditions

3.3 Crash Analysis Summary

The crash patterns identified at signalized and unsignalized intersections were considered during the concept development process. Patterns of rear-end crashes at signalized intersections can be targeted by operational improvements that reduce delay and queuing. As described above, coordinated traffic signal timing plans including calculating red and amber clearance intervals consistent with current VDOT standards were implemented as part of this project which is expected reduce the occurrence of those crashes. Angle crashes, which typically correlate with higher crash severities, comprised 25-percent of the total crashes throughout the corridor.

Findings from the crash data analysis indicate that poor lighting, weather, and roadway conditions are not major contributing factors in the cause of these crashes. Based on the crash data, crash trends and patterns were analyzed for each focus area and are summarized below.

Focus Area 1

Forty-six percent of the crashes within this focus area are rear end collisions. Most of the rear end collisions are a result of vehicles following too close and are unable to stop when another vehicle slows down to make a turning movement. The crashes along this segment are relatively evenly distributed and not specific to any one location. However, six of the crashes occur in vicinity to the 13th Street and 14th Street intersections which are closely spaced.

Focus Area 2

Seven (7) of the crashes within Focus Area 2 are a result of people disregarding the traffic signal and running red lights. Additionally, five (5) of the crashes in Focus Area 2 involve cars parallel parking along Park Avenue.

Focus Area 3

Fifty-percent of the crashes within Focus Area 3 are rear end collisions that are caused by vehicles having to stop at the signal at Coeburn Avenue.

Focus Area 4

Seventy-seven percent of the crashes in Focus Area 4 were rear end collisions. The posted speed limit of this segment is 25 MPH; however, the 85th percentile speed is approximately 40 MPH, measured east of the intersection.

Focus Area 5

Nine (9) of the crashes in Focus Area 5 are a result of people disregarding the traffic signal and running the red light at the intersection of Norton Coeburn Road at Trent Street/Wharton Lane.

Focus Area 6

Sixty-two percent of the crashes in Focus Area 6 are rear end collisions at the intersection of Norton Coeburn Road at Hawthorne Drive.

Focus Area 7

Five (5) of the crashes in focus area 7 are a result of misjudging the gap when making a turning movement. The segment of 11th Street between Kentucky Avenue and Park Avenue also has significant grades which reduces drivers' sight distance and their ability to determine if a gap is adequate to complete their movement.

4 Existing Conditions Analysis

Traffic operational analyses were conducted to evaluate the overall performance of the study corridor under existing (2019) AM and PM peak hour conditions. The intent of the existing conditions analyses was to provide a general understanding of the baseline traffic conditions as a starting point for developing future improvement strategies. Existing conditions were modeled using Synchro, Version 10 and SimTraffic, Version 10.

4.1 Traffic Analysis Assumptions

The existing Synchro and SimTraffic models were developed for the AM and PM peak hour conditions based on the existing roadway geometry and collected traffic count data. Inputs, analysis methodologies, and calibration approaches were consistent with the *TOSAM* and are documented in *Appendix C*.

4.2 Traffic Analysis Results

The existing conditions traffic analysis results are summarized in the following section of the report. Two measures of effectiveness were selected to measure the quantitative performance of the study area intersections:

- Control delay by lane group, approach, and intersection – measured in seconds per vehicle [Synchro 10]
- Maximum queue length by lane group – measured in feet [SimTraffic 10]

Ten simulations were conducted for both the AM and PM models using different random seeds. Average speeds for Park Avenue at Hawthorne Drive were used in the VDOT Sample Size Determination Tool to confirm that the ten runs would provide the acceptable 95 percent confidence level for both the AM and PM models. The speed results and the Sample Size Determination results are documented in *Appendix D*.

4.2.1 Level of Service Criteria

Level of Service (LOS) was used to supplement control delay results from Synchro 10 based on the criteria outlined in the *Highway Capacity Manual (HCM) 2000*. LOS is a quality measure describing operating conditions and the driver's perception of those conditions. LOS A indicates a condition of little or no congestion whereas LOS F indicates a condition of sever congestion, unstable traffic flow, and stop-and-go conditions. *Table 11* summarizes the delay thresholds associated with each LOS category for signalized and unsignalized intersections. If intersection traffic volume exceeds capacity, LOS F is automatically reported.

Table 11: Signalized and Unsignalized Intersection LOS Criteria

LOS	Control Delay (sec/veh)	
	Signalized Intersections	Unsignalized Intersections
A	≤ 10	≤ 10
B	> 10 – 20	> 10 – 15
C	> 20 – 35	> 15 – 25
D	> 35 – 55	> 25 – 35
E	> 55 – 80	> 35 – 50
F	> 80	> 50

4.2.2 Control Delay and LOS Results

A table summarizing the existing conditions control delay and LOS results by lane group, approach, and intersection at each study area intersection is provided in *Appendix E*. *Figure 13* through *Figure 14* show a depictive representation of the control delay and LOS results in the study area for the AM and PM peak hours. The corresponding Synchro output sheets are included in *Appendix E*.

Under existing conditions, intersections operated at or better than LOS C except for the following movements/approaches:

- The westbound left-turn movement at the intersection of Norton Coeburn Road at Wharton Lane/Trent Street operates at LOS D during the PM peak hour. This movement operates with relatively low volumes (i.e., approximately 9 vehicles per hour) so it does not have a significant impact on the overall intersection.
- The southbound approach at the intersection of Park Avenue at 7th Street operates at LOS D during the AM and PM peak hours. The northbound approach also operates at LOS D during the AM peak hour.
- The northbound and southbound approaches at the intersection of Park Avenue at 9th Street operate at LOS D during the AM peak hour. The southbound left-turn movement operates at LOS D during the PM peak hour.
- The southbound shared left-right lane at the intersection of Park Avenue at 14th Street operates at LOS D during the PM peak hour due to traffic on 14th Street unable to find a sufficient gap to complete their movement.

4.2.3 Maximum Queue Length Results

A table summarizing the existing conditions maximum queue lengths by lane group at each study area intersection is provided in *Appendix E*. *Figure 15* through *Figure 16* show a depictive representation of the queue results in the study area for the AM and PM peak hours. The corresponding SimTraffic output sheets are included in *Appendix E*.

None of the study area intersections operate with significant queueing under the existing conditions.

Figure 13: 2019 Existing Conditions – AM Control Delay and LOS

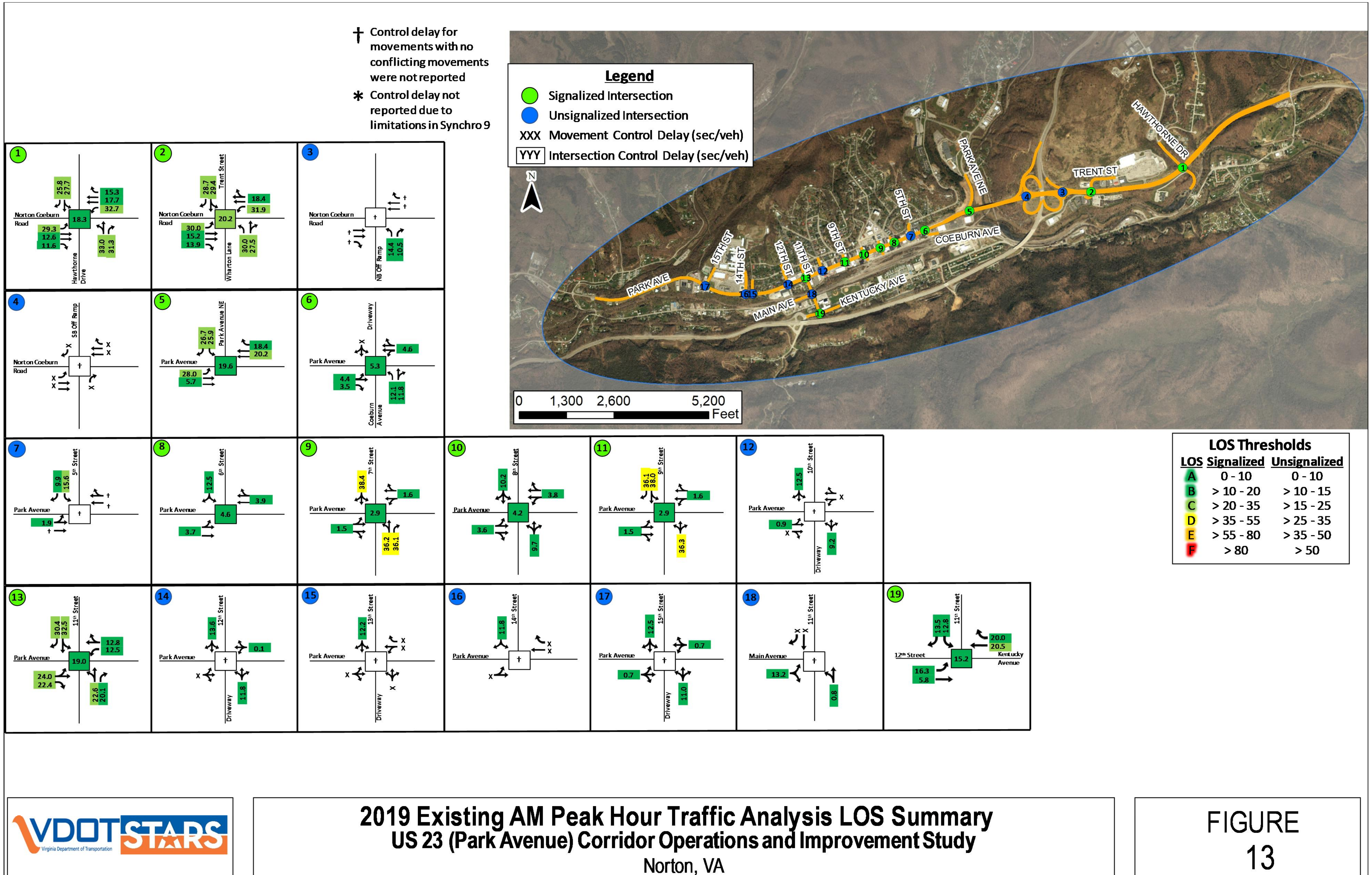
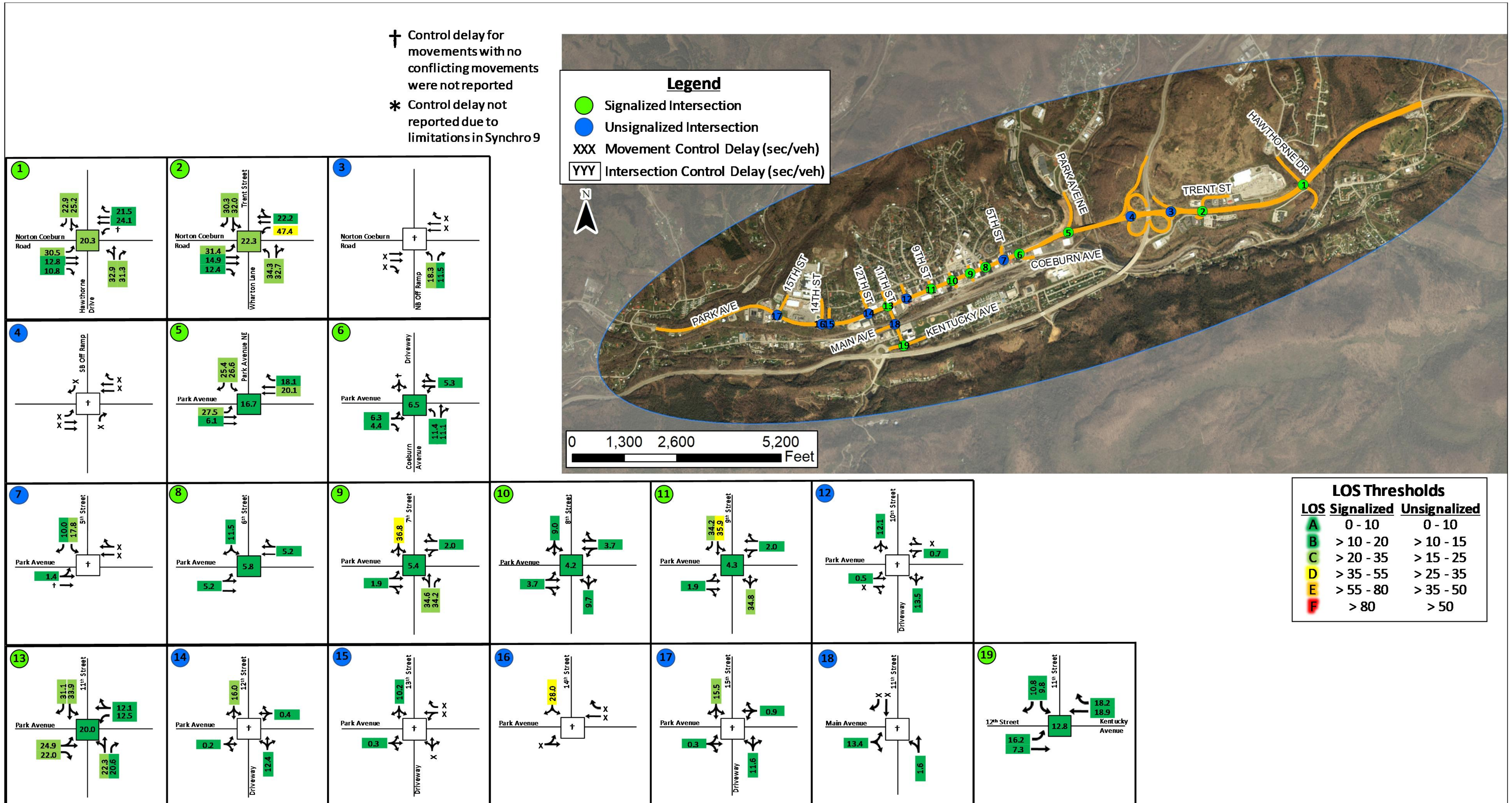


Figure 14: 2019 Existing Conditions – PM Control Delay and LOS



2019 Existing PM Peak Hour Traffic Analysis LOS Summary
US 23 (Park Avenue) Corridor Operations and Improvement Study
Norton, VA

FIGURE 14

Figure 15: 2019 Existing Conditions – AM Maximum Queue Lengths

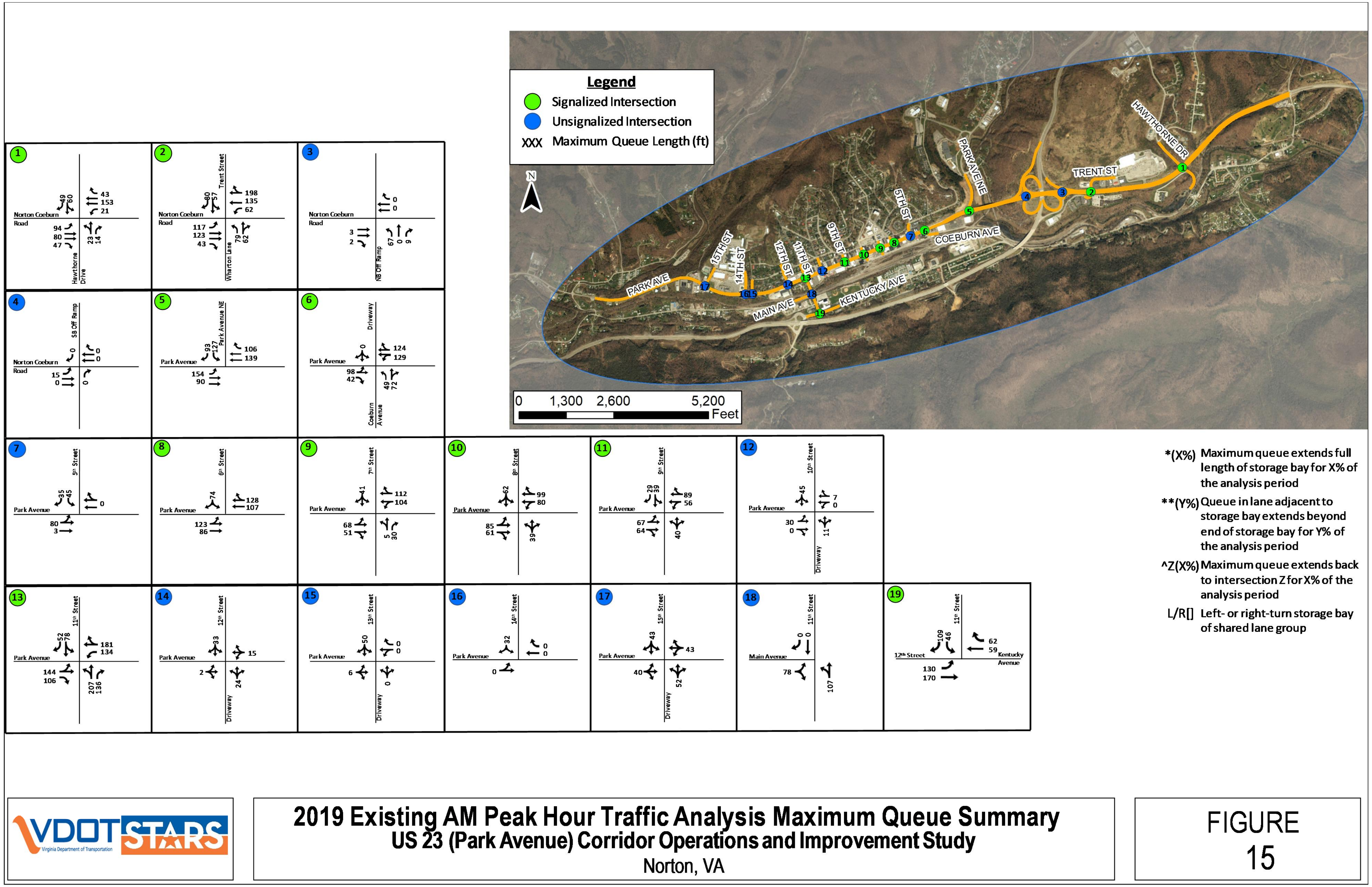
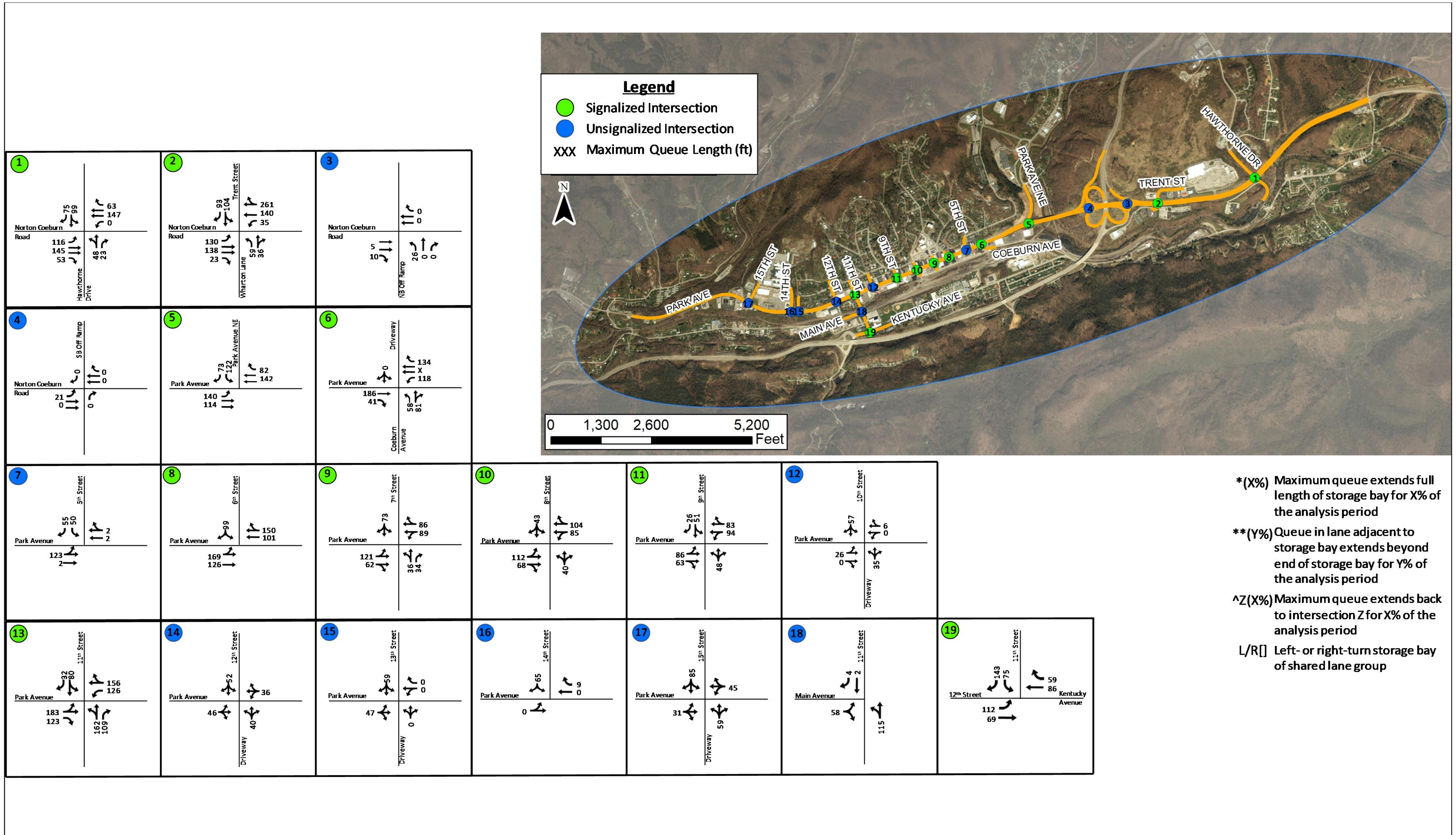


Figure 16: 2019 Existing Conditions – PM Maximum Queue Lengths



2019 Existing PM Peak Hour Traffic Analysis Maximum Queue Summary
US 23 (Park Avenue) Corridor Operations and Improvement Study
Norton, VA

FIGURE 16

5 Coordinated Traffic Signal Timings

5.1 Timing Plan Development

Timing plans for coordinated signal systems were developed with several objectives:

- To minimize overall system and turning movement vehicular delay and the frequency of stop-and-go conditions
- To develop timing plans that accommodate current traffic volumes
- To progress through movements along Park Avenue
- To improve overall signal performance associated with unsynchronized and inefficient traffic signal timing plans
- To calculate yellow, red, and pedestrian clearance intervals consistent with current VDOT standards
- Develop subpeak timing plans associated with the peaking characteristics and dense arrival/departures associated with area schools
- Subsequent to these objectives is to ultimately reduce rear-end and angle crashes

Using turning movement count data and other field observations, timing plans were developed for the system. Four (4) base timing plans were developed with sub-peak plans (i.e., school ingress/egress) at individual intersections per observed vehicle demands. The Synchro 10.0 signal optimization program was used as a tool to develop optimized timing plans. The plan development included determining cycle lengths, developing phase splits, phase sequencing, and offsets. Phase splits were determined at each intersection using Synchro 10.0 and manually verified using a technique based on the Poisson distribution.

Using turning movement count data and other field observations, the following intersections were included in the retiming of the existing signal system:

- Park Avenue at Park Avenue NE
- Park Avenue at Coeburn Avenue
- Park Avenue at 6th Street
- Park Avenue at 7th Street
- Park Avenue at 8th Street
- Park Avenue at 9th Street

Park Avenue at 11th Street was also evaluated to be included within the signal timing corridor limits. Proximity to the other intersections included within the system would suggest the need to be included with the coordinated study area signals; however, after careful consideration field, traffic count data, and modeled conditions review, it was determined to maintain uncoordinated operations for two primary reasons. First, 11th Street serves as the primary heavy truck route as through trucks are prohibited downtown. As such, the intersection experiences a high percentage of heavy vehicle trips which significantly increases the split requirements and increases the cycle length needs to adequately serve those truck demands. The intersections considered with the system had much lower split demands and lower cycle length requirements. Implementing a higher cycle length along the system downtown would create unnecessarily long delays for side street and pedestrian traffic downtown and would likely result in citizen complaints based on those delays. Therefore, leaving 11th Street as uncoordinated was determined the best solution for the overall system.

5.2 Timing Plans and Time-of-Day Clocks

Three timing plans were developed to accommodate typical weekday and weekend traffic per the methodology described. The cycle lengths were established by measuring the total split time requirements based on the vehicle movements. Once those were established, pedestrian crossing times were considered given the high activity of pedestrian movement downtown. All vehicle splits were developed with enough time to accommodate the Walk and Flash Don't Walk timings associated with the pedestrian signals which will maintain signal coordination when pedestrian calls are placed. The following three timing plan patterns were determined.

- AM Peak Plan – Pattern 1 – 80 second cycle length
- Midday/Off Peak Plan – Pattern 2 – 70 second cycle length
- PM Peak Plan – Pattern 3 – 80 second cycle length

Time clock information was generated to identify when the various plans are in operation. The time clock information was developed using ADT volumes, characteristics of the analysis period, and knowledge of local generators based on field observation. *Figure 17* and *Figure 18* illustrate the weekday and weekend time-of-day clocks for how the timing plans operate.

Figure 17: Weekday Timing Plan Operations

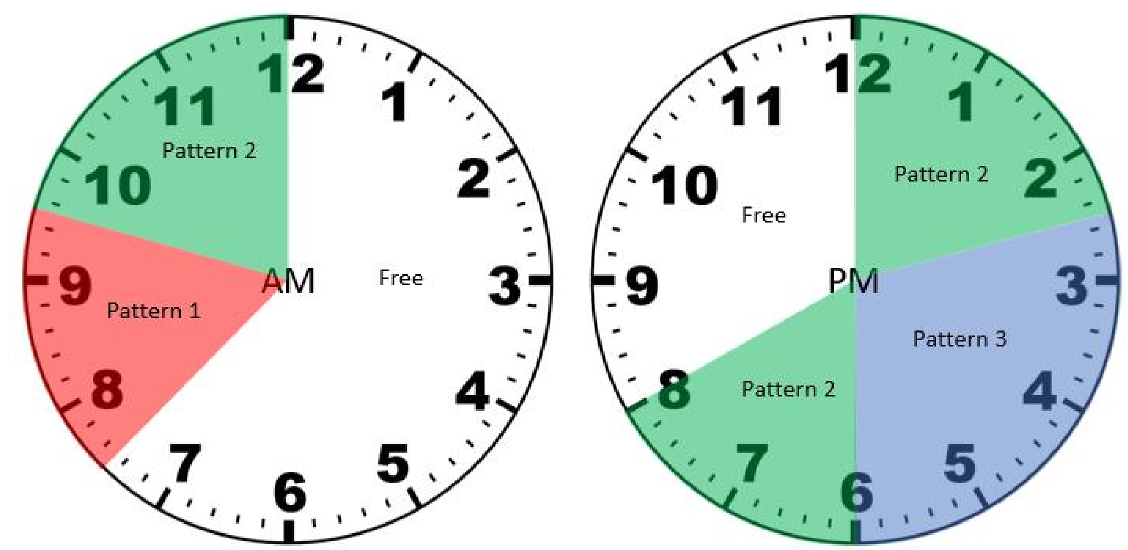
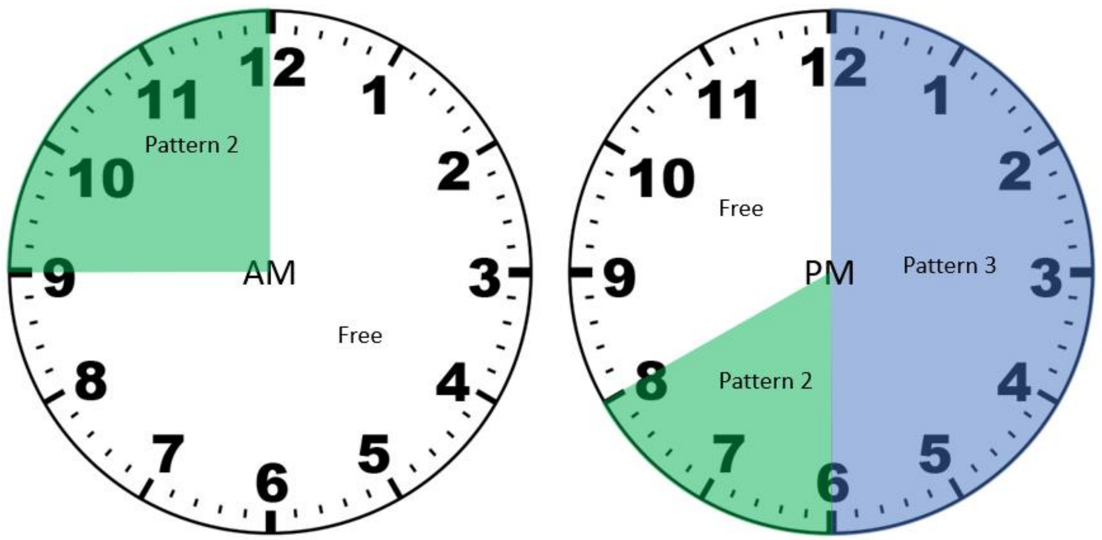


Figure 18: Weekend Timing Plan Operations



5.3 Field Implementation, Observations, and Fine Tuning

Timing plans developed by Kimley-Horn were transferred from Synchro 10.0 onto coding sheets compatible with the City's Naztec and Siemens controllers. Kimley-Horn used the coding sheets to enter the new timing plans directly into the controller and manually reset the controller clocks since there was not active communication.

Kimley-Horn then observed and verified the operation of the new timing plans in the field and made fine-tuning adjustments, as necessary. Observations were performed Tuesday, May 7 through Thursday, May 9, 2019.

During implementation, several field adjustments to offsets were made. Many of the offset adjustments were made to remove slow-downs experienced by the mainline platoon. These slow-downs were caused by queues developing at the downstream intersection and not clearing prior to the primary platoon's arrival. Additionally, several offset adjustments were made due to controller functionality and/or as a result of varying versions of controller firmware per intersection. Splits were adjusted to accommodate brief peaking movements that were observed in the field but not captured in the turning movement counts.

6 TRAFFIC FORECASTING

To understand future traffic conditions in the study area and assess the long-term benefits of proposed improvements, traffic volumes were forecasted for 2028 traffic conditions. The following sections describe the methodology for developing the traffic growth rate and projecting future traffic volumes for the study area.

6.1 Traffic Growth Rate and Background Development

VDOT's Statewide Planning System (SPS) database was reviewed to determine growth rates to apply to existing traffic volumes to develop 2028 traffic volume forecasts. A growth rate of 0.5% was determined to be appropriate and agreed upon by the SWG.

Additionally, two phases of potential development were included to determine the future background volumes. The development is generally located in the northeast quadrant of the US 58/US 23 interchange. This development is anticipated to develop in several phases. Phase 1 and a portion of Phase 2 are anticipated to occur within the 10-year study horizon. Phase 1 includes approximately 350,000 square feet (SF) of light industrial/manufacturing space built in three (3), separate facilities. Phase 2 of the development involves redevelopment of the existing Virginia Kentucky Regional shopping center. Due to the 10-year planning horizon, it was assumed 142,000 SF would redevelop. The existing shopping center generates vehicle trips which were captured in the turning movement counts. Those trips were not deducted from the future conditions analysis which provides a conservative trip estimate for Phase 2 development conditions.

Primary access will be provided from a new roadway connection which will intersect Hawthorne Drive north of the study area. The site plan provided by the LENOWISCO Planning District Commission illustrates a new roadway access along US 23; however, US 23 is limited access and the conditional approval granted by the Commonwealth Transportation Board (CTB) has since expired. Therefore, no traffic was assigned to this access. A second access was assumed from Trent Avenue which impacts the study area. The site plan is included in the Appendix F.

Trips resulting from the proposed development were estimated using *Institute of Transportation Engineers (ITE) Trip Generation (10th Edition)*. Land use mix for Phase 1 and Phase 2 development was determined to be general light industrial (ITE Code 110) and shopping center (ITE Code 820), respectively. The land uses and densities were agreed upon based on discussions with the SWG. The trip generation values for the Phase 1 and Phase 2 background developments are shown in Table 12.

Table 12: Background Development Trip Generation

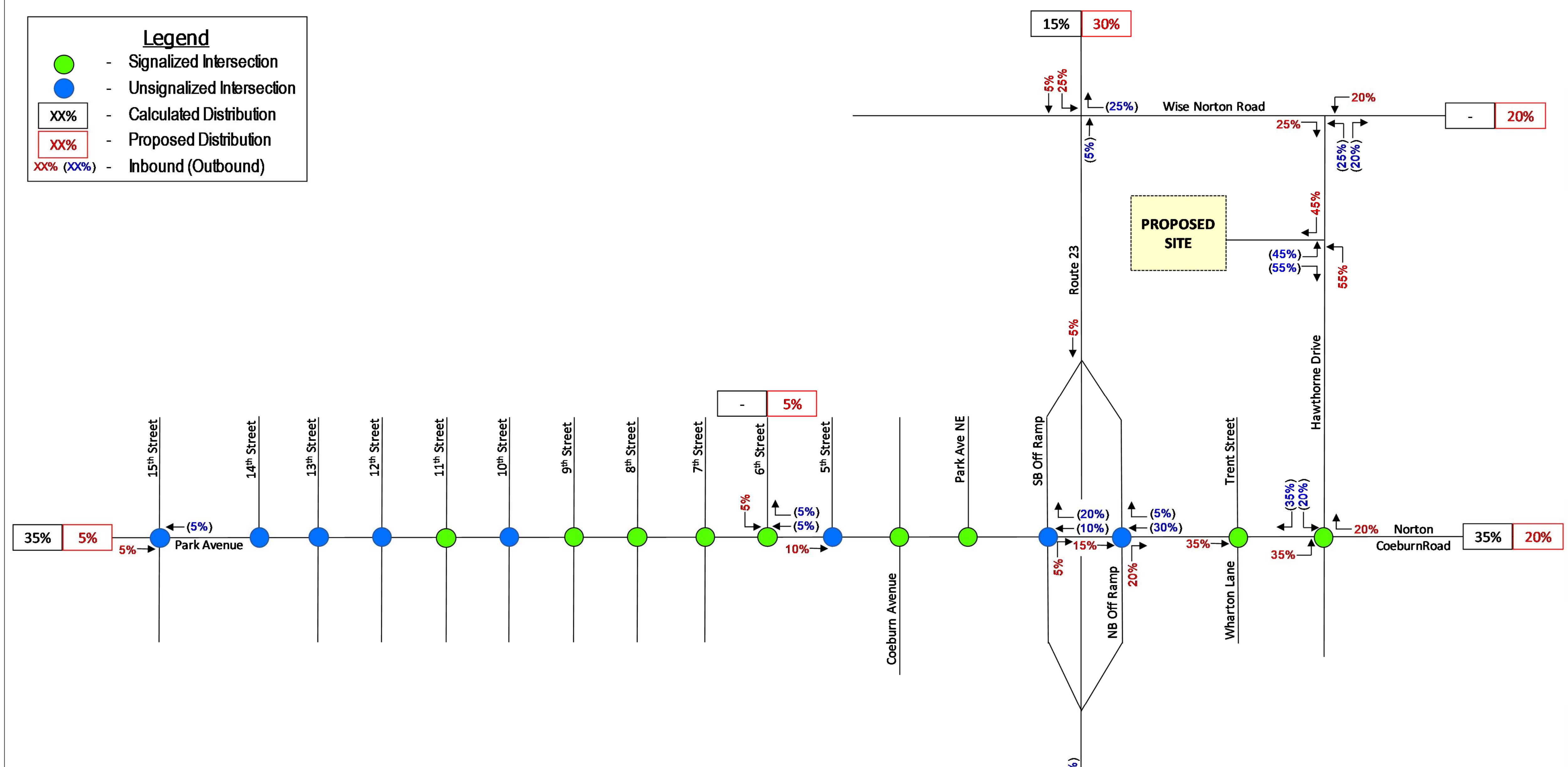
Description	Intensity	LU Code	Daily	AM Peak Hour Total	AM Peak Hour Entering	AM Peak Hour Exiting	PM Peak Hour Total	PM Peak Hour Entering	PM Peak Hour Exiting
Phase 1	*350,000 SF*	*110*	*766*	*187*	*155*	*32*	*185*	*41*	*144*
Phase 2	*142,000 SF*	*820*	*7,631*	*223*	*138*	*85*	*704*	*338*	*366*
Phase 2 (Pass-By Trips)			*0*	*0*	*0*	*0*	*-240*	*-120*	*-120*
Phase 2 Total Trips			*7,631*	*223*	*138*	*85*	*464*	*218*	*246*
TOTAL New Trips			*7,631*	*410*	*293*	*117*	*649*	*259*	*390*

Trip distributions for the background developments were determined based on existing travel patterns, access to/from the external adjacent street network, and discussions with the SWG. The trip distribution for the background Phase 1 and 2 developments are shown in *Figure 19* and *Figure 20*, respectively.

6.2 Projected 2028 Traffic Volumes

Exponential traffic growth rates were applied to the 2018 existing traffic volumes to generate projected 2028 traffic volumes. Future peak hour trip assignments for the background developments were determined by multiplying the proposed new trips by the agreed upon trip distributions. The projected traffic volumes were balanced throughout the study network using the same methodology as *Section 2.4.5*. The projected 2028 AM and PM peak hour traffic volumes are summarized in *Figure 21* and *Figure 22*.

Figure 19: Phase 1 Trip Distribution



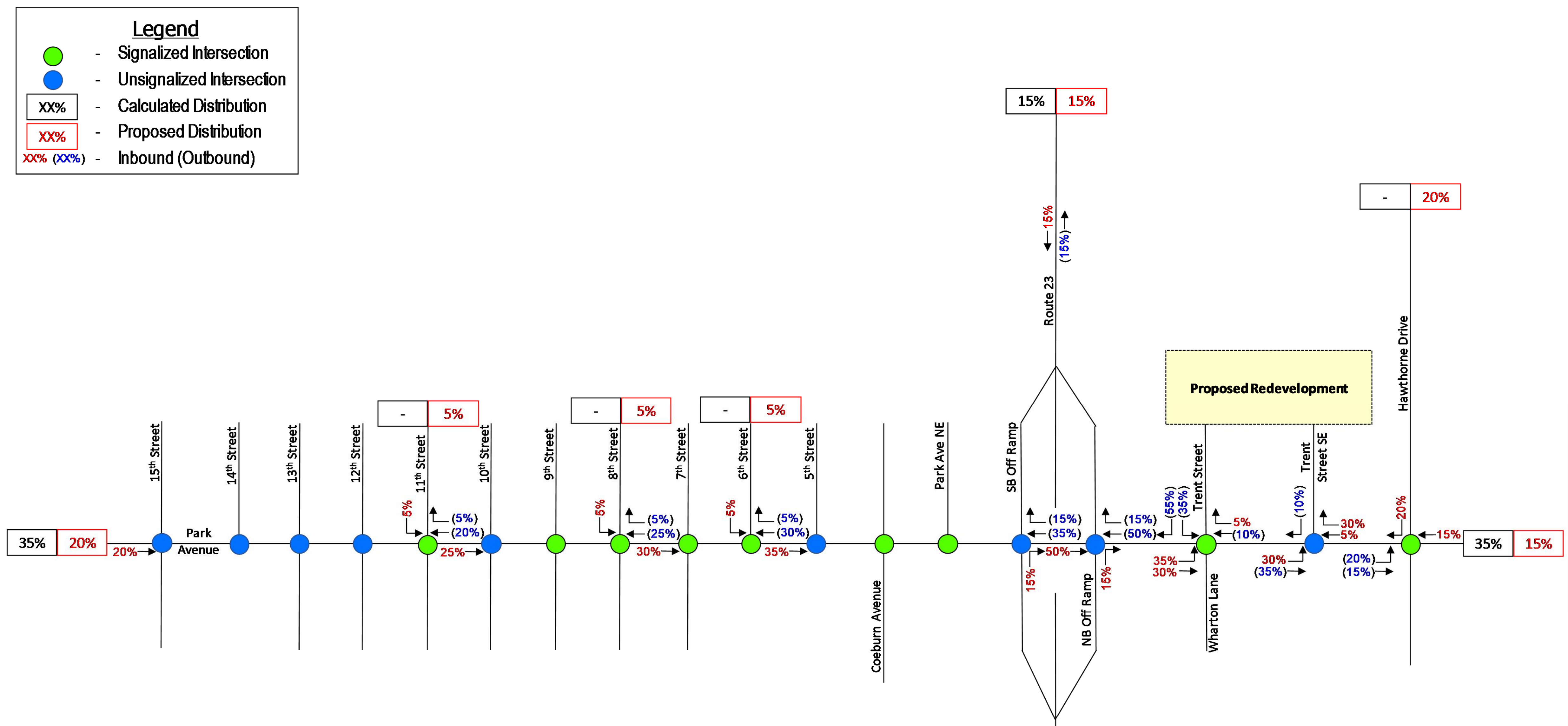
				Trips					
					AM			PM	
Description	ITE Code	Intensity		Daily	Total	Entering	Exiting	Total	Entering	Exiting
General Light Industrial	110	350,000	SF	766	187	155	32	185	41	144
		Total Trips		766	187	155	32	185	41	144

VDOT STARS

Phase 1 Proposed Development Distribution (Industrial Only)
US 23 (Park Avenue) Corridor Operations and Improvement Study
Norton, VA

FIGURE 19

Figure 20: Phase 2 Trip Distribution



Description	ITE Code	Intensity		Trips Daily	AM Total	AM Entering	AM Exiting	PM Total	PM Entering	PM Exiting
Shopping Center	820	142,000	SF	7,631	223	138	85	704	338	366
		Total Trips Generated		7,631	223	138	85	704	338	366
		Total Pass-By Trips		*0*	*0*	*0*	*0*	*-240*	*-120*	*-120*
		Total Trips After Pass-By		*7,631*	*223*	*138*	*85*	*464*	*218*	*246*

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Phase 2 Proposed Development Distribution (Shopping Center Redevelopment)
US 23 (Park Avenue) Corridor Operations and Improvement Study
Norton, VA

FIGURE 20

Figure 21: 2028 AM Traffic Volumes

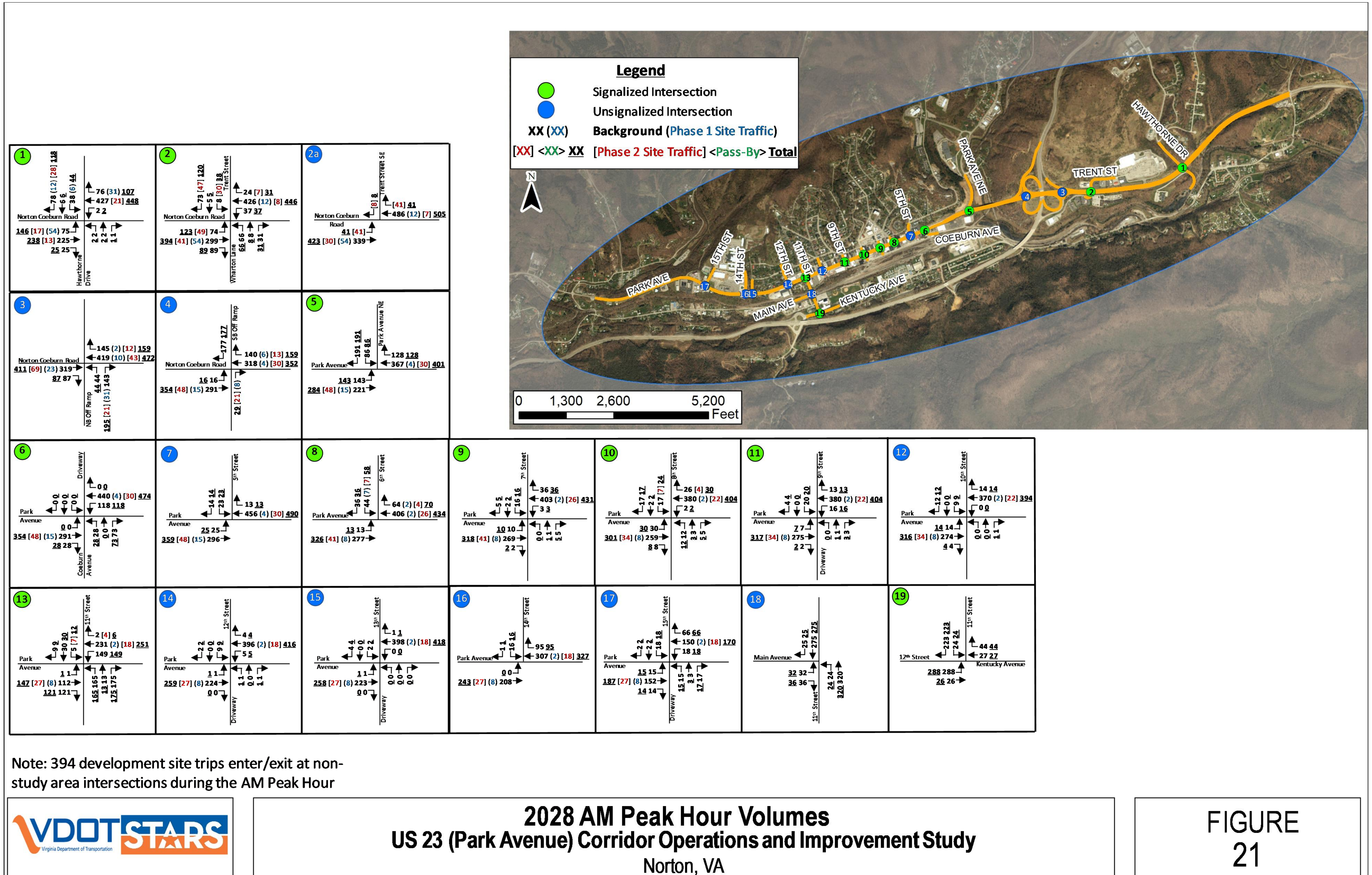
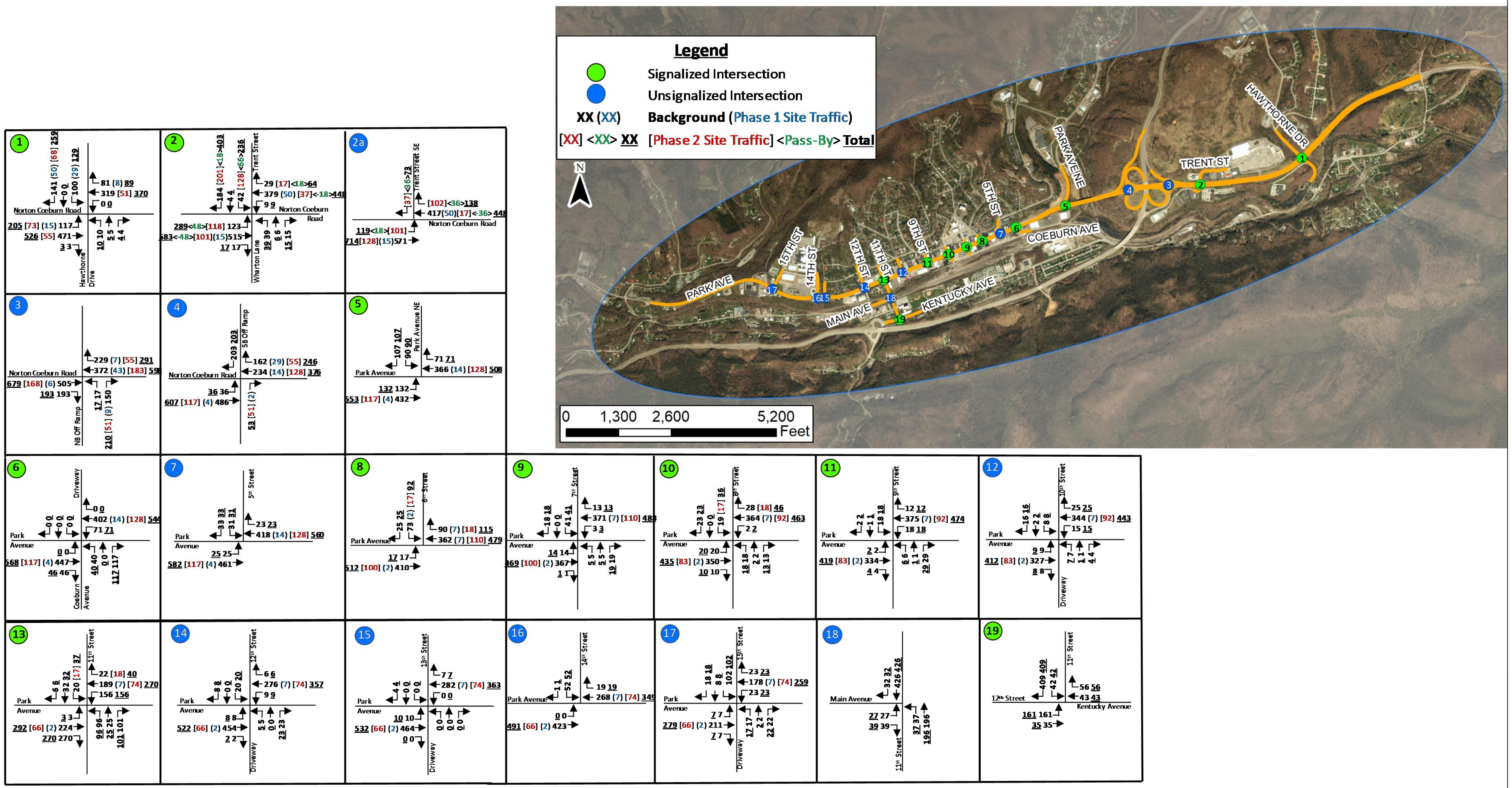


Figure 22: 2028 PM Traffic Volumes



Note: 388 development site trips enter/exit at non-study area intersections during the PM Peak Hour

2028 PM Peak Hour Volumes
US 23 (Park Avenue) Corridor Operations and Improvement Study
Norton, VA

FIGURE 22

7 Future No Build Conditions Analysis

Traffic operational analyses were conducted to evaluate the overall performance of the study corridor under No-Build (2028) AM and PM peak hour conditions. The intent of the No-Build conditions analyses was to provide a general understanding of the baseline future traffic conditions as a starting point for developing future improvement strategies. The No Build scenario includes the Phase 1 and 2 background development traffic without any geometric improvements. It also includes approved transportation improvements that are not constructed. The implemented signal timing data was modeled under the No Build scenarios. The No-Build conditions were analyzed using Synchro, Version 10 and SimTraffic, Version 10.

7.1 Traffic Analysis Assumptions

The existing conditions Synchro and SimTraffic models were used as a basis to develop the No-Build models for the AM and PM peak hour conditions. No geometric or traffic signal timing changes were made to the existing Synchro and SimTraffic models, except for the planned projects listed in Section 7.2 below. The models were updated with projected 2028 traffic volumes. Inputs, analysis methodologies, and calibration approaches were consistent with methodologies defined in the *TOSAM.*

7.2 Approved Background Improvements

Background improvements were approved at the following locations within the study area:

- Norton Coeburn Road at the Northbound Off Ramp
  - The Northbound Off Ramp right-turn lane will be modified from a channelized right-turn lane to a traditional stop controlled right-turn lane to improve the safety of traffic coming onto Norton Coeburn Road
- Park Avenue at 7th Street
  - The northbound approach will be reconfigured to have a single shared left-through-right lane.

These improvements were modeled under the No-Build scenarios as they are anticipated to be completed by 2028.

7.3 Traffic Analysis Results

The future conditions traffic analysis results are summarized in the following section of the report.

The same methodologies used to analyze existing conditions were also used to analyze No-Build conditions. Refer to Table 11 for the delay thresholds associated with each LOS category for signalized and unsignalized intersections.

Ten simulations were conducted for both the AM and PM models using different random seeds.

7.3.1 Control Delay and LOS Results

A table summarizing the No-Build conditions control delay and LOS results by lane group, approach, and intersection at each study area intersection is provided in *Appendix G*. *Figure 23* and *Figure 24* show a depictive representation of the projected control delay and LOS results in the study area. The corresponding Synchro output sheets are included in *Appendix G*.

Under No-Build conditions, movements were projected to operate at or better than LOS C except for the following:

Norton Coeburn Road/Hawthorne Drive

- The northbound approach is anticipated to operate at LOS D during the AM and PM peak hours.
- The westbound left-turn movement is anticipated to operate at LOS D during the AM peak hour.

Norton Coeburn Road/Trent Street/Wharton Lane

- The northbound left-turn and the westbound left-turn are anticipated to operate at LOS D during the AM peak hour.
- The overall intersection is anticipated to operate at an overall LOS D during the PM peak hour.
  - The southbound shared left-through lane and westbound left-turn lane operate at LOS F during the PM peak hour.
  - The eastbound left-turn lane is anticipated to operate at LOS E during the PM peak hour.

Norton Coeburn Road/U.S. 23 Northbound Off-Ramp

- The northbound left-turn lane is anticipated to operates at LOS D during the PM peak hour.

Park Avenue/7th Street

- The northbound and southbound approaches are anticipated to operate at LOS D during the AM and PM peak hours.

Park Avenue/8th Street

- The northbound and southbound approaches are anticipated to operate at LOS D during the AM peak hour.

Park Avenue/9th Street

- The northbound and southbound approaches are anticipated to operate at LOS D during the AM peak hour.
- The southbound through/left-turn movement is anticipated to operate at LOS D during the PM peak hour.

Park Avenue/11th Street

- The southbound approach is anticipated to operate at LOS D during the AM and PM peak hours.

Park Avenue/14th Street

- The southbound approach is anticipated to operate at LOS E during the PM peak hour.

Control delay and LOS was not reported at the U.S. Route 23 southbound off-ramp because the intersection functions with a yield/merge condition which cannot be modeled in Synchro 10. The projected operations for these unsignalized intersections should be evaluated based on the maximum queue lengths from SimTraffic.

7.3.2 Maximum Queue Length Results

A table summarizing the No-Build conditions maximum queue lengths by lane group at each study area intersection is provided in *Appendix G*. *Figure 25* and *Figure 26* show a depictive representation of the queue length results in the study area. The corresponding SimTraffic output sheets are included in *Appendix G*.

The following movements are projected to have significant maximum queue lengths under No-Build conditions.

Norton Coeburn Road/Trent Street/Wharton Lane

- The eastbound left-turn queue at Norton Coeburn Road at Wharton Lane/Trent Street is anticipated to experience queues that exceed 350 feet during the PM peak hour. The westbound shared through-right lane has a queue of 390 feet during the PM peak hour. The southbound shared left-through lane has a maximum queue of 230 feet. This queue will result in 41-percent of traffic being blocked from accessing the adjacent right-turn lane.
  - The operational results at this intersection is attributable to the increased traffic volumes associated with the new development and redevelopment access at this intersection. This intersection will require geometric improvements to support the potential anticipated level of redevelopment once that is clearly identified.

Park Avenue/11th Street

- The northbound shared left-through lane at Park Avenue and 11th Street is anticipated to operate with a maximum queue of 310 feet during the AM peak hour. This queue will result in three percent of traffic being blocked from entering the adjacent right-turn lane.

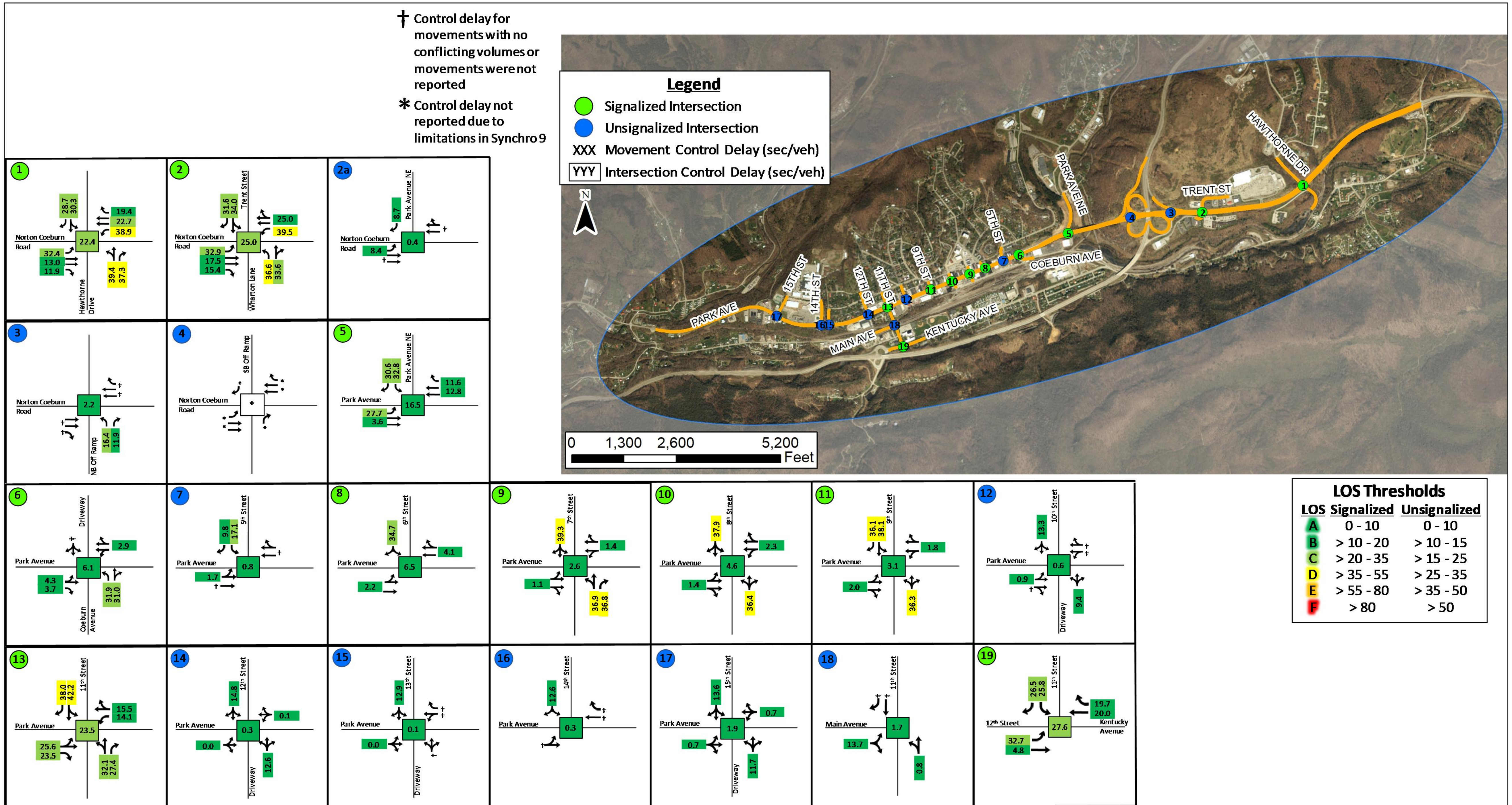
Kentucky Avenue/12th Avenue SW/11th Street

- The eastbound left-turn lane of Kentucky Avenue/12th Street at 11th Street is anticipated to have a maximum queue of approximately 130 feet during the AM and PM peak hours. This queue will result in traffic being blocked six percent of the time during the AM peak hour and two percent of the time during the PM peak hour. The eastbound through lane will experience a maximum queue of 280 feet during the AM peak hour. This queue will block one percent of traffic from entering the adjacent left-turn lane.

No other movements experience queuing that will extend upstream or block access to adjacent lanes.

.

Figure 23: 2028 No-Build Conditions – AM Control Delay and LOS



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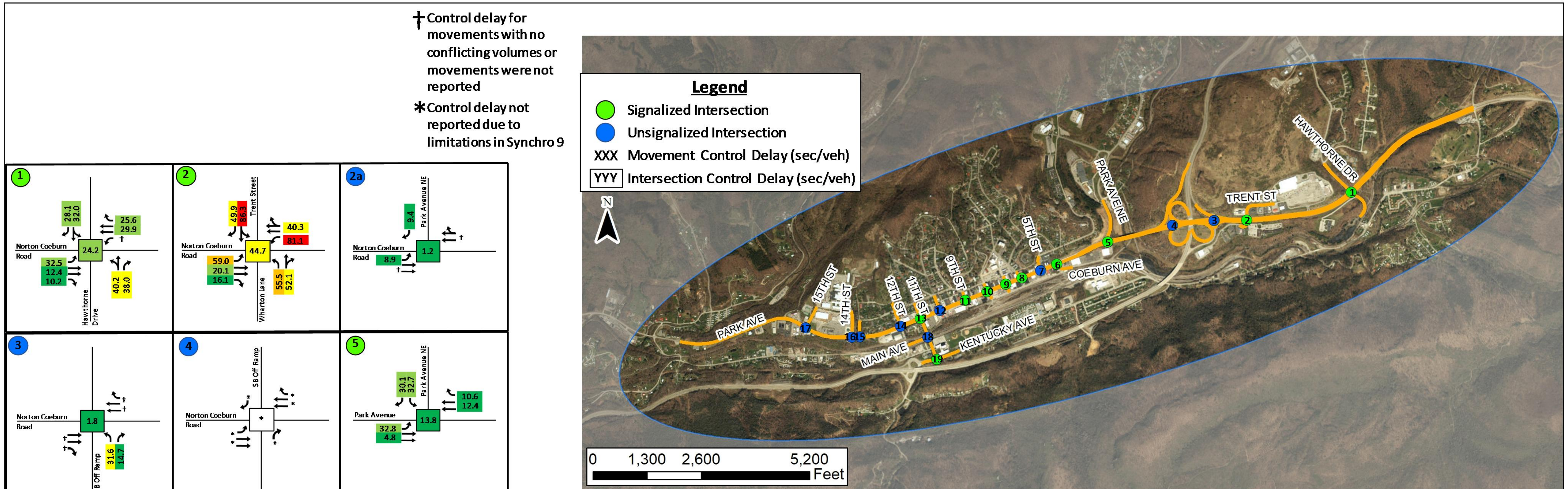
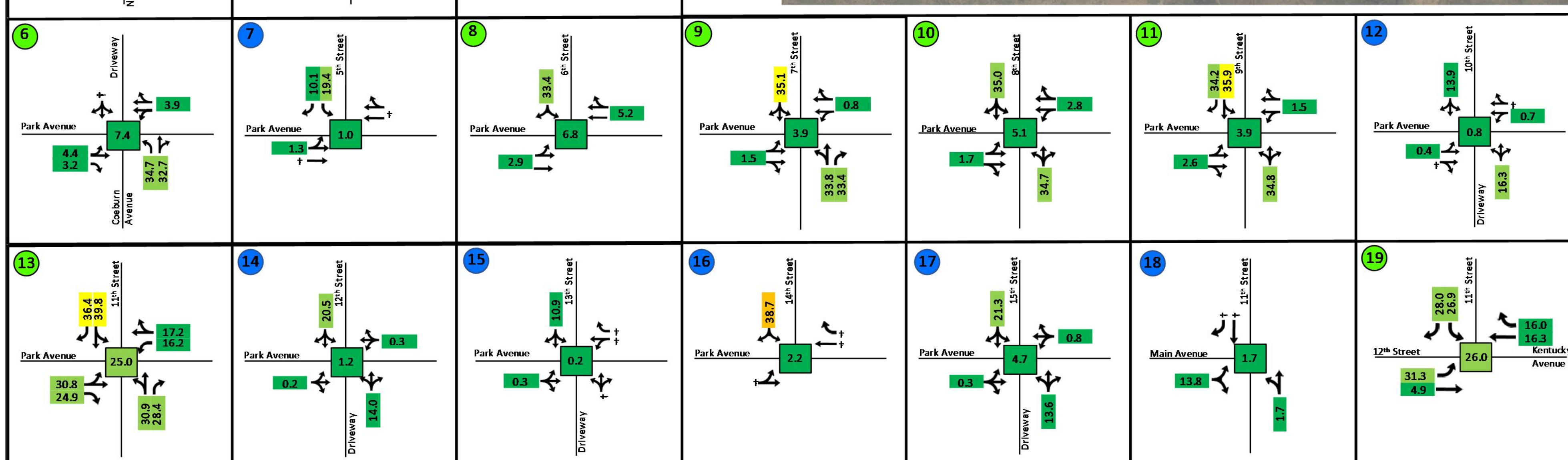
2028 No Build AM Peak Hour Traffic Analysis LOS Summary
US 23 (Park Avenue) Corridor Operations and Improvement Study
Norton, VA

FIGURE
23

Figure 24: 2028 No-Build Conditions – PM Control Delay and LOS





LOS Thresholds

LOS	Signalized	Unsignalized
A	0 - 10	0 - 10
B	> 10 - 20	> 10 - 15
C	> 20 - 35	> 15 - 25
D	> 35 - 55	> 25 - 35
E	> 55 - 80	> 35 - 50
F	> 80	> 50

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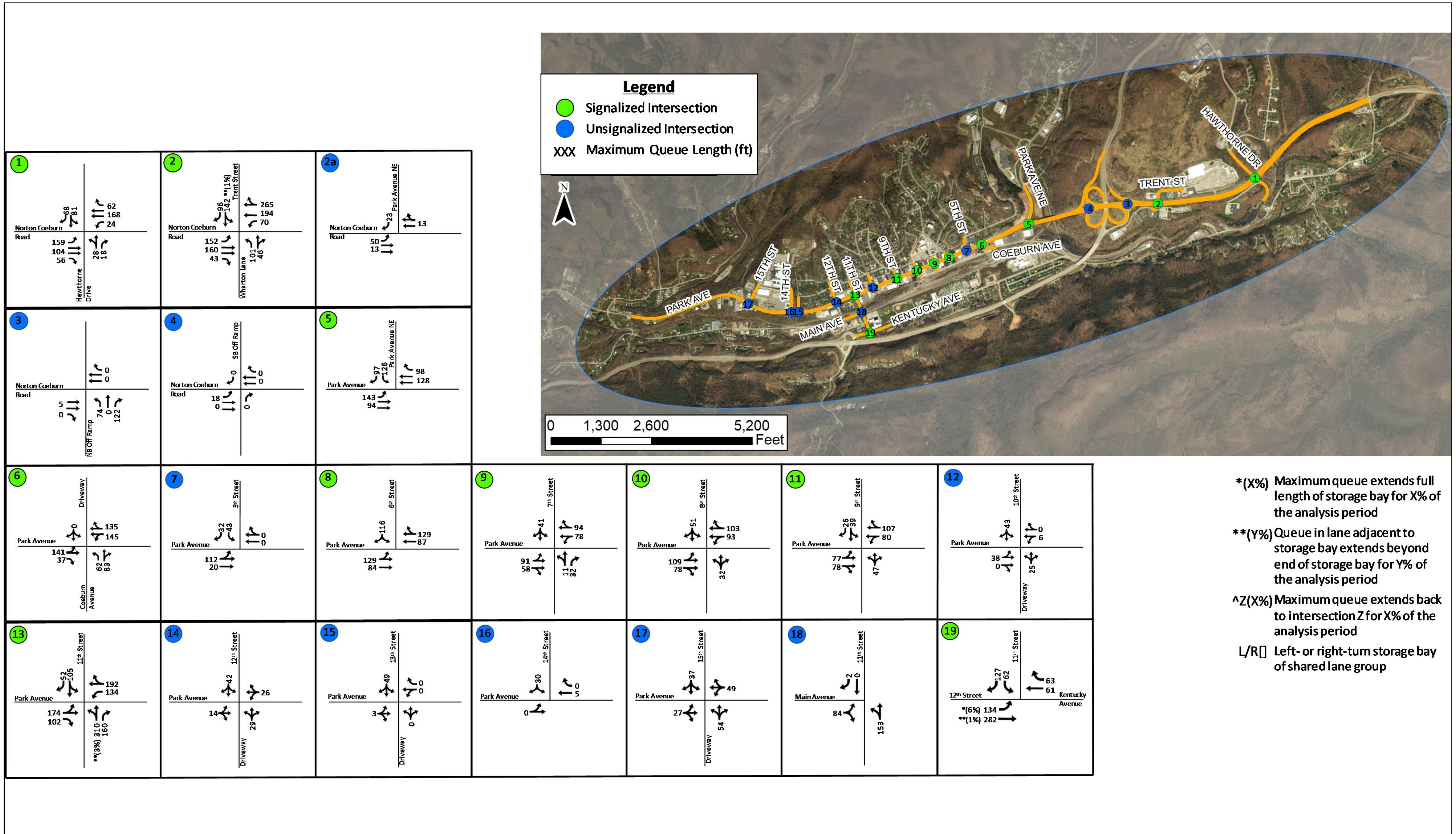
2028 No Build PM Peak Hour Traffic Analysis LOS Summary
US 23 (Park Avenue) Corridor Operations and Improvement Study
Norton, VA

FIGURE 24

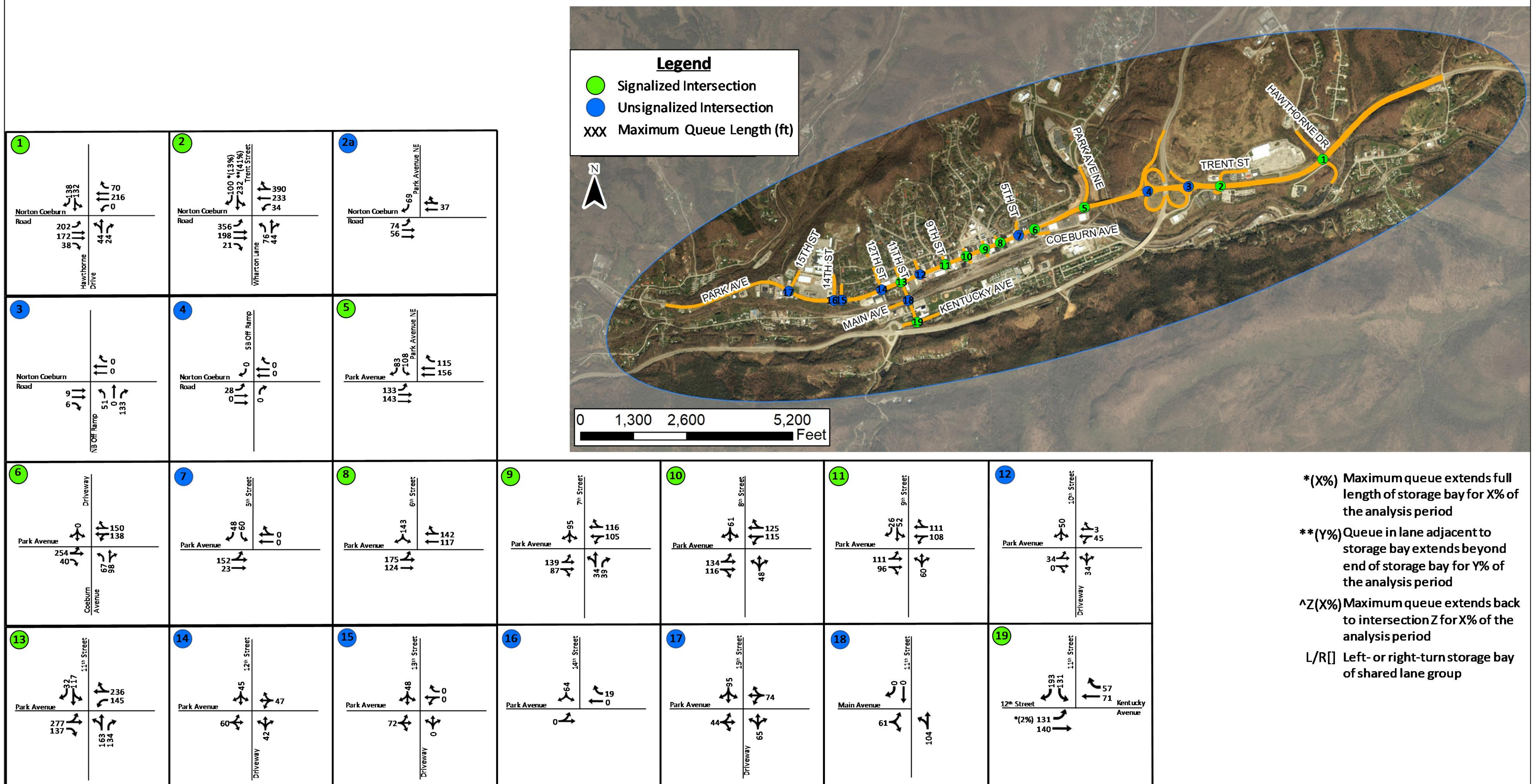
Figure 25: 2028 No-Build Conditions – AM Maximum Queue Lengths



2028 No Build AM Peak Hour Traffic Analysis Maximum Queue Summary
US 23 (Park Avenue) Corridor Operations and Improvement Study
Norton, VA

FIGURE 25

Figure 26: 2028 No-Build Conditions – PM Maximum Queue Lengths



2028 No Build PM Peak Hour Traffic Analysis Maximum Queue Summary
US 23 (Park Avenue) Corridor Operations and Improvement Study
Norton, VA

FIGURE 26

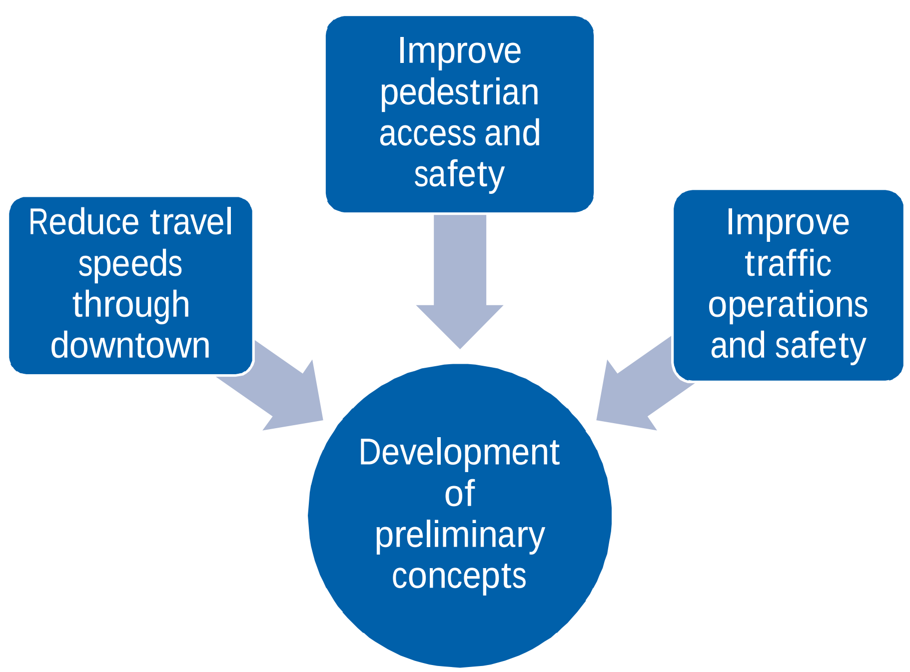
8 Improvement Screening and Analysis

Improvement concepts were developed to address safety, geometric, and operational deficiencies along the study corridor identified in the existing and No Build analyses, as well as during the field review. Improvement project concepts were vetted through internal meetings, shared with the SWG at a concept development workshop, and then screened based on operational analyses and feedback on feasibility from the SWG. Additionally, the concepts were presented at a citizen's information meeting (CIM) to gain public feedback prior to advancing these concepts into funding. Based on the screening results, final improvement projects were selected. More detailed analysis, design, cost estimates, and schedule estimates were developed for these improvement projects.

The primary focus in improving safety, primarily through downtown Norton, is to implement design solutions that mitigate the excessive speeds at which vehicles are traveling through downtown. Secondarily, improvements that provide a more comprehensive transportation system such as Complete Streets (less auto-centric and more multi-modal) were also considered in the downtown section of Park Avenue.

8.1 Concept Development

The SWG participated in a concept development workshop on September 10, 2019. During this workshop, the preliminary concepts developed were shared and through further consideration, additional concepts and alternatives were identified that focused on the following key objectives:



The concepts considered signing, traffic signal improvements/upgrades, geometric improvements, and corridor modifications. Once concepts were developed, they were presented to City Council members at a retreat for discussion and input. Then, they were presented to the public at a Citizens Information Meeting (CIM) on January 15, 2020 as described in *Section 9*. Based on the results of the existing and No-Build conditions analyses, the SWG developed recommendations as summarized in Table 13.

Table 13: Improvement Concepts

Project Identifier	Intersection	Concept	Improvement	Advance to Analysis and Cost Estimates
A	Norton Coeburn Road/Hawthorne Drive	1	Install signal-actuated flashing beacons with advance traffic signal warning signs	Yes
B	Norton Coeburn Road/Trent Street Median	1	Modify unsignalized median opening to right-in/right-out/left-in (EBL)	Yes
C	Traffic Signal System Upgrades/Safety Improvements	1	Controller/cabinet upgrades with fiber or wireless communications and central system and coordinated signal timings	No
		2	Controller/cabinet upgrades with GPS Time Sync units and coordinated signal timings	Yes
		3	Controller/cabinet using adaptive traffic signal controllers	No
D	Park Avenue/Park Avenue NW (Tipple Hill)	1	Modify WBL signal phasing from protected only to protected/permissive with FYA	Yes
E	Park Avenue – Tipple Hill to Coeburn Avenue Lane Reduction	1	Reduce WB Park Avenue from two lanes to one lane and install raised medians and islands to create chicanes	No
		2	Reduce WB Park Avenue from two lanes to one lane with a traditional lane merge	Yes

Project Identifier	Intersection	Concept	Improvement	Advance to Analysis and Cost Estimates
F	Park Avenue – Coeburn Road to 11th Street	1	Road Diet (4-Lanes reduced to 2-Lanes) with on-street parking, bike lanes, and dedicated left-turn lanes (mid-block pedestrian crossings with raised refuge and chokers optional per block)	Yes
		2	Road Diet (4-Lanes reduced to 2-Lanes) with on-street parking and wider sidewalks (mid-block pedestrian crossings with raised refuge and chokers optional per block)	No
		3	Road Diet (4-Lanes reduced to 2-Lanes) with reverse angle parking along north curb and dedicated left-turn lanes (mid-block pedestrian crossings with raised refuge and chokers optional per block)	No
		4	Road Diet (4-Lanes reduced to 2-Lanes) with on-street parking, wide landscaped median, and dedicated left-turns (mid-block pedestrian crossings with raised refuge and chokers optional per block)	No
		5	Road Diet (4-Lanes reduced to 2-Lanes) with on-street parking, increased lane width and shared bike facilities (shared lane markings), and dedicated left-turns (mid-block pedestrian crossings with raised refuge and chokers optional per block)	No
		6	Maintain 4-lane typical section with on-street parking. Install mid-block pedestrian crossings with chokers and refuge islands from 8th Street to 6th Street where Park Avenue widens.	Yes

Project Identifier	Intersection	Concept	Improvement	Advance to Analysis and Cost Estimates
G	Park Avenue at 11th Street	1	Widen sidewalk on southeast corner. Install curb bulb-out on southeast corner. Improve radii on southwest corner for heavy truck turning movements. Relocate traffic signal pole and cabinet to eliminate equipment from the southwest corner. Install FYA for WBL. Install sidewalk from 11th Street to 12th Street.	Yes
		2	Widen sidewalk on southeast corner. Install curb bulb-out on northeast and southeast corner. Improve radii on southwest corner for heavy truck turning movements. Modify north leg to one-way northbound traffic and construct angled on-street parking along 11th Street. Remove signal pole on the southwest corner. Install FYA for WBL. Install sidewalk from 11th Street to 12th Street.	No
H	Park Avenue – 11th Street to 15th Street	1	Restripe roadway to provide a three-lane typical section to include one through lane in each direction with center two-way, left-turn lane. Install crosswalks with pedestrian refuge islands at 12th Street. Install bike lanes in residual space.	No
		2	Restripe roadway to provide a three-lane typical section to include one through lane in each direction with center two-way, left-turn lane. Install crosswalks with pedestrian refuge islands at 12th Street. Provide on-street parking along south curb in residual space.	Yes

Project Identifier	Intersection	Concept	Improvement	Advance to Analysis and Cost Estimates
I	11th Street – Park Avenue to 12th Street/Kentucky Avenue	1	Eliminate dedicated SB right-turn lane onto Main Street. Widen the existing sidewalk along the east side of 11th Street to an approximate 10' – 12' wide shared use path.	Yes

8.1.1 Project A – Norton Coeburn Road/Hawthorne Drive

Project A is intended to provide advanced notification of a green indication which is about to change to red particularly for motorists as they approach the signalized intersection from the east. To the east, Norton Coeburn Road functions like a limited access facility with minimal disruptions to free-flow travel speeds and a posted speed limit of 55MPH. A sample of the sign configuration is illustrated in *Figure 27*.

Figure 27: Advanced Signal Warning Flashing Beacons

8.1.2 Project B – Norton Coeburn Road/Trent Street Median Modification

Project B is intended to improve the safety for left-turning vehicles out of the Virginia-Kentucky Regional Shopping Center. The existing median access is located in a curve with limited sight distance to the east and mainline vehicles traveling at high travel speeds. The median will be modified to geometrically prohibit the ability to make the left-turn out of the shopping center; however, the left-turn movement into the shopping center will still be allowed.

8.1.3 Project C – Traffic Signal System Upgrades

Project C will replace the existing traffic signal equipment which includes the traffic signal cabinets and controllers for the seven (7) existing signalized intersections between Tipple Hill and 11th Street. The primary purpose of the traffic signal upgrades is to maintain the signal coordination which will improve both operations and safety through downtown. Signal coordination has measured safety benefits by reducing the frequency of crashes involving major street left-turning and minor street right-turning vehicles where adequate safe gaps in opposing traffic are not available. Furthermore, major road rear-end crashes associated with speed changes can also be reduced by maintaining coordinated signals to promote platooning. High vehicle speeds were a major documented safety issue through this project. The progression patterns for the coordinated signal timings were set to the posted speed limit of the roadway, so maintaining their timings will be important to help reduce the measured 85th percentile speed through downtown.

During deployment of the coordinated timing plans detailed in Chapter 5, the need for updated equipment was apparent. There are two separate controller platforms and mixed firmware along the corridor which made the operations inconsistent and troubleshooting challenging for maintenance staff and technicians. Additionally, the cabinets often require maintenance and troubleshooting, particularly with detection faults further deteriorating operations and safety. Furthermore, the intersections do not communicate or maintain consistent local controller clocks. As such, the developed timing plan functionality will deteriorate as the local controller clocks drift, thereby impacting traffic operations and safety. During deployment of the timing plans, the clocks had to be reset daily due to drift. This would be a daily requirement of a signal technician and takes approximately an hour of time or more to ensure the system is functioning as intended by the timing plans. The following provides description of the concepts considered. Each of the concepts below describe the hardware and ITS components associated with correcting the clock drift. They assume that each of the traffic signals' cabinets, controllers, detection, and other cabinet-related hardware is also replaced to correct the operations and equipment functionality.

- Concept 1 – In addition to the traffic signal cabinet and controller upgrades, Concept 1 includes the installation of either fiber optic communications or wireless radio communications. The system could be operated as a master/local closed loop system, or the communications could be installed to a central traffic operations center (TOC). The TOC allows for detailed traffic operations and traffic signal functionality could be remotely monitored.
- Concept 2 – In lieu of fiber optic or wireless communications, install GPS Time Sync modules to maintain a consistent local clock. Without communications or time-sync, the local clocks will drift and negatively impact the function of the coordinated timing plans and could impact safety.
- Concept 3 – Concept 3 will require communication upgrades through fiber optic or wireless radios and will utilize adaptive signal control technology (ASCT) opposed to traditional timings. ATCS requires additional hardware and software to function and generally benefit safety and operations by continuously distributing green time, progressively moving vehicles through green lights, creates smoother traffic flow, and extends the operational benefits of a system of traditional retiming.

Concept 2 was recommended due to the costs associated with Concept 1. Concept 3 (ASCT) was screened out of consideration for the following reasons:

- There are mixed opinions on its functionality and value. There are regions within VDOT who have deployed the technology and, in some cases, it's being removed due to ongoing citizen complaints.
- ASCT requires functioning detection and additional detection zones for proper operation. As such, it will increase the maintenance requirements to ensure the zones are properly configured and operating as intended.
- There are limited opportunities for the adaptive adjustments to the green times since most of the intersections are only two-phase (mainline and side street permissive phases).
- It is not anticipated that the additional costs associated with ASCT will balance the extended time Norton should experience from traditional timing plans. The typical three to five year timing cycle will likely extend due to the traffic volumes and intersection phasing previously discussed. All the side street green times were calculated for

the pedestrian crossings, so there should be limited, if any, occurrences where there isn't enough green time to serve all waiting vehicles.

8.1.4 Project D – Tipple Hill Signal Phasing Improvements

Project D will improve the intersection operations at the Park Avenue/Park Avenue NE intersection, particularly for the eastbound left-turn movement onto Park Avenue NE (towards Norton Elementary and Middle Schools). The existing protected-only left-turn signal head will be replaced with a flashing yellow arrow indication, so motorists can yield to opposing traffic and make a permissive left-turn movement when there is a gap.

8.1.5 Project E – Tipple Hill to Coeburn Avenue Lane Reduction

Project E focuses on reducing the travel speeds through Tipple Hill as Norton Coeburn Road transitions from a four-lane divided arterial into a local collector a downtown setting. As discussed above, the travel speeds through this segment need to be reduced in advance of vehicles entering downtown Norton where the character of the roadway shifts from median divided arterial to building fronts with wide sidewalks and on-street parking. There are two alternatives considered as follows:

- Concept 1 introduces a lane reduction for westbound traffic just beyond the traffic signal Park Avenue NE. The purpose of the improvement is to merge all vehicles into a single lane to help reduce vehicle speeds down the hill. In addition, small raised islands would be constructed to create chicanes which are common traffic calming features used in neighborhoods. The single lane would weave through the chicanes which would require vehicles to further reduce their speeds to reasonable levels to navigate through the section.
- Concept 2 also introduces a lane reduction for westbound traffic just beyond the traffic signal at Park Avenue NE. This concept includes a traditional lane drop with a more gradual transition through an elongated median and using pavement markings. It will still have the traffic calming effect, but less weaving than created by the chicanes.

Both concepts will create the ability to stripe a dedicated westbound left-turn lane at the Coeburn Avenue signalized intersection (the left-turn is currently shared with the through movement) and would include a radar indicated real-time speed display sign.

8.1.6 Project F – Coeburn Avenue to 11th Street

Multiple concepts were developed and considered throughout the downtown section of Park Avenue from Coeburn Avenue to 11th Street. Based on the capacity analysis results in No Build conditions, there is available capacity to consider repurposing one vehicle lane in each direction to be used for another transportation element (i.e., a "road diet"). Road diets have been studied by FHWA and documented as a Proven Safety Countermeasures which can provide the following benefits:

- An overall crash reduction of 19 to 47 percent
- Reduction of rear-end crashes and left-turn crashes due to the creation of dedicated left-turn lanes
- Reduced right-angle crashes as side street motorists cross three versus four lanes travel lanes
- Fewer lanes for pedestrians to cross
- Opportunity to install pedestrian refuge islands, bicycle lanes, on-street parking, or transit stops
- Traffic calming and more consistent speeds
- A more community-focused, "Complete Streets" environment that better accommodates the needs of all road users

When considering the road diet for Park Avenue, the available "new" pavement created by repurposing the vehicle lane created opportunities and considerations for how to use the additional space. Overall, each concept considered a dedicated left-turn lane at each intersection downtown, mid-block pedestrian crossings, choker islands at the mid-block pedestrian crossings, dedicated on-street parking, pedestrian refuge islands, and streetscaping where appropriate. It is noted that curb extensions (i.e., bulb-outs) were considered at each intersection to reduce the pedestrian crossing distances; however, due to concerns expressed by the City of Norton residents and business owners at the public meeting due to large vehicle movements and deliveries, they were removed for consideration. With each concept, dedicated loading zones along the curb face can be provided along each block by removing three to four on-street parking spaces. The following concepts were developed and considered for advancement:

- Concept 1 – Stripe dedicate bike lanes
- Concept 2 – Stripe an approximate 14' wide vehicle lane with shared bicycle lane markings
- Concept 3 – Install reverse angle parking along the northern curb line
- Concept 4 – Construct wide, landscaped medians throughout downtown
- Concept 5 – Widen the sidewalks
- Concept 6 – Maintain four travel lanes through downtown but transition the vehicle lanes between 8th Street and 6th Street to create a center median with mid-block pedestrian crossings using the existing, wide pavement section in this area.

Concept 1 was identified as the preferred alternative because it improved multimodal transportation by providing bike lanes, is consistent with the overall tourism goals and outdoor activities promoted by the City of Norton, and complimented other City improvements.

Roadway typical sections and plan view layouts for one street block for all concepts are included in *Appendix H*.

8.1.7 Project G – Park Avenue at 11th Street

Improvements for Park Avenue at 11th Street primarily consist of improving the radius for the southwest corner of the intersection. The eastbound right-turn movement experiences high heavy vehicle movements along the designated truck route and the existing signal pole is often hit as a result. Additionally, both concepts consider extending the sidewalk along the southside of Park Avenue from 11th Street to 12th Street.

- Concept 1 – In addition to the improvements described above, this concept also includes widening the sidewalk and extending the curb on the southwest corner of the intersection. The wider sidewalk will allow placement of a new traffic signal pole with twin mast arms and removal of the existing traffic signal pole on the southwest corner of the intersection.
- Concept 2 – Concept 2 includes reconfiguring the north leg of the intersection to only allow one-way northbound traffic flow. This will eliminate the southbound signal phase from the intersection thus improving overall intersection operations. The remaining phases will be serviced more frequently reducing delays and queueing per approach. In addition to the one-way traffic, angled on-street parking can be striped along Park Avenue using the available pavement. The traffic signal pole on the southwest corner can be removed since the signal phase is no longer needed.

8.1.8 Project H – Park Avenue - 11th Street to 15th Street

Park Avenue from 11th Street to 15th Street consists of two travel lanes with a long continuous right-turn lane in the westbound direction and a long continuous left-turn in the eastbound direction. This improvement proposes restriping the segment into a consistent 3-lane typical section to include two travel lanes and a continuous center two-way left-turn lane. There is additional residual pavement to provide either dedicated bike lanes in both directions or an on-street parking lane along the south curb.

8.1.9 Project I – 11th Street Shared Use Path

The existing sidewalk along 11th Street from Park Avenue to Kentucky Avenue will be widened to an approximate 10 to 12-foot wide shared use path. This will provide better pedestrian and bicycle connectivity to the high school as well as connection to the City's proposed sidewalk projects along 12th Street under US Route 23/US Route 58 Alt.

9 CITIZEN'S INFORMATION MEETING (CIM)

To promote public awareness about the proposed project concepts under consideration and gain community buy-in, a CIM was hosted at Norton City Hall on January 15, 2020 from 5:30 PM – 7:30 PM to gather public input on the improvements listed above. The CIM was formatted as an open house which allowed the attendees to circulate the room, review the conceptual designs being proposed, ask any questions of the facilitators, and then leave their comments on a response sheet that corresponded with the proposed improvement. All the responses were compiled, and the rankings were averaged to help the SWG further screen the proposed improvements and advance the preferred alternatives. The compiled responses are summarized in *Appendix I.*

Figure 28: Citizen Information Meeting Station with Display Boards

10 PREFERRED BUILD CONDITIONS ANALYSIS

Traffic operational analyses were conducted to evaluate the overall performance of the study corridor under Build (2028) AM and PM peak hour conditions. The intent of the Build conditions analysis was to evaluate the effectiveness of the selected improvement projects and understand how the improvement projects work in conjunction with one another. The Build scenario was analyzed with the selected improvements modeled under the AM and PM peak hour scenarios. Build conditions were modeled using Synchro, Version 10 and SimTraffic, Version 10. It is noted that the primary corridor improvement included implementation of a "road diet" along Park Avenue from Tipple Hill to 11th Street. As such, the capacity of the roadway was reduced, and some delay calculations may increase in Build conditions. These delay increases are offset by the potential reductions in vehicle speed, creation of dedicated left-turn lanes, and reduction of crashes along the corridor.

10.1 Traffic Analysis Results

The improvement strategies set forth in the preferred Build alternative were modeled under the Build scenario. The implemented traffic signal timings were maintained. The cycle lengths and vehicle splits are anticipated to remain adequate even with a reduction in through lanes along Park Avenue. Additionally, the existing yellow change and red clearance intervals were maintained for the Build conditions analysis. It is recommended that a corridor-wide signal optimization be performed after implementing the recommended improvements to evaluate cycle length, clearance intervals, offsets, pedestrian timings, and splits.

The same methodologies used to analyze the existing and No-Build conditions were also used to analyze the Build conditions. Refer to Table 11 for the delay thresholds associated with each LOS category for signalized and unsignalized intersections.

Ten simulations were conducted for both the AM and PM models using different random seeds. Average speeds for the eastbound approach at Norton Coeburn Road at Hawthorne Drive were used in the VDOT Sample Size Determination Tool to confirm that the ten runs would provide the acceptable 95 percent confidence level for both the AM and PM models. The speed results and the Sample Size Determination results are documented in *Appendix J*.

10.1.1 Control Delay and LOS Results

A table summarizing the Build conditions control delay and LOS results by lane group, approach, and intersection at each study area intersection is provided in *Appendix K*. *Figure 29* and *Figure 30* show a depictive representation of the projected control delay and LOS results in the study area. The corresponding Synchro output sheets are included in *Appendix K*.

Control delay and LOS is anticipated to experience negligible changes from no build to build conditions. The improvements above primarily improve safety, pedestrian access and connectivity, and reducing vehicle speeds. None of which are measured through control delay and LOS. It is noted that the capacity results reflect the road diet throughout downtown and delays changes are minimal which support the future operations with the road diet. Table 14 summarizes the overall intersection LOS for No-Build and Build conditions as well as the projected reduction in overall intersection delay at the study intersections.

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Table 14: Projected Changes in Intersection Delay for Build Conditions

Intersection	AM Peak Hour			PM Peak Hour		
	No-Build LOS	Build LOS	Change in Delay (seconds)	No-Build LOS	Build LOS	Change in Delay (seconds)
Norton Coeburn Road at Hawthorne Drive	C	C	0	C	C	0
Norton Coeburn Road at Trent Street	C	C	0	D	D	0
Norton Coeburn Road at Trent Street SE	A	A	0	A	A	0
Northbound Off-Ramp at Norton Coeburn Road	A	A	0	A	A	0
Park Avenue at Park Avenue NE	B	B	-3.5	B	B	-2.2
Park Avenue at Coeburn Avenue	A	A	+2.1	A	B	+2.9
Park Avenue at 5th Street	A	A	+0.1	A	A	+0.1
Park Avenue at 6th Street	A	A	-0.2	A	B	+3.4
Park Avenue at 7th Street	A	A	-0.2	A	A	+1.1
Park Avenue at 8th Street	A	A	+0.9	A	A	+0.5
Park Avenue at 9th Street	A	A	0.5	A	A	+1.2
Park Avenue at 10th Street	A	A	-0.1	A	A	-0.1
Park Avenue at 11th Street	C	C	+0.1	C	C	0
Park Avenue at 12th Street	A	A	0	A	A	-0.3
Park Avenue at 13th Street	A	A	0	A	A	-0.1
Park Avenue at 14th Street	A	A	0	A	A	-1.2
Park Avenue at 15th Street	A	A	0	A	A	0
11th Street at Main Avenue	A	A	0	A	A	0
11th Street at Kentucky Avenue	C	C	0	C	C	0

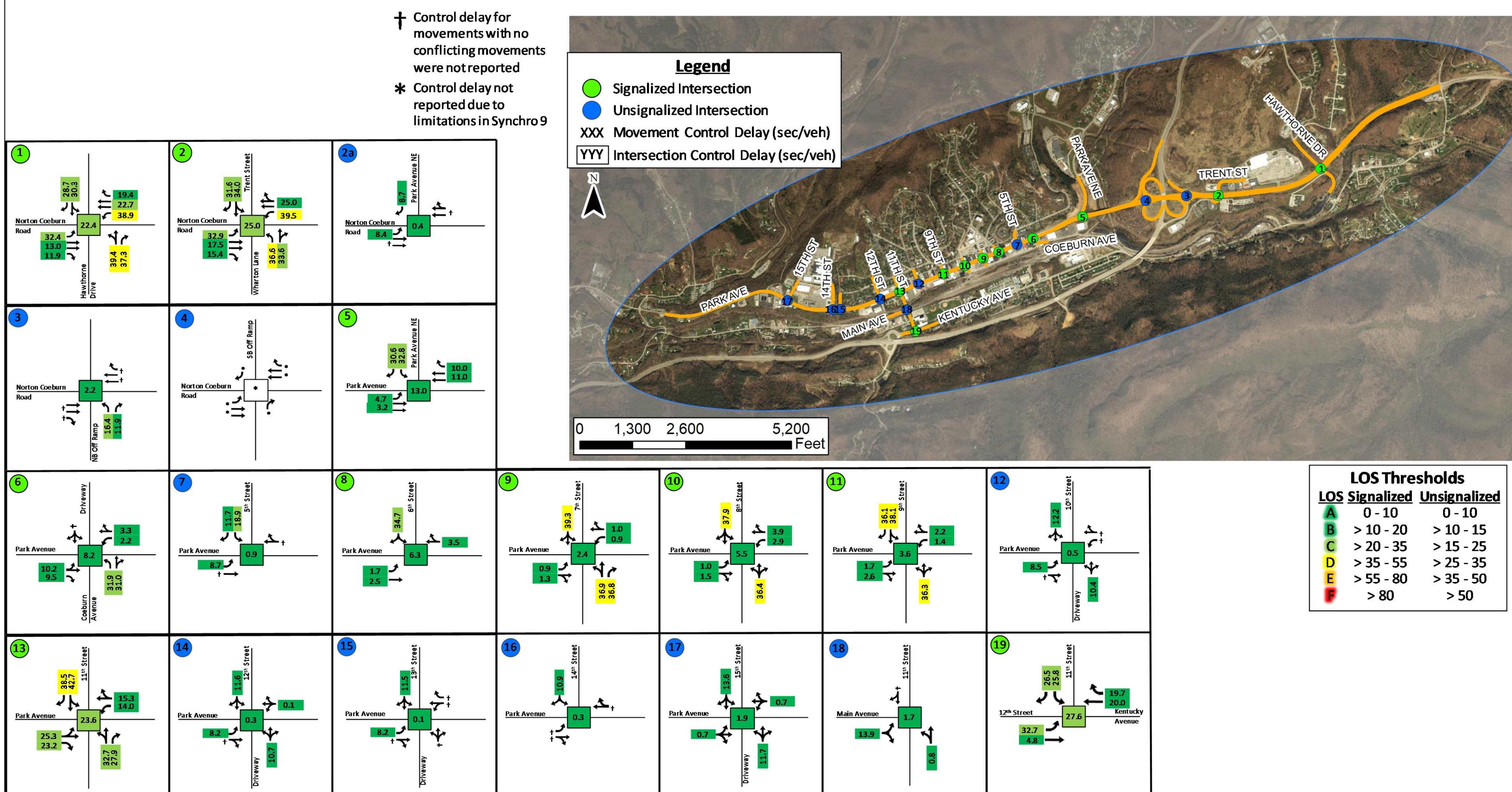
Table 14 summarizes the projected LOS for No-Build and Build conditions. Overall minor changes in delay can be anticipated due to the proposed improvements. The resulting delays, particularly along the downtown area of Norton, indicate the available capacity to support the recommended road diet.

10.1.2 Maximum Queue Length Results

The proposed improvements are anticipated to have minimal impacts on queueing; however, queueing throughout the study area is generally minor. The proposed road diet is anticipated to slightly increase mainline Park Avenue queuing based on reducing to a single through lane. The queueing results calculated approximately 100-feet of queueing per lane in no build conditions and 200-feet of queueing when modeled as a single lane.

The proposed FYA improvement for the eastbound left-turn movement at Tipple Hill is anticipated to reduce queues by approximately 30-feet (one vehicle length). *Figure 31* and *Figure 32* show a depictive representation of the queue results in the study area. The corresponding SimTraffic output sheets are included in *Appendix K*.

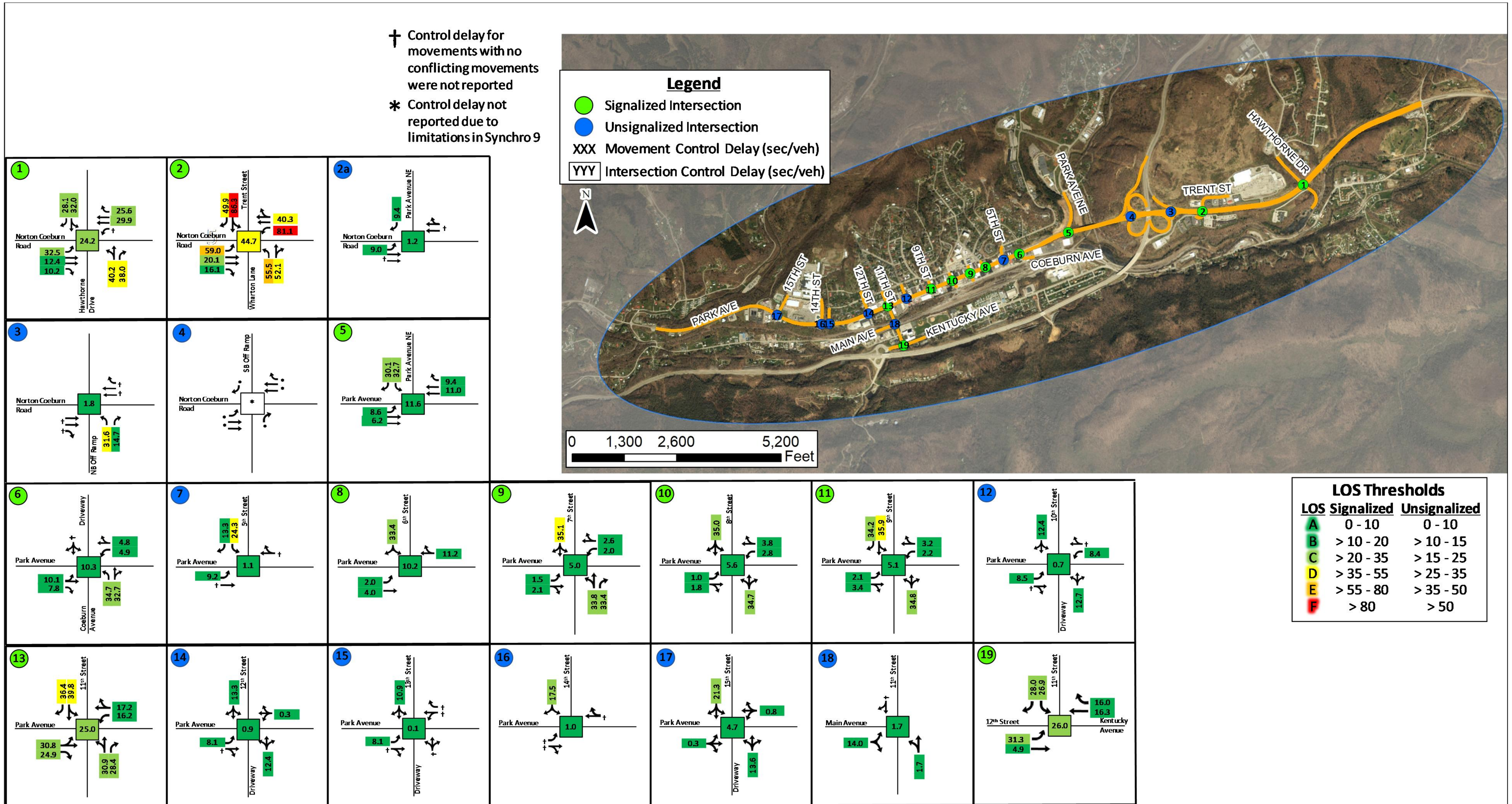
Figure 29: 2028 Build Conditions – AM Control Delay and LOS



2028 Build AM Peak Hour Traffic Analysis LOS Summary
US 23 (Park Avenue) Corridor Operations and Improvement Study
Norton, VA

FIGURE 29

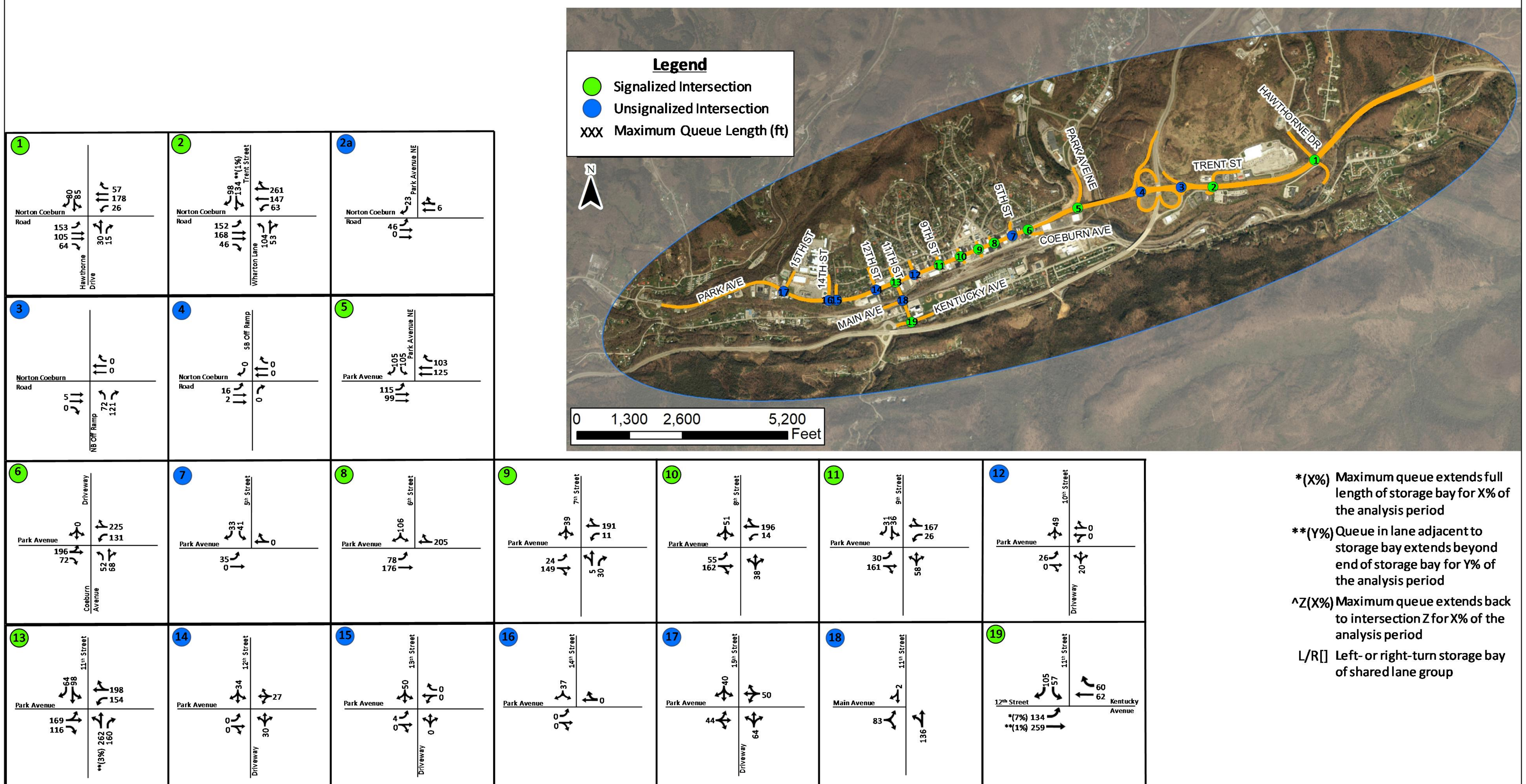
Figure 30: 2028 Build Conditions – PM Control Delay and LOS



2028 Build PM Peak Hour Traffic Analysis LOS Summary
US 23 (Park Avenue) Corridor Operations and Improvement Study
Norton, VA

FIGURE 30

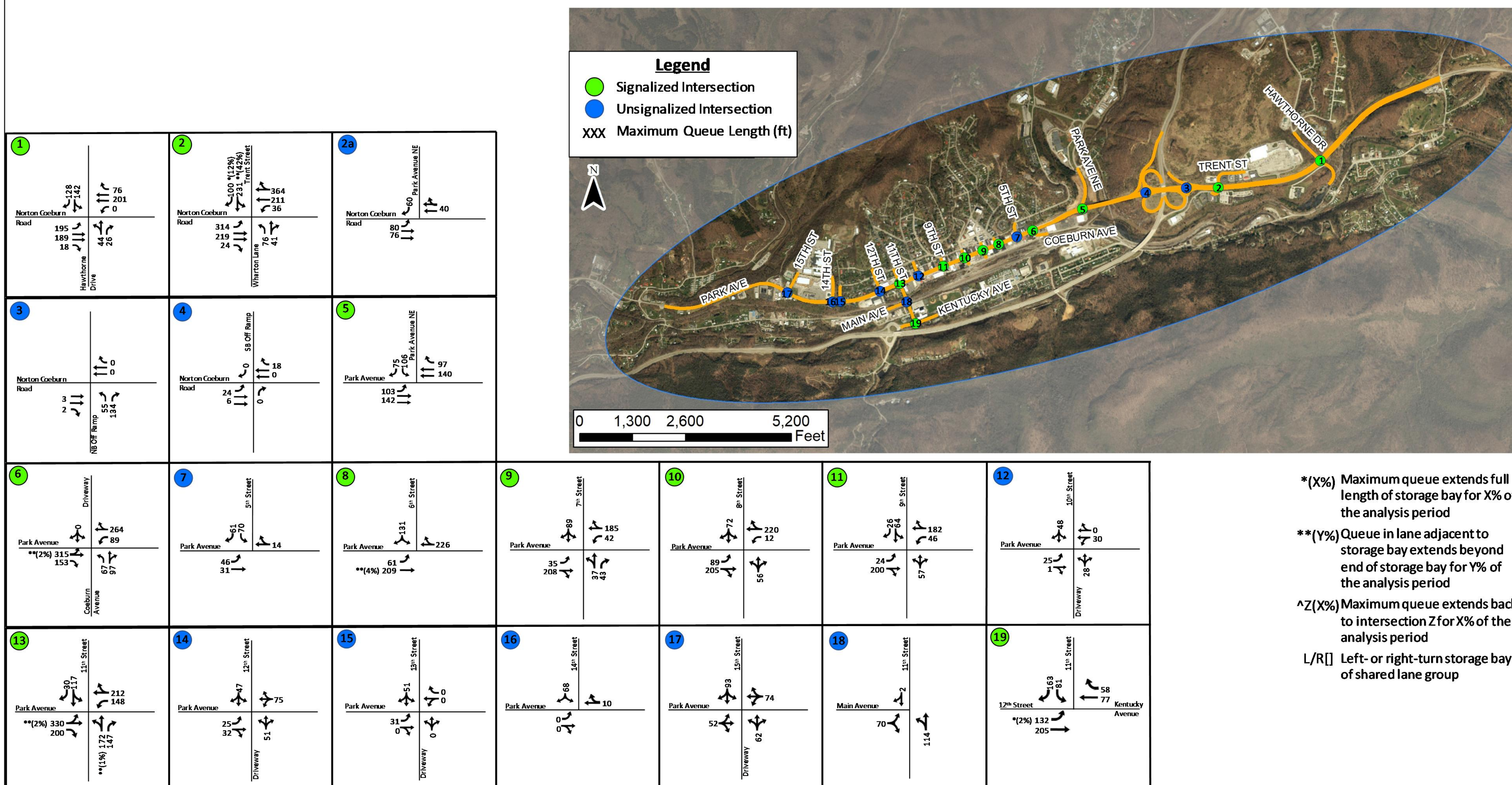
Figure 31: 2028 Build Conditions – AM Maximum Queue Lengths



2028 Build AM Peak Hour Traffic Analysis Maximum Queue Summary
US 23 (Park Avenue) Corridor Operations and Improvement Study
Norton, VA

FIGURE 31

Figure 32: 2028 Build Conditions – PM Maximum Queue Lengths



VDOT STARS

2028 Build PM Peak Hour Traffic Analysis Maximum Queue Summary

US 23 (Park Avenue) Corridor Operations and Improvement Study

Norton, VA

FIGURE 32

10.2 Safety Analysis

Crash modification factors (CMFs) were used to determine the potential safety benefits of the recommended improvements. CMFs were chosen from the approved list of CMFs used for the VDOT SMART SCALE safety scoring process. The CMFs used for SMART SCALE are applicable to all crash types, but only applied to fatal and injury (FI) crashes. The best applicable CMF was applied to crashes in the influence area of each intersection rather than applying multiple CMFs. This method is consistent with the methodology used during the SMART SCALE scoring process. However, the influence areas used in SMART SCALE are likely to differ from those selected for this Study since influence areas were extended as needed based on types and descriptions of nearby crashes.

Equivalent property damage only (EPDO) scores were calculated for each intersection influence area based on the following scale. The EPDO scores were based on fatal and injury crashes only. Alcohol related crashes were excluded to be consistent with the SMART SCALE methodology.

- K (Fatality) = 85*
- A (Disabling Injury) = 85
- B (Evident Injury) = 10
- C (Possible Injury) = 5

*There were no fatal crashes in the study area between 2014 and 2018.

The applicable CMFs and potential safety benefits of the recommended improvements are documented in Table 15. Not all recommendations described above were assigned a CMF due to several of the improvements being preventative and/or pedestrian related. Therefore, those improvements would not recognize a safety improvement since there isn't crash history.

Table 15: Projected Reductions in EPDO Crashes by Intersection

Intersection or Segment	Existing Crashes (2013-2017)				EPDO (FI)	CMF Applied	EPDO Reduction	CMF Notes
	A	B	C	*PDO*				
Park Avenue from Coeburn Road to 11th Street	2	10	1	*27*	275	0.71	80	Road diet (Convert 4-lane undivided to 2-lanes plus turning lane)
Park Avenue from 11th Street to 15th Street	1	3	0	*9*	115	0.80	23	Install TWLTL on two lane road with continuous exclusive right and/or left-turn lanes
Norton Coeburn Road/Hawthorne Drive	0	6	1	*2*	65	0.64	23	Install flashing beacons as advance warning (filtered for rear end crashes only per applied CMF)
Norton Coeburn Road/Trent Street Median	0	0	0	*3*	0	0.8	0	Replace direct left-turn with right-turn/U-turn
Park Avenue Traffic Signal Equipment Improvements	2	12	4	*54*	310	0.79	62	Coordinate arterial signals

11 Conceptual Design, Costs, and Schedules

Conceptual designs, planning-level cost estimates, and schedule estimates were developed for each selected improvement project. One-page summary sheets were developed for each project and are provided in *Appendix L.* Each summary sheet includes a project description, project sketch, location map, planning-level cost estimate, schedule estimate, and a summary of the projected operations and safety benefits.

11.1 Conceptual Design

Conceptual designs were developed in MicroStation for improvement projects along the Park Avenue and Norton Coeburn Road corridors in accordance with the following applicable guidelines:

- A Policy on Geometric Design of Highways and Streets (AASHTO 2011)
- VDOT Road Design Manual (Issued January 2005, Revised July 2016)
- VDOT Road and Bridge Standards (VDOT 2016, latest revisions)
- Manual on Uniform Traffic Control Devices (MUTCD 2009)
- 2011 Virginia Supplement to the MUTCD

Design criteria and guidance from these documents were applied to roadways within the project limits based on functional classification and roadway design speeds. All single-lane left-turn movements were designed to accommodate the turning radius for a WB-67 vehicle except along Park Avenue from 11th Street to Tipple Hill where through trucks are prohibited. A S-BUS-36 (school bus) was used for that segment.

All pedestrian refuges will need to be designed to a minimum of six feet wide. There should be sufficient width through the road diet and lane modifications to accommodate a full width pedestrian refuge; however, detailed design will need to be performed as these projects advance.

Curb Ramps (Std. CG-12) shown are for illustrative purposes only. A detailed curb ramp design was not included in the conceptual design drawings; however; a curb ramp cost is included within the sidewalk cost for each improvement.

11.2 Planning-Level Cost Estimates

A refined planning-level cost estimate, in 2020 dollars, was developed for all selected improvement projects. A 25 percent preliminary engineering (PE) cost was estimated as a percentage of construction costs, including contingency. For projects with anticipated right-of-way and/or utility impacts, right-of-way and utility relocation costs were estimated on a project-by-project basis based on the size and complexity of the project, as well as the existing right-of-way limits. Construction (CN) costs were estimated using a combination of PCES, the 2015 version of Transportation and Mobility Planning Division Statewide Planning Level Cost Estimate Spreadsheet, and recent bid costs. In addition, the construction cost included an additional 30 percent contingency of the base roadway construction cost, 20 percent for construction engineering and inspection (CEI), and 20-percent for VDOT/City management/oversight. Table 16 summarizes the preliminary engineering (PE); right-of-way and utility relocation (RW); construction (CN); and total planning level cost estimates for each improvement project. A more detailed breakdown of the planning-level cost estimates is provided in *Appendix M*.

Table 16: Planning-Level Cost Estimates

Improvement	Cost Estimate (2020 dollars)			
	PE	RW	CN	Total
Project A and B - Norton Coeburn Road/Trent Street Median Improvements	$67,000	$0	$179,000	$246,000
Project C - Traffic Signal System Upgrades	$166,000	$0	$565,000	$731,000
Project D and E Tipple Hill Improvements	$204,000	$0	$705,000	$909,000
Project F - Park Avenue Road Diet from Coeburn Avenue to 11th Street	$1,536,000	$200,000	$5,828,000	$7,564,000
Project G – Park Avenue at 11th Street	$426,000	$30,000	$1,558,000	$2,014,000
Project H – Park Avenue from 11th Street to 15th Street	$293,000	$0	$1,047,000	$1,340,000
Project I – 11th Street Shared Use Path	$1,052,000	$0	$4,042,000	$5,094,000

11.3 Schedule Estimates

Schedule estimates were developed for all selected improvement projects using VDOT's Locally Administered Projects (LAP) Schedule Tool. PE is based on when funding is authorized and spans procurement, preliminary and final designs, environmental, public involvement, etc. until CN authorization. The only project that includes a RW phase is Project G which includes partial land acquisition. All other projects are not anticipated to include RW or utility relocations. CN includes advertisement, bid opening, contract execution, construction, and project close out. Table 17 summarizes the projected timeframes for the PE, RW, and CN phases of each improvement project.

Table 17: Schedule Estimates

Improvement	Schedule Estimate (months)			
	PE	RW	CN	Total
Project A and B - Norton Coeburn Road/Trent Street Median Improvements	20	0	13	33
Project C - Traffic Signal System Upgrades	14	0	12	26
Project D and E Tipple Hill Improvements	20	0	13	33
Project F - Park Avenue Road Diet from Coeburn Avenue to 11th Street	20	0	19	39
Project G – Park Avenue at 11th Street	17	9	19	45
Project H – Park Avenue from 11th Street to 15th Street	20	0	13	33
Project I – 11th Street Shared Use Path	31	0	19	50

12 PROJECT ADVANCEMENT

This Study should be used as a planning tool to achieve the next steps of planning, programming, designing, and constructing the identified safety and operational improvements in the study corridor. To build upon the efforts of this Study, the City of Norton should continue to coordinate with the LENOWISCO PDC, VDOT, and other stakeholders. To advance these projects beyond the planning stage, members of the SWG should use the following steps:

Prepare Projects for Advancement

The City should conduct additional outreach meetings for further vetting of the proposed projects, as needed. These outreach meetings should include additional stakeholders that were not in the SWG. Other stakeholders may include business owners on the corridor and/or City of Norton residents.

Improvement projects should be prioritized on a local and regional level. Prior to submitting funding applications, applicant must have one of the following:

1. Inclusion or proven consistency with the Constrained Long-Range Transportation Plan (CLRP)
2. Resolution of support from governing body

Apply for Funding

The following funding sources should be considered for improvement projects identified in this Study.

- Revenue Sharing – a program that provides a dollar for dollar state match to local funds for transportation projects. Projects eligible for Revenue Sharing funds include construction, reconstruction, improvement, and maintenance projects.
- Economic Development Access Program – a program which has a goal to direct state grants to construction or improvements of secondary or local roads to attract new or growing business enterprises that will create jobs, and add new, sustainable economic activity to the jurisdiction tax base. Projects potentially eligible for this grant include the Park Avenue Road Diet from 11th Street to Coeburn Avenue.
- Congestion Mitigation and Air Quality (CMAQ) – a program that allocates funding to surface transportation projects that improve air quality by reducing congestion.
- Transportation Alternatives (TAP) - The TA Set-Aside authorizes funding for programs and projects defined as transportation alternatives, including on- and off-road pedestrian and bicycle facilities, infrastructure projects for improving non-driver access to public transportation and enhanced mobility, community improvement activities such as historic preservation and vegetation management, and environmental mitigation related to stormwater and habitat connectivity; recreational trail projects; safe routes to school projects; and projects for planning, designing, or constructing boulevards and other roadways largely in the right-of-way of former divided highways. Projects potentially eligible for this grant include the Park Avenue Road Diet from 11th Street to Coeburn Avenue, Park Avenue from 11th Street to 15th Street (with bike lanes), 11th Street Shared Use Path.
- SMART SCALE – a program that allocates funding from the construction District Grants Program (DGP) and High-Priority Projects Program (HPPP) to transportation projects. SMART SCALE uses a scoring process that evaluates, scores, and ranks project applications based on six measures: congestion mitigation, economic development, accessibility, safety, environmental quality, and land use. All proposed projects included in this Study are eligible for SMART SCALE funding.

Norton submitted two applications for SMART SCALE FY 2026-2027 based on the proposed projects from this Study. The two submitted applications include the following.

1. Traffic Signal System Upgrades, Norton Coeburn Road/Trent Street median modification, and Norton Coeburn Road/Hawthorne Drive flashing beacons
2. Park Avenue Restriping from 11th Street to 15th Street, Park Avenue/11th Street intersection improvements, and 11th Street Shared Use Path