TIMMONS GROUP

Afton Mountain Transportation Study

May 24, 2024

Submitted to:

Central Shenandoah Planning District Commission (CSPDC)

&

Staunton Augusta Waynesboro Metropolitan Planning Organization (SAWMPO)

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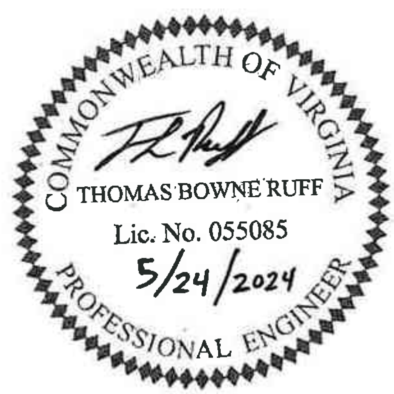

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Prepared For:

Central Shenandoah Planning District Commission (CSPDC)

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Staunton Augusta Waynesboro Metropolitan Planning Organization (SAWMPO)

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May 2024

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1 INTRODUCTION

1.1 PROJECT OVERVIEW

At the request of the Central Shenandoah Planning District Commission (CSPDC), Timmons Group completed a traffic study to review the operations, safety, access management, and potential improvements necessary along US Route 250 (Rockfish Gap Turnpike) and Route 610 (Howardsville Turnpike) to support future redevelopment of the Skyline Swannanoa property located on top of Afton Mountain at Rockfish Gap in Augusta and Nelson Counties. Traffic counts for intersections within the study area were recorded during the weekday AM and PM peak hours, as well as during the weekend midday peak hours.

In addition, the area between the western portal of the Blue Ridge Tunnel to the Blue Ridge Parkway was reviewed for potential bicycle and pedestrian accommodations along US Route 250.

This assessment has been prepared in accordance with the VDOT Traffic Operations and Safety Analysis Manual (TOSAM) and the Scope of Study agreed upon by CSPDC and Timmons Group.

1.2 STUDY LIMITS

The study limits include the following four (4) existing intersections as shown on Figure 1-1:

1. US Route 250 at Blue Ridge Parkway/Skyline Drive Access
2. US Route 250 at Route 610
3. US Route 250 at Afton Circle
4. Route 610 at Blue Ridge Parkway/Skyline Drive Access

1.3 EXISTING ROADWAY NETWORK

<u>US Route 250 (Rockfish Gap Turnpike)</u> is a four-lane, median divided, minor arterial with a posted speed limit of 35 mph within the vicinity of the site. According to the 2021 VDOT AADT traffic data, US Route 250 carries approximately 11,000 vehicles per day between the I-64 on/off ramp and Route 6 (Afton Mountain Road).

<u>Route 610 (Howardsville Turnpike)</u> is a two-lane, undivided, local roadway, with a posted speed limit of 35 mph. According to the 2021 VDOT AADT traffic data, Route 610 carries approximately 310 vehicles per day between US 250 and Blue Ridge Parkway.

<u>Blue Ridge Parkway</u> is a two-lane, undivided, minor arterial, with a posted speed limit of 45 mph. According to the 2021 VDOT AADT traffic data, Blue Ridge Parkway carries approximately 390 vehicles per day between US 250 and the Albemarle County Line.

The 2023 existing geometry and traffic control at the study intersections is shown on Figure 1-2.

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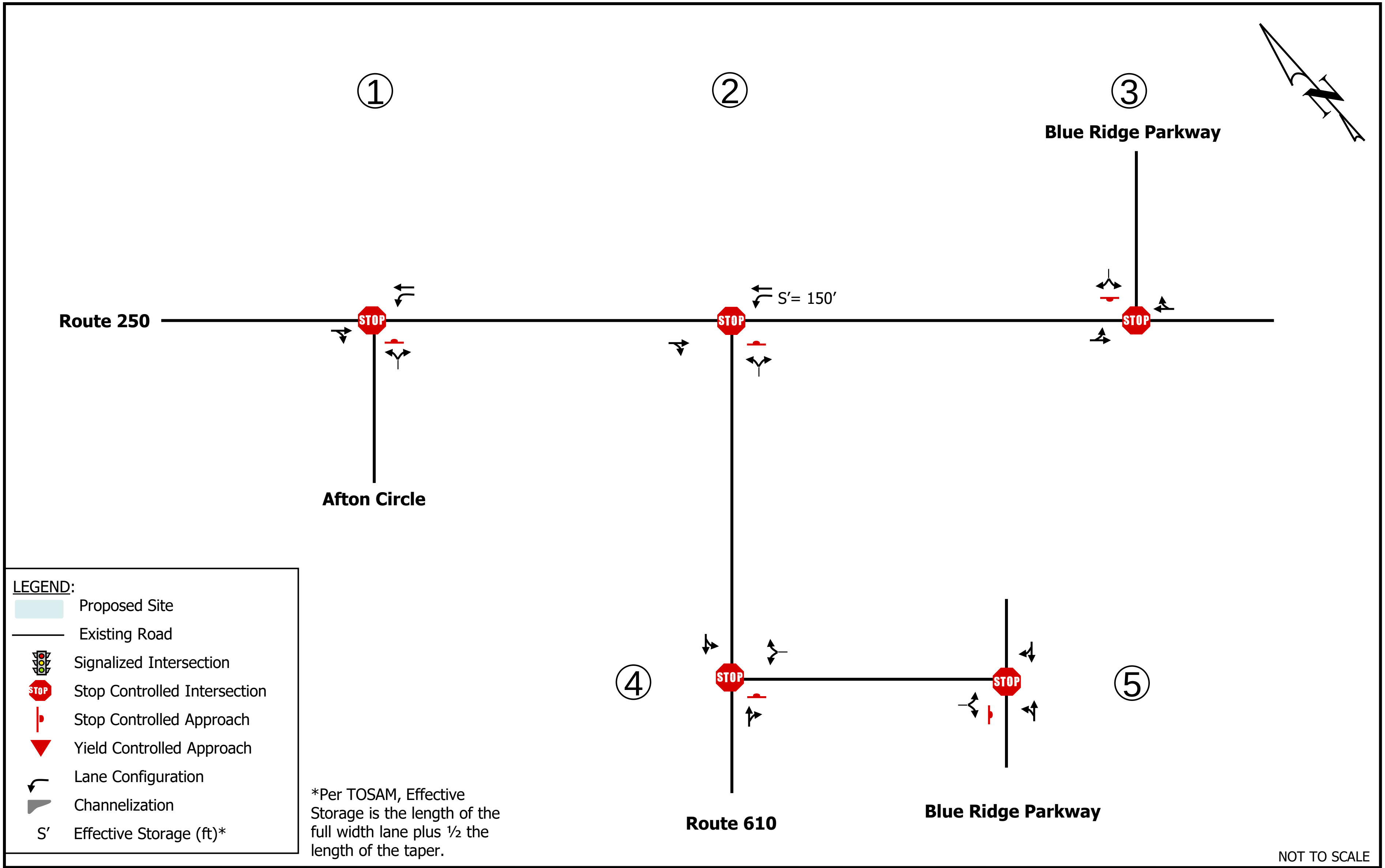
Site Location and Study Intersections
Afton Mountain Traffic Study – Rockfish Gap
Augusta County, Virginia

Figure
1-1



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Existing Geometry and Stop Control
Afton Mountain Traffic Study – Rockfish Gap
Augusta County, Virginia

Figure 1-2

2 2023 EXISTING CONDITIONS

2.1 EXISTING TRAFFIC

Directional turning movement counts (TMC) were conducted at the study intersections in October 2023. All the study intersections were conducted during the weekday AM (7:00-9:00) and PM (4:00-6:00) peak hours, as well as the weekend midday (10:00 AM-2:00 PM) peak hour timeframes. The counts included heavy vehicles by movement, pedestrians, and bikes.

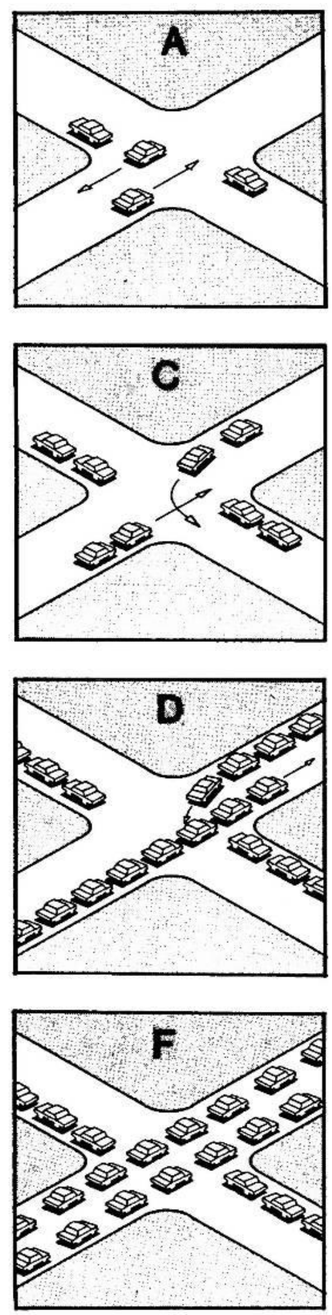
The common peak hours across all study intersections were found to be 8:00–9:00 AM and 4:15–5:15 PM on a typical weekday and 12:30 AM-1:30 PM on a typical weekend. The existing vehicle traffic counts are shown on Figure 2-1. The complete traffic data is included in Appendix A.

2.2 CAPACITY ANALYSIS

A capacity analysis allows traffic engineers to determine the impacts of traffic on the surrounding roadway network. The Transportation Research Board's (TRB) Highway Capacity Manual (HCM) methodologies govern how capacity analyses are conducted and how the results are interpreted. There are six letter grades of Levels of Service (LOS) from A to F, with LOS A representing the best operating conditions and LOS F representing the worst operating conditions. Table 2-1 shows in detail how each of these LOS are interpreted.

Table 2-1: Level of Service Definitions

Level of Service	Roadway Segments or Controlled Access Highways	Intersections
A	Free flow, low traffic density.	No vehicle waits longer than one signal indication.
B	Delay is not unreasonable, stable traffic flow.	On a rare occasion motorists wait through more than one signal indication.
C	Stable condition, movements somewhat restricted due to higher volumes, but not objectionable for motorists.	Intermittently drivers wait through more than one signal indication, and occasionally backups may develop behind left turning vehicles, traffic flow still stable and acceptable.
D	Movements more restricted, queues and delays may occur during short peaks, but lower demands occur often enough to permit clearing, thus preventing excessive backups.	Delays at intersections may become extensive with some, especially left-turning vehicles waiting two or more signal indications, but enough cycles with lower demand occur to permit periodic clearance, thus preventing excessive backups.
E	Actual capacity of the roadway invloves delay to all motorists due to congestion.	Very long queues may create lengthly delays, especially for left-turning vehicles.
F	Forced flow with demand volumes greater than capacity resulting in complete congestion. Volumes drop to zero in extreme cases.	Backups from locations downstream restrict or prevent movement of vehicles out of approach creating a storage ares during part or all of an hour.



SOURCE: *"A Policy on Design of Design of Urban Highways and Arterial Streets"* - AASHTO, 1973 based upon material published in *"Highway Capacity Manual"*, National Academy of Sciences, 1965.

For signalized and unsignalized intersections, LOS is defined in terms of delay, a measure of driver discomfort, frustration, fuel consumption, and lost travel time. Table 1-2 summarizes the delay associated with each LOS category:

Table 2-2: Signalized and Unsignalized Level of Service Criteria

Signalized Intersections		Unsignalized Intersections	
Level of Service	Control Delay per Vehicle (sec/veh)	Level of Service	Average Control Delay (sec/veh)
A	≤ 10	A	0 to 10
B	> 10 to ≤ 20	B	> 10 to ≤ 15
C	> 20 to ≤ 35	C	> 15 to ≤ 25
D	> 35 to ≤ 55	D	> 25 to ≤ 35
E	> 55 to ≤ 80	E	> 35 to ≤ 50
F	> 80	F	> 50

Source: Exhibit 16-2 and Exhibit 17-2 from TRB's "Highway Capacity Manual 2000"

The standard acceptable minimum for an overall intersection is LOS D, while the standard acceptable minimum for an individual traffic movement is LOS E. Capacity analyses were performed using SYNCHRO Version 11 based on HCM 2000 Edition methodologies with the following assumptions:

- 11-foot lane widths;
- No parking activity or bus stops;
- Existing peak hour factor as determined by the traffic counts (by intersection) for the existing conditions scenario;
- The higher of the existing peak hour factor as determined by traffic counts or a peak hour factor of 0.92 for future scenarios; and
- Heavy vehicle percentage as determined by the traffic counts (by movement).

HCM 2000 methodologies were utilized in the analysis (instead of HCM 6th) as HCM 6th requires strict lane geometries that were not possible to accommodate at all study intersections. HCM 2000 was chosen to present a consistent analysis format for comparison purposes.

2.3 EXISTING CONDITIONS ANALYSIS RESULTS

Table 2-3 summarizes the 2023 existing intersection LOS, delay, 95th percentile queue lengths (Synchro), and maximum queue lengths (SimTraffic) based on the 2023 existing intersection geometry (Figure 1-2), peak hour traffic volumes shown on Figure 2-1. The corresponding SYNCHRO and SimTraffic reports are included in Appendix B.

Note that the intersection numbers shown on the LOS, delay, and queue length summary tables correspond to the intersection numbers used in the SYNCHRO models and report figures.

As shown in Table 2-3, under 2023 existing conditions:

At the unsignalized intersection of US Route 250 and Blue Ridge Parkway, all mainline movements operate at a LOS A during the AM, PM, and weekend midday peaks, except the southbound left and right movements which operate at an acceptable LOS B during all peak hours. All 95th percentile and maximum queues are contained within the available storage.

At the unsignalized intersection of US Route 250 and Route 610, all mainline movements operate at a LOS B during the AM, PM, and weekend midday peaks, except the northbound left/right movements from the side street of Route 610, which operate at an acceptable LOS D during the PM and weekend peaks. All 95th percentile and maximum queues are contained within the available storage.

At the unsignalized intersection of US Route 250 and Afton Circle, all mainline movements operate at a LOS B during the AM, PM, and weekend midday peaks, except the northbound left/right movements from the side street, which operate at an acceptable LOS C during the PM and weekend midday peaks. All 95th percentile and maximum queues are contained within the available storage.

At the unsignalized intersection of Route 610 and Blue Ridge Parkway, all mainline movements operate at a LOS A during the AM, PM, and weekend midday peaks. All 95th percentile and maximum queues are contained within the available storage and do not create any issues.

Table 2-3: Intersection LOS, Delay, and Queue Length Summary 2023 Existing Conditions

Intersection and Type of Control	Movement and Approach	Turn Lane Storage (ft)	AM PEAK HOUR				PM PEAK HOUR				SATURDAY PEAK HOUR			
			Delay [1] (sec/veh)	LOS [1]	HCS 95th Percentile Queue Length (ft)	Simulated Maximum Queue Length[(2)] (ft)	Delay [1] (sec/veh)	LOS [1]	HCS 95th Percentile Queue Length (ft)	Simulated Maximum Queue Length[(2)] (ft)	Delay [1] (sec/veh)	LOS [1]	HCS 95th Percentile Queue Length (ft)	Simulated Maximum Queue Length[(2)] (ft)
1. US 250 (E-W) at	EB U-Turn/Left/Thru		0.1	A	0	15	0.3	A	1	82	0.7	A	2	108
Blue Ridge Parkway (N-S)	*EB Approach*		0.1	A	--	--	0.3	A	--	--	0.7	A	--	--
Unsignalized	WB Thru/Right		†	†	--	--	†	†	--	--	†	†	--	2
	WB Approach		†	†	--	--	†	†	--	--	†	†	--	--
	SB Left/Right		10.3	B	1	31	14.7	B	11	55	14.3	B	11	62
	SB Approach		*10.3*	B	--	--	*14.7*	B	--	--	*14.3*	B	--	--
2. US 250 (E-W) at	EB Thru/Right		†	†	0	5	†	†	0	13	†	†	0	70
Rte 610 (N-S)	*EB Approach*		†	†	--	--	†	†	--	--	†	†	--	--
Unsignalized	WB Left	150	8.2	A	1	35	8.5	A	0	27	8.9	A	1	33
	WB Thru		†	†	†	†	†	†	†	†	†	†	†	†
	WB Approach		0.2	A	--	--	0.1	A	--	--	0.3	A	--	--
	NB Left/Right		14.1	B	5	52	25.6	D	42	92	28.6	D	39	75
	NB Approach		*14.1*	B	--	--	*25.6*	D	--	--	*28.6*	D	--	--
3. US 250 (E-W) at	EB U-Turn/Thru/Right		0.0	A	0	0	0.0	A	0	†	0.0	A	†	85
Afton Circle (N-S)	*EB Approach*		0.0	A	--	--	0.0	A	--	--	0.0	A	--	--
Unsignalized	WB U-Turn/Left		0.0	A	0	0	8.5	A	0	15	9.0	A	0	28
	WB Thru		†	†	†	†	†	†	†	8	†	†	†	†
	WB Approach		0.0	A	--	--	8.5	A	--	--	0.0	A	--	--
	NB Left/Right		14.4	B	1	35	16.2	C	1	31	20.5	C	10	43
	NB Approach		*14.4*	B	--	--	*16.2*	C	--	--	*20.5*	C	--	--
4. Blue Ridge Parkway (N-S) at	EB Left/Right		8.7	A	5	52	9.1	A	5	38	9.2	A	8	58
Rte 610 (E-W)	*EB Approach*		8.7	A	--	--	9.1	A	--	--	9.2	A	--	--
Unsignalized	NB Left/Thru		4.9	A	1	0	4.9	A	3	26	5.1	A	2	24
	NB Approach		4.9	A	--	--	†	†	--	--	5.1	A	--	--
	SB Thru/Right		†	†	†	†	†	†	†	†	†	†	†	†
	SB Approach		†	†	--	--	†	†	--	--	†	†	--	--
5. Rte 610 (N-E) at	EB Thru/Right		0.0	A	0	0	0.0	A	0	0	0.0	A	0	0
Blue Ridge Parkway (E-W)	*EB Approach*		0.0	A	--	--	0.0	A	--	--	0.0	A	--	--
Unsignalized	WB Thru/Left		0.0	A	0	0	0.0	A	0	0	0.9	A	0	6
	WB Approach		0.0	A	--	--	0.0	A	--	--	0.9	A	--	--
	NB Left/Right		9.1	A	1	29	9.6	A	4	55	9.5	A	3	40
	NB Approach		9.1	A	--	--	9.6	A	--	--	9.5	A	--	--

[1] Overall intersection LOS and delay reported for signalized intersections and roundabouts only.
[2] SimTraffic Queues are average maximum queues after 10 runs of 60 minutes each.

† SYNCHRO does not provide level of service or delay for unsignalized movements with no conflicting volumes.
SimTraffic Queues are average maximum queues after 10 runs of 60 minutes each.

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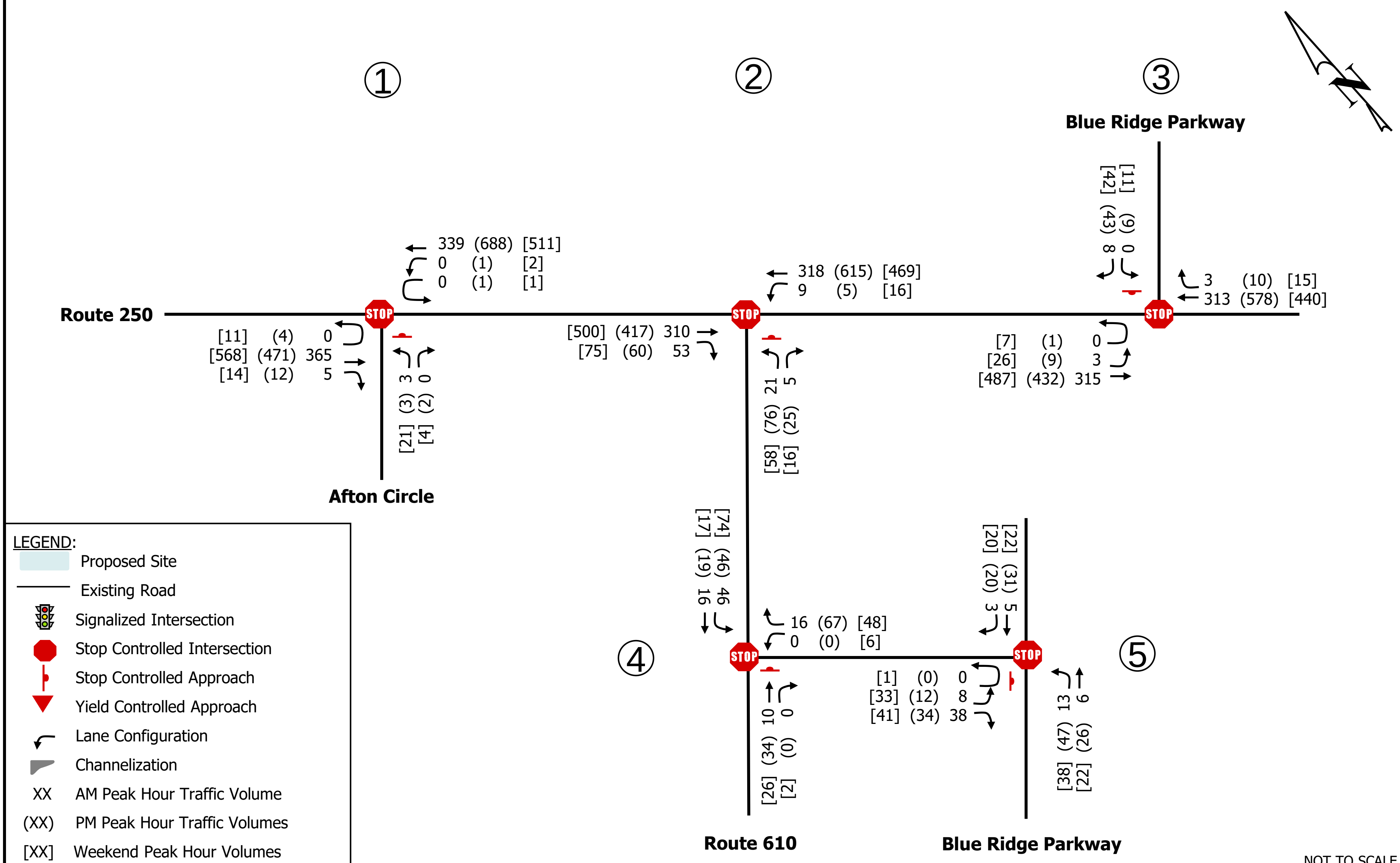

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2023 Existing Peak Hour Volumes
Afton Mountain Traffic Study – Rockfish Gap
Augusta County, Virginia

Figure
2-1

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3 2033 BACKGROUND CONDITIONS

To determine future traffic conditions at the intersections without any improvements, a 2033 background conditions analysis was completed.

3.1 General Traffic Growth

The background volumes were based on a 1.0% annual growth rate. The growth rate was compounded annually for the ten-year period from 2023 to 2033 and was applied to all movements at the study intersections. The resulting 2033 vehicle background (existing + growth) volumes are shown on Figure 3-1.

3.2 Background 2033 Capacity Analysis Results

Table 3-1 summarizes the 2033 background intersection LOS, delay, 95th percentile queue lengths (Synchro), and maximum queue lengths (SimTraffic) based on the 2023 existing intersection geometry (Figure 1-2) and peak hour traffic volumes shown on Figure 3-1. The corresponding SYNCHRO and SimTraffic reports are included in Appendix C.

Note that the intersection numbers shown on the LOS, delay, and queue length summary Tables correspond to the intersection numbers used in the SYNCHRO models and report Figures.

As shown in Table 3-1, under 2033 background conditions, all intersections experience similar levels of service, delay, and queueing as under existing conditions. Specifically:

At the unsignalized intersection of US Route 250 and Blue Ridge Parkway, all mainline movements operate at a LOS B or higher during the AM, PM, and weekend midday peaks, except the southbound left and right movements from the side street which operate at an acceptable LOS C during the PM and weekend midday peaks. All 95th percentile and maximum queues are contained within the available storage.

At the unsignalized intersection of US Route 250 and Route 610, all mainline movements operate at a LOS A during the AM, PM, and weekend midday peaks. The northbound left/right movements from the side street operate at a LOS C, LOS D, and LOS E during the AM, PM, and weekend midday peaks, respectively. All 95th percentile and maximum queues are contained within the available storage.

At the unsignalized intersection of US Route 250 and Afton Circle, all mainline movements operate at a LOS A during the AM, PM, and weekend midday peaks. The northbound movements operate at an acceptable LOS C during the AM, PM, and weekend midday peaks. All 95th percentile and maximum queues are contained within the available storage.

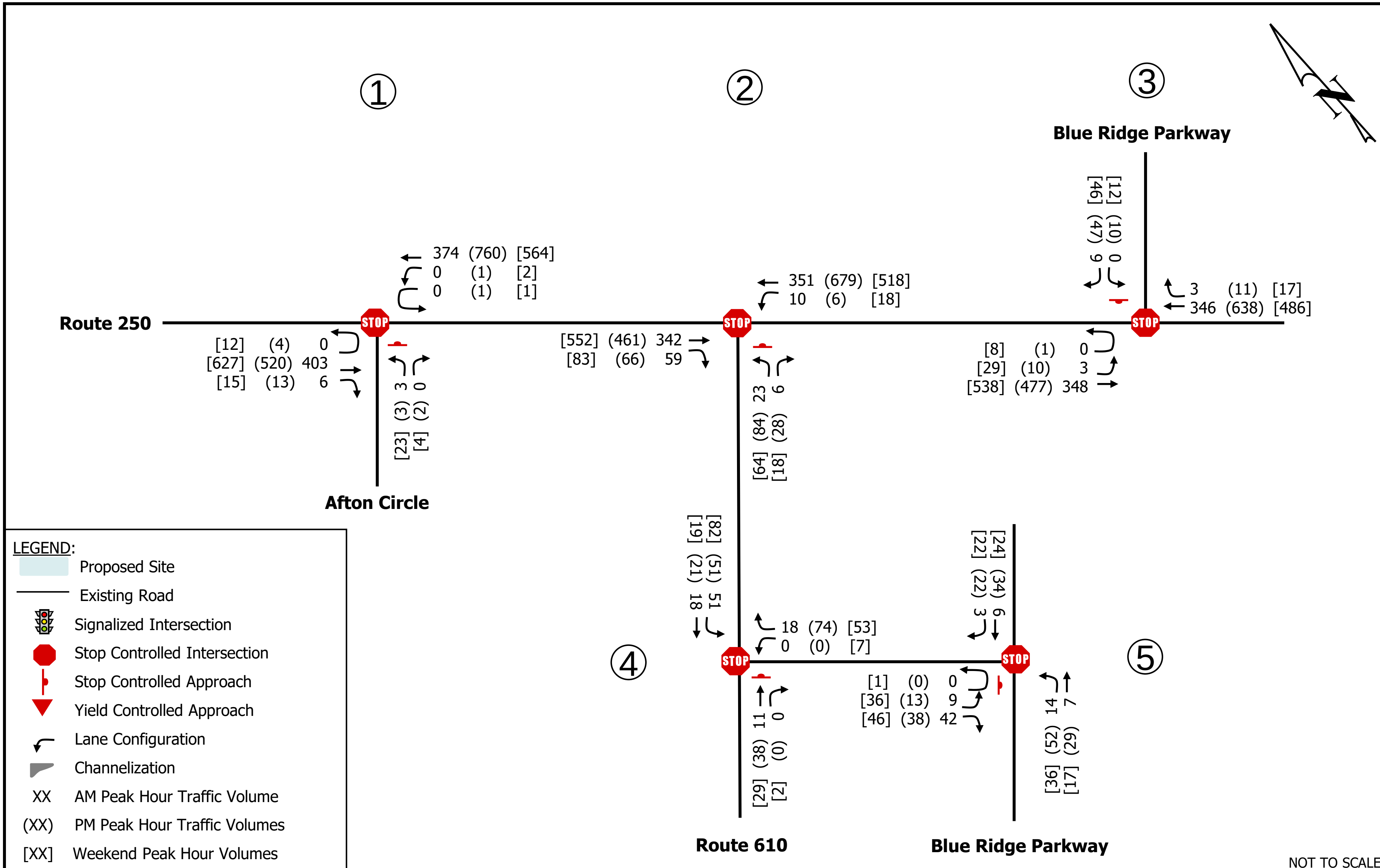
At the unsignalized intersection of Route 610 and Blue Ridge Parkway, all mainline movements operate at a LOS A during the AM, PM, and weekend midday peaks. All 95th percentile and maximum queues are contained within the available storage.

Table 3-1: Intersection LOS, Delay, and Queue Length Summary
2033 Background Conditions

Intersection and Type of Control	Movement and Approach	Turn Lane Storage (ft)	AM PEAK HOUR				PM PEAK HOUR				SATURDAY PEAK HOUR			
			Delay [1] (sec/veh)	LOS [1]	HCS 95th Percentile Queue Length (ft)	Simulated Maximum Queue Length[2] (ft)	Delay [1] (sec/veh)	LOS [1]	HCS 95th Percentile Queue Length (ft)	Simulated Maximum Queue Length[2] (ft)	Delay [1] (sec/veh)	LOS [1]	HCS 95th Percentile Queue Length (ft)	Simulated Maximum Queue Length[2] (ft)
1. US 250 (E-W) at	EB Thru/Right		†	†	†	2	†	†	†	19	†	†	†	35
Rte 610 (N-S)	*EB Approach*		†	†	--	--	†	†	--	--	†	†	--	--
Unsignalized	WB Left	150	8.3	A	1	37	8.5	A	0	30	9.1	A	2	35
	WB Thru		†	†	†	†	†	†	†	†	†	†	†	†
	WB Approach		0.2	†	--	--	†	†	--	--	†	†	--	--
	NB Left/Right		15.1	C	6	48	33.2	D	60	95	38.0	E	56	93
	NB Approach		*15.1*	C	--	--	*33.2*	D	--	--	*38.0*	E	--	--
2. US 250 (E-W) at	EB Left/Thru		0.1	A	0	41	0.3	A	1	95	0.8	A	2	129
Blue Ridge Parkway (N-S)	*EB Approach*		0.1	A	--	--	0.3	A	--	--	0.8	A	--	--
Unsignalized	WB Thru/Right		†	†	--	--	†	†	--	--	†	†	--	2
	WB Approach		†	†	--	--	†	†	--	--	†	†	--	--
	SB Left/Right		10.5	B	1	35	16.2	C	13	70	15.7	C	14	65
	SB Approach		*10.5*	B	--	--	*16.2*	C	--	--	*15.7*	C	--	--
3. US 250 (E-W) at	EB Thru/Right		†	†	†	†	†		†	†	†	†	†	132
Afton Circle (N-S)	*EB Approach*		†	†	--	--	†	†	--	--	†	†	--	--
Unsignalized	WB U-Turn/Left		0.0	A	0	2	8.7	A	0	15	9.1	A	0	27
	WB Thru		†	†	†	†	†	†	†	9	†	†	†	4
	WB Approach		0.0	A	--	--	0.0	A	--	--	0.1	A	--	--
	NB Left/Right		15.4	C	1	56	17.7	C	1	31	22.0	C	11	60
	NB Approach		*15.4*	C	--	--	*17.7*	C	--	--	*22.0*	C	--	--
4. Blue Ridge Parkway (N-S) at	EB Left/Right		8.6	A	4	46	9.1	A	5	32	9.3	A	8	37
Rte 610 (E-W)	*EB Approach*		8.6	A	--	--	9.1	A	--	--	9.3	A	--	--
Unsignalized	NB Left/Thru		4.9	A	1	--	4.9	A	3	29	5.1	A	2	23
	NB Approach		4.9	A	--	--	4.9	A	--	--	5.1	A	--	--
	SB Thru/Right		†	†	†	†	†	†	†	†	†	†	†	†
	SB Approach		†	†	--	--	†	†	--	--	†	†	--	--
5. Rte 610 (N-E) at	EB Thru/Right		0.0	A	0	24	0.0	A	0	26	0.0	A	0	36
Blue Ridge Parkway (E-W)	*EB Approach*		0.0	A	--	--	0.0	A	--	--	0.0	A	--	--
Unsignalized	WB Thru/Left		0.0	A	0	0	0.0	A	0	0	0.9	A	0	0
	WB Approach		0.0	A	--	--	0.0	A	--	--	0.9	A	--	--
	NB Left/Right		9.1	A	1	37	9.5	A	4	55	9.5	A	2	42
	NB Approach		9.1	A	--	--	9.5	A	--	--	9.5	A	--	--

[1] Overall intersection LOS and delay reported for signalized intersections and roundabouts only.
[2] SimTraffic Queues are average maximum queues after 10 runs of 60 minutes each.

† SYNCHRO does not provide level of service or delay for unsignalized movements with no conflicting volumes.
SimTraffic Queues are average maximum queues after 10 runs of 60 minutes each.



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2033 Background Peak Hour Volumes
Afton Mountain Traffic Study – Rockfish Gap
Augusta County, Virginia

Figure
3-1

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4 Phase 1 Trip Generation

To determine future traffic conditions as the intersections as the site is developed, two phases of 2033 future conditions analyses were completed. The analyses tested the site under different build conditions to benchmark how the intersections would respond to various intensities of development. In the first phase, the development was assumed to consist of only a 14-pump gas station and convenience store as the representative development level under 2,500 trips per day. Other options are available for development of the site that can fit under the 2,500 trips per day limit. Access to the site will be provided via an entrance on Route 610 and the US Route 250 / Afton Circle intersection will be closed. A generalized layout of the roadway geometry changes is shown on Figure 4-1.

4.1 Site Trip Generation

The site-generated traffic volumes shown in Table 4-1 were estimated using the 11th Edition of the Institute of Transportation Engineers' (ITE) *Trip Generation Manual* and were calculated using the number of fueling pumps as the independent variable.

Table 4-1: Phase 1 Trip Generation Summary

Buildout				Weekday						Weekend			
			Land Use	AM Peak Hour			PM Peak Hour			Satruday Peak Hour			Average
Land Use	Size	Units	Code	In	Out	Total	In	Out	Total	In	Out	Total	Daily Trips
1. ITE Trip Generation[1]													
Proposed Development													
Gas Station	14	Fueling Pumps	944	72	72	144	97	97	195	89	89	179	2,408
Total ITE Generated Trips				**72**	**72**	**144**	**97**	**97**	**195**	**89**	**89**	**179**	**2,408**

Notes: (1) Based on the Institute of Transportation Engineers Trip Generation, 11th Edition. Assumes General Urban/Suburban land use category.
(2) Land Use Subcategory "Not Close to Rail Transit" utilized.

As shown in Table 4-1, the proposed development will generate a total of 144 trips (72 in and 72 out) during the AM peak, 195 trips (97 in and 97 out) during the PM peak, 179 trips (89 in and 89 out) during the weekend midday peak, and 2,408 average daily trips.

4.2 External Trip Distributions

The distribution of trips generated by the proposed developed was based on other traffic studies in the area, the existing traffic volumes on US Route 250, the nature of the land use, and local knowledge. The following overall directional distributions were assumed for the site:

- 45% to/from the west on Route 250;
- 45% to/from the east on Route 250; and
- 10 to/from the south on Route 610 via Blue Ridge Parkway.

The overall distributions were applied to the local study intersections as shown on Figure 4-2.

4.3 Traffic Assignment

The trip distribution percentages for the external trips from Figure 4-2 were applied to the trip generation table (Table 4-1) to distribute the external trips to the surrounding roadway network. The resulting site generated external trips are shown on Figure 4-3.

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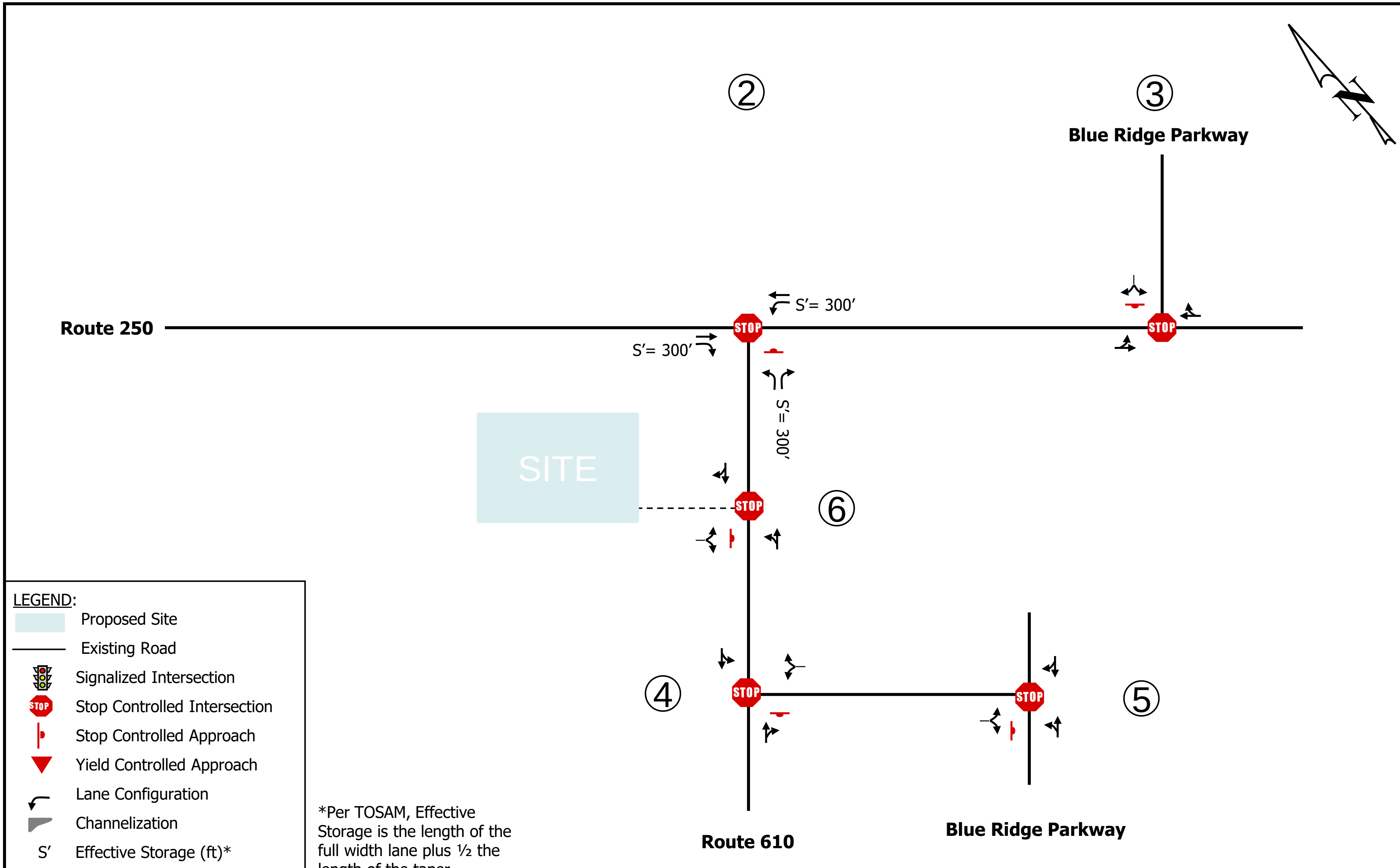

*Per TOSAM, Effective Storage is the length of the full width lane plus ½ the length of the taper.

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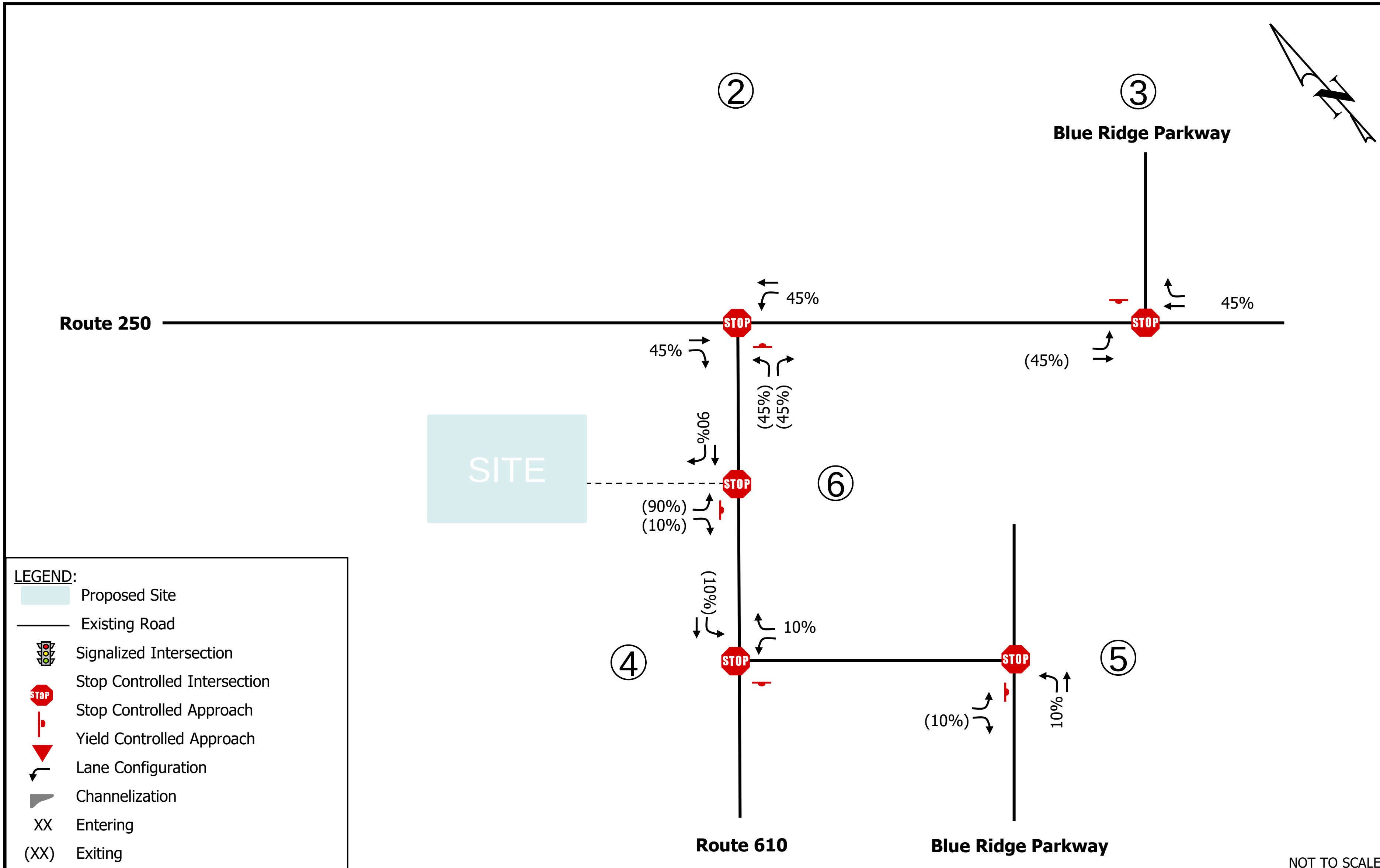
Proposed Geometry and Stop Control
Afton Mountain Traffic Study – Rockfish Gap
Augusta County, Virginia

Figure
4-1



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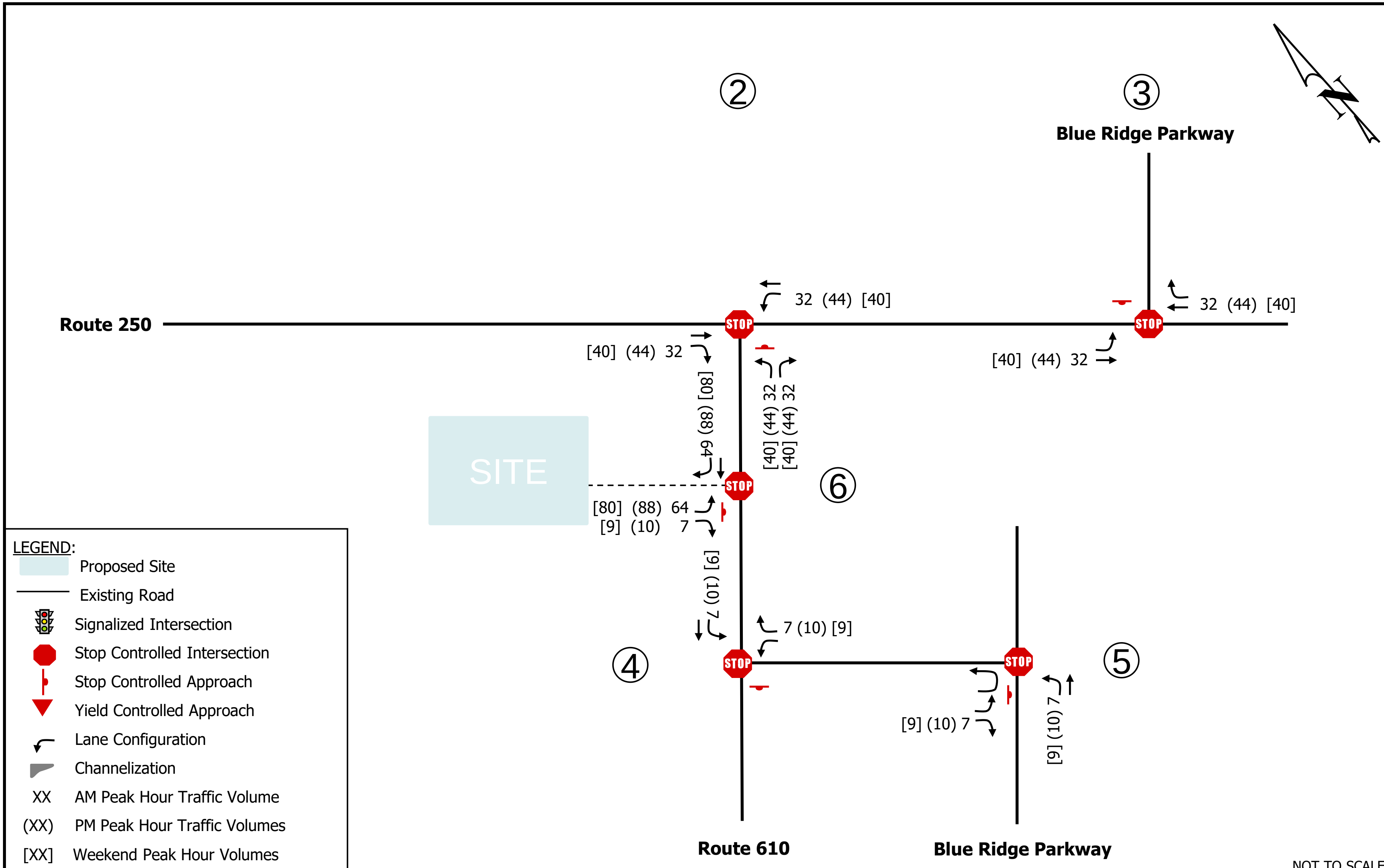
Phase 1 and 2 Trip Distributions
Afton Mountain Traffic Study – Rockfish Gap
Augusta County, Virginia

Figure 4-2



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Phase 1 Site Generated Trips
Afton Mountain Traffic Study – Rockfish Gap
Augusta County, Virginia

Figure
4-3

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5 Phase 1 2033 Total Future Conditions

To complete the analysis of 2033 total conditions (with the phase 1 proposed development), the estimated site trips were added to the background 2033 traffic volumes. The projected volumes were then used to complete the capacity analysis.

5.1 Total Future Traffic Volumes

The site generated trips shown on Figure 4-3 were added to the 2033 background traffic volumes (Figure 3-1) to yield the 2033 total future traffic volumes shown in Figure 5-1.

5.2 2033 Future Conditions Analysis Results

Table 5-1 summarizes the 2033 total future intersection LOS, delay, 95th percentile queue lengths (Synchro), and maximum queue lengths (SimTraffic) based on 2033 total future peak hour traffic volumes (Figure 5-1). The corresponding SYNCHRO and SimTraffic reports are included in Appendix D. Note that the intersection numbers shown on the LOS, delay, and queue length summary tables correspond with the intersection numbers used in the SYNCHRO models and report figures.

As shown in Table 5-1, under 2033 total future conditions, with buildout of the proposed development, all intersections experience similar levels of service compared to 2033 background conditions, except for the US Route 250 and Route 610 intersection which begins to experience operational delays.

At the unsignalized intersection of US Route 250 and Route 610, all eastbound and westbound mainline movements operate at a LOS A during the AM, PM, and weekend midday peaks. The northbound approach from the side street operates at LOS C, LOS E, and LOS F during the AM, PM, and Saturday midday peaks, respectively. The northbound right movements operates at LOS B during all peak hours and the northbound left operates at LOS C during the AM peak hour and at LOS F during the PM and weekend midday peak hours. All 95th percentile and maximum queues are contained within the available storage on mainline US Route 250.

At the unsignalized intersection of US Route 250 and Blue Ridge Parkway, all mainline movements operate at a LOS B or higher during the AM, PM, and weekend midday peaks. The southbound left and right movements from the side street operate at an acceptable LOS C during the PM, and weekend midday peaks. All 95th percentile and maximum queues are contained within the available storage.

At the unsignalized intersection of Route 610 and the proposed site entrance, all movements operate at LOS B or better during the AM, PM, and weekend midday peaks.

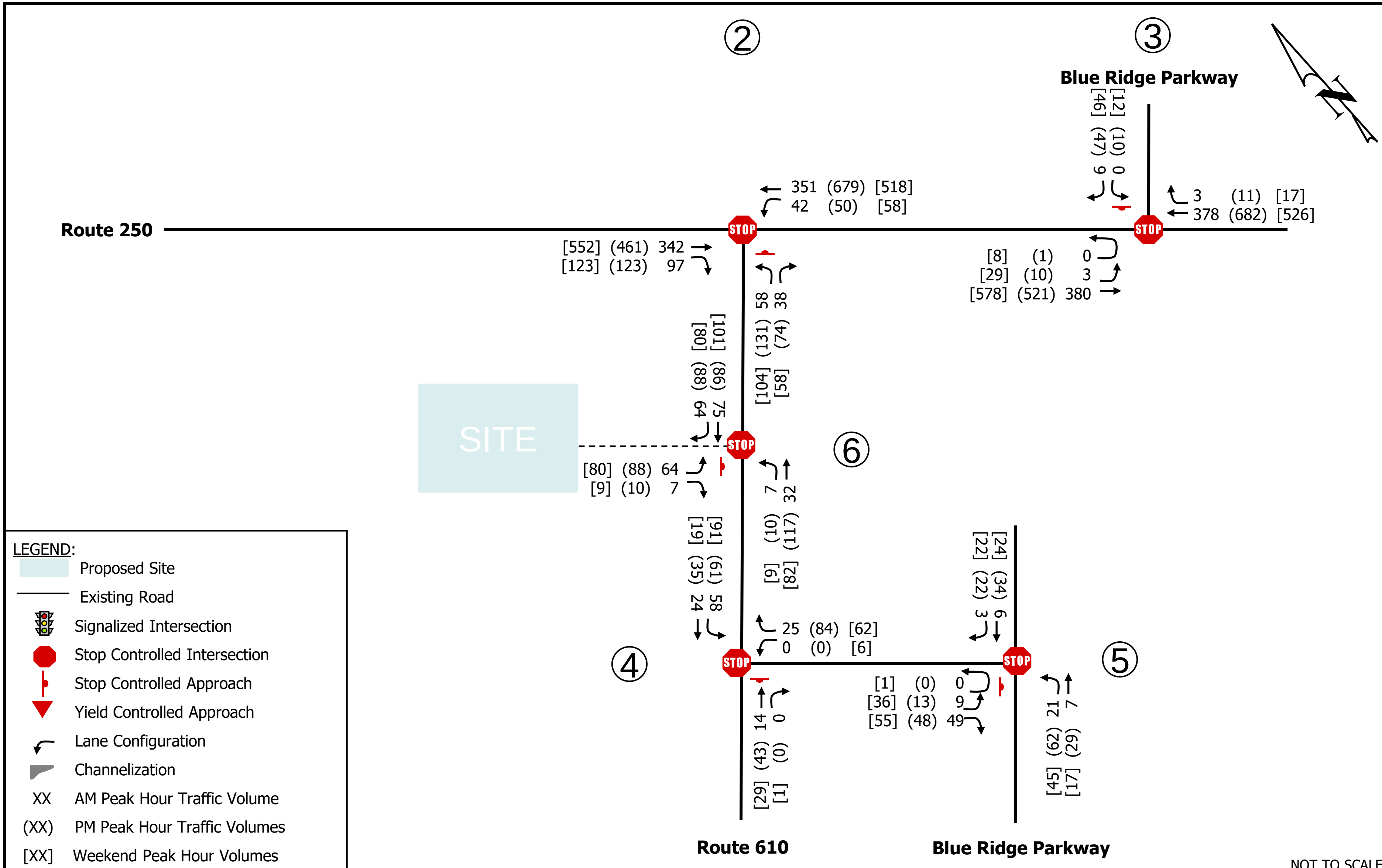
At the unsignalized intersection of Route 610 and Blue Ridge Parkway, all mainline movements operate at a LOS A during the AM, PM, and weekend midday peaks. All 95th percentile and maximum queues are contained within the available storage.

Table 5-1: Intersection LOS, Delay, and Queue Length Summary
2033 Phase 1 Total Conditions

Intersection and Type of Control	Movement and Approach	Turn Lane Storage (ft)	AM PEAK HOUR				PM PEAK HOUR				SATURDAY PEAK HOUR			
			Delay [1] (sec/veh)	LOS [1]	HCS 95th Percentile Queue Length (ft)	Simulated Maximum Queue Length[(2)] (ft)	Delay [1] (sec/veh)	LOS [1]	HCS 95th Percentile Queue Length (ft)	Simulated Maximum Queue Length[(2)] (ft)	Delay [1] (sec/veh)	LOS [1]	HCS 95th Percentile Queue Length (ft)	Simulated Maximum Queue Length[(2)] (ft)
1. US 250 (E-W) at	EB Thru/Right		†	†	†	8	†	†	†	6	†	†	†	2
Rte 610 (N-S)	*EB Approach*		†	†	--	--	†	†	--	--	†	†	--	--
Unsignalized	WB Left	150	8.6	A	3	67	8.8	A	5	55	9.6	A	5	56
	WB Thru		†	†	†	†	†	†	†	†	†	†	†	†
	WB Approach		0.9	A	--	--	0.6	A	--	--	1.0	A	--	--
	NB Left		18.8	C	18	90	70.9	F	123	181	81.3	F	120	161
	NB Right	300	10.6	B	5	45	11.9	B	10	167	13.5	B	13	98
	NB Approach		*15.6*	C	--	--	*49.6*	E	--	--	*57.0*	F	--	--
2. US 250 (E-W) at	EB Left/Thru		8.1	A	0	24	0.2	A	0	120	0.9	A	3	164
Blue Ridge Parkway (N-S)	*EB Approach*		0.1	A	--	--	0.2	A	--	--	0.9	A	--	--
Unsignalized	WB Thru/Right		†	†	--	--	†	†	--	--	†	†	--	--
	WB Approach		†	†	--	--	†	†	--	--	†	†	--	--
	SB Left/Right		10.8	B	0	36	17.4	C	13	73	16.7	C	13	66
	SB Approach		*10.8*	B	--	--	*17.4*	C	--	--	*16.7*	C	--	--
3. Rte 610 (N-S) at	EB Left/Right		9.8	A	†	45	10.9	B	13	117	10.6	B	13	73
Site Entrance (E-W)	*EB Approach*		9.8	A	--	--	10.9	B	--	--	10.6	B	--	--
Unsignalized	NB Left/Thru		1.4	A	8	22	0.6	A	0	113	0.8	A	0	32
	NB Approach		1.4	A	--	--	0.6	A	--	--	0.8	A	--	--
	SB Thru/Right		0.0	A	--	--	0.0	A	--	6	0.0	A	--	2
	SB Approach		*0.0*	A	--	--	*0.0*	A	--	--	*0.0*	A	--	--
4. Rte 610 (N-S) at	SB Thru/Right		0.0	A	0	25	0.0	A	0	29	0.0	A	0	34
Blue Ridge Parkway (E-W)	*EB Approach*		0.0	A	--	--	0.0	A	--	--	0.0	A	--	--
Unsignalized	WB Thru/Left		0.0	A	0	0	0.0	A	0	0	0.0	A	0	5
	WB Approach		0.0	A	--	--	0.0	A	--	--	0.0	A	--	--
	NB Left/Right		9.2	A	3	55	9.8	A	5	65	9.6	A	3	49
	NB Approach		9.2	A	--	--	9.8	A	--	--	9.6	A	--	--
5. Blue Ridge Parkway (N-S) at	EB Left/Right		8.7	A	5	50	9.1	A	5	32	9.4	A	10	41
Rte 610 (E-W)	*EB Approach*		8.7	A	--	--	9.1	A	--	--	9.4	A	--	--
Unsignalized	NB Left/Thru		5.4	A	0	2	5.1	A	3	32	5.4	A	3	39
	NB Approach		5.4	A	--	--	5.1	A	--	--	5.4	A	--	--
	SB Thru/Right		†	†	†	†	†	†	†	†	†	†	†	2
	SB Approach		†	†	--	--	†	†	--	--	†	†	--	--

[1] Overall intersection LOS and delay reported for signalized intersections and roundabouts only.
[2] SimTraffic Queues are average maximum queues after 10 runs of 60 minutes each.

† SYNCHRO does not provide level of service or delay for unsignalized movements with no conflicting volumes.
SimTraffic Queues are average maximum queues after 10 runs of 60 minutes each.



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2033 Total Peak Hour Traffic Volumes – Phase 1
Afton Mountain Traffic Study – Rockfish Gap
Augusta County, Virginia

Figure
5-1

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6 Phase 2 Trip Generation

To determine future traffic conditions as the intersections as the site is developed, two phases of 2033 future conditions analyses were completed. The analyses tested the site under different build conditions to benchmark how the intersections would respond to various intensities of development. In the second phase, the intensity of development was increased to the point at which the additional ADT from site-generated trips causes the study intersections to operate at LOS F and queue lengths become excessively long. This point was determined to be around 2,750 ADT, equivalent to a 16-pump gas station and convenience store. The development potential is not limited by this trip generation assumption – the goal is to provide an understanding of traffic impact for alternatives. Access to the site will still be provided via an entrance on Route 610 and the US Route 250 / Afton Circle intersection will be closed. A generalized layout of the roadway geometry changes is shown on Figure 4--1.

6.1 Site Trip Generation

The site-generated traffic volumes shown in Table 6-1 were estimated using the 11th Edition of the Institute of Transportation Engineers' (ITE) *Trip Generation Manual* and were calculated using the number of fueling pumps as the independent variable.

Table 6-1: Phase 2 Trip Generation Summary

Buildout				Weekday						Weekend			
			Land Use	AM Peak Hour			PM Peak Hour			Satruday Peak Hour			Average
Land Use	Size	Units	Code	In	Out	Total	In	Out	Total	In	Out	Total	Daily Trips
1. ITE Trip Generation[1]													
Proposed Development													
Gas Station	16	Fueling Pumps	944	82	82	164	111	111	223	102	102	204	2,752
Total ITE Generated Trips				**82**	**82**	**164**	**111**	**111**	**223**	**102**	**102**	**204**	**2,752**

Notes: (1) Based on the Institute of Transportation Engineers Trip Generation, 11th Edition. Assumes General Urban/Suburban land use category.
(2) Land Use Subcategory "Not Close to Rail Transit" utilized.

As shown in Table 6-1, the proposed development will generate a total of 164 trips (82 in and 82 out) during the AM peak, 223 trips (111 in and 111 out) during the PM peak, 204 trips (102 in and 102 out) during the weekend midday peak, and 2,752 average daily trips.

6.2 External Trip Distributions

The distribution of trips generated by the proposed developed was based on other traffic studies in the area, the existing traffic volumes, the nature of the use, and local knowledge. The overall distributions were applied to the local study intersections as shown on Figure 4-2. The following overall directional distributions were assumed for the site:

- 45% to/from the west on US Route 250;
- 45% to/from the east on US Route 250; and
- 10 to/from the south on Route 610 via Blue Ridge Parkway.

6.3 Traffic Assignment

The trip distribution percentages for the external trips from Figure 4-2 were applied to the trip generation table (Table 6-1) to distribute the external trips to the surrounding roadway network. The resulting site generated external trips are shown on Figure 6-1.

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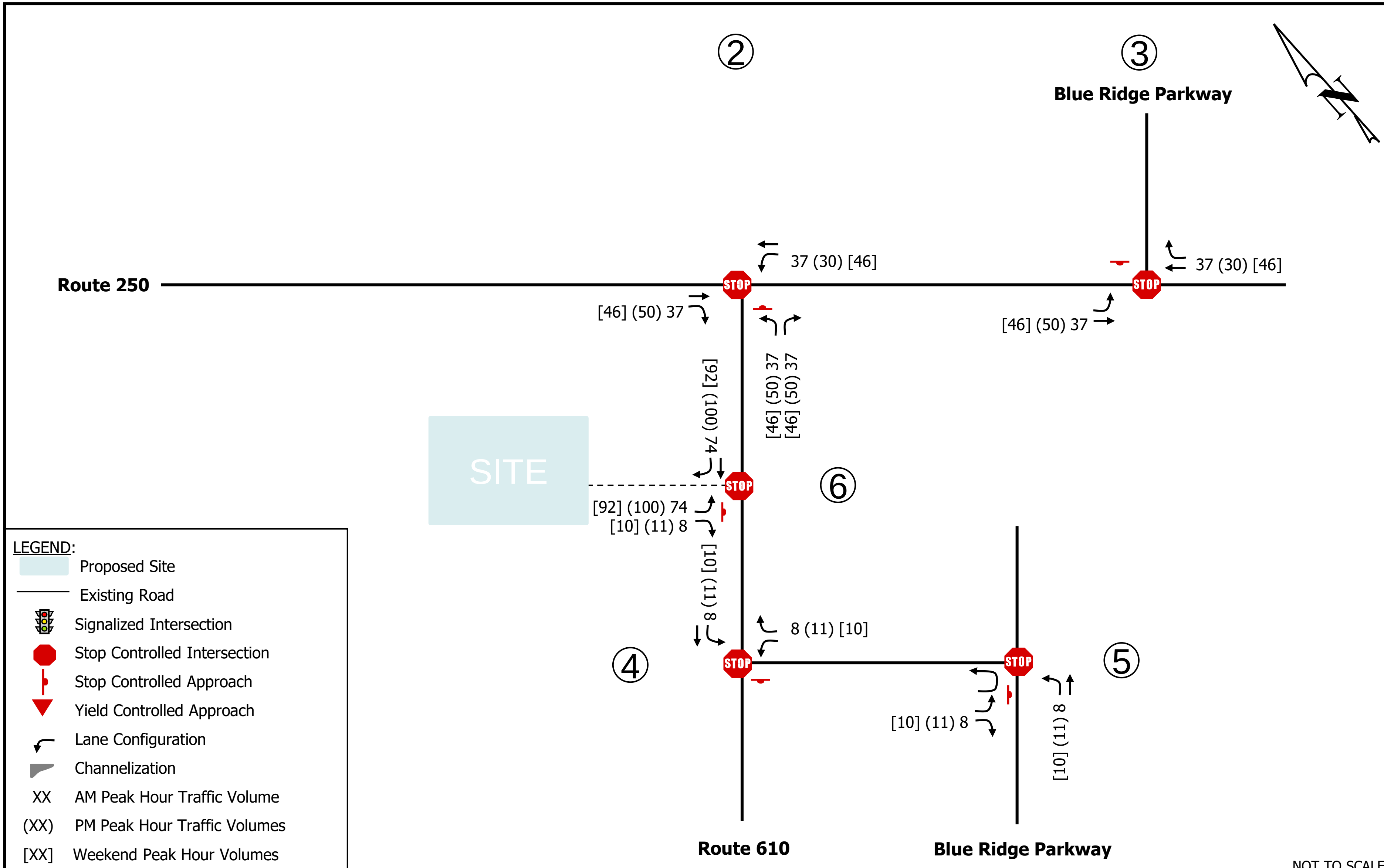

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Phase 2 Site Generated Trips
Afton Mountain Traffic Study – Rockfish Gap
Augusta County, Virginia

Figure
6-1

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7 Phase 2 2033 Total Future Conditions

To complete the analysis of 2033 total conditions (with the phase 2 proposed development), the estimated site trips were added to the background 2033 traffic volumes. The projected volumes were then used to complete the capacity analysis.

7.1 Total Future Traffic Volumes

The site generated trips shown on Figure 6-1 were added to the 2033 background traffic volumes (Figure 3-1) to yield the 2033 total future traffic volumes shown in Figure 7-1.

7.2 2033 Future Conditions Analysis Results

Table 7-1 summarizes the 2033 total future intersection LOS, delay, 95th percentile queue lengths (Synchro), and maximum queue lengths (SimTraffic) based on 2033 total future peak hour traffic volumes (Figure 7-1). The corresponding SYNCHRO and SimTraffic reports are included in Appendix D. Note that the intersection numbers shown on the LOS, delay, and queue length summary tables correspond with the intersection numbers used in the SYNCHRO models and report figures.

As shown in Table 7-1, under 2033 total future conditions, with buildout of the proposed phase 2 development, all intersections experience similar levels of service compared to 2033 background conditions, except for the US Route 250 and Route 610 intersection which now operates at LOS F during the PM and weekend midday peak hours, and queue lengths are excessively long.

At the unsignalized intersection of US Route 250 and Route 610, all eastbound and westbound mainline movements continue to operate at LOS A during the AM, PM, and weekend midday peaks. The northbound approach from the side street operates at LOS C during the AM peak hour and at LOS F during both the PM and weekend midday peaks. The northbound right movements operate at LOS B during all peak hours, and the northbound left operates at LOS C during the AM peak hour, and LOS F during the PM and weekend midday peak hours. All 95th percentile and maximum queues are contained within the available storage.

At the unsignalized intersection of US Route 250 and Blue Ridge Parkway, all mainline movements operate at a LOS B or higher during the AM, PM, and weekend midday peaks. The southbound left and right movements from the side street operate at LOS C or better during the AM, PM, and weekend midday peaks. All 95th percentile and maximum queues are contained within the available storage.

At the unsignalized intersection of Route 610 and the site entrance, all movements operate at LOS B or better during the AM, PM, and weekend midday peaks. All 95th percentile and maximum queues are contained within the available storage.

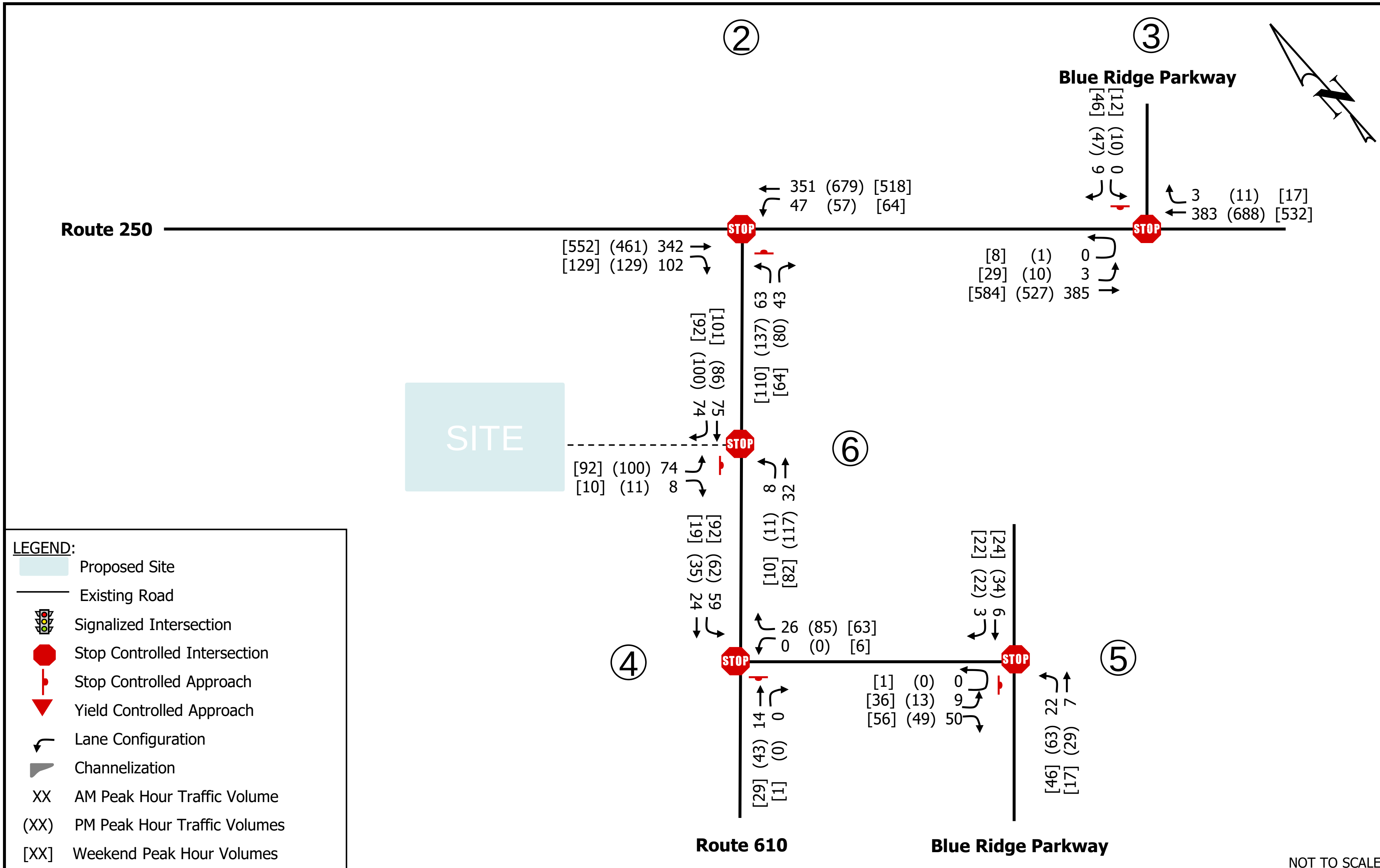
At the unsignalized intersection of Route 610 and Blue Ridge Parkway, all mainline movements operate at a LOS A during the AM, PM, and midday peaks. All side street movements operate at LOS A during all peaks as well. All 95th percentile and maximum queues are contained within the available storage.

Table 7-1: Intersection LOS, Delay, and Queue Length Summary
2033 Phase 2 Total Conditions

Intersection and Type of Control	Movement and Approach	Turn Lane Storage (ft)	AM PEAK HOUR				PM PEAK HOUR				SATURDAY PEAK HOUR			
			Delay [1] (sec/veh)	LOS [1]	HCS 95th Percentile Queue Length (ft)	Simulated Maximum Queue Length(2) (ft)	Delay [1] (sec/veh)	LOS [1]	HCS 95th Percentile Queue Length (ft)	Simulated Maximum Queue Length(2) (ft)	Delay [1] (sec/veh)	LOS [1]	HCS 95th Percentile Queue Length (ft)	Simulated Maximum Queue Length(2) (ft)
1. US 250 (E-W) at	EB Thru/Right		†	†	†	6	†	†	†	5	†	†	†	11
Rte 610 (N-S)	*EB Approach*		†	†	--	--	†	†	--	--	†	†	--	--
Unsignalized	WB Left	150	8.6	A	5	69	8.9	A	5	60	0.3	A	8	65
	WB Thru		†	†	†	†	†	†	†	†	†	†	†	†
	WB Approach		1.0	A	--	--	0.7	A	--	--	1.1	A	--	--
	NB Left		19.4	C	20	69	82.1	F	138	182	96.7	F	140	174
	NB Right	300	10.6	B	5	43	12.0	B	13	167	13.7	B	13	146
	NB Approach		*15.8*	C	--	--	*56.3*	F	--	--	*66.2*	F	--	--
2. US 250 (E-W) at	EB Left/Thru		8.1	A	0	24	0.3	A	1	108	0.9	A	3	145
Blue Ridge Parkway (N-S)	*EB Approach*		0.1	A	--	--	0.3	A	--	--	0.9	A	--	--
Unsignalized	WB Thru/Right		†	†	--	--	†	†	--	4	†	†	--	--
	WB Approach		†	†	--	--	†	†	--	--	†	†	--	--
	SB Left/Right		10.8	B	0	41	17.5	C	15	80	17.0	C	16	73
	SB Approach		*10.8*	B	--	--	*17.5*	C	--	--	*17.0*	C	--	--
3. Rte 610 (N-S) at	EB Left/Right		9.9	A	10	47	11.2	B	15	105	10.9	B	13	86
Site Entrance (E-W)	*EB Approach*		9.9	A	--	--	11.2	B	--	--	10.9	B	--	--
Unsignalized	NB Left/Thru		1.5	A	0	18	0.7	A	0	112	0.8	A	0	29
	NB Approach		1.5	A	--	--	0.7	A	--	--	0.8	A	--	--
	SB Thru/Right		0.0	A	--	--	0.0	A	--	4	0.0	A	--	2
	SB Approach		*0.0*	A	--	--	*0.0*	A	--	--	*0.0*	A	--	--
4. Rte 610 (N-S) at	SB Thru/Right		0.0	A	--	32	0.0	A	--	32	0.0	A	--	45
Blue Ridge Parkway (E-W)	*EB Approach*		0.0	A	--	--	0.0	A	--	--	0.0	A	--	--
Unsignalized	WB Thru/Left		0.0	A	0	--	0.0	A	0	--	0.0	A	0	--
	WB Approach		0.0	A	--	--	0.0	A	--	--	0.0	A	--	--
	NB Left/Right		9.2	A	3	47	9.8	A	5	59	9.7	A	3	52
	NB Approach		9.2	A	--	--	9.8	A	--	--	9.7	A	--	--
5. Blue Ridge Parkway (N-S) at	EB Left/Right		8.7	A	5	46	9.1	A	5	32	9.4	A	10	38
Rte 610 (E-W)	*EB Approach*		8.7	A	--	--	9.1	A	--	--	9.4	A	--	--
Unsignalized	NB Left/Thru		5.5	A	0	3	5.1	A	3	35	5.4	A	3	31
	NB Approach		5.5	A	--	--	5.1	A	--	--	5.4	A	--	--
	SB Thru/Right		†	†	†	†	†	†	†	†	†	†	†	2
	SB Approach		†	†	--	--	†	†	--	--	†	†	--	--

[1] Overall intersection LOS and delay reported for signalized intersections and roundabouts only.
[2] SimTraffic Queues are average maximum queues after 10 runs of 60 minutes each.

† SYNCHRO does not provide level of service or delay for unsignalized movements with no conflicting volumes.
SimTraffic Queues are average maximum queues after 10 runs of 60 minutes each.



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2033 Total Peak Hour Traffic Volumes – Phase 2
Afton Mountain Traffic Study – Rockfish Gap
Augusta County, Virginia

Figure
7-1

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8 Crash History and Analysis

A crash analysis was completed using publicly available VDOT crash data for a 5-year period from January 1, 2018, through August 18, 2023. To assess crash patterns that would suggest a specific improvement, the crashes were summarized by collision type, severity, surface conditions, and light condition. There were a total of 65 crashes along the study corridor, which extends from the Blue Ridge Tunnel Trail Western Trailhead in the north/west and the Blue Ridge Parkway eastern access in the south/east, as well as along Route 610 from US Route 250 to the Blue Ridge Parkway. Figure 8-1 shows a map of the 5-year crash data.

In summary, the crash analysis revealed a high number of angle crashes along the study corridor, particularly at the intersection of US 250 and the I-64 on/off ramp. The angle crashes are likely attributed to drivers having difficulty finding gaps in mainline traffic before conducting a left-turn movement. There are no crash patterns that would indicate that poor lighting or poor drainage are contributing factors to the crashes. With the redevelopment of the property on Route 610, there is the potential that additional angle crashes would occur at the intersection in the future.

The highest crash density along the study corridor was found to be at the intersection of US Route 250 and the I-64 on/off ramp, which experienced 33 of the 65 total crashes (51%). These 33 crashes resulted in 2 severe injury crashes, 9 visible injury crashes, and 22 property damage only crashes. The crashes were predominantly angle crashes, 27 out of 33.

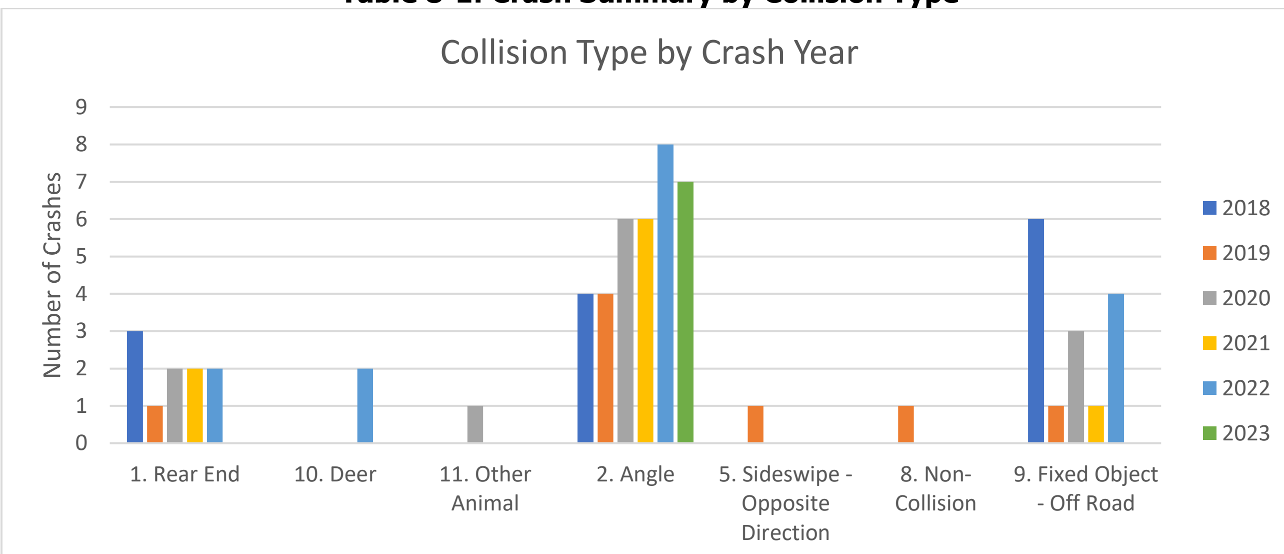
The US Route 250 and Afton Circle/Route 610 intersection had a total of 4 crashes (6%). Of these crashes, one was a rear end, one was an angle crash, and two were collisions with a fixed object of the road. All crashes resulted in property damage only.

The US Route 250 and Blue Ridge Parkway intersection had a total of 4 crashes (6%). Three (3) of these crashes were rear ends that resulted in property damage only. One crash was an angle crash that resulted in nonvisible injury (severity C).

The remaining 24 of the 65 crashes occurred in between the study intersections along the corridors. 23 of the non-intersection crashes occurred on US Route 250 and one crash occurred along Route 610.

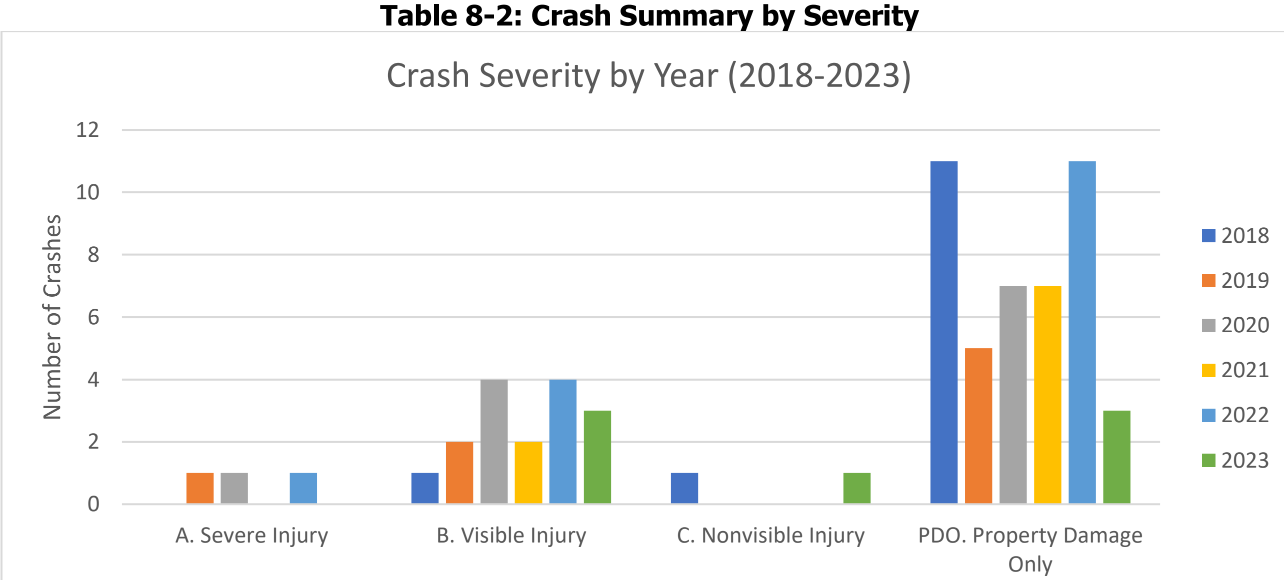
The crash data for the study area indicated that there was a total of 65 crashes within the 5-year period with the highest number occurring in 2020 and 2022. A review of Table 8-1 indicates that approximately 54% (35/65) of the total were angle crashes, 77% of which occurred at the intersection of US Route 250 and the I-64 on/off ramp. This may be associated with drivers making left-turns from or to the on/off ramp without adequate gap in conflicting traffic or poor sight distance. The next highest collision types were fixed object (off road) crashes, with approximately 23% (15/65) of all crashes, followed by rear end crashes, comprising approximately 15% (10/65) of all crashes.

Table 8-1: Crash Summary by Collision Type



There were no fatalities in the study area during the 5-year study period. 21 of the 65 crashes resulted in injury (32%) and the remaining 44 crashes (68%) resulted in property damage only. Table 8-2 shows the summary by crash severity.

Table 8-2: Crash Summary by Severity



Regarding the driving conditions, approximately 62% (40/65) of crashes occurred in the daylight and approximately 77% (50/65) occurred on a dry roadway surface. The data indicates that poor lighting or roadway surface conditions are likely not attributed to the crashes. Tables 8-3 and 8-4 show the summary of crashes by surface and lighting conditions.

Table 8-3: Crash Summary by Roadway Surface Conditions

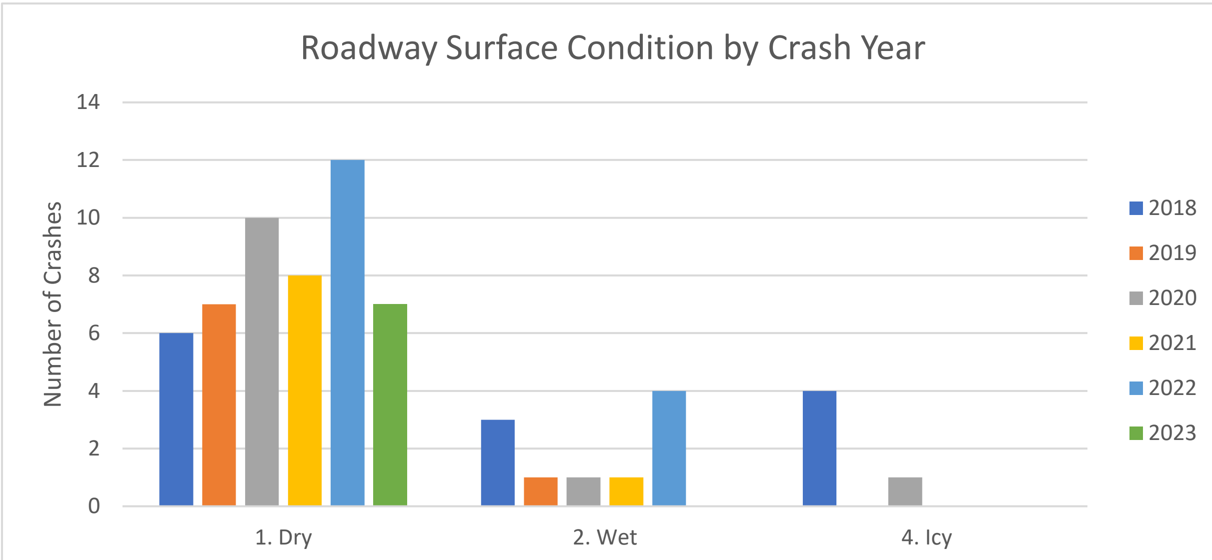
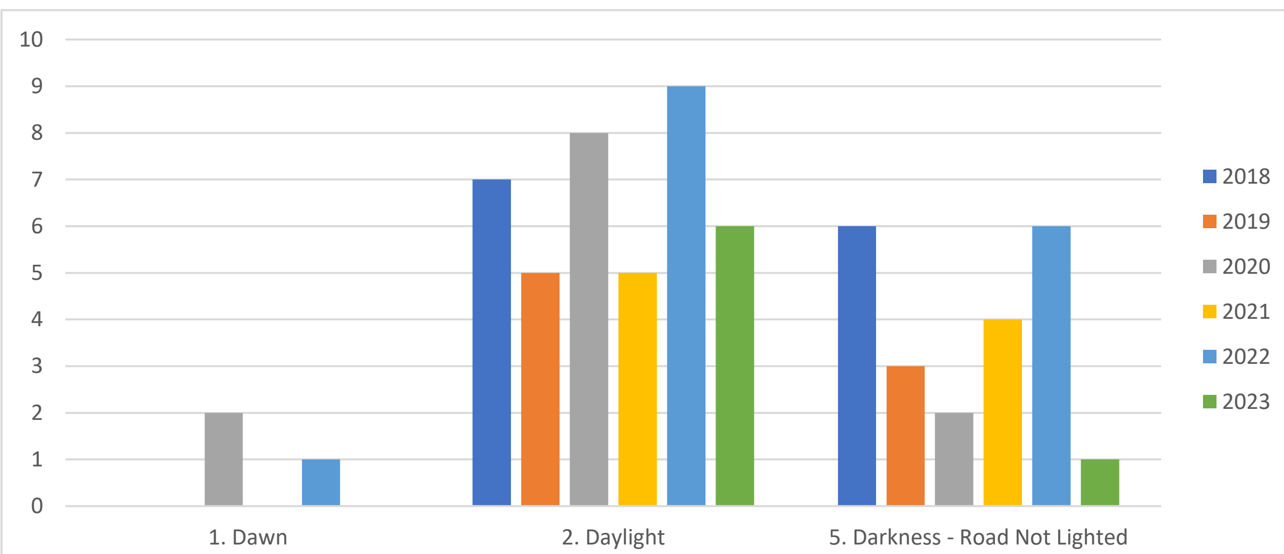


Table 8-4: Crash Summary by Light Conditions



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5 Year Crash Data
Afton Mountain Traffic Study – Rockfish Gap
Augusta County, Virginia

Figure
8-1

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9 Alternative Intersection Analysis

To accommodate any level of development greater than Phase 1 with 2,500 trips per day (a 14-pump gas station and convenience store or equivalent), the traffic analysis and crash analysis results validate the need for an alternative intersection configuration at the US Route 250 and Route 610 intersection from both an operational and a safety perspective. The VDOT Junction Screening Tool (VJuST) was utilized to provide a high-level screening of possible options and remove any alternatives that are not compatible. Geometric design considerations and operational analyses were then considered for those alternatives identified as potential candidates.

9.1 VDOT Junction Screening Tool (VJuST)

The VJuST Tool was used to complete an initial, high-level screening of potential intersection treatments. This screening provided a preliminary subset of intersection options based on the volume-to-capacity ratio of each alternative configuration, the allowance for pedestrian accommodations, and the safety benefits implied via the number of conflict points. A copy of the completed VJuST worksheets for the US Route 250 and Route 610 intersection using the 2033 phase 2 total volumes can be found in Appendix E.

Tables 9-1, 9-2, and 9-3 below show the performance of the intersection's alternatives considered in the AM PM, and weekend midday peak hour, respectively.

Table 9-1: 2033 AM VJuST Results

Intersection Results					
		Congestion	Pedestrian	Safety	Notes
Type	Dir	Maximum V/C	Accommodation Compared to Conventional	Weighted Total Conflict Points	
Conventional	-	0.34		48	
Continuous Green-T	-	0.35	-	12*	
Median U-Turn	-	N/A*	+	20	
Partial Median U-Turn	-	N/A*	+	28	
Restricted Crossing U-Turn	-	N/A*		20	
Roundabout	-	0.37		8	
Two-Way Stop Control	-	0.20		48	

*The continuous green-T is the only three-legged innovative intersection in this tool. To compare the continuous green-T to other innovative intersections, conflicts corresponding with the fourth leg must be removed. This has been done for the conventional intersection. Conflict point diagrams for three-legged and four-legged conventional intersections have been provided on the conventional intersection worksheet for reference.

Table 9-2: 2033 PM VJuST Results

Intersection Results					
		Congestion	Pedestrian	Safety	Notes
Type	Dir	Maximum V/C	Accommodation Compared to Conventional	Weighted Total Conflict Points	
Conventional	-	0.65		48	
Continuous Green-T	-	0.48	-	12*	
Median U-Turn	-	N/A*	+	20	
Partial Median U-Turn	-	N/A*	+	28	
Restricted Crossing U-Turn	-	N/A*		20	
Roundabout	-	0.65		8	
Two-Way Stop Control	-	0.80		48	

*The continuous green-T is the only three-legged innovative intersection in this tool. To compare the continuous green-T to other innovative intersections, conflicts corresponding with the fourth leg must be removed. This has been done for the conventional intersection. Conflict point diagrams for three-legged and four-legged conventional intersections have been provided on the conventional intersection worksheet for reference.

Table 9-3: 2033 Weekend Midday VJuST Results

Intersection Results					
		Congestion	Pedestrian	Safety	Notes
Type	Dir	Maximum V/C	Accommodation Compared to Conventional	Weighted Total Conflict Points	
Conventional	-	0.53		48	
Continuous Green-T	-	0.52	-	12*	
Median U-Turn	-	N/A*	+	20	
Partial Median U-Turn	-	N/A*	+	28	
Restricted Crossing U-Turn	-	N/A*		20	
Roundabout	-	0.54		8	
Two-Way Stop Control	-	0.60		48	

*The continuous green-T is the only three-legged innovative intersection in this tool. To compare the continuous green-T to other innovative intersections, conflicts corresponding with the fourth leg must be removed. This has been done for the conventional intersection. Conflict point diagrams for three-legged and four-legged conventional intersections have been provided on the conventional intersection worksheet for reference.

9.2 FURTHER ANALYSIS INTERSECTIONS

Three (3) alternatives for the US Route 250 and Route 610 intersection were selected for further analysis – a conventional signalized intersection, a continuous green-T, and a roundabout. All three options that included u-turn operations were excluded from consideration given the challenges with constructing a sufficient space along the grade of US Route 250 to accommodate a u-turn maneuver (loon) and the operational issues of upgrade u-turns.

9.2.1 Conventional Signal

A conventional signalized intersection would allow for full-access movement on all legs of the intersection. It would also maintain the general operations with the current intersection of US Route 250 at Route 610, with minimal need for changes to the geometric layout of the intersection given the large amount of right-of-way available.

The effectiveness of a signal at this location may be hampered by heavy fog that is known to occur at the top of Afton Mountain, which may limit visibility of the traffic signal light. Additionally, a signal will require greater advanced warning for higher vehicular speeds to avoid rear-ends. The current bridge carrying the Blue Ridge Parkway over US Route 250 in this area would present a sight distance concern that may allow vehicles to be hidden for westbound traffic approaching the signal.

9.2.2 Continuous Green-T

Continuous Green-T intersections allow through traffic on the top side of the T-intersection (US Route 250 westbound) to pass through the intersection without stopping and the opposite direction of travel (US Route 250 eastbound) is typically controlled by a traffic signal. Left-turn vehicles form the side street (Route 610) use a channelized receiving lane on the major street to merge into the continuous lane of traffic after completing the left-turn. The continuous green-T should be considered at three-leg intersections with moderate to low left-turn volumes on the minor roadway, high through volumes on the major roadway, and few pedestrian crossings.

The effectiveness of a signal at this location may be hampered by heavy fog that is known to occur at the top of Afton Mountain, which may limit visibility of the traffic signal light. Additionally, a signal will require greater advanced warning for higher vehicular speeds to avoid rear-ends. The current bridge carrying the Blue Ridge Parkway over US Route 250 in this area would present a sight distance concern that may allow vehicles to be hidden for westbound traffic approaching the signal.

Another consideration is the anticipated installation of a future signaled continuous green-T at the I-64/US Route 250 intersection less than 1000' west of the Route 610 intersection. The installation of a continuous green-T at both intersections may create weaving traffic patterns as drivers navigate in and out of the CGT's lanes which could pose a potential safety hazard.

9.2.3 Roundabout

A roundabout should be considered for all proposed intersection improvement projects to determine if the option is appropriate given the notable safety benefits. A roundabout at the intersection of US Route 250 and Route 610 would provide access for all directions of travel and remove the need for signalization. Given the existing footprint of US Route 250, a roundabout could fit within the right-of-way with minimal impacts. The roundabout would assist with better access management along the US Route 250 and Route 610 corridors, allowing for more access to the proposed development on Route 610. In addition, the roundabout option would allow for a more fluid transition to the proposed continuous green-T intersection at the I-64 ramp intersection.

9.3 2033 Phase 2 Peak Hour Volumes and Analysis Results

To accommodate any level of development greater than Phase 1 with 2,500 trips per day (a 14-pump gas station and convenience store or equivalent), the 2033 Phase 2 total traffic volumes shown on Figure 7-1 were used for the analysis. Only the US Route 250 and Route 610 intersection was considered in this analysis since all other study intersections experience acceptable LOS and minimal queuing issues during the 2033 full buildout peak hours.

9.3.1 2033 Phase 2 Capacity Analysis Results – With Conventional Signal

Table 9-4 summarizes the 2033 buildout intersection LOS, delay, 95th percentile queue lengths (Synchro), and maximum queue lengths (SimTraffic) based on the 2033 proposed intersection geometry (Figure 4-1), the peak hour traffic volumes shown on Figure 7-1, and the optimized signal timings as determined by Synchro. The corresponding SYNCHRO and SimTraffic reports are included in Appendix F.

As shown in Table 9-4, under 2033 phase 2 conditions with the conventional signal, the US Route 250 and Route 610 intersection will operate at acceptable levels of service in all peak hours. All movements operate at an acceptable LOS C or better during all peak hours. The westbound left turn lane can be designed to have a minimum of 200' of storage, which will fit within the footprint of the US Route 250 corridor without impacting the Blue Ridge Parkway overpass bridge.

Table 9-4: Intersection LOS, Delay, and Queue Length Summary
2033 Phase 2 Total Conditions – With Conventional Signal

Intersection and Type of Control	Movement and Approach	Turn Lane Storage (ft)	AM PEAK HOUR				PM PEAK HOUR				SATURDAY PEAK HOUR			
			Delay [1] (sec/veh)	LOS [1]	HCS 95th Percentile Queue Length (ft)	Simulated Maximum Queue Length[2] (ft)	Delay [1] (sec/veh)	LOS [1]	HCS 95th Percentile Queue Length (ft)	Simulated Maximum Queue Length[2] (ft)	Delay [1] (sec/veh)	LOS [1]	HCS 95th Percentile Queue Length (ft)	Simulated Maximum Queue Length[2] (ft)
1. US 250 (E-W) at	EB Thru		11.6	B	151	186	12.5	B	#322	285	15.3	B	#367	282
Rte 610 (N-S)	EB Right	300	8.1	A	24	62	8.3	A	33	111	8.0	A	27	138
Signalized	*EB Approach*		10.8	B	--	--	11.6	B	--	--	13.9	B	--	--
Conventional	WB Left	150	19.6	B	34	90	20.8	C	39	88	23.9	C	m55	84
	WB Thru		5.3	A	74	139	7.7	A	220	227	5.5	A	154	161
	WB Approach		7.0	A	--	--	8.7	A	--	--	7.5	A	--	--
	NB Left		11.8	B	41	68	15.5	B	83	116	18.2	B	81	115
	NB Right	300	11.2	B	20	47	13.8	B	28	72	16.5	B	27	66
	NB Approach		*11.5*	B	--	--	*14.9*	B	--	--	*17.6*	B	--	--
	Overall		9.3	A	--	--	10.7	B	--	--	11.8	B	--	--

[1] Overall intersection LOS and delay reported for signalized intersections and roundabouts only.

[2] SimTraffic Queues are average maximum queues after 10 runs of 60 minutes each.

 # - 95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after two cycles.

9.3.2 2033 Phase 2 Capacity Analysis Results – With Continuous Green-T

Table 9-5 summarizes the 2033 buildout intersection LOS, delay, 95th percentile queue lengths (Synchro), and maximum queue lengths (SimTraffic) based on the 2033 proposed intersection geometry (Figure 4-1) with a continuous Green-T, the peak hour traffic volumes shown on Figure 7-1, and the optimized signal timings as determined by Synchro. The corresponding SYNCHRO and SimTraffic reports are included in Appendix F.

As shown in Table 9-5, under 2033 phase 2 conditions with the continuous green-T, the US Route 250 and Route 610 intersection will operate at acceptable levels of service in all peak hours. All movements operate at an acceptable LOS C or better during all peak hours. Additionally, the queue lengths for mainline through movements are significantly shorter than with the conventional signal. The westbound left turn lane can be designed to have a minimum of 200' of storage, which will fit within the footprint of the US Route 250 corridor without impacting the Blue Ridge Parkway overpass bridge.

Table 9-5: Intersection LOS, Delay, and Queue Length Summary
2033 Phase 2 Total Conditions – With Continuous Green-T

Intersection and Type of Control	Movement and Approach	Turn Lane Storage (ft)	AM PEAK HOUR				PM PEAK HOUR				SATURDAY PEAK HOUR			
			Delay [1] (sec/veh)	LOS [1]	HCS 95th Percentile Queue Length (ft)	Simulated Maximum Queue Length[2] (ft)	Delay [1] (sec/veh)	LOS [1]	HCS 95th Percentile Queue Length (ft)	Simulated Maximum Queue Length[2] (ft)	Delay [1] (sec/veh)	LOS [1]	HCS 95th Percentile Queue Length (ft)	Simulated Maximum Queue Length[2] (ft)
1. US 250 (E-W) at	EB Thru		11.5	B	152	175	14.3	B	231	232	15.9	B	332	257
Rte 610 (N-S)	EB Right	150	8.5	A	23	104	9.4	A	26	126	8.8	A	29	150
Signalized	*EB Approach*		10.8	B	--	--	13.2	B	--	--	14.6	B	--	--
Continuous Green T	WB Left	150	18.3	B	40	89	20.3	C	54	87	24.4	C	73	94
	WB Thru		0.3	A	0	--	0.6	A	0	--	0.4	A	0	--
	WB Approach		2.4	A	--	--	2.1	A	--	--	3.1	A	--	--
	NB Left		13.5	B	49	66	17.0	B	101	124	20.7	C	109	125
	NB Right	300	7.1	A	15	35	8.3	A	22	70	11.0	B	24	70
	NB Approach		*10.9*	B	--	--	*13.8*	B	--	--	*17.1*	B	--	--
	Overall		7.3	A	--	--	8.0	A	--	--	10.2	B	--	--

[1] *Overall intersection LOS and delay reported for signalized intersections and roundabouts only.*
[2] SimTraffic Queues are average maximum queues after 10 runs of 60 minutes each.
SimTraffic Queues are average maximum queues after 10 runs of 60 minutes each.

9.3.3 2033 Phase 2 Capacity Analysis Results – With Roundabout

Table 9-6 summarizes the 2033 buildout intersection LOS, delay, 95th percentile queue lengths (SIDRA), based on the 2033 proposed intersection geometry (Figure 4-1) with a roundabout, and the peak hour traffic volumes shown on Figure 7-1. The corresponding SIDRA reports are included in Appendix F.

As shown in Table 9-6, under 2033 phase 2 conditions with the roundabout, the US Route 250 and Route 610 intersection will operate at a level of service better than the conventional signal and the continuous green-T. All movements operate at a LOS A or better during all peak hours. Additionally, the queue lengths for mainline through movements are significantly shorter than with the conventional signal and the continuous green-T.

Table 9-6: Intersection LOS, Delay, and Queue Length Summary
2033 Phase 2 Total Conditions – With Roundabout

Intersection and Type of Control	Movement and Approach	Turn Lane Storage (ft)	AM PEAK HOUR			PM PEAK HOUR			SATURDAY PEAK HOUR		
			Delay [1] (sec/veh)	LOS [1]	SIDRA 95th Percentile Queue Length (ft)	Delay [1] (sec/veh)	LOS [1]	SIDRA 95th Percentile Queue Length (ft)	Delay [1] (sec/veh)	LOS [1]	SIDRA 95th Percentile Queue Length (ft)
1. US 250 (E-W) at	EB Thru		6.4	A	61	7.5	A	92	9.8	A	149
Rte 610 (N-S)	EB Right		6.1	A	61	7.3	A	92	9.8	A	149
Roundabout	*EB Approach*		6.3	A	--	7.5	A	--	9.8	A	--
	WB Left		6.0	A	54	12.0	B	165	9.1	A	112
	WB Thru		6.4	A	54	12.5	B	165	9.3	A	112
	WB Approach		6.3	A	--	12.4	B	--	9.3	A	--
	NB Left		5.4	A	13	7.7	A	92	8.8	A	31
	NB Right		5.0	A	13	7.2	A	92	8.2	A	31
	NB Approach		*5.2*	A	--	*7.5*	A	--	*8.6*	A	--
	Overall		6.2	A	--	9.8	A	--	9.4	A	--

[1] Overall intersection LOS and delay reported for signalized intersections and roundabouts only.

10 CONCLUSIONS

Based on the analysis contained within this report, the following conclusions are offered:

- The 2023 existing conditions analysis found that the majority of movements and intersections operated at acceptable levels of service during the AM, PM, and weekend midday peak hours. All movements operated at LOS D or better and there were no documented concerns with available storage for existing turn lanes.

- Under 2033 background conditions, all intersections continue to operate at LOS C or better during each of the peak hour periods, with the exception of the Route 610 northbound approach to US Route 250, which operates at LOS D during the PM peak hour and at LOS E during the weekend midday peak hour. Overall, the study area operates similarly to the existing conditions and there are minimal operational issues and no queuing issues documented.

- A crash analysis was completed for the most recent 5-year period available and found a total of 65 crashes along the study corridors of US Route 250 and Route 610. The majority of the crashes occurred at the US Route 250 and I-64 on/off ramp intersection (51%). The combined US Route 250 at Afton Circle / Route 610 intersection had a total of 4 crashes (6%). The US Route 250 corridor experienced 23 non-intersection crashes. Angle crashes were the most prevalent crash type, with 54% of all crashes (35/65). The next highest collision types were fixed object (off road) crashes, with approximately 23% (15/65) of all crashes, followed by rear end crashes, with approximately 15% (10/65) of all crashes. Overall, there were no fatalities within the study period and only 3 severe injury crashes. The majority of crashes were property damage only (68%). The crash data also suggests that lighting and weather were not primary causes of crashes.

- Given the potential for development of the Rockfish Gap property on the south side of US Route 250 at Route 610, an iterative analysis was completed to determine the potential development that could be accommodated at the intersection. The analysis found that the US Route 250 at Route 610 unsignalized stop-controlled intersection could accommodate the equivalent of 2,500 trips per day (similar to a 14-pump gas station and convenience store) before the operations and queuing along the Route 610 side street left turn approach would reach unacceptable levels. As development increases beyond 2,500 trips per day, the current intersection geometry will not support without further improvements.

- The 2033 development volumes were used to perform an alternatives analysis for the intersection of US Route 250 at Route 610. The results of the preliminary screening through the VDOT Junction Screening Tool (VJuST) found that the best options to consider further were a conventional signalized intersection, a continuous green-T intersection, and a roundabout. All three options that included u-turn operations were excluded from consideration given the challenges with constructing a sufficient space along the grade of US Route 250 to accommodate a u-turn maneuver (loon) and the operational issues of upgrade u-turns.

- The operational analysis for the conventional signal, continuous green-T, and roundabout found that all 3 alternatives would provide improvements in levels of service and safety for the US Route 250 at Route 610 intersection. The roundabout would perform best from both an operational and a safety standpoint. The conventional signal and continuous green-T signal options were determined to be difficult to implement given the limited sight distance in the westbound US Route 250 direction due to the Blue Ridge Parkway overpass. In addition, given the proximity to the proposed continuous green-T signal improvements for the US Route 250 at I-64 on/off ramp intersection, the installation of another signal was deemed unsuitable.

- There is currently no site plan or conceptual land use plan for the Rockfish Gap property. The proposed project was completed utilizing the assumption that any development would install entrances that meet VDOT access management standards and entrance requirements. The recommendations require the coordination with property owners to meet right-of-way needs for installation of improvements and change of access.

- The potential for bicycle/pedestrian improvements were considered with the development of this report. Overall, the redevelopment of the Rockfish Gap property is located in a prime location to take advantage of the Blue Ridge Parkway and the Appalachian Trail. It is expected that any development that occurs will incorporate bicycle/pedestrian connections to the Blue Ridge Parkway across the frontage of the site.

- The report considered bicycle/pedestrian connections along US Route 250 from the Rockfish Gap property to the Blude Ridge Tunnel Trail. The City of Waynesboro prepared a federal RAISE grant application (unsuccessful in 2023) to fund a connection from the Blue Ridge Tunnel Trail into the developed area of the City. Given the potential to connect the Blue Ridge Parkway to the City of Waynesboro, options were considered to bring pedestrians/bicycles along US Route 250 to the Blue Ridge Tunnel Trail on the east. Although US Route 250 carries 11,000 vehicles per day in the vicinity of Rockfish Gap, the roadway geometry includes 3-lanes of traffic to account for the truck climbing lanes in the uphill direction on each side of Afton Mountain. The roadway could be narrowed to 2-lanes only to convert some travel lane space for a bicycle/pedestrian accommodation, however, in coordination with VDOT, this was determined to be an unfeasible solution due to the needs of US Route 250 for alternate routes from I-64. Further field review of the grades and roadside nature of US Route 250 determined that installing a shared-use path along the corridor would be costly and not economically feasible at this time. An improvement on either side of US Route 250 would require extensive retaining walls to maintain the existing slopes, as well as major impacts to property owners along the route. The best route for a bicycle/pedestrian improvement would be along the north side of US Route 250 given the more favorable slope considerations, right-of-way, and avoidance of the I-64 off-ramp free flow lane activity. Pedestrians could cross US Route 250 at the proposed roundabout improvement location to avoid the proposed continuous green-T at the I-64 interchange.

- The conceptual improvements for the continuous green-T intersection, the roundabout intersection, and the potential alignment of a pedestrian/bicycle shared-use path are shown in Appendix G for reference.

The focus of this report is to identify a potential plan that provides functional access to the Rockfish Gap site and preserves the capacity of the surrounding roadway network. This report identifies the proposed phasing of the site development and the roadway improvements associated with each.

To accommodate the anticipated traffic associated with the Rockfish Gap redevelopment site, the recommended improvement plan is as follows:

1. The US Route 250 at Afton Circle median crossover should be closed and all access relocated/combined with the US Route 250 at Route 610 intersection. The current median breaks do not meet VDOT access management standards and access to all properties can be accommodated through proper development plans on Route 610.

2. If any proposed development occurs at the Rockfish Gap redevelopment site has an average daily trip rate of 2,500 or less, the only operational improvements needed are the combination of the Route 610 / Afton Circle median breaks. The existing turn lane geometry at the intersection of US Route 250 and Route 610 is sufficient to handle development to the 2,500 ADT threshold.

3. When proposed development occurs at the Rockfish Gap redevelopment site (or additional phases of development after a smaller one) reaches an average daily trip rate of more than 2,500, it is recommended that a roundabout be installed at the intersection of US Route 250 and Route 610.

    a. The roundabout could provide a unique opportunity for placemaking to welcome motorists to the area and serve as an entrance to the Blue Ridge Parkway. The recent successful implementation of a roundabout on US Route 250 at Route 151 at the base of Afton Mountain to the east can serve as an educational tool to support a roundabout at the Route 610 location.

    b. In addition, when the roundabout is implemented, it is recommended that the access to the US Route 250 from the Blue Ridge Parkway to the east be reevaluated. There are current sight distance issues related to the Blue Ridge Parkway ramp for westbound traffic on US Route 250 that could create a safety problem with increased traffic volume. There is potential to utilize the roundabout as the main gateway to/from the Blue Ridge Parkway and remove the eastern ramp access directly to US Route 250 or modify to some type of one-way traffic operation.

    c. The roundabout inscribed diameter and truck apron design will need to ensure that the appropriate design vehicle will be able to traverse the intersection geometry. Retaining walls and other improvements may be required to address potential drainage, grading, and geotechnical challenges presented at this location.

4. When proposed development occurs at the Rockfish Gap redevelopment site, it is recommended that all efforts be made to provide bicycle/pedestrian accommodations to connect the site with the Blue Ridge Parkway across the site frontage.

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