

STARS

ROUTE 7 (BERRYVILLE AVENUE/BERRYVILLE PIKE) CORRIDOR STUDY

Route 7 (Berryville Avenue/Berryville Pike) Corridor Study

From Pleasant Valley Road to Greenwood Drive/First Woods Drive

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Prepared for:



Virginia Department of Transportation

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I N T E R N A T I O N A L

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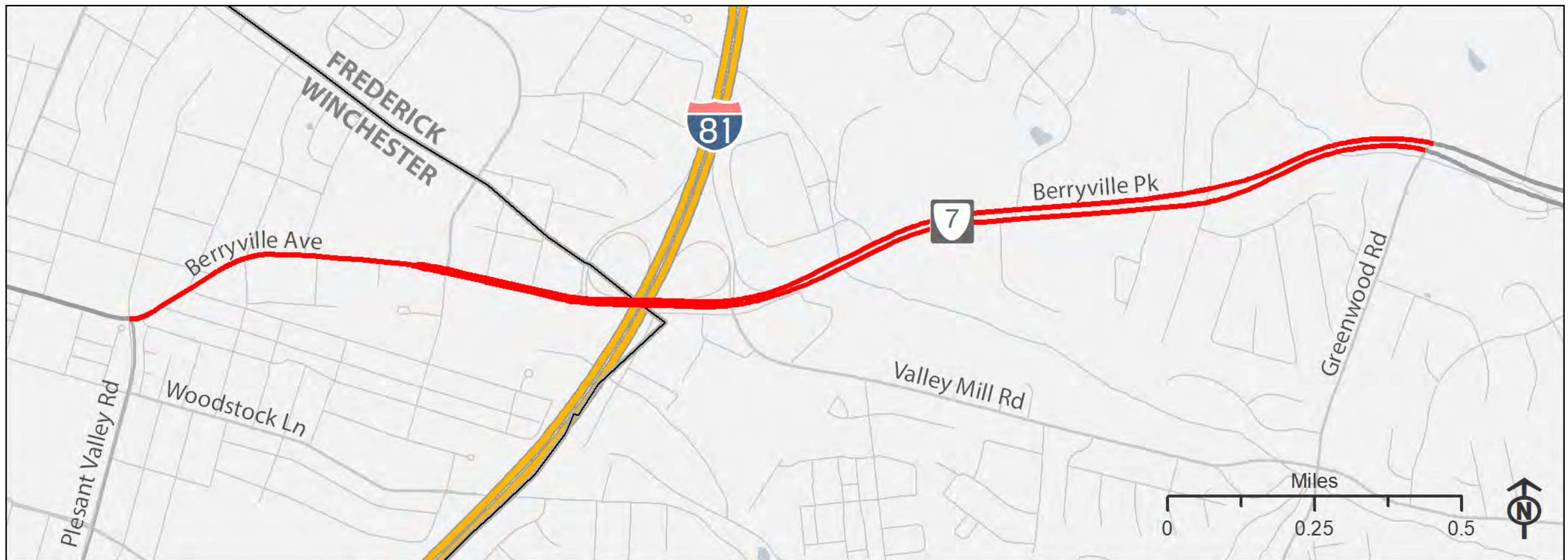
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1. INTRODUCTION

The Virginia Department of Transportation (VDOT), in coordination with Frederick County, the City of Winchester, and the WinFred Metropolitan Planning Organization, initiated a STARS corridor study on Route 7 (Berryville Avenue / Berryville Pike) between N Pleasant Valley Road and Greenwood Road/First Woods Drive in 2018. The 2018 Route 7 STARS effort reviewed existing traffic conditions, crashes between 2013 and 2018, and included a field review with recommendations. The findings and recommendations were summarized in the Route 7 Existing Conditions and Future Volumes Report dated August 2, 2019. The report can be found in Appendix A.

The purpose of this follow-up study is to recommend capital improvements along the Route 7 corridor that will improve identified operational and safety deficiencies, inclusive of future needs. This study utilized the data collected from the Route 7 Existing Conditions and Future Volumes Report (August 2019) to evaluate recommendations.

Figure 1. Study Area



2. FUTURE NO-BUILD CONDITION ANALYSIS

Traffic operational analyses were conducted to evaluate the overall performance of the study corridor under No-Build (2030) 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 conditions were analyzed using the 2030 No-Build peak hour traffic volumes from the Route 7 Existing Conditions and Future Volumes Report (August 2019) and optimizing the signal timings in the Existing Condition Synchro and SimTraffic models.

2.1 Operational Analysis Results

The results of the 2030 No-Build operational analysis and reported queue lengths are presented in Table 1 and Table 2, respectively. Figure 2 displays the overall Level of Service (LOS) for each study intersection for both peak hours. The detailed output from the SimTraffic analysis are included in Appendix B. It is important to note that the 2030 No-Build analysis results shown in Table 1, Table 2, and Figure 2 are from the SimTraffic analysis module to allow for comparison to the Existing Conditions analysis output presented in Appendix A. Later in this report, the analysis output from the Highway Capacity Manual (HCM) analysis module is used to better evaluate the recommended improvements. This is discussed in detail in Section 3.1.

As shown in the tables and figure, traffic conditions are anticipated to worsen in the 2030 No-Build scenario, particularly the PM peak hour intersection operations along the corridor, between the intersections of Fort Collier Road and Regency Lakes Drive. These intersections are expected to operate at a LOS C or worse during the PM peak hour due to the operations and resulting queue lengths at the I-81 Exit 315 interchange. The remaining intersections outside of the interchange area are expected to operate at a LOS D or better. Additional notes from the comparison of the Existing Conditions SimTraffic analysis results to the 2030 No-Build SimTraffic analysis results are described below.

Intersection 1: N Pleasant Valley Road:

- The overall PM peak hour intersection delay degrades from 25.8 seconds/vehicle (LOS C), to 35.2 seconds/vehicle (LOS D).
- The eastbound PM peak hour approach delay degrades from 37.1 seconds/vehicle (LOS D), to 69.6 (LOS E). The maximum queue length for the eastbound approach is expected to extend approximately 562 feet, potentially blocking access to the eastbound left-turn lane.

Intersection 8: Fort Collier Road/Elm Street:

- The overall PM peak hour intersection delay degrades from 46.9 seconds/vehicle (LOS D), to 77.3 seconds/vehicle (LOS E).
- The maximum queue length for the eastbound approach is expected to extend approximately 741 feet, block potentially blocking access to the eastbound left-turn lane.

Intersection 12: I-81 Southbound Ramp:

- The eastbound Route 7 left-turn lane will continue to backup onto eastbound Route 7 and impact upstream traffic operations back to the intersection of Fort Collier Road/Elm Street.

Intersection 13: I-81 Northbound Ramp/Valley Mill Road:

- The overall AM peak hour intersection delay increases from 37.5 seconds/vehicle (LOS D), to 63.2 seconds/vehicle (LOS D).
- The overall PM peak hour intersection delay increases from 49.8 seconds/vehicle (LOS D), to 92.7 seconds/vehicle (LOS F).
- The westbound PM peak hour approach will extend up to 1,341 feet impacting westbound traffic operations along the corridor back to the intersection of Regency Lakes Drive.
- The eastbound Route 7 left-turn lane will continue to backup onto eastbound Route 7.
- During the PM peak hour, the overall delay for the Valley Mill Road northbound approach will significantly increase to 131.6 seconds/vehicle (LOS F) from 67.8 (LOS D).

Intersection 16: Millbrook/Blossom Drive

- Intersection operations are relatively maintained but with queue lengths on Route 7 increasing up to 35 percent.

Intersection 17: First Woods Drive/Greenwood Road

- Intersection operations are relatively maintained but with queue lengths on Route 7 increasing up to 41 percent.

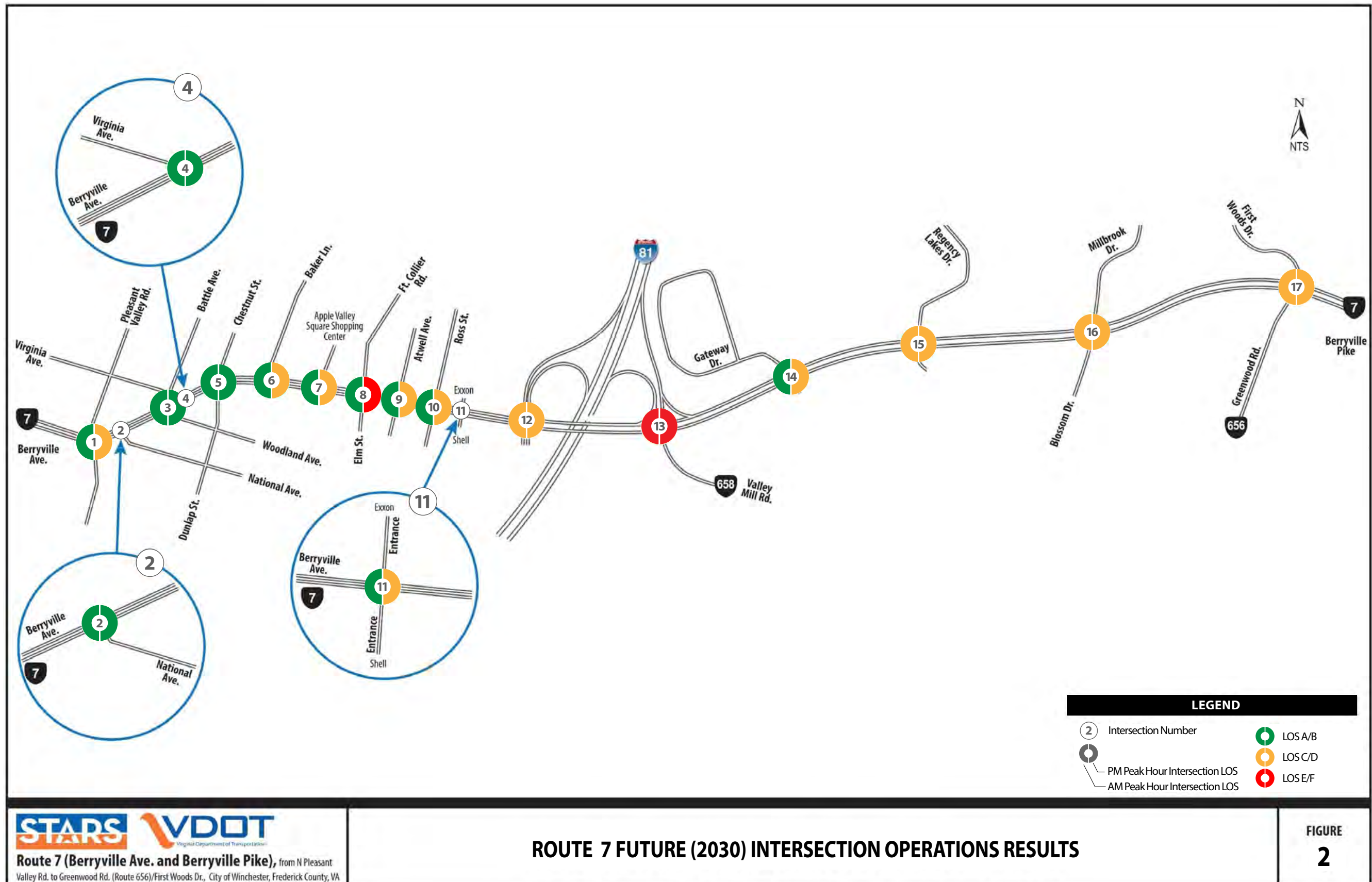
The I-81 interchange has significant impacts on the Route 7 study area. As mentioned previously, queue lengths due to poor operations at the I-81 ramp junctions affect operations as far west as the intersection of Fort Collier Road/Elm Street in the City of Winchester, and east of the interchange to the intersection of Regency Lakes Drive in Frederick County. Based on feedback from VDOT Staunton District Planning, the evaluation of large-scale concepts to improve interstate and interchange operations was outside of the scope of this study, due to analysis year and software requirements necessary to conduct an interchange analysis. It is recommended that a standalone feasibility study be conducted to evaluate multiple interchange alternatives. The standalone interchange feasibility study should focus on the following:

- Extend Horizon Year beyond 2030 to 2045+
 - Scenario planning of development within the area based on City of Winchester Comprehensive Plan updates and the proposed development near the intersection of Gateway Drive and Route 7.
- Environmental constraints assessment and Right-of-Way analysis evaluating impacts of preferred alternatives given existing space constraints.
- Use of advanced analysis software such as VISSIM.

An interim recommendation is proposed at the southbound I-81 ramp, which will be discussed in the following section. The northbound I-81 ramp junction with Route 7 is a complex intersection due to multiple constraints, however the Frederick County Comprehensive plan includes a project to relocate Valley Mill Road and extend the existing eastbound Route 7 left-turn lane which should be pursued further.

It is important to note that under current SMART SCALE guidelines, once a project is selected for funding, the submitting agency or entity must wait for two rounds of SMART SCALE following the end date of construction before submitting a new project for the same location. For example, a project relocating Valley Mill Road at the I-81 Northbound Ramp, may preclude the intersection from multiple rounds of SMART SCALE should SMART SCALE funds be used to fund the relocation. Therefore, it is recommended to discuss with VDOT officials and study this interchange further before submitting a SMART SCALE application.

Figure 2. Future Intersection Operations Results



STARS **VDOT**
 Virginia Department of Transportation
 Route 7 (Berryville Ave. and Berryville Pike), from N Pleasant Valley Rd. to Greenwood Rd. (Route 656)/First Woods Dr., City of Winchester, Frederick County, VA

Table 2. SimTraffic 2030 No Build Max Queue Length Results

Intersection Number and Description		Control Type	Lane Group	Maximum Queue Lengths (Feet)											
				Eastbound			Westbound			Northbound			Southbound		
				Storage Bay Length	AM Queue	PM Queue	Storage Bay Length	AM Queue	PM Queue	Storage Bay Length	AM Queue	PM Queue	Storage Bay Length	AM Queue	PM Queue
1	Route 7 & N Pleasant Valley Road	Signal	Left	National Avenue			Berryville Avenue			N Pleasant Valley Road			N Pleasant Valley Road		
				175	125	175	-	98	96	165	93	154	100	99	100
				-	369	562	-	104	93	-	144	282	-	194	281
2	Route 7 & National Avenue	Two-Way Stop Control	Left	Berryville Avenue			Berryville Avenue			National Avenue					
				-	-	-	-	234	419	-	-	-	-	24	31
				-	54	87	-	273	386	-	-	-	-	-	-
3	Route 7 & Battle Avenue / Woodland Avenue	Signal	Left	Berryville Avenue			Berryville Avenue			Woodland Avenue			Battle Avenue		
				-	114	320	-	140	150	-	-	-	-	51	52
				-	114	320	-	164	152	-	40	65	-	-	-
4	Route 7 & Virginia Avenue	Two-Way Stop Control	Left	Berryville Avenue			Berryville Avenue			Virginia Avenue					
				-	51	146	-	-	-	-	-	-	-	-	-
				-	-	-	-	88	170	-	-	-	-	-	-
5	Route 7 & Dunlap Street / Chestnut Street	Two-Way Stop Control	Left	Berryville Avenue			Berryville Avenue			Chestnut Street			Dunlap Street		
				-	52	265	-	103	238	-	-	-	-	21	18
				-	-	-	-	-	-	-	51	78	-	-	-
6	Route 7 & Baker Lane	Signal	Left	Berryville Avenue			Berryville Avenue			Baker Lane					
				-	186	483	-	-	-	-	-	-	70	69	70
				-	-	-	-	170	209	-	-	-	-	147	250
7	Route 7 & Apple Valley Marketplace	Signal	Left	Berryville Avenue			Berryville Avenue			Apple Valley Marketplace					
				-	87	451	-	-	-	-	-	-	90	70	89
				-	-	-	-	166	196	-	-	-	-	33	307
8	Route 7 & Elm Street / Fort Collier Road	Signal	Left	Berryville Avenue			Berryville Avenue			Elm Street			Fort Collier Road		
				105	98	104	120	114	119	100	82	100	100	99	100
				-	256	741	-	303	305	-	202	258	-	382	400
9	Route 7 & Atwell Avenue / Pharmhouse SC	Two-Way Stop Control	Left	Berryville Avenue			Berryville Avenue			Pharmhouse Shopping Center			Atwell Avenue		
				120	22	120	60	39	53	-	-	-	115	33	320
				-	58	330	-	109	91	-	37	57	-	56	66

Intersection Number and Description		Control Type	Lane Group	Maximum Queue Lengths (Feet)											
				Eastbound			Westbound			Northbound			Southbound		
				Storage Bay Length	AM Queue	PM Queue	Storage Bay Length	AM Queue	PM Queue	Storage Bay Length	AM Queue	PM Queue	Storage Bay Length	AM Queue	PM Queue
10	Route 7 & Ross Street / Pharmhouse SC	Signal	Left	Berryville Avenue			Berryville Avenue			Pharmhouse Shopping Center			Ross Street		
				75	72	75	70	49	59	-	50	72	-	144	231
				-	197	395	-	217	164	-	44	138	-	57	53
11	Route 7 & Exxon Driveway / Shell Driveway	Two-Way Stop Control	Left	Berryville Avenue			Berryville Avenue			Shell Driveway			Exxon Driveway		
				35	32	32	45	34	44	-	70	185	-	110	152
				-	186	239	-	169	223	-	-	-	-	-	-
12	Route 7 & I-81 Southbound Ramp	Signal	Left	Berryville Avenue			Berryville Avenue			Driveway			I-81 Southbound Ramp		
				145	144	144	100	84	96	-	40	71	-	387	388
				-	316	323	-	427	565	-	30	60	-	180	222
13	Route 7 & I-81 Northbound Ramp / Valley Mill Road	Signal	Left	Berryville Avenue			Berryville Pike			Valley Mill Road			I-81 Northbound Ramp		
				240	240	240	340	340	335	210	417	442	-	250	352
				-	417	434	-	928	1341	-	295	295	-	-	326
14	Route 7 & Winchester Gateway Drive	Signal	Left	Berryville Pike			Berryville Pike			Winchester Gateway Drive					
				575	129	246	75	11	70	-	-	-	-	130	332
				-	252	363	-	338	1001	-	-	-	-	-	-
15	Route 7 & Regency Lakes Drive	Signal	Left	Berryville Pike			Berryville Pike			Driveway			Regency Lakes Drive		
				275	241	274	100	63	51	-	0	75	-	224	187
				-	145	502	-	443	925	-	-	-	-	124	226
16	Route 7 & Millbrook Drive / Blossom Drive	Signal	Left	Berryville Pike			Berryville Pike			Blossom Drive			Millbrook Drive		
				605	139	98	165	52	152	200	135	102	290	68	27
				-	442	290	-	422	537	-	127	51	-	95	76
17	Route 7 & First Woods Drive / Greenwood Road	Signal	Left	Berryville Pike			Berryville Pike			Greenwood Drive			First Woods Drive		
				325	265	220	335	149	321	-	391	302	-	186	196
				-	499	523	-	373	565	-	-	-	-	41	42

Red highlighted text indicates queue exceed storage bay length

3. ROUTE 7 IMPROVEMENTS

Intersection and roadway improvement concepts were developed to address safety and operational deficiencies along the Route 7 corridor. Preliminary alternative concepts were presented to VDOT and at Study Work Group (SWG) meetings to evaluate alternatives and provide feedback on concepts. The preferred alternative concepts were then presented to the public via a Metroquest survey that was made available from May 14th, 2021 to May 28th, 2021. The concepts for the preferred improvements recommended as part of this study are presented at the end of this section. Cost estimates were also developed for the preferred improvements and are presented in Section 5.

3.1 Evaluating Recommendations

The recommended improvements primarily focus on increasing safety along the corridor however it is also important that traffic operations along the corridor be maintained or improved. The VDOT TOSAM states that the SimTraffic module should be used to analyze oversaturated conditions along a corridor because the SimTraffic module accounts for upstream and downstream operations. However, within the Route 7 study area, traffic operations along the corridor are greatly influenced by the operations of the I-81 interchange and using the SimTraffic module for the analysis would not properly assess the recommended improvements at each independent intersection.

Alternatively, the HCM module of the Synchro software evaluates each intersection independently without accounting for operational deficiencies at adjacent intersections. Table 3 compares the SimTraffic and HCM analysis results for the study area intersections. As shown in the table, the analysis results for the intersections adjacent to the I-81 interchange show a greater discrepancy between the two analysis modules because the operations of the interchange impact the operations of the adjacent intersections in the SimTraffic results. As shown in the table, the analysis results for the intersections adjacent to the I-81 interchange show a greater discrepancy between the two analysis modules because the operations of the interchange impact the operations of the adjacent intersections in the SimTraffic results. For example, at intersections #9 through #11, the PM peak hour intersection delay is significantly better using the HCM analysis. This is because queuing from the downstream intersection in SimTraffic at the I-81 southbound ramp termini impedes the flow of through traffic on Route 7 traveling eastbound and prevents minor street vehicles from entering the intersection. Whereas, the HCM analysis does not account for this downstream queuing.

Through conversations with VDOT Staunton District Planning staff and due to the difference in methodology between the two analysis modules, it was determined that the HCM module would be used to analyze each intersection so that the operations related to the I-81 interchange would be excluded from the analysis. As such, the HCM analysis results for intersections adjacent to the I-81 interchange may not accurately reflect future conditions. However, a comparison of the HCM analysis results for the future No-Build versus future Build scenarios does provide assurance that the traffic operations at each independent location will improve or be maintained.

The safety impacts, presented in section 4 of this report, were evaluated using Clearinghouse Crash Modification Factors from the Federal Highway Administration (FHWA) and VDOT Crash Modification Factors used in SMART Scale.

3.2 Corridor Limitations

Route 7 within the City of Winchester has limited right-of-way due to commercial and residential structures abutting Route 7. Contextual sensitivity in an urban environment is also important to ensure drivers understand and expect the control proposed. Alternatives presented to stakeholders typically involved using existing infrastructure, devices or equipment that can be used within the existing right-of-way, or traffic control that can be expected in an urban environment.

The Route 7 corridor segment within Frederick County has more available right-of-way, however the current alignment of

Table 3. SimTraffic and HCM 2030 No-Build Operational Results

	Intersection	AM PEAK HOUR		PM PEAK HOUR	
		SimTraffic	HCM	SimTraffic	HCM
1	N Pleasant Valley Road & National Avenue/Berryville Avenue	17.7 - B	32.2 - C	35.2 - D	40.4 - D
2	Route 7 & National Avenue	4.4 - A	0.1 - A	13.1 - B	0.1 - A
3	Route 7 & Battle Avenue/Woodland Avenue	2.8 - A	6.7 - A	11.6 - B	9.7 - A
4	Route 7 & Virginia Avenue	1.0 - A	0.0 - A	4.3 - A	0.0 - A
5	Route 7 & Dunlap Street/Chestnut Street	1.5 - A	0.7 - A	11.6 - A	0.5 - A
6	Route 7 & Baker Lane	6.4 - A	8.7 - A	33.8 - C	15.6 - B
7	Route 7 & Apple Valley Marketplace	3.7 - A	3.7 - A	44.2 - D	10.6 - B
8	Route 7 & Fort Collier Rd/Elm Street	17.3 - B	21.3 - C	77.3 - E	22.8 - C
9	Route 7 & Atwell Avenue/Pharmhouse Shopping Center	2.6 - A	0.2 - A	31.3 - C	0.5 - A
10	Route 7 & Ross Street/Pharmhouse Shopping Center	6.9 - A	9.7 - A	36.0 - D	8.8 - A
11	Route 7 & Exxon Driveway/Shell Driveway	5.2 - A	0.6 - A	20.2 - C	0.2 - A
12	Route 7 & I-81 SB Ramp	26.2 - C	37.3 - D	36.0 - D	34.4 - C
13	Route 7 & I-81 NB Ramp	63.2 - E	64.9 - E	92.7 - E	62.7 - E
14	Route 7 & Winchester Gateway	17.9 - B	20.4 - C	43.2 - D	22.5 - C
15	Route 7 & Regency Lakes Drive	21.0 - C	22.5 - C	38.7 - D	23.9 - C
16	Route 7 & Millbrook Drive/Blossom Drive	28.1 - C	39.8 - D	21.8 - C	20.5 - C
17	Route 7 & Greenwood Road/First Wood Drive	32.7 - C	46.4 - D	31.3 - C	45.2 - D

this segment is complex. Travel lanes are bifurcated, or at different elevations, and the median reduces in width as vehicles travel westbound towards the northbound I-81 ramp. Although few recommendations are made within Frederick County as the focus should be on the interchange, any future recommendations will need to overcome these challenges. Therefore, the recommendations presented along this portion of the Route 7 corridor make use of existing infrastructure and roadway networks.

3.3 Recommendation Overview

Intersection 1: N Pleasant Valley Road:

The evaluation for the intersection of N Pleasant Valley Road and Route 7 revealed subpar intersection operations, particularly on eastbound Route 7, and poor safety conditions, with high angle crashes and pedestrian incidents. Preliminary alternatives were targeted towards reducing delay and improving vehicular and pedestrian safety. The preliminary alternatives presented to the SWG included relocating the northbound and southbound Pleasant Valley Road left-turns through the network, a multi-lane roundabout, and a single lane roundabout with a dedicated westbound Route 7 left-turn lane. Based on feedback from the City of Winchester, the relocated left-turn option was determined to not be contextually appropriate. Additionally, the standard multi-lane roundabout required more right-of-way compared to the alternative roundabout and was therefore eliminated. The single lane roundabout that was advanced as the preferred alternative is expected to reduce crashes up to 40%. The operational results are presented in Table 4. The conceptual drawing is presented in Figure 3.

Overall, the intersection improves significantly both in the AM and PM peak hours. The eastbound Route 7 approach improves from 20.8 seconds/vehicle (LOS C) in the AM peak hour to 11.5 seconds/vehicle (LOS B), and from 46.5 seconds/vehicle (LOS D) to 37.2 seconds/vehicle (LOS D). Another improvement is the northbound right-turn on Pleasant Valley Road. This improves operations from 40.9 seconds/vehicle (LOS D) in the AM peak hour to 6.7 seconds/vehicle (LOS A), and from 33.5 seconds/vehicle (LOS C) to 13.9 seconds/vehicle (LOS B).

Table 4. Route 7 and N Pleasant Valley Road Intersection Operations

Intersection	Scenario	Overall Delay (LOS)	Delay per Lane Group by Approach (sec/veh) (Level of Service)											
			Eastbound			Westbound			Northbound			Southbound		
			LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
1. N Pleasant Valley Road & National Avenue/Berryville Avenue	AM Peak Hour													
	Existing	19.2	16.5	20.4	15.3	11.5	7.2	4.5	50.6	54.0	5.6	54.3	56.0	34.3
		B	B	C	B	B	A	A	D	D	A	D	E	C
		B	19.4 - B			8.9 - A			22.1 - C			52.2 - D		
	Future No Build	32.2	14.2	21.3	21.3	21.2	24.7	24.7	52.6	61.7	40.9	50.6	67.7	67.7
		B	B	C	C	C	C	C	D	E	D	D	E	E
		C	20.8 - C			23.2 - C			46.2 - D			64.2 - E		
	Future Build	7.8	11.2	11.5	11.6	6.0	6.3	6.3	6.6	6.1	6.7	9.9	10.5	10.5
		B	B	B	B	A	A	A	A	A	A	A	B	B
		A	11.5 - B			6.2 - A			6.6 - A			10.3 - B		
	PM Peak Hour													
	Existing	25.8	25.6	39.0	33.8	16.4	9.0	4.1	49.3	51.2	9.1	49.4	53.9	38.8
C		C	D	C	B	A	A	D	D	A	D	D	D	
C		37.1 - D			12.6 - B			23.4 - C			51.5 - D			
Future No Build	40.4	24.1	48.4	48.4	39.2	20.3	20.3	57.0	67.8	33.5	50.3	64.9	64.9	
	C	C	D	D	D	C	C	E	E	C	D	E	E	
	D	46.5 - D			29.8 - C			42.5 - D			62.0 - E			
Future Build	17.0	37.2	37.2	37.2	6.8	8.0	7.9	11.1	11.2	13.9	12.2	12.1	12.3	
	D	D	D	D	A	A	A	B	B	B	B	B	B	
	B	37.2 - D			7.4 - A			13.1 - B			12.2 - B			

Intersection 6: Baker Lane Area:

Angle and rear-end crashes were observed on the Route 7 mainline between the adjacent commercial driveways on the north side of Route 7. It is recommended to perform access management by constructing right-in/right-out islands and installing flex posts along Route 7. These improvements are presented in Figure 4 and will reduce rear-ends and angle crashes by up to 20%.

Route 7 segment between Intersection 8: Fort Collier Road/Elm Street and Intersection 12: the I-81 Southbound Ramp:

A majority of operational deficiencies along Route 7 in the study area are a result of the poor operations at the intersection with the I-81 southbound ramps. Recommendations were focused on improving safety, increasing turn lane storage where possible to reduce encroachments into the Route 7 mainline, and reducing conflicting movements from side streets. The following options were presented to the SWG but not pursued based on stakeholder feedback:

- Relocating all left-turns from Atwell Avenue and Ross Street to Fort Collier Road/Elm Street via a new extension of Conway Street.
- Extending the eastbound Route 7 left-turn lane at the I-81 Southbound Ramp by removing the median break that allows access to the gas stations and removing the westbound Route 7 left-turn lane at Ross Street.

Table 5. Fort Collier Road to I-81 Southbound Ramp Intersection Operations

Intersection	Scenario	Overall Delay (LOS)	Delay per Lane Group by Approach (sec/veh) (Level of Service)											
			Eastbound			Westbound			Northbound			Southbound		
			LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
8. Route 7 & Fort Collier Road/Elm Street	AM Peak Hour													
	Existing	17.3	17.7	11.2	6.8	11.2	9.6	5.6	57.4	63.3	23.7	54.2	53.7	26.3
		B	B	A	A	B	A	A	E	E	C	D	D	C
		B	11.4 - B			8.6 - A			35.7 - D			48.5 - D		
	Future No Build	21.3	15.1	20.9	20.9	8.1	11.5	1.5	56.3	61.7	61.7	51.0	45.7	45.7
		C	B	C	C	A	B	A	E	E	E	D	D	D
		C	20.6 - C			8.8 - A			61.0 - E			49.5 - D		
	Future Build	26.1	14.8	20.8	20.8	7.6	13.7	16.6	55.8	55.8	68.7	63.9	61.9	61.9
		C	B	C	C	B	C	C	D	E	E	D	D	D
		C	20.5 - C			14.1 - B			66.7 - E			62.9 - E		
	PM Peak Hour													
	Existing	46.9	56.4	42.0	31.6	32.8	17.3	8.3	47.5	61.4	36.3	134.9	141.7	122.3
D		E	D	C	C	B	A	D	E	D	F	F	F	
D		42.8 - D			16.9 - B			46.0 - D			134.6 - F			
Future No Build	22.8	11.0	22.2	22.2	16.1	9.9	1.7	55.6	63.2	63.2	55.0	46.8	46.8	
	C	B	C	C	B	A	A	E	E	E	E	D	D	
	C	21.6 - C			8.8 - A			60.9 - E			52.7 - D			
Future Build	27.3	18.0	29.5	29.5	22.7	6.5	3.8	59.2	69.8	69.8	67.5	66.2	66.2	
	C	B	C	C	D	C	C	D	E	E	D	D	D	
	C	28.8 - C			7.6 - A			66.5 - E			66.9 - E			
9. Route 7 & Atwell Avenue/Pharmhouse Shopping Center	AM Peak Hour													
	Existing	2.0	8.6	1.3	1.1	7.0	2.3	1.8	21.5	N/A	4.8	23.2	18.5	12.3
		A	A	A	A	A	A	A	C	A	C	C	B	A
		A	1.3 - A			2.4 - A			6.1 - A			16.2 - C		
	Future No Build	0.2	11.8	0.0	0.0	9.8	0.0	0.0	12.1	12.1	12.1	18.0	18.0	18.0
		A	B	A	A	A	A	A	B	B	B	C	C	C
		A	0.0 - A			0.1 - A			12.1 - B			18.0 - C		
	Future Build	0.1	11.7	0.0	0.0	N/A	0.0	0.0	N/A	N/A	9.8	N/A	N/A	10.2
		A	B	A	A	A	A	A	A	A	A	N/A	N/A	B
		A	0.0 - A			0.0 - A			9.8 - A			10.2 - B		
	PM Peak Hour													
	Existing	19.7	29.8	21.0	10.4	21.3	3.5	2.9	570.5	N/A	433.4	267.6	57.4	30.4
C		D	C	B	C	A	A	F	F	F	F	F	C	
C		20.6 - C			4.0 - A			451.6 - F			110.9 - F			
Future No Build	0.5	11.4	0.0	0.0	12.3	0.0	0.0	26.5	26.5	26.5	21.8	21.8	21.8	
	A	B	A	A	B	A	A	D	D	D	C	C	C	
	A	0.3 - A			0.3 - A			26.5 - D			21.8 - C			
Future Build	0.2	11.5	0.0	0.0	N/A	0.0	0.0	N/A	N/A	9.6	N/A	N/A	9.9	
	A	B	A	A	A	A	A	N/A	N/A	A	N/A	N/A	A	
	A	0.3 - A			0.0 - A			9.6 - A			9.9 - A			

Table 5. Fort Collier Road to I-81 Southbound Ramp Intersection Operations (Continued)

Intersection	Scenario	Overall Delay (LOS)	Delay per Lane Group by Approach (sec/veh) (Level of Service)											
			Eastbound			Westbound			Northbound			Southbound		
			LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
10. Route 7 & Ross Street/Pharmhouse Shopping Center	AM Peak Hour													
	Existing	5.8	12.3	3.2	0.5	8.0	4.4	2.8	38.8	N/A	6.1	40.8	N/A	9.8
			B	A	A	A	A	A	D	A	D	N/A	A	
	A	3.8 - A			4.4 - A			21.6 - C			32.0 - C			
	Future No Build	9.7	2.5	4.5	4.5	3.9	7.7	7.7	60.1	60.1	59.1	75.6	75.6	59.2
			A	A	A	A	A	A	E	E	E	E	E	E
	A	4.4 - A			7.6 - A			59.6 - E			71.4 - E			
	Future Build	10.7	2.8	4.3	4.3	4.7	9.3	9.3	56.7	56.7	55.8	69.6	69.6	55.9
			A	A	A	A	A	A	D	D	D	E	E	D
	B	4.2 - A			9.2 - A			56.2 - E			66.6 - E			
	PM Peak Hour													
	Existing	33.8	67.9	45.1	20.6	64.1	8.7	5.9	69.4	82.8	61.9	112.4	86.0	22.5
E			D	C	E	A	A	E	F	E	F	F	C	
C	45.4 - D			11.9 - B			63.8 - E			90.0 - F				
Future No Build	8.8	4.0	6.8	6.8	5.0	2.0	2.0	56.3	56.3	55.3	70.1	70.1	55.1	
		A	A	A	A	A	A	E	E	E	E	E	E	
A	6.7 - A			2.2 - A			55.5 - E			66.6 - E				
Future Build	9.7	4.2	6.2	6.2	5.5	4.4	4.4	55.4	55.4	54.2	71.7	71.1	54.0	
		A	A	A	B	A	A	D	D	D	E	E	D	
A	6.1 - A			4.4 - A			54.5 - D			67.5 - E				
AM Peak Hour														
Existing	3.2	11.9	1.5	0.5	9.0	3.9	2.9	21.0	N/A	6.5	24.8	N/A	12.4	
		B	A	A	A	A	A	C	A	C	N/A	B		
A	1.6 - A			3.9 - A			7.1 - A			15.2 - C				
Future No Build	0.6	9.8	0.0	0.0	10.1	0.0	0.0	11.4	11.4	11.4	14.3	14.3	14.3	
		A	A	A	B	A	A	B	B	B	B	B	B	
A	0.1 - A			0.1 - A			11.4 - B			14.3 - B				
Future Build	0.3	N/A	0.0	0.0	N/A	0.0	0.0	N/A	N/A	10.4	N/A	N/A	9.8	
		A	A	A	A	A	A	N/A	N/A	B	N/A	N/A	A	
A	0.0 - A			0.0 - A			10.4 - B			9.8 - A				
PM Peak Hour														
Existing	48.5	44.0	16.4	4.0	226.3	14.7	8.0	1561.4	N/A	1745.6	1224.7	N/A	1354.2	
		E	C	A	F	B	A	F	N/A	F	F	N/A	F	
E	16.1 - C			18.0 - C			1754.0 - F			1337.8 - F				
Future No Build	0.2	10.9	0.0	0.0	0.0	0.0	0.0	12.7	12.7	12.7	12.5	12.5	12.5	
		B	A	A	A	A	A	B	B	B	B	B	B	
A	0.0 - A			0.0 - A			12.7 - B			12.5 - B				
Future Build	0.2	N/A	0.0	0.0	N/A	0.0	0.0	N/A	N/A	10.9	N/A	N/A	9.9	
		A	A	A	A	A	A	N/A	N/A	B	N/A	N/A	A	
A	0.0 - A			0.0 - A			10.9 - B			9.9 - A				

- Extending the westbound Route 7 left-turn lane at Fort Collier Road/Elm Street to improve capacity by reducing back-ups onto westbound Route 7.
- Restricting the minor approach through and left-turn movements at Atwell Avenue onto Route 7 to reduce angle crashes.
- Extending the eastbound Route 7 left-turn lane at Ross Street to improve left-turn lane capacity and reduce back-ups onto Route 7 eastbound.
- Extending the eastbound Route 7 left-turn lane at the I-81 southbound ramp by eliminating only the access between the gas stations to improve left-turn lane capacity and reduce back-ups onto Route 7 eastbound. This will also eliminate the angle crash hot-spot at this access point.
- Extend Conway Street and provide parallel parking to maintain safety and parking capacity.

Overall, the intersections along the Route 7 segment between Fort Collier Road/Elm Street and the I-81 southbound ramp are expected to maintain similar operations when comparing the future No-Build and Build analysis results. Improvements in delay will mostly be realized on minor approaches where vehicles will be required to make a right-in/right-out from unsignalized intersections such as at Atwell Avenue or the gas stations just west of the I-81 interchange. The extended left-turn lane improvements will also provide a much-needed refuge for vehicles to turn without queues extending into the Route 7 mainline where they increase the risk of rear-end crashes.

Through discussions with the SWG, it was determined that some access management improvements along this portion of the corridor could be beneficial. As such, the following improvements are recommended for this segment (also presented in Figures 5-8).

- Changing the signal operation at Fort Collier Road/Elm Street on the side streets from concurrent phasing to split phasing to reduce confusion and conflicting movements.
- Restricting Right Turns on Red at Fort Collier Road/Elm Street and Ross Street to improve pedestrian safety and conflicts with Route 7 through vehicles.
- Reconfiguring the southbound Fort Collier Road approach from a single left-turn lane to one left-turns lane and one thru-left-right lane. This improves capacity on Fort Collier Road.

Intersection 16: Millbrook Drive/Blossom Drive

This location is anticipated to see longer queues by 2030 on Route 7. Accommodating dedicated U-turn areas for the intersection proved to be difficult because of the bifurcated travel lanes, slopes abutting the Route 7 shoulders, and horizontal and vertical curves along Route 7. In addition to increased construction costs, the geometric features makes it challenging to meet minimum sight distance requirements for U-turn areas. Therefore, improvements focused on using the existing roadway network with minimal adjustment and relocating low-volume movements in order to reduce the number of traffic signal phases. The recommended improvement at this intersection focuses on reducing delay on Route 7 by eliminating the westbound Route 7 left-turn lane and relocating the movement, as well as relocating the side street through-movement to the First Woods Drive/Greenwood Road intersection. This concept can be found in Figure 9. Table 6 presents the results of the HCM analysis module for the existing condition, future No-Build, and future Build scenarios for this location.

It is anticipated that the intersection is expected to improve from a LOS D to LOS C in the AM peak hour and from a LOS C to LOS A in the PM peak hour. The LOS for the Route 7 through movements are expected to improve from LOS D to LOS C in the AM peak hour, and LOS C to LOS A in the PM peak hour. Relocating the left and through movements from the minor approaches also has the benefit to reduce crashes by up to 20%.

Table 6. Route 7 and Millbrook Drive/Blossom Drive Intersection Operations

Intersection	Scenario	Overall Delay (LOS)	"Delay per Lane Group by Approach (sec/veh) (Level of Service)"											
			Eastbound			Westbound			Northbound			Southbound		
			LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
16. Route 7 & Millbrook Drive/Blossom Drive	AM Peak Hour													
	Existing	26.9	47.7	20.7	9.6	64.4	29.6	8.6	50.8	43.2	20.9	51.7	48.4	10.1
		D	D	C	A	E	C	A	D	D	C	D	D	B
		D	24.2 - C			29.7 - C			44.1 - D			15.1 - B		
	Future No Build	39.8	60.9	32.0	11.7	42.0	43.1	14.8	62.7	51.6	51.6	51.3	51.3	50.0
		E	C	B	D	D	B	E	D	D	D	D	D	D
		D	35.1 - D			43.1 - D			57.5 - E			50.2 - D		
	Future Build	21.5	47.8	6.2	3.7	N/A	27.5	9.3	51.5	N/A	47.4	48.6	N/A	47.8
		D	D	A	A		C	A	D		D	D		D
		C	13.6 - B			26.8 - C			50.6 - D			47.9 - D		
	PM Peak Hour													
	Existing	17.6	39.8	10.7	7.0	52.7	20.1	8.8	49.3	46.2	8.7	50.3	53.6	15.5
		D	D	B	A	D	C	A	D	D	A	D	D	B
		C	12.9 - B			20.7 - C			37.8 - D			21.9 - C		
Future No Build	20.5	57.6	9.8	8.9	72.6	21.6	11.4	67.9	65.1	65.1	65.9	65.9	64.8	
	E	A	A	E	C	B	E	E	E	E	E	E	E	
	C	13.4 - B			22.5 - C			66.9 - E			65.0 - E			
Future Build	9.0	63.6	2.7	2.9	N/A	3.8	5.6	66.1	N/A	63.8	64.6	N/A	64.0	
	E	A	A		A	A	E		E	E	E		E	
	A	8.4 - A			3.8 - A			65.5 - E			64.1 - E			

Intersection 17: First Woods Drive/Greenwood Road

As with Millbrook Drive/Blossom Drive, First Woods Drive/Greenwood is expected to have increased delay on all approaches when comparing the future No-Build scenario to the existing conditions. Similar to Millbrook Drive/Blossom Drive, accommodating dedicated U-turn areas for the intersection proved to be difficult because of the bifurcated travel lanes, slopes abutting the Route 7 shoulders, and horizontal and vertical curves along Route 7. Therefore, improvements focused on using the existing roadway network with minimal adjustment and relocating low-volume movements in order to reduce the number of traffic signal phases. The recommended improvement at this intersection focuses on improving the capacity of the westbound Route 7 left-turn lane and reducing delay and rear-ends on Route 7 by eliminating the eastbound Route 7 left-turn lane and relocating the movement to Millbrook/Blossom Drive. The concept can be found in Figure 10. Table 7 presents the results of the HCM analysis module for the existing condition, future No-Build, and future Build scenarios for this location.

It is anticipated that the overall intersection delay will decrease from 46.4 seconds/vehicle (LOS D) to 33.0 seconds/vehicle (LOS C) in the AM peak hour and 45.2 seconds/vehicle (LOS D) to 36.8 seconds/vehicles (LOS D), in the PM peak hour as a result of the recommended improvement. The LOS for the westbound Route 7 through movement is also expected to improve from LOS D to B in the AM peak hour, and LOS D to C in the PM peak hour. Relocating the noted movements and increasing storage capacity also has the benefit to potentially reduce crashes by up to 20%.

Table 7. Route 7 and First Woods Drive/Greenwood Road Intersection Operations

Intersection	Scenario	Overall Delay (LOS)	"Delay per Lane Group by Approach (sec/veh) (Level of Service)"											
			Eastbound			Westbound			Northbound			Southbound		
			LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
17. Route 7 & Greenwood Road/First Wood Drive	AM Peak Hour													
	Existing	35.1	68.7	29.3	14.9	69.0	18.7	6.7	53.6	57.9	49.1	54.5	53.9	7.5
		E	C	B	E	B	A	D	E	D	D	D	D	A
		D	31.9 - C			24.2 - C			56.1 - E			43.8 - D		
	Future No Build	46.4	65.4	45.0	21.9	60.8	35.1	22.3	75.6	75.6	75.6	71.6	71.6	46.2
		E	D	C	E	D	C	E	E	E	E	E	E	D
		D	45.6 - D			35.9 - D			75.6 - E			66.3 - E		
	Future Build	33.0	N/A	31.5	16.9	61.6	15.9	11.0	70.0	70.0	70.0	68.1	68.1	45.9
		D		C	B	E	B	B	E	E	E	E	E	D
		C	31.0 - C			18.7 - B			70.0 - E			63.5 - E		
	PM Peak Hour													
	Existing	29.4	65.4	27.0	11.4	69.0	18.7	6.7	63.9	61.6	43.3	68.5	68.4	11.2
		E	C	B	E	B	A	E	E	D	E	E	B	
		C	26.6 - C			24.2 - C			53.2 - D			61.1 - D		
Future No Build	45.2	69.3	41.7	26.1	79.7	41.3	19.8	61.0	61.0	61.0	66.3	66.3	57.2	
	E	D	C	E	D	B	E	E	E	E	E	E	E	
	D	40.8 - D			44.6 - D			61.0 - E			65.1 - E			
Future Build	36.8	N/A	39.1	24.8	76.9	20.3	11.1	77.6	77.6	77.6	77.3	77.3	57.9	
	D		D	C	E	C	B	E	E	E	E	E	E	
	D	37.8 - D			26.6 - C			77.6 - E			75.0 - E			

Figure 3. Route 7 & Pleasant Valley Road Roundabout

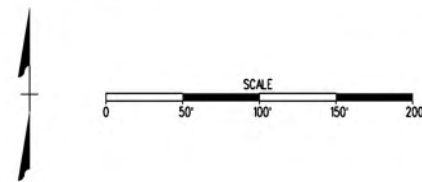


Route 7 & Pleasant Valley Road Roundabout Winchester, VA

Project Location

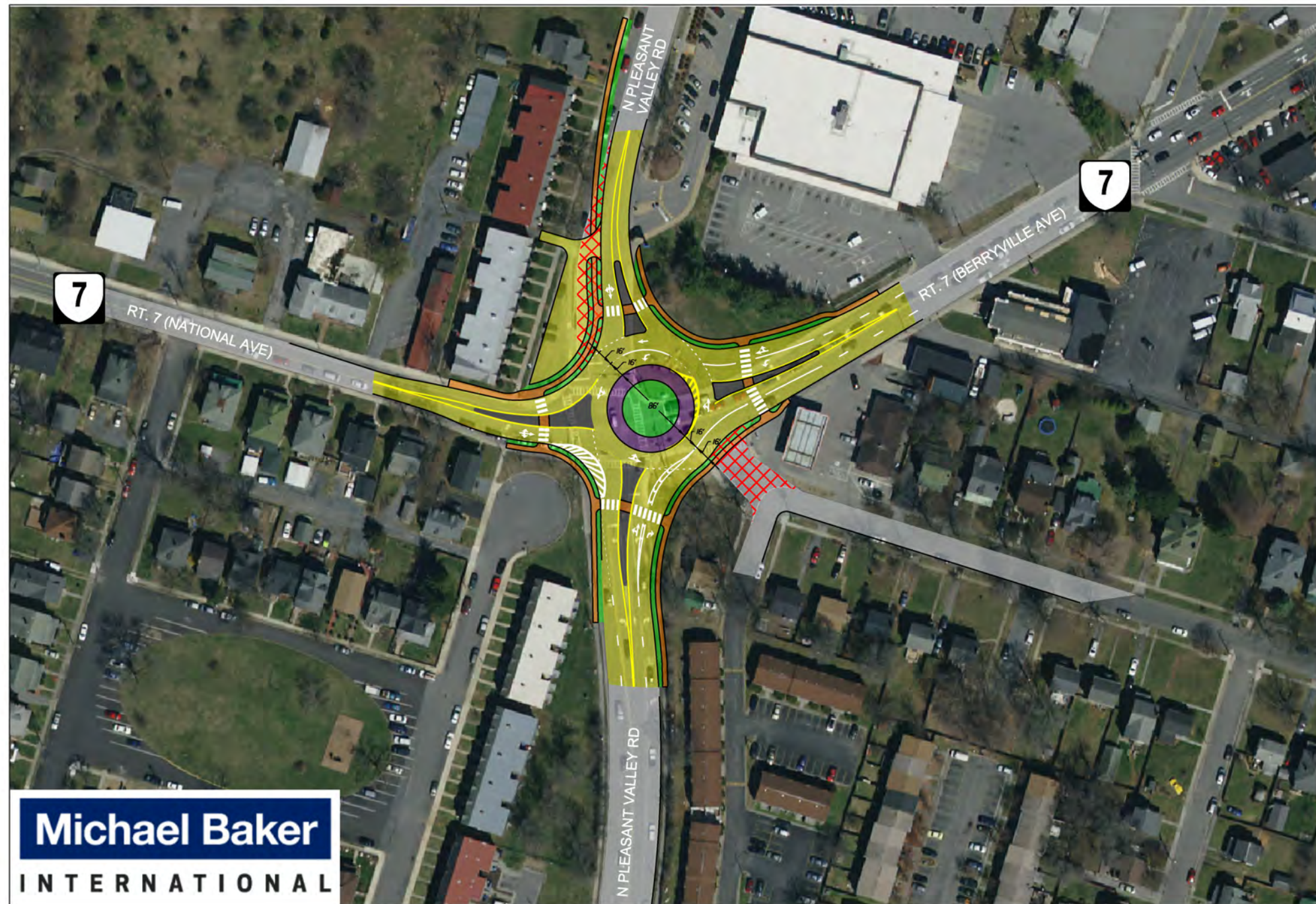


North Arrow & Scale



Legend

EXISTING PAVEMENT	PROPOSED PAVEMENT
TRUCK APRON	PROPOSED RAISED MEDIAN
PEDESTRIAN FACILITY	GRASS / VEGETATION
DEMOLISH EXISTING PAVEMENT	PROPOSED PAVEMENT MARKINGS



VDOT SmartScale
City of Winchester, Virginia
November 23, 2020

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Figure 4. Baker Lane



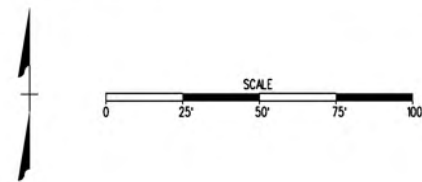
Baker Lane

City of Winchester: Route 7 STARS Improvements

Project Location



North Arrow & Scale



Legend

EXISTING PAVEMENT	PROPOSED PAVEMENT
EXISTING PAVEMENT MARKING	PROPOSED MEDIAN
PROPOSED PAVEMENT MARKING	PAVEMENT DEMOLITION



VDOT SmartScale

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Figure 5. Fort Collier Road Exhibit



VDOT Virginia Department of Transportation

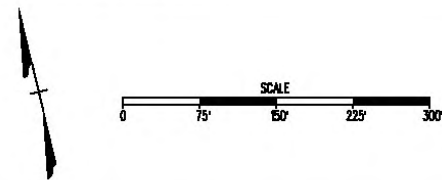
Fort Collier Road Exhibit

STARS Route 7 Improvements

Project Location



North Arrow & Scale



Legend

- EXISTING PAVEMENT
- PROPOSED PAVEMENT
- PEDESTRIAN FACILITY
- PROPOSED RAISED MEDIAN
- GRASS / VEGETATION
- PROPOSED PAVEMENT MARKINGS

VDOT SmartScale
City of Winchester, Virginia
October 27, 2020

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Michael Baker
INTERNATIONAL

Figure 6. Fort Collier Road

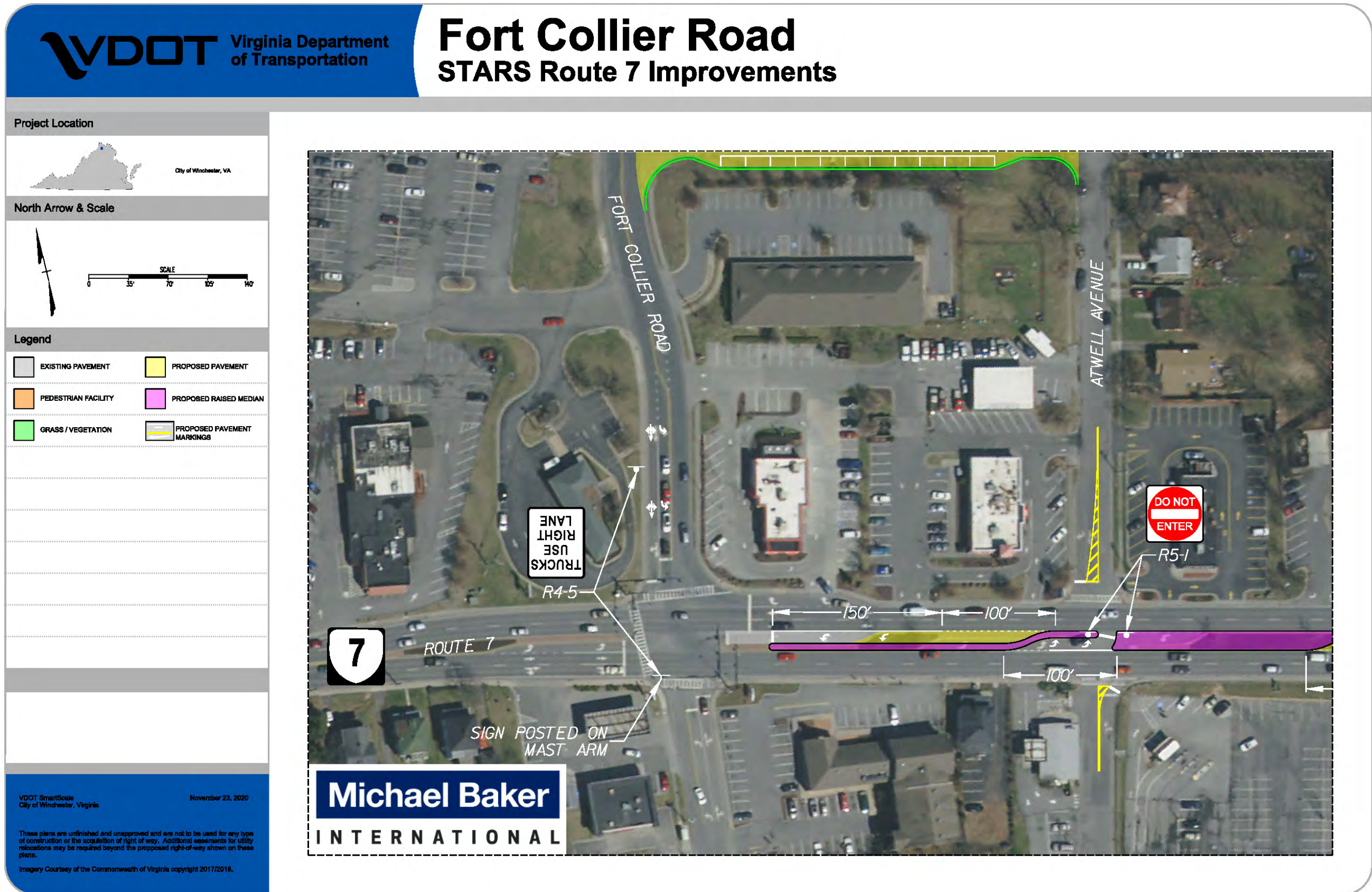


Figure 7. Conway Street Extension

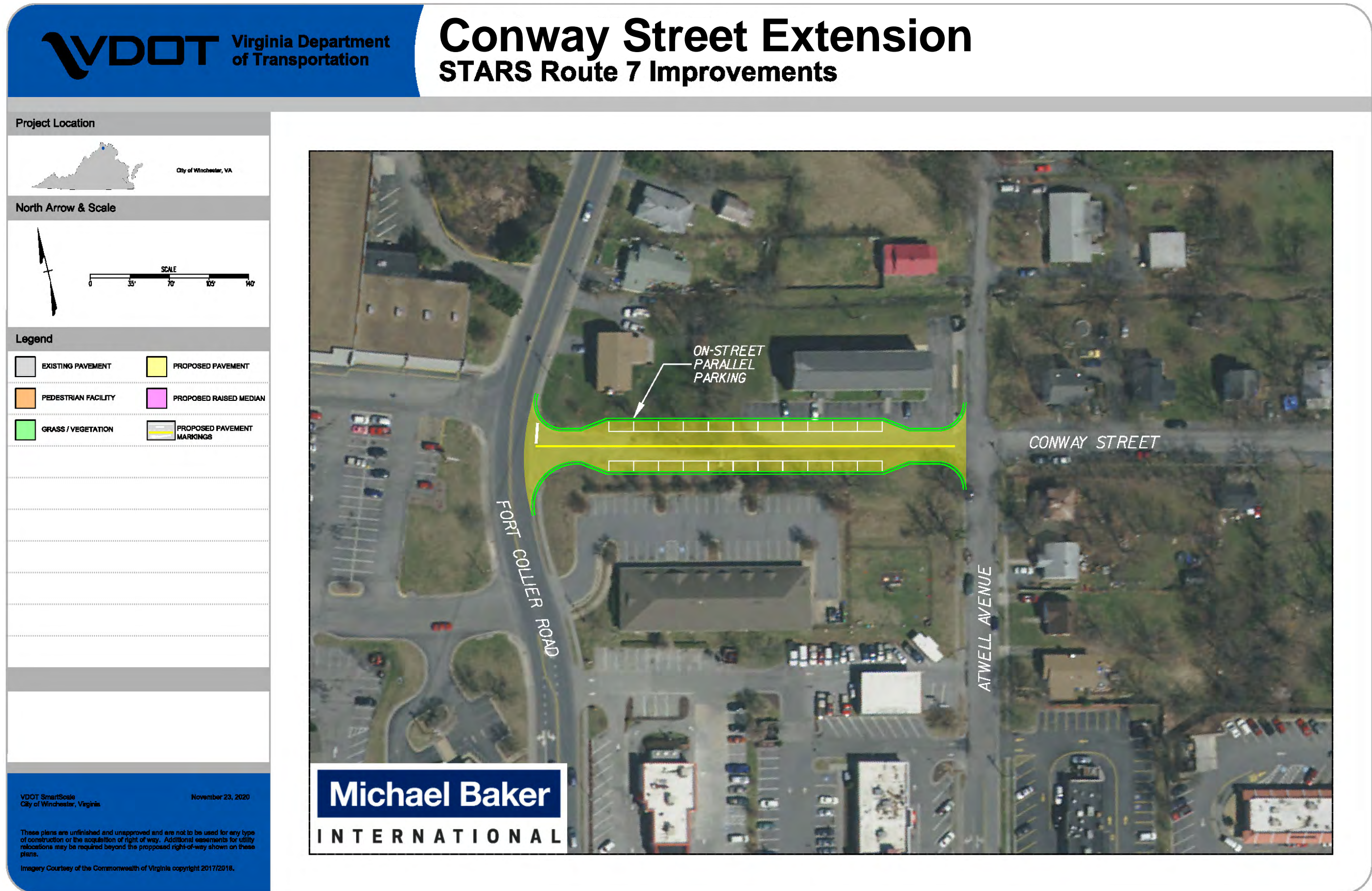


Figure 8. Ross Street



Figure 9. Millbrook Drive Lane



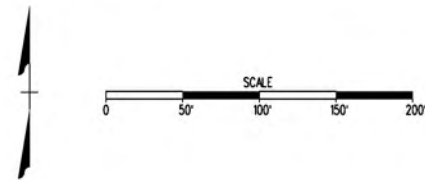
Milbrook Drive Lane

Frederick County: Route 7 STARS Improvements

Project Location



North Arrow & Scale



Legend

EXISTING PAVEMENT	PROPOSED PAVEMENT
EXISTING PAVEMENT MARKING	PROPOSED MEDIAN
PROPOSED PAVEMENT MARKING	PAVEMENT DEMOLITION



VDOT SmartScale

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Figure 10. First Woods Drive



4. EXPECTED SAFETY IMPROVEMENT

The crash modification factors (CMF) from Clearinghouse and SMART SCALE were used to evaluate the safety performance of each improvement. Table 8 summarizes the CMF used.

Table 8. Crash Modification Factors

Treatment	Crash Modification Factor Range
Roundabout	0.60
Access Management	0.40 to 0.70
Extended Turn Lane	0.97
Improved Signal Timing	0.91
Displaced Left-turn	0.80

The CMFs were applied to the intersection total crashes. Table 9 summarizes the expected range of crash reduction.

Table 9. Crash Analysis

Intersection	Total Crashes	Applied CMF Range	Estimated Crash Reduction
RT 7/North Pleasant Valley Rd	34	0.60	14
RT 7/Baker Lane	26	0.40-0.70	8 - 16
RT 7/Elm St/Fort Collier Rd	17	0.91-0.97	1 - 2
RT 7/Atwell Ave	8	0.40-0.70	2 - 5
RT 7/Ross St	34	0.97	2
RT 7/Median Opening	17	0.40-0.70	5 - 10
RT 7/I-81 South Off ramp	25	0.97	2
RT 7/Millbrook Drive/Blossom Rd	15	0.8	3
RT 7/Greenwood Rd/First Woods Dr	24	0.8-0.97	1 - 4

This crash reductions presented in Table 9 are estimated based on available data and may take two to three years following project completion to fully realize the benefits. Therefore, when assessing improvements post-project completion, especially at innovative intersections, there will be a learning period for drivers to become familiar with the new traffic patterns.

5. CONCEPTUAL DESIGNS AND COSTS

Conceptual designs and construction estimates were developed for each preferred improvement. The conceptual designs are shown in Figure 3 through Figure 11. Table 10 presents a summary of the construction costs for the improvements. Detailed cost estimates are included in Appendix C.

All concepts were designed using guidelines and standards from the following documents:

- VDOT Road Design Manual
- VDOT Road and Bridge Standards
- Manual on Uniform Traffic Control Devices
- 2011 Virginia Supplement to the MUTCD
- AASHTO 2011: A Policy of Geometric Design on Highways and Streets
- NCHRP Report 672: Roundabouts – An Informational Guide

Where applicable, Auto-Turn analyses were conducted to confirm acceptable turning radii for heavy vehicles and school buses.

All cost estimates were developed assuming 2021 dollars and using the VDOT Statewide Planning Tool (SPLCE) and district and statewide averages. All estimates include a 20% contingency for unaccounted items, 25% construction contingency, 5% contract contingency, and 20% for construction engineering and inspection (CEI). Preliminary engineering estimates were developed using the following scale which includes a 10% contingency:

- **Construction Cost < \$2.4M:** Not to Exceed \$600K
- **\$2.4M < Construction Cost < \$5M:** 25% of Construction Cost
- **\$5M < Construction Cost < \$8M:** 20% of Construction Cost
- **Construction Cost > \$8M:** 15% of Construction Cost

No right-of-way costs are anticipated except for the Conway Street Extension and N Pleasant Valley Roundabout. The VDOT R/W estimate process and VDOT R/W estimating worksheet were used to estimate right-of-way and utility costs for these improvements.

Table 10 summarizes the anticipated costs associated with each proposed improvement.

Table 10. Cost Estimate Summary

Intersection Number	Location	Recommendation	Estimated Construction Cost	Estimated R/W Cost	Estimated Preliminary Engineering Cost	Total Estimated Cost
1	Pleasant Valley Road and Route 7	Roundabout	\$4,485,000	\$551,400	\$1,121,250	\$6,157,650
6	Baker Lane and Route 7	Access Management	\$200,000	-	\$100,000	\$300,000
8-11	Fort Collier Road to Atwell Ave Route 7 Segment	Turn Lane extension and Access Management	\$636,000	-	\$318,000	\$954,000
10	Ross Street and Route 7	Turn Lane extension	\$462,000		\$231,000	\$693,000
12	I-81 SB Ramp and Route 7	Turn Lane extension and Access Management	\$337,000	-	\$168,500	\$505,500
-	Conway Street Extension	Access Improvement	\$1,783,000	\$379,800	\$891,500	\$3,054,300
16	Millbrook Drive and Route 7	Thru Cut	\$200,000	-	\$100,000	\$300,000
17	First Woods Drive and Route 7	Turn Lane Extension and Turn Relocation	\$260,000	-	\$130,000	\$390,000

6. PUBLIC SURVEY RESULTS

A public MetroQuest survey was conducted to obtain public feedback for the Route 7 STARS (Berryville Avenue/Berryville Pike) recommendations. The survey collected public input from May 14, 2021 to May 31, 2021. During this period, 1,879 participants completed the survey, with 85% of the participants (1,602 people) accessing the survey via Facebook. Fifty-six percent of participants lived within five miles of the study area, 23% worked within five miles of the study area, 12% both lived and worked within five miles of the study area, and 10% did not live or work within five miles of the study area.

6.1 Scoring and Comments of Draft Improvements

The MetroQuest survey asked participants to give a 1-to-5-star rating for the draft improvements, with 1 being the least favorable and 5 being the most favorable opinion. The average ratings and general comments are presented in the following discussion.

Intersection 1: N Pleasant Valley Road:

The Pleasant Valley Road concept received an average rating of 3.2 out of 5. Participants were divided on the concept, with 525 participants rating it five stars and 432 participants rating it one star. There were 110 comments submitted on this concept. Almost half of these comments were in opposition to roundabouts, which commenters felt were too confusing and dangerous for drivers in the area. A few positive comments noted a roundabout could be effective. Other commenter concerns regarded closing National Avenue.

It is important to note that the recommended roundabout at this location is a hybrid-style roundabout with only one true circulating lane as opposed to multiple circulating lanes. This hybrid roundabout concept will reduce driver confusion and reduce vehicle conflict points while increasing safety. Additionally, National Avenue will be closed due to access management requirements for a roundabout.

Near Baker Lane

The Baker Lane area concept received an average rating of 3.1 out of 5. The most common rating was three stars. There were 40 comments submitted on this concept. Some commenters believed that concrete islands would be beneficial by restricting turns. Other commenters believed this would not solve an existing issue, with some specifying a concern for the passage of emergency vehicles.

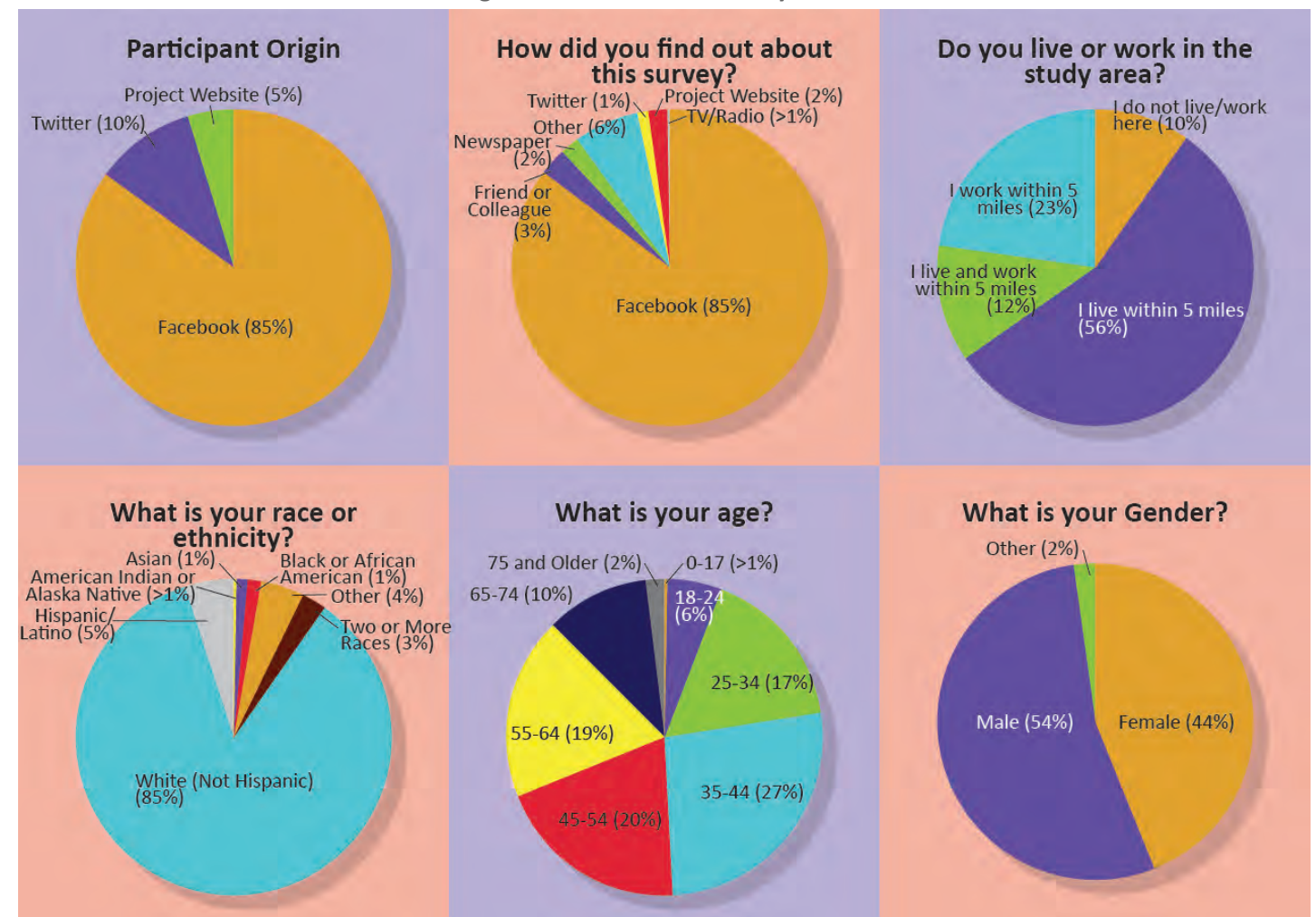
Concrete islands are effective at restricting movements and provide refuge for pedestrians. These islands can also be constructed with mountable curbing to permit emergency vehicle ingress/egress.

Fort Collier Road Area

The Fort Collier Road Area concept received an average rating of 3.9 out of 5 and was the highest-rated concept. The most common rating was five stars. There were 24 comments submitted on this concept. These comments did not express a consensus and instead offered specific, participant-held ideas for improving the area. A few commenters noted signal timing as a solution, other commenters reiterated that they did not want to see any turn lanes removed, and additional commenters noted potential difficulties for truck traffic.

The proposed improvements will improve the turning radius for all vehicle types. Restricting movements at Atwell Ave will also reduce the likelihood of an angle crash and improve traffic flow along the corridor.

Figure 11. MetroQuest Survey Results



Ross Street: The Ross Street concept received an average score of 3.9 out of 5 and was the second highest-rated concept. The most common rating was five stars. There were 36 comments submitted on this concept. Many commenters agreed that removing the two-way median left turn lane would solve congestion issues. Many commenters expressed the need for a continuous right turn lane on westbound Route 7, while some commenters noted disagreement in closing the median access to the gas stations.

Although a right-turn lane would be beneficial, the available land and topography found the solution too costly for the benefit. Additionally, closing the median access to the gas stations targeted a primary safety hot spot on the corridor.

Conway Street: The Conway Street concept received an average score of 3.6 out of 5 and was the third highest-rated concept. The most common rating was five stars. There were 21 comments submitted on this concept. Many commenters expressed support for this concept, including a self-identified bus driver who stated this.

Intersection 16: Millbrook Drive/Blossom Drive

The Millbrook Drive concept received an average rating of 3.1 out of 5. The most common rating was three stars. There were 62 comments submitted on this concept. Several commenters believed the left-turn lane should be preserved or extended while other commenters expressed a desire for a traffic signal.

The current intersection is signalized and is proposed to remain signalized in the future.

Intersection 17: First Woods Drive/Greenwood Road

The First Woods Drive concept received an average rating of 3.5 out of 5. The most common rating was five stars. There were 68 comments submitted on this concept. Many commenters supported the extension of the westbound left-turn lane, while others expressed the desire to preserve or extend the eastbound left-turn lane.

The left-turn lane at the intersection of Millbrook Drive and Route 7 is under capacity. Relocating left-turning vehicles to the Millbrook Drive intersection will help traffic move more efficiently and more safely through the First Woods Drive and Route 7 intersection. This improvement will also reduce stop-and-go traffic that results in rear-end crashes.

6.2 General Comments

Participants left 202 general comments at the end of the MetroQuest survey. Most of these comments reiterated comments on specific improvements. The most common areas of concern were:

- The need to preserve or increase number of lanes
- The need to retune traffic signals
- The need to complete improvements along VA 37

7. POSSIBLE FUNDING SOURCES

Implementation of the recommended improvements will require funding sources. The VDOT SMART SCALE Program is a process which invests in projects that meet the most critical transportation needs in the state. Projects are evaluated based on improvements in certain categories such as congestion and safety. At the corridor level, more specific strategies and operational improvements can be assessed in studies and implemented using a variety of funding sources, including Federal funding streams such as the Surface Transportation Program (STP), National Highway System (NHS) funds, and the Congestion Mitigation and Air Quality Improvement (CMAQ) Program, Revenue Sharing, Highway Safety Improvement Program (HSIP), as well as through state or local funding or other discretionary funding sources. The Northern Shenandoah Valley Regional Commission did submit a Fiscal Year 2022 SMART SCALE application for the Route 7 improvements at Millbrook Drive/Blossom Drive and First Woods Drive / Greenwood Road recommendations. The recommendations were selected to be funded and is anticipated to begin by August 2028 and be completed by September 2029.

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APPENDIX A. STARS ROUTE 7 CORRIDOR EXISTING CONDITIONS REPORT



ROUTE 7 (BERRYVILLE AVENUE/BERRYVILLE PIKE) CORRIDOR STUDY

EXISTING CONDITIONS AND FUTURE VOLUMES REPORT





Route 7 (Berryville Avenue/Berryville Pike) Corridor Study

From Pleasant Valley Road to Greenwood Drive/First Woods Drive
Existing Conditions and Future Volumes Report

August 2, 2019

Prepared for



Prepared by



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1 INTRODUCTION

1.1 Background

The Virginia Department of Transportation (VDOT) Transportation Mobility and Planning Division (TMPD), VDOT Staunton District Office, City of Winchester and Frederick County identified the need to study safety and operational challenges along the Route 7 corridor, also known as Berryville Avenue/Berryville Pike in the Winchester area. Currently, Route 7 is a critical east-west corridor in the City of Winchester and Frederick County, which functions as an important route for access to retail centers, schools, commercial centers, and residential neighborhoods along the corridor. Significant congestion, high number of crashes and access management issues are noted along this corridor. Between I-81 Southbound Ramp and Regency Lake Drive, Route 7 is characterized by severe/chronic congestion lasting over two hours per day. The corridor includes one Potential for Safety Improvements (PSI) intersection and six PSI segments. This STARS corridor study focuses on evaluating the Route 7 corridor between Pleasant Valley Road and Greenwood Road (Route 656)/First Wood Drive, assessing measures to reduce congestion, and recommending possible spot improvements to address congestion, safety and access management issues.

The year 2017 daily traffic volume along this corridor were 25,000 vehicles per day (veh/day) west of Ross Street, 35,000 veh/day between Ross Street and I-81 Southbound Ramp, and 27,000 vehicles per day (veh/day) east of the I-81 Southbound Ramp.

1.2 Purpose of Study

The primary goal of this study is to determine and assess measures to reduce congestion, recommend possible adjustments to signal phasing and/or spot improvements to alleviate congestion and address safety as well as access management issues. This study is intended to develop short-term and long-term improvement projects, with a goal of identifying improvements that can be programmed into the VDOT Six-Year Improvement Program (SYIP).

The *operational* issues intended to be addressed by this study include existing and future projected congestion within the corridor. This congestion is centered at the major intersections within the corridor, which are currently heavily utilized by passenger cars and some truck traffic. Reduction in intersection delays would mitigate congestion, improve mobility and reduce travel time.

This study also intends to address existing and future *safety* concerns within the study corridor. During the recent five-year period (2013-2018), 544 crashes resulting in 1 death and 99 injuries were reported within this corridor. The types of crashes frequently reported include rear-end, and angle. These crash types are typically associated with recurring congestion for a corridor.

Route 7 (Berryville Avenue/Berryville Pike) serves a mix of commercial, retail and residential uses. This study also intends to address *access* deficiencies within the limits of the study corridor by identifying and documenting driveway locations and their spacing, with the objective of recommending access management improvements in the context of the *VDOT Access Management Standards for Entrances and Intersections*.

1.3 Study Work Group

The Study Work Group (SWG) includes local stakeholders, who provide local and institutional knowledge of the corridor, review study goals and methodologies, provide input on key assumptions, and review and approve proposed improvement concepts developed through the study process. The key members included in the SWG represent the following Agencies:

- § VDOT Staunton District Office and TMPD
- § Frederick County
- § WinFred Metropolitan Planning Organization Project Steering Committee
- § City of Winchester
- § WSP Team

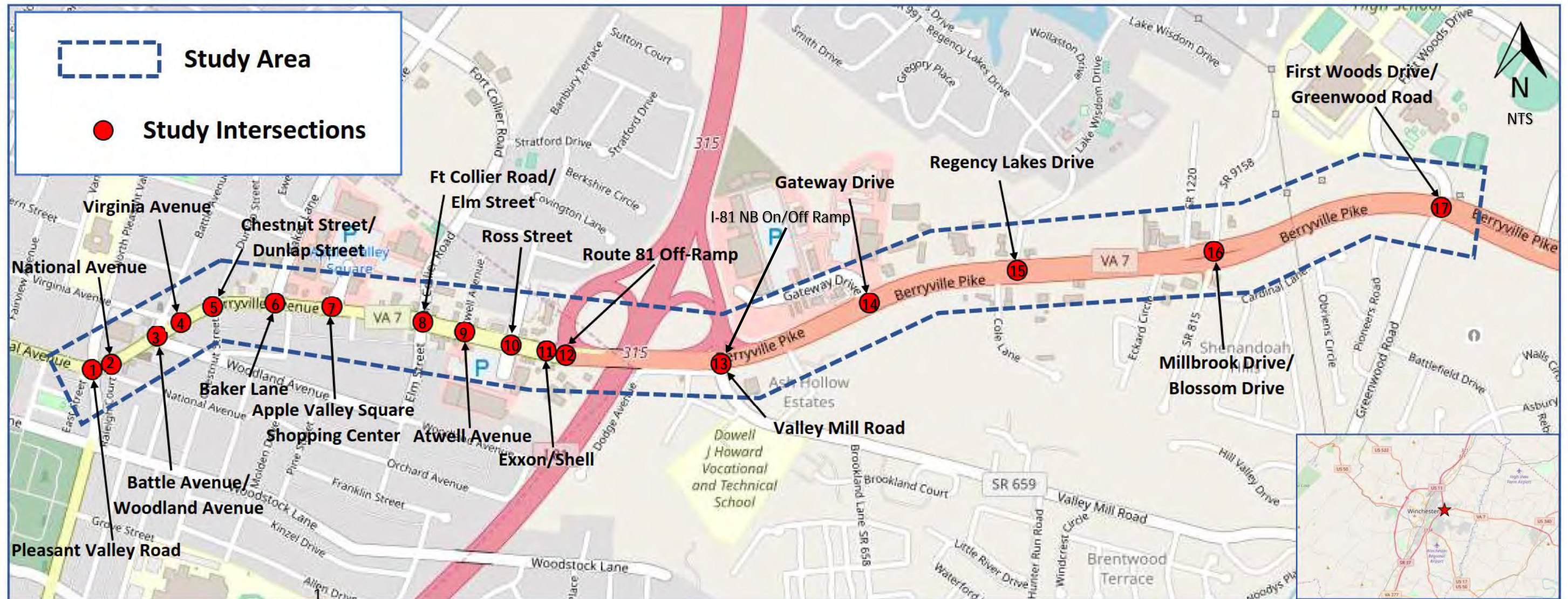
1.4 Study Area

Route 7 (Berryville Avenue/Berryville Pike) is in the City of Winchester within Frederick County, Virginia. The east-west study corridor of Route 7 (Berryville Avenue/Berryville Pike) is approximately 2.3 miles in length and includes seventeen (17) study intersections. These study intersections are listed below and shown in Figure 1.

Study Area Intersections

1. Route 7 at Pleasant Valley Road
2. Route 7 at National Avenue
3. Route 7 at Battle Avenue/Woodland Avenue
4. Route 7 at Virginia Avenue
5. Route 7 at Dunlap Street/Chestnut Street
6. Route 7 at Baker Lane
7. Route 7 at Apple Valley Marketplace
8. Route 7 at Fort Collier Road/Elm Street
9. Route 7 at Atwell Avenue
10. Route 7 at Ross Street
11. Route 7 at Median opening at Exxon/Shell
12. Route 7 at I-81 Southbound Ramp
13. Route 7 at I-81 Northbound Ramp/Valley Mill Road
14. Route 7 at Winchester Gateway
15. Route 7 at Regency Lakes Drive
16. Route 7 at Millbrook Drive/Blossom Road
17. Route 7 at First Woods Drive/Greenwood Road (Route 656)

Figure 1. Study Area Map



2 EXISTING CONDITIONS

2.1 Existing Zoning

A review of existing zoning and future land use plans was conducted for the areas adjacent to the Route 7 corridor. The existing zoning classification includes a range of zones including primarily, B-2 (General Business District), MR (Medium Density Residential District), RP (Residential Performance District); and to a lower extent, B-3 (Industrial Transition District), M-1 (Light Industrial District), MH-1 (Mobile Home Community), and HR-1 (Limited High Density Residential District).

2.2 Existing Roadway Network

An inventory of the existing roadway condition was prepared along Route 7 (Berryville Avenue/Berryville Pike) based on field reviews. Traffic, crash and Geographic Information System (GIS) data was used to document existing conditions. During the field review, the following data was collected and documented:

- § Digital photographs, videos, and observation to capture:
 - Roadway geometry to include lane configuration, lane/shoulder widths
 - Signs and pavement markings
 - Posted speed limits
 - Sight distance issues
 - Safety concerns
 - Existing driveway locations, their spacing and potential impact on crashes
 - Observation of traffic operations (traffic mix, congestion, driver behavior)
 - Inventory of existing roadway conditions to determine potential for safety improvements
 - Inventory of intersection operations (signal phasing, queuing)

The study corridor includes twelve (12) signalized and five (5) unsignalized intersections as discussed in Sections 2.2.1 through 2.2.18 below:

2.2.1 Route 7 (Berryville Avenue/Berryville Pike) Corridor

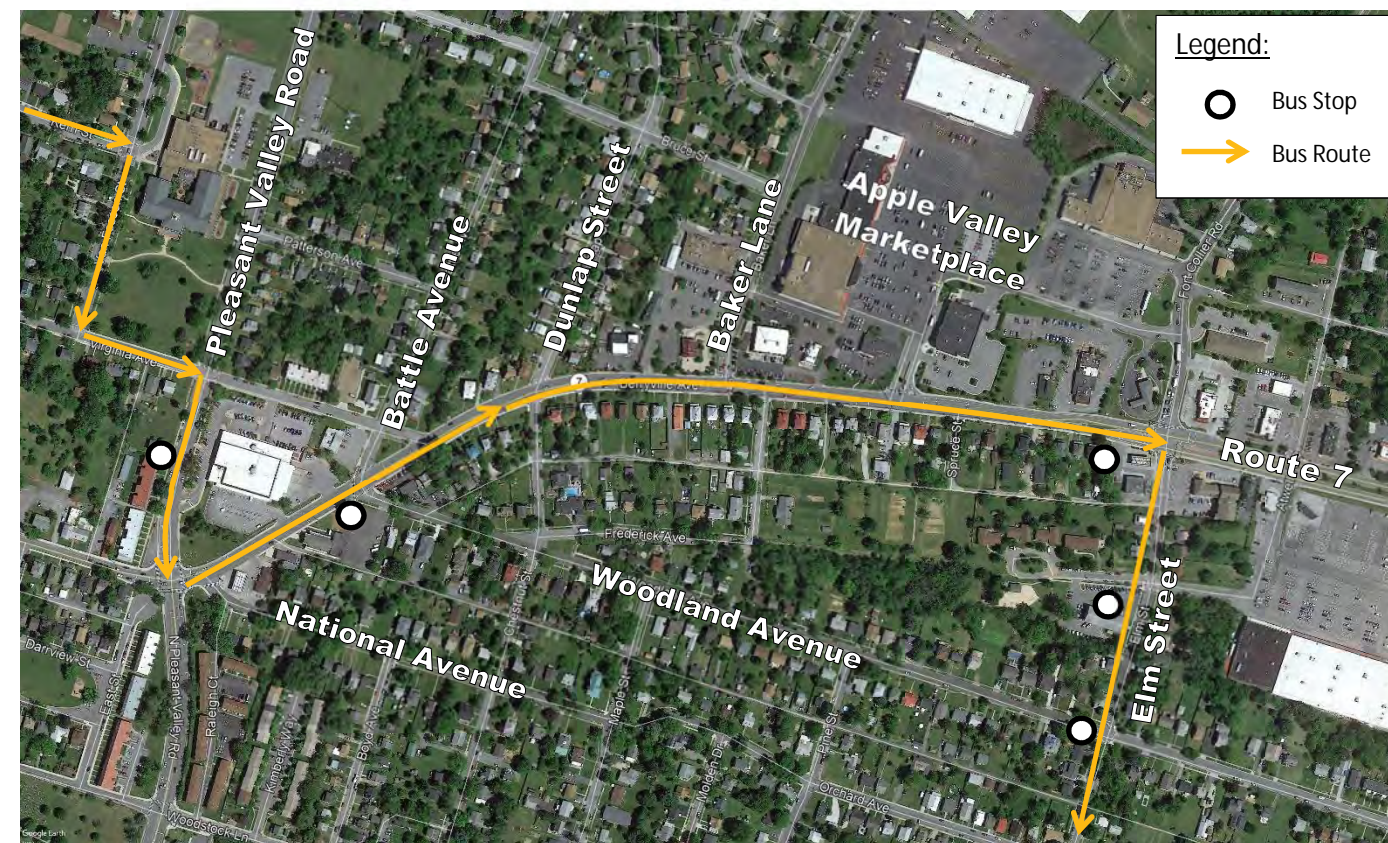
Route 7 (Berryville Avenue/Berryville Pike) between Pleasant Valley Road and Greenwood Road/First Woods Drive is classified as Other Principal Arterial per the *VDOT Functional Classification*. Within the study area, Route 7 is a 4-lane divided roadway. The posted speed limit is 25 mph west of Pleasant Valley Road, transitions to 35 mph west of Winchester Gateway, and to 45 miles per hour along the corridor east of Winchester Gateway.

Pedestrian facilities such as sidewalks, pedestrian crossing signals with ADA ramps are currently present west of the I-81 Southbound Ramps along the corridor in the City of Winchester. The sidewalk present west of the I-81 Southbound Ramps in the City of Winchester does not meet the standards for minimum clear zone. No pedestrian facilities (crosswalks, pedestrian signals) are currently present east of the I-81 Southbound Ramps along the corridor. A shared use path is present between Valley Mill Road and Martin Drive south of Route 7. There is no connectivity for the shared use path on Route 7. No designated bike facilities are present within the study corridor.

The Winchester Public Transit System (WinTran) 'Berryville Avenue' route operates along Berryville Avenue in the study area. The eastbound Berryville Avenue Route begins west of the study area in Old Town Winchester, with intermediate stops within the study area at Woodland Avenue, Apple Valley Marketplace and Elm Street. The route

and stops that are located within the study area are shown in Figure 2. The 'Berryville Avenue' transit route, schedule, and passenger data are included in the Appendix.

Figure 2. Winchester Transit 'Berryville Avenue' Route and Bus Stop Locations



Information regarding the total number of passenger for Berryville Avenue route was provided by City of Winchester and are summarized in Table 1.

Table 1. Route 7 Bus Stop – Annual Total Passenger Data (July 1, 2016 - March 28, 2019)

Stop Name	Bus Shelter	Total Passengers		
		FY17	FY18	FY19
BERRYVILLE AVE @ WOODLAND AVE	No	279	149	39
BERRYVILLE AVE @ ELM ST	No	2,062	1,324	307

2.2.2 Intersection 1: Route 7 at Pleasant Valley Road

The northbound approach of Pleasant Valley Road is classified as Minor Arterial per the *VDOT Functional Classification*. The intersection of Route 7 at Pleasant Valley Road is a 4-leg signalized intersection. The posted speed limit along Pleasant Valley Road is 25 mph north of Route 7 and 40mph south of Route 7. The northbound approach of Pleasant Valley Road has one left-turn lane, one through lane, and one right-turn lane. The southbound approach has one left-turn lane, and one shared thru-right lane. The eastbound approach of Route 7 has one left-turn lane, and one shared thru-right lane. The westbound approach of Route 7 has one left-turn lane, and one shared thru-right lane. The signal operations include protected-permissive left turns for all approaches and an overlap phase for northbound right turn. The intersection operates as an adaptive system. Pedestrian facilities (crosswalks, pedestrian signals) are currently present on all the approaches at this intersection. Figure 3 shows an aerial of the intersection.

Figure 3: Route 7 at Pleasant Valley Road



Source: Google Imagery

2.2.3 Intersection 2: Route 7 at National Avenue

The intersection of Route 7 at National Avenue is currently a 3-leg unsignalized intersection. The northbound approach of National Avenue is stop-controlled, while the eastbound and westbound approaches of Route 7 are free-flow. The speed limit along National Avenue is 25mph. The northbound approach of National Avenue has one shared left-thru-right lane. The eastbound approach of Route 7 has one through lane and one shared thru-right lane. The westbound approach has one shared left-thru lane and one through lane. Pedestrian facilities (crosswalks) is currently present on the northbound approach at this intersection. Figure 4 shows an aerial of the intersection.

Figure 4: Route 7 at National Avenue



Source: Google Imagery

2.2.4 Intersection 3: Route 7 at Battle Avenue/Woodland Avenue

The intersection of Route 7 at Battle Avenue/ Woodland Avenue is a 4-leg signalized intersection. The posted speed limit along Battle Avenue and Woodland Avenue is 25mph. The northbound approach of Woodland Avenue has one shared left-thru-right lane. The southbound approach of Battle Avenue has one shared left-thru-right lane. The eastbound approach of Route 7 has one shared left-thru lane and one shared thru-right lane. The westbound approach of Route 7 has one shared left-thru lane and one through lane. The westbound right turns are prohibited onto Battle Avenue from Route 7. The signal operations include permissive left turn for all approaches. The intersection is controlled by adaptive system technology. Pedestrian facilities (crosswalks, pedestrian signals) are currently present on the eastbound, northbound and southbound approaches at this intersection. Figure 4 shows an aerial of the intersection.

Figure 5: Route 7 at Battle Avenue/Woodland Avenue



Source: Google Imagery

2.2.5 Intersection 4: Route 7 at Virginia Avenue

The intersection of Route 7 at Virginia Avenue is a 3-leg unsignalized intersection. The posted speed limit along Virginia Avenue is 25mph. The southbound approach of Virginia Avenue is one-way northbound, while the eastbound and westbound approaches of Route 7 are free-flow. The southbound approach of Virginia Avenue has one receiving lane and is one-way northbound. The eastbound approach of Route 7 has one shared left-thru lane and one through lane. The westbound approach has one through lane and one shared thru-right lane. Pedestrian facility (crosswalks) is currently provided only on the Virginia Avenue at this intersection. Figure 6 shows an aerial of the intersection.

Figure 6: Route 7 at Virginia Avenue

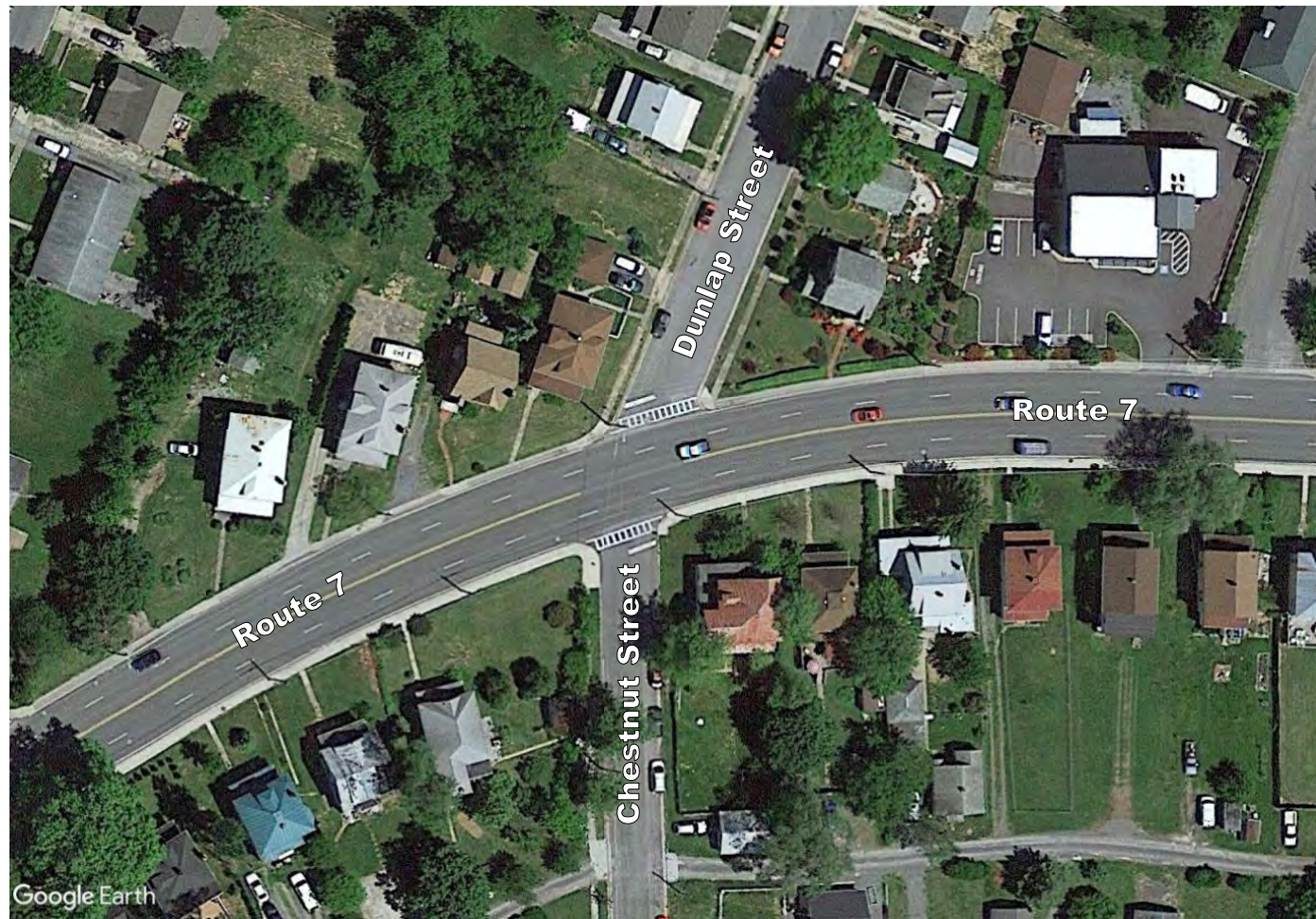


Source: Google Imagery

2.2.6 Intersection 5: Route 7 at Dunlap Street/Chestnut Street

The intersection of Route 7 at Dunlap Street/Chestnut Street is currently a 4-leg unsignalized intersection. There is no posted speed limit along the northbound approach of Chestnut Street or the southbound approach of Dunlap Street. The northbound approach of Chestnut Street and southbound approach of Dunlap Street are stop-controlled, while the eastbound and westbound approaches of Route 7 are free-flow. The northbound approach of Chestnut Street has one shared left-thru-right lane. The southbound approach of Dunlap Street has one shared left-thru-right lane. The eastbound approach of Route 7 has one shared left-thru lane and one shared thru-right lane. The westbound approach of Route 7 has one shared left-thru lane and one shared thru-right lane. Pedestrian facilities (crosswalks) are currently provided for the southbound and northbound approaches at this intersection. Figure 7 shows an aerial of the intersection.

Figure 7: Route 7 at Dunlap Street/Chestnut Street

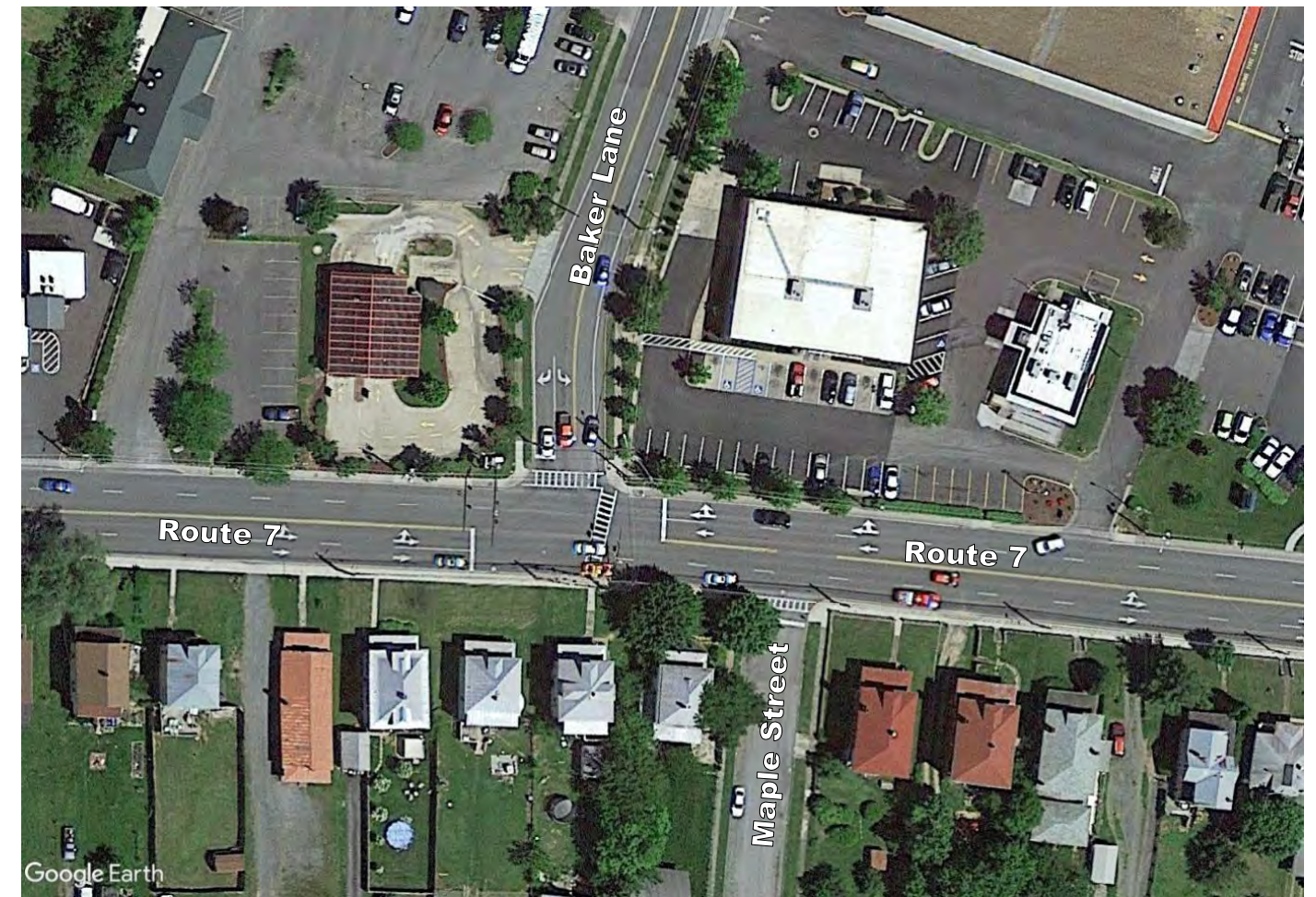


Source: Google Imagery

2.2.7 Intersection 6: Route 7 at Baker Lane

The intersection of Route 7 at Baker Lane is a 3-leg signalized intersection. The posted speed limit for the southbound approach along Baker Lane is 25mph. The southbound approach of Baker Lane has one left-turn lane and one right-turn lane. The eastbound approach of Route 7 has one shared left-thru lane and one through lane. The westbound approach of Route 7 has one through lane and one shared thru-right lane. The signal operations include a protected-permissive left turn for the eastbound approach. The intersection is controlled by adaptive system technology. Pedestrian facilities (crosswalks, pedestrian signals) are currently present on the westbound and southbound approaches at this intersection. Figure 8 shows an aerial of the intersection.

Figure 8: Route 7 at Baker Lane



Source: Google Imagery

2.2.8 Intersection 7: Route 7 at Apple Valley Marketplace

The intersection of Route 7 at Apple Valley Marketplace is a 3-leg signalized intersection. There is no posted speed limit along Apple Valley Marketplace. The southbound approach of Apple Valley Marketplace has one left-turn lane and one right-turn lane. The eastbound approach of Route 7 has one shared left-through lane and one through lane. The westbound approach of Route 7 has one through lane and one shared thru-right lane. The signal operations include a protected-permissive left turn for the eastbound approach. The intersection is controlled by adaptive system technology. Pedestrian facilities (crosswalks, pedestrian signals) are currently present on the southbound approach at this intersection. Figure 9 shows an aerial of the intersection.

Figure 9: Route 7 at Apple Valley Marketplace



Source: Google Imagery

2.2.9 Intersection 8: Route 7 at Fort Collier Road/Elm Street

The southbound approach of Fort Collier Road is classified as Major Collector per the *VDOT Functional Classification*. The intersection of Route 7 at Fort Collier Road/Elm Street is a 4-leg signalized intersection. There is no posted speed limit along the northbound approach of Elm Street. The posted speed limit along the southbound approach of Fort Collier Road is 25mph. The northbound approach of Elm Street has one left-turn lane and one shared thru-right lane. The southbound approach of Fort Collier Road has one left-turn lane and one shared thru-right lane. The eastbound approach of Route 7 has one left-turn lane, one through lane, one shared thru-right lane. The westbound approach of Route 7 has one left-turn lane, two through lanes, and one right-turn lane. The signal operations include protected-permissive left turn for all the approaches and an overlap phase for the westbound right-turn. The intersection is controlled by adaptive system technology. Pedestrian facilities (crosswalks, pedestrian signals) are currently present on the eastbound, northbound and southbound approaches at this intersection. Figure 10 shows an aerial of the intersection.

Figure 10: Route 7 at Fort Collier Road/Elm Street



Source: Google Imagery

2.2.10 Intersection 9: Route 7 at Atwell Avenue

The intersection of Route 7 at Atwell Avenue is a 4-leg unsignalized intersection. There is no posted speed limit along Atwell Avenue. The northbound and southbound approach of Atwell Avenue is stop-controlled, while the eastbound and westbound approaches of Route 7 are free-flow. The southbound approach of Atwell Avenue has one shared left-thru lane and one right-turn lane. The northbound approach of Atwell Avenue has one shared left-thru-right lane. The eastbound has one left-turn lane, one through lane, and one shared thru-right lane. The westbound approach of Route 7 has one left-turn lane, one through lane, and one shared thru-right lane. Pedestrian facilities (crosswalks) are currently present on the northbound and southbound approaches at this intersection. Figure 11 shows an aerial of the intersection.

Figure 11: Route 7 at Atwell Avenue



Source: Google Imagery

2.2.11 Intersection 10: Route 7 at Ross Street

The intersection of Route 7 at Ross Street is a 4-leg signalized intersection. There is no posted speed limit along Ross Street. The northbound approach of Ross Street has one shared left-thru lane and one right-turn lane. The southbound approach of Ross Street has one shared left-thru lane and one right-turn lane. The eastbound approach of Route 7 has one left-turn lane, one through lane, and one shared thru-right lane. The westbound approach of Route 7 has one left-turn lane, one through lane, and one shared thru-right lane. The signal operations include protected-permissive left turns for eastbound and westbound approaches, and permissive left turns for northbound and southbound approaches. The intersection is controlled by adaptive system technology. Pedestrian facilities (crosswalks, pedestrian signals) are currently present on the eastbound, northbound and southbound approaches at this intersection. Figure 12 shows an aerial of the intersection.

Figure 12: Route 7 at Ross Street



Source: Google Imagery

2.2.12 Intersection 11: Route 7 at Median Opening at Exxon/Shell

The median opening on Route 7 at the Exxon/Shell is currently a 4-leg unsignalized intersection. The northbound approach of Shell Entrance and southbound approach of Exxon Entrance has one shared left-thru-right lane. The eastbound and westbound approach of Route 7 has one left turn lane, one through lane, and one shared thru-right lane. Pedestrian facilities (crosswalks, pedestrian signals) are not currently provided at this intersection. Figure 13 shows an aerial of the intersection.

Figure 13: Route 7 at Median Opening at Exxon/Shell



Source: Google Imagery

2.2.13 Intersection 12: Route 7 at I-81 Southbound Ramps

The intersection of Route 7 at I-81 Southbound Ramps is currently a 4-leg signalized intersection. The posted speed limit for I-81 Southbound off ramp is 40mph. There is no posted speed limit for the northbound approach. The southbound approach of I-81 Southbound off ramp has two left-turn lanes and one channelized right-turn lane. The northbound approach has one shared left-thru lane and one right-turn lane. The eastbound approach of Route 7 has one left-turn lane, one through lane, and one shared thru-right lane. The westbound approach has one left-turn lane, two through lanes, and one channelized right-turn lane. The signal operations include protected left turns for the eastbound and westbound approaches and split phasing for the northbound and southbound approaches. The eastbound/westbound through movements are coordinated with adjacent signalized intersections. Pedestrian facilities (crosswalks, pedestrian signals) are currently not provided at this intersection. Figure 14 shows an aerial of the intersection.

Figure 14: Route 7 at I-81 Southbound Ramps



Source: Google Imagery

2.2.14 Intersection 13: Route 7 at I-81 Northbound Ramps/Valley Mill Road

The northbound approach of Valley Mill Road is classified as Major Collector per *VDOT Functional Classification*. The intersection of Route 7 at I-81 Northbound Ramps/Valley Mill Road is currently a 4-leg signalized intersection. The posted speed limit for I-81 Northbound off ramp is 40mph. The posted speed limit for the northbound approach of Valley Mill Road is 35mph. The southbound approach of I-81 Northbound off ramp has one left-turn lane, one shared left-thru lane, and one channelized right-turn lane. The northbound approach of Valley Mill Road has two left-turn lanes and one shared thru-right lane. The eastbound approach of Route 7 has one left-turn lane, two through lanes, and one right-turn lane. The westbound approach of Route 7 has one left-turn lane, two through lanes, and one right-turn lane. The signal operations include protected left turns for the eastbound and westbound approaches and split phasing for the northbound and southbound. The eastbound/westbound through movements are coordinated with adjacent signalized intersections. Pedestrian facilities (crosswalks, pedestrian signals) are currently not provided at this intersection. Figure 15 shows an aerial of the intersection.

Figure 15: Route 7 at I-81 Northbound Ramps/Valley Mill Road



Source: Google Imagery

2.2.15 Intersections 14: Route 7 at Winchester Gateway Drive

The intersection of Route 7 at Winchester Gateway Drive is currently a 3-leg signalized intersection. There is no posted speed limit for the southbound approach of Winchester Gateway Drive. The southbound approach of Winchester Gateway Drive has two left-turn lanes and two right-turn lanes. The eastbound approach of Route 7 has two left-turn lanes and two through lanes. The westbound approach has one left-turn lane, two through lanes, and one right-turn lane. The signal operations include protected left turns for the eastbound and westbound approaches. The eastbound/westbound through movements are coordinated with adjacent signalized intersections. Pedestrian facilities (crosswalks, pedestrian signals) are not currently provided at this intersection. Figure 16 shows an aerial of the intersection.

Figure 16: Route 7 at Winchester Gateway Drive



Source: Google Imagery

2.2.16 Intersection 15: Route 7 at Regency Lakes Drive

The intersection of Route 7 at Regency Lakes Drive is currently a 4-leg signalized intersection. The posted speed limit for Regency Lakes Drive is 25mph. The northbound approach of Regency Lakes Drive has one shared left-thru-right lane. The southbound approach of Regency Lakes Drive has one shared left-thru lane and one right-turn lane. The eastbound approach of Route 7 has one left-turn lane, two through lanes, and one right-turn lane. The westbound approach of Route 7 has one left-turn lane, two through lanes, and one right-turn lane. The signal operations include protected left turns for the eastbound and westbound approaches and split phasing for the northbound and southbound approaches. The eastbound/westbound through movements are coordinated with adjacent signalized intersections. Pedestrian facilities (crosswalks, pedestrian signals) are not currently provided at this intersection. Figure 17 shows an aerial of the intersection.

Figure 17: Route 7 at Regency Lakes Drive



Source: Google Imagery

2.2.17 Intersection 16: Route 7 at Millbrook Drive/Blossom Drive

The intersection of Route 7 at Millbrook Drive/Blossom Drive is currently a 4-leg signalized intersection. The posted speed limit for Millbrook Drive/Blossom Drive is 25mph. The northbound approach of Blossom Drive has one left-turn lane and one shared thru-right lane. The southbound approach of Millbrook Drive has one shared left-thru lane and one right-turn lane. The eastbound approach of Route 7 has two left-turn lanes, two through lanes, and one channelized right-turn lane. The westbound approach has one left-turn lane, two through lanes, and one right-turn lane. The signal operations include protected left turns for the eastbound and westbound approaches and split phasing for the northbound and southbound approaches. The eastbound/westbound through movements are coordinated with adjacent signalized intersections. Pedestrian facilities (crosswalks, pedestrian signals) are currently not provided at this intersection. Figure 18 shows an aerial of the intersection.

Figure 18: Route 7 at Millbrook Drive/Blossom Drive



Source: Google Imagery

2.2.18 Intersection 17: Route 7 at Greenwood Road/First Woods Drive

The northbound approach of Greenwood Road is classified as Major Collector per *VDOT Functional Classification*. The intersection of Route 7 at Greenwood Road/First Woods Drive is currently a 4-leg signalized intersection. The posted speed limit along the northbound approach of Greenwood Drive is 35mph. There is no posted speed limit along the southbound approach of First Woods Drive. The northbound approach of Greenwood Drive has one shared left-thru-right lane. The southbound approach of First Woods Drive has one shared left-thru lane and one right-turn lane. The eastbound approach of Route 7 has one left-turn lane, two through lanes, and one right-turn lane. The westbound approach of Route 7 has one left-turn lane, two through lanes, and one right-turn lane. The signal operations include protected left turns for the eastbound and westbound approaches and split phasing for the northbound and southbound approaches. The eastbound/westbound through movements are coordinated with adjacent signalized intersections. Pedestrian facilities (crosswalks, pedestrian signals) are currently not provided at this intersection. Figure 19 shows an aerial of the intersection.

Figure 19: Route 7 at Greenwood Road/First Woods Drive



Source: Google Imagery

2.3 Traffic Data

2.3.1 2018 Existing Traffic Volumes

Existing traffic volume data along the study corridor was collected in November 2018 while school was in session:

- § 24-hour classification counts were collected on November 8, 2018 at the following locations:
 - Route 7 at Virginia Avenue
 - Route 7 at Regency Lakes Drive
- § AM and PM peak period turning movement counts were collected on November 8, 2018 from 6:00 am – 10:00 am and 3:00 – 7:00 pm at the previously mentioned locations in study area, section 1.4.

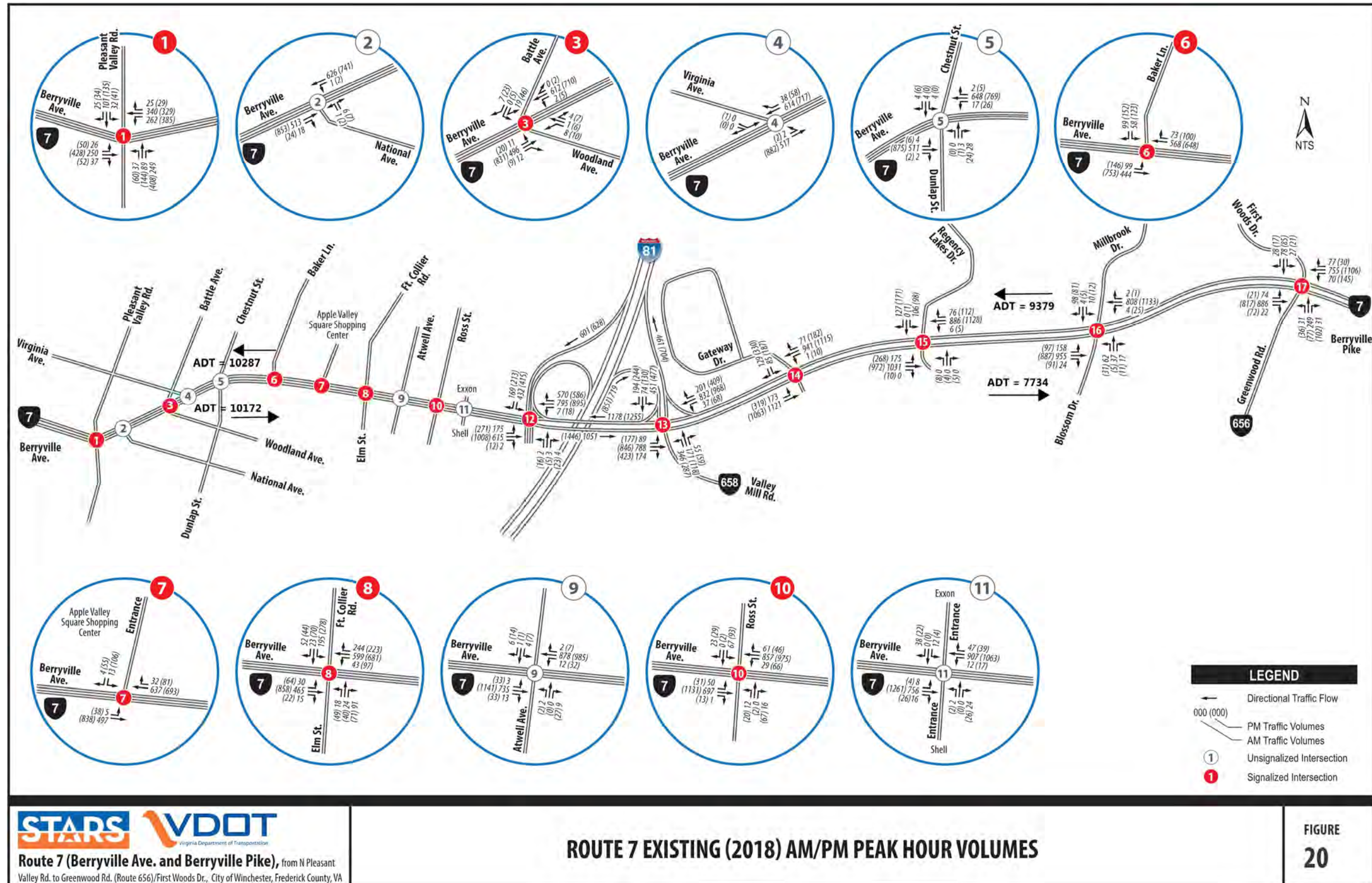
The field counts are enclosed with this report in the Appendix. The existing (2018) peak hour volumes and Average Daily Traffic (ADT) volumes are summarized in Figure 20.

2.3.2 Additional Data

In addition to traffic volumes, following supplemental data was collected to support this study, as needed:

- § Travel time runs to be used in the calibration of the existing network Synchro models. Travel time data was collected on November 8, 2018 during AM and PM peak periods.
- § Queue length measurements for all approaches at each of the study area intersections to be used in the calibration of the existing Synchro models. Data was collected on March 7, 2019 during both peak periods.
- § Crash Data from the last five years to perform the crash analysis.
- § Signal timing data from Frederick County and the City of Winchester for input into the Synchro analysis model

Figure 20. Existing (2018) Peak Hour Volumes and Average Daily Traffic



2.3.3 Existing Access Management

An evaluation of the existing driveways and access points along the study area corridor was completed to assess their compliance with *VDOT Access Management Design Standards for Entrances and Intersections*, which is included as *Appendix F* of the *VDOT Roadway Design Manual*. The assessment involved analysis of existing spacing of driveways and intersections, and compliance with VDOT minimum spacing standards for commercial entrances, intersections and median crossovers. Table 2 provides a summary of the minimum spacing requirements for a posted speed limit of 35 mph to 45 mph for a Principal Arterial.

Table 2. Minimum Spacing Standards for Commercial Entrances, Intersections, and Median Crossovers

Highway Functional Classification	Minimum Centerline to Centerline Spacing (Feet)			
	Spacing between Signalized Intersections	Spacing between Unsignalized Intersections and Full/Directional Median Crossovers and Other Intersections or Median Crossovers	Spacing between Full Access Entrances and Other Full Access Entrances, Intersections, or Median Crossovers	Spacing between Partial Access Entrances (one or two-way) and Other Entrances, Intersections, or Median Crossovers
Principal Arterial	1,320	1,050	565	305

Source: *VDOT Roadway Design Manual, Appendix F (Table 2-2)*

A total of 92 access points are located within the study corridor of Route 7 (Berryville Avenue/Berryville Pike) between Pleasant Valley Road and Greenwood Drive/First Woods Drive. Most of these access points are closely spaced and serve residential parcels, retail parcels and commercial parcels. The commercial driveways are typically wide and typically experience a relatively high number of vehicle trips in and out of the parcels. These access points are shown graphically in the Appendix and identified as AP1 through AP92. The spacing of these points were analyzed to assess their compliance with the VDOT minimum spacing standards shown in Table 2. Table 3 below identifies the access points that do not meet the minimum spacing standard; as well as those that are compliant with the spacing standard.

Table 3. Access Points Analysis for Route 7

Roadway	Number of Access Points	Per VDOT Spacing Guidelines	
		Compliant	Non-Compliant
Route 7	92	<u>5 Total:</u> AP62, AP64-AP65, AP91 – AP92	<u>87 Total:</u> AP1 – AP61, AP63, AP66 – AP90

Notes: Refer to the Appendix for graphical presentation of access points.

Initial analysis of existing access points and their spacing reveals that, the spacing standards are not satisfied for 87 out of the 92 access point locations involving full/partial access driveways, entrances, median crossovers and intersections. The area serves urban / suburban land uses, with significant development along both sides of the roadway. Application of access management practices would benefit corridor operations by reducing conflict points

along the corridor. Further detailed analyses of these access points will be conducted to prioritize the locations which will have greater impact on improving the overall operations and safety of the corridor.

3 TRAFFIC OPERATIONAL ANALYSIS

3.1 Analysis Peak Periods

Weekday peak periods were identified from the count data for the arterial segments and for each study intersection. The common AM and PM peak hours for the overall network were determined based on the hourly variations in traffic volumes at each intersection, travel patterns along the study corridor and percentage of traffic during the highest hour. Based upon a review of the traffic count data, the following peak hours were identified for this study:

AM Peak: 7:15 AM – 8:15 AM
 PM Peak: 4:30 PM – 5:30 PM

Peak Hour Factors (PHFs) were calculated at each intersection for the AM and PM peak hours using the turning movement count data. Similarly, heavy vehicle percentages were calculated for the AM and PM peak hours per movement at each study intersection.

The raw traffic counts were balanced throughout the network. Traffic volume balancing was required considering individual intersection peak hours and the resulting volume variations observed throughout the corridor. The peak hour traffic volumes were balanced using an iterative process of adjusting intersection approach and departure volumes until intersection volumes were within 10% for most movements. This 10% threshold was allowed to exceed for links with significant number of access points (traffic generators or sinks) between the intersections.

3.2 Analysis Tools

Traffic operations analysis for the corridor was conducted using analysis tools *Synchro 10* as well as *SimTraffic*, which is a companion microsimulation tool for Synchro. The operational analysis was based on guidance provided in *VDOT Traffic Operations and Safety Analysis Manual (TOSAM), Version 1.0, November 2015 update*. *Synchro* is based on methodologies presented in *2010 Highway Capacity Manual*. *SimTraffic* was used to assess the traffic operations at the signalized and unsignalized intersections within the study area, as well as to evaluate arterial segments between the intersections. Section 3.3 below presents a summary of Measures of Effectiveness (MOE) that were evaluated for this study.

3.3 Measure of Effectiveness

The Measures of Effectiveness (MOEs) in traffic operations analysis is a factor that quantifies operational and safety objectives and provides a basis for evaluating the performance of a transportation network. Several MOEs for a corridor can be reported from *Synchro* and *SimTraffic*. For the purposes of this study, guidance for reporting MOEs for a corridor involving intersections and arterial segments as provided in *VDOT TOSAM, Chapter 4* was utilized. A summary of the MOEs evaluated for the study corridor is presented below:

SimTraffic:

- Maximum Queue Lengths
- Microsimulation Delay for each movement at intersections
- Total Delay (hours), Delay/Vehicle (seconds), Travel Time (hours), Average Speed (miles/hour)

Per the *TOSAM* guidance under *Section 8.6*, Level of Service (LOS) is not reported for intersections with *SimTraffic* as an analysis tool. Instead, the microsimulation delay is reported for individual intersection movements as well as the overall delay for the intersection. The overall intersection delay can be presented graphically by assigning color coding for ranges of microsimulation delay. This color coding as shown in Table 4 is based on *2010 Highway Capacity Manual (HCM)* delay thresholds and the associated LOS. Green, yellow and red colors were assigned to delay thresholds for each study intersection.

Table 4: Intersection Color Coding based on Intersection Delay

Signalized Intersection Delay Thresholds (sec/veh)	Unsignalized Intersection Delay Thresholds (sec/veh)	Color
< 10	< 10	Green
>10-20	>10-15	Green
>20-35	>15-25	Yellow
>35-55	>25-35	Yellow
>55-80	>35-50	Red
>80	>50	Red

Source of Delay Thresholds: Highway Capacity Manual 2010

3.4 Base Model Development and Calibration

AM and PM peak hour base *Synchro* models were developed using the data discussed under *Section 2.3.1* and following the guidance in *TOSAM*. The *SimTraffic* input parameters were in accordance with *Section 7.6.1* of *VDOT TOSAM* and included 1-60-minute seed interval and 4-15-minute recording intervals. To account for simulation variance, 10 simulation runs were conducted and averaged together. The simulation settings generally remained at the default settings.

To provide a more accurate representation of field conditions, the existing conditions *SimTraffic* models were calibrated to reasonably replicate balanced field observed traffic volumes and intersection queue lengths. This calibration process is an essential part of the model development as it ensures that the simulation reasonably replicates existing field conditions and can be used as the base for the evaluation of future scenarios.

A summary of the volume, queue, and travel time calibration is provided in Table 5, with supporting documentation in the Appendix.

Table 5: Calibration Summary

Peak Period	Calibration Measure	Evaluation	Criteria	Total Number Evaluated	Total Number Met	Percent Met	Target Criteria	Target Met
AM	Volume (vph)	All Movements	Within ± 20% for < 100 vph Within ± 15% for ≥ 100 vph to < 300 vph Within ± 10% for ≥ 300 vph to < 1000 vph Within ± 5% for ≥ 1000 vph	119	113	95%	85%	Yes
	Queue Length	Turning Movements	Within ± 20% on oversaturated arterials	91	89	98%	85%	Yes
PM	Volume (vph)	All Movements	Within ± 20% for < 100 vph Within ± 15% for ≥ 100 vph to < 300 vph Within ± 10% for ≥ 300 vph to < 1000 vph Within ± 5% for ≥ 1000 vph	161	154	96%	85%	Yes
	Queue Length	Turning Movements	Within ± 20% on oversaturated arterials	91	79	87%	85%	Yes

3.4.1 Volume Calibration

The volume calibration results summary in Table 5 shows that the calibration parameters are met for both AM and PM models. The full *SimTraffic* volume calibration results table is shown in the Appendix. The volume calibration includes a comparison between simulated volumes (the average of 10 runs) and balanced field counts modeled in *Synchro* for the AM and PM Peak Hours. The tables show the difference and percentage difference between field counts and the average volumes from the simulation runs.

3.4.2 Queue Length Calibration

The queue calibration results summary in Table 5 shows that the calibration parameters are met for both AM and PM models. The *SimTraffic* average queue calibration results table is shown in the Appendix. The average queue length calibration includes a comparison between theoretical (simulated) average intersection queues obtained from an average of 10 simulation runs and the field measured queues during the AM and PM peak hours.

3.4.3 Microsimulation Sample Size

In addition to conducting proper model calibration, determining and applying an appropriate number of microsimulation runs is an important step in developing accurate microsimulation results. WSP followed the guidelines provided in *Section 5.4* of the *VDOT TOSAM* and utilized the macro-enabled *VDOT Sample Size Determination Tool* to finalize the number of *SimTraffic* runs necessary for correctly reporting arterial and intersection MOEs. Ten *SimTraffic* microsimulation runs were initially recorded following the guidelines for *SimTraffic* Input Parameters found in *Section 7.6* of the *VDOT TOSAM*. The MOE, Average Travel Speed obtained from each of these ten runs was then input into the *VDOT Sample Size Determination Tool* to verify that MOEs from these runs meet the required tolerance error and confidence interval. Appendix shows a screen capture of the *VDOT Sample Size Determination Tool*.

3.5 Intersection Operations: 2019 Existing Conditions

Traffic operations analyses was conducted using *SimTraffic* to evaluate overall performance of the study intersections and arterial segments within the corridor. *SimTraffic* run outputs were also used to report the maximum queues formed for each intersection approach. Operational analyses were performed at each of the study intersections for the Existing 2019 Conditions scenario.

Microsimulation Delay in sec/veh were reported from *SimTraffic* for all the signalized and unsignalized intersections. Table 6 summarizes the AM and PM peak hour delay for each movement for the study intersections along the study corridor. Figure 21 presents the overall intersection delay graphically with color coding. *SimTraffic* output sheets are provided in Appendix.

A delay of 35 sec/veh is used as the threshold for the existing conditions evaluation due to the fact that these delays have the potential to increase to unacceptable delays in the future year conditions. The results from Table 6 suggest that the following intersections operate with an overall delay value that exceeds 35 sec/veh:

Intersection 8 - Route 7 and Fort Collier Road/Elm Street

- Microsimulation delay of 46.9 sec/veh during the PM peak hour

Intersection 11 – Route 7 and Exxon Driveway

- Microsimulation delay of 48.5 sec/veh during the PM peak hour

Intersection 12 – Route 7 and I-81 Southbound Ramp

- Microsimulation delay of 52.4 sec/veh during the PM peak hour

Intersection 13 – Route 7 and I-81 Northbound Ramp

- Microsimulation delay of 37.5 sec/veh during the AM peak hour and 49.8 sec/veh during the PM peak hour

Intersection 17 – Route 7 and First Woods Drive/Greenwood Road

- Microsimulation delay of 35.1 sec/veh during the AM peak hour

Table 6. Existing (2019) SimTraffic AM and PM Peak Hour Delay (veh/sec)

Intersection Number and Description	Type of Control	Lane Group	Eastbound		Westbound		Northbound		Southbound		Overall	
			AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
			Delay	Delay	Delay	Delay	Delay	Delay	Delay	Delay	Delay	Delay
1 Route 7 and N Pleasant Valley Road	National Avenue		Berryville Avenue		N Pleasant Valley Road		N Pleasant Valley Road				Delay	Delay
	Signal	Left	16.5	25.6	11.5	16.6	50.6	52.4	54.3	53.2	19.2	25.8
		Through	20.4	39.0	7.2	9.1	54.0	51.6	56.0	54.3		
		Right	15.3	33.8	4.5	4.3	5.8	9.5	34.3	39.2		
		Approach	19.4	37.1	8.9	12.6	22.1	23.4	52.2	51.5		
2 Route 7 and National Avenue	Berryville Avenue		Berryville Avenue		National Avenue						Delay	Delay
	Two-Way Stop	Left	--	--	0.0	14.7	0.0	41.1	--	--	3.5	5.7
		Through	0.8	1.1	5.7	11.1	--	--	--	--		
		Right	0.6	0.8	--	--	3.5	8.7	--	--		
		Approach	0.8	1.1	5.7	11.2	4.2	15.2	--	--		
3 Route 7 and Battle Avenue/Woodland Avenue	Berryville Avenue		Berryville Avenue		Woodland Avenue		Battle Avenue				Delay	Delay
	Signal	Left	8.7	11.5	4.4	12.4	22.0	33.3	27.7	35.3	2.4	5.1
		Through	1.8	3.8	1.8	3.2	13.0	22.9	--	43.0		
		Right	0.9	1.6	--	--	7.0	10.4	7.3	17.1		
		Approach	1.9	3.9	1.8	3.3	18.4	23.6	21.4	30.2		
4 Route 7 and Virginia Avenue	Berryville Avenue		Berryville Avenue				Virginia Avenue				Delay	Delay
	Two-Way Stop	Left	4.6	6.1	--	--	--	--	--	--	0.7	1.1
		Through	0.5	0.9	0.9	1.5	--	--	--	--		
		Right	--	--	0.4	0.7	--	--	--	--		
		Approach	0.5	0.9	0.9	1.4	--	--	--	--		
5 Route 7 and Dunlap Street/Chestnut Street	Berryville Avenue		Berryville Avenue		Chestnut Street		Dunlap Street				Delay	Delay
	Two-Way Stop	Left	6.5	9.1	5.3	9.2	0.0	0.0	20.5	0.0	1.3	1.6
		Through	0.3	0.6	1.5	2.3	15.7	17.6	20.4	0.0		
		Right	0.2	0.2	1.5	1.6	4.0	6.5	6.7	7.6		
		Approach	0.4	0.6	1.6	2.5	5.2	6.9	15.5	7.6		
6 Route 7 and Baker Lane	Berryville Avenue		Berryville Avenue				Baker Lane				Delay	Delay
	Signal	Left	11.4	23.0	--	--	--	--	40.0	51.2	5.9	12.3
		Through	3.8	9.7	3.5	6.3	--	--	--	--		
		Right	--	--	2.7	5.1	--	--	7.5	14.4		
		Approach	5.1	11.8	3.4	6.1	--	--	19.8	30.7		

Table 6. Existing (2019) SimTraffic AM and PM Peak Hour Delay (veh/sec) (Continued)

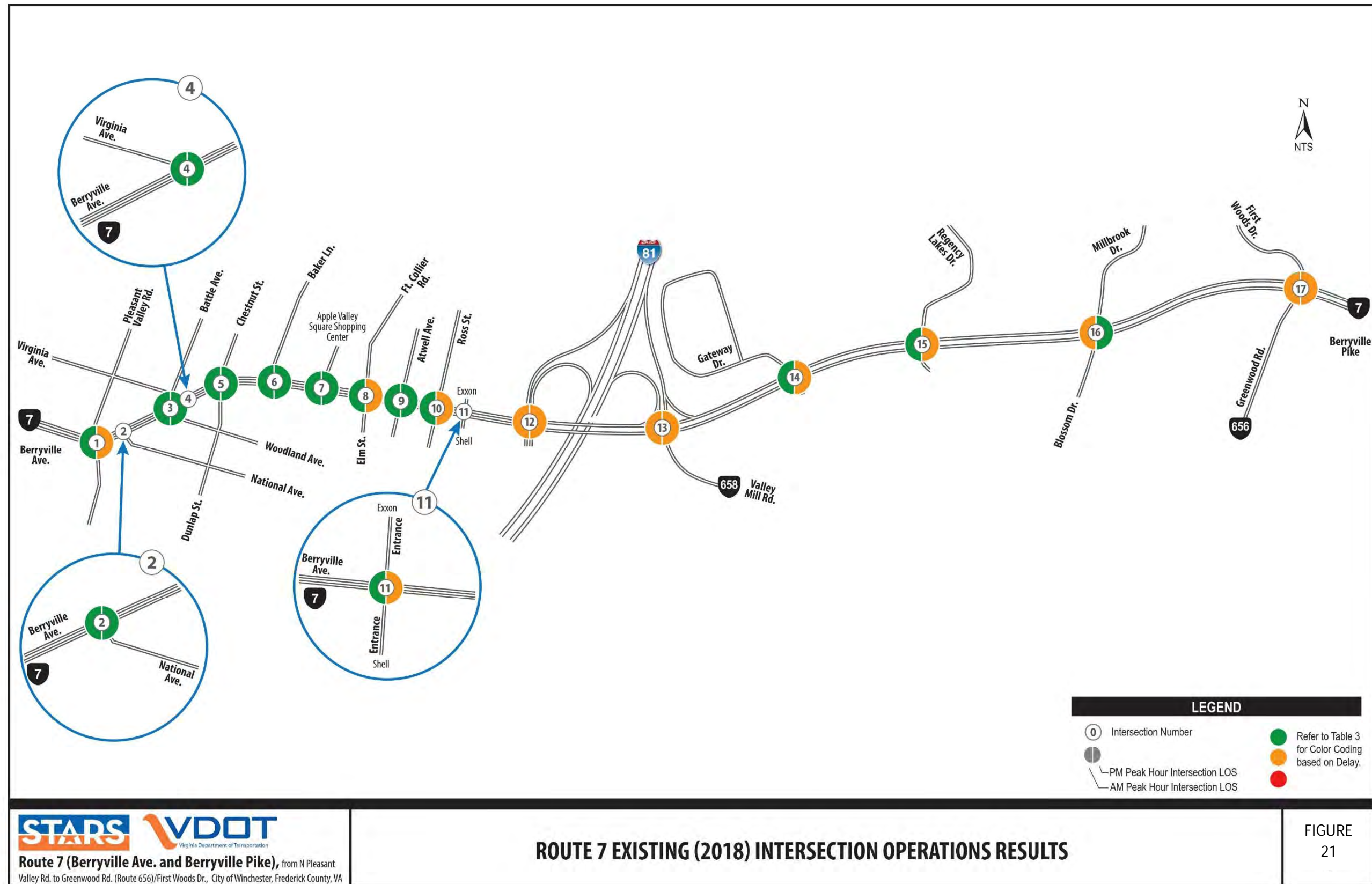
Intersection Number and Description	Type of Control	Lane Group	Eastbound		Westbound		Northbound		Southbound		Overall	
			AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
			Delay	Delay	Delay	Delay	Delay	Delay	Delay	Delay		
7 Route 7 and Apple Valley Marketplace			Berryville Avenue		Berryville Avenue				Apple Valley Marketplace			
	Signal	Left	10.1	18.7	--	--	--	--	67.5	52.3	Delay	Delay
		Through	1.5	8.4	3.1	5.7	--	--	--	--	3.1	10.3
		Right	--	--	3.2	4.5	--	--	5.6	14.5		
		Approach	1.6	8.9	3.1	5.6	--	--	52.0	40.0		
		Berryville Avenue		Berryville Avenue		Elm Street		Fort Collier Road				
8 Route 7 and Fort Collier Road/Elm Street	Signal	Left	17.7	56.7	11.2	32.8	57.4	51.4	54.2	134.9	Delay	Delay
		Through	11.2	42.2	9.6	17.3	63.3	61.7	53.7	141.7	17.3	46.9
		Right	6.8	31.6	5.6	8.6	23.7	36.6	26.3	122.3		
		Approach	11.4	43.0	8.6	17.0	35.7	47.4	48.5	134.6		
		Berryville Avenue		Berryville Avenue		Pharmhouse Shopping Center		Atwell Avenue				
9 Route 7 and Atwell Avenue/Pharmhouse Shopping Center	Two-Way Stop	Left	8.6	29.8	7.0	21.3	21.5	570.5	23.3	267.7	Delay	Delay
		Through	1.3	21.0	2.3	3.5	--	--	18.5	57.4	2.0	19.7
		Right	1.1	10.4	1.8	2.9	4.8	433.4	12.3	30.4		
		Approach	1.3	21.0	2.4	4.0	6.1	451.6	16.2	110.9		
		Berryville Avenue		Berryville Avenue		Pharmhouse Shopping Center		Ross Street				
10 Route 7 and Ross Street/Pharmhouse Shopping Center	Signal	Left	12.3	67.9	8.0	64.1	38.8	69.4	40.8	112.4	Delay	Delay
		Through	3.2	45.1	4.4	8.7	0.0	82.8	0.0	86.0	5.8	33.8
		Right	0.5	20.6	2.8	5.9	6.1	61.9	9.8	22.5		
		Approach	3.8	45.4	4.4	11.9	21.6	63.8	32.0	90.0		
		Berryville Avenue		Berryville Pike		Shell Driveway		Exxon Driveway				
11 Route 7 and Exxon Driveway	Two-Way Stop	Left	11.9	44.0	9.0	226.3	21.1	1561.4	24.8	1224.7	Delay	Delay
		Through	1.5	16.4	3.9	14.7	0.0	0.0	0.0	0.0	3.2	48.5
		Right	0.5	4.0	2.9	8.0	6.6	1745.6	12.4	1354.2		
		Approach	1.6	16.2	3.9	18.0	7.1	1754.0	15.2	1337.8		
		Berryville Pike		Berryville Pike		Driveway		I-81 SB Ramp				
12 Route 7 and I-81 SB Ramp	Signal	Left	49.1	100.5	63.1	106.8	69.9	84.7	45.4	109.1	Delay	Delay
		Through	12.5	21.2	23.3	63.2	68.3	97.9	--	--	22.2	52.4
		Right	11.0	11.7	7.2	12.3	8.7	15.2	12.6	84.3		
		Approach	20.6	37.7	17.1	44.5	41.5	54.3	35.8	100.7		

Table 6. Existing (2019) SimTraffic AM and PM Peak Hour Delay (veh/sec) (Continued)

Intersection Number and Description	Type of Control	Lane Group	Eastbound		Westbound		Northbound		Southbound		Overall	
			AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
			Delay	Delay	Delay	Delay	Delay	Delay	Delay	Delay		
13 Route 7 and I-81 NB Ramp	Signal	Berryville Pike		Berryville Pike		Valley Mill Road		I-81 NB Ramp		Delay	Delay	
		Left	51.7	75.6	64.7	79.1	46.9	70.4	49.1	56.5	37.5	49.8
		Through	35.3	36.4	39.7	75.7	48.2	71.0	31.3	52.5		
		Right	7.9	13.1	5.3	7.8	34.7	48.2	--	--		
		Approach	32.4	34.4	34.2	56.9	46.1	67.8	44.9	55.6		
14 Route 7 and Winchester Gateway	Signal	Berryville Pike		Berryville Pike				Winchester Gateway		Delay	Delay	
		Left	37.8	52.8	0.0	73.0	--	--	35.9	46.7	14.6	23.2
		Through	10.2	11.0	13.9	23.1	--	--	--	--		
		Right	--	--	10.1	18.1	--	--	14.8	21.0		
		Approach	13.9	20.8	13.7	22.8	--	--	23.2	30.4		
15 Route 7 and Regency Lakes Drive	Signal	Berryville Pike		Berryville Pike		Driveway		Regency Lakes Drive		Delay	Delay	
		Left	58.9	62.3	69.5	64.9	0.0	73.1	50.7	63.3	19.6	23.5
		Through	6.8	8.6	24.7	25.0	0.0	63.4	0.0	70.3		
		Right	0.0	7.4	12.8	13.5	0.0	13.8	11.7	19.7		
		Approach	14.5	20.1	24.1	24.1	0.0	55.6	28.0	35.4		
16 Route 7 and Millbrook Drive/Blossom Drive	Signal	Berryville Pike		Berryville Pike		Blossom Drive		Millbrook Drive		Delay	Delay	
		Left	47.7	39.8	64.4	52.7	50.8	49.3	51.7	50.3	26.9	17.6
		Through	20.7	10.7	29.6	20.1	43.2	46.2	48.4	53.6		
		Right	9.6	7.0	8.6	8.8	20.9	8.7	10.1	15.5		
		Approach	24.2	12.9	29.7	20.7	44.1	37.8	15.1	21.9		
17 Route 7 and First Woods Drive/Greenwood Road	Signal	Berryville Pike		Berryville Pike		Greenwood Drive		First Woods Drive		Delay	Delay	
		Left	68.7	65.4	58.3	69.0	54.2	63.9	54.5	68.5	35.1	29.4
		Through	29.3	27.0	28.4	18.7	58.3	61.6	53.9	68.4		
		Right	14.9	11.4	10.5	6.7	49.6	43.3	7.5	11.2		
		Approach	31.9	26.6	29.1	24.2	56.1	53.2	43.8	61.1		

NOTE: Microsimulation Delay (sec/veh) results shown represent an average of 10 SimTraffic runs.
 ‘—’ represents a movement that is not applicable

Figure 21. Existing (2018) AM(PM) Peak Intersection Operations Results



Queue length, or the distance to which stopped vehicles accumulate in a lane at an intersection, is another performance measure of intersection operations. Lengthy queues may be indicative of intersection capacity or operational issues, such as absence of or insufficient dedicated turn lanes, inefficient signal timings or phasing. A queuing analysis was completed for the study intersections during the AM and PM peak hours. SimTraffic Maximum Queue Lengths in feet were reported for each lane. These queue lengths are based on an average of 10 simulation runs. Table 7 provides a summary of the maximum queue lengths during the AM and PM peak hours as compared to the available storage bay lengths. The highlighted queue lengths in Table 7 are the movements where the reported maximum queue lengths value exceeds the storage length available for that turning movement. The SimTraffic output sheets including the maximum queue lengths are included in Appendix.

The results presented in Table 7 indicate the number of intersection movements experiencing heavy demand and queuing.

Table 7. 2018 Existing Conditions: Summary of Maximum Queues (feet)

Intersection Number and Description	Type of Control	Lane Group	Eastbound			Westbound			Northbound			Southbound		
			Storage Bay Length	AM Queue (ft.)	PM Queue (ft.)	Storage Bay Length	AM Queue (ft.)	PM Queue (ft.)	Storage Bay Length	AM Queue (ft.)	PM Queue (ft.)	Storage Bay Length	AM Queue (ft.)	PM Queue (ft.)
1 Route 7 and N Pleasant Valley Road			National Avenue			Berryville Avenue			N Pleasant Valley Road			N Pleasant Valley Road		
	Signal	Left	175	134	174	--	97	98	165	108	150	100	100	100
		Through	--	307	537	--	99	93	--	152	236	--	197	262
		Right	--			--			119	193	115			
2 Route 7 and National Avenue			Berryville Avenue			Berryville Avenue			National Avenue					
	Two-Way Stop	Left	--	--	--	--	191	322	--	--	--	--	25	27
		Through	--	23	72	--	244	221	--	--	--	--	--	--
		Right	--	30	73	--	--	--	--	--	--	--	25	27
3 Route 7 and Battle Avenue/Woodland Avenue			Berryville Avenue			Berryville Avenue			Woodland Avenue			Battle Avenue		
	Signal	Left	--	103	181	--	116	140	--	47	58	--	46	48
		Through	--	--	--	--	141	0	--					
		Right	--	89	174	--	0	137	--					
4 Route 7 and Virginia Avenue			Berryville Avenue			Berryville Avenue						Virginia Avenue		
	Two-Way Stop	Left	--	26	34	--	--	--	--	--	--	--	--	--
		Through	--	9	9	--	38	63	--	--	--	--	--	--
		Right	--	--	--	--		62	--	--	--	--	--	--
5 Route 7 and Dunlap Street/Chestnut Street			Berryville Avenue			Berryville Avenue			Chestnut Street			Dunlap Street		
	Two-Way Stop	Left	--	42	67	--	78	124	--	45	46	--	19	16
		Through	--	--	--	--	--	--	--					
		Right	--	8	14	--	19	77	--					
6 Route 7 and Baker Lane			Berryville Avenue			Berryville Avenue						Baker Lane		
	Signal	Left	--	161	318	--	--	--	--	--	--	70	70	69
		Through	--	102	240	--	113	190	--	--	--	--	--	--
		Right	--	--	--	--	141	214	--	--	--	--	177	238
7 Route 7 and Apple Valley Marketplace			Berryville Avenue			Berryville Avenue						Apple Valley Marketplace		
	Signal	Left	--	95	242	--	--	--	--	--	--	90	71	87
		Through	--	74	229	--	141	134	--	--	--	--	--	--
		Right	--	--	--	--	173	173	--	--	--	--	23	233
8 Route 7 and Elm Street/Fort Collier Road			Berryville Avenue			Berryville Avenue			Elm Street			Fort Collier Road		
	Signal	Left	105	98	104	120	96	120	100	84	99	100	99	100
		Through	--	212	393	--	295	326	--	196	225	--	352	384
		Right	--	204	355	95	95	95	--					
9 Route 7 and Atwell Avenue/Pharmhouse Shopping Center			Berryville Avenue			Berryville Avenue			Pharmhouse Shopping Center			Atwell Avenue		
	Two-Way Stop	Left	120	21	97	60	45	52	--	35	114	115	37	61
		Through	--	14	247	--	59	145	--					
		Right	--	7	229	--	116	182	--			90		

Table 7. 2018 Existing Conditions: Summary of Maximum Queues (feet) (Continued)

Intersection Number and Description	Type of Control	Lane Group	Eastbound			Westbound			Northbound			Southbound		
			Storage Bay Length	AM Queue (ft.)	PM Queue (ft.)	Storage Bay Length	AM Queue (ft.)	PM Queue (ft.)	Storage Bay Length	AM Queue (ft.)	PM Queue (ft.)	Storage Bay Length	AM Queue (ft.)	PM Queue (ft.)
10 Route 7 and Ross Street/Pharmhouse Shopping Center			Berryville Avenue			Berryville Avenue			Pharmhouse Shopping Center			Ross Street		
	Signal	Left	75	66	74	70	51	59	--	50	69	--	114	246
		Through	--	129	362	--	193	157	--					
		Right	--	102	375	--	206	162	--			44		
11 Route 7 and Exxon Driveway			Berryville Avenue			Berryville Pike			Shell Driveway			Exxon Driveway		
	Two-Way Stop	Left	35	32	32	45	37	44	--	55	190	--	72	160
		Through	--	68	222	--	92	233	--					
		Right	--	53	221	--	145	241	--					
12 Route 7 and I-81 SB Ramp			Berryville Pike			Berryville Pike			Driveway			I-81 SB Ramp		
	Signal	Left	145	144	145	100	84	99	--	38	62	--	349	332
		Through	--	291	322	--	394	480	--					
		Right	--	240	306	--	322	506	--			33		
13 Route 7 and I-81 NB Ramp/Valley Mill Road			Berryville Pike			Berryville Pike			Valley Mill Road			I-81 NB Ramp		
	Signal	Left	240	239	240	340	290	334	210	380	378	--	232	234
		Through	--	386	428	--	618	930	--					
		Right	250	250	250	--	50	524	295			293		
14 Route 7 and Winchester Gateway Drive			Berryville Pike			Berryville Pike						Winchester Gateway Drive		
	Signal	Left	575	115	216	75	9	50	--	--	--	--	107	248
		Through	--	178	268	--	357	660	--	--	--	--	--	--
		Right	--	--	--	220	185	220	--	--	--	170	109	169
15 Route 7 and Regency Lakes Drive			Berryville Pike			Berryville Pike			Driveway			Regency Lakes Drive		
	Signal	Left	275	263	274	100	46	47	--	0	70	--	200	200
		Through	--	292	507	--	355	590	--					
		Right	--	244	440	430	66	430	--			--		
16 Route 7 and Millbrook Drive/Blossom Drive			Berryville Pike			Berryville Pike			Blossom Drive			Millbrook Drive		
	Signal	Left	605	141	95	165	25	100	200	132	89	290	58	20
		Through	--	337	271	--	366	398	--	138	43	--		
		Right	175	157	175	250	43	8	--			--		
17 Route 7 and First Woods Drive/Greenwood Road			Berryville Pike			Berryville Pike			Greenwood Drive			First Woods Drive		
	Signal	Left	325	200	123	335	183	293	--	525	321	--	203	192
		Through	--	414	372	--	391	402	--					
		Right	260	201	213	340	95	177	--			--		

NOTE: The maximum queues in feet are obtained from 10 SimTraffic simulation runs averaged together.
 '--' Storage Bay Length not provided or the movements do not exist.
 Red and bold text indicates queue lengths that reach or exceed the available storage lengths OR indicates turn lane storage blockage.

3.6 Future Traffic Volumes

The existing traffic volumes were forecasted to the Future Year 2030, which was determined by the SWG as the design year for the improvements suggested by this study. Projecting the traffic volumes at the study intersections to the design year with an appropriate growth rate was the first step in developing future conditions analysis. The methodology that was followed for development of growth rate is discussed below.

3.6.1 Traffic Forecasting Methodology

To validate the growth rate, historic AADT volumes published by VDOT were reviewed from year 2005 to 2017 for the study corridor for segments listed below:

- § Route 7: From Pleasant Valley Road to Ross Street
- § Route 7: From Ross Street to I-81 ECL Winchester
- § Route 7: From I-81 ECL Winchester to Clarke County

Table 8 summarizes the AADT volumes per year from 2005 through 2017 along the three segments.

Table 8. VDOT Historic Traffic Volumes (veh/day)

Year	Roadway Segment/AADT Volume		
	Pleasant Valley Road to Ross Street	Ross Street to I-81 ECL Winchester	I-81 ECL Winchester to Clarke County
2005	24,000	29,000	32,000
2006	24,000	28,000	32,000
2007	25,000	30,000	32,000
2008	22,000	25,000	26,000
2009	22,000	25,000	27,000
2010	22,000	25,000	28,000
2011	22,000	25,000	25,000
2012	22,000	25,000	25,000
2013	22,000	25,000	25,000
2014	25,000	36,000	25,000
2015	26,000	37,000	25,000
2016	27,000	39,000	26,000
2017	25,000	35,000	27,000

Linear growth rates were calculated for these segments three periods: 3-year, 9-year and 12-year and are summarized in Table 9.

Table 9. Historic Traffic Growth Rates

Roadway Segment	Linear Growth Rates		
	3-Year (2014-2017)	9-Year (2008-2017)	12-Year (2005-2017)
Pleasant Valley Road to Ross Street	0.00%	4.35%	1.37%
Ross Street to I-81 ECL Winchester	-0.93%	11.87%	6.47%
I-81 ECL Winchester to Clarke County	2.60%	1.27%	-5.51%

The calculated linear historic growth rates show primarily positive growth in the study area.

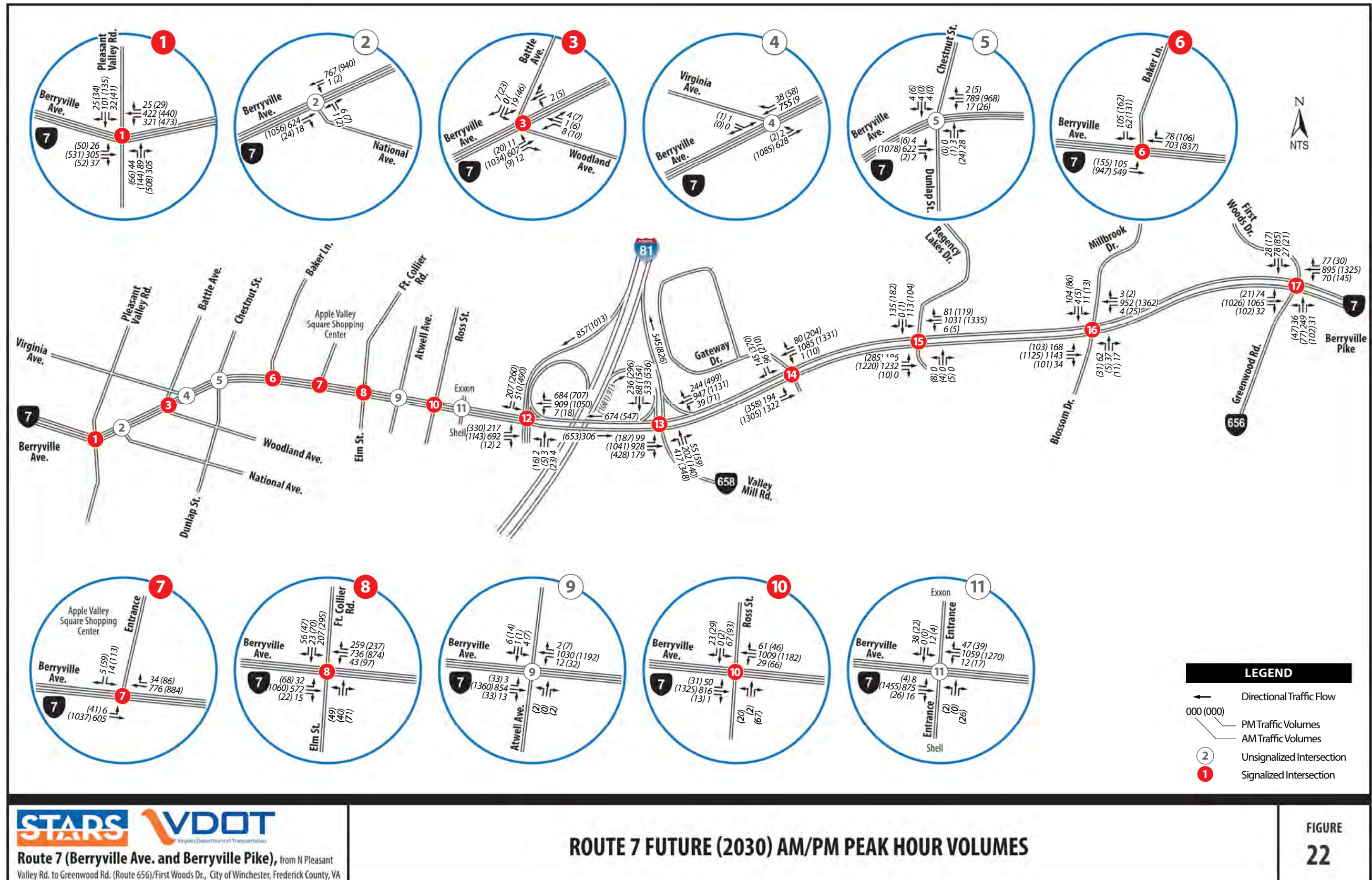
In addition to the VDOT historic AADT volumes, Statewide Planning System (SPS) data, which is an internal VDOT database maintained by TMPD was obtained from Staunton District for Route 7 corridor. Table 10 summarizes the segments of Route 7 along with SPS recommended growth rates.

Table 10. SPS Recommended Growth Rates

County	Route	From	To	2015 AADT Volume	2040 AADT Volume	SPS Annualized Simple Growth Rate
Staunton	7	Pleasant Valley Road	Baker Lane	22,936	34,678	2.0%
Staunton	7	Fort Collier Road	I-81 Southbound Ramps	27,876	41,637	2.0%
Staunton	7	I-81 Northbound Ramps	Regency Lakes Drive	35,266	47,732	1.4%
Staunton	7	Regency Lakes Drive	Greenwood Road	27,927	40,623	1.8%

Based on the historic AADT data and review of SPS recommended growth forecasts, the suggested linear growth rate of 2.0% was applied to the Existing 2018 traffic volumes to generate projected 2030 AM and PM peak hour traffic volumes. These volumes are presented in Figure 22.

Figure 22. Future (2030) AM(PM) Peak Hour Traffic Volumes



STARS VDOT
Virginia Department of Transportation
Route 7 (Berryville Ave. and Berryville Pike), from N Pleasant Valley Rd. to Greenwood Rd. (Route 656)/First Woods Dr., City of Winchester, Frederick County, VA

ROUTE 7 FUTURE (2030) AM/PM PEAK HOUR VOLUMES

FIGURE 22

Updated by Michael Baker Intl in coordination with VDOT Staunton District Planning

4 SAFETY ANALYSIS

Crash data for the most recent five (5) years (November, 2013 through October, 2018) was obtained from VDOT's *Crashtools* database. The crash data and collision diagrams were examined to identify high-crash locations within the study limits. These locations, along with the rest of the corridor were evaluated during field investigations. These investigations were conducted with attention to the analyzed crash patterns and to evaluate field conditions that could be potentially contributing to the crash patterns as observed in the collision diagrams. These peak hours fell in the AM Peak period (7:15AM–8:15AM), and a PM Peak period (4:30PM–5:30PM), which correlate with 2 (two) of the top 3 (three) time periods experiencing the highest crash frequencies. Field reviews were conducted during both these AM and PM peak periods in order to examine factors such as traffic conditions, human-vehicle interaction, geometric layout, and the presence and condition of signing, pavement markings, and delineation.

The crash data analysis and field review data were used to identify factors that could potentially contribute to crashes and to make short-term maintenance type project recommendations regarding safety improvements that could mitigate future crashes.

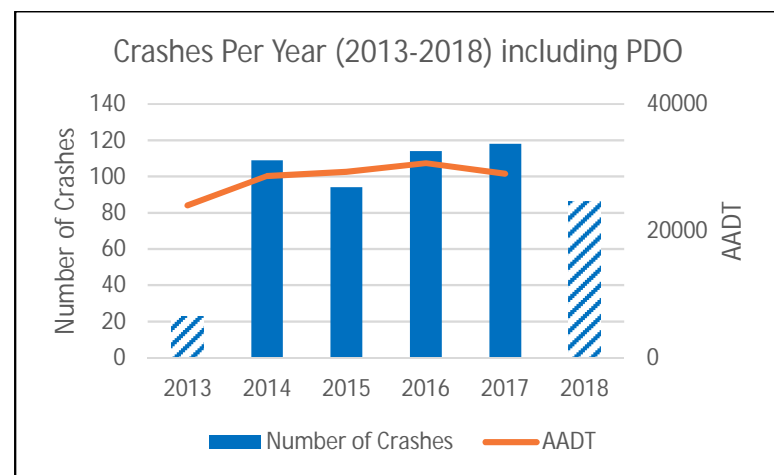
The findings for the project area are separated by Crash Data Analysis findings and Field Review findings. The Crash Data Analysis findings describe trends in the data regarding the year, time of day, type of crash, and roadway condition. The Field Review findings describe the field observations and discuss how those observations may relate to trends identified in the crash data. The findings and recommendations are provided in the following sections.

4.1 Crash Data Analysis

4.1.1 Crashes by Year

A total of 544 crashes occurred from Battle Park Drive to Renaissance Drive between November, 2013 through October, 2018, as shown in Figure 23 & 24. It should be noted that the crashes for years 2013 and 2018 are for partial years, as only partial year data was available for year 2018. To combine the data for total analysis period of 5-years, the partial crash data from years 2013 and 2018 were selected. The AADT values were used to associate the traffic volume with crashes per year, as shown in Figure 23 (orange line). The AADT values increased from 2013 to 2016, The total number of crashes decreased slightly in 2015 and then peaked in 2017.

Figure 23. Number of crashes per year for the project study area including PDO.



Additionally, Figure 25 shows that 1 fatal injury (0.2%), 12 non-visible injuries (2.2%), 14 severe injuries (2.6%) and 99 visible injuries (18.2%) occurred in the study area within the six-year period. The majority of crashes that occurred were property damage, which accounted for 76.8% of all crashes. Figure 26 provides a crash heat map of the overall corridor.

Figure 24. Number of crashes per year for the project study area excluding PDO.

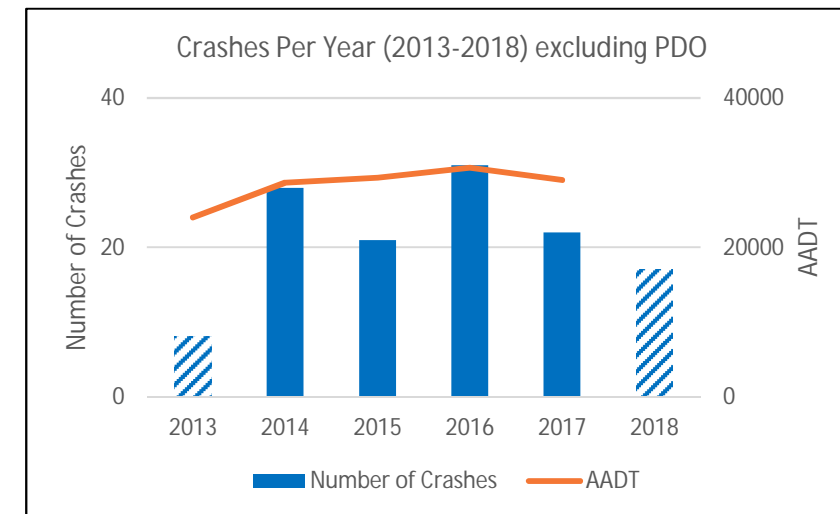


Figure 25. Severity of crashes for the project study area.

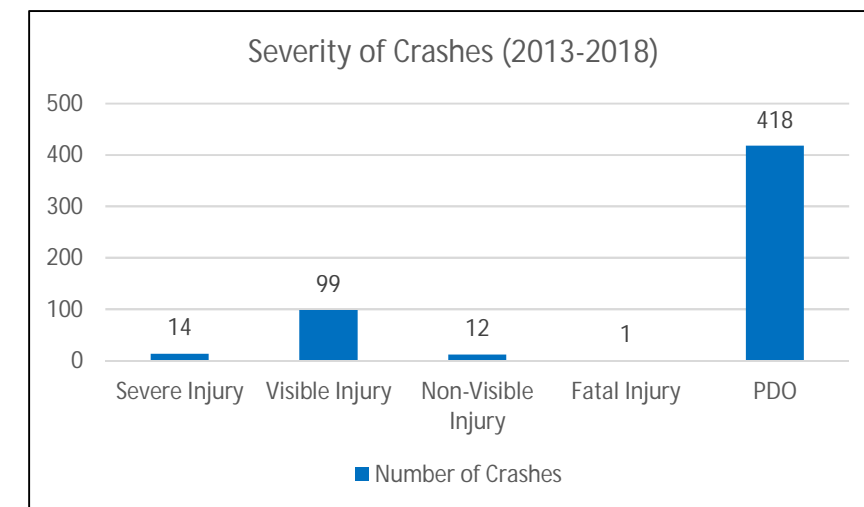
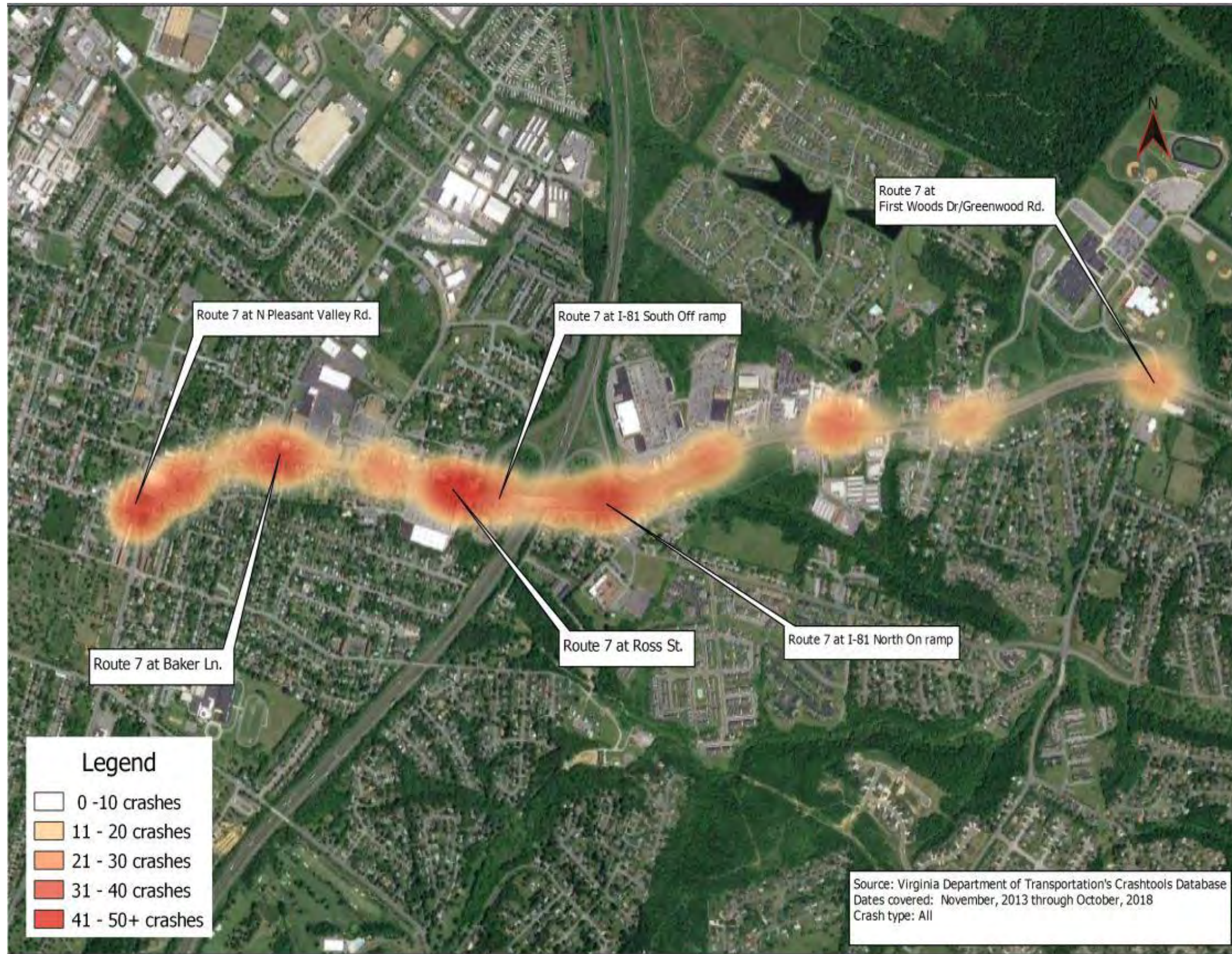


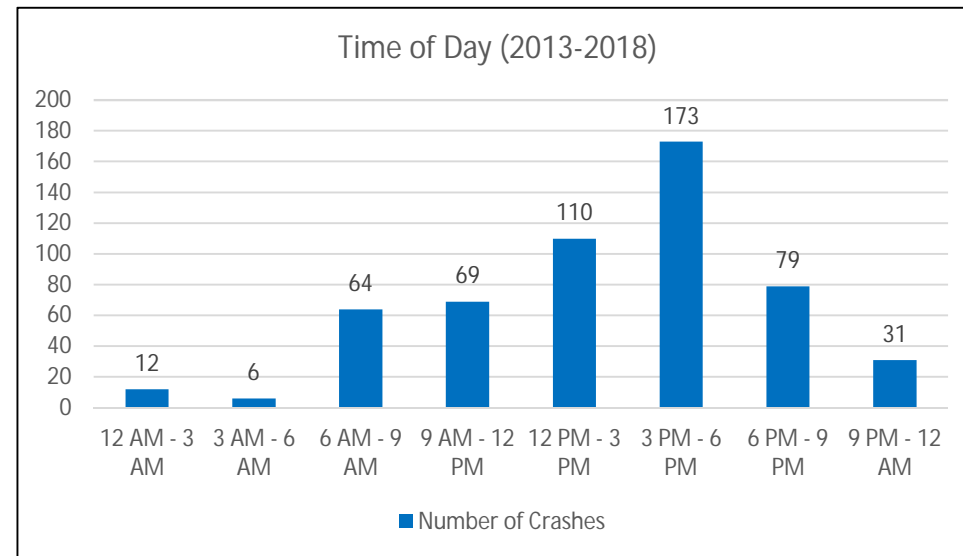
Figure 26. Crash heat map (2013-2018) (Includes PDO)



4.1.2 Crashes by Time of Day

Figure 27 displays the number of crashes that occurred by time of day, presented in 3-hour increments. The highest frequency of crashes occurred from 3PM-6PM (32%), from 12PM-3PM (20%), from 6PM-9PM (15%), and from 9AM-12PM (13%). Nine (12%) of the total crashes occurred during AM peak hour from 7:15AM to 8:15AM.

Figure 27. Number of crashes by time of day.



4.1.3 Crashes by Type

As shown in Figures 28 & 29, the majority of crashes that occurred were rear-end crashes (50%), followed by angle crashes (28%), sideswipe same-direction crashes (10%), and fixed object off-road crashes (5%); the remaining crash types each accounted for less than 7% of the overall crashes. Three (6) pedestrian related crashes occurred between five-year period. It should be noted that 16 crashes were incorrectly categorized within the *CrashTools* database; these crash classifications were corrected and updated to ensure the accuracy of the crash type analysis.

Figure 28. Number of crashes by type of crash.

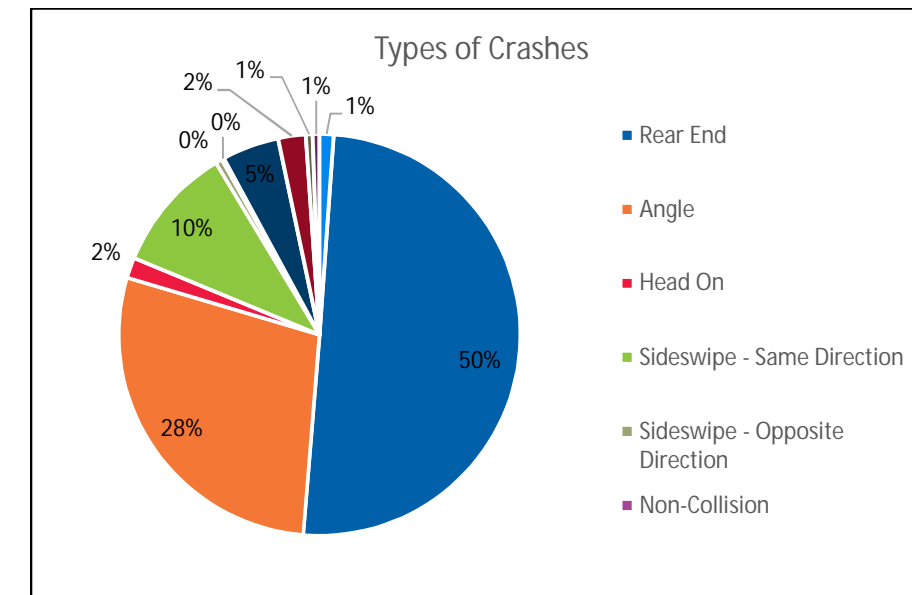
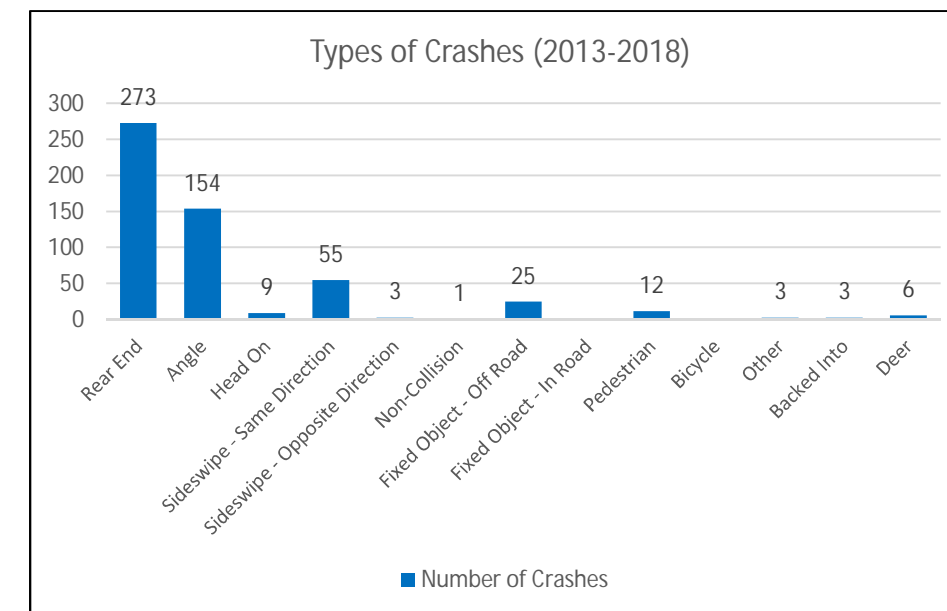


Figure 29. Number of crashes by type of crash.



Based on the *historical crash data* that were reviewed, Table 11 includes the most prominent crash types along the route. Note that for the purposes of analyzing the most frequent crashes, not all crashes are included in the crash pattern analysis.

Table 11. Crash patterns along the project study area.

Location (Intersection)	Approach / Intersection	Most Prominent Crash Type(s)	Total Crashes (Approach / Intersection)	Year(s)	Prominent Crash (Highest Crash Type %)
Route 7 at North Pleasant Valley	NB Approach	Rear-end	4	2013-2018	3 Total (75% rear-end)
	EB Approach	Rear-end	4	2013-2018	3 Total (75% rear-end)
	WB Approach	Rear-end	9	2013-2018	9 Total (100% rear-end)
	Intersection	Angle	14	2013-2018	10 Total (71% angle)
Route 7 at Baker Lane	EB approach	Rear-end	4	2013-2018	3 Total (75% rear-end)
	WB approach	Rear-end	5	2014-2018	4 Total (80% rear-end)
	Intersection	Angle; Rear-end	20	2014-2018	13 Total (65% angle) 7 Total (35% rear-end)
Route 7 at Ross Street	EB approach	Rear-end	9	2013-2018	8 Total (89% rear-end)
	WB approach	Angle	1	2014-2018	1 Total (100% angle)
	Intersection	Angle	17	2014-2018	13 Total (76% angle)
Route 7 at I-81 South Off ramp	EB approach	Rear-end	7	2013-2018	4 Total (57% rear-end)
	WB approach	Rear-end	6	2014-2018	6 Total (100% rear-end)
	Intersection	Angle; Rear-end	5	2014-2018	2 Total (40% angle) 2 Total (40% rear-end)
Route 7 at I-81 North On ramp	EB approach	Rear-end	10	2013-2018	8 Total (80% rear-end)
	WB approach	Rear-end	8	2014-2018	6 Total (75% rear-end)
	Intersection	Angle	13	2014-2018	10 Total (77% angle)
	NB approach	Rear-end	5	2013-2018	2 Total (40% rear-end)
	SB approach	Rear-end	6	2014-2018	3 Total (50% rear-end)
Route 7 at Gateway Drive	EB approach	Rear-end	3	2013-2018	3 Total (100% rear-end)
	WB approach	Rear-end	5	2014-2018	5 Total (100% rear-end)
	Intersection	Angle	6	2014-2018	4 Total (67% angle)

4.1.4 Crashes by Roadway and Weather Conditions

Figure 30 indicates the number of crashes by roadway surface condition. The majority (85%) of crashes occurred during dry roadway conditions. Wet conditions accounted for 14% of crashes. Remaining 1% of the crashes occurred on snowy or icy or slushy roadway conditions. Additionally, Figure 31 shows that most of the collisions occurred under clear/cloudy weather conditions (86%), followed by rainy weather conditions (12%). Snowy weather conditions accounted for less than 2% of the total accidents.

Figure 30. Number of crashes by roadway surface condition for the project study area.

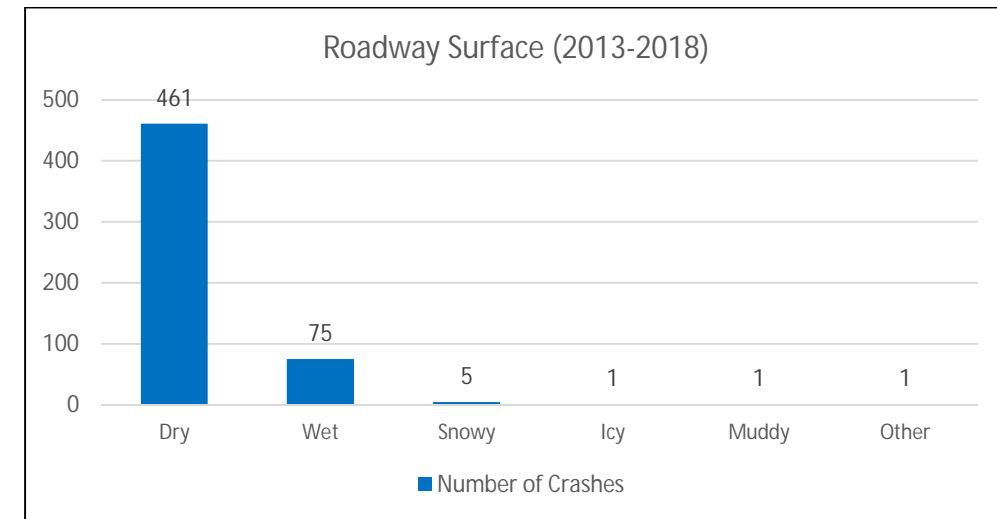
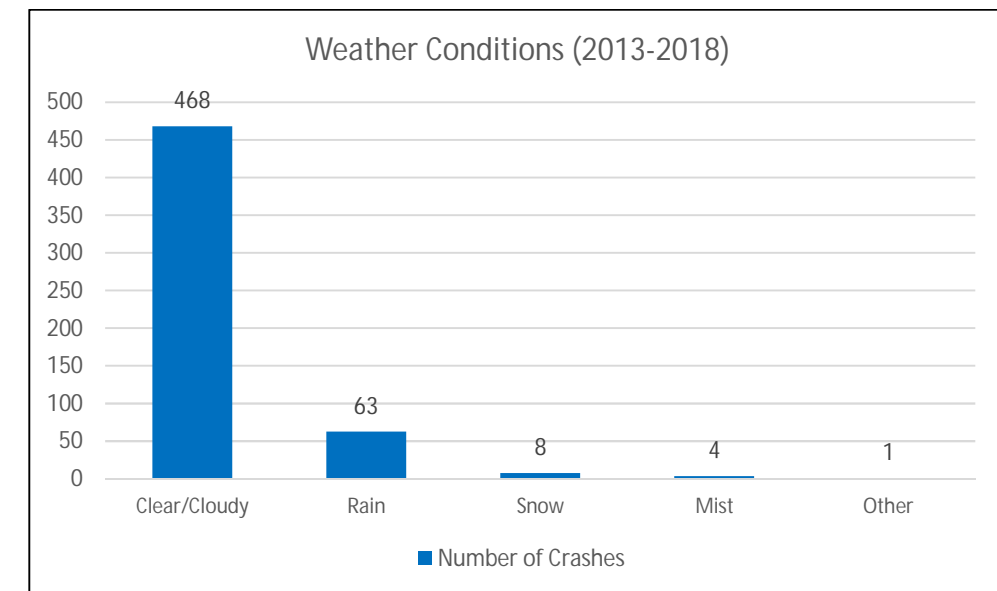


Figure 31. Number of crashes by weather condition for the project study area.



4.1.5 Crash Density by ¼-mile

Crash density histograms were developed in ¼-mile increments to provide a visual representation of crashes along the corridor based on crash type, crash severity, time-of-day, and roadway conditions. Crash hot spots were identified along the corridor as locations with the highest crash density. As shown in Figure 32, three (3) crash hotspots were identified along Route 7: 1) North Pleasant Valley-Dunlap Street (Milepost 0.85-1.10) and 2) Ross Street-Middle of Bridge Deck above I-81 (Milepost 1.60-1.85) 3) Middle of Bridge Deck-Martin Drive (Milepost 1.85-2.10). A discussion of the crash hotspots is provided below.

4.1.5.1 Route 11 Eastbound

HOTSPOT 1: NORTH PLEASANT VALLEY-DUNLAP STREET (MILEPOST 0.85-1.10)

A total of 37 crashes occurred at this hotspot. The majority of crashes were rear-end (30%) and angle (41%) crashes, with most crashes resulting in property damage and visible injuries. In addition, the crashes predominately occurred from 3:00-6:00PM (43%) and 12:00PM-3:00PM (14%) and primarily under dry pavement conditions.

HOTSPOT 2: ROSS STREET-MIDDLE OF BRIDGE DECK ABOVE I-81 (MILEPOST 1.60-1.85)

A total of 53 crashes occurred at this hotspot. The majority of crashes were rear-end (40%) and angle (34%), with almost all crashes resulting in property damage and visible injuries. In addition, the crashes predominately occurred from 3:00-6:00PM (38%) and 6:00AM-9:00AM (17%) and primarily under dry pavement conditions.

HOTSPOT 3: MIDDLE OF BRIDGE DECK-MARTIN DRIVE ABOVE I-81 (MILEPOST 1.85-2.10)

A total of 37 crashes occurred at this hotspot. The majority of crashes were rear-end (59%) and angle (19%), with almost all crashes resulting in property damage and visible injuries. In addition, the crashes predominately occurred from 6:00AM-6:00PM (19%) and primarily under dry pavement conditions.

4.1.5.2 Route 11 Westbound

HOTSPOT 1: NORTH PLEASANT VALLEY-DUNLAP STREET (MILEPOST 0.85-1.10)

A total of 61 crashes occurred at this hotspot. The majority of crashes were rear-end (56%) and angle (34%) crashes, with most crashes resulting in property damage and visible injuries. In addition, the crashes predominately occurred from 3:00-6:00PM (36%) and 12:00PM-3:00PM (28%) and primarily under dry pavement conditions.

HOTSPOT 2: ROSS STREET-MIDDLE OF BRIDGE DECK ABOVE I-81 (MILEPOST 1.60-1.85)

A total of 41 crashes occurred at this hotspot. The majority of crashes were rear-end (56%) and angle (32%), with almost all crashes resulting in property damage and visible injuries. In addition, the crashes predominately occurred from 3:00-6:00PM (39%) and 6:00AM-9:00AM (17%) and primarily under dry pavement conditions.

HOTSPOT 3: MIDDLE OF BRIDGE DECK ABOVE I-81 - MARTIN DRIVE (MILEPOST 1.85-2.10)

A total of 37 crashes occurred at this hotspot. The majority of crashes were rear-end (72%) and Sideswipe-same direction (11%), with almost all crashes resulting in property damage and visible injuries. In addition, the crashes predominately occurred from 3:00-6:00PM (30%) and 12:00PM-3:00PM (28%) and primarily under dry pavement conditions.

Figure 32. Crash density histograms per ¼-mile (Route 7).

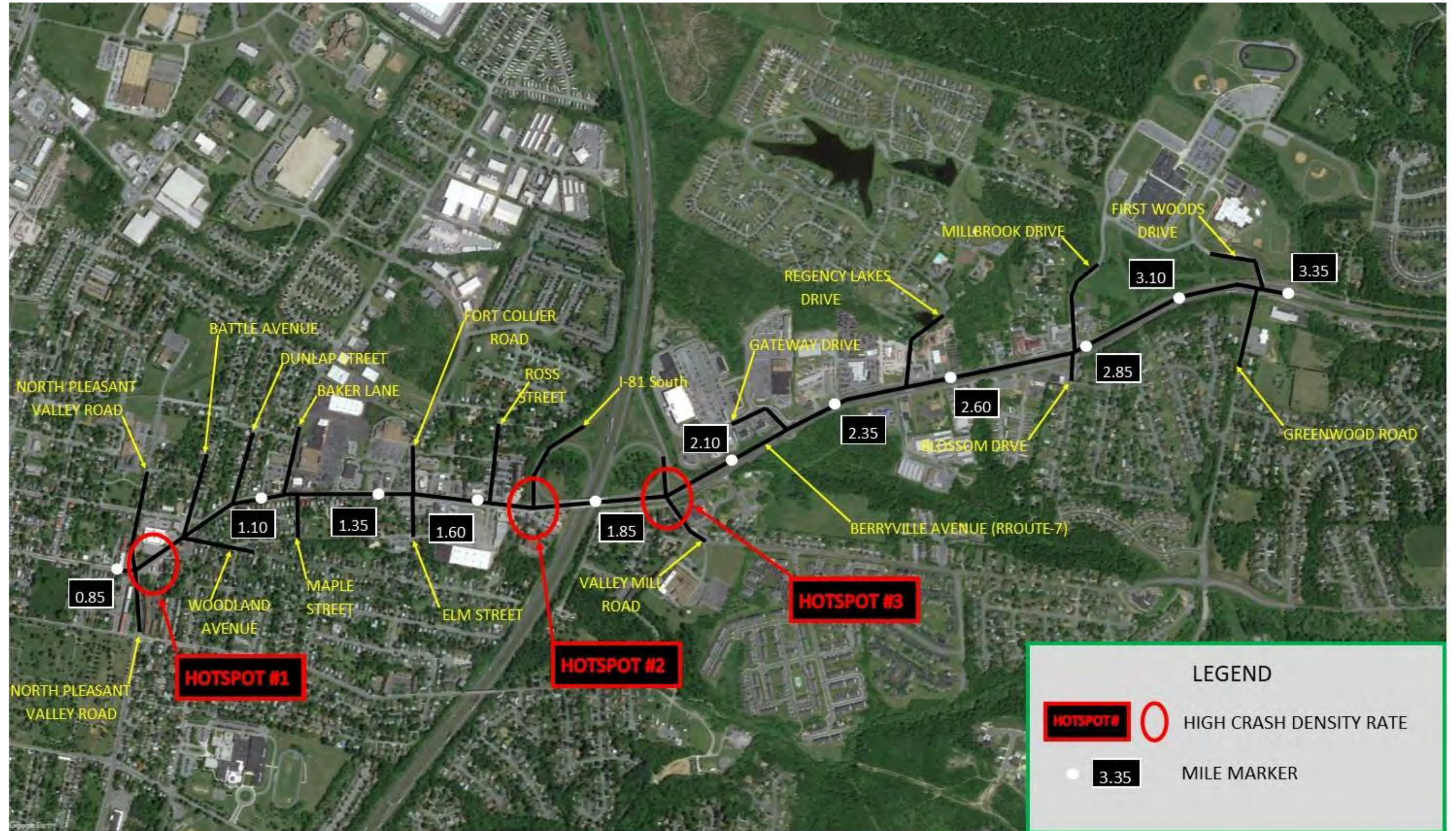


Figure 33. Eastbound Crash Type Histogram.

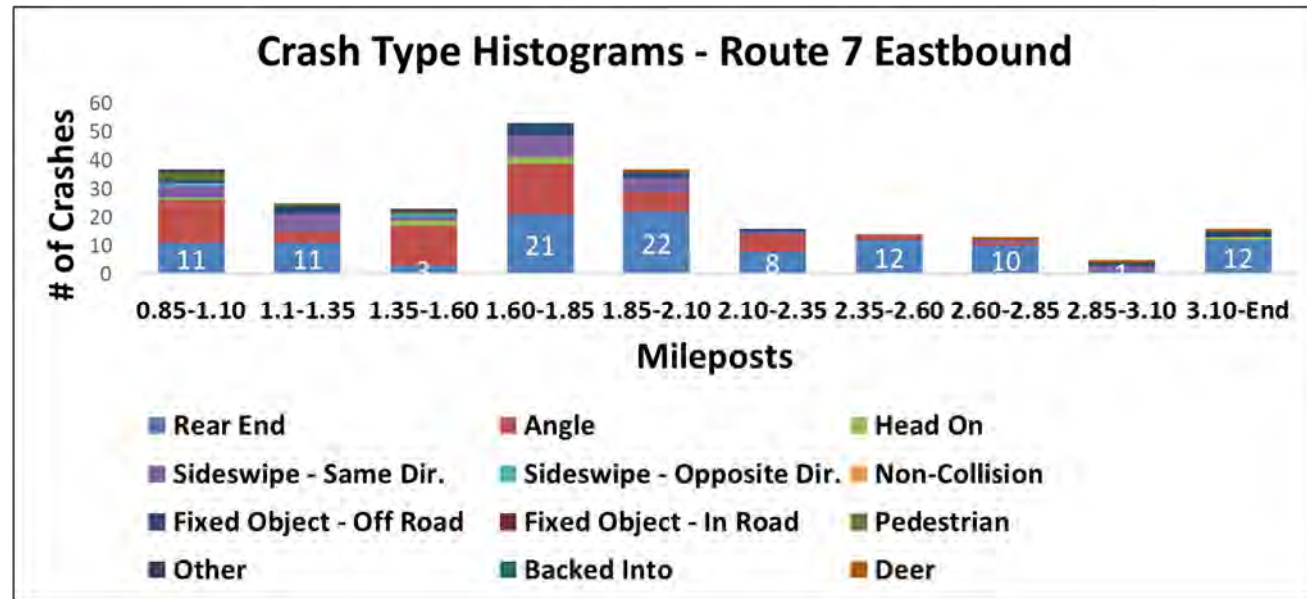


Figure 35. Eastbound Time of Day Histogram.

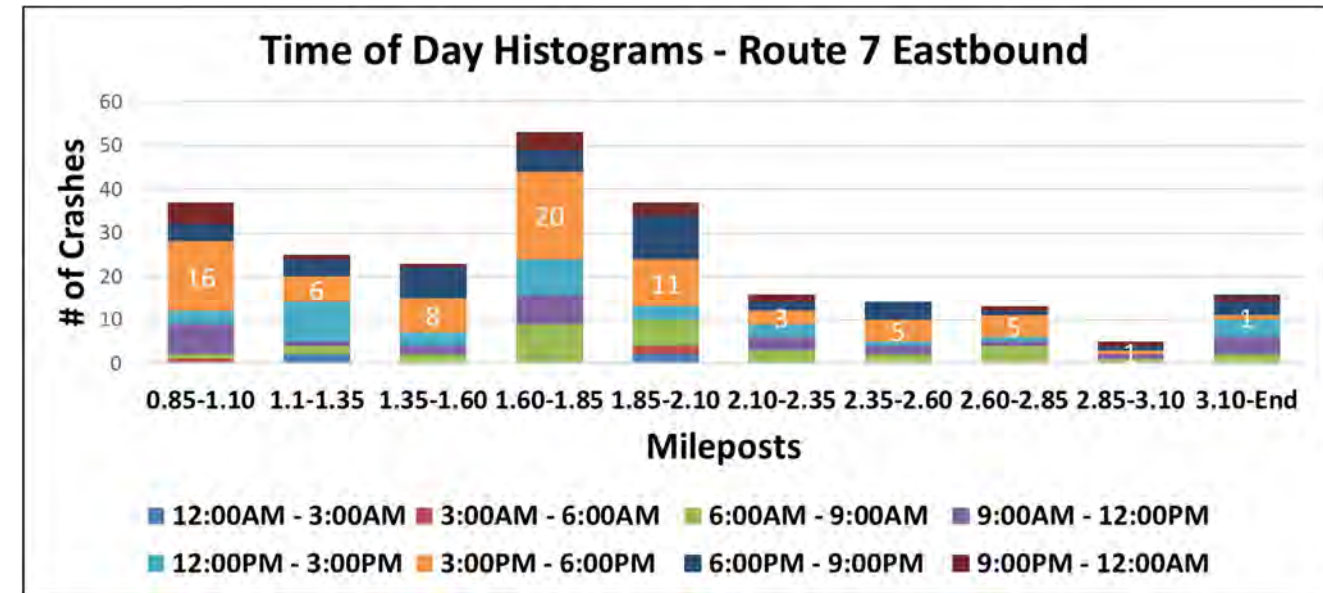


Figure 34. Eastbound Crash Severity Histogram.

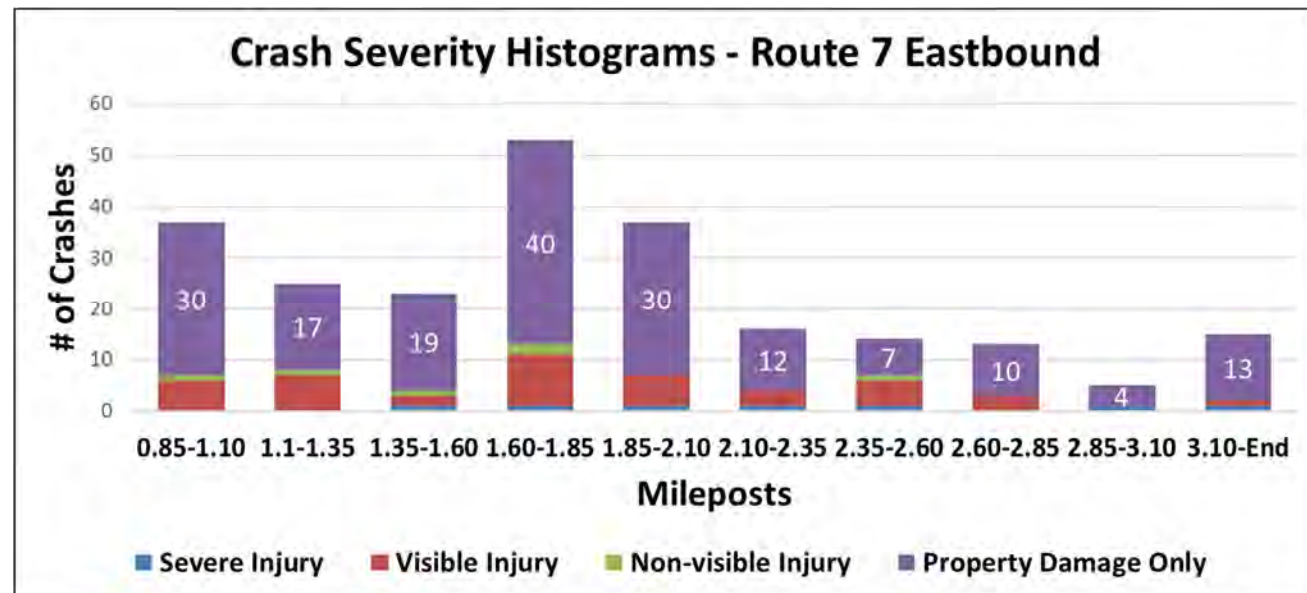


Figure 36. Eastbound Road Surface Condition Histogram.

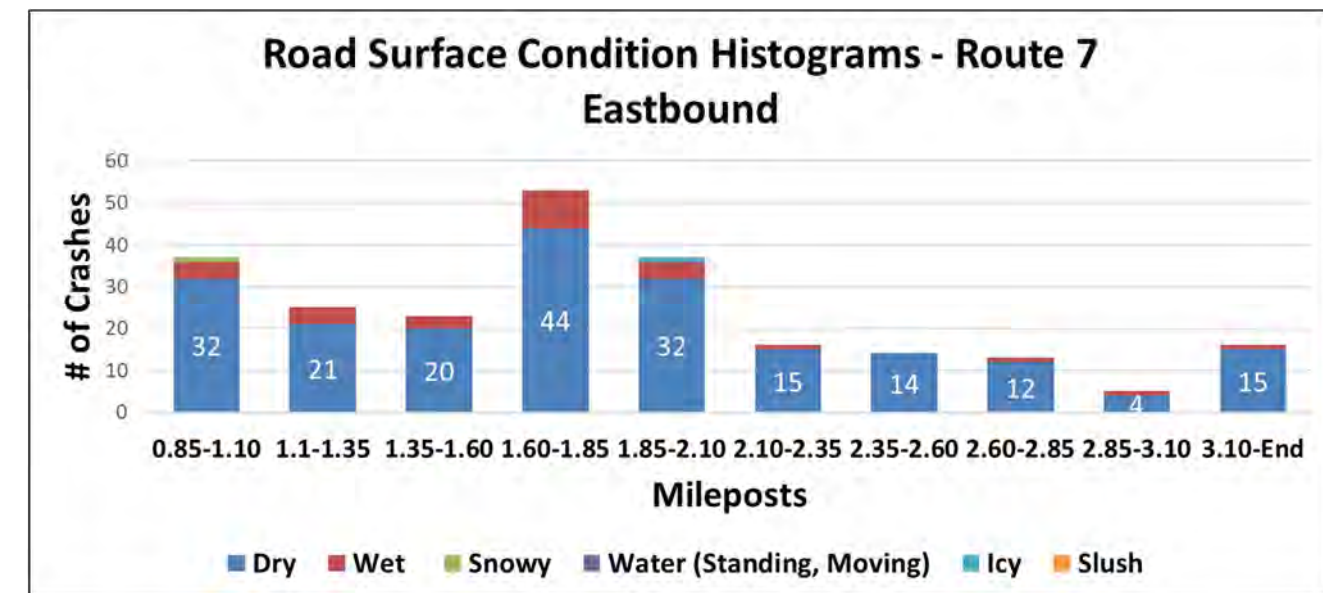


Figure 37. Westbound Crash Type Histogram.

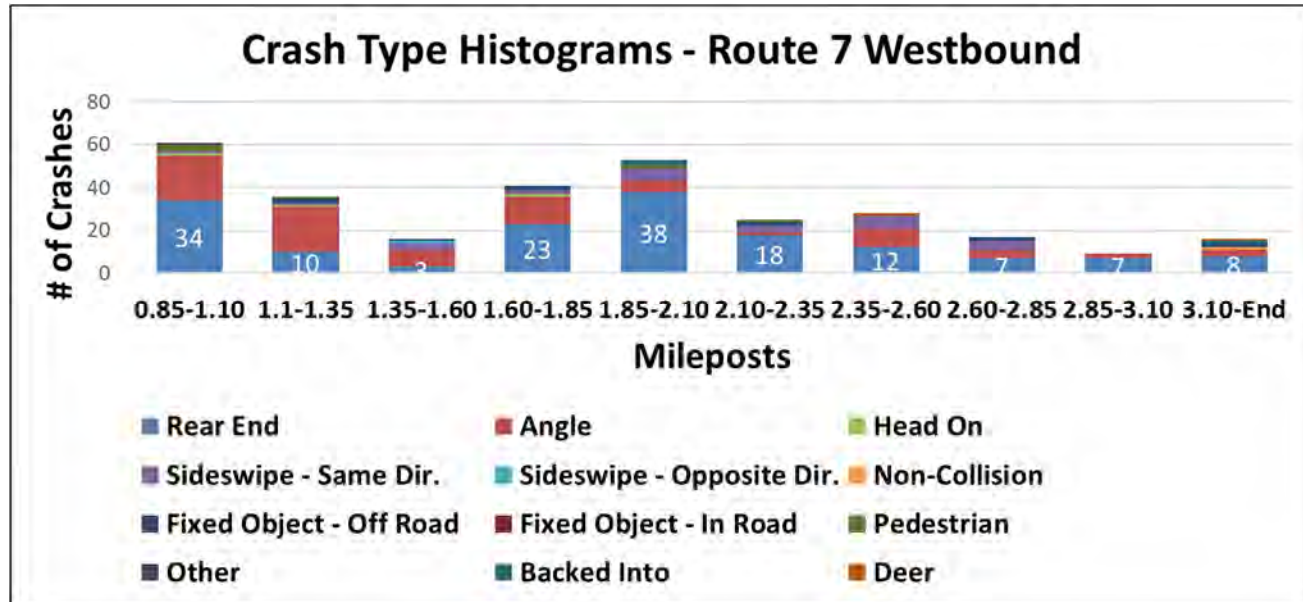


Figure 39. Westbound Time of Day Histogram.

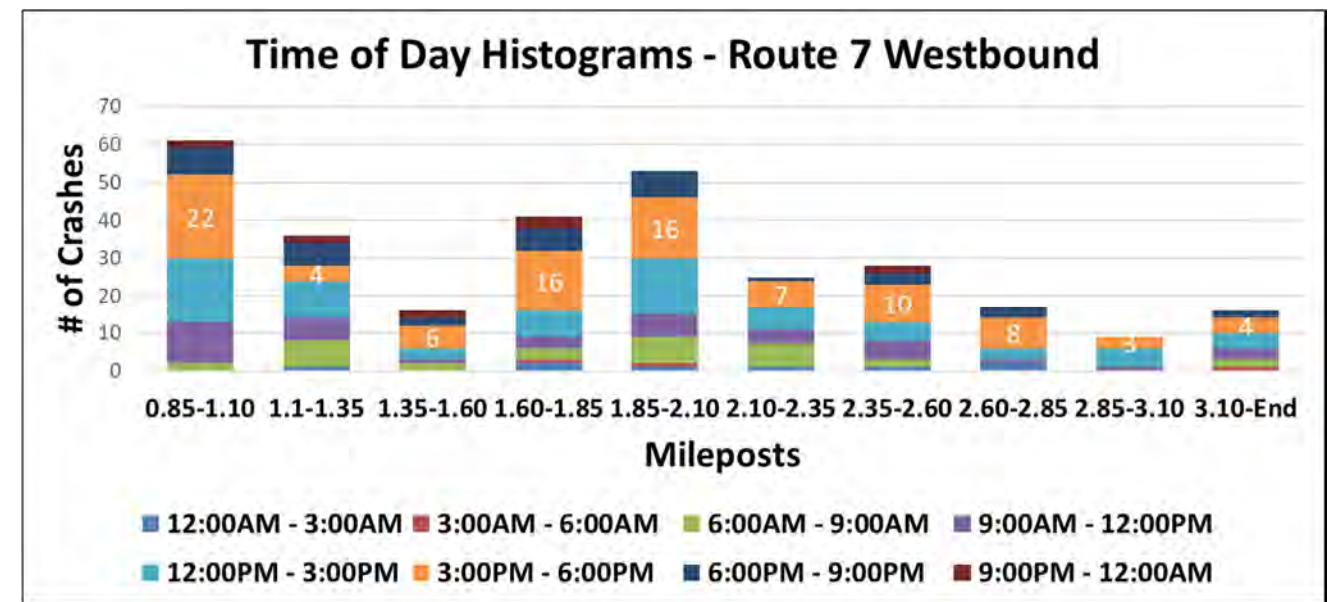


Figure 38. Westbound Crash Severity Histogram.

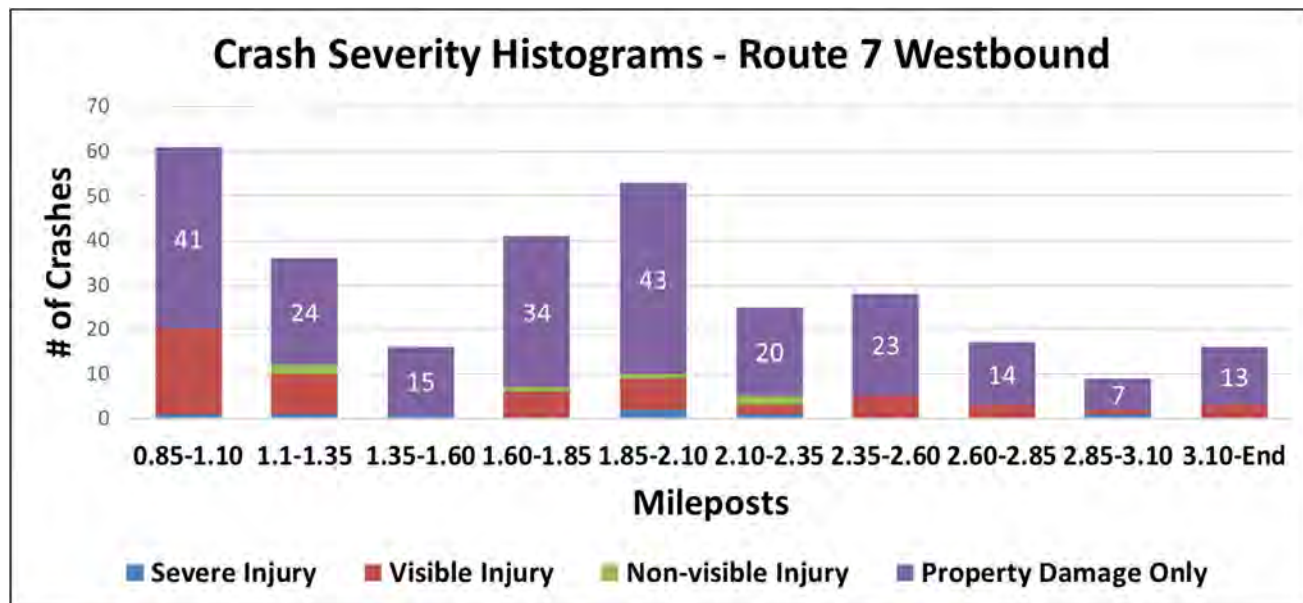
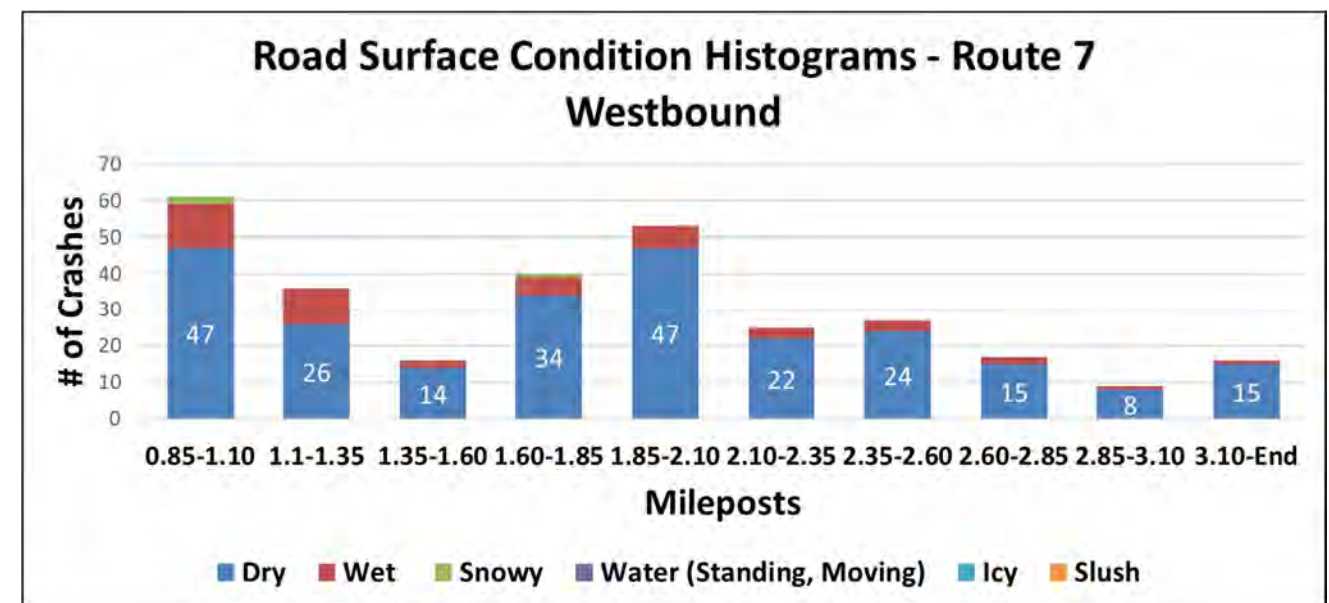


Figure 40. Westbound Road Surface Condition Histogram.



4.1.6 Intersection Crash Rate

The crash rates were calculated utilizing the crash rate calculations described in the *FHWA Roadway Safety Information Analysis*. The intersection crash rates per million entering vehicles were calculated for the study intersections using the formula,

$$R = \frac{C \times 1,000,000}{365 \times N \times V}$$

Where, R = Crash Rate expressed as crashes per 1 million entering vehicles
 N = Number of years of data = 5 years
 V = Total traffic volume entering the intersection

The Fatal, Injury and PDO crash rates were similarly calculated by using the total fatal, injury and PDO crashes at each study location. Intersection crash rate results are provided in Table 12.

Table 12. Crash rates (Intersections)

Intersection	Total Crash Rate (R)	Injury Crash Rate (Ri)	Fatal Crash Rate (Rf)	PDO Crash Rate (Rpdo)
RT 7/North Pleasant Valley Rd	0.444	0.13	0	0.31
RT 7/Battle Ave/Woodland Ave	0.701	0.20	0	0.50
RT 7/Dunlap St/Chestnut St	0.219	0.07	0	0.15
RT 7/Baker Lane	0.570	0.04	0	0.53
RT 7/Apple valley Marketplace	0.153	0.02	0	0.13
RT 7/Elm St/fort Collier Rd	0.291	0.03	0	0.26
RT 7/Atwell Ave	0.175	0.02	0	0.15
RT 7/Ross St	0.532	0.11	0	0.42
RT 7/Median Opening	0.266	0.05	0	0.22
RT 7/I-81 South Off ramp	0.391	0.05	0	0.34
RT 7/I-81 North On ramp	0.934	0.12	0	0.81
RT 7/Winchester Gateway Dr	0.507	0.10	0	0.41
RT 7/Regency Lakes Drive	0.507	0.10	0	0.41
RT 7/Millbrook Drive/Blossom Rd	0.304	0.10	0	0.20
RT 7/Greenwood Rd/First Woods Dr	0.487	0.10	0.02	0.37

4.1.7 Roadway Departure Crash Rate

The roadway departure crash rates were calculated by following the methodology described in *FHWA Safety Information Analysis* and using the formula,

$$R = \frac{C \times 100,000,000}{365 \times N \times V \times L}$$

Where, R = Crash Rate expressed as crashes per 100 million vehicle miles traveled (VMT)
 N = Number of years of data = 5 years
 V = Total traffic volume entering the intersection
 L = Length of segment (mile)

The Fatal, Injury and PDO crash rates were similarly calculated by using the total fatal, injury and PDO crashes at each study location. Roadway segment crash rate results are provided in Table 13. The calculated crash rates (total, injury and fatal) were compared with *2016 Statewide Summary of Crash Data*, which VDOT developed for all the roadway system under their jurisdiction. *The Crash Summary by Facility Type/Primary Roads 2016 and Divided, no control of access type* was selected for comparison, since this facility type is like Route 7 corridor.

Table 13. Crash Rates (Segments)

Road Segment	Total Crash Rate (R)	Injury Crash Rate (Ri)	Fatal Crash Rate (Rf)	PDO Crash Rate (Rpdo)
National Avenue to Battle Ave/Woodland Ave	219.18	21.92	0.00	197.26
Battle Ave/Woodland Ave to Dunlap St/Chestnut St	48.71	24.35	0.00	24.35
Dunlap St to Baker Ln	146.12	48.71	0.00	97.41
Baker Ln to Apple Valley Marketplace	301.37	164.38	0.00	136.99
Apple Valley Rd to Elm St/Fort Collier Rd	134.88	16.86	0.00	118.02
Elm St/Fort Collier Rd to Atwell Ave	73.06	0.00	0.00	73.06
Atwell Ave to Ross St	27.40	0.00	0.00	27.40
I-81 South Off ramp to I-81 North On ramp	211.01	61.26	0.00	149.75
I-81 North On ramp to Winchester Gateway Dr	175.34	31.31	0.00	144.03
Gateway Dr to Regency lakes Dr	87.62	35.05	0.00	52.57
Regency Lakes Dr to Millbrook Dr/Blossom Rd	164.89	31.71	0.00	133.18
Millbrook Dr to Firstwoods Dr/Greenwood Rd	60.33	5.48	0.00	54.85

Notes:

- Highlighted values indicate the crash rates that exceed statewide average for similar facility (Primary Roads)
- The statewide averages were obtained from *Commonwealth of Virginia 2017 Virginia Traffic Crash Facts*
- The following statewide average crash rates were obtained:
 - Total Crashes – 138.51
 - Fatal Crashes – 0.99
 - Injury Crashes – 72.69
- The statewide data does not provide average crash rates for PDO crashes.

4.1.8 Crash Data Summary

The following observations were made for crashes that occurred during the five (5) year period from North Pleasant Valley Road to Greenwood Road:

- § One (1) fatal pedestrian crash occurred in 2016 during the 9AM to 12PM time period. The collision occurred under dry roadway conditions and in clear weather. The driver had a medical emergency and ran off the road striking the right guard rail at 150' west of Greenwood Road.
- § 23 percent (23%) of crashes resulted in non-fatal injuries (e.g., ambulatory, visible, and non-visible injuries) (125 crashes).
- § 85 percent (85%) of crashes occurred under dry pavement conditions (461 crashes).
- § 14 percent (14%) of crashes occurred under wet pavement conditions (75 crashes).
- § 50 percent (50%) of crashes that occurred over the five (5) year period were rear-end crashes (273 crashes).
- § 28 percent (28%) of crashes that occurred over the five (5) year period were angle crashes (154 crashes) and another 10 percent (10%) of crashes were side-swipe – same direction crashes (55 crashes).
- § 22 percent (22%) of crashes occurred during dark lighting conditions, which includes the following time periods: 9PM–12AM, 12AM–3AM, and 3AM–6AM (122 crashes).
- § 12 percent (12%) of crashes (64 crashes) occurred during the AM peak period (6AM–9AM). 32 percent (32%) of crashes (173 crashes) occurred during the PM peak period (3PM–6PM).

4.2 Field Review

Field observations were conducted at the project study area on Thursday, March 9, 2019 and Tuesday, March 12, 2019 during the AM and PM peak periods to assess traffic operations, roadway geometrics, safety, queuing, vehicle interaction conflicts, and existing signage. In order to evaluate these conditions within the field, various engineering manuals (e.g., Manual on Uniform Traffic Control Devices (MUTCD), Virginia Supplement to MUTCD, 2010 ADA Standards for Accessible Design (ADA)) were used to guide the recommendations. It should be noted, that while *historical crash data* were utilized to determine crash patterns and areas of focus within the field, other recommendations and/or observations were noted that may not be directly related to crash patterns.

Table 14 lists common observations/recommendations from the field and the respective standards. Note that existing standards will be cited within the Field Review and Recommendations sections for any unique observations/recommendations that are not listed within Table 14.

Table 14. Common Field Observations/Recommendations and the Associated Standards

Observation/Recommendation	Associated Standard
Tactile domes do not comply with standards and should be updated	VDOT RBS; ADA Section 705.1
Pedestrian crossing pavement markings are faded and should be refurbished	MUTCD Section 3B.18
Stop bar/yield lines are faded and should be refurbished	MUTCD Section 3B.16
Pavement marking arrows	MUTCD Section 3B.24
Pavement and Curb markings	MUTCD Section 3B
Pavement marking line extensions through intersections	MUTCD Section 3B.08
Stop sign is not present and should be installed	MUTCD Section 2B.10
Pedestrian facilities are not provided and should be installed	MUTCD Section 3B.18 and MUTCD Chapter 4E
Distance buffer between the stop bar and crosswalk at an intersection approach	MUTCD Section 3B.16
Movement prohibition sign at an intersection	MUTCD Section 2B.18
Street name sign letter height appears smaller than recommended	MUTCD Section 2D.43

4.2.1 Route 7 (Berryville Avenue) at North Pleasant Valley Road

- § This is a signalized intersection, left-turns are controlled by protected permissive phasing on all approaches. During the PM peak hours, extensive vehicle queues were observed along the eastbound and westbound lanes. Westbound queues backed up until the Battle Avenue. At the time of field observations, pedestrians were observed crossing in the middle of east leg of the intersection. Based on the crash data, two pedestrian crashes occurred in the vicinity of the intersection (Figure 41).
- § All signal heads have backplates; however, the backplates do not have yellow retroreflective borders installed. Five-section protected/permitted left-turn signal heads are provided on all approaches. (See Recommendation A1)
- § The High visibility crosswalk markings on the north and south legs of the intersection are faded. Additionally, the stop bar is faded on the eastbound approach. (See Recommendation A2)

Figure 41. Westbound Route 7 at North Pleasant Valley Road



4.2.2 Route 7 (Berryville Avenue) at National Avenue

- § National Avenue is provided with a High visibility crosswalk and is controlled by a stop sign; However, there is no stop bar. (See Recommendation A3)

§ National Avenue provides the access to a Gas station which generates significant pedestrian trips. National Avenue is less than 100 feet from North pleasant valley Road. Two (2) Pedestrian crashes were associated with this location. (See Recommendation A4)

4.2.3 Route 7 (Berryville Avenue) at Battle Avenue/Woodland Avenue

- § This is a signalized intersection with pedestrian facilities on north, south and west legs of the intersection. (See Recommendation A5)
- § Currently “No Right Turn” (R3-1) sign panel is located on the mast arm restricting westbound traffic from turning right onto Battle Avenue. However, vehicles were recorded violating right turn restrictions (Figure 42). (See Recommendation A6)
- § All signal heads have backplates; however, the backplates do not have yellow retroreflective borders installed. (See Recommendation A7)
- § Roadway lighting is provided on northeast corner of the intersection; However, the existing roadway lighting does not seem adequate per IESNA standards. (See Recommendation A8)

Figure 42. Westbound approach Route 7 at Battle Avenue



4.2.4 Route 7 (Berryville Avenue) at Virginia Avenue

- § Virginia Avenue is a one-way street. Vehicular movements from Virginia Avenue onto Route 7 are restricted.
- § Currently, a street name sign is provided on the northeast corner of the intersection; However, it is difficult to read the sign from eastbound and westbound directions. (See Recommendation A9, A10)

4.2.5 Route 7 (Berryville Avenue) at Dunlap Street/Chestnut Street

- § This is an unsignalized intersection with a two-way stop control on northbound Chestnut Street and southbound Dunlap Street.
- § Pavement striping along the north and south legs of the intersection are faded. (See Recommendation A10)
- § Horizontal curvature along route 7 restricts the line of sight of the westbound traffic.

4.2.6 Route 7 (Berryville Avenue) at Baker Lane

- § This is a signalized T-intersection with pedestrian facilities on south and east legs. Based on the crash data, one pedestrian crash occurred on the west leg of the intersection. (See Recommendation A11)
- § The High visibility crosswalk markings on south and east legs of the intersection are faded (Figure 43). (See Recommendation A12)
- § All signal heads have backplates; however, the backplates do not have yellow retroreflective borders

Figure 43. Route 7 at Baker Lane



installed. Five-section protected/permitted left-turn signal heads is provided on eastbound approach (See Recommendation A13)

4.2.7 Route 7 (Berryville Avenue) at Maple Street

- § Maple Street is located 100 feet east of Baker lane. It is controlled by a stop sign in the northbound direction.
- § The stop bar and high visibility crosswalks on south leg are faded. (See Recommendation A14)

4.2.8 Route 7 (Berryville Avenue) at Apple Valley Marketplace

- § This is a signalized T-intersection with pedestrian facilities on the south leg (Figure 44). (See Recommendation A15)
- § All signal heads have backplates; however, the backplates do not have yellow retroreflective borders installed. Five-section protected/permitted left-turn signal head is provided on eastbound approach (See Recommendation A16)

Figure 44. Eastbound Route 7 at Apple Valley Market Place



4.2.9 Route 7 (Berryville Avenue) at Elm Street/Fort Collier Road

- § This is a signalized intersection with protected permissive left-turn phasing on all approaches. Pedestrian facilities are provided on all approaches except east leg of the intersection (Figure 45). (See Recommendation A17)
- § The High visibility crosswalk markings on north and south legs of the intersection are faded (See Recommendation A18)
- § All signal heads have backplates; however, the backplates do not have yellow retroreflective borders installed. Five-section protected/permitted left-turn signal heads are provided on all approaches. (See Recommendation A19)
- § During the AM peak hour, extensive vehicle queues were observed along the southbound left turn lane. Queues on the southbound left-turn lane spilled over thru lane blocking private driveways. Due to very heavy traffic, the southbound approach frequently experiences frequent cycle failures. During AM and PM peak periods, large semi-tractor trailers were observed making the right turns from the westbound thru lane. Additionally, the stop bars on southbound left-turn and westbound approaches are pulled back from the intersection to improve the turning radius. (See Recommendation A20)

Figure 45. Route 7 at Elm street /Fort Collier Road



4.2.10 Route 7 (Berryville Avenue) at Atwell Avenue

- § This is an unsignalized intersection with a two-way stop control on northbound Atwell Avenue and southbound Atwell Avenue.
- § Crosswalk Markings along the north and south legs of the intersection are faded. (See Recommendation A21)

4.2.11 Route 7 (Berryville Avenue) at Ross Street

- § This is a signalized intersection with protected permissive left-turn phasing on main line. Pedestrian facilities are provided on all approaches except east leg of the intersection. (See Recommendation A22)
- § Pavement markings along the north and south legs of the intersection are faded. (See Recommendation A23)
- § Currently, the signal heads for all approaches of the intersection have backplates; however, the signal heads do not have yellow retroreflective borders. Five-section protected/permitted left-turn signal heads are provided on eastbound and westbound approaches (See Recommendation A24)
- § During the AM and PM peak hours, extensive vehicle queues were observed along the eastbound approach due to vehicular backups from the intersections of Route 7 at I-81 South off Ramp (Figure 46). Eastbound queued vehicles caused the blockages at this intersection, making it difficult for vehicles to enter eastbound approach from north or south legs of the intersection. Near-miss incidents were recorded during the field visits. Based on the historical crash data, rear-end crashes were prominent and could be attributed to queueing issues at the intersection. (See Recommendation A55)

Figure 46. Route 7 at Ross Street



4.2.12 Route 7 (Berryville Pike) at Median opening

- § During AM and PM peak hours, extensive vehicle queues were observed along the eastbound lanes due to vehicle backups from the intersection of Route 7 at I-81 South Off Ramp. Mid-block median opening shortened the eastbound left turn storage bay at Route 7 at I-81 South Off Ramp. Conflicts were observed between vehicles entering and exiting from the gas station and queued vehicles on eastbound approach which sometimes resulted in near-miss incidents (Figure 47). Based on the historical crash data, angle crashes were prominent and could be attributed to the median opening and queueing issues along this stretch of corridor. (See Recommendation A25)

Figure 47. Median Opening



4.2.13 Route 7 (Berryville Pike) at I-81 South Off-Ramp

- § This is a signalized intersection with no pedestrian facilities. Currently, the signal heads for all approaches of the intersection have backplates; however, the signal heads do not have yellow retroreflective borders. (See Recommendation A26)
- § Pavement markings on eastbound, westbound and southbound approaches of the intersection are faded. Additionally, southbound dual left turn puppy tracks were faded. (See Recommendation A27)
- § Gore were faded on the eastbound channelized right turn towards I-81 south. (See Recommendation A28)
- § During the AM and PM peak hours, extensive vehicle queues were observed along the eastbound approach due to left turning vehicular queues exceeding the storage bay. Large semi-tractor trailer vehicles were primarily observed occupying the left turn storage bay. Left turning vehicular queues spilled into thru lanes which reduced the capacity from two thru lanes to one thru lane which in turn caused congestion until Ross Street (Figure 48). Vehicles were observed making lane changes with inadequate spacing, which sometimes resulted in near-miss incidents. Additionally, vehicles were seen exiting the Liberty gas station driveway which is located very close to the eastbound stop bar (Figure 48). (See Recommendations A25, A29)
- § Queues were recorded on southbound right turn and westbound thru approaches due to vehicles entering and exiting the Exxon gas station in the northwest corner of the intersection. (See Recommendation A29)

Figure 48. Eastbound Route 7 at I-81 South off Ramp



4.2.14 Route 7 (Berryville Pike) at I-81 North On-Ramp/Valley Mill Road

- § This is a signalized intersection with no pedestrian facilities. Pavement markings are faded along northbound and westbound directions of the intersection. The northbound approach does not have a stop bar marking. (See Recommendation A30)
- § Currently, the signal heads for all approaches of the intersection have backplates; however, the signal heads do not have yellow retroreflective borders. (See Recommendation A31)
- § Overhead street name signs on the mast arms are not provided for any approaches. A damaged street sign post is present on the southeast corner of the intersection with no street name signs. (See Recommendation A32)
- § During the AM and PM peak hours, extensive vehicle queues were observed along the westbound lanes which extended till the intersection of Route 7 at Winchester Gateway Drive (Figure 49). Additionally, vehicle queues were observed on eastbound and northbound approaches which frequently experienced cycle failures. Based on the historical crash data, rear-end crashes were prominent and could be attributed to queueing issues at the intersection. (See Recommendations A52, A54)

Figure 49. Westbound Route 7 at North On Ramp



§ A worn footpath is present along the eastbound approach to Valley Mill Road. (See Recommendations A48)

4.2.15 Route 7 (Berryville Pike) at Winchester Gateway Drive

§ Intersection is signalized with no pedestrian facilities. Currently, the signal heads for all approaches of the intersection have backplates; however, the signal heads do not have yellow retroreflective borders. (See Recommendation A33)

§ Pedestrian facilities are not provided at this intersection. During the observation, four (4) pedestrians were found crossing Route 7 at 400' to the west of the intersection (Figure 50). (See Recommendations A34)

§ During the PM peak hour, extensive vehicle queues were observed along the westbound lanes due to vehicle backups from the intersection of Route 7 at I-81 North On Ramp. (See Recommendations A52, A53, A54)

§ A worn footpath is present along the westbound approach to Winchester Gateway Drive. (See Recommendations A48)

Figure 50. Route 7 Westbound at Gateway Drive



4.2.16 Route 7 (Berryville Pike) at Cole Lane

§ Cole Lane is provided with stop sign; However, there is no stop bar. (See Recommendation A35)

§ Cole lane is less than 140 feet from the intersection of Route 7 at Regency Lake Drive. (See Recommendation A36)

4.2.17 Route 7 (Berryville Pike) at Regency Lakes Drive

§ Intersection is signalized with no pedestrian facilities. Eastbound edge line stripe is missing. (See Recommendation A37)

§ Overhead street name signs on the mast arms are not provided for any approaches. A damaged street name sign post is present on the southeast corner of the intersection with no street name sign. (See Recommendation A38)

§ Currently, the signal heads for all approaches of the intersection have backplates; however, the signal heads do not have yellow retroreflective borders. (See Recommendation A39)

4.2.18 Route 7 (Berryville Pike) at Millbrook Drive/Blossom Drive

§ Intersection is signalized without any pedestrian facilities. Pavement markings and arrows are faded along the northbound and westbound approaches of the intersection. (See Recommendation A40)

§ Overhead street name signs on the mast arms are not provided for eastbound and westbound approaches. A small street sign post is provided in the northwest and southeast corners of the intersection. (See Recommendation A41, A41)

§ Currently, the signal heads for all approaches of the intersection have backplates; however, the signal heads do not have yellow retroreflective borders. (See Recommendation A42)

§ Currently, the eastbound channelized right turn does not have a yield sign (Figure 51). (See Recommendation A43)

Figure 51. North bound approach Route 7 at Blossom Drive



4.2.19 Route 7 (Berryville Pike) at First Woods Drive/Greenwood Road

§ Intersection is signalized without any pedestrian facilities. Pavement markings and arrows are faded along the northbound and southbound approaches of the intersection. (See Recommendation A44)

§ Overhead street name signs on the mast arms are not provided for any approaches. A small street sign post is provided on the northwest and southeast corners of the intersection. (See Recommendation A45, A45)

§ Northbound approach has a steep downhill grade, coupled with horizontal curvature, which affects sight distance. Based on the historical crash data, rear-end crashes were prominent, and could be attributed due to sight distance issues at the intersection. (See Recommendation A46)

4.2.20 Overall Corridor

§ A number of private driveways are present along the Route 7 corridor, and in most cases, these driveways provide little to no pavement markings and/or signage. While neither the City of Winchester nor VDOT is responsible for the maintenance of these private driveways, lack of these improvements could be contributing to driving maneuvers not suitable for the conditions and crashes along the corridor. A combination of considerable heavy vehicle traffic and frequent maneuvers to and from these driveways resulted in slower speeds and queues on Route 7. (See Recommendation A47)

§ Pedestrian facilities are provided inconsistently along the length of the corridor and in most cases, are non-compliant with ADA standards and/or are discontinuous. During the field visit, a significant amount of pedestrian and bicycle activities were observed. (Figure 48) Generally, pedestrian and bicycle facilities along the corridor are insufficient. Transit operations on Route 7 between Pleasant Valley Road and Elm Street were observed during the field visit. Based on historical crash data, pedestrian related crashes occurred in this corridor and the lack of these facilities could be contributing to these crash rates. (See Recommendations A48, A52)

§ The corridor provides little to no overhead lighting along the sides of the road for this stretch of roadway. Businesses provide commercial lighting along the corridor which helps light the corridor; however, the

existing roadway lighting does not seem adequate per IESNA standards. Intersection lighting is provided at Route 7 at Pleasant Valley Road, Route 7 at Fort Collier Road/Elm Street, Route 7 at Ross Street, and Route 7 at Millbrook Drive/Blossom Drive. (See Recommendation A49)

§ There are numerous private driveways and cross streets which serve industrial facilities, and ultimately subjects Route 7 to increased volumes of semi-tractor trailer trucks. As a result, trucks entering and exiting Route 7 were observed throughout the day. Vehicles entering onto Route 7 at the unsignalized intersections created additional conflict points. Based on historical crash data, semi-tractor trailer truck related crashes occurred along the corridor which could be due to no advanced warning of trucks entering the roadway. (See Recommendation A51)

§ A number of short length left-turn lanes are present along the corridor. Although they provide access to the cross streets or businesses, these short left-turn lanes increase the number of conflict points and reduce the length of the adjacent left-turn bays. (See Recommendation A55)

4.3 Recommendations

The following recommendations are strictly based on field observations during the peak hours. These recommendations should be treated as low cost, short-term maintenance type projects which can be implemented using maintenance funds. The more detailed medium and high-cost improvement alternative recommendations will be made after the full operations and safety analysis and upon discussion with the SWG.

The City of Winchester and/or VDOT may implement some or none the following recommendations at their discretion.

4.3.1 Route 7 (Berryville Avenue) at North Pleasant Valley Road

- A1. Consider installing retroreflective yellow borders to all signal heads. Implementing these borders will improve signal visibility and potentially mitigate crashes. Consider converting five-section protected/permissive left-turn signal heads to the flashing yellow arrow indications.
- A2. Refurbish pavement markings on north and south legs of the intersection, per standards outlined in Table 14.

4.3.2 Route 7 (Berryville Avenue) at National Avenue

- A3. Consider installing a stop bar for the northbound approach of National Avenue, per standards outlined in Table 14.
- A4. Consider converting the National Avenue as right-in and right-out only approach.

4.3.3 Route 7 (Berryville Avenue) at Battle Avenue/Woodland Avenue

- A5. Consider installing pedestrian facilities on the east leg of the intersection, per standards outlined in Table 14.
- A6. Consider installing a "No Right Turn" sign panel (R3-1) for the westbound approach.
- A7. Consider installing retroreflective yellow borders to all signal heads. Implementing these borders could improve visibility and mitigate future rear-end crashes.
- A8. Evaluate the existing lighting at this intersection and install new lighting if warranted.

4.3.4 Route 7 (Berryville Avenue) at Virginia Avenue

- A9. Consider relocating the street sign panel further east of Virginia Avenue.

4.3.5 Route 7 (Berryville Avenue) at Dunlap Street/Chestnut Street

- A10. Refurbish pavement markings on the north leg and south legs of the intersection, per standards outlined in Table 14.

4.3.6 Route 7 (Berryville Avenue) at Baker Lane

- A11. Consider installing pedestrian facilities on west leg of the intersection, per standards in Table 14
- A12. Refurbish high visibility crosswalks on south leg, per standards outlined in Table 14.
- A13. Consider installing retroreflective yellow borders to all signal heads. Implementing these borders could improve visibility and mitigate crashes. Consider converting five-section protected/permissive left-turn signal heads to the flashing yellow arrow indications.

4.3.7 Route 7 (Berryville Avenue) at Maple Street

- A14. Refurbish High visibility pavement markings and stop bar on the south leg of the intersection, per standards outlined in Table 14.

4.3.8 Route 7 (Berryville Avenue) at Apple Valley Marketplace

- A15. Consider installing pedestrian facility on west and east legs of the intersection, per standards in Table 14
- A16. Consider installing retroreflective yellow borders to all signal heads. Implementing these borders could improve visibility and mitigate future rear-end crashes. Consider converting five-section protected/permissive left-turn signal head to the flashing yellow arrow indications.

4.3.9 Route 7 (Berryville Avenue) at Elm Street/Fort Collier Road

- A17. Consider installing pedestrian facility on west and east legs of the intersection, per standards outlined in Table 14.
- A18. Refurbish High visibility pavement markings and stop bar on the south leg of the intersection, per standards outlined in Table 14.
- A19. Consider installing retroreflective yellow borders to all signal heads. Implementing these borders could improve visibility and mitigate crashes. Consider converting five-section protected/permissive left-turn signal heads to the flashing yellow arrow indications.
- A20. Consider evaluating westbound right turn lane's turning radius per VDOT standards.

4.3.10 Route 7 (Berryville Avenue) at Atwell Avenue

- A21. Refurbish pavement markings on the north leg and south legs of the intersection, per standards outlined in Table 14.

4.3.11 Route 7 (Berryville Avenue) at Ross Street

- A22. Consider installing pedestrian facility on east leg of the intersection, per standards outlined in Table 14.
- A23. Refurbish pavement markings and pavement striping along the northbound and southbound lanes, per standards outlined in Table 14.
- A24. Consider installing retroreflective yellow borders to all signal heads. Implementing these borders could improve visibility and mitigate crashes. Consider converting five-section protected/permissive left-turn signal heads to the flashing yellow arrow indications.

4.3.12 Route 7 (Berryville Pike) at Median opening (mid-block)

- A25. Consider closing the median opening and extending the eastbound left turn bay at Route 7 and I-81 South Off Ramp intersection.

4.3.13 Route 7 (Berryville Pike) at I-81 South

- A26. Consider installing retroreflective yellow borders to all signal heads. Implementing these borders could improve visibility and mitigate crashes.
- A27. Refurbish pavement markings and striping along the eastbound westbound, southbound approaches of the intersection, per standards outlined in Table 14.
- A28. Refurbish gore markings along eastbound channelized right turn, per standards outlined in Table 14.
- A29. Consider managing the accesses to the gas stations closer to the intersection.

4.3.14 Route 7 (Berryville Pike) at I-81 North/Valley Mill Road

- A30. Refurbish pavement markings and striping along the northbound and westbound approaches of the intersection, per standards outlined in Table 14.
- A31. Consider installing retroreflective yellow borders to all signal heads. Implementing these borders could improve visibility and mitigate crashes.
- A32. Consider installing overhead street name sign panels on the mast arms for all approaches at the intersection, per standards outlined in Table 14.

4.3.15 Route 7 (Berryville Pike) at Winchester Gateway Drive

- A33. Consider installing retroreflective yellow borders to all signal heads. Implementing these borders could improve visibility and mitigate crashes.
- A34. Consider installing pedestrian facilities on the east and west legs of the intersection.

4.3.16 Route 7 (Berryville Pike) at Cole Lane

- A35. Consider installing a stop bar for the northbound approach of Cole Lane, per standards outlined in Table 14.
- A36. Consider evaluating alignment of Cole Lane. Evaluate aligning Cole Lane with the Regency Lake Drive.

4.3.17 Route 7 (Berryville Pike) at Regency Lakes Drive

- A37. Refurbish the eastbound edge line stripe, per standards outlined in Table 14.
- A38. Consider installing sign panels on the mast arms for all approaches at the intersection, per standards outlined in Table 14.
- A39. Consider installing retroreflective yellow border to all signal heads. Implementing these borders could improve and mitigate future rear-end crashes.

4.3.18 Route 7 (Berryville Pike) at Millbrook Drive/Blossom Drive

- A40. Refurbish pavement markings and striping along the northbound and westbound approaches of the intersection, per standards outlined in Table 14.
- A41. Consider installing street name sign panels on the mast arms for all approaches at the intersection, per standards outlined in Table 14.
- A42. Consider installing retroreflective yellow border to all signal heads. Implementing these borders could improve and mitigate crashes.
- A43. Consider installing ground mounted yield sign panel for the channelized right turn, per standards outlined in Table 14.

4.3.19 Route 7 (Berryville Pike) at First Woods Drive/Greenwood Road

- A44. Refurbish pavement markings and striping along the northbound and southbound approaches, per standards outlined in Table 14.

- A45. Consider installing street name sign panels on the mast arms for all approaches at the intersection, per standards outlined in Table 14.

- A46. Consider installing advisory 'Signal Ahead' sign (W3-3) along the northbound approach of the intersection.

4.3.20 Overall Corridor

- A47. Consider conducting an access management study along the corridor to evaluate the multiple access driveways.

- A48. Consider updating and/or installing pedestrian facilities along the length of the corridor, per standards outlined in Table 14.

- A49. Consider conducting a lighting study to evaluate the extent and level of existing lighting along the corridor.

- A50. Consider evaluating and/or optimizing current signal timings along the corridor, mainly for the intersections to the east of Route 7 and Ross Street, to help alleviate congestion and queuing issues, and to improve air quality. Providing flashing yellow arrows along the corridor could allow lead/lag optimizations and improve overall signal operations. To relieve the congestion, Rhythm Engineering's InSync Adaptive Traffic signal technology is used in the City between the intersections of Route 7 at Pleasant Valley Road, and Route 7 at Ross Street. Adaptive traffic signal technology changes the signal timings based on actual traffic demand. Sometimes the queues contribute to the crashes as vehicles approach or proceed through the intersection. Optimization of signals could benefit the corridor by improving platooning as well as reducing the crashes caused due to blockages or speed differentials caused by congestion. As number of signals grow along the corridor, signal retiming or optimization provides economical way of managing the transportation network as well as annual savings to the motorists traveling the corridor. Signal operations engineers from the City and VDOT need to be involved in the discussion to continue use of and expansion of InSync system on the corridor.

- A51. Install "Trucks Entering Highway" along Route 7 where there is significant number of trucks entering/exiting cross streets and driveways.

- A52. One way to reduce single occupant vehicles along the corridor is to promote transit. While transit services are provided along the corridor, mainly in the City between Pleasant Valley Road and Elm Street, extending the service to east, converting existing bus stops to bus shelters and placing the bus stops on the far side of the intersection could be considered.

- A53. Consider extending multiuse path to the east of the Martin Drive that could promote other modes of transportation.

- A54. Consider evaluating alignment of Valley Mill Road to reduce overall vehicular traffic and mitigate future queuing and collisions. Evaluate aligning Valley Mill Road with Winchester Gateway Drive.

- A55. Consider evaluating the possibility of closing short left-turn turn bays to improve access management by taking advantage of City street grid.

APPENDIX B. AM AND PM RESULTS

SimTraffic Simulation Summary
 AM FUTURE NO BUILD

Summary of All Intervals

Run Number	1	10	2	3	4	5	6
Start Time	7:00	7:00	7:00	7:00	7:00	7:00	7:00
End Time	8:30	8:30	8:30	8:30	8:30	8:30	8:30
Total Time (min)	90	90	90	90	90	90	90
Time Recorded (min)	60	60	60	60	60	60	60
# of Intervals	5	5	5	5	5	5	5
# of Recorded Intervals	4	4	4	4	4	4	4
Vehs Entered	9334	9504	9398	9448	9405	9420	9344
Vehs Exited	9322	9513	9481	9494	9420	9450	9385
Starting Vehs	478	451	517	436	428	451	440
Ending Vehs	490	442	434	390	413	421	399
Travel Distance (mi)	7014	6805	6880	6866	6707	6826	6750
Travel Time (hr)	512.2	472.8	520.2	456.5	461.0	439.7	440.0
Total Delay (hr)	309.8	274.8	320.7	257.6	266.2	242.1	243.5
Total Stops	18961	18441	18970	17831	16844	17571	17220
Fuel Used (gal)	331.5	318.1	331.3	317.0	311.7	311.1	308.8

Summary of All Intervals

Run Number	7	8	9	Avg
Start Time	7:00	7:00	7:00	7:00
End Time	8:30	8:30	8:30	8:30
Total Time (min)	90	90	90	90
Time Recorded (min)	60	60	60	60
# of Intervals	5	5	5	5
# of Recorded Intervals	4	4	4	4
Vehs Entered	9423	9385	9545	9417
Vehs Exited	9484	9436	9532	9451
Starting Vehs	476	425	492	448
Ending Vehs	415	374	505	420
Travel Distance (mi)	6748	6806	6920	6832
Travel Time (hr)	483.2	463.5	496.0	474.5
Total Delay (hr)	287.0	265.9	295.6	276.3
Total Stops	17920	17752	18392	17985
Fuel Used (gal)	318.3	317.0	328.0	319.3

Interval #0 Information Seeding

Start Time	7:00
End Time	7:30
Total Time (min)	30

Volumes adjusted by Growth Factors.

No data recorded this interval.

SimTraffic Simulation Summary

AM FUTURE NO BUILD

Interval #1 Information

Start Time	7:30
End Time	7:45
Total Time (min)	15

Volumes adjusted by Growth Factors, Anti PHF.

Run Number	1	10	2	3	4	5	6
Vehs Entered	2241	2376	2269	2328	2298	2241	2288
Vehs Exited	2295	2355	2301	2317	2328	2292	2298
Starting Vehs	478	451	517	436	428	451	440
Ending Vehs	424	472	485	447	398	400	430
Travel Distance (mi)	1723	1675	1688	1692	1675	1648	1680
Travel Time (hr)	116.5	109.6	123.5	104.8	109.9	101.5	113.0
Total Delay (hr)	66.6	60.8	74.6	55.9	61.1	53.7	64.0
Total Stops	4484	4374	4508	4117	4132	3992	4280
Fuel Used (gal)	79.8	76.7	80.6	76.0	76.5	73.9	77.5

Interval #1 Information

Start Time	7:30
End Time	7:45
Total Time (min)	15

Volumes adjusted by Growth Factors, Anti PHF.

Run Number	7	8	9	Avg
Vehs Entered	2315	2279	2326	2294
Vehs Exited	2321	2277	2355	2309
Starting Vehs	476	425	492	448
Ending Vehs	470	427	463	433
Travel Distance (mi)	1678	1613	1694	1677
Travel Time (hr)	117.4	101.7	123.2	112.1
Total Delay (hr)	68.8	54.6	74.0	63.4
Total Stops	4350	3985	4531	4266
Fuel Used (gal)	78.6	73.0	80.2	77.3

SimTraffic Simulation Summary
 AM FUTURE NO BUILD

Interval #2 Information

Start Time	7:45
End Time	8:00
Total Time (min)	15

Volumes adjusted by PHF, Growth Factors.

Run Number	1	10	2	3	4	5	6
Vehs Entered	2581	2514	2539	2572	2452	2630	2524
Vehs Exited	2433	2496	2457	2457	2381	2498	2505
Starting Vehs	424	472	485	447	398	400	430
Ending Vehs	572	490	567	562	469	532	449
Travel Distance (mi)	1844	1754	1825	1804	1699	1813	1807
Travel Time (hr)	133.8	123.2	138.5	126.6	111.8	126.6	119.6
Total Delay (hr)	80.6	72.0	85.8	74.4	62.5	74.1	66.9
Total Stops	4997	4869	5173	5092	4190	5060	4636
Fuel Used (gal)	86.6	82.2	87.5	85.0	77.7	84.7	83.0

Interval #2 Information

Start Time	7:45
End Time	8:00
Total Time (min)	15

Volumes adjusted by PHF, Growth Factors.

Run Number	7	8	9	Avg
Vehs Entered	2547	2620	2545	2551
Vehs Exited	2517	2514	2466	2474
Starting Vehs	470	427	463	433
Ending Vehs	500	533	542	513
Travel Distance (mi)	1755	1802	1802	1790
Travel Time (hr)	130.7	125.6	129.5	126.6
Total Delay (hr)	79.7	73.3	77.2	74.7
Total Stops	4879	5073	4809	4870
Fuel Used (gal)	84.5	85.2	86.0	84.2

SimTraffic Simulation Summary
 AM FUTURE NO BUILD

Interval #3 Information

Start Time	8:00
End Time	8:15
Total Time (min)	15

Volumes adjusted by Growth Factors, Anti PHF.

Run Number	1	10	2	3	4	5	6
Vehs Entered	2293	2352	2335	2337	2295	2268	2266
Vehs Exited	2350	2327	2428	2489	2377	2421	2311
Starting Vehs	572	490	567	562	469	532	449
Ending Vehs	515	515	474	410	387	379	404
Travel Distance (mi)	1760	1668	1748	1731	1646	1740	1642
Travel Time (hr)	137.1	125.0	138.2	120.8	120.0	112.6	104.0
Total Delay (hr)	86.2	76.6	87.7	70.6	72.0	62.3	56.0
Total Stops	4846	4785	5042	4581	4354	4483	4164
Fuel Used (gal)	84.8	80.2	85.6	81.7	78.2	80.1	74.6

Interval #3 Information

Start Time	8:00
End Time	8:15
Total Time (min)	15

Volumes adjusted by Growth Factors, Anti PHF.

Run Number	7	8	9	Avg
Vehs Entered	2284	2259	2348	2300
Vehs Exited	2380	2342	2381	2377
Starting Vehs	500	533	542	513
Ending Vehs	404	450	509	436
Travel Distance (mi)	1679	1715	1695	1702
Travel Time (hr)	124.5	125.8	123.4	123.1
Total Delay (hr)	75.7	76.0	74.1	73.7
Total Stops	4449	4486	4517	4565
Fuel Used (gal)	79.8	82.1	80.0	80.7

SimTraffic Simulation Summary
 AM FUTURE NO BUILD

Interval #4 Information Recording

Start Time	8:15
End Time	8:30
Total Time (min)	15

Volumes adjusted by Growth Factors, Anti PHF.

Run Number	1	10	2	3	4	5	6
Vehs Entered	2219	2262	2255	2211	2360	2281	2266
Vehs Exited	2244	2335	2295	2231	2334	2239	2271
Starting Vehs	515	515	474	410	387	379	404
Ending Vehs	490	442	434	390	413	421	399
Travel Distance (mi)	1687	1709	1619	1639	1686	1626	1621
Travel Time (hr)	124.9	114.9	119.9	104.3	119.4	99.0	103.3
Total Delay (hr)	76.3	65.4	72.7	56.7	70.5	51.9	56.6
Total Stops	4634	4413	4247	4041	4168	4036	4140
Fuel Used (gal)	80.3	79.0	77.6	74.3	79.4	72.4	73.7

Interval #4 Information Recording

Start Time	8:15
End Time	8:30
Total Time (min)	15

Volumes adjusted by Growth Factors, Anti PHF.

Run Number	7	8	9	Avg
Vehs Entered	2277	2227	2326	2266
Vehs Exited	2266	2303	2330	2291
Starting Vehs	404	450	509	436
Ending Vehs	415	374	505	420
Travel Distance (mi)	1637	1676	1729	1663
Travel Time (hr)	110.6	110.5	119.9	112.7
Total Delay (hr)	62.8	62.0	70.2	64.5
Total Stops	4242	4208	4535	4267
Fuel Used (gal)	75.4	76.7	81.8	77.1

SimTraffic Performance Report
 AM FUTURE NO BUILD

1: N Pleasant Valley Road & National Avenue/Berryville Avenue Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	3.6	0.4	0.5	0.0	0.0	0.1	3.3	0.3	0.3	4.6	1.3	1.1
Total Del/Veh (s)	15.6	23.3	18.2	11.6	6.9	3.7	44.9	51.5	6.7	44.3	51.4	33.2

1: N Pleasant Valley Road & National Avenue/Berryville Avenue Performance by movement

Movement	All
Denied Del/Veh (s)	0.5
Total Del/Veh (s)	17.7

2: National Avenue & Berryville Avenue Performance by movement

Movement	EBT	EBR	WBL	WBT	NWL	NWR	All
Denied Del/Veh (s)	0.0	0.0		0.0	0.1	0.1	0.0
Total Del/Veh (s)	0.8	0.5		7.5	46.0	4.1	4.4

3: Woodland Avenue/Battle Avenue & Berryville Avenue Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBR	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.3	0.0
Total Del/Veh (s)	12.5	2.0	0.9	7.4	2.3	23.8	14.0	4.9	31.5	11.3	2.8

4: Berryville Avenue & Virginia Avenue Performance by movement

Movement	EBL	EBT	WBT	WBR	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0
Total Del/Veh (s)	9.9	0.6	1.4	0.7	1.0

5: Chestnut Street/Dunlap Street & Berryville Avenue Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBT	NBR	SBL	SBT	SBR	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.0
Total Del/Veh (s)	7.8	0.4	0.0	7.5	1.9	1.5	24.3	4.9	18.0	22.3	11.6	1.5

6: Berryville Avenue & Baker Lane Performance by movement

Movement	EBL	EBT	WBT	WBR	SBL	SBR	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	3.9	0.4	0.2
Total Del/Veh (s)	14.9	4.4	4.0	3.3	41.4	8.2	6.4

7: Berryville Avenue & Apple Valley Marketplace Performance by movement

Movement	EBL	EBT	WBT	WBR	SBL	SBR	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	4.2	0.2	0.0
Total Del/Veh (s)	10.2	1.7	3.9	3.2	69.4	5.0	3.7

SimTraffic Performance Report
 AM FUTURE NO BUILD

8: Elm Street/Fort Collier Road & Berryville Avenue Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0	0.0	3.9	0.2	0.2	4.1	0.9	1.2
Total Del/Veh (s)	24.3	13.2	9.0	13.1	10.3	5.8	49.0	69.4	24.9	49.9	53.8	24.0

8: Elm Street/Fort Collier Road & Berryville Avenue Performance by movement

Movement	All
Denied Del/Veh (s)	0.5
Total Del/Veh (s)	17.3

9: Pharmhouse Shopping Center Driveway/Atwell Avenue & Berryville Avenue Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBR	SBL	SBT	SBR	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1		4.1	0.0
Total Del/Veh (s)	16.3	2.1	1.2	8.4	2.8	1.7	16.7	6.6	34.0		12.4	2.6

10: Pharmhouse Shopping Center Driveway/Ross Street & Berryville Avenue Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBR	SBL	SBR	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.1	0.0
Total Del/Veh (s)	17.8	4.8	0.8	8.5	4.7	2.8	47.7	8.2	51.4	9.3	6.9

11: Shell Driveway/Exxon Driveway & Berryville Avenue/Berryville Pike Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBR	SBL	SBR	All
Denied Del/Veh (s)	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.1	0.0
Total Del/Veh (s)	18.8	3.5	0.4	24.1	4.4	3.1	23.9	23.3	69.2	30.3	5.2

12: Driveway/I-81 SB Ramp & Berryville Pike Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBR	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0	0.1	0.8	41.1	2.4	0.2	0.2	0.1
Total Del/Veh (s)	58.7	16.4	7.0	80.2	28.8	8.7	72.4	39.9	10.2	47.8	14.5	26.2

13: Valley Mill Road/I-81 NB Ramp & Berryville Pike Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	All
Denied Del/Veh (s)	1.0	1.9	0.4	0.0	0.0	0.0	2.0	3.8	3.9	12.2	5.0	2.9
Total Del/Veh (s)	66.3	42.3	11.3	92.9	111.1	6.5	54.4	52.0	42.5	71.6	55.6	63.2

14: Berryville Pike & Winchester Gateway Performance by movement

Movement	EBL	EBT	WBL	WBT	WBR	SBL	SBR	All
Denied Del/Veh (s)	0.0	0.0		0.0	0.0	0.2	3.7	0.2
Total Del/Veh (s)	48.5	12.3		18.0	13.4	41.0	13.1	17.9

SimTraffic Performance Report
 AM FUTURE NO BUILD

15: Berryville Pike & Regency Lakes Drive Performance by movement

Movement	EBL	EBT	WBL	WBT	WBR	SBL	SBR	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.0
Total Del/Veh (s)	61.4	7.2	71.2	28.1	14.8	51.3	13.6	21.0

16: Blossom Drive/Millbrook Drive & Berryville Pike Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	0.1	0.0	0.0	0.0	0.0	0.0	3.9	0.3	0.4	3.9	4.3	0.2
Total Del/Veh (s)	49.7	22.1	11.4	55.3	31.7	16.5	47.0	46.5	23.7	48.3	57.2	10.8

16: Blossom Drive/Millbrook Drive & Berryville Pike Performance by movement

Movement	All
Denied Del/Veh (s)	0.2
Total Del/Veh (s)	28.1

17: Greenwood Road/First Woods Drive & Berryville Pike Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	0.0	0.0	0.1	2.6	0.3	2.7	0.4	0.3	0.4	0.2	0.2	0.1
Total Del/Veh (s)	67.1	28.9	16.3	53.7	26.4	8.0	53.5	56.0	44.5	53.9	53.5	7.5

17: Greenwood Road/First Woods Drive & Berryville Pike Performance by movement

Movement	All
Denied Del/Veh (s)	0.3
Total Del/Veh (s)	32.7

19: Berryville Pike Performance by movement

Movement	EBT	WBT	SWR	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0
Total Del/Veh (s)	4.0	3.8	8.2	4.2

37: Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	3.3	1.0	2.9	2.5	0.3	2.7	2.5	3.0	2.8	0.9	1.5	0.4
Total Del/Veh (s)	67.4	41.6	11.9	52.1	28.9	6.8	55.2	55.0	46.9	48.2	54.2	6.8

37: Performance by movement

Movement	All
Denied Del/Veh (s)	1.2
Total Del/Veh (s)	38.5

SimTraffic Performance Report
AM FUTURE NO BUILD

41: I-81 NB Ramp Performance by movement

Movement	NBT	SBT	SBR	All
Denied Del/Veh (s)	0.1	42.1	43.6	25.7
Total Del/Veh (s)	8.7	60.2	49.1	38.0

42: Battle Avenue & Virginia Avenue Performance by movement

Movement	WBT	NBT	All
Denied Del/Veh (s)	0.0	0.0	0.0
Total Del/Veh (s)	0.1	0.7	0.2

Total Network Performance

Denied Del/Veh (s)	5.9
Total Del/Veh (s)	95.2

Queuing and Blocking Report
 AM FUTURE NO BUILD

Intersection: 1: N Pleasant Valley Road & National Avenue/Berryville Avenue

Movement	EB	EB	WB	WB	NB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	T	R	L	TR
Maximum Queue (ft)	125	369	98	104	93	144	124	99	194
Average Queue (ft)	19	161	79	74	22	60	63	32	108
95th Queue (ft)	74	301	109	120	57	114	106	83	195
Link Distance (ft)		551	78	78		685	685		173
Upstream Blk Time (%)			16	13					4
Queuing Penalty (veh)			62	52					0
Storage Bay Dist (ft)	175				165			100	
Storage Blk Time (%)	0	8				0		0	16
Queuing Penalty (veh)	0	2				0		0	5

Intersection: 2: National Avenue & Berryville Avenue

Movement	EB	EB	WB	WB	NW
Directions Served	T	TR	LT	T	LR
Maximum Queue (ft)	26	54	234	273	24
Average Queue (ft)	1	2	65	74	6
95th Queue (ft)	16	21	176	204	23
Link Distance (ft)	78	78	404	404	278
Upstream Blk Time (%)	0	0	0		
Queuing Penalty (veh)	0	0	0		
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 3: Woodland Avenue/Battle Avenue & Berryville Avenue

Movement	EB	EB	WB	WB	NB	SB
Directions Served	LT	TR	LT	T	LTR	LTR
Maximum Queue (ft)	114	83	140	164	40	51
Average Queue (ft)	32	23	28	40	10	8
95th Queue (ft)	87	67	93	122	34	30
Link Distance (ft)	404	404	141	141	228	
Upstream Blk Time (%)			0	1		0
Queuing Penalty (veh)			1	2		0
Storage Bay Dist (ft)						
Storage Blk Time (%)						
Queuing Penalty (veh)						

Queuing and Blocking Report
 AM FUTURE NO BUILD

Intersection: 4: Berryville Avenue & Virginia Avenue

Movement	EB	EB	WB	WB
Directions Served	LT	T	T	TR
Maximum Queue (ft)	51	3	37	88
Average Queue (ft)	3	0	1	6
95th Queue (ft)	25	3	15	42
Link Distance (ft)	141	141	274	274
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 5: Chestnut Street/Dunlap Street & Berryville Avenue

Movement	EB	EB	WB	WB	NB	SB
Directions Served	LT	TR	LT	TR	LTR	LTR
Maximum Queue (ft)	52	19	103	76	51	21
Average Queue (ft)	3	1	14	3	14	5
95th Queue (ft)	26	11	62	34	38	17
Link Distance (ft)	274	274	446	446	332	507
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)						
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 6: Berryville Avenue & Baker Lane

Movement	EB	EB	WB	WB	SB	SB
Directions Served	LT	T	T	TR	L	R
Maximum Queue (ft)	186	134	140	170	69	147
Average Queue (ft)	80	36	29	43	41	49
95th Queue (ft)	151	93	95	123	74	102
Link Distance (ft)	446	446	436	436		197
Upstream Blk Time (%)						0
Queuing Penalty (veh)						0
Storage Bay Dist (ft)					70	
Storage Blk Time (%)					7	1
Queuing Penalty (veh)					7	1

Queuing and Blocking Report
 AM FUTURE NO BUILD

Intersection: 7: Berryville Avenue & Apple Valley Marketplace

Movement	EB	EB	WB	WB	SB	SB
Directions Served	LT	T	T	TR	L	R
Maximum Queue (ft)	87	78	152	166	70	33
Average Queue (ft)	17	12	23	31	21	5
95th Queue (ft)	65	50	93	114	58	22
Link Distance (ft)	436	436	707	707		282
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)					90	
Storage Blk Time (%)					0	0
Queuing Penalty (veh)					0	0

Intersection: 8: Elm Street/Fort Collier Road & Berryville Avenue

Movement	EB	EB	EB	WB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	TR	L	T	T	R	L	TR	L	TR
Maximum Queue (ft)	98	256	231	114	290	303	95	82	202	99	382
Average Queue (ft)	26	106	91	25	88	112	34	16	78	89	170
95th Queue (ft)	73	213	187	73	236	281	99	52	160	115	355
Link Distance (ft)		707	707		290	290			376		364
Upstream Blk Time (%)					0	1					2
Queuing Penalty (veh)					2	7					0
Storage Bay Dist (ft)	105			120			95	100		100	
Storage Blk Time (%)	0	8		0	5	7	0	0	8	20	5
Queuing Penalty (veh)	0	3		0	2	18	2	0	1	16	11

Intersection: 9: Pharmhouse Shopping Center Driveway/Atwell Avenue & Berryville Avenue

Movement	EB	EB	EB	WB	WB	WB	NB	SB	SB
Directions Served	L	T	TR	L	T	TR	LTR	LT	R
Maximum Queue (ft)	22	58	55	39	58	109	37	33	56
Average Queue (ft)	1	6	4	6	4	10	9	4	8
95th Queue (ft)	12	62	54	27	32	59	33	20	33
Link Distance (ft)		290	290		339	339	194	408	
Upstream Blk Time (%)		0	0						
Queuing Penalty (veh)		1	0						
Storage Bay Dist (ft)	120			60					90
Storage Blk Time (%)		1		0	0				0
Queuing Penalty (veh)		0		0	0				0

Queuing and Blocking Report
 AM FUTURE NO BUILD

Intersection: 10: Pharmhouse Shopping Center Driveway/Ross Street & Berryville Avenue

Movement	EB	EB	EB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	TR	L	T	TR	LT	R	LT	R
Maximum Queue (ft)	72	197	153	49	201	217	50	44	144	57
Average Queue (ft)	25	56	43	13	57	79	11	13	59	19
95th Queue (ft)	61	163	127	37	169	202	38	39	115	48
Link Distance (ft)		339	339		127	127	236	236	237	237
Upstream Blk Time (%)		1	0		2	3				
Queuing Penalty (veh)		6	1		10	17				
Storage Bay Dist (ft)	75			70						
Storage Blk Time (%)	0	5		0	3					
Queuing Penalty (veh)	1	2		0	1					

Intersection: 11: Shell Driveway/Exxon Driveway & Berryville Avenue/Berryville Pike

Movement	EB	EB	EB	WB	WB	WB	NB	SB
Directions Served	L	T	TR	L	T	TR	LTR	LTR
Maximum Queue (ft)	32	186	141	34	107	169	70	110
Average Queue (ft)	5	32	13	6	7	19	23	41
95th Queue (ft)	22	137	82	26	49	97	59	87
Link Distance (ft)		127	127		215	215	194	175
Upstream Blk Time (%)		5	1			0	0	
Queuing Penalty (veh)		25	4			0	0	
Storage Bay Dist (ft)	35			45				
Storage Blk Time (%)	2	9		1	1			
Queuing Penalty (veh)	10	1		5	0			

Intersection: 12: Driveway/I-81 SB Ramp & Berryville Pike

Movement	EB	EB	EB	WB	WB	WB	WB	NB	NB	SB	SB	SB
Directions Served	L	T	TR	L	T	T	R	LT	R	L	L	R
Maximum Queue (ft)	144	316	277	84	405	427	418	40	30	387	318	180
Average Queue (ft)	127	199	135	10	219	273	103	5	5	222	178	80
95th Queue (ft)	178	326	252	43	368	404	351	24	22	327	282	144
Link Distance (ft)		215	215		813	813	813	77	77	495	495	495
Upstream Blk Time (%)		17	3									0
Queuing Penalty (veh)		77	12									0
Storage Bay Dist (ft)	145			100								
Storage Blk Time (%)	17	17		0	23							
Queuing Penalty (veh)	60	37		0	2							

Queuing and Blocking Report
 AM FUTURE NO BUILD

Intersection: 13: Valley Mill Road/I-81 NB Ramp & Berryville Pike

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB	SB
Directions Served	L	T	T	R	L	T	T	R	L	L	TR	L
Maximum Queue (ft)	240	415	417	250	340	890	928	382	210	417	295	242
Average Queue (ft)	127	315	308	146	102	563	611	50	158	254	190	223
95th Queue (ft)	265	445	441	322	305	1060	1079	364	257	396	319	237
Link Distance (ft)		268	268			1301	1301	1301		404		212
Upstream Blk Time (%)		18	16	0		0	1			3		58
Queuing Penalty (veh)		110	95	0		1	2			0		182
Storage Bay Dist (ft)	240			250	340				210			295
Storage Blk Time (%)	0	23	18	1	0	28			1	16	1	
Queuing Penalty (veh)	1	23	32	3	1	11			3	74	4	

Intersection: 13: Valley Mill Road/I-81 NB Ramp & Berryville Pike

Movement	SB
Directions Served	LT
Maximum Queue (ft)	250
Average Queue (ft)	222
95th Queue (ft)	250
Link Distance (ft)	212
Upstream Blk Time (%)	50
Queuing Penalty (veh)	155
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 14: Berryville Pike & Winchester Gateway

Movement	EB	EB	EB	EB	WB	WB	WB	WB	SB	SB	SB	SB
Directions Served	L	L	T	T	L	T	T	R	L	L	R	R
Maximum Queue (ft)	113	129	252	247	11	290	338	188	130	75	117	65
Average Queue (ft)	46	66	98	113	0	116	166	44	58	10	52	18
95th Queue (ft)	94	111	203	210	8	243	303	150	105	40	90	49
Link Distance (ft)			1301	1301		1208	1208		504	504		
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	575	575			75			220			170	170
Storage Blk Time (%)						10	4	0			0	0
Queuing Penalty (veh)						0	3	1			0	0

Queuing and Blocking Report
 AM FUTURE NO BUILD

Intersection: 15: Berryville Pike & Regency Lakes Drive

Movement	EB	EB	EB	WB	WB	WB	WB	SB	SB
Directions Served	L	T	TR	L	T	T	R	LT	R
Maximum Queue (ft)	241	145	164	63	408	443	215	224	124
Average Queue (ft)	143	47	58	6	207	250	29	92	48
95th Queue (ft)	227	109	123	32	375	419	106	175	95
Link Distance (ft)		1208	1208		1628	1628		331	331
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (ft)	275			100			430		
Storage Blk Time (%)	0			0	16	0	0		
Queuing Penalty (veh)	0			0	1	0	0		

Intersection: 16: Blossom Drive/Millbrook Drive & Berryville Pike

Movement	EB	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	SB
Directions Served	L	L	T	T	R	L	T	T	R	L	TR	LT
Maximum Queue (ft)	108	139	435	442	174	52	394	422	44	135	127	68
Average Queue (ft)	43	75	230	249	21	2	203	229	2	56	47	10
95th Queue (ft)	95	121	386	398	115	30	371	389	28	109	100	41
Link Distance (ft)			1628	1628			1916	1916			535	
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	605	605			175	165			250	200		290
Storage Blk Time (%)				14	0	0	11	8	0			
Queuing Penalty (veh)				5	1	0	0	0	0			

Intersection: 16: Blossom Drive/Millbrook Drive & Berryville Pike

Movement	SB
Directions Served	R
Maximum Queue (ft)	95
Average Queue (ft)	20
95th Queue (ft)	59
Link Distance (ft)	376
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Queuing and Blocking Report
 AM FUTURE NO BUILD

Intersection: 17: Greenwood Road/First Woods Drive & Berryville Pike

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	SB	SB
Directions Served	L	T	T	R	L	T	T	R	LTR	LT	R
Maximum Queue (ft)	265	476	499	241	149	373	331	76	391	186	41
Average Queue (ft)	69	193	205	32	52	214	186	28	215	84	13
95th Queue (ft)	160	372	386	136	111	319	292	61	347	158	34
Link Distance (ft)		1916	1916			786	786		584	442	442
Upstream Blk Time (%)											
Queuing Penalty (veh)											
Storage Bay Dist (ft)	325			260	335			340			
Storage Blk Time (%)	0	2	5	0		1	0				
Queuing Penalty (veh)	0	1	2	0		0	0				

Intersection: 19: Berryville Pike

Movement	EB	EB	WB	WB	SW
Directions Served	T	T	T	T	R
Maximum Queue (ft)	116	99	63	173	199
Average Queue (ft)	15	14	3	21	48
95th Queue (ft)	83	78	41	104	131
Link Distance (ft)	813	813	268	268	329
Upstream Blk Time (%)			0	0	
Queuing Penalty (veh)			0	1	
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 37:

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	SB	SB
Directions Served	L	T	T	R	L	T	T	R	LTR	LT	R
Maximum Queue (ft)	324	639	594	241	170	425	371	107	280	160	38
Average Queue (ft)	99	363	316	34	62	250	202	28	201	83	13
95th Queue (ft)	271	589	542	148	136	370	318	74	298	150	32
Link Distance (ft)		701	701			519	519		249	142	142
Upstream Blk Time (%)		2	1						11	4	
Queuing Penalty (veh)		0	0						0	0	
Storage Bay Dist (ft)	325			260	335			340			
Storage Blk Time (%)	0	13	12	0		2	0	0			
Queuing Penalty (veh)	0	10	4	0		1	0	0			

Queuing and Blocking Report AM FUTURE NO BUILD

Intersection: 41: I-81 NB Ramp

Movement	NB	SB	SB
Directions Served	T	T	TR
Maximum Queue (ft)	266	340	346
Average Queue (ft)	95	264	247
95th Queue (ft)	201	418	440
Link Distance (ft)	212	311	311
Upstream Blk Time (%)	0	33	37
Queuing Penalty (veh)	1	0	0
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 42: Battle Avenue & Virginia Avenue

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Network Summary

Network wide Queuing Penalty: 1196

SimTraffic Performance Report
AM FUTURE NO BUILD

1: N Pleasant Valley Road & National Avenue/Berryville Avenue Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.7	0.0	0.5	1.9	0.5
Total Del/Veh (s)	22.1	8.7	19.0	47.0	17.7

2: National Avenue & Berryville Avenue Performance by approach

Approach	EB	WB	NW	All
Denied Del/Veh (s)	0.0	0.0	0.1	0.0
Total Del/Veh (s)	0.8	7.5	9.4	4.4

3: Woodland Avenue/Battle Avenue & Berryville Avenue Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.1	0.2	0.0
Total Del/Veh (s)	2.1	2.3	17.7	25.5	2.8

4: Berryville Avenue & Virginia Avenue Performance by approach

Approach	EB	WB	All
Denied Del/Veh (s)	0.0	0.0	0.0
Total Del/Veh (s)	0.6	1.3	1.0

5: Chestnut Street/Dunlap Street & Berryville Avenue Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.1	0.1	0.0
Total Del/Veh (s)	0.4	2.0	6.4	17.7	1.5

6: Berryville Avenue & Baker Lane Performance by approach

Approach	EB	WB	SB	All
Denied Del/Veh (s)	0.0	0.0	1.7	0.2
Total Del/Veh (s)	6.1	3.9	20.6	6.4

7: Berryville Avenue & Apple Valley Marketplace Performance by approach

Approach	EB	WB	SB	All
Denied Del/Veh (s)	0.0	0.0	3.2	0.0
Total Del/Veh (s)	1.8	3.9	51.8	3.7

8: Elm Street/Fort Collier Road & Berryville Avenue Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.7	3.2	0.5
Total Del/Veh (s)	13.6	9.3	36.5	44.9	17.3

SimTraffic Performance Report
 AM FUTURE NO BUILD

9: Pharmhouse Shopping Center Driveway/Atwell Avenue & Berryville Avenue Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.1	2.9	0.0
Total Del/Veh (s)	2.1	2.8	8.6	19.6	2.6

10: Pharmhouse Shopping Center Driveway/Ross Street & Berryville Avenue Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.1	0.1	0.0
Total Del/Veh (s)	5.6	4.7	24.5	39.9	6.9

11: Shell Driveway/Exxon Driveway & Berryville Avenue/Berryville Pike Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.1	0.1	0.0
Total Del/Veh (s)	3.6	4.5	23.3	38.7	5.2

12: Driveway/I-81 SB Ramp & Berryville Pike Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	13.7	0.2	0.1
Total Del/Veh (s)	26.6	20.8	31.6	38.2	26.2

13: Valley Mill Road/I-81 NB Ramp & Berryville Pike Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	1.6	0.0	2.7	10.4	2.9
Total Del/Veh (s)	39.8	89.8	52.7	67.8	63.2

14: Berryville Pike & Winchester Gateway Performance by approach

Approach	EB	WB	SB	All
Denied Del/Veh (s)	0.0	0.0	2.3	0.2
Total Del/Veh (s)	16.9	17.8	24.5	17.9

15: Berryville Pike & Regency Lakes Drive Performance by approach

Approach	EB	WB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.2	0.0
Total Del/Veh (s)	14.2	27.4	30.8	21.0

16: Blossom Drive/Millbrook Drive & Berryville Pike Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	2.4	0.7	0.2
Total Del/Veh (s)	25.2	31.7	43.1	15.5	28.1

SimTraffic Performance Report
AM FUTURE NO BUILD

17: Greenwood Road/First Woods Drive & Berryville Pike Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.6	0.4	0.2	0.3
Total Del/Veh (s)	30.9	26.6	54.5	45.4	32.7

19: Berryville Pike Performance by approach

Approach	EB	WB	SW	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0
Total Del/Veh (s)	4.0	3.8	8.2	4.2

37: Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	1.2	0.6	2.9	1.2	1.2
Total Del/Veh (s)	42.3	28.9	54.1	42.8	38.5

41: I-81 NB Ramp Performance by approach

Approach	NB	SB	All
Denied Del/Veh (s)	0.1	42.5	25.7
Total Del/Veh (s)	8.7	57.2	38.0

42: Battle Avenue & Virginia Avenue Performance by approach






















Approach	WB	NB	All
Denied Del/Veh (s)	0.0	0.0	0.0
Total Del/Veh (s)	0.1	0.7	0.2

Total Network Performance

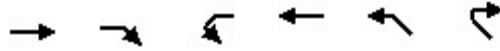
Denied Del/Veh (s)	5.9
Total Del/Veh (s)	95.2

HCM Signalized Intersection Capacity Analysis

1: N Pleasant Valley Road & National Avenue/Berryville Avenue

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	26	305	37	321	422	25	37	89	305	32	101	25
Future Volume (vph)	26	305	37	321	422	25	37	89	305	32	101	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.5	5.5		6.0	6.5		6.0	6.0	6.0	6.5	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	0.99	1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	1.00	0.99	1.00	
Frt	1.00	0.98		1.00	0.99		1.00	1.00	0.85	1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1801	1752		1587	1809		1670	1900	1510	1742	1699	
Flt Permitted	0.49	1.00		0.42	1.00		0.37	1.00	1.00	0.65	1.00	
Satd. Flow (perm)	922	1752		698	1809		654	1900	1510	1189	1699	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	28	332	40	349	459	27	40	97	332	35	110	27
RTOR Reduction (vph)	0	2	0	0	1	0	0	0	247	0	7	0
Lane Group Flow (vph)	28	370	0	349	485	0	40	97	85	35	130	0
Confl. Peds. (#/hr)	4		8	8		4	1		7	7		1
Heavy Vehicles (%)	0%	6%	8%	2%	4%	4%	8%	0%	6%	3%	9%	4%
Parking (#/hr)				0								
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA	pm+ov	pm+pt		NA
Protected Phases	5	2		1	6		7	4	1	3		8
Permitted Phases	2			6			4		4	8		
Actuated Green, G (s)	77.6	73.6		100.3	89.8		21.3	14.2	35.9	22.6		16.1
Effective Green, g (s)	77.6	73.6		100.3	89.8		21.3	14.2	35.9	22.6		16.1
Actuated g/C Ratio	0.55	0.53		0.72	0.64		0.15	0.10	0.26	0.16		0.12
Clearance Time (s)	6.5	5.5		6.0	6.5		6.0	6.0	6.0	6.5		4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0		3.0
Lane Grp Cap (vph)	536	921		637	1160		151	192	451	217		195
v/s Ratio Prot	0.00	0.21		c0.08	0.27		c0.01	0.05	0.03	0.01		c0.08
v/s Ratio Perm	0.03			c0.31			0.03		0.03	0.02		
v/c Ratio	0.05	0.40		0.55	0.42		0.26	0.51	0.19	0.16		0.67
Uniform Delay, d1	14.1	20.0		9.1	12.3		51.7	59.6	40.7	50.2		59.4
Progression Factor	1.00	1.00		2.23	1.92		1.00	1.00	1.00	1.00		1.00
Incremental Delay, d2	0.0	1.3		0.9	1.1		0.9	2.1	0.2	0.4		8.3
Delay (s)	14.2	21.3		21.2	24.7		52.6	61.7	40.9	50.6		67.7
Level of Service	B	C		C	C		D	E	D	D		E
Approach Delay (s)		20.8			23.2			46.2				64.2
Approach LOS		C			C			D				E
Intersection Summary												
HCM 2000 Control Delay			32.2			HCM 2000 Level of Service			C			
HCM 2000 Volume to Capacity ratio			0.58									
Actuated Cycle Length (s)			140.0			Sum of lost time (s)		25.5				
Intersection Capacity Utilization			71.8%			ICU Level of Service			C			
Analysis Period (min)			15									
c	Critical Lane Group											

















HCM Unsignalized Intersection Capacity Analysis 2: National Avenue & Berryville Avenue



Movement	EBT	EBR	WBL	WBT	NWL	NWR
Lane Configurations	↑↑			↑↑	↑↑	
Traffic Volume (veh/h)	624	18	1	767	1	6
Future Volume (Veh/h)	624	18	1	767	1	6
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	678	20	1	834	1	7
Pedestrians				3	10	
Lane Width (ft)				12.0	12.0	
Walking Speed (ft/s)				3.5	3.5	
Percent Blockage				0	1	
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (ft)	142			470		
pX, platoon unblocked					0.97	
vC, conflicting volume			708	1117		362
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			708	1054		362
tC, single (s)			6.1	6.8		6.9
tC, 2 stage (s)						
tF (s)			3.2	3.5		3.3
p0 queue free %			100	100		99
cM capacity (veh/h)			452	215		633
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NW 1	
Volume Total	452	246	279	556	8	
Volume Left	0	0	1	0	1	
Volume Right	0	20	0	0	7	
cSH	1700	1700	452	1700	509	
Volume to Capacity	0.27	0.14	0.00	0.33	0.02	
Queue Length 95th (ft)	0	0	0	0	1	
Control Delay (s)	0.0	0.0	0.1	0.0	12.2	
Lane LOS	A			B		
Approach Delay (s)	0.0		0.0		12.2	
Approach LOS						B
Intersection Summary						
Average Delay			0.1			
Intersection Capacity Utilization			32.8%	ICU Level of Service		A
Analysis Period (min)			15			

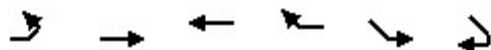
HCM Signalized Intersection Capacity Analysis

3: Woodland Avenue/Battle Avenue & Berryville Avenue

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	11	607	12	2	753	0	8	1	4	19	0	7
Future Volume (vph)	11	607	12	2	753	0	8	1	4	19	0	7
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0			7.0			5.0			6.0	
Lane Util. Factor		0.95			0.95			1.00			1.00	
Frb, ped/bikes		1.00			1.00			1.00			1.00	
Flpb, ped/bikes		1.00			1.00			1.00			1.00	
Frt		1.00			1.00			0.96			0.96	
Flt Protected		1.00			1.00			0.97			0.97	
Satd. Flow (prot)		3388			3505			1633			1582	
Flt Permitted		0.94			0.95			0.79			0.80	
Satd. Flow (perm)		3173			3344			1328			1314	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	12	660	13	2	818	0	9	1	4	21	0	8
RTOR Reduction (vph)	0	0	0	0	0	0	0	4	0	0	28	0
Lane Group Flow (vph)	0	685	0	0	820	0	0	10	0	0	1	0
Confl. Peds. (#/hr)	3		2	2		3						
Heavy Vehicles (%)	9%	6%	8%	0%	3%	0%	13%	0%	0%	5%	0%	29%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			4			8	
Permitted Phases	2			6			4			8		
Actuated Green, G (s)		123.7			122.7			5.3			4.3	
Effective Green, g (s)		123.7			122.7			5.3			4.3	
Actuated g/C Ratio		0.88			0.88			0.04			0.03	
Clearance Time (s)		6.0			7.0			5.0			6.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		2803			2930			50			40	
v/s Ratio Prot												
v/s Ratio Perm		0.22			c0.25			c0.01			0.00	
v/c Ratio		0.24			0.28			0.20			0.02	
Uniform Delay, d1		1.2			1.4			65.3			65.8	
Progression Factor		0.94			5.49			1.00			1.00	
Incremental Delay, d2		0.2			0.2			2.0			0.2	
Delay (s)		1.3			8.0			67.3			66.0	
Level of Service		A			A			E			E	
Approach Delay (s)		1.3			8.0			67.3			66.0	
Approach LOS		A			A			E			E	
Intersection Summary												
HCM 2000 Control Delay			6.7									A
HCM 2000 Volume to Capacity ratio			0.28									
Actuated Cycle Length (s)			140.0							13.0		
Intersection Capacity Utilization			40.0%									A
Analysis Period (min)			15									
c Critical Lane Group												

















HCM Unsignalized Intersection Capacity Analysis

4: Berryville Avenue & Virginia Avenue



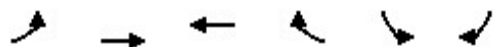
Movement	EBL	EBT	WBT	WBR	SEL	SER
Lane Configurations		↔↑	↔↑			
Traffic Volume (veh/h)	2	628	755	38	0	0
Future Volume (Veh/h)	2	628	755	38	0	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	683	821	41	0	0
Pedestrians			1		2	
Lane Width (ft)			12.0		0.0	
Walking Speed (ft/s)			3.5		3.5	
Percent Blockage			0		0	
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (ft)		246	876			
pX, platoon unblocked	0.98				0.99	0.98
vC, conflicting volume	864				1190	433
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	816				1064	375
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	100
cM capacity (veh/h)	802				217	614
Direction, Lane #	EB 1	EB 2	WB 1	WB 2		
Volume Total	230	455	547	315		
Volume Left	2	0	0	0		
Volume Right	0	0	0	41		
cSH	802	1700	1700	1700		
Volume to Capacity	0.00	0.27	0.32	0.19		
Queue Length 95th (ft)	0	0	0	0		
Control Delay (s)	0.1	0.0	0.0	0.0		
Lane LOS	A					
Approach Delay (s)	0.0		0.0			
Approach LOS						
Intersection Summary						
Average Delay			0.0			
Intersection Capacity Utilization			25.4%		ICU Level of Service	A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis
 5: Chestnut Street/Dunlap Street & Berryville Avenue

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	4	622	2	17	789	2	0	3	28	4	4	4
Future Volume (Veh/h)	4	622	2	17	789	2	0	3	28	4	4	4
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	4	676	2	18	858	2	0	3	30	4	4	4
Pedestrians					2			3			4	
Lane Width (ft)					12.0			12.0			12.0	
Walking Speed (ft/s)					3.5			3.5			3.5	
Percent Blockage					0			0			0	
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)		586			536							
pX, platoon unblocked	0.96			0.99			0.97	0.97	0.99	0.97	0.97	0.96
vC, conflicting volume	864			681			1159	1588	344	1278	1588	434
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	777			656			1045	1489	315	1169	1489	330
tC, single (s)	4.1			4.1			7.5	6.5	7.0	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.4	3.5	4.0	3.3
p0 queue free %	100			98			100	97	95	97	97	99
cM capacity (veh/h)	812			928			169	117	656	132	117	643
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1						
Volume Total	342	340	447	431	33	12						
Volume Left	4	0	18	0	0	4						
Volume Right	0	2	0	2	30	4						
cSH	812	1700	928	1700	462	170						
Volume to Capacity	0.00	0.20	0.02	0.25	0.07	0.07						
Queue Length 95th (ft)	0	0	1	0	6	6						
Control Delay (s)	0.2	0.0	0.6	0.0	13.4	27.8						
Lane LOS	A		A		B	D						
Approach Delay (s)	0.1		0.3		13.4	27.8						
Approach LOS					B	D						
Intersection Summary												
Average Delay			0.7									
Intersection Capacity Utilization			44.9%	ICU Level of Service	A							
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis

6: Berryville Avenue & Baker Lane



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕↕	↕↔		↔	↔
Traffic Volume (vph)	105	549	703	78	62	105
Future Volume (vph)	105	549	703	78	62	105
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0	5.0		6.0	6.0
Lane Util. Factor		0.95	0.95		1.00	1.00
Frbp, ped/bikes		1.00	1.00		1.00	1.00
Flpb, ped/bikes		1.00	1.00		1.00	1.00
Frt		1.00	0.98		1.00	0.85
Flt Protected		0.99	1.00		0.95	1.00
Satd. Flow (prot)		3382	3458		1656	1538
Flt Permitted		0.67	1.00		0.95	1.00
Satd. Flow (perm)		2269	3458		1656	1538
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	114	597	764	85	67	114
RTOR Reduction (vph)	0	0	2	0	0	105
Lane Group Flow (vph)	0	711	847	0	67	9
Confl. Peds. (#/hr)	4			4	1	
Heavy Vehicles (%)	5%	6%	2%	7%	9%	5%
Turn Type	pm+pt	NA	NA		Prot	Perm
Protected Phases	5	2	6		8	
Permitted Phases	2					8
Actuated Green, G (s)		117.0	118.0		11.0	11.0
Effective Green, g (s)		117.0	118.0		11.0	11.0
Actuated g/C Ratio		0.84	0.84		0.08	0.08
Clearance Time (s)		6.0	5.0		6.0	6.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		1896	2914		130	120
v/s Ratio Prot			0.24		c0.04	
v/s Ratio Perm		c0.31				0.01
v/c Ratio		0.38	0.29		0.52	0.07
Uniform Delay, d1		2.8	2.3		61.9	59.8
Progression Factor		0.94	0.89		1.00	1.00
Incremental Delay, d2		0.1	0.2		3.4	0.3
Delay (s)		2.7	2.3		65.4	60.0
Level of Service		A	A		E	E
Approach Delay (s)		2.7	2.3		62.0	
Approach LOS		A	A		E	
Intersection Summary						
HCM 2000 Control Delay			8.7		HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.40			
Actuated Cycle Length (s)			140.0		Sum of lost time (s)	16.5
Intersection Capacity Utilization			58.7%		ICU Level of Service	B
Analysis Period (min)			15			

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
























7: Berryville Avenue & Apple Valley Marketplace



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕↕	↕↔		↗	↗
Traffic Volume (vph)	6	605	776	34	14	5
Future Volume (vph)	6	605	776	34	14	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		7.0	6.0		7.0	7.0
Lane Util. Factor		0.95	0.95		1.00	1.00
Frbp, ped/bikes		1.00	1.00		1.00	1.00
Flpb, ped/bikes		1.00	1.00		1.00	1.00
Frt		1.00	0.99		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		3368	3474		1467	1615
Flt Permitted		0.95	1.00		0.95	1.00
Satd. Flow (perm)		3185	3474		1467	1615
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	7	658	843	37	15	5
RTOR Reduction (vph)	0	0	1	0	0	5
Lane Group Flow (vph)	0	665	879	0	15	0
Confl. Peds. (#/hr)	5			5		
Heavy Vehicles (%)	20%	7%	3%	6%	23%	0%
Turn Type	pm+pt	NA	NA		Prot	Perm
Protected Phases	5	2	6		8	
Permitted Phases	2					8
Actuated Green, G (s)		121.2	122.2		4.8	4.8
Effective Green, g (s)		121.2	122.2		4.8	4.8
Actuated g/C Ratio		0.87	0.87		0.03	0.03
Clearance Time (s)		7.0	6.0		7.0	7.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		2757	3032		50	55
v/s Ratio Prot			c0.25		c0.01	
v/s Ratio Perm		0.21				0.00
v/c Ratio		0.24	0.29		0.30	0.00
Uniform Delay, d1		1.6	1.5		66.0	65.3
Progression Factor		0.61	2.67		1.00	1.00
Incremental Delay, d2		0.0	0.2		3.4	0.0
Delay (s)		1.0	4.3		69.3	65.3
Level of Service		A	A		E	E
Approach Delay (s)		1.0	4.3		68.3	
Approach LOS		A	A		E	
Intersection Summary						
HCM 2000 Control Delay			3.7		HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.31			
Actuated Cycle Length (s)			140.0		Sum of lost time (s)	20.0
Intersection Capacity Utilization			95.8%		ICU Level of Service	F
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis




















8: Elm Street/Fort Collier Road & Berryville Avenue

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations		 			 								
Traffic Volume (vph)	32	572	15	43	736	259	18	24	91	207	23	56	
Future Volume (vph)	32	572	15	43	736	259	18	24	91	207	23	56	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	6.0	6.0		6.0	6.0	6.0	6.0	6.0		6.0	6.0		
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	1.00		1.00	1.00		
Frbp, ped/bikes	1.00	1.00		1.00	1.00	0.98	1.00	1.00		1.00	0.99		
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00		
Frt	1.00	1.00		1.00	1.00	0.85	1.00	0.88		1.00	0.89		
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00		
Satd. Flow (prot)	1640	3361		1736	3505	1436	1797	1635		1612	1651		
Flt Permitted	0.29	1.00		0.36	1.00	1.00	0.70	1.00		0.30	1.00		
Satd. Flow (perm)	504	3361		665	3505	1436	1326	1635		502	1651		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	35	622	16	47	800	282	20	26	99	225	25	61	
RTOR Reduction (vph)	0	1	0	0	0	53	0	91	0	0	49	0	
Lane Group Flow (vph)	35	637	0	47	800	229	20	34	0	225	37	0	
Confl. Peds. (#/hr)	3					3	5					5	
Heavy Vehicles (%)	10%	7%	7%	4%	3%	10%	0%	0%	3%	12%	0%	2%	
Turn Type	pm+pt	NA		pm+pt	NA	pm+ov	pm+pt	NA		pm+pt	NA		
Protected Phases	5	2		1	6	3	7	4		3	8		
Permitted Phases	2			6		6	4			8			
Actuated Green, G (s)	82.9	77.3		83.5	77.6	99.3	15.5	11.1		38.8	28.4		
Effective Green, g (s)	82.9	77.3		83.5	77.6	99.3	15.5	11.1		38.8	28.4		
Actuated g/C Ratio	0.59	0.55		0.60	0.55	0.71	0.11	0.08		0.28	0.20		
Clearance Time (s)	6.0	6.0		6.0	6.0	6.0	6.0	6.0		6.0	6.0		
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0		
Lane Grp Cap (vph)	343	1855		441	1942	1080	161	129		311	334		
v/s Ratio Prot	0.00	0.19		c0.00	c0.23	0.03	0.00	0.02		c0.11	0.02		
v/s Ratio Perm	0.06			0.06		0.13	0.01			c0.09			
v/c Ratio	0.10	0.34		0.11	0.41	0.21	0.12	0.26		0.72	0.11		
Uniform Delay, d1	12.5	17.3		12.0	18.0	7.0	56.0	60.6		42.9	45.5		
Progression Factor	1.20	1.18		0.66	0.60	0.20	1.00	1.00		1.00	1.00		
Incremental Delay, d2	0.1	0.5		0.1	0.6	0.1	0.3	1.1		8.1	0.1		
Delay (s)	15.1	20.9		8.1	11.5	1.5	56.3	61.7		51.0	45.7		
Level of Service	B	C		A	B	A	E	E		D	D		
Approach Delay (s)		20.6			8.8			61.0			49.5		
Approach LOS		C			A			E			D		
Intersection Summary													
HCM 2000 Control Delay			21.3									HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio			0.51										
Actuated Cycle Length (s)			140.0									Sum of lost time (s)	24.0
Intersection Capacity Utilization			57.3%									ICU Level of Service	B
Analysis Period (min)			15										

c Critical Lane Group





















HCM Unsignalized Intersection Capacity Analysis

9: Pharmhouse Shopping Center Driveway/Atwell Avenue & Berryville Avenue

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	3	854	13	12	1030	2	2	0	9	4	1	6
Future Volume (Veh/h)	3	854	13	12	1030	2	2	0	9	4	1	6
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	3	928	14	13	1120	2	2	0	10	4	1	7
Pedestrians		1										3
Lane Width (ft)		12.0									12.0	
Walking Speed (ft/s)		3.5									3.5	
Percent Blockage		0									0	
Right turn flare (veh)												4
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)		373			407							
pX, platoon unblocked	0.87			0.90			0.92	0.92	0.90	0.92	0.92	0.87
vC, conflicting volume	1125			942			1528	2092	471	1630	2098	565
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	843			714			910	1523	190	1021	1530	199
tC, single (s)	4.8			4.3			7.5	6.5	6.9	7.5	6.5	7.2
tC, 2 stage (s)												
tF (s)	2.5			2.3			3.5	4.0	3.3	3.5	4.0	3.5
p0 queue free %	99			98			99	100	99	98	99	99
cM capacity (veh/h)	536			759			206	107	743	172	106	662
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1				
Volume Total	3	619	323	13	747	375	12	12				
Volume Left	3	0	0	13	0	0	2	4				
Volume Right	0	0	14	0	0	2	10	7				
cSH	536	1700	1700	759	1700	1700	518	380				
Volume to Capacity	0.01	0.36	0.19	0.02	0.44	0.22	0.02	0.03				
Queue Length 95th (ft)	0	0	0	1	0	0	2	2				
Control Delay (s)	11.8	0.0	0.0	9.8	0.0	0.0	12.1	18.0				
Lane LOS	B			A			B	C				
Approach Delay (s)	0.0			0.1			12.1	18.0				
Approach LOS							B	C				
Intersection Summary												
Average Delay			0.2									
Intersection Capacity Utilization			45.5%	ICU Level of Service	A							
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis




















10: Pharmhouse Shopping Center Driveway/Ross Street & Berryville Avenue

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	50	816	1	29	1009	61	12	0	16	67	0	23
Future Volume (vph)	50	816	1	29	1009	61	12	0	16	67	0	23
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5		5.5	8.0			6.0	6.0		6.0	6.0
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00	1.00		1.00	1.00
Frbp, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00		1.00	1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00		1.00	1.00
Frt	1.00	1.00		1.00	0.99			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.95	1.00		0.95	1.00
Satd. Flow (prot)	1769	3312		1805	3408			1805	1615		1736	1553
Flt Permitted	0.22	1.00		0.31	1.00			0.71	1.00		0.75	1.00
Satd. Flow (perm)	403	3312		584	3408			1348	1615		1368	1553
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	54	887	1	32	1097	66	13	0	17	73	0	25
RTOR Reduction (vph)	0	0	0	0	2	0	0	0	16	0	0	23
Lane Group Flow (vph)	54	888	0	32	1161	0	0	13	1	0	73	2
Confl. Peds. (#/hr)	1					1						
Heavy Vehicles (%)	2%	9%	0%	0%	5%	3%	0%	0%	0%	4%	0%	4%
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases	5	2		1	6			4			8	
Permitted Phases	2			6			4		4	8		8
Actuated Green, G (s)	113.1	107.9		107.6	103.9			11.4	11.4		11.4	11.4
Effective Green, g (s)	113.1	107.9		107.6	103.9			11.4	11.4		11.4	11.4
Actuated g/C Ratio	0.81	0.77		0.77	0.74			0.08	0.08		0.08	0.08
Clearance Time (s)	5.5	5.5		5.5	8.0			6.0	6.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	376	2552		481	2529			109	131		111	126
v/s Ratio Prot	c0.01	0.27		0.00	c0.34							
v/s Ratio Perm	0.11			0.05				0.01	0.00		c0.05	0.00
v/c Ratio	0.14	0.35		0.07	0.46			0.12	0.01		0.66	0.02
Uniform Delay, d1	3.3	5.0		3.9	7.1			59.6	59.1		62.4	59.1
Progression Factor	0.73	0.83		1.00	1.00			1.00	1.00		1.00	1.00
Incremental Delay, d2	0.2	0.4		0.1	0.6			0.5	0.0		13.2	0.1
Delay (s)	2.5	4.5		3.9	7.7			60.1	59.1		75.6	59.2
Level of Service	A	A		A	A			E	E		E	E
Approach Delay (s)		4.4			7.6			59.6			71.4	
Approach LOS		A			A			E			E	
Intersection Summary												
HCM 2000 Control Delay			9.7	HCM 2000 Level of Service				A				
HCM 2000 Volume to Capacity ratio			0.46									
Actuated Cycle Length (s)			140.0	Sum of lost time (s)				19.5				
Intersection Capacity Utilization			60.6%	ICU Level of Service				B				
Analysis Period (min)			15									

c Critical Lane Group






















HCM Unsignalized Intersection Capacity Analysis

11: Shell Driveway/Exxon Driveway & Berryville Avenue/Berryville Pike

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	8	875	16	12	1059	47	2	0	24	12	0	38
Future Volume (Veh/h)	8	875	16	12	1059	47	2	0	24	12	0	38
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	9	951	17	13	1151	51	2	0	26	13	0	41
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type												
		None			None							
Median storage (veh)												
Upstream signal (ft)												
		198			290							
pX, platoon unblocked	0.73			0.92			0.77	0.77	0.92	0.77	0.77	0.73
vC, conflicting volume	1202			968			1620	2206	484	1722	2188	601
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	527			786			722	1484	259	855	1462	0
tC, single (s)	4.1			4.3			7.5	6.5	7.0	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.3			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			98			99	100	96	93	100	95
cM capacity (veh/h)	764			726			226	94	674	184	97	793
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1				
Volume Total	9	634	334	13	767	435	28	54				
Volume Left	9	0	0	13	0	0	2	13				
Volume Right	0	0	17	0	0	51	26	41				
cSH	764	1700	1700	726	1700	1700	590	442				
Volume to Capacity	0.01	0.37	0.20	0.02	0.45	0.26	0.05	0.12				
Queue Length 95th (ft)	1	0	0	1	0	0	4	10				
Control Delay (s)	9.8	0.0	0.0	10.1	0.0	0.0	11.4	14.3				
Lane LOS	A			B			B	B				
Approach Delay (s)	0.1			0.1			11.4	14.3				
Approach LOS							B	B				
Intersection Summary												
Average Delay			0.6									
Intersection Capacity Utilization			43.8%			ICU Level of Service		A				
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis

12: Driveway/I-81 SB Ramp & Berryville Pike

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	217	692	2	7	909	684	2	3	4	510	0	207
Future Volume (vph)	217	692	2	7	909	684	2	3	4	510	0	207
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.2	5.7		5.9	6.4	4.0		8.6	8.6	9.1		9.1
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		1.00	1.00	0.97		1.00
Frbp, ped/bikes	1.00	1.00		1.00	1.00	1.00		1.00	1.00	1.00		1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00		1.00	1.00	1.00		1.00
Frt	1.00	1.00		1.00	1.00	0.85		1.00	0.85	1.00		0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.98	1.00	0.95		1.00
Satd. Flow (prot)	1641	3373		1805	3438	1524		1863	1615	3155		1482
Flt Permitted	0.95	1.00		0.95	1.00	1.00		0.98	1.00	0.95		1.00
Satd. Flow (perm)	1641	3373		1805	3438	1524		1863	1615	3155		1482
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	236	752	2	8	988	743	2	3	4	554	0	225
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	4	0	0	174
Lane Group Flow (vph)	236	754	0	8	988	743	0	5	0	554	0	51
Confl. Peds. (#/hr)			3	3								
Heavy Vehicles (%)	10%	7%	0%	0%	5%	6%	0%	0%	0%	11%	0%	9%
Turn Type	Prot	NA		Prot	NA	Free	Split	NA	Perm	Prot		Perm
Protected Phases	5	2		1	6		4	4		3		
Permitted Phases						Free			4			3
Actuated Green, G (s)	18.5	53.9		1.0	35.4	110.0		0.9	0.9	24.9		24.9
Effective Green, g (s)	18.5	53.9		1.0	35.4	110.0		0.9	0.9	24.9		24.9
Actuated g/C Ratio	0.17	0.49		0.01	0.32	1.00		0.01	0.01	0.23		0.23
Clearance Time (s)	6.2	5.7		5.9	6.4			8.6	8.6	9.1		9.1
Vehicle Extension (s)	1.0	1.0		1.0	1.0			1.0	1.0	1.0		1.0
Lane Grp Cap (vph)	275	1652		16	1106	1524		15	13	714		335
v/s Ratio Prot	c0.14	0.22		0.00	c0.29			0.00		c0.18		
v/s Ratio Perm						c0.49			0.00			0.03
v/c Ratio	0.86	0.46		0.50	0.89	0.49		0.33	0.00	0.78		0.15
Uniform Delay, d1	44.5	18.4		54.3	35.5	0.0		54.3	54.1	39.9		34.1
Progression Factor	1.00	1.00		0.69	1.72	1.00		1.00	1.00	1.00		1.00
Incremental Delay, d2	21.6	0.9		5.2	7.0	0.7		4.7	0.0	4.8		0.1
Delay (s)	66.1	19.3		42.5	68.1	0.7		59.0	54.1	44.8		34.2
Level of Service	E	B		D	E	A		E	D	D		C
Approach Delay (s)		30.5			39.2			56.8			41.7	
Approach LOS		C			D			E			D	
Intersection Summary												
HCM 2000 Control Delay			37.3				HCM 2000 Level of Service		D			
HCM 2000 Volume to Capacity ratio			0.90									
Actuated Cycle Length (s)			110.0				Sum of lost time (s)		30.3			
Intersection Capacity Utilization			72.2%				ICU Level of Service		C			
Analysis Period (min)			15									

c Critical Lane Group


























HCM Signalized Intersection Capacity Analysis

13: Valley Mill Road/I-81 NB Ramp & Berryville Pike

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	99	928	179	39	947	244	417	202	55	533	88	0
Future Volume (vph)	99	928	179	39	947	244	417	202	55	533	88	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.7	5.3	5.3	8.0	5.3	4.0	7.5	7.5		7.4	7.4	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	1.00		0.95	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	0.97	
Satd. Flow (prot)	1719	3312	1538	1671	3438	1495	3400	1810		1504	1548	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	0.97	
Satd. Flow (perm)	1719	3312	1538	1671	3438	1495	3400	1810		1504	1548	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	108	1009	195	42	1029	265	453	220	60	579	96	0
RTOR Reduction (vph)	0	0	134	0	0	0	0	9	0	0	0	0
Lane Group Flow (vph)	108	1009	61	42	1029	265	453	271	0	336	339	0
Heavy Vehicles (%)	5%	9%	5%	8%	5%	8%	3%	2%	0%	14%	9%	6%
Turn Type	Prot	NA	Perm	Prot	NA	Free	Split	NA		Split	NA	
Protected Phases	5	2		1	6		3	3		4	4	
Permitted Phases			2			Free						
Actuated Green, G (s)	8.6	34.4	34.4	4.3	31.4	110.0	19.1	19.1		24.0	24.0	
Effective Green, g (s)	8.6	34.4	34.4	4.3	31.4	110.0	19.1	19.1		24.0	24.0	
Actuated g/C Ratio	0.08	0.31	0.31	0.04	0.29	1.00	0.17	0.17		0.22	0.22	
Clearance Time (s)	6.7	5.3	5.3	8.0	5.3		7.5	7.5		7.4	7.4	
Vehicle Extension (s)	1.0	1.0	1.0	1.0	1.0		1.0	1.0		1.0	1.0	
Lane Grp Cap (vph)	134	1035	480	65	981	1495	590	314		328	337	
v/s Ratio Prot	c0.06	c0.30		0.03	0.30		0.13	c0.15		c0.22	0.22	
v/s Ratio Perm			0.04			c0.18						
v/c Ratio	0.81	0.97	0.13	0.65	1.05	0.18	0.77	0.86		1.02	1.01	
Uniform Delay, d1	49.9	37.4	27.1	52.1	39.3	0.0	43.3	44.2		43.0	43.0	
Progression Factor	0.86	1.06	2.01	0.98	0.87	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	23.8	20.4	0.5	13.6	40.7	0.2	5.4	20.3		56.1	50.5	
Delay (s)	66.8	59.9	54.7	64.4	75.0	0.2	48.7	64.5		99.1	93.5	
Level of Service	E	E	D	E	E	A	D	E		F	F	
Approach Delay (s)		59.7			59.9			54.7			96.3	
Approach LOS		E			E			D			F	
Intersection Summary												
HCM 2000 Control Delay			64.9			HCM 2000 Level of Service				E		
HCM 2000 Volume to Capacity ratio			1.00									
Actuated Cycle Length (s)			110.0			Sum of lost time (s)			28.2			
Intersection Capacity Utilization			85.1%			ICU Level of Service				E		
Analysis Period (min)			15									
c	Critical Lane Group											

HCM Signalized Intersection Capacity Analysis





















14: Berryville Pike & Winchester Gateway

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 		 	 					 		 
Traffic Volume (vph)	194	1322	0	1	1085	80	0	0	0	96	0	145
Future Volume (vph)	194	1322	0	1	1085	80	0	0	0	96	0	145
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	8.3	5.8		7.8	5.8	5.8				7.6		7.6
Lane Util. Factor	0.97	0.95		1.00	0.95	1.00				0.97		0.88
Frbp, ped/bikes	1.00	1.00		1.00	1.00	0.99				1.00		1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00				1.00		1.00
Frt	1.00	1.00		1.00	1.00	0.85				1.00		0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00				0.95		1.00
Satd. Flow (prot)	3467	3252		1805	3406	1505				3467		2787
Flt Permitted	0.95	1.00		0.95	1.00	1.00				0.95		1.00
Satd. Flow (perm)	3467	3252		1805	3406	1505				3467		2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	211	1437	0	1	1179	87	0	0	0	104	0	158
RTOR Reduction (vph)	0	0	0	0	0	31	0	0	0	0	0	148
Lane Group Flow (vph)	211	1437	0	1	1179	56	0	0	0	104	0	10
Confl. Peds. (#/hr)	1					1						
Heavy Vehicles (%)	1%	11%	0%	0%	6%	6%	0%	0%	0%	1%	0%	2%
Turn Type	Prot	NA		Prot	NA	Perm				Prot		Perm
Protected Phases	5	2		1	6					4		
Permitted Phases						6						4
Actuated Green, G (s)	10.1	80.9		1.0	71.3	71.3				6.9		6.9
Effective Green, g (s)	10.1	80.9		1.0	71.3	71.3				6.9		6.9
Actuated g/C Ratio	0.09	0.74		0.01	0.65	0.65				0.06		0.06
Clearance Time (s)	8.3	5.8		7.8	5.8	5.8				7.6		7.6
Vehicle Extension (s)	1.0	1.0		1.0	1.0	1.0				1.0		1.0
Lane Grp Cap (vph)	318	2391		16	2207	975				217		174
v/s Ratio Prot	c0.06	c0.44		0.00	0.35					c0.03		
v/s Ratio Perm						0.04						0.00
v/c Ratio	0.66	0.60		0.06	0.53	0.06				0.48		0.06
Uniform Delay, d1	48.3	6.9		54.0	10.4	7.1				49.8		48.5
Progression Factor	0.74	2.21		0.68	1.36	5.99				1.00		1.00
Incremental Delay, d2	1.5	0.4		0.5	0.8	0.1				0.6		0.0
Delay (s)	37.4	15.7		37.3	14.9	42.5				50.4		48.5
Level of Service	D	B		D	B	D				D		D
Approach Delay (s)		18.5			16.8			0.0			49.3	
Approach LOS		B			B			A			D	
Intersection Summary												
HCM 2000 Control Delay			20.4				HCM 2000 Level of Service				C	
HCM 2000 Volume to Capacity ratio			0.64									
Actuated Cycle Length (s)			110.0				Sum of lost time (s)				21.7	
Intersection Capacity Utilization			58.7%				ICU Level of Service				B	
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis





























15: Berryville Pike & Regency Lakes Drive

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	186	1232	0	6	1031	81	0	0	0	113	0	135
Future Volume (vph)	186	1232	0	6	1031	81	0	0	0	113	0	135
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.6	5.7		7.6	5.7	5.7					7.1	7.1
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00					1.00	1.00
Frbp, ped/bikes	1.00	1.00		1.00	1.00	1.00					1.00	0.98
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00					1.00	1.00
Frt	1.00	1.00		1.00	1.00	0.85					1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00					0.95	1.00
Satd. Flow (prot)	1736	3282		1805	3374	1482					1671	1555
Flt Permitted	0.95	1.00		0.95	1.00	1.00					0.95	1.00
Satd. Flow (perm)	1736	3282		1805	3374	1482					1671	1555
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	202	1339	0	7	1121	88	0	0	0	123	0	147
RTOR Reduction (vph)	0	0	0	0	0	39	0	0	0	0	0	133
Lane Group Flow (vph)	202	1339	0	7	1121	49	0	0	0	0	123	14
Confl. Peds. (#/hr)							2					2
Heavy Vehicles (%)	4%	10%	0%	0%	7%	9%	0%	0%	0%	8%	0%	2%
Turn Type	Prot	NA		Prot	NA	Perm				Split	NA	Perm
Protected Phases	1	6		5	2		4	4		3	3	
Permitted Phases						2						3
Actuated Green, G (s)	18.0	77.9		1.0	60.9	60.9					10.7	10.7
Effective Green, g (s)	18.0	77.9		1.0	60.9	60.9					10.7	10.7
Actuated g/C Ratio	0.16	0.71		0.01	0.55	0.55					0.10	0.10
Clearance Time (s)	7.6	5.7		7.6	5.7	5.7					7.1	7.1
Vehicle Extension (s)	1.0	1.0		1.0	1.0	1.0					1.0	1.0
Lane Grp Cap (vph)	284	2324		16	1867	820					162	151
v/s Ratio Prot	c0.12	0.41		0.00	c0.33						c0.07	
v/s Ratio Perm						0.03						0.01
v/c Ratio	0.71	0.58		0.44	0.60	0.06					0.76	0.09
Uniform Delay, d1	43.5	7.9		54.2	16.4	11.3					48.4	45.2
Progression Factor	1.00	0.67		1.29	1.76	1.00					1.00	1.00
Incremental Delay, d2	5.9	0.9		5.7	1.2	0.1					16.4	0.1
Delay (s)	49.3	6.2		75.5	30.0	11.4					64.8	45.3
Level of Service	D	A		E	C	B					E	D
Approach Delay (s)		11.9			28.9			0.0			54.2	
Approach LOS		B			C			A			D	
Intersection Summary												
HCM 2000 Control Delay			22.5				HCM 2000 Level of Service				C	
HCM 2000 Volume to Capacity ratio			0.71									
Actuated Cycle Length (s)			110.0				Sum of lost time (s)				28.7	
Intersection Capacity Utilization			62.1%				ICU Level of Service				B	
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis






















16: Blossom Drive/Millbrook Drive & Berryville Pike

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 			 			 			 	
Traffic Volume (vph)	168	1143	34	4	952	3	62	37	17	11	4	104
Future Volume (vph)	168	1143	34	4	952	3	62	37	17	11	4	104
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	10.1	6.1	6.1	9.1	5.6	5.6	8.8	8.8			9.5	9.5
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	1.00			1.00	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99			1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.95			1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00			0.96	1.00
Satd. Flow (prot)	3213	3223	1615	1805	3406	1615	1752	1567			1154	1392
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00			0.96	1.00
Satd. Flow (perm)	3213	3223	1615	1805	3406	1615	1752	1567			1154	1392
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	183	1242	37	4	1035	3	67	40	18	12	4	113
RTOR Reduction (vph)	0	0	17	0	0	2	0	15	0	0	0	107
Lane Group Flow (vph)	183	1242	20	4	1035	1	67	43	0	0	16	6
Confl. Peds. (#/hr)									1	1		
Heavy Vehicles (%)	9%	12%	0%	0%	6%	0%	3%	19%	6%	70%	25%	16%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA		Split	NA	Perm
Protected Phases	1	6		5	2		4	4		3	3	
Permitted Phases			6			2						3
Actuated Green, G (s)	11.1	59.6	59.6	5.0	53.0	53.0	6.4	6.4			5.5	5.5
Effective Green, g (s)	11.1	59.6	59.6	5.0	53.0	53.0	6.4	6.4			5.5	5.5
Actuated g/C Ratio	0.10	0.54	0.54	0.05	0.48	0.48	0.06	0.06			0.05	0.05
Clearance Time (s)	10.1	6.1	6.1	9.1	5.6	5.6	8.8	8.8			9.5	9.5
Vehicle Extension (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0			1.0	1.0
Lane Grp Cap (vph)	324	1746	875	82	1641	778	101	91			57	69
v/s Ratio Prot	0.06	c0.39		0.00	c0.30		c0.04	0.03			c0.01	
v/s Ratio Perm			0.01			0.00						0.00
v/c Ratio	0.56	0.71	0.02	0.05	0.63	0.00	0.66	0.47			0.28	0.08
Uniform Delay, d1	47.1	18.8	11.7	50.2	21.2	14.8	50.7	50.2			50.3	49.8
Progression Factor	1.27	1.59	1.00	0.84	1.98	1.00	1.00	1.00			1.00	1.00
Incremental Delay, d2	1.1	2.1	0.0	0.1	1.2	0.0	12.0	1.4			1.0	0.2
Delay (s)	60.9	32.0	11.7	42.0	43.1	14.8	62.7	51.6			51.3	50.0
Level of Service	E	C	B	D	D	B	E	D			D	D
Approach Delay (s)		35.1			43.1			57.5			50.2	
Approach LOS		D			D			E			D	
Intersection Summary												
HCM 2000 Control Delay			39.8				HCM 2000 Level of Service				D	
HCM 2000 Volume to Capacity ratio			0.73									
Actuated Cycle Length (s)			110.0				Sum of lost time (s)				34.0	
Intersection Capacity Utilization			65.9%				ICU Level of Service				C	
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

17: Greenwood Road/First Woods Drive & Berryville Pike

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (vph)	74	1065	32	70	895	77	36	249	31	27	78	28	
Future Volume (vph)	74	1065	32	70	895	77	36	249	31	27	78	28	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	9.3	6.6	6.6	8.6	6.1	6.1		8.6			6.6	6.6	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		1.00			1.00	1.00	
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00		1.00			1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00		1.00			1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		0.99			1.00	0.85	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.99			0.99	1.00	
Satd. Flow (prot)	1805	3167	1129	1787	3374	1568		1806			1722	1615	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.99			0.99	1.00	
Satd. Flow (perm)	1805	3167	1129	1787	3374	1568		1806			1722	1615	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	80	1158	35	76	973	84	39	271	34	29	85	30	
RTOR Reduction (vph)	0	0	22	0	0	53	0	4	0	0	0	27	
Lane Group Flow (vph)	80	1158	13	76	973	31	0	340	0	0	114	3	
Confl. Peds. (#/hr)									1	1			
Heavy Vehicles (%)	0%	14%	43%	1%	7%	3%	3%	3%	4%	0%	12%	0%	
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA		Split	NA	Perm	
Protected Phases	1	6		5	2		4	4		3		3	
Permitted Phases			6			2						3	
Actuated Green, G (s)	7.1	41.2	41.2	7.1	41.0	41.0		22.0			9.3	9.3	
Effective Green, g (s)	7.1	41.2	41.2	7.1	41.0	41.0		22.0			9.3	9.3	
Actuated g/C Ratio	0.06	0.37	0.37	0.06	0.37	0.37		0.20			0.08	0.08	
Clearance Time (s)	9.3	6.6	6.6	8.6	6.1	6.1		8.6			6.6	6.6	
Vehicle Extension (s)	1.0	1.0	1.0	1.0	1.0	1.0		1.0			1.0	1.0	
Lane Grp Cap (vph)	116	1186	422	115	1257	584		361			145	136	
v/s Ratio Prot	c0.04	c0.37		0.04	0.29			c0.19			c0.07		
v/s Ratio Perm			0.01			0.02						0.00	
v/c Ratio	0.69	0.98	0.03	0.66	0.77	0.05		0.94			0.79	0.02	
Uniform Delay, d1	50.4	33.9	21.8	50.3	30.4	22.1		43.4			49.4	46.2	
Progression Factor	1.11	0.82	1.00	1.00	1.00	1.00		1.00			1.00	1.00	
Incremental Delay, d2	9.4	17.3	0.1	10.5	4.7	0.2		32.3			22.2	0.0	
Delay (s)	65.4	45.0	21.9	60.8	35.1	22.3		75.6			71.6	46.2	
Level of Service	E	D	C	E	D	C		E			E	D	
Approach Delay (s)		45.6			35.9			75.6			66.3		
Approach LOS		D			D			E			E		
Intersection Summary													
HCM 2000 Control Delay			46.4									HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio			0.92										
Actuated Cycle Length (s)			110.0									Sum of lost time (s)	30.6
Intersection Capacity Utilization			77.1%									ICU Level of Service	D
Analysis Period (min)			15										

c Critical Lane Group






















HCM Unsignalized Intersection Capacity Analysis

19: Berryville Pike

Intersection Sign configuration not allowed in HCM analysis.

HCM Signalized Intersection Capacity Analysis

37:

















														
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR		
Lane Configurations														
Traffic Volume (vph)	74	1065	32	70	895	77	36	249	31	27	78	28		
Future Volume (vph)	74	1065	32	70	895	77	36	249	31	27	78	28		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900		
Total Lost time (s)	9.3	6.6	6.6	8.6	6.1	6.1		8.6			6.6	6.6		
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		1.00			1.00	1.00		
Frt	1.00	1.00	0.85	1.00	1.00	0.85		0.99			1.00	0.85		
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.99			0.99	1.00		
Satd. Flow (prot)	1805	3167	1129	1787	3374	1568		1808			1722	1615		
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.99			0.99	1.00		
Satd. Flow (perm)	1805	3167	1129	1787	3374	1568		1808			1722	1615		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92		
Adj. Flow (vph)	80	1158	35	76	973	84	39	271	34	29	85	30		
RTOR Reduction (vph)	0	0	22	0	0	52	0	4	0	0	0	27		
Lane Group Flow (vph)	80	1158	13	76	973	32	0	340	0	0	114	3		
Heavy Vehicles (%)	0%	14%	43%	1%	7%	3%	3%	3%	4%	0%	12%	0%		
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA		Split	NA	Perm		
Protected Phases	1	6		5	2		4	4		3		3		
Permitted Phases			6			2						3		
Actuated Green, G (s)	6.0	39.3	39.3	8.2	41.3	41.3		22.1			10.0	10.0		
Effective Green, g (s)	6.0	39.3	39.3	8.2	41.3	41.3		22.1			10.0	10.0		
Actuated g/C Ratio	0.05	0.36	0.36	0.07	0.38	0.38		0.20			0.09	0.09		
Clearance Time (s)	9.3	6.6	6.6	8.6	6.1	6.1		8.6			6.6	6.6		
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0			3.0	3.0		
Lane Grp Cap (vph)	98	1131	403	133	1266	588		363			156	146		
v/s Ratio Prot	c0.04	c0.37		0.04	0.29			c0.19			c0.07			
v/s Ratio Perm			0.01			0.02						0.00		
v/c Ratio	0.82	1.02	0.03	0.57	0.77	0.05		0.94			0.73	0.02		
Uniform Delay, d1	51.5	35.4	23.0	49.2	30.2	21.9		43.3			48.7	45.5		
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00			1.00	1.00		
Incremental Delay, d2	38.7	33.0	0.1	5.8	4.5	0.2		31.1			16.1	0.1		
Delay (s)	90.2	68.3	23.1	55.0	34.7	22.1		74.4			64.8	45.6		
Level of Service	F	E	C	E	C	C		E			E	D		
Approach Delay (s)		68.5			35.1			74.4			60.8			
Approach LOS		E			D			E			E			
Intersection Summary														
HCM 2000 Control Delay			55.7									HCM 2000 Level of Service	E	
HCM 2000 Volume to Capacity ratio			0.92											
Actuated Cycle Length (s)			110.0								30.6			
Intersection Capacity Utilization			77.1%										ICU Level of Service	D
Analysis Period (min)			15											
c	Critical Lane Group													

HCM Unsignalized Intersection Capacity Analysis
41: I-81 NB Ramp

Intersection Sign configuration not allowed in HCM analysis.













HCM Unsignalized Intersection Capacity Analysis

42: Battle Avenue & Virginia Avenue

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	0	0	0	0	0	0	0	0
Future Volume (Veh/h)	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free			Free			Stop			Stop		
Grade	0%			0%			0%			0%		
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	0			0			0			0		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	0			0			0			0		
tC, single (s)	4.1			4.1			7.1			6.5		
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5			4.0		
p0 queue free %	100			100			100			100		
cM capacity (veh/h)	1623			1623			1023			896		
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	0	0	0	0								
Volume Left	0	0	0	0								
Volume Right	0	0	0	0								
cSH	1700	1700	1700	1700								
Volume to Capacity	0.00	0.00	0.00	0.00								
Queue Length 95th (ft)	0	0	0	0								
Control Delay (s)	0.0	0.0	0.0	0.0								
Lane LOS				A	A							
Approach Delay (s)	0.0	0.0	0.0	0.0								
Approach LOS				A	A							
Intersection Summary												
Average Delay				0.0								
Intersection Capacity Utilization				0.0%	ICU Level of Service				A			
Analysis Period (min)				15								

HCM Signalized Intersection Capacity Analysis

3:

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations		↑↑	↗	↖	↑↑	↗		↕			↖	↗	
Traffic Volume (vph)	0	1065	36	74	891	77	73	249	31	27	78	28	
Future Volume (vph)	0	1065	36	74	891	77	73	249	31	27	78	28	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)		4.5	4.5	4.5	4.5	4.5		4.5			4.5	4.5	
Lane Util. Factor		0.95	1.00	1.00	0.95	1.00		1.00			1.00	1.00	
Frt		1.00	0.85	1.00	1.00	0.85		0.99			1.00	0.85	
Flt Protected		1.00	1.00	0.95	1.00	1.00		0.99			0.99	1.00	
Satd. Flow (prot)		3129	1129	1787	3320	1568		1803			1722	1615	
Flt Permitted		1.00	1.00	0.95	1.00	1.00		0.99			0.99	1.00	
Satd. Flow (perm)		3129	1129	1787	3320	1568		1803			1722	1615	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	0	1158	39	80	968	84	79	271	34	29	85	30	
RTOR Reduction (vph)	0	0	21	0	0	37	0	3	0	0	0	27	
Lane Group Flow (vph)	0	1158	18	80	968	47	0	381	0	0	114	3	
Heavy Vehicles (%)	0%	14%	43%	1%	7%	3%	3%	3%	4%	0%	12%	0%	
Bus Blockages (#/hr)	0	6	0	0	8	0	3	0	1	0	0	0	
Turn Type		NA	Perm	Prot	NA	Perm	Split	NA		Split	NA	Perm	
Protected Phases		6		5	2		4	4		3		3	
Permitted Phases			6			2						3	
Actuated Green, G (s)		49.8	49.8	7.6	61.9	61.9		24.9			9.7	9.7	
Effective Green, g (s)		49.8	49.8	7.6	61.9	61.9		24.9			9.7	9.7	
Actuated g/C Ratio		0.45	0.45	0.07	0.56	0.56		0.23			0.09	0.09	
Clearance Time (s)		4.5	4.5	4.5	4.5	4.5		4.5			4.5	4.5	
Vehicle Extension (s)		3.0	3.0	3.0	3.0	3.0		3.0			3.0	3.0	
Lane Grp Cap (vph)		1416	511	123	1868	882		408			151	142	
v/s Ratio Prot		c0.37		0.04	c0.29			c0.21			c0.07		
v/s Ratio Perm			0.02			0.03						0.00	
v/c Ratio		0.82	0.03	0.65	0.52	0.05		0.93			0.75	0.02	
Uniform Delay, d1		26.2	16.7	49.9	14.8	10.8		41.7			49.0	45.8	
Progression Factor		1.00	1.00	1.00	1.00	1.00		1.00			1.00	1.00	
Incremental Delay, d2		5.4	0.1	11.7	1.0	0.1		28.3			19.1	0.1	
Delay (s)		31.5	16.9	61.6	15.9	11.0		70.0			68.1	45.9	
Level of Service		C	B	E	B	B		E			E	D	
Approach Delay (s)		31.0			18.7			70.0			63.5		
Approach LOS		C			B			E			E		
Intersection Summary													
HCM 2000 Control Delay			33.0									HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio			0.83										
Actuated Cycle Length (s)			110.0									Sum of lost time (s)	18.0
Intersection Capacity Utilization			70.5%									ICU Level of Service	C
Analysis Period (min)			15										

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis


















8: Elm Street/Fort Collier Road & Berryville Avenue

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	32	572	15	55	734	259	20	24	91	207	23	56
Future Volume (vph)	32	572	15	55	734	259	20	24	91	207	23	56
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0	6.0	6.0	6.0		6.0	6.0	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	1.00		0.95	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00		1.00	1.00	0.85	1.00	0.88		1.00	0.94	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	0.98	
Satd. Flow (prot)	1641	3361		1736	3505	1468	1805	1635		1531	1566	
Flt Permitted	0.28	1.00		0.35	1.00	1.00	0.95	1.00		0.95	0.98	
Satd. Flow (perm)	490	3361		644	3505	1468	1805	1635		1531	1566	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	35	622	16	60	798	282	22	26	99	225	25	61
RTOR Reduction (vph)	0	1	0	0	0	70	0	0	0	0	0	0
Lane Group Flow (vph)	35	637	0	60	798	212	22	125	0	157	154	0
Confl. Peds. (#/hr)	1					1						
Heavy Vehicles (%)	10%	7%	7%	4%	3%	10%	0%	0%	3%	12%	0%	2%
Turn Type	pm+pt	NA		pm+pt	NA	pt+ov	Split	NA		Split	NA	
Protected Phases	5	2		1	6	6 8	4	4		8	8	
Permitted Phases	2			6								
Actuated Green, G (s)	78.1	72.3		79.5	73.0	94.2	16.0	16.0		21.2	21.2	
Effective Green, g (s)	78.1	72.3		79.5	73.0	94.2	16.0	16.0		21.2	21.2	
Actuated g/C Ratio	0.56	0.52		0.57	0.52	0.67	0.11	0.11		0.15	0.15	
Clearance Time (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	321	1735		416	1827	987	206	186		231	237	
v/s Ratio Prot	0.00	0.19		c0.01	c0.23	0.14	0.01	c0.08		c0.10	0.10	
v/s Ratio Perm	0.06			0.08								
v/c Ratio	0.11	0.37		0.14	0.44	0.21	0.11	0.67		0.68	0.65	
Uniform Delay, d1	14.7	20.2		13.9	20.8	8.8	55.6	59.5		56.2	55.9	
Progression Factor	1.00	1.00		0.53	0.63	1.88	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.2	0.6		0.1	0.7	0.1	0.2	9.2		7.7	6.0	
Delay (s)	14.8	20.8		7.6	13.7	16.6	55.8	68.7		63.9	61.9	
Level of Service	B	C		A	B	B	E	E		E	E	
Approach Delay (s)		20.5			14.1			66.7			62.9	
Approach LOS		C			B			E			E	
Intersection Summary												
HCM 2000 Control Delay			26.1				HCM 2000 Level of Service				C	
HCM 2000 Volume to Capacity ratio			0.50									
Actuated Cycle Length (s)			140.0			Sum of lost time (s)				24.0		
Intersection Capacity Utilization			54.7%			ICU Level of Service				A		
Analysis Period (min)			15									

c Critical Lane Group





















HCM Unsignalized Intersection Capacity Analysis

9: Pharmhouse Shopping Center Driveway/Atwell Avenue & Berryville Avenue

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	3	854	13	0	1042	2	0	0	9	0	0	6
Future Volume (Veh/h)	3	854	13	0	1042	2	0	0	9	0	0	6
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	3	928	14	0	1133	2	0	0	10	0	0	7
Pedestrians												2
Lane Width (ft)												12.0
Walking Speed (ft/s)												3.5
Percent Blockage												0
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)		373			407							
pX, platoon unblocked	0.85			0.89			0.91	0.91	0.89	0.91	0.91	0.85
vC, conflicting volume	1137			942			1514	2078	471	1616	2084	570
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	820			692			829	1449	164	941	1456	156
tC, single (s)	4.8			4.3			7.5	6.5	6.9	7.5	6.5	7.2
tC, 2 stage (s)												
tF (s)	2.5			2.3			3.5	4.0	3.3	3.5	4.0	3.5
p0 queue free %	99			100			100	100	99	100	100	99
cM capacity (veh/h)	540			767			238	119	765	197	118	697
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	NB 1	SB 1					
Volume Total	3	619	323	755	380	10	7					
Volume Left	3	0	0	0	0	0	0					
Volume Right	0	0	14	0	2	10	7					
cSH	540	1700	1700	1700	1700	765	697					
Volume to Capacity	0.01	0.36	0.19	0.44	0.22	0.01	0.01					
Queue Length 95th (ft)	0	0	0	0	0	1	1					
Control Delay (s)	11.7	0.0	0.0	0.0	0.0	9.8	10.2					
Lane LOS	B					A	B					
Approach Delay (s)	0.0			0.0		9.8	10.2					
Approach LOS						A	B					
Intersection Summary												
Average Delay			0.1									
Intersection Capacity Utilization			38.9%	ICU Level of Service	A							
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis

















10: Pharmhouse Shopping Center Driveway/Ross Street & Berryville Avenue

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	58	804	1	41	1007	61	14	0	16	83	1	23
Future Volume (vph)	58	804	1	41	1007	61	14	0	16	83	1	23
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5		5.5	8.0			6.0	6.0		6.0	6.0
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00		1.00	0.99
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00		1.00	1.00
Frt	1.00	1.00		1.00	0.99			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.95	1.00		0.95	1.00
Satd. Flow (prot)	1769	3312		1805	3407			1803	1615		1742	1530
Flt Permitted	0.21	1.00		0.30	1.00			0.67	1.00		0.72	1.00
Satd. Flow (perm)	398	3312		573	3407			1267	1615		1312	1530
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	63	874	1	45	1095	66	15	0	17	90	1	25
RTOR Reduction (vph)	0	0	0	0	2	0	0	0	15	0	0	22
Lane Group Flow (vph)	63	875	0	45	1159	0	0	15	2	0	91	3
Confl. Peds. (#/hr)	2					2	1					1
Heavy Vehicles (%)	2%	9%	0%	0%	5%	3%	0%	0%	0%	4%	0%	4%
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases	5	2		1	6			4			8	
Permitted Phases	2			6			4		4	8		8
Actuated Green, G (s)	108.2	102.8		105.1	100.0			15.1	15.1		15.1	15.1
Effective Green, g (s)	108.2	102.8		105.1	100.0			15.1	15.1		15.1	15.1
Actuated g/C Ratio	0.77	0.73		0.75	0.71			0.11	0.11		0.11	0.11
Clearance Time (s)	5.5	5.5		5.5	8.0			6.0	6.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	360	2431		475	2433			136	174		141	165
v/s Ratio Prot	c0.01	0.26		0.00	c0.34							
v/s Ratio Perm	0.13			0.07				0.01	0.00		c0.07	0.00
v/c Ratio	0.17	0.36		0.09	0.48			0.11	0.01		0.65	0.02
Uniform Delay, d1	4.4	6.7		4.6	8.7			56.4	55.8		59.9	55.8
Progression Factor	0.58	0.59		1.00	1.00			1.00	1.00		1.00	1.00
Incremental Delay, d2	0.2	0.4		0.1	0.7			0.4	0.0		9.7	0.0
Delay (s)	2.8	4.3		4.7	9.3			56.7	55.8		69.6	55.9
Level of Service	A	A		A	A			E	E		E	E
Approach Delay (s)		4.2			9.2			56.2			66.6	
Approach LOS		A			A			E			E	
Intersection Summary												
HCM 2000 Control Delay			10.7			HCM 2000 Level of Service			B			
HCM 2000 Volume to Capacity ratio			0.48									
Actuated Cycle Length (s)			140.0			Sum of lost time (s)			19.5			
Intersection Capacity Utilization			60.7%			ICU Level of Service			B			
Analysis Period (min)			15									

c Critical Lane Group

























HCM Unsignalized Intersection Capacity Analysis

11: Shell Driveway/Exxon Driveway & Berryville Avenue/Berryville Pike

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	887	16	0	1071	47	0	0	24	0	0	38
Future Volume (Veh/h)	0	887	16	0	1071	47	0	0	24	0	0	38
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	964	17	0	1164	51	0	0	26	0	0	41
Pedestrians		3			3			1			4	
Lane Width (ft)		12.0			12.0			12.0			12.0	
Walking Speed (ft/s)		3.5			3.5			3.5			3.5	
Percent Blockage		0			0			0			0	
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)		186			302							
pX, platoon unblocked	0.73			0.91			0.78	0.78	0.91	0.78	0.78	0.73
vC, conflicting volume	1219			982			1600	2192	494	1704	2176	614
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	572			773			665	1424	235	799	1403	0
tC, single (s)	4.1			4.2			7.5	6.5	7.0	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			100	100	96	100	100	95
cM capacity (veh/h)	739			741			257	106	687	208	110	795
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1						
Volume Total	643	338	776	439	26	41						
Volume Left	0	0	0	0	0	0						
Volume Right	0	17	0	51	26	41						
cSH	1700	1700	1700	1700	687	795						
Volume to Capacity	0.38	0.20	0.46	0.26	0.04	0.05						
Queue Length 95th (ft)	0	0	0	0	3	4						
Control Delay (s)	0.0	0.0	0.0	0.0	10.4	9.8						
Lane LOS					B	A						
Approach Delay (s)	0.0		0.0		10.4	9.8						
Approach LOS					B	A						
Intersection Summary												
Average Delay			0.3									
Intersection Capacity Utilization			42.1%		ICU Level of Service				A			
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis

16: Blossom Drive/Millbrook Drive & Berryville Pike

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 			 							
Traffic Volume (vph)	242	1069	34	0	952	40	62	0	17	15	0	104
Future Volume (vph)	242	1069	34	0	952	40	62	0	17	15	0	104
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	10.1	6.1	6.1		5.6	5.6	8.8		8.8	8.8		8.8
Lane Util. Factor	0.97	0.95	1.00		0.95	1.00	1.00		1.00	1.00		1.00
Frt	1.00	1.00	0.85		1.00	0.85	1.00		0.85	1.00		0.85
Flt Protected	0.95	1.00	1.00		1.00	1.00	0.95		1.00	0.95		1.00
Satd. Flow (prot)	3213	3223	1615		3406	1615	1752		1524	1062		1392
Flt Permitted	0.95	1.00	1.00		1.00	1.00	0.95		1.00	0.95		1.00
Satd. Flow (perm)	3213	3223	1615		3406	1615	1752		1524	1062		1392
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	263	1162	37	0	1035	43	67	0	18	16	0	113
RTOR Reduction (vph)	0	0	8	0	0	18	0	0	17	0	0	105
Lane Group Flow (vph)	263	1162	29	0	1035	25	67	0	1	16	0	8
Heavy Vehicles (%)	9%	12%	0%	0%	6%	0%	3%	19%	6%	70%	25%	16%
Turn Type	Prot	NA	Perm		NA	Perm	Prot		Perm	Prot		Perm
Protected Phases	1	6			2		4			4		
Permitted Phases			6			2			4			4
Actuated Green, G (s)	12.4	87.2	87.2		65.2	65.2	7.9		7.9	7.9		7.9
Effective Green, g (s)	12.4	87.2	87.2		65.2	65.2	7.9		7.9	7.9		7.9
Actuated g/C Ratio	0.11	0.79	0.79		0.59	0.59	0.07		0.07	0.07		0.07
Clearance Time (s)	10.1	6.1	6.1		5.6	5.6	8.8		8.8	8.8		8.8
Vehicle Extension (s)	1.0	1.0	1.0		1.0	1.0	1.0		1.0	1.0		1.0
Lane Grp Cap (vph)	362	2554	1280		2018	957	125		109	76		99
v/s Ratio Prot	0.08	c0.36			c0.30		c0.04			0.02		
v/s Ratio Perm			0.02			0.02			0.00			0.01
v/c Ratio	0.73	0.45	0.02		0.51	0.03	0.54		0.01	0.21		0.08
Uniform Delay, d1	47.2	3.7	2.4		13.1	9.3	49.3		47.4	48.1		47.7
Progression Factor	0.90	1.53	1.54		2.04	1.00	1.00		1.00	1.00		1.00
Incremental Delay, d2	5.2	0.5	0.0		0.8	0.0	2.2		0.0	0.5		0.1
Delay (s)	47.8	6.2	3.7		27.5	9.3	51.5		47.4	48.6		47.8
Level of Service	D	A	A		C	A	D		D	D		D
Approach Delay (s)		13.6			26.8			50.6				47.9
Approach LOS		B			C			D				D
Intersection Summary												
HCM 2000 Control Delay			21.5		HCM 2000 Level of Service				C			
HCM 2000 Volume to Capacity ratio			0.55									
Actuated Cycle Length (s)			110.0		Sum of lost time (s)				24.5			
Intersection Capacity Utilization			57.8%		ICU Level of Service				B			
Analysis Period (min)			15									
c Critical Lane Group												

ROUNABOUT ANALYSIS

 Site: 101 [Route 7 at Pleasant Valley Road - AM Peak - Preferred]

Future Build - AM Peak
Site Category: (None)
Roundabout

Roundabout Basic Parameters												
Location	Name	Central Island Diam	Circ Width	Insc Diam	Entry Radius	Entry Angle	Circ Lanes	Entry Lanes	Av.Entry Lane Width	App. Dist	Prop Queued Upstr Signal	Extra Bunching
		ft	ft	ft	ft	°			ft	ft		%
South	N Pleasant Valley Road	86.00	16.00	150.0 ⁷	65.0	30.0	1	2	13.00	1600.0	NA ⁵	0.0 ¹
East	Route 7	86.00	16.00	150.0 ⁷	65.0	30.0	1	2	13.00	1600.0	NA ⁵	0.0 ¹
North	N Pleasant Valley Road	86.00	32.00	150.0 ⁷	65.0	30.0	2	1	13.00	1600.0	NA ⁵	0.0 ¹
West	Route 7	86.00	16.00	150.0 ⁷	65.0	30.0	1	1	13.00	1600.0	NA ⁵	0.0 ¹

Roundabout Capacity Model: SIDRA Standard

- ¹ Program option resulted in zero value (single Site analysis or unconnected Site in Network analysis).
- ⁵ Not Applicable (single Site analysis or unconnected Site in Network analysis).
- ⁷ Inscribed diameter value was specified by the user.

Roundabout Entry and Circulating / Exiting Stream Parameters													
To Approach	Turn	Lane No	Lane Type	Opng Flow	Opng In-Bunch Flow	In-Bunch Headway	Prop. Bunched	Cap Const Effect	Priority Sharing	OD Factor	HVE for Entry	Critical Gap	Follow-up Headway
				veh/h	pcu/h	sec						sec	sec
South: N Pleasant Valley Road													
Environment Factor: 1.10													
Entry/Circ Flow Adjustment: None													
West	L2	1	Subdom.	395	416	2.00	0.398	No	No	0.925	1.08	5.24	2.86
North	T1	1	Subdom.	395	416	2.00	0.398	No	No	0.925	1.00	4.85	2.65
East	R2	2	Dominant	395	416	2.00	0.398	No	Yes ¹⁰	0.925	1.06	4.13	2.25
East: Route 7													
Environment Factor: 1.10													
Entry/Circ Flow Adjustment: None													
South	L2	1	Subdom.	173	177	2.00	0.193	No	No	0.975	1.02	4.90	2.57
West	T1	2	Dominant	173	177	2.00	0.193	No	No	0.975	1.04	4.39	2.30
North	R2	2	Dominant	173	177	2.00	0.193	No	No	0.975	1.04	4.39	2.30
North: N Pleasant Valley Road													
Environment Factor: 1.10													
Entry/Circ Flow Adjustment: None													
East	L2	1	Dominant	855	885	1.15	0.463	No	No	0.904	1.03	4.05	2.82
South	T1	1	Dominant	855	885	1.15	0.463	No	No	0.904	1.09	4.29	2.99
West	R2	1	Dominant	855	885	1.15	0.463	No	No	0.904	1.04	4.09	2.85
West: Route 7													
Environment Factor: 1.10													
Entry/Circ Flow Adjustment: None													
North	L2	1	Dominant	493	511	2.00	0.466	No	No	0.957	1.00	4.50	2.50
East	T1	1	Dominant	493	511	2.00	0.466	No	No	0.957	1.06	4.77	2.65
South	R2	1	Dominant	493	511	2.00	0.466	No	No	0.957	1.08	4.86	2.70

Roundabout Capacity Model: SIDRA Standard

- ¹⁰ Priority sharing means Follow-up Headway plus Intra-bunch Headway is larger than the Critical Gap.

Circulating Lane Flow Rates			
Lane No	veh/h	Circulating Flow Rate pcu/h	Percent
South: N Pleasant Valley Road			
Lane 1	395	415	100.0
Approach	395	415	
East: Route 7			
Lane 1	173	177	100.0
Approach	173	177	
North: N Pleasant Valley Road			
Lane 1	349	356	40.2
Lane 2	507	529	59.8
Approach	856	885	
West: Route 7			
Lane 1	493	511	100.0
Approach	493	511	

Roundabout Capacity Model: The SIDRA Standard roundabout capacity model option is in use. This model takes into account the total circulating flow as well as the effect of flow distribution in circulating lanes on the entry capacity results.

Gap Acceptance Cycle Parameters (Lanes)					
Opposed Lane	Cycle Time sec	Blocked Time sec	Unblocked Time sec	Unblocked Time Ratio	Minimum Delay sec
South: N Pleasant Valley Road					
1	20.37	7.94	12.42	0.610	4.5
2	18.85	6.66	12.19	0.647	3.5
East: Route 7					
1	29.41	5.34	24.06	0.818	3.1
2	28.76	4.83	23.93	0.832	2.8
North: N Pleasant Valley Road					
1	14.72	7.81	6.91	0.470	6.2
West: Route 7					
1	18.47	7.71	10.76	0.582	4.5

Roundabout Capacity Model: SIDRA Standard

Gap Acceptance Cycle Parameters (Movements)							
To Approach	Turn	Lane No	Cycle Time sec	Blocked Time sec	Unblocked Time sec	Unblocked Time Ratio	Minimum Delay sec
South: N Pleasant Valley Road							
West	L2	1	20.85	8.35	12.49	0.599	4.8
North	T1	1	20.13	7.74	12.39	0.615	4.3
East	R2	2	18.85	6.66	12.19	0.647	3.5
East: Route 7							
South	L2	1	29.41	5.34	24.06	0.818	3.1
West	T1	2	28.76	4.83	23.93	0.832	2.8
North	R2	2	28.76	4.83	23.93	0.832	2.8
North: N Pleasant Valley Road							
East	L2	1	14.30	7.44	6.86	0.480	5.9
South	T1	1	14.93	7.99	6.94	0.465	6.4

West	R2	1	14.40	7.53	6.87	0.477	6.0
West: Route 7							
North	L2	1	17.97	7.28	10.69	0.595	4.2
East	T1	1	18.49	7.73	10.76	0.582	4.5
South	R2	1	18.67	7.88	10.79	0.578	4.7

Roundabout Capacity Model: SIDRA Standard

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Project: \\RICHFS1.bkr.mbakercorp.com\PROJECTS\VDOT TMPD On-Call 2017\Term 2 Task Orders_CHECK RATES ONE PENNY OFF\TO 34 - Route 7 STARS\Work_Files\Analysis\Build\Sidra\Pleasant Valley Road Roundabout\Pleasant Vally Roundabout_Future.sip8

DELAY (CONTROL)

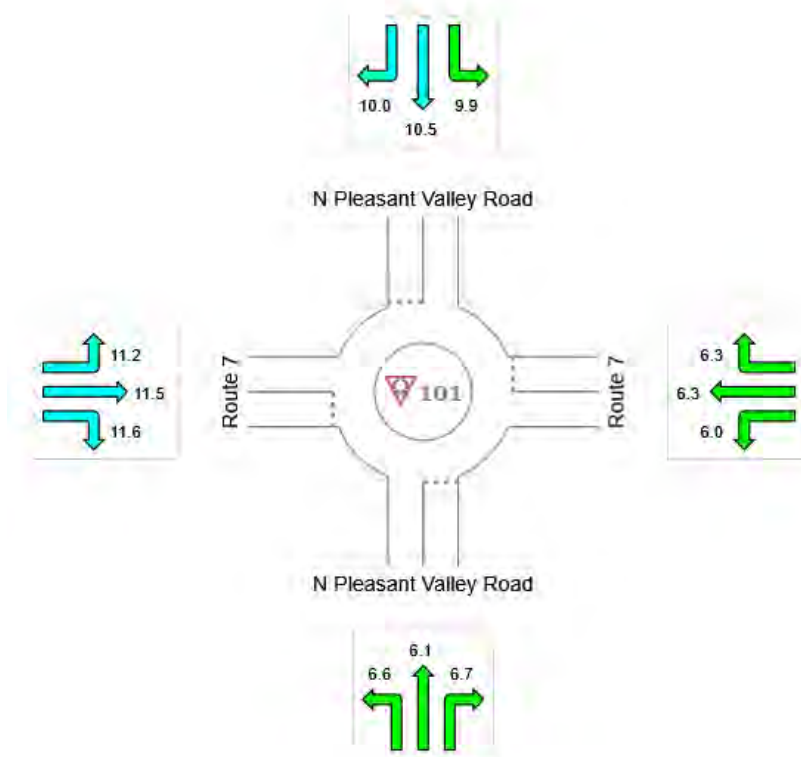
Average control delay per vehicle, or average pedestrian delay (seconds)

 **Site: 101 [Route 7 at Pleasant Valley Road - AM Peak - Preferred]**

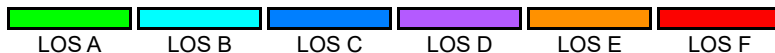
Future Build - AM Peak
 Site Category: (None)
 Roundabout

All Movement Classes

	Approaches				Intersection
	South	East	North	West	
Delay (Control)	6.6	6.2	10.3	11.5	7.8
LOS	A	A	B	B	A



Colour code based on Level of Service



Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
 LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).

NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Roundabout Level of Service Method: Same as Signalised Intersections

HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.

Project: \\RICHFS1.bkr.mbakercorp.com\PROJECTS\VDOT TMPD On-Call 2017\Term 2 Task Orders_CHECK RATES ONE PENNY OFF\TO 34 - Route 7 STARS\Work_Files\Analysis\Build\Sidra\Pleasant Valley Road Roundabout\Pleasant Vally Roundabout_Future.sip8

SimTraffic Simulation Summary
 FUTURE PM NO BUILD

Summary of All Intervals

Run Number	1	10	2	3	4	5	6
Start Time	3:30	3:30	3:30	3:30	3:30	3:30	3:30
End Time	5:30	5:30	5:30	5:30	5:30	5:30	5:30
Total Time (min)	120	120	120	120	120	120	120
Time Recorded (min)	60	60	60	60	60	60	60
# of Intervals	5	5	5	5	5	5	5
# of Recorded Intervals	4	4	4	4	4	4	4
Vehs Entered	11614	11658	11758	11707	11411	11549	11605
Vehs Exited	11469	11569	11739	11527	11344	11398	11490
Starting Vehs	744	853	731	764	703	675	792
Ending Vehs	889	942	750	944	770	826	907
Travel Distance (mi)	8376	8346	8446	8306	8277	8298	8303
Travel Time (hr)	977.1	1072.4	844.2	944.8	762.8	742.2	1074.3
Total Delay (hr)	729.9	825.7	593.7	698.3	518.0	496.0	827.7
Total Stops	30839	30734	28706	29865	26999	27010	31986
Fuel Used (gal)	475.2	494.8	449.0	464.5	425.5	422.7	494.2

Summary of All Intervals

Run Number	7	8	9	Avg
Start Time	3:30	3:30	3:30	3:30
End Time	5:30	5:30	5:30	5:30
Total Time (min)	120	120	120	120
Time Recorded (min)	60	60	60	60
# of Intervals	5	5	5	5
# of Recorded Intervals	4	4	4	4
Vehs Entered	11625	11910	11723	11654
Vehs Exited	11614	11673	11688	11549
Starting Vehs	827	682	652	730
Ending Vehs	838	919	687	838
Travel Distance (mi)	8478	8486	8565	8388
Travel Time (hr)	899.7	875.2	767.2	896.0
Total Delay (hr)	649.8	623.4	513.3	647.6
Total Stops	29792	30662	26306	29296
Fuel Used (gal)	460.4	453.4	435.7	457.5

Interval #0 Information Seeding

Start Time	3:30
End Time	4:30
Total Time (min)	60
Volumes adjusted by Growth Factors.	
No data recorded this interval.	

SimTraffic Simulation Summary
 FUTURE PM NO BUILD

Interval #1 Information

Start Time	4:30
End Time	4:45
Total Time (min)	15

Volumes adjusted by Growth Factors, Anti PHF.

Run Number	1	10	2	3	4	5	6
Vehs Entered	2873	2921	2959	2890	2782	2755	2839
Vehs Exited	2819	2963	2883	2859	2814	2754	2768
Starting Vehs	744	853	731	764	703	675	792
Ending Vehs	798	811	807	795	671	676	863
Travel Distance (mi)	2134	2121	2164	2052	2057	2027	1974
Travel Time (hr)	215.9	216.7	196.5	206.0	177.1	168.4	239.7
Total Delay (hr)	153.4	153.9	132.5	145.1	116.2	107.8	180.6
Total Stops	7236	7372	7381	6965	6646	6339	7329
Fuel Used (gal)	113.8	113.9	111.1	109.2	103.0	100.4	114.1

Interval #1 Information

Start Time	4:30
End Time	4:45
Total Time (min)	15

Volumes adjusted by Growth Factors, Anti PHF.

Run Number	7	8	9	Avg
Vehs Entered	2769	2940	2863	2856
Vehs Exited	2821	2837	2830	2835
Starting Vehs	827	682	652	730
Ending Vehs	775	785	685	761
Travel Distance (mi)	2076	2128	2098	2083
Travel Time (hr)	209.0	197.3	170.8	199.7
Total Delay (hr)	147.7	134.4	108.8	138.0
Total Stops	7430	7050	6068	6976
Fuel Used (gal)	110.4	109.0	103.7	108.9

SimTraffic Simulation Summary
 FUTURE PM NO BUILD

Interval #2 Information

Start Time	4:45
End Time	5:00
Total Time (min)	15

Volumes adjusted by PHF, Growth Factors.

Run Number	1	10	2	3	4	5	6
Vehs Entered	3170	3117	3105	3098	3093	3069	3017
Vehs Exited	3022	2996	3061	3009	2981	3032	2907
Starting Vehs	798	811	807	795	671	676	863
Ending Vehs	946	932	851	884	783	713	973
Travel Distance (mi)	2128	2142	2153	2086	2134	2148	2066
Travel Time (hr)	241.3	257.8	215.8	233.6	187.3	181.1	278.6
Total Delay (hr)	178.4	194.5	152.1	171.6	124.2	117.5	217.2
Total Stops	8017	7381	7392	7488	6933	6750	8045
Fuel Used (gal)	119.3	122.4	114.3	116.7	108.2	106.5	125.0

Interval #2 Information

Start Time	4:45
End Time	5:00
Total Time (min)	15

Volumes adjusted by PHF, Growth Factors.

Run Number	7	8	9	Avg
Vehs Entered	3202	3215	3169	3120
Vehs Exited	3112	3112	3113	3034
Starting Vehs	775	785	685	761
Ending Vehs	865	888	741	851
Travel Distance (mi)	2187	2201	2197	2144
Travel Time (hr)	218.2	212.5	193.6	222.0
Total Delay (hr)	153.6	147.1	128.4	158.5
Total Stops	7241	7468	6924	7366
Fuel Used (gal)	116.5	115.3	110.7	115.5

SimTraffic Simulation Summary
 FUTURE PM NO BUILD

Interval #3 Information

Start Time	5:00
End Time	5:15
Total Time (min)	15

Volumes adjusted by Growth Factors, Anti PHF.

Run Number	1	10	2	3	4	5	6
Vehs Entered	2784	2815	2861	2824	2799	2855	2876
Vehs Exited	2850	2816	2881	2860	2853	2751	2902
Starting Vehs	946	932	851	884	783	713	973
Ending Vehs	880	931	831	848	729	817	947
Travel Distance (mi)	2093	2068	2039	2096	2072	2027	2076
Travel Time (hr)	253.8	290.8	215.9	249.2	196.4	192.4	280.6
Total Delay (hr)	191.5	229.7	155.1	187.2	134.9	132.3	218.9
Total Stops	8216	8239	6896	7782	6944	7055	8279
Fuel Used (gal)	121.0	127.9	110.8	119.0	107.5	105.5	125.9

Interval #3 Information

Start Time	5:00
End Time	5:15
Total Time (min)	15

Volumes adjusted by Growth Factors, Anti PHF.

Run Number	7	8	9	Avg
Vehs Entered	2843	2890	2846	2832
Vehs Exited	2845	2878	2869	2845
Starting Vehs	865	888	741	851
Ending Vehs	863	900	718	834
Travel Distance (mi)	2121	2080	2097	2077
Travel Time (hr)	235.3	237.1	205.2	235.7
Total Delay (hr)	172.5	175.3	142.7	174.0
Total Stops	7947	8118	6841	7624
Fuel Used (gal)	116.4	115.7	110.2	116.0

SimTraffic Simulation Summary
 FUTURE PM NO BUILD

Interval #4 Information Recording

Start Time	5:15
End Time	5:30
Total Time (min)	15

Volumes adjusted by Growth Factors, Anti PHF.

Run Number	1	10	2	3	4	5	6
Vehs Entered	2787	2805	2833	2895	2737	2870	2873
Vehs Exited	2778	2794	2914	2799	2696	2861	2913
Starting Vehs	880	931	831	848	729	817	947
Ending Vehs	889	942	750	944	770	826	907
Travel Distance (mi)	2021	2015	2090	2073	2015	2096	2187
Travel Time (hr)	266.1	307.1	216.0	256.1	202.1	200.3	275.4
Total Delay (hr)	206.6	247.6	154.0	194.5	142.7	138.4	210.9
Total Stops	7370	7742	7037	7630	6476	6866	8333
Fuel Used (gal)	121.1	130.6	112.7	119.5	106.7	110.3	129.3

Interval #4 Information Recording

Start Time	5:15
End Time	5:30
Total Time (min)	15

Volumes adjusted by Growth Factors, Anti PHF.

Run Number	7	8	9	Avg
Vehs Entered	2811	2865	2845	2824
Vehs Exited	2836	2846	2876	2827
Starting Vehs	863	900	718	834
Ending Vehs	838	919	687	838
Travel Distance (mi)	2094	2076	2173	2084
Travel Time (hr)	237.2	228.3	197.6	238.6
Total Delay (hr)	176.0	166.5	133.4	177.1
Total Stops	7174	8026	6473	7307
Fuel Used (gal)	117.2	113.3	111.1	117.2

SimTraffic Performance Report
 FUTURE PM NO BUILD

1: N Pleasant Valley Road & National Avenue/Berryville Avenue Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	17.2	17.9	16.1	0.4	0.1	0.1	3.2	0.4	0.6	3.8	0.4	0.3
Total Del/Veh (s)	50.6	72.3	63.8	18.2	9.0	5.8	52.6	52.5	18.5	48.6	52.4	37.6

1: N Pleasant Valley Road & National Avenue/Berryville Avenue Performance by movement

Movement	All
Denied Del/Veh (s)	4.9
Total Del/Veh (s)	35.2

2: National Avenue & Berryville Avenue Performance by movement

Movement	EBT	EBR	WBL	WBT	NWL	NWR	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.1	0.1	0.0
Total Del/Veh (s)	1.7	1.0	42.4	26.2	169.4	8.1	13.1

3: Woodland Avenue/Battle Avenue & Berryville Avenue Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR	All
Denied Del/Veh (s)	0.0	0.1	0.0	0.1	0.0	0.1	0.1	0.1	4.6	5.2	5.2	0.2
Total Del/Veh (s)	37.0	14.2	9.3	23.8	5.1	46.0	52.5	20.9	46.3	36.9	26.1	11.6

4: Berryville Avenue & Virginia Avenue Performance by movement

Movement	EBL	EBT	WBT	WBR	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0
Total Del/Veh (s)	23.6	6.0	2.5	1.0	4.3

5: Chestnut Street/Dunlap Street & Berryville Avenue Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBT	NBR	SBR	All
Denied Del/Veh (s)	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0
Total Del/Veh (s)	50.5	16.5	12.5	16.1	3.2	1.7	81.4	122.9	9.9	11.6

6: Berryville Avenue & Baker Lane Performance by movement

Movement	EBL	EBT	WBT	WBR	SBL	SBR	All
Denied Del/Veh (s)	8.2	7.2	0.0	0.0	55.3	51.6	10.3
Total Del/Veh (s)	85.6	46.3	5.2	4.3	84.0	32.6	33.8

7: Berryville Avenue & Apple Valley Marketplace Performance by movement

Movement	EBL	EBT	WBT	WBR	SBL	SBR	All
Denied Del/Veh (s)	0.0	0.2	0.0	0.0	545.1	574.8	45.6
Total Del/Veh (s)	75.2	54.5	6.1	4.6	263.2	157.5	44.2

SimTraffic Performance Report
 FUTURE PM NO BUILD

8: Elm Street/Fort Collier Road & Berryville Avenue Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	3.1	4.5	1.4	0.0	0.0	0.3	4.6	0.4	0.6	140.1	144.4	145.0
Total Del/Veh (s)	160.6	137.4	121.8	42.3	19.8	10.1	50.9	68.5	53.1	88.7	81.8	64.8

8: Elm Street/Fort Collier Road & Berryville Avenue Performance by movement

Movement	All
Denied Del/Veh (s)	23.0
Total Del/Veh (s)	77.3

9: Pharmhouse Shopping Center Driveway/Atwell Avenue & Berryville Avenue Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBR	SBL	SBT	SBR	All
Denied Del/Veh (s)	1.3	0.5	0.0	0.0	0.0	0.0	0.1	0.1	48.9	3.7	87.1	0.9
Total Del/Veh (s)	50.3	37.4	19.4	29.2	3.0	2.1	247.2	420.7	1636.9	565.8	744.6	31.3

10: Pharmhouse Shopping Center Driveway/Ross Street & Berryville Avenue Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	0.0	10.6	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.6	0.3	0.4
Total Del/Veh (s)	92.0	57.4	35.3	77.7	4.7	2.0	55.3	46.3	46.2	87.5	90.0	13.0

10: Pharmhouse Shopping Center Driveway/Ross Street & Berryville Avenue Performance by movement

Movement	All
Denied Del/Veh (s)	4.8
Total Del/Veh (s)	36.0

11: Shell Driveway/Exxon Driveway & Berryville Avenue/Berryville Pike Performance by movement

Movement	EBL	EBT	EBR	WBT	WBR	NBL	NBR	SBL	SBR	All
Denied Del/Veh (s)	2.5	0.1	0.1	0.0	0.0	7.1	22.8	332.4	224.6	2.4
Total Del/Veh (s)	36.2	18.3	8.9	6.3	3.8	521.7	272.2	868.5	442.7	20.2

12: Driveway/I-81 SB Ramp & Berryville Pike Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	All
Denied Del/Veh (s)	0.4	0.1	0.0	0.0	0.0	0.4	1.6	18.7	1.2	0.2	0.3	0.2	0.2
Total Del/Veh (s)	68.7	28.5	20.9	88.1	39.4	13.2	66.9	66.3	18.2	63.1	19.0	36.0	36.0

13: Valley Mill Road/I-81 NB Ramp & Berryville Pike Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	All
Denied Del/Veh (s)	0.5	0.3	0.1	0.0	0.5	0.5	73.1	71.2	77.9	2.2	0.0	9.5	9.5
Total Del/Veh (s)	99.2	39.2	17.1	188.4	189.0	17.3	128.9	143.0	122.9	70.9	61.7	92.7	92.7

SimTraffic Performance Report
 FUTURE PM NO BUILD

14: Berryville Pike & Winchester Gateway Performance by movement

Movement	EBL	EBT	WBL	WBT	WBR	SBL	SBR	All
Denied Del/Veh (s)	0.0	0.0	2.2	0.4	0.5	0.4	3.3	0.5
Total Del/Veh (s)	63.0	12.4	128.4	66.5	59.8	55.4	27.9	43.2

15: Berryville Pike & Regency Lakes Drive Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.1	0.2	0.2	0.2
Total Del/Veh (s)	66.3	11.5	11.2	85.8	55.9	35.4	70.5	81.3	28.6	65.0	58.2	31.2

15: Berryville Pike & Regency Lakes Drive Performance by movement

Movement	All
Denied Del/Veh (s)	0.1
Total Del/Veh (s)	38.7

16: Blossom Drive/Millbrook Drive & Berryville Pike Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0	0.0	4.1	0.2	0.2	4.1	4.4	0.2
Total Del/Veh (s)	50.7	11.2	8.1	63.3	27.5	20.4	54.0	51.5	14.1	54.0	61.2	21.8

16: Blossom Drive/Millbrook Drive & Berryville Pike Performance by movement

Movement	All
Denied Del/Veh (s)	0.1
Total Del/Veh (s)	21.8

17: Greenwood Road/First Woods Drive & Berryville Pike Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	0.0	0.0	0.0	2.3	0.4	2.2	0.3	0.3	0.3	0.2	0.2	0.1
Total Del/Veh (s)	67.9	31.5	15.3	68.5	21.6	5.5	60.0	65.6	44.5	67.6	70.4	15.7

17: Greenwood Road/First Woods Drive & Berryville Pike Performance by movement

Movement	All
Denied Del/Veh (s)	0.3
Total Del/Veh (s)	31.3

19: Berryville Pike Performance by movement

Movement	EBT	WBT	SWR	All
Denied Del/Veh (s)	0.0	0.1	0.0	0.0
Total Del/Veh (s)	7.9	5.3	22.6	8.0

SimTraffic Performance Report
 FUTURE PM NO BUILD

35: Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	2.5	0.3	2.6	2.6	0.6	2.6	0.5	0.4	0.5	0.2	0.2	0.1
Total Del/Veh (s)	70.1	33.3	7.1	72.6	25.5	5.7	64.3	63.0	42.8	59.9	58.1	13.4

35: Performance by movement

Movement	All
Denied Del/Veh (s)	0.7
Total Del/Veh (s)	33.4

41: I-81 NB Ramp Performance by movement

Movement	NBT	SBT	SBR	All
Denied Del/Veh (s)	0.3	2.5	2.9	1.6
Total Del/Veh (s)	15.2	13.0	9.7	13.5

42: Battle Avenue & Virginia Avenue Performance by movement

Movement	WBT	NBT	All
Denied Del/Veh (s)	0.0	0.0	0.0
Total Del/Veh (s)	0.1	0.9	0.3

Total Network Performance

Denied Del/Veh (s)	23.8
Total Del/Veh (s)	165.6

Queuing and Blocking Report
 FUTURE PM NO BUILD

Intersection: 1: N Pleasant Valley Road & National Avenue/Berryville Avenue

Movement	EB	EB	WB	WB	NB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	T	R	L	TR
Maximum Queue (ft)	175	562	96	93	154	282	354	100	281
Average Queue (ft)	51	476	90	79	44	112	146	40	137
95th Queue (ft)	162	655	98	110	105	251	336	95	245
Link Distance (ft)		544	78	78		685	685		461
Upstream Blk Time (%)		22	48	17		0	1		
Queuing Penalty (veh)		0	225	82		0	0		
Storage Bay Dist (ft)	175				165			100	
Storage Blk Time (%)	0	50			0	2		0	22
Queuing Penalty (veh)	1	25			0	2		0	9

Intersection: 2: National Avenue & Berryville Avenue

Movement	EB	EB	WB	WB	NW
Directions Served	T	TR	LT	T	LR
Maximum Queue (ft)	85	87	419	386	31
Average Queue (ft)	14	18	259	125	7
95th Queue (ft)	60	72	455	290	26
Link Distance (ft)	78	78	404	404	278
Upstream Blk Time (%)	1	2	4	0	
Queuing Penalty (veh)	6	10	20	1	
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 3: Woodland Avenue/Battle Avenue & Berryville Avenue

Movement	EB	EB	WB	WB	NB	SB
Directions Served	LT	TR	LT	TR	LTR	LTR
Maximum Queue (ft)	320	288	150	152	65	52
Average Queue (ft)	135	116	67	60	18	23
95th Queue (ft)	318	305	150	140	49	55
Link Distance (ft)	404	404	130	130	228	
Upstream Blk Time (%)	3	2	4	1		0
Queuing Penalty (veh)	13	12	18	6		0
Storage Bay Dist (ft)						
Storage Blk Time (%)						
Queuing Penalty (veh)						

Queuing and Blocking Report
 FUTURE PM NO BUILD

Intersection: 4: Berryville Avenue & Virginia Avenue

Movement	EB	EB	WB	WB
Directions Served	LT	T	T	TR
Maximum Queue (ft)	146	122	170	144
Average Queue (ft)	40	32	20	11
95th Queue (ft)	145	133	98	66
Link Distance (ft)	130	130	280	280
Upstream Blk Time (%)	10	5	0	0
Queuing Penalty (veh)	54	27	0	0
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 5: Chestnut Street/Dunlap Street & Berryville Avenue

Movement	EB	EB	WB	WB	NB	SB
Directions Served	LT	TR	LT	TR	LTR	LTR
Maximum Queue (ft)	265	264	238	189	78	18
Average Queue (ft)	110	96	43	14	26	3
95th Queue (ft)	320	310	148	92	85	12
Link Distance (ft)	280	280	447	447	337	507
Upstream Blk Time (%)	12	6				
Queuing Penalty (veh)	63	32				
Storage Bay Dist (ft)						
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 6: Berryville Avenue & Baker Lane

Movement	EB	EB	WB	WB	SB	SB
Directions Served	LT	T	T	TR	L	R
Maximum Queue (ft)	483	479	178	209	70	250
Average Queue (ft)	353	306	38	49	62	166
95th Queue (ft)	574	573	136	164	80	296
Link Distance (ft)	447	447	436	436		223
Upstream Blk Time (%)	28	11				25
Queuing Penalty (veh)	153	62				0
Storage Bay Dist (ft)					70	
Storage Blk Time (%)					46	18
Queuing Penalty (veh)					74	24

Queuing and Blocking Report
 FUTURE PM NO BUILD

Intersection: 7: Berryville Avenue & Apple Valley Marketplace

Movement	EB	EB	WB	WB	SB	SB
Directions Served	LT	T	T	TR	L	R
Maximum Queue (ft)	451	439	159	196	89	307
Average Queue (ft)	324	293	44	55	78	212
95th Queue (ft)	556	549	118	144	101	405
Link Distance (ft)	436	436	707	707		291
Upstream Blk Time (%)	12	7				55
Queuing Penalty (veh)	63	39				0
Storage Bay Dist (ft)					90	
Storage Blk Time (%)					65	50
Queuing Penalty (veh)					39	57

Intersection: 8: Elm Street/Fort Collier Road & Berryville Avenue

Movement	EB	EB	EB	WB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	TR	L	T	T	R	L	TR	L	TR
Maximum Queue (ft)	104	735	741	119	288	305	95	100	258	100	400
Average Queue (ft)	71	646	632	62	141	163	59	45	111	98	325
95th Queue (ft)	136	900	912	120	267	294	125	99	228	105	453
Link Distance (ft)		707	707		290	290			356		364
Upstream Blk Time (%)		29	24		1	2			1		35
Queuing Penalty (veh)		169	137		4	11			0		0
Storage Bay Dist (ft)	105			120			95	100		100	
Storage Blk Time (%)	1	71		2	15	24	1	0	16	37	22
Queuing Penalty (veh)	5	48		8	15	56	4	1	8	44	66

Intersection: 9: Pharmhouse Shopping Center Driveway/Atwell Avenue & Berryville Avenue

Movement	EB	EB	EB	WB	WB	WB	NB	SB	SB
Directions Served	L	T	TR	L	T	TR	LTR	LT	R
Maximum Queue (ft)	120	321	330	53	88	91	57	320	66
Average Queue (ft)	47	281	267	22	5	5	13	175	10
95th Queue (ft)	130	390	403	51	39	43	47	420	48
Link Distance (ft)		290	290		339	339	194	408	
Upstream Blk Time (%)		23	12					12	
Queuing Penalty (veh)		164	83					0	
Storage Bay Dist (ft)	120			60					90
Storage Blk Time (%)	0	63		0	0			56	0
Queuing Penalty (veh)	2	21		3	0			8	0

Queuing and Blocking Report
 FUTURE PM NO BUILD

Intersection: 10: Pharmhouse Shopping Center Driveway/Ross Street & Berryville Avenue

Movement	EB	EB	EB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	TR	L	T	TR	LT	R	LT	R
Maximum Queue (ft)	75	367	395	59	155	164	72	138	231	53
Average Queue (ft)	28	341	339	46	69	65	25	56	106	18
95th Queue (ft)	77	412	428	69	159	145	63	113	198	47
Link Distance (ft)		339	339		127	127	236	236	262	262
Upstream Blk Time (%)		48	31		11	1			1	
Queuing Penalty (veh)		328	211		72	8			0	
Storage Bay Dist (ft)	75			60						
Storage Blk Time (%)	1	72		29	7					
Queuing Penalty (veh)	3	23		173	6					

Intersection: 11: Shell Driveway/Exxon Driveway & Berryville Avenue/Berryville Pike

Movement	EB	EB	EB	WB	WB	NB	SB
Directions Served	L	T	TR	T	TR	LTR	LTR
Maximum Queue (ft)	32	239	235	216	223	185	152
Average Queue (ft)	3	209	177	40	31	76	90
95th Queue (ft)	18	248	276	146	133	183	210
Link Distance (ft)		127	127	215	215	194	172
Upstream Blk Time (%)		50	24	0	0	9	36
Queuing Penalty (veh)		368	182	1	2	0	0
Storage Bay Dist (ft)	35						
Storage Blk Time (%)	2	55		8			
Queuing Penalty (veh)	13	2		0			

Intersection: 12: Driveway/I-81 SB Ramp & Berryville Pike

Movement	EB	EB	EB	WB	WB	WB	WB	NB	NB	SB	SB	SB
Directions Served	L	T	TR	L	T	T	R	LT	R	L	L	R
Maximum Queue (ft)	144	323	314	96	545	565	590	71	60	388	333	222
Average Queue (ft)	141	293	276	23	316	360	146	21	21	233	195	104
95th Queue (ft)	173	308	358	71	476	514	472	57	51	344	300	183
Link Distance (ft)		215	215		813	813	813	77	77	495	495	495
Upstream Blk Time (%)		58	28					1	0	0		
Queuing Penalty (veh)		434	206					0	0	0		
Storage Bay Dist (ft)	145			100								
Storage Blk Time (%)	32	48		0	33							
Queuing Penalty (veh)	183	158		0	6							

Queuing and Blocking Report
 FUTURE PM NO BUILD

Intersection: 13: Valley Mill Road/I-81 NB Ramp & Berryville Pike

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB	SB
Directions Served	L	T	T	R	L	T	T	R	L	L	TR	L
Maximum Queue (ft)	240	434	424	250	335	1332	1341	1282	205	442	295	352
Average Queue (ft)	195	333	310	188	145	1114	1133	459	180	376	260	313
95th Queue (ft)	282	478	468	321	352	1539	1531	1299	256	513	364	372
Link Distance (ft)		268	268			1304	1304	1304		404		212
Upstream Blk Time (%)		24	16	0		5	6	0		43		47
Queuing Penalty (veh)		200	134	0		27	32	0		0		167
Storage Bay Dist (ft)	240			250	335				205			295
Storage Blk Time (%)	8	25	17	1	0	48			2	49	14	
Queuing Penalty (veh)	40	47	71	8	1	34			8	181	49	

Intersection: 13: Valley Mill Road/I-81 NB Ramp & Berryville Pike

Movement	SB
Directions Served	LT
Maximum Queue (ft)	326
Average Queue (ft)	255
95th Queue (ft)	321
Link Distance (ft)	212
Upstream Blk Time (%)	32
Queuing Penalty (veh)	116
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 14: Berryville Pike & Winchester Gateway

Movement	EB	EB	EB	EB	WB	WB	WB	WB	SB	SB	SB	SB
Directions Served	L	L	T	T	L	T	T	R	L	L	R	R
Maximum Queue (ft)	234	246	350	363	70	964	1001	220	220	332	170	161
Average Queue (ft)	123	137	113	125	10	503	569	134	131	114	130	101
95th Queue (ft)	203	215	283	301	44	1187	1223	295	202	268	189	191
Link Distance (ft)			1304	1304		1210	1210		490	490		
Upstream Blk Time (%)						2	2					
Queuing Penalty (veh)						12	18					
Storage Bay Dist (ft)	575	575			75			220			170	170
Storage Blk Time (%)					0	30	29	1		2	4	0
Queuing Penalty (veh)					1	3	59	7		8	4	0

Queuing and Blocking Report
 FUTURE PM NO BUILD

Intersection: 15: Berryville Pike & Regency Lakes Drive

Movement	EB	EB	EB	WB	WB	WB	WB	NB	SB	SB
Directions Served	L	T	TR	L	T	T	R	LTR	LT	R
Maximum Queue (ft)	274	502	437	51	892	925	430	75	187	226
Average Queue (ft)	214	165	134	5	414	461	122	23	87	95
95th Queue (ft)	305	404	324	27	1017	1057	405	61	156	179
Link Distance (ft)		1210	1210		1630	1630		227	326	326
Upstream Blk Time (%)					1	1				
Queuing Penalty (veh)					4	6				
Storage Bay Dist (ft)	275			100			430			
Storage Blk Time (%)	6	2		0	33	13	0			
Queuing Penalty (veh)	35	5		0	2	15	2			

Intersection: 16: Blossom Drive/Millbrook Drive & Berryville Pike

Movement	EB	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	SB
Directions Served	L	L	T	T	R	L	T	T	R	L	TR	LT
Maximum Queue (ft)	70	98	276	290	156	152	504	537	35	102	51	27
Average Queue (ft)	20	50	94	114	16	13	223	250	1	31	13	3
95th Queue (ft)	55	89	218	236	99	71	452	475	26	79	41	15
Link Distance (ft)			1630	1630			1916	1916			544	
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	605	605			175	165			250	200		290
Storage Blk Time (%)				3	0	0	12	10	0			
Queuing Penalty (veh)				3	1	0	3	0	0			

Intersection: 16: Blossom Drive/Millbrook Drive & Berryville Pike

Movement	SB
Directions Served	R
Maximum Queue (ft)	76
Average Queue (ft)	14
95th Queue (ft)	49
Link Distance (ft)	376
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Queuing and Blocking Report
 FUTURE PM NO BUILD

Intersection: 17: Greenwood Road/First Woods Drive & Berryville Pike

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	SB	SB
Directions Served	L	T	T	R	L	T	T	R	LTR	LT	R
Maximum Queue (ft)	220	523	518	260	321	565	515	217	302	196	42
Average Queue (ft)	26	241	251	70	141	277	253	14	160	96	11
95th Queue (ft)	105	428	441	222	269	483	443	75	261	173	33
Link Distance (ft)		1916	1916			786	786		584	442	442
Upstream Blk Time (%)											
Queuing Penalty (veh)											
Storage Bay Dist (ft)	325			260	335			340			
Storage Blk Time (%)	0	5	10	0	0	4	3	0			
Queuing Penalty (veh)	0	1	10	1	0	6	1	0			

Intersection: 19: Berryville Pike

Movement	EB	EB	WB	WB	SW
Directions Served	T	T	T	T	R
Maximum Queue (ft)	317	322	133	259	473
Average Queue (ft)	55	52	7	52	186
95th Queue (ft)	222	207	73	194	433
Link Distance (ft)	813	813	268	268	329
Upstream Blk Time (%)			0	0	0
Queuing Penalty (veh)			0	3	0
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 35:

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	SB	SB
Directions Served	L	T	T	R	L	T	T	R	LTR	LT	R
Maximum Queue (ft)	231	487	464	260	335	522	526	192	307	194	40
Average Queue (ft)	32	335	270	48	173	349	292	20	164	89	9
95th Queue (ft)	135	489	416	172	335	554	485	113	290	162	28
Link Distance (ft)		467	467			493	493		301	224	224
Upstream Blk Time (%)		1	0			4	1		1	0	
Queuing Penalty (veh)		0	0			0	0		0	0	
Storage Bay Dist (ft)	325			260	335			340			
Storage Blk Time (%)	0	9	5	0	0	9	4	0			
Queuing Penalty (veh)	0	2	5	1	1	13	1	0			

Queuing and Blocking Report FUTURE PM NO BUILD

Intersection: 41: I-81 NB Ramp

Movement	NB	SB	SB
Directions Served	T	T	TR
Maximum Queue (ft)	376	265	280
Average Queue (ft)	253	110	92
95th Queue (ft)	421	294	284
Link Distance (ft)	212	311	311
Upstream Blk Time (%)	7	3	5
Queuing Penalty (veh)	59	0	0
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 42: Battle Avenue & Virginia Avenue

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Network Summary

Network wide Queuing Penalty: 5762

SimTraffic Performance Report
FUTURE PM NO BUILD

1: N Pleasant Valley Road & National Avenue/Berryville Avenue Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	17.7	0.2	0.8	1.1	4.9
Total Del/Veh (s)	69.9	13.5	28.3	48.9	35.2

2: National Avenue & Berryville Avenue Performance by approach

Approach	EB	WB	NW	All
Denied Del/Veh (s)	0.0	0.0	0.1	0.0
Total Del/Veh (s)	1.7	26.3	26.0	13.1

3: Woodland Avenue/Battle Avenue & Berryville Avenue Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.1	0.0	0.1	4.8	0.2
Total Del/Veh (s)	14.5	5.2	42.0	39.6	11.6

4: Berryville Avenue & Virginia Avenue Performance by approach

Approach	EB	WB	All
Denied Del/Veh (s)	0.0	0.0	0.0
Total Del/Veh (s)	6.0	2.4	4.3

5: Chestnut Street/Dunlap Street & Berryville Avenue Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.1	0.0	0.1	0.1	0.0
Total Del/Veh (s)	16.6	3.5	121.1	9.9	11.6

6: Berryville Avenue & Baker Lane Performance by approach

Approach	EB	WB	SB	All
Denied Del/Veh (s)	7.3	0.0	53.3	10.3
Total Del/Veh (s)	51.7	5.1	55.6	33.8

7: Berryville Avenue & Apple Valley Marketplace Performance by approach

Approach	EB	WB	SB	All
Denied Del/Veh (s)	0.2	0.0	555.3	45.6
Total Del/Veh (s)	55.3	5.9	228.0	44.2

8: Elm Street/Fort Collier Road & Berryville Avenue Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	4.4	0.1	1.7	141.3	23.0
Total Del/Veh (s)	138.5	19.8	56.4	84.9	77.3

SimTraffic Performance Report
FUTURE PM NO BUILD

9: Pharmhouse Shopping Center Driveway/Atwell Avenue & Berryville Avenue Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.5	0.0	0.1	71.8	0.9
Total Del/Veh (s)	37.3	3.6	351.3	1034.6	31.3

10: Pharmhouse Shopping Center Driveway/Ross Street & Berryville Avenue Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	10.2	0.0	0.2	0.6	4.8
Total Del/Veh (s)	57.9	9.2	48.5	70.9	36.0

11: Shell Driveway/Exxon Driveway & Berryville Avenue/Berryville Pike Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.1	0.0	21.8	237.5	2.4
Total Del/Veh (s)	18.2	6.2	287.3	508.2	20.2

12: Driveway/I-81 SB Ramp & Berryville Pike Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.2	0.2	3.3	0.3	0.2
Total Del/Veh (s)	37.4	29.9	40.3	47.6	36.0

13: Valley Mill Road/I-81 NB Ramp & Berryville Pike Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.2	0.5	73.2	1.7	9.5
Total Del/Veh (s)	40.1	140.5	131.6	68.6	92.7

14: Berryville Pike & Winchester Gateway Performance by approach

Approach	EB	WB	SB	All
Denied Del/Veh (s)	0.0	0.5	2.2	0.5
Total Del/Veh (s)	23.2	66.1	38.2	43.2

15: Berryville Pike & Regency Lakes Drive Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.1	0.1	0.2	0.1
Total Del/Veh (s)	21.9	54.5	64.2	43.6	38.7

16: Blossom Drive/Millbrook Drive & Berryville Pike Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	2.9	0.8	0.1
Total Del/Veh (s)	14.0	28.0	46.0	26.9	21.8

SimTraffic Performance Report
FUTURE PM NO BUILD

17: Greenwood Road/First Woods Drive & Berryville Pike Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.6	0.3	0.2	0.3
Total Del/Veh (s)	30.7	25.8	54.6	62.3	31.3

19: Berryville Pike Performance by approach

Approach	EB	WB	SW	All
Denied Del/Veh (s)	0.0	0.1	0.0	0.0
Total Del/Veh (s)	7.9	5.3	22.6	8.0

35: Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.6	0.9	0.5	0.2	0.7
Total Del/Veh (s)	31.7	29.8	54.1	52.7	33.4

41: I-81 NB Ramp Performance by approach

Approach	NB	SB	All
Denied Del/Veh (s)	0.3	2.6	1.6
Total Del/Veh (s)	15.2	12.1	13.5

42: Battle Avenue & Virginia Avenue Performance by approach























Approach	WB	NB	All
Denied Del/Veh (s)	0.0	0.0	0.0
Total Del/Veh (s)	0.1	0.9	0.3

Total Network Performance

Denied Del/Veh (s)	23.8
Total Del/Veh (s)	165.6

HCM Signalized Intersection Capacity Analysis

1: N Pleasant Valley Road & National Avenue/Berryville Avenue

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	50	531	52	473	440	29	66	144	508	41	135	34
Future Volume (vph)	50	531	52	473	440	29	66	144	508	41	135	34
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.5	5.5		6.0	6.5		6.0	6.0	6.0	6.5	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	0.99	1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.99		1.00	0.99		1.00	1.00	0.85	1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1803	1864		1787	1862		1770	1845	1590	1765	1817	
Flt Permitted	0.49	1.00		0.12	1.00		0.32	1.00	1.00	0.47	1.00	
Satd. Flow (perm)	925	1864		227	1862		588	1845	1590	871	1817	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	52	547	54	488	454	30	68	148	524	42	139	35
RTOR Reduction (vph)	0	2	0	0	1	0	0	0	115	0	7	0
Lane Group Flow (vph)	52	599	0	488	483	0	68	148	409	42	167	0
Confl. Peds. (#/hr)	2		8	8		2			5	5		
Heavy Vehicles (%)	0%	0%	2%	1%	1%	0%	2%	3%	1%	2%	1%	3%
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA	pm+ov	pm+pt	NA	
Protected Phases	5	2		1	6		7	4	1	3	8	
Permitted Phases	2			6			4		4	8		
Actuated Green, G (s)	60.4	54.7		99.8	87.6		21.2	16.5	56.6	23.7	19.0	
Effective Green, g (s)	60.4	54.7		99.8	87.6		21.2	16.5	56.6	23.7	19.0	
Actuated g/C Ratio	0.43	0.39		0.71	0.63		0.15	0.12	0.40	0.17	0.14	
Clearance Time (s)	6.5	5.5		6.0	6.5		6.0	6.0	6.0	6.5	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	434	728		608	1165		128	217	710	177	246	
v/s Ratio Prot	0.00	0.32		c0.23	0.26		c0.02	0.08	0.16	0.01	c0.09	
v/s Ratio Perm	0.05			c0.34			0.06		0.09	0.03		
v/c Ratio	0.12	0.82		0.80	0.41		0.53	0.68	0.58	0.24	0.68	
Uniform Delay, d1	24.0	38.3		33.0	13.2		52.8	59.2	32.4	49.6	57.6	
Progression Factor	1.00	1.00		0.97	1.45		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.1	10.1		7.3	1.0		4.2	8.5	1.1	0.7	7.3	
Delay (s)	24.1	48.4		39.2	20.3		57.0	67.8	33.5	50.3	64.9	
Level of Service	C	D		D	C		E	E	C	D	E	
Approach Delay (s)		46.5			29.8			42.5			62.0	
Approach LOS		D			C			D			E	
Intersection Summary												
HCM 2000 Control Delay			40.4				HCM 2000 Level of Service			D		
HCM 2000 Volume to Capacity ratio			0.81									
Actuated Cycle Length (s)			140.0				Sum of lost time (s)			25.5		
Intersection Capacity Utilization			91.3%				ICU Level of Service			F		
Analysis Period (min)			15									

c Critical Lane Group

















HCM Unsignalized Intersection Capacity Analysis 2: National Avenue & Berryville Avenue



Movement	EBT	EBR	WBL	WBT	NWL	NWR
Lane Configurations	↑↑			↑↑	↑↑	
Traffic Volume (veh/h)	1056	24	2	940	2	7
Future Volume (Veh/h)	1056	24	2	940	2	7
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	1135	26	2	1011	2	8
Pedestrians				12	10	
Lane Width (ft)				12.0	12.0	
Walking Speed (ft/s)				3.5	3.5	
Percent Blockage				1	1	
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (ft)	142			470		
pX, platoon unblocked					0.94	
vC, conflicting volume			1171	1668	602	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			1171	1576	602	
tC, single (s)			4.1	6.8	6.9	
tC, 2 stage (s)						
tF (s)			2.2	3.5	3.3	
p0 queue free %			100	98	98	
cM capacity (veh/h)			598	95	438	
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NW 1	
Volume Total	757	404	339	674	10	
Volume Left	0	0	2	0	2	
Volume Right	0	26	0	0	8	
cSH	1700	1700	598	1700	254	
Volume to Capacity	0.45	0.24	0.00	0.40	0.04	
Queue Length 95th (ft)	0	0	0	0	3	
Control Delay (s)	0.0	0.0	0.1	0.0	19.8	
Lane LOS	A			C		
Approach Delay (s)	0.0		0.0		19.8	
Approach LOS						C
Intersection Summary						
Average Delay			0.1			
Intersection Capacity Utilization			43.3%	ICU Level of Service	A	
Analysis Period (min)			15			

HCM Signalized Intersection Capacity Analysis

3: Woodland Avenue/Battle Avenue & Berryville Avenue

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (vph)	20	1034	9	5	909	0	10	6	7	46	5	23	
Future Volume (vph)	20	1034	9	5	909	0	10	6	7	46	5	23	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)		6.0			7.0			5.0			6.0		
Lane Util. Factor		0.95			0.95			1.00			1.00		
Frbp, ped/bikes		1.00			1.00			1.00			1.00		
Flpb, ped/bikes		1.00			1.00			1.00			1.00		
Frt		1.00			1.00			0.96			0.96		
Flt Protected		1.00			1.00			0.98			0.97		
Satd. Flow (prot)		3563			3573			1783			1735		
Flt Permitted		0.92			0.95			0.88			0.80		
Satd. Flow (perm)		3280			3393			1609			1424		
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	
Adj. Flow (vph)	21	1088	9	5	957	0	11	6	7	48	5	24	
RTOR Reduction (vph)	0	0	0	0	0	0	0	6	0	0	15	0	
Lane Group Flow (vph)	0	1118	0	0	962	0	0	18	0	0	62	0	
Confl. Peds. (#/hr)	1		2	2		1	1					1	
Heavy Vehicles (%)	5%	1%	0%	0%	1%	0%	0%	0%	0%	0%	0%	4%	
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA		
Protected Phases		2			6			4			8		
Permitted Phases	2			6			4			8			
Actuated Green, G (s)		116.7			115.7			12.3			11.3		
Effective Green, g (s)		116.7			115.7			12.3			11.3		
Actuated g/C Ratio		0.83			0.83			0.09			0.08		
Clearance Time (s)		6.0			7.0			5.0			6.0		
Vehicle Extension (s)		3.0			3.0			3.0			3.0		
Lane Grp Cap (vph)		2734			2804			141			114		
v/s Ratio Prot													
v/s Ratio Perm		c0.34			0.28			0.01			c0.04		
v/c Ratio		0.41			0.34			0.12			0.55		
Uniform Delay, d1		2.9			2.9			58.9			61.9		
Progression Factor		1.74			2.87			1.00			1.00		
Incremental Delay, d2		0.3			0.3			0.4			5.3		
Delay (s)		5.4			8.8			59.3			67.2		
Level of Service		A			A			E			E		
Approach Delay (s)		5.4			8.8			59.3			67.2		
Approach LOS		A			A			E			E		
Intersection Summary													
HCM 2000 Control Delay			9.7									HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.42										
Actuated Cycle Length (s)			140.0									Sum of lost time (s)	13.0
Intersection Capacity Utilization			59.5%									ICU Level of Service	B
Analysis Period (min)			15										
c Critical Lane Group													

















HCM Unsignalized Intersection Capacity Analysis

4: Berryville Avenue & Virginia Avenue



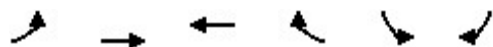
Movement	EBL	EBT	WBT	WBR	SEL	SER
Lane Configurations		↔↑	↔↑			
Traffic Volume (veh/h)	2	1085	909	58	0	0
Future Volume (Veh/h)	2	1085	909	58	0	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96
Hourly flow rate (vph)	2	1130	947	60	0	0
Pedestrians			1		2	
Lane Width (ft)			12.0		0.0	
Walking Speed (ft/s)			3.5		3.5	
Percent Blockage			0		0	
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (ft)		246	877			
pX, platoon unblocked	0.95				0.95	0.95
vC, conflicting volume	1009				1549	506
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	898				1221	366
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	100
cM capacity (veh/h)	724				166	603
Direction, Lane #	EB 1	EB 2	WB 1	WB 2		
Volume Total	379	753	631	376		
Volume Left	2	0	0	0		
Volume Right	0	0	0	60		
cSH	724	1700	1700	1700		
Volume to Capacity	0.00	0.44	0.37	0.22		
Queue Length 95th (ft)	0	0	0	0		
Control Delay (s)	0.1	0.0	0.0	0.0		
Lane LOS	A					
Approach Delay (s)	0.0		0.0			
Approach LOS						
Intersection Summary						
Average Delay			0.0			
Intersection Capacity Utilization			34.7%		ICU Level of Service	A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis
 5: Chestnut Street/Dunlap Street & Berryville Avenue

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	6	1078	2	26	968	5	0	1	24	0	0	6
Future Volume (Veh/h)	6	1078	2	26	968	5	0	1	24	0	0	6
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	6	1111	2	27	998	5	0	1	25	0	0	6
Pedestrians					1			2			11	
Lane Width (ft)					12.0			12.0			12.0	
Walking Speed (ft/s)					3.5			3.5			3.5	
Percent Blockage					0			0			1	
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)		587			536							
pX, platoon unblocked	0.93			0.92			0.96	0.96	0.92	0.96	0.96	0.93
vC, conflicting volume	1014			1115			1685	2194	560	1660	2192	512
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	870			962			1311	1842	362	1284	1840	332
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			96			100	99	96	100	100	99
cM capacity (veh/h)	723			668			107	69	591	106	69	618
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1						
Volume Total	562	558	526	504	26	6						
Volume Left	6	0	27	0	0	0						
Volume Right	0	2	0	5	25	6						
cSH	723	1700	668	1700	457	618						
Volume to Capacity	0.01	0.33	0.04	0.30	0.06	0.01						
Queue Length 95th (ft)	1	0	3	0	5	1						
Control Delay (s)	0.2	0.0	1.1	0.0	13.3	10.9						
Lane LOS	A		A		B	B						
Approach Delay (s)	0.1		0.6		13.3	10.9						
Approach LOS					B	B						
Intersection Summary												
Average Delay			0.5									
Intersection Capacity Utilization			56.0%		ICU Level of Service				B			
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis

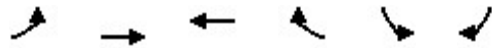
6: Berryville Avenue & Baker Lane



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕↕	↕↔		↘	↘
Traffic Volume (vph)	155	947	837	106	131	162
Future Volume (vph)	155	947	837	106	131	162
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0	5.0		6.0	6.0
Lane Util. Factor		0.95	0.95		1.00	1.00
Frbp, ped/bikes		1.00	1.00		1.00	1.00
Flpb, ped/bikes		1.00	1.00		1.00	1.00
Frt		1.00	0.98		1.00	0.85
Flt Protected		0.99	1.00		0.95	1.00
Satd. Flow (prot)		3548	3501		1770	1599
Flt Permitted		0.61	1.00		0.95	1.00
Satd. Flow (perm)		2196	3501		1770	1599
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	167	1018	900	114	141	174
RTOR Reduction (vph)	0	0	4	0	0	154
Lane Group Flow (vph)	0	1185	1010	0	141	20
Confl. Peds. (#/hr)	4			4	6	
Heavy Vehicles (%)	1%	1%	1%	1%	2%	1%
Turn Type	pm+pt	NA	NA		Prot	Perm
Protected Phases	5	2	6		8	
Permitted Phases	2					8
Actuated Green, G (s)		111.6	112.6		16.4	16.4
Effective Green, g (s)		111.6	112.6		16.4	16.4
Actuated g/C Ratio		0.80	0.80		0.12	0.12
Clearance Time (s)		6.0	5.0		6.0	6.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		1750	2815		207	187
v/s Ratio Prot			0.29		c0.08	
v/s Ratio Perm		c0.54				0.01
v/c Ratio		0.68	0.36		0.68	0.11
Uniform Delay, d1		6.3	3.8		59.3	55.3
Progression Factor		1.83	1.28		1.00	1.00
Incremental Delay, d2		1.0	0.3		8.9	0.3
Delay (s)		12.5	5.2		68.2	55.5
Level of Service		B	A		E	E
Approach Delay (s)		12.5	5.2		61.2	
Approach LOS		B	A		E	
Intersection Summary						
HCM 2000 Control Delay			15.6		HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.70			
Actuated Cycle Length (s)			140.0		Sum of lost time (s)	16.5
Intersection Capacity Utilization			78.7%		ICU Level of Service	D
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

7: Berryville Avenue & Apple Valley Marketplace



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕↕	↕↔		↗	↗
Traffic Volume (vph)	41	1037	884	86	113	59
Future Volume (vph)	41	1037	884	86	113	59
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		7.0	6.0		7.0	7.0
Lane Util. Factor		0.95	0.95		1.00	1.00
Frbp, ped/bikes		1.00	1.00		1.00	1.00
Flpb, ped/bikes		1.00	1.00		1.00	1.00
Frt		1.00	0.99		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		3565	3523		1787	1615
Flt Permitted		0.85	1.00		0.95	1.00
Satd. Flow (perm)		3020	3523		1787	1615
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	44	1115	951	92	122	63
RTOR Reduction (vph)	0	0	3	0	0	56
Lane Group Flow (vph)	0	1159	1040	0	122	7
Confl. Peds. (#/hr)	1			1		
Heavy Vehicles (%)	3%	1%	1%	0%	1%	0%
Turn Type	pm+pt	NA	NA		Prot	Perm
Protected Phases	5	2	6		8	
Permitted Phases	2					8
Actuated Green, G (s)		111.1	112.1		14.9	14.9
Effective Green, g (s)		111.1	112.1		14.9	14.9
Actuated g/C Ratio		0.79	0.80		0.11	0.11
Clearance Time (s)		7.0	6.0		7.0	7.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		2396	2820		190	171
v/s Ratio Prot			0.30		c0.07	
v/s Ratio Perm		c0.38				0.00
v/c Ratio		0.48	0.37		0.64	0.04
Uniform Delay, d1		4.8	3.9		60.0	56.1
Progression Factor		0.85	2.01		1.00	1.00
Incremental Delay, d2		0.1	0.3		7.2	0.1
Delay (s)		4.2	8.3		67.2	56.2
Level of Service		A	A		E	E
Approach Delay (s)		4.2	8.3		63.5	
Approach LOS		A	A		E	
Intersection Summary						
HCM 2000 Control Delay			10.6		HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.53			
Actuated Cycle Length (s)			140.0		Sum of lost time (s)	20.0
Intersection Capacity Utilization			76.6%		ICU Level of Service	D
Analysis Period (min)			15			
c Critical Lane Group						




















HCM Signalized Intersection Capacity Analysis

8: Elm Street/Fort Collier Road & Berryville Avenue

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	68	1060	22	97	874	237	49	40	71	295	70	47
Future Volume (vph)	68	1060	22	97	874	237	49	40	71	295	70	47
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0	6.0	6.0	6.0		6.0	6.0	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.98	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00		1.00	1.00	0.85	1.00	0.90		1.00	0.94	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1805	3560		1805	3574	1456	1736	1707		1752	1786	
Flt Permitted	0.25	1.00		0.15	1.00	1.00	0.68	1.00		0.34	1.00	
Satd. Flow (perm)	468	3560		281	3574	1456	1240	1707		634	1786	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	71	1104	23	101	910	247	51	42	74	307	73	49
RTOR Reduction (vph)	0	1	0	0	0	47	0	52	0	0	21	0
Lane Group Flow (vph)	71	1126	0	101	910	200	51	64	0	307	101	0
Confl. Peds. (#/hr)	1					1						
Heavy Vehicles (%)	0%	1%	5%	0%	1%	9%	4%	0%	1%	3%	0%	0%
Turn Type	pm+pt	NA		pm+pt	NA	pm+ov	pm+pt	NA		pm+pt	NA	
Protected Phases	5	2		1	6	3	7	4		3	8	
Permitted Phases	2			6		6	4			8		
Actuated Green, G (s)	77.7	71.1		83.3	73.9	97.6	18.0	11.8		41.5	29.3	
Effective Green, g (s)	77.7	71.1		83.3	73.9	97.6	18.0	11.8		41.5	29.3	
Actuated g/C Ratio	0.56	0.51		0.59	0.53	0.70	0.13	0.08		0.30	0.21	
Clearance Time (s)	6.0	6.0		6.0	6.0	6.0	6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	322	1807		269	1886	1077	181	143		377	373	
v/s Ratio Prot	0.01	c0.32		c0.03	c0.25	0.03	0.01	0.04		c0.14	0.06	
v/s Ratio Perm	0.11			0.20		0.11	0.02			c0.10		
v/c Ratio	0.22	0.62		0.38	0.48	0.19	0.28	0.45		0.81	0.27	
Uniform Delay, d1	15.4	24.8		16.4	20.9	7.4	54.8	61.0		42.4	46.4	
Progression Factor	0.70	0.84		0.93	0.43	0.22	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.3	1.5		0.8	0.8	0.1	0.9	2.2		12.7	0.4	
Delay (s)	11.0	22.2		16.1	9.9	1.7	55.6	63.2		55.0	46.8	
Level of Service	B	C		B	A	A	E	E		E	D	
Approach Delay (s)		21.6			8.8			60.9			52.7	
Approach LOS		C			A			E			D	
Intersection Summary												
HCM 2000 Control Delay			22.8	HCM 2000 Level of Service				C				
HCM 2000 Volume to Capacity ratio			0.69									
Actuated Cycle Length (s)			140.0	Sum of lost time (s)				24.0				
Intersection Capacity Utilization			73.4%	ICU Level of Service				D				
Analysis Period (min)			15									
c Critical Lane Group												

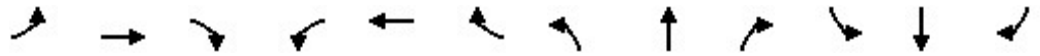
HCM Unsignalized Intersection Capacity Analysis

9: Pharmhouse Shopping Center Driveway/Atwell Avenue & Berryville Avenue

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	33	1360	33	32	1192	7	2	0	2	7	1	14
Future Volume (Veh/h)	33	1360	33	32	1192	7	2	0	2	7	1	14
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	35	1447	35	34	1268	7	2	0	2	7	1	15
Pedestrians												2
Lane Width (ft)												12.0
Walking Speed (ft/s)												3.5
Percent Blockage												0
Right turn flare (veh)												4
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)		373			407							
pX, platoon unblocked	0.84			0.77			0.85	0.85	0.77	0.85	0.85	0.84
vC, conflicting volume	1277			1482			2237	2880	741	2137	2894	640
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	946			1032			1254	2008	72	1137	2025	187
tC, single (s)	4.2			4.1			7.5	6.5	7.0	7.8	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.4	3.6	4.0	3.3
p0 queue free %	94			94			98	100	100	94	98	98
cM capacity (veh/h)	599			525			97	45	741	110	44	695
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1				
Volume Total	35	965	517	34	845	430	4	23				
Volume Left	35	0	0	34	0	0	2	7				
Volume Right	0	0	35	0	0	7	2	15				
cSH	599	1700	1700	525	1700	1700	172	292				
Volume to Capacity	0.06	0.57	0.30	0.06	0.50	0.25	0.02	0.08				
Queue Length 95th (ft)	5	0	0	5	0	0	2	6				
Control Delay (s)	11.4	0.0	0.0	12.3	0.0	0.0	26.5	21.8				
Lane LOS	B			B			D	C				
Approach Delay (s)	0.3			0.3			26.5	21.8				
Approach LOS							D	C				
Intersection Summary												
Average Delay			0.5									
Intersection Capacity Utilization			49.8%		ICU Level of Service			A				
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis

10: Pharmhouse Shopping Center Driveway/Ross Street & Berryville Avenue






















Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	31	1325	13	83	1182	46	20	2	67	93	2	29
Future Volume (vph)	31	1325	13	83	1182	46	20	2	67	93	2	29
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5		5.5	8.0			6.0	6.0		6.0	6.0
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00	1.00		1.00	1.00
Frbp, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00		1.00	0.99
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00		1.00	1.00
Frt	1.00	1.00		1.00	0.99			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.96	1.00		0.95	1.00
Satd. Flow (prot)	1805	3535		1805	3518			1815	1615		1743	1591
Flt Permitted	0.19	1.00		0.14	1.00			0.71	1.00		0.71	1.00
Satd. Flow (perm)	364	3535		270	3518			1338	1615		1305	1591
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	32	1380	14	86	1231	48	21	2	70	97	2	30
RTOR Reduction (vph)	0	0	0	0	1	0	0	0	62	0	0	27
Lane Group Flow (vph)	32	1394	0	86	1278	0	0	23	8	0	99	3
Confl. Peds. (#/hr)	2					2	1					1
Heavy Vehicles (%)	0%	2%	0%	0%	2%	0%	0%	0%	0%	4%	0%	0%
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases	5	2		1	6			4			8	
Permitted Phases	2			6			4		4	8		8
Actuated Green, G (s)	103.0	99.2		108.5	100.7			16.0	16.0		16.0	16.0
Effective Green, g (s)	103.0	99.2		108.5	100.7			16.0	16.0		16.0	16.0
Actuated g/C Ratio	0.74	0.71		0.78	0.72			0.11	0.11		0.11	0.11
Clearance Time (s)	5.5	5.5		5.5	8.0			6.0	6.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	306	2504		294	2530			152	184		149	181
v/s Ratio Prot	0.00	c0.39		c0.02	c0.36							
v/s Ratio Perm	0.07			0.21				0.02	0.00		c0.08	0.00
v/c Ratio	0.10	0.56		0.29	0.50			0.15	0.04		0.66	0.02
Uniform Delay, d1	5.5	9.8		7.0	8.7			55.9	55.2		59.4	55.0
Progression Factor	0.71	0.62		0.66	0.17			1.00	1.00		1.00	1.00
Incremental Delay, d2	0.1	0.7		0.4	0.5			0.5	0.1		10.6	0.0
Delay (s)	4.0	6.8		5.0	2.0			56.3	55.3		70.1	55.1
Level of Service	A	A		A	A			E	E		E	E
Approach Delay (s)		6.7			2.2			55.5			66.6	
Approach LOS		A			A			E			E	
Intersection Summary												
HCM 2000 Control Delay			8.8	HCM 2000 Level of Service				A				
HCM 2000 Volume to Capacity ratio			0.57									
Actuated Cycle Length (s)			140.0	Sum of lost time (s)				19.5				
Intersection Capacity Utilization			67.7%	ICU Level of Service				C				
Analysis Period (min)			15									

c Critical Lane Group






















HCM Unsignalized Intersection Capacity Analysis

11: Shell Driveway/Exxon Driveway & Berryville Avenue/Berryville Pike

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	4	1455	26	0	1287	39	2	0	26	4	0	22
Future Volume (Veh/h)	4	1455	26	0	1287	39	2	0	26	4	0	22
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	4	1548	28	0	1369	41	2	0	28	4	0	23
Pedestrians		3			3			1			4	
Lane Width (ft)		12.0			12.0			12.0			12.0	
Walking Speed (ft/s)		3.5			3.5			3.5			3.5	
Percent Blockage		0			0			0			0	
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)		198			290							
pX, platoon unblocked	0.70			0.81			0.80	0.80	0.81	0.80	0.80	0.70
vC, conflicting volume	1414			1577			2282	2985	792	2206	2978	712
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	734			1235			1004	1887	261	910	1879	0
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			100			99	100	95	98	100	97
cM capacity (veh/h)	614			460			152	56	597	174	57	759
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1				
Volume Total	4	1032	544	0	913	497	30	27				
Volume Left	4	0	0	0	0	0	2	4				
Volume Right	0	0	28	0	0	41	28	23				
cSH	614	1700	1700	1700	1700	1700	499	507				
Volume to Capacity	0.01	0.61	0.32	0.00	0.54	0.29	0.06	0.05				
Queue Length 95th (ft)	0	0	0	0	0	0	5	4				
Control Delay (s)	10.9	0.0	0.0	0.0	0.0	0.0	12.7	12.5				
Lane LOS	B						B	B				
Approach Delay (s)	0.0			0.0			12.7	12.5				
Approach LOS							B	B				
Intersection Summary												
Average Delay			0.2									
Intersection Capacity Utilization			52.0%	ICU Level of Service	A							
Analysis Period (min)			15									

HCM Signalized Intersection Capacity Analysis

























12: Driveway/I-81 SB Ramp & Berryville Pike

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	330	1143	12	18	1050	707	16	5	23	490	0	260
Future Volume (vph)	330	1143	12	18	1050	707	16	5	23	490	0	260
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.2	5.7		5.9	6.4	4.0		8.6	8.6	9.1		9.1
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		1.00	1.00	0.97		1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00	1.00		1.00	1.00	1.00		1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00		1.00	1.00	1.00		1.00
Frt	1.00	1.00		1.00	1.00	0.85		1.00	0.85	1.00		0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.96	1.00	0.95		1.00
Satd. Flow (prot)	1752	3568		1805	3505	1495		1829	1553	3400		1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00		0.96	1.00	0.95		1.00
Satd. Flow (perm)	1752	3568		1805	3505	1495		1829	1553	3400		1583
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	344	1191	12	19	1094	736	17	5	24	510	0	271
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	23	0	0	225
Lane Group Flow (vph)	344	1204	0	19	1094	736	0	22	1	510	0	46
Confl. Peds. (#/hr)			5	5								
Heavy Vehicles (%)	3%	1%	0%	0%	3%	8%	0%	0%	4%	3%	0%	2%
Turn Type	Prot	NA		Prot	NA	Free	Split	NA	Perm	Prot		Perm
Protected Phases	5	2		1	6		4	4		3		
Permitted Phases						Free			4			3
Actuated Green, G (s)	33.5	79.2		3.3	48.0	140.0		4.2	4.2	24.0		24.0
Effective Green, g (s)	33.5	79.2		3.3	48.0	140.0		4.2	4.2	24.0		24.0
Actuated g/C Ratio	0.24	0.57		0.02	0.34	1.00		0.03	0.03	0.17		0.17
Clearance Time (s)	6.2	5.7		5.9	6.4			8.6	8.6	9.1		9.1
Vehicle Extension (s)	1.0	1.0		1.0	1.0			1.0	1.0	1.0		1.0
Lane Grp Cap (vph)	419	2018		42	1201	1495		54	46	582		271
v/s Ratio Prot	c0.20	0.34		0.01	c0.31			0.01		c0.15		
v/s Ratio Perm						c0.49			0.00			0.03
v/c Ratio	0.82	0.60		0.45	0.91	0.49		0.41	0.02	0.88		0.17
Uniform Delay, d1	50.4	19.9		67.5	44.0	0.0		66.7	65.9	56.6		49.5
Progression Factor	1.13	0.87		1.30	0.73	1.00		1.00	1.00	1.00		1.00
Incremental Delay, d2	14.6	1.1		1.7	8.4	0.4		1.8	0.0	13.5		0.1
Delay (s)	71.3	18.4		89.1	40.6	0.4		68.5	65.9	70.1		49.6
Level of Service	E	B		F	D	A		E	E	E		D
Approach Delay (s)		30.2			25.1			67.2			63.0	
Approach LOS		C			C			E			E	
Intersection Summary												
HCM 2000 Control Delay			34.4									HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio			0.90									
Actuated Cycle Length (s)			140.0									Sum of lost time (s) 30.3
Intersection Capacity Utilization			81.8%									ICU Level of Service D
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

13: Valley Mill Road/I-81 NB Ramp & Berryville Pike

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	187	1041	428	71	1131	499	348	140	59	563	154	0
Future Volume (vph)	187	1041	428	71	1131	499	348	140	59	563	154	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.7	5.3	5.3	8.0	5.3	4.0	7.5	7.5		7.4	7.4	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	1.00		0.95	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.96		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	0.97	
Satd. Flow (prot)	1787	3539	1615	1805	3406	1524	3467	1768		1603	1687	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	0.97	
Satd. Flow (perm)	1787	3539	1615	1805	3406	1524	3467	1768		1603	1687	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	199	1107	455	76	1203	531	370	149	63	599	164	0
RTOR Reduction (vph)	0	0	219	0	0	0	0	11	0	0	0	0
Lane Group Flow (vph)	199	1107	236	76	1203	531	370	201	0	377	386	0
Heavy Vehicles (%)	1%	2%	0%	0%	6%	6%	1%	3%	2%	7%	0%	6%
Turn Type	Prot	NA	Perm	Prot	NA	Free	Split	NA		Split	NA	
Protected Phases	5	2		1	6		3	3		4	4	
Permitted Phases			2			Free						
Actuated Green, G (s)	15.3	54.2	54.2	7.5	47.7	140.0	17.0	17.0		33.1	33.1	
Effective Green, g (s)	15.3	54.2	54.2	7.5	47.7	140.0	17.0	17.0		33.1	33.1	
Actuated g/C Ratio	0.11	0.39	0.39	0.05	0.34	1.00	0.12	0.12		0.24	0.24	
Clearance Time (s)	6.7	5.3	5.3	8.0	5.3		7.5	7.5		7.4	7.4	
Vehicle Extension (s)	1.0	1.0	1.0	1.0	1.0		1.0	1.0		1.0	1.0	
Lane Grp Cap (vph)	195	1370	625	96	1160	1524	420	214		378	398	
v/s Ratio Prot	c0.11	c0.31		0.04	c0.35		0.11	c0.11		c0.24	0.23	
v/s Ratio Perm			0.15			0.35						
v/c Ratio	1.02	0.81	0.38	0.79	1.04	0.35	0.88	0.94		1.00	0.97	
Uniform Delay, d1	62.4	38.3	30.8	65.5	46.1	0.0	60.5	61.0		53.4	53.0	
Progression Factor	1.02	1.02	1.74	1.21	0.69	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	62.9	4.2	1.4	26.7	33.5	0.5	18.5	44.7		45.2	36.5	
Delay (s)	126.3	43.2	54.9	106.1	65.3	0.5	79.0	105.7		98.6	89.5	
Level of Service	F	D	D	F	E	A	E	F		F	F	
Approach Delay (s)		55.6			48.0			88.7			94.0	
Approach LOS		E			D			F			F	
Intersection Summary												
HCM 2000 Control Delay			62.7									E
HCM 2000 Volume to Capacity ratio			1.03									
Actuated Cycle Length (s)			140.0							28.2		
Intersection Capacity Utilization			94.6%									F
ICU Level of Service												
Analysis Period (min)			15									
c Critical Lane Group												





















HCM Signalized Intersection Capacity Analysis

14: Berryville Pike & Winchester Gateway

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (vph)	358	1305	0	10	1331	204	0	0	0	210	0	370	
Future Volume (vph)	358	1305	0	10	1331	204	0	0	0	210	0	370	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	8.3	5.8		7.8	5.8	5.8				7.6		7.6	
Lane Util. Factor	0.97	0.95		1.00	0.95	1.00				0.97		0.88	
Frt	1.00	1.00		1.00	1.00	0.85				1.00		0.85	
Flt Protected	0.95	1.00		0.95	1.00	1.00				0.95		1.00	
Satd. Flow (prot)	3467	3438		1805	3374	1599				3467		2814	
Flt Permitted	0.95	1.00		0.95	1.00	1.00				0.95		1.00	
Satd. Flow (perm)	3467	3438		1805	3374	1599				3467		2814	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	
Adj. Flow (vph)	377	1374	0	11	1401	215	0	0	0	221	0	389	
RTOR Reduction (vph)	0	0	0	0	0	61	0	0	0	0	0	317	
Lane Group Flow (vph)	377	1374	0	11	1401	154	0	0	0	221	0	72	
Heavy Vehicles (%)	1%	5%	0%	0%	7%	1%	0%	0%	0%	1%	0%	1%	
Turn Type	Prot	NA		Prot	NA	Perm				Prot		Perm	
Protected Phases	5	2		1	6					4			
Permitted Phases						6						4	
Actuated Green, G (s)	18.6	104.2		2.2	87.3	87.3				12.4		12.4	
Effective Green, g (s)	18.6	104.2		2.2	87.3	87.3				12.4		12.4	
Actuated g/C Ratio	0.13	0.74		0.02	0.62	0.62				0.09		0.09	
Clearance Time (s)	8.3	5.8		7.8	5.8	5.8				7.6		7.6	
Vehicle Extension (s)	1.0	1.0		1.0	1.0	1.0				1.0		1.0	
Lane Grp Cap (vph)	460	2558		28	2103	997				307		249	
v/s Ratio Prot	c0.11	0.40		0.01	c0.42					c0.06			
v/s Ratio Perm						0.10						0.03	
v/c Ratio	0.82	0.54		0.39	0.67	0.15				0.72		0.29	
Uniform Delay, d1	59.1	7.6		68.2	17.0	11.0				62.1		59.7	
Progression Factor	1.01	0.75		1.39	0.62	0.45				1.00		1.00	
Incremental Delay, d2	5.1	0.4		2.3	1.2	0.2				6.6		0.2	
Delay (s)	64.6	6.1		97.4	11.7	5.2				68.7		59.9	
Level of Service	E	A		F	B	A				E		E	
Approach Delay (s)		18.7			11.4			0.0			63.1		
Approach LOS		B			B			A			E		
Intersection Summary													
HCM 2000 Control Delay			22.5									HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio			0.70										
Actuated Cycle Length (s)			140.0							21.7			
Intersection Capacity Utilization			68.1%									ICU Level of Service	C
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis




























15: Berryville Pike & Regency Lakes Drive

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	285	1220	10	5	1355	119	8	4	5	104	1	182
Future Volume (vph)	285	1220	10	5	1355	119	8	4	5	104	1	182
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.6	5.7		7.6	5.7	5.7		8.3			7.1	7.1
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		1.00			1.00	1.00
Frbp, ped/bikes	1.00	1.00		1.00	1.00	0.98		1.00			1.00	1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00		1.00			1.00	1.00
Frt	1.00	1.00		1.00	1.00	0.85		0.96			1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.98			0.95	1.00
Satd. Flow (prot)	1787	3433		1805	3374	1550		1684			1793	1599
Flt Permitted	0.95	1.00		0.95	1.00	1.00		0.98			0.95	1.00
Satd. Flow (perm)	1787	3433		1805	3374	1550		1684			1793	1599
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	288	1232	10	5	1369	120	8	4	5	105	1	184
RTOR Reduction (vph)	0	0	0	0	0	60	0	5	0	0	0	169
Lane Group Flow (vph)	288	1242	0	5	1369	60	0	12	0	0	106	15
Confl. Peds. (#/hr)	1					1						
Heavy Vehicles (%)	1%	5%	9%	0%	7%	2%	0%	25%	0%	1%	0%	1%
Turn Type	Prot	NA		Prot	NA	Perm	Split	NA		Split	NA	Perm
Protected Phases	1	6		5	2		4	4		3	3	
Permitted Phases						2						3
Actuated Green, G (s)	27.9	96.5		1.0	69.6	69.6		2.4			11.4	11.4
Effective Green, g (s)	27.9	96.5		1.0	69.6	69.6		2.4			11.4	11.4
Actuated g/C Ratio	0.20	0.69		0.01	0.50	0.50		0.02			0.08	0.08
Clearance Time (s)	7.6	5.7		7.6	5.7	5.7		8.3			7.1	7.1
Vehicle Extension (s)	1.0	1.0		1.0	1.0	1.0		1.0			1.0	1.0
Lane Grp Cap (vph)	356	2366		12	1677	770		28			146	130
v/s Ratio Prot	c0.16	0.36		0.00	c0.41			c0.01			c0.06	
v/s Ratio Perm						0.04						0.01
v/c Ratio	0.81	0.52		0.42	0.82	0.08		0.43			0.73	0.12
Uniform Delay, d1	53.5	10.6		69.2	29.8	18.4		68.1			62.8	59.6
Progression Factor	1.01	0.85		1.09	0.51	1.00		1.00			1.00	1.00
Incremental Delay, d2	10.7	0.7		6.4	3.5	0.2		3.8			14.1	0.1
Delay (s)	64.8	9.7		81.8	18.8	18.6		72.0			76.9	59.8
Level of Service	E	A		F	B	B		E			E	E
Approach Delay (s)		20.1			19.0			72.0			66.0	
Approach LOS		C			B			E			E	
Intersection Summary												
HCM 2000 Control Delay			23.9				HCM 2000 Level of Service				C	
HCM 2000 Volume to Capacity ratio			0.80									
Actuated Cycle Length (s)			140.0				Sum of lost time (s)			28.7		
Intersection Capacity Utilization			81.0%				ICU Level of Service			D		
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

16: Blossom Drive/Millbrook Drive & Berryville Pike

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 			 						 	
Traffic Volume (vph)	103	1125	101	25	1362	1	31	5	11	13	5	86
Future Volume (vph)	103	1125	101	25	1362	1	31	5	11	13	5	86
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	10.1	6.1	6.1	9.1	5.6	5.6	8.8	8.8			9.5	9.5
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	1.00			1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.90			1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00			0.96	1.00
Satd. Flow (prot)	3433	3438	1599	1736	3343	1615	1752	1704			1832	1615
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00			0.96	1.00
Satd. Flow (perm)	3433	3438	1599	1736	3343	1615	1752	1704			1832	1615
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	107	1172	105	26	1419	1	32	5	11	14	5	90
RTOR Reduction (vph)	0	0	36	0	0	0	0	11	0	0	0	86
Lane Group Flow (vph)	107	1172	69	26	1419	1	32	5	0	0	19	4
Heavy Vehicles (%)	2%	5%	1%	4%	8%	0%	3%	0%	0%	0%	0%	0%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA		Split	NA	Perm
Protected Phases	1	6		5	2		4	4		3		3
Permitted Phases			6			2						3
Actuated Green, G (s)	11.4	91.4	91.4	4.1	83.6	83.6	5.4	5.4			5.6	5.6
Effective Green, g (s)	11.4	91.4	91.4	4.1	83.6	83.6	5.4	5.4			5.6	5.6
Actuated g/C Ratio	0.08	0.65	0.65	0.03	0.60	0.60	0.04	0.04			0.04	0.04
Clearance Time (s)	10.1	6.1	6.1	9.1	5.6	5.6	8.8	8.8			9.5	9.5
Vehicle Extension (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0			1.0	1.0
Lane Grp Cap (vph)	279	2244	1043	50	1996	964	67	65			73	64
v/s Ratio Prot	0.03	c0.34		0.01	c0.42		c0.02	0.00			c0.01	
v/s Ratio Perm			0.04			0.00						0.00
v/c Ratio	0.38	0.52	0.07	0.52	0.71	0.00	0.48	0.08			0.26	0.06
Uniform Delay, d1	61.0	12.8	8.8	67.0	19.7	11.4	65.9	64.9			65.2	64.7
Progression Factor	0.94	0.70	1.00	1.04	1.03	1.00	1.00	1.00			1.00	1.00
Incremental Delay, d2	0.3	0.8	0.1	2.6	1.3	0.0	1.9	0.2			0.7	0.1
Delay (s)	57.6	9.8	8.9	72.6	21.6	11.4	67.9	65.1			65.9	64.8
Level of Service	E	A	A	E	C	B	E	E			E	E
Approach Delay (s)		13.4			22.5			66.9			65.0	
Approach LOS		B			C			E			E	
Intersection Summary												
HCM 2000 Control Delay			20.5				HCM 2000 Level of Service				C	
HCM 2000 Volume to Capacity ratio			0.69									
Actuated Cycle Length (s)			140.0				Sum of lost time (s)			34.0		
Intersection Capacity Utilization			67.1%				ICU Level of Service			C		
Analysis Period (min)			15									
c Critical Lane Group												






















HCM Unsignalized Intersection Capacity Analysis

19: Berryville Pike

Intersection Sign configuration not allowed in HCM analysis.

HCM Signalized Intersection Capacity Analysis

















35:

														
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR		
Lane Configurations														
Traffic Volume (vph)	21	1026	102	145	1325	30	47	77	102	21	85	17		
Future Volume (vph)	21	1026	102	145	1325	30	47	77	102	21	85	17		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900		
Total Lost time (s)	9.3	6.6	6.6	8.6	6.1	6.1		8.6			6.6	6.6		
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		1.00			1.00	1.00		
Frt	1.00	1.00	0.85	1.00	1.00	0.85		0.94			1.00	0.85		
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.99			0.99	1.00		
Satd. Flow (prot)	1805	3406	1615	1805	3343	1615		1747			1881	1615		
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.99			0.99	1.00		
Satd. Flow (perm)	1805	3406	1615	1805	3343	1615		1747			1881	1615		
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95		
Adj. Flow (vph)	22	1080	107	153	1395	32	49	81	107	22	89	18		
RTOR Reduction (vph)	0	0	64	0	0	17	0	20	0	0	0	16		
Lane Group Flow (vph)	22	1080	43	153	1395	15	0	217	0	0	111	2		
Heavy Vehicles (%)	0%	6%	0%	0%	8%	0%	3%	0%	1%	0%	0%	0%		
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA		Split	NA	Perm		
Protected Phases	1	6		5	2		4	4		3		3		
Permitted Phases			6			2						3		
Actuated Green, G (s)	4.9	56.0	56.0	15.1	66.0	66.0		24.9			13.6	13.6		
Effective Green, g (s)	4.9	56.0	56.0	15.1	66.0	66.0		24.9			13.6	13.6		
Actuated g/C Ratio	0.04	0.40	0.40	0.11	0.47	0.47		0.18			0.10	0.10		
Clearance Time (s)	9.3	6.6	6.6	8.6	6.1	6.1		8.6			6.6	6.6		
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0			3.0	3.0		
Lane Grp Cap (vph)	63	1362	646	194	1575	761		310			182	156		
v/s Ratio Prot	0.01	0.32		c0.08	c0.42			c0.12			c0.06			
v/s Ratio Perm			0.03			0.01						0.00		
v/c Ratio	0.35	0.79	0.07	0.79	0.89	0.02		0.70			0.61	0.01		
Uniform Delay, d1	66.0	36.9	25.9	60.9	33.6	19.7		54.1			60.7	57.1		
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00			1.00	1.00		
Incremental Delay, d2	3.3	4.8	0.2	18.8	7.7	0.0		7.0			5.7	0.0		
Delay (s)	69.3	41.7	26.1	79.7	41.3	19.8		61.0			66.3	57.2		
Level of Service	E	D	C	E	D	B		E			E	E		
Approach Delay (s)		40.8			44.6			61.0			65.1			
Approach LOS		D			D			E			E			
Intersection Summary														
HCM 2000 Control Delay			45.2									HCM 2000 Level of Service	D	
HCM 2000 Volume to Capacity ratio			0.85											
Actuated Cycle Length (s)			140.0								30.6			
Intersection Capacity Utilization			80.4%										ICU Level of Service	D
Analysis Period (min)			15											
c Critical Lane Group														

HCM Unsignalized Intersection Capacity Analysis
41: I-81 NB Ramp


























Intersection Sign configuration not allowed in HCM analysis.

HCM Unsignalized Intersection Capacity Analysis
 42: Battle Avenue & Virginia Avenue

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	0	0	0	0	0	0	0	0	0
Future Volume (Veh/h)	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free			Free			Stop			Stop		
Grade	0%			0%			0%			0%		
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	0			0			0			0		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	0			0			0			0		
tC, single (s)	4.1			4.1			7.1			6.5		
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5			4.0		
p0 queue free %	100			100			100			100		
cM capacity (veh/h)	1623			1623			1023			896		
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	0	0	0	0								
Volume Left	0	0	0	0								
Volume Right	0	0	0	0								
cSH	1700	1700	1700	1700								
Volume to Capacity	0.00	0.00	0.00	0.00								
Queue Length 95th (ft)	0	0	0	0								
Control Delay (s)	0.0	0.0	0.0	0.0								
Lane LOS				A	A							
Approach Delay (s)	0.0	0.0	0.0	0.0								
Approach LOS				A	A							
Intersection Summary												
Average Delay				0.0								
Intersection Capacity Utilization				0.0%	ICU Level of Service				A			
Analysis Period (min)				15								













HCM Signalized Intersection Capacity Analysis

35:

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 			 			 	
Traffic Volume (vph)	21	1026	102	145	1325	30	47	77	102	21	85	17
Future Volume (vph)	21	1026	102	145	1325	30	47	77	102	21	85	17
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	9.3	6.6	6.6	8.6	6.1	6.1		8.6			6.6	6.6
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		1.00			1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		0.94			1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.99			0.99	1.00
Satd. Flow (prot)	1805	3406	1615	1805	3343	1615		1747			1881	1615
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.99			0.99	1.00
Satd. Flow (perm)	1805	3406	1615	1805	3343	1615		1747			1881	1615
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	22	1080	107	153	1395	32	49	81	107	22	89	18
RTOR Reduction (vph)	0	0	64	0	0	17	0	20	0	0	0	16
Lane Group Flow (vph)	22	1080	43	153	1395	15	0	217	0	0	111	2
Heavy Vehicles (%)	0%	6%	0%	0%	8%	0%	3%	0%	1%	0%	0%	0%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA		Split	NA	Perm
Protected Phases	1	6		5	2		4	4		3		3
Permitted Phases			6			2						3
Actuated Green, G (s)	4.9	56.0	56.0	15.1	66.0	66.0		24.9			13.6	13.6
Effective Green, g (s)	4.9	56.0	56.0	15.1	66.0	66.0		24.9			13.6	13.6
Actuated g/C Ratio	0.04	0.40	0.40	0.11	0.47	0.47		0.18			0.10	0.10
Clearance Time (s)	9.3	6.6	6.6	8.6	6.1	6.1		8.6			6.6	6.6
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0			3.0	3.0
Lane Grp Cap (vph)	63	1362	646	194	1575	761		310			182	156
v/s Ratio Prot	0.01	0.32		c0.08	c0.42			c0.12			c0.06	
v/s Ratio Perm			0.03			0.01						0.00
v/c Ratio	0.35	0.79	0.07	0.79	0.89	0.02		0.70			0.61	0.01
Uniform Delay, d1	66.0	36.9	25.9	60.9	33.6	19.7		54.1			60.7	57.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00			1.00	1.00
Incremental Delay, d2	3.3	4.8	0.2	18.8	7.7	0.0		7.0			5.7	0.0
Delay (s)	69.3	41.7	26.1	79.7	41.3	19.8		61.0			66.3	57.2
Level of Service	E	D	C	E	D	B		E			E	E
Approach Delay (s)		40.8			44.6			61.0			65.1	
Approach LOS		D			D			E			E	
Intersection Summary												
HCM 2000 Control Delay			45.2				HCM 2000 Level of Service				D	
HCM 2000 Volume to Capacity ratio			0.85									
Actuated Cycle Length (s)			140.0				Sum of lost time (s)			30.6		
Intersection Capacity Utilization			80.4%				ICU Level of Service			D		
Analysis Period (min)			15									
c Critical Lane Group												

























HCM Signalized Intersection Capacity Analysis

3: Greenwood Road/First Woods Drive & Berryville Pike

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations		↑↑	↗	↖	↑↑	↗		↕			↗	↖	
Traffic Volume (vph)	0	1026	102	170	1300	30	47	82	102	21	90	17	
Future Volume (vph)	0	1026	102	170	1300	30	47	82	102	21	90	17	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)		6.6	6.6	8.6	6.1	6.1		8.6			6.6	6.6	
Lane Util. Factor		0.95	1.00	1.00	0.95	1.00		1.00			0.95	0.95	
Frt		1.00	0.85	1.00	1.00	0.85		0.94			1.00	0.85	
Flt Protected		1.00	1.00	0.95	1.00	1.00		0.99			0.99	1.00	
Satd. Flow (prot)		3406	1615	1805	3343	1615		1750			1784	1534	
Flt Permitted		1.00	1.00	0.95	1.00	1.00		0.99			0.99	1.00	
Satd. Flow (perm)		3406	1615	1805	3343	1615		1750			1784	1534	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	
Adj. Flow (vph)	0	1080	107	179	1368	32	49	86	107	22	95	18	
RTOR Reduction (vph)	0	0	63	0	0	13	0	20	0	0	0	15	
Lane Group Flow (vph)	0	1080	44	179	1368	19	0	222	0	0	119	1	
Heavy Vehicles (%)	0%	6%	0%	0%	8%	0%	3%	0%	1%	0%	0%	0%	
Turn Type		NA	Perm	Prot	NA	Perm	Split	NA		Split	NA	Perm	
Protected Phases		6		5	2		4	4		3		3	
Permitted Phases			6			2						3	
Actuated Green, G (s)		58.1	58.1	17.5	84.7	84.7		21.2			12.8	12.8	
Effective Green, g (s)		58.1	58.1	17.5	84.7	84.7		21.2			12.8	12.8	
Actuated g/C Ratio		0.42	0.42	0.12	0.61	0.61		0.15			0.09	0.09	
Clearance Time (s)		6.6	6.6	8.6	6.1	6.1		8.6			6.6	6.6	
Vehicle Extension (s)		3.0	3.0	3.0	3.0	3.0		3.0			3.0	3.0	
Lane Grp Cap (vph)		1413	670	225	2022	977		265			163	140	
v/s Ratio Prot		c0.32		0.10	c0.41			c0.13			c0.07		
v/s Ratio Perm			0.03			0.01						0.00	
v/c Ratio		0.76	0.07	0.80	0.68	0.02		0.84			0.73	0.01	
Uniform Delay, d1		35.1	24.6	59.5	18.5	11.1		57.7			61.9	57.8	
Progression Factor		1.00	1.00	1.00	1.00	1.00		1.00			1.00	1.00	
Incremental Delay, d2		4.0	0.2	17.4	1.8	0.0		19.9			15.4	0.0	
Delay (s)		39.1	24.8	76.9	20.3	11.1		77.6			77.3	57.9	
Level of Service		D	C	E	C	B		E			E	E	
Approach Delay (s)		37.8			26.6			77.6			75.0		
Approach LOS		D			C			E			E		
Intersection Summary													
HCM 2000 Control Delay			36.8		HCM 2000 Level of Service						D		
HCM 2000 Volume to Capacity ratio			0.80										
Actuated Cycle Length (s)			140.0		Sum of lost time (s)					30.4			
Intersection Capacity Utilization			77.4%		ICU Level of Service					D			
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis





















8: Elm Street/Fort Collier Road & Berryville Avenue

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 						 	
Traffic Volume (vph)	68	1060	22	129	872	237	51	40	71	295	70	47
Future Volume (vph)	68	1060	22	129	872	237	51	40	71	295	70	47
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0	6.0	6.0	6.0		6.0	6.0	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	1.00		0.95	0.95	
Frbp, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00		1.00	1.00	0.85	1.00	0.90		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	0.98	
Satd. Flow (prot)	1805	3560		1805	3574	1482	1736	1707		1665	1685	
Flt Permitted	0.26	1.00		0.13	1.00	1.00	0.95	1.00		0.95	0.98	
Satd. Flow (perm)	485	3560		248	3574	1482	1736	1707		1665	1685	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	71	1104	23	134	908	247	53	42	74	307	73	49
RTOR Reduction (vph)	0	1	0	0	0	59	0	0	0	0	0	0
Lane Group Flow (vph)	71	1126	0	134	908	188	53	116	0	215	214	0
Confl. Peds. (#/hr)	1					1						
Heavy Vehicles (%)	0%	1%	5%	0%	1%	9%	4%	0%	1%	3%	0%	0%
Turn Type	pm+pt	NA		pm+pt	NA	pt+ov	Split	NA		Split	NA	
Protected Phases	5	2		1	6	6 8	4	4		8	8	
Permitted Phases	2			6								
Actuated Green, G (s)	72.5	67.4		83.7	73.0	96.6	14.3	14.3		23.6	23.6	
Effective Green, g (s)	72.5	67.4		83.7	73.0	96.6	14.3	14.3		23.6	23.6	
Actuated g/C Ratio	0.52	0.48		0.60	0.52	0.69	0.10	0.10		0.17	0.17	
Clearance Time (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	299	1713		267	1863	1022	177	174		280	284	
v/s Ratio Prot	0.01	c0.32		c0.04	c0.25	0.13	0.03	c0.07		c0.13	0.13	
v/s Ratio Perm	0.11			0.26								
v/c Ratio	0.24	0.66		0.50	0.49	0.18	0.30	0.67		0.77	0.75	
Uniform Delay, d1	17.6	27.5		18.4	21.5	7.7	58.2	60.6		55.6	55.4	
Progression Factor	1.00	1.00		1.16	0.26	0.48	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.4	2.0		1.3	0.8	0.1	1.0	9.3		11.9	10.8	
Delay (s)	18.0	29.5		22.7	6.5	3.8	59.2	69.8		67.5	66.2	
Level of Service	B	C		C	A	A	E	E		E	E	
Approach Delay (s)		28.8			7.6			66.5			66.9	
Approach LOS		C			A			E			E	
Intersection Summary												
HCM 2000 Control Delay			27.3									HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio			0.67									
Actuated Cycle Length (s)			140.0							24.0		
Intersection Capacity Utilization			70.3%									ICU Level of Service C
Analysis Period (min)			15									

c Critical Lane Group






















HCM Signalized Intersection Capacity Analysis

10: Pharmhouse Shopping Center Driveway/Ross Street & Berryville Avenue

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	35	1314	13	83	1180	46	22	2	67	104	3	29
Future Volume (vph)	35	1314	13	83	1180	46	22	2	67	104	3	29
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5		5.5	8.0			6.0	6.0		6.0	6.0
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00	1.00		1.00	1.00
Frbp, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00		1.00	0.99
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00		1.00	1.00
Frt	1.00	1.00		1.00	0.99			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.96	1.00		0.95	1.00
Satd. Flow (prot)	1805	3535		1805	3518			1814	1615		1744	1592
Flt Permitted	0.19	1.00		0.14	1.00			0.68	1.00		0.71	1.00
Satd. Flow (perm)	352	3535		275	3518			1299	1615		1305	1592
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	36	1369	14	86	1229	48	23	2	70	108	3	30
RTOR Reduction (vph)	0	0	0	0	1	0	0	0	61	0	0	26
Lane Group Flow (vph)	36	1383	0	86	1276	0	0	25	9	0	111	4
Confl. Peds. (#/hr)	2					2	1					1
Heavy Vehicles (%)	0%	2%	0%	0%	2%	0%	0%	0%	0%	4%	0%	0%
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases	5	2		1	6			4			8	
Permitted Phases	2			6			4		4	8		8
Actuated Green, G (s)	103.3	98.3		105.8	98.3			17.2	17.2		17.2	17.2
Effective Green, g (s)	103.3	98.3		105.8	98.3			17.2	17.2		17.2	17.2
Actuated g/C Ratio	0.74	0.70		0.76	0.70			0.12	0.12		0.12	0.12
Clearance Time (s)	5.5	5.5		5.5	8.0			6.0	6.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	311	2482		289	2470			159	198		160	195
v/s Ratio Prot	0.00	c0.39		c0.02	0.36							
v/s Ratio Perm	0.08			0.21				0.02	0.01		c0.09	0.00
v/c Ratio	0.12	0.56		0.30	0.52			0.16	0.04		0.69	0.02
Uniform Delay, d1	5.7	10.2		7.4	9.7			54.9	54.1		58.9	54.0
Progression Factor	0.71	0.53		0.69	0.39			1.00	1.00		1.00	1.00
Incremental Delay, d2	0.1	0.7		0.4	0.5			0.5	0.1		12.3	0.0
Delay (s)	4.2	6.2		5.5	4.4			55.4	54.2		71.1	54.0
Level of Service	A	A		A	A			E	D		E	D
Approach Delay (s)		6.1			4.4			54.5			67.5	
Approach LOS		A			A			D			E	
Intersection Summary												
HCM 2000 Control Delay			9.7									A
HCM 2000 Volume to Capacity ratio			0.57									
Actuated Cycle Length (s)			140.0								19.5	
Intersection Capacity Utilization			68.1%									C
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

























12: Driveway/I-81 SB Ramp & Berryville Pike

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (vph)	330	1143	12	18	1050	707	16	5	23	490	0	260	
Future Volume (vph)	330	1143	12	18	1050	707	16	5	23	490	0	260	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	6.2	5.7		5.9	6.4	4.0		8.6	8.6	9.1		9.1	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		1.00	1.00	0.97		1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	1.00		1.00	1.00	1.00		1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00		1.00	1.00	1.00		1.00	
Frt	1.00	1.00		1.00	1.00	0.85		1.00	0.85	1.00		0.85	
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.96	1.00	0.95		1.00	
Satd. Flow (prot)	1752	3568		1805	3505	1495		1829	1553	3400		1583	
Flt Permitted	0.95	1.00		0.95	1.00	1.00		0.96	1.00	0.95		1.00	
Satd. Flow (perm)	1752	3568		1805	3505	1495		1829	1553	3400		1583	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	
Adj. Flow (vph)	344	1191	12	19	1094	736	17	5	24	510	0	271	
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	23	0	0	227	
Lane Group Flow (vph)	344	1204	0	19	1094	736	0	22	1	510	0	44	
Confl. Peds. (#/hr)			5	5									
Heavy Vehicles (%)	3%	1%	0%	0%	3%	8%	0%	0%	4%	3%	0%	2%	
Turn Type	Prot	NA		Prot	NA	Free	Split	NA	Perm	Prot		Perm	
Protected Phases	5	2		1	6		4	4		3			
Permitted Phases						Free			4			3	
Actuated Green, G (s)	29.4	80.6		3.3	53.5	140.0		4.0	4.0	22.8		22.8	
Effective Green, g (s)	29.4	80.6		3.3	53.5	140.0		4.0	4.0	22.8		22.8	
Actuated g/C Ratio	0.21	0.58		0.02	0.38	1.00		0.03	0.03	0.16		0.16	
Clearance Time (s)	6.2	5.7		5.9	6.4			8.6	8.6	9.1		9.1	
Vehicle Extension (s)	1.0	1.0		1.0	1.0			1.0	1.0	1.0		1.0	
Lane Grp Cap (vph)	367	2054		42	1339	1495		52	44	553		257	
v/s Ratio Prot	c0.20	0.34		0.01	c0.31			0.01		c0.15			
v/s Ratio Perm						c0.49			0.00			0.03	
v/c Ratio	0.94	0.59		0.45	0.82	0.49		0.42	0.02	0.92		0.17	
Uniform Delay, d1	54.4	19.0		67.5	38.9	0.0		66.9	66.1	57.7		50.5	
Progression Factor	0.98	1.27		1.12	0.93	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2	28.1	1.1		1.7	3.8	0.4		2.0	0.1	20.7		0.1	
Delay (s)	81.4	25.3		77.5	39.9	0.4		68.9	66.1	78.5		50.6	
Level of Service	F	C		E	D	A		E	E	E		D	
Approach Delay (s)		37.8			24.5			67.4			68.8		
Approach LOS		D			C			E			E		
Intersection Summary													
HCM 2000 Control Delay			38.0									HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio			0.90										
Actuated Cycle Length (s)			140.0									Sum of lost time (s)	30.3
Intersection Capacity Utilization			81.8%									ICU Level of Service	D
Analysis Period (min)			15										

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

16: Blossom Drive/Millbrook Drive & Berryville Pike

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 			 							
Traffic Volume (vph)	124	1104	101	0	1362	2	31	0	11	13	0	86
Future Volume (vph)	124	1104	101	0	1362	2	31	0	11	13	0	86
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	10.1	6.1	6.1		5.6	5.6	8.8		8.8	8.8		8.8
Lane Util. Factor	0.97	0.95	1.00		0.95	1.00	1.00		1.00	1.00		1.00
Frt	1.00	1.00	0.85		1.00	0.85	1.00		0.85	1.00		0.85
Flt Protected	0.95	1.00	1.00		1.00	1.00	0.95		1.00	0.95		1.00
Satd. Flow (prot)	3433	3438	1599		3343	1615	1752		1615	1805		1615
Flt Permitted	0.95	1.00	1.00		1.00	1.00	0.95		1.00	0.95		1.00
Satd. Flow (perm)	3433	3438	1599		3343	1615	1752		1615	1805		1615
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	129	1150	105	0	1419	2	32	0	11	14	0	90
RTOR Reduction (vph)	0	0	16	0	0	1	0	0	10	0	0	86
Lane Group Flow (vph)	129	1150	89	0	1419	1	32	0	1	14	0	4
Heavy Vehicles (%)	2%	5%	1%	4%	8%	0%	3%	0%	0%	0%	0%	0%
Turn Type	Prot	NA	Perm		NA	Perm	Prot		Perm	Prot		Perm
Protected Phases	1	6			2		4			4		
Permitted Phases			6			2			4		4	
Actuated Green, G (s)	8.7	118.7	118.7		100.4	100.4	6.4		6.4	6.4		6.4
Effective Green, g (s)	8.7	118.7	118.7		100.4	100.4	6.4		6.4	6.4		6.4
Actuated g/C Ratio	0.06	0.85	0.85		0.72	0.72	0.05		0.05	0.05		0.05
Clearance Time (s)	10.1	6.1	6.1		5.6	5.6	8.8		8.8	8.8		8.8
Vehicle Extension (s)	1.0	1.0	1.0		1.0	1.0	1.0		1.0	1.0		1.0
Lane Grp Cap (vph)	213	2914	1355		2397	1158	80		73	82		73
v/s Ratio Prot	0.04	c0.33			c0.42		c0.02			0.01		
v/s Ratio Perm			0.06			0.00			0.00			0.00
v/c Ratio	0.61	0.39	0.07		0.59	0.00	0.40		0.01	0.17		0.06
Uniform Delay, d1	64.0	2.4	1.7		9.7	5.6	64.9		63.8	64.2		63.9
Progression Factor	0.95	0.95	1.66		0.31	1.00	1.00		1.00	1.00		1.00
Incremental Delay, d2	3.0	0.4	0.1		0.8	0.0	1.2		0.0	0.4		0.1
Delay (s)	63.6	2.7	2.9		3.8	5.6	66.1		63.8	64.6		64.0
Level of Service	E	A	A		A	A	E		E	E		E
Approach Delay (s)		8.4			3.8			65.5			64.1	
Approach LOS		A			A			E			E	
Intersection Summary												
HCM 2000 Control Delay			9.0		HCM 2000 Level of Service				A			
HCM 2000 Volume to Capacity ratio			0.59									
Actuated Cycle Length (s)			140.0		Sum of lost time (s)			24.5				
Intersection Capacity Utilization			66.4%		ICU Level of Service				C			
Analysis Period (min)			15									
c Critical Lane Group												

ROUNABOUT ANALYSIS

 Site: 102 [Route 7 at Pleasant Valley Road - PM Peak - Preferred]

Future Build - PM Peak
Site Category: (None)
Roundabout

Roundabout Basic Parameters												
Location	Name	Central Island Diam	Circ Width	Insc Diam	Entry Radius	Entry Angle	Circ Lanes	Entry Lanes	Av.Entry Lane Width	App. Dist	Prop Queued Upstr Signal	Extra Bunching
		ft	ft	ft	ft	°			ft	ft		%
South	N Pleasant Valley Road	86.00	16.00	150.0 ⁷	65.0	30.0	1	2	13.00	1600.0	NA ⁵	0.0 ¹
East	Route 7	86.00	16.00	150.0 ⁷	65.0	30.0	1	2	13.00	1600.0	NA ⁵	0.0 ¹
North	N Pleasant Valley Road	86.00	32.00	150.0 ⁷	65.0	30.0	2	1	13.00	1600.0	NA ⁵	0.0 ¹
West	Route 7	86.00	16.00	150.0 ⁷	65.0	30.0	1	1	13.00	1600.0	NA ⁵	0.0 ¹

Roundabout Capacity Model: SIDRA Standard

- ¹ Program option resulted in zero value (single Site analysis or unconnected Site in Network analysis).
- ⁵ Not Applicable (single Site analysis or unconnected Site in Network analysis).
- ⁷ Inscribed diameter value was specified by the user.

Roundabout Entry and Circulating / Exiting Stream Parameters													
To Approach	Turn	Lane No	Lane Type	Opng Flow	Opng In-Bunch Flow	In-Bunch Headway	Prop. Bunched	Cap Const Effect	Priority Sharing	OD Factor	HVE for Entry	Critical Gap	Follow-up Headway
				veh/h	pcu/h	sec						sec	sec
South: N Pleasant Valley Road													
Environment Factor: 1.10													
Entry/Circ Flow Adjustment: None													
West	L2	1	Subdom.	641	642	2.00	0.550	No	No	0.816	1.02	4.64	2.62
North	T1	1	Subdom.	641	642	2.00	0.550	No	No	0.816	1.03	4.68	2.65
East	R2	2	Dominant	641	642	2.00	0.550	No	Yes ¹⁰	0.816	1.01	3.65	2.06
East: Route 7													
Environment Factor: 1.10													
Entry/Circ Flow Adjustment: None													
South	L2	1	Dominant	268	274	2.00	0.283	No	Yes ¹⁰	0.953	1.01	4.13	2.20
West	T1	2	Subdom.	268	274	2.00	0.283	No	No	0.953	1.01	4.54	2.42
North	R2	2	Subdom.	268	274	2.00	0.283	No	No	0.953	1.00	4.49	2.40
North: N Pleasant Valley Road													
Environment Factor: 1.10													
Entry/Circ Flow Adjustment: None													
East	L2	1	Dominant	1009	1020	1.03	0.475	No	No	0.848	1.02	3.87	2.74
South	T1	1	Dominant	1009	1020	1.03	0.475	No	No	0.848	1.01	3.83	2.72
West	R2	1	Dominant	1009	1020	1.03	0.475	No	No	0.848	1.03	3.91	2.77
West: Route 7													
Environment Factor: 1.10													
Entry/Circ Flow Adjustment: None													
North	L2	1	Dominant	669	676	2.00	0.570	No	Yes ¹⁰	0.910	1.00	4.29	2.43
East	T1	1	Dominant	669	676	2.00	0.570	No	Yes ¹⁰	0.910	1.00	4.29	2.43
South	R2	1	Dominant	669	676	2.00	0.570	No	Yes ¹⁰	0.910	1.02	4.37	2.48

Roundabout Capacity Model: SIDRA Standard

- ¹⁰ Priority sharing means Follow-up Headway plus Intra-bunch Headway is larger than the Critical Gap.

Circulating Lane Flow Rates			
Lane No	veh/h	Circulating Flow Rate pcu/h	Percent
South: N Pleasant Valley Road			
Lane 1	641	642	100.0
Approach	641	642	
East: Route 7			
Lane 1	268	274	100.0
Approach	268	274	
North: N Pleasant Valley Road			
Lane 1	488	493	48.3
Lane 2	522	528	51.7
Approach	1010	1021	
West: Route 7			
Lane 1	669	676	100.0
Approach	669	676	

Roundabout Capacity Model: The SIDRA Standard roundabout capacity model option is in use. This model takes into account the total circulating flow as well as the effect of flow distribution in circulating lanes on the entry capacity results.

Gap Acceptance Cycle Parameters (Lanes)					
Opposed Lane	Cycle Time sec	Blocked Time sec	Unblocked Time sec	Unblocked Time Ratio	Minimum Delay sec
South: N Pleasant Valley Road					
1	21.29	11.96	9.33	0.438	6.0
2	18.73	9.70	9.04	0.482	4.3
East: Route 7					
1	22.06	5.42	16.65	0.754	2.9
2	22.65	5.90	16.75	0.740	3.3
North: N Pleasant Valley Road					
1	14.33	8.20	6.13	0.428	6.4
West: Route 7					
1	18.29	9.35	8.94	0.489	5.0

Roundabout Capacity Model: SIDRA Standard

Gap Acceptance Cycle Parameters (Movements)							
To Approach	Turn	Lane No	Cycle Time sec	Blocked Time sec	Unblocked Time sec	Unblocked Time Ratio	Minimum Delay sec
South: N Pleasant Valley Road							
West	L2	1	21.21	11.89	9.32	0.439	6.0
North	T1	1	21.33	12.00	9.33	0.437	6.0
East	R2	2	18.73	9.70	9.04	0.482	4.3
East: Route 7							
South	L2	1	22.06	5.42	16.65	0.754	2.9
West	T1	2	22.66	5.90	16.76	0.740	3.3
North	R2	2	22.59	5.85	16.74	0.741	3.2
North: N Pleasant Valley Road							
East	L2	1	14.39	8.25	6.13	0.426	6.4
South	T1	1	14.27	8.15	6.12	0.429	6.3

West	R2	1	14.50	8.35	6.15	0.424	6.5
West: Route 7							
North	L2	1	18.27	9.33	8.94	0.489	5.0
East	T1	1	18.27	9.33	8.94	0.489	5.0
South	R2	1	18.48	9.51	8.97	0.485	5.1

Roundabout Capacity Model: SIDRA Standard

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Project: \\RICHFS1.bkr.mbakercorp.com\PROJECTS\VDOT TMPD On-Call 2017\Term 2 Task Orders_CHECK RATES ONE PENNY OFF\TO 34 - Route 7 STARS\Work_Files\Analysis\Build\Sidra\Pleasant Valley Road Roundabout\Pleasant Vally Roundabout_Future.sip8

DELAY (CONTROL)

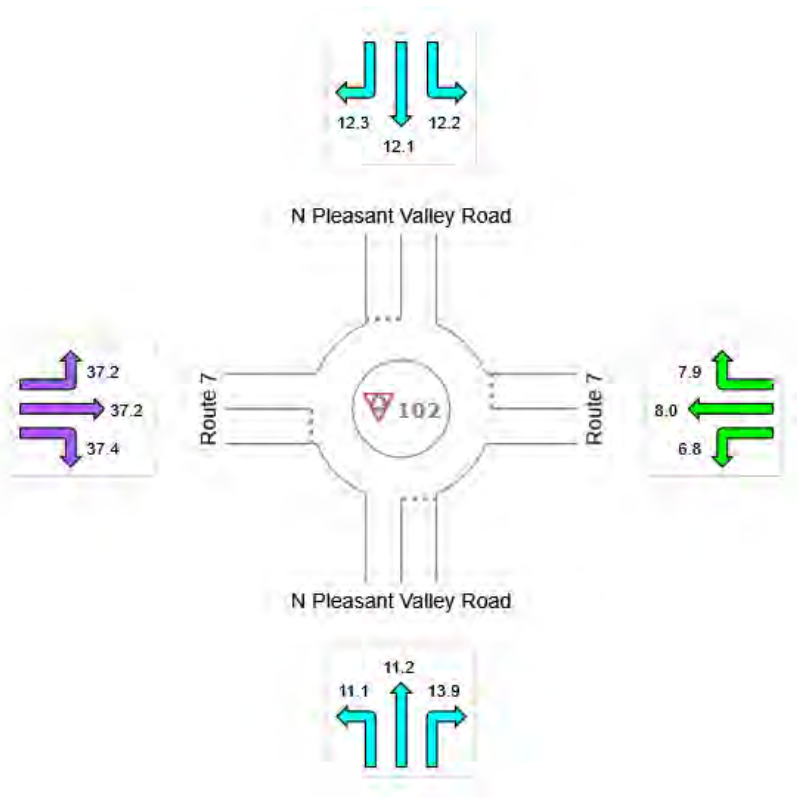
Average control delay per vehicle, or average pedestrian delay (seconds)

Site: 102 [Route 7 at Pleasant Valley Road - PM Peak - Preferred]

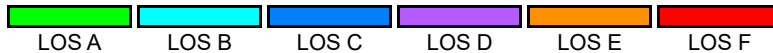
Future Build - PM Peak
 Site Category: (None)
 Roundabout

All Movement Classes

	Approaches				Intersection
	South	East	North	West	
Delay (Control)	13.1	7.4	12.2	37.2	17.0
LOS	B	A	B	D	B



Colour code based on Level of Service



Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
 LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).

NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Roundabout Level of Service Method: Same as Signalised Intersections

HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.

APPENDIX C. DETAILED CONSTRUCTION COST ESTIMATES

Route 7 & N Pleasant Valley Roundabout
Opinion of Probable Project Costs - Dec 2020
Non-inflated Costs are in FY2020 Dollars

Item	Description	Unit	Quantity	Unit Cost	Extension
Mobilization Items					
Mobilization	LS	1	\$	168,294	\$ 168,294
CN Surveying	LS	1	\$	55,317	\$ 55,317
MOBILIZATION SUB-TOTAL					\$ 223,611
Maintenance of Traffic (MOT) Items					
Maintenance of Traffic	LS	1	\$	307,288	\$ 307,288
MAINTENANCE OF TRAFFIC (MOT) SUB-TOTAL					\$ 307,288
Roadway Items					
SM-12.5D	TON	700	\$	150.00	\$ 105,000
SM-12.5D (Overlay)	TON	400	\$	150.00	\$ 60,000
IM-19.0D	TON	1,100	\$	115.00	\$ 126,500
BM-25.0D	TON	1,300	\$	107.00	\$ 139,100
Stone 21B	TON	3,700	\$	36.00	\$ 133,200
Saw Cutting	LF	1,000	\$	50.00	\$ 50,000
Curb and Gutter (CG-6)	LF	2,300	\$	33.66	\$ 77,418
Curb (Truck Apron, Mod. CG-3)	LF	300	\$	25.00	\$ 7,500
Curb (Central Island, CG-2)	LF	200	\$	135.71	\$ 27,142
Truck Apron	SY	400	\$	200.00	\$ 80,000
Splitter Islands	SY	500	\$	90.00	\$ 45,000
Hydr. Cement Concrete Sidewalk (4")	SY	1,000	\$	60.59	\$ 60,590
Flexible Pavement Planning 0"-2"	SY	4,000	\$	10.00	\$ 40,000
Pavement Demolition	SY	700	\$	10.00	\$ 7,000
ROADWAY SUB-TOTAL					\$ 958,450
Hydraulics Items					
Storm Sewer Pipe (assume 24" avg size)	LF	2,200	\$	105.49	\$ 232,078
Storm Structures	EA	20	\$	5,500.00	\$ 110,000
Underdrain UD-4	LF	2,300	\$	10.19	\$ 23,437
SWM/BMP	LS	1	\$	100,000.00	\$ 100,000
E&S Controls	LS	1	\$	49,966	\$ 49,966
HYDRAULICS SUB-TOTAL					\$ 515,481
In-Plan Utilities Items					
	LS		\$	-	\$ -
IN-PLAN UTILITIES SUB-TOTAL					\$ -
Traffic Items					
Paint/Striping	LF	8,300	\$	2.85	\$ 23,655
Pavement Messages / Arrows / Stop Bars	EA	45	\$	300.00	\$ 13,500
Traffic Signal Demo	EA	1	\$	50,000.00	\$ 50,000
Lighting	LS	1	\$	100,000.00	\$ 100,000
TRAFFIC SUB-TOTAL					\$ 187,155
Structures/Bridges Items					
STRUCTURES/BRIDGES SUB-TOTAL					\$ -
Earthwork/Materials Items					
Regular Excavation	CY	7,100	\$	25.00	\$ 177,500
Borrow Excavation	CY	2,100	\$	40.00	\$ 84,000
Unsuitable Materials	CY	3,800	\$	20.00	\$ 76,000
EARTHWORK/MATERIALS SUB-TOTAL					\$ 337,500
Sound Wall Items					
SOUND WALL SUB-TOTAL					\$ -
Other Items					
Clear and Grubbing	ACRE	0.00			\$ -
Landscaping	LS	1	\$	50,000	\$ 50,000
OTHER SUB-TOTAL					\$ 50,000
MAJOR ITEMS SUBTOTAL					\$ 2,579,000
Construction Totals					
Unaccounted for Items (20%)	LS	1	\$	410,000	\$ 410,000
Construction Contract Total					\$ 2,989,000
Construction Contingency (25%)	LS	1	\$	748,000	\$ 748,000
Contract Contingency (5%)	LS	1	\$	150,000	\$ 150,000
Construction Engineering & Inspection (20%)	LS	1	\$	598,000	\$ 598,000
Total Construction Phase (in FY2020 Dollars)					\$ 4,485,000
Preliminary Engineering					
Preliminary Engineering					
Total Preliminary Engineering Phase (in FY2020 Dollars)					\$ -
Right of Way					
Right of Way					
Utilities					
Total Right of Way Phase (in FY2020 Dollars)					\$ -
Total Project Cost in FY2020 Dollars					\$ 4,485,000

Item Comments/Assumptions

(Project Total-1,000,000)*5%+80,000 of all items + 20% unaccounted for items less mobilization
2% of all items + 20% unaccounted for items less mobilization

15% of Roadway Items, hydraulics, traffic, earthwork, and other items

District Avg
Microstation Quantities

District Avg
District Avg
District Avg
District Avg
Estimated
District Avg
District Avg

MS-1 - 21020
13220
Estimated
Estimated

District Avg
Estimated

District Avg
Estimated

3% of Roadway Items, hydraulics, traffic, earthwork, and other items

See Utilities Tab
Estimated

State Avg
Estimated
District Average

Estimated
Estimated
Estimated

120
140
Estimated

17.5

20% of all items less mobilization and MOT
25% of Construction Contract Subtotal
5% of Construction Contract Subtotal
20% of Construction Contract Subtotal

25% of Construction Total

Estimated at 50% high risk of ROW and utility impacts

Quantities from Microstation

2 inch Surface
2 inch Surface Overlay =/= Planning SY due to MS-1 area includes potential additional mill/overlay for approaches
3.5 inch Intermediate
4 inch base material
6 inch Subbase for Truck Apron and Pavement

Estimated
Microstation Quantities / CG-6
Microstation Quantity / CG-3
Microstation Quantity / CG-2
Assumed Concrete Travel Lane 9"
Assumed MS-1

This includes milling for median area (as necessary), roundedup to account for potential additional mill/overlay for approaches
Demolition of Existing Pavement under proposed truck aprons and area north of roundabout

Estimated at 2 times length of roundabout
Estimated at 75' x 1.25% for additional structures
Underdrain + Median Strip
Estimated small-to-moderate in size

New pavement areas assumed to be excavated at average depth of 2' plus 3' x 3' x length of stormwater length x 3' length of curb and gutter x 5 for truck apron
Regular Excavation less volume of Proposed Pavement
100% of Regular Excavation (assumed all unsuitable soils)

ROW COST ESTIMATE WORKSHEET

UPC:
Date:

PARCEL #	001	TAX MAP #	125-05--2-3	Zoning	B2	LAND	\$ 151,600
ASSESSMENT	LAND	\$ 170,600	\$ 12.01			BUILDING	\$ -
	IMPROV.	\$ 610,200				IMPROVEMENTS	\$ -
		SUBJ. SIZE	0			DAMAGES	\$ 7,000
EST. FMV. PER ACQUISITION	SF/AC/SM	\$ 17.00				TOTAL	\$ 158,600
	FEE	8,000	SF/AC/SM				\$ 136,000
	Pres		SF/AC/SM				\$ -
	PDE		SF/AC/SM	95%			\$ -
	UTILITY	1,650	SF/AC/SM	40%			\$ 11,300
	TCE	1,650	SF/AC/SM	15%			\$ 4,300

-Type:

Potential sidewalk damages (140*50/ft)

PARCEL #	002	TAX MAP #	195-07-S-133C	Zoning	B2	LAND	\$ 27,400
ASSESSMENT	LAND	\$ 244,700	\$ 15.02			BUILDING	\$ -
	IMPROV.	\$ 231,000				IMPROVEMENTS	\$ -
		SUBJ. SIZE	0			DAMAGES	\$ 100,000
EST. FMV. PER ACQUISITION	SF/AC/SM	\$ 21.03				TOTAL	\$ 127,400
	FEE	500	SF/AC/SM				\$ 10,600
	Pres		SF/AC/SM				\$ -
	PDE		SF/AC/SM				\$ -
	UTILITY	1,000	SF/AC/SM	40%			\$ 8,500
	TCE	2,600	SF/AC/SM	15%			\$ 8,300

-Type:

Sign impact estimated at 100K

PARCEL #	003	TAX MAP #	175-05--A	Zoning	B2	LAND	\$ 78,100
ASSESSMENT	LAND	\$ 1,464,500	\$ 10.00			BUILDING	\$ -
	IMPROV.	\$ 2,242,600				IMPROVEMENTS	\$ -
		SUBJ. SIZE	3			DAMAGES	\$ -
EST. FMV. PER ACQUISITION	SF/AC/SM	\$ 14.00				TOTAL	\$ 78,100
	FEE	4,000	SF/AC/SM				\$ 56,100
	Pres		SF/AC/SM				\$ -
	PDE		SF/AC/SM				\$ -
	UTILITY	2,850	SF/AC/SM	40%			\$ 16,000
	TCE	2,850	SF/AC/SM	15%			\$ 6,000

-Type:

Postal Office Property

PARCEL #	004	TAX MAP #	195-01-A-1A	Zoning	B2	LAND	\$ 3,500
ASSESSMENT	LAND	\$ 54,000	\$ 4.96			BUILDING	\$ -
	IMPROV.	\$ 98,700				IMPROVEMENTS	\$ -
		SUBJ. SIZE	0			DAMAGES	\$ -
EST. FMV. PER ACQUISITION	SF/AC/SM	\$ 6.94				TOTAL	\$ 3,500
	FEE	500	SF/AC/SM				\$ 3,500
	Pres		SF/AC/SM				\$ -
	PDE		SF/AC/SM				\$ -
	UTILITY	1,400	SF/AC/SM				\$ -
	TCE	1,400	SF/AC/SM				\$ -

-Type:

	VALUE	AREA	\$/SF
Proposed Right of Way	\$ 206,200	13,000.000	\$ 15.86153846
Proposed Prescriptive Right of Way	\$ -	0.000	#DIV/0!
Proposed Permanent Drainage Easement	\$ -	0.000	#DIV/0!
Proposed Permanent Utility Easement	\$ 35,800	6,900.000	\$ 5.18840580
Proposed Temporary Construction Easement	\$ 18,600	8,500.000	\$ 2.18823529
TOTAL	\$ 260,600		
Buildings	\$ -		
Improvements	\$ -		
Damages	\$ 107,000		
Total Costs (Land + Above)	\$ 367,600		
Condemnation increment (50%)	\$ 183,800		
ROW Cost (\$10,000/parcel) + \$35,000 for Condemnation Staff costs	\$ -		
Right of Way P.E. Costs (\$)	\$ -		
Total Admin and P.E Costs	\$ 183,800.00		
*Estimated Total Acquisitions	0		
*Estimated Parcel Count	0		
Commercial Relocation Costs	\$ -		
Residential Relocation Costs	\$ -		
Hazmat Costs	\$ -		
Demolition Costs	\$ -		
Grand Total with Relo Costs (No Utility Costs)	\$ 551,400.00		

Baker Lane Area
Opinion of Probable Project Costs - 12/09/2020
Non-inflated Costs are in FY2020 Dollars

Item	Description	Unit	Quantity	Unit Cost	Extension
Mobilization Items					
	Mobilization	LS	1	\$ 13,049	\$ 13,049
	CN Surveying	LS	1	\$ 2,146	\$ 2,146
	MOBILIZATION SUB-TOTAL				\$ 15,195
Maintenance of Traffic (MOT) Items					
	Maintenance of Traffic	LS	1	\$ 18,464	\$ 18,464
	MAINTENANCE OF TRAFFIC (MOT) SUB-TOTAL				\$ 18,464
Roadway Items					
	SM-12.5D	TON	10	\$ 150.00	\$ 1,500
	SM-12.5D (Overlay)	TON	0	\$ 150.00	\$ -
	IM-19.0D	TON	10	\$ 115.00	\$ 1,150
	BM-25.0D	TON	10	\$ 107.00	\$ 1,070
	Stone 21B	TON	30	\$ 36.00	\$ 1,080
	Saw Cutting	LF	200	\$ 50.00	\$ 10,000
	Splitter Islands	SY	40	\$ 90.00	\$ 3,600
	Pavement Demolition	SY	70	\$ 10.00	\$ 700
	ADA Ramp Reconstruction	EA	1	\$ 25,000.00	\$ 25,000
	ROADWAY SUB-TOTAL				\$ 44,100
Hydraulics Items					
	E&S Controls	LS	1	\$ 6,714	\$ 6,714
	HYDRAULICS SUB-TOTAL				\$ 6,714
In-Plan Utilities Items					
	IN-PLAN UTILITIES SUB-TOTAL				\$ -
Traffic Items					
	Paint/Striping	LF	950	\$ 10.00	\$ 9,500
	Flex Posts	EA	10	\$ 50.00	\$ 500
	Pavement Marking Eradication	LF	400	\$ 10.00	\$ 4,000
	Sign Panel	EA	18	\$ 30.00	\$ 540
	TRAFFIC SUB-TOTAL				\$ 14,540
Structures/Bridges Items					
	STRUCTURES/BRIDGES SUB-TOTAL				\$ -
Earthwork/Materials Items					
	Regular Excavation	CY	100	\$ 25.00	\$ 2,500
	Borrow Excavation	CY	100	\$ 40.00	\$ 4,000
	Unsuitable Materials	CY	100	\$ 20.00	\$ 2,000
	EARTHWORK/MATERIALS SUB-TOTAL				\$ 8,500
Sound Wall Items					
	SOUND WALL SUB-TOTAL				\$ -
Other Items					
	OTHER SUB-TOTAL				\$ -
	MAJOR ITEMS SUBTOTAL				\$ 108,000
Construction Totals					
	Unaccounted for Items (20%)	LS	1	\$ 15,000	\$ 15,000
	Construction Contract Total				\$ 123,000
	Construction Contingency (25%)	LS	1	\$ 31,000	\$ 31,000
	Construction Contingency (5%)	LS	1	\$ 7,000	\$ 7,000
	Construction Engineering & Inspection (20%)	LS	1	\$ 25,000	\$ 25,000
	Total Construction Phase (in FY2020 Dollars)				\$ 186,000

Item Comments/Assumptions

(Project Total-200,000)*7.5%+20,000 of all items + 20% unaccounted for items less mobilization
 2% of all items + 20% unaccounted for items less mobilization

25% of Roadway Items, hydraulics, traffic, earthwork, and other items

10607 District Avg Microstation Quantities
 10607 District Avg Microstation Quantities
 10610 District Avg Microstation Quantities
 10643 District Avg Microstation Quantities
 10128 District Avg Microstation Quantities
 68576 MS-1A - 21020
 Estimated

Quantities from Microstation

2 inch Surface
 2 inch Surface Overlay +/- Planning SY due to MS-1 area includes potential additional mill/overlay for approaches
 3.5 inch Intermediate
 4 inch base material
 8 inch Subbase for Truck Apron and Pavement
 Estimated
 Assumed MS-1

10% of Roadway Items, hydraulics, traffic, earthwork, and other items

54075 Painting TY B CI VI 4"
 State Avg
 Left-turn arrows, stop bars
 Estimated
 50108 District Average

Estimated
 Estimated
 Estimated 3 Turn Restriction Signs

120
 140 19.5

New pavement areas assumed to be excavated at average depth of 2' plus 3' x 3' x length of stormwater length x 3' length of curb and gutter x 5 for truck apron
 Regular Excavation less volume of Proposed Pavement
 100% of Regular Excavation (assumed all unsuitable soils)

Ross Street and Route 7
Opinion of Probable Project Costs - 12/09/2020
Non-inflated Costs are in FY2020 Dollars

Item	Description	Unit	Quantity	Unit Cost	Extension
Mobilization Items					
Mobilization	LS	1	\$	25,684	\$ 25,684
CN Surveying	LS	1	\$	5,516	\$ 5,516
MOBILIZATION SUB-TOTAL					\$ 31,200
Maintenance of Traffic (MOT) Items					
Maintenance of Traffic	LS	1	\$	21,163	\$ 21,163
MAINTENANCE OF TRAFFIC (MOT) SUB-TOTAL					\$ 21,163
Roadway Items					
SM-12.5D	TON	100	\$	150.00	\$ 15,000
SM-12.5D (Overlay)	TON	100	\$	150.00	\$ 15,000
IM-19.0D	TON	100	\$	115.00	\$ 11,500
BM-25.0D	TON	100	\$	107.00	\$ 10,700
Stone 21B	TON	100	\$	36.00	\$ 3,600
Saw Cutting	LF	1,300	\$	50.00	\$ 65,000
Curb and Gutter (CG-6)	LF	0	\$	33.66	\$ -
Curb (Truck Apron, Mod. CG-3)	LF	0	\$	25.00	\$ -
Curb (Central Island, CG-2)	LF	0	\$	135.71	\$ -
Truck Apron	SY	0	\$	200.00	\$ -
Splitter Islands	SY	200	\$	90.00	\$ 18,000
Flexible Pavement Planning 0"-2"	SY	1,000	\$	10.00	\$ 10,000
Pavement Demolition	SY	200	\$	10.00	\$ 2,000
ROADWAY SUB-TOTAL					\$ 150,800
Hydraulics Items					
Storm Sewer Pipe (assume 24" avg size)	LF	0	\$	105.49	\$ -
Storm Structures	EA	0	\$	5,500.00	\$ -
Underdrain UD-4	LF	0	\$	10.19	\$ -
SWM/BMP	LS	0	\$	100,000.00	\$ -
E&S Controls	LS	1	\$	10,078	\$ 10,078
HYDRAULICS SUB-TOTAL					\$ 10,078
In-Plan Utilities Items					
IN-PLAN UTILITIES SUB-TOTAL					\$ -
Traffic Items					
Paint/Striping	LF	1,000	\$	2.85	\$ 2,850
Pavement Messages / Arrows / Stop Bars	EA	3	\$	300.00	\$ 900
SIGN POST STP-1, 2 1/2", 10 GAUGE	LF	0	\$	27.28	\$ -
CONC. SIGN FDN. STP-1 TY.B	EA	0	\$	590.03	\$ -
SignPanel	EA	0	\$	28.01	\$ -
Remove existing heads on SB approach, Reuse Sign and Camera	EA	0	\$	10,000.00	\$ -
New Signal Heads on SB approach	EA	0	\$	2,500.00	\$ -
Mast Arm Replacement 60'	EA	0	\$	12,000.00	\$ -
Retime Traffic Signal	EA	1	\$	30,000.00	\$ 30,000
TRAFFIC SUB-TOTAL					\$ 33,750
Structures/Bridges Items					
STRUCTURES/BRIDGES SUB-TOTAL					\$ -
Earthwork/Materials Items					
Regular Excavation	CY	200	\$	25.00	\$ 5,000
Borrow Excavation	CY	200	\$	40.00	\$ 8,000
Unsuitable Materials	CY	200	\$	20.00	\$ 4,000
EARTHWORK/MATERIALS SUB-TOTAL					\$ 17,000
Sound Wall Items					
SOUND WALL SUB-TOTAL					\$ -
Other Items					
Clear and Grubbing	ACRE	0.00	\$	15,807	\$ -
Landscaping	LS	0	\$	50,000	\$ -
OTHER SUB-TOTAL					\$ -
MAJOR ITEMS SUBTOTAL					\$ 264,000
Construction Totals					
Unaccounted for Items (20%)	LS	1	\$	43,000	\$ 43,000
Construction Contract Total					\$ 307,000
Construction Contingency (25%)	LS	1	\$	77,000	\$ 77,000
Contract Contingency (5%)	LS	1	\$	16,000	\$ 16,000
Construction Engineering & Inspection (20%)	LS	1	\$	62,000	\$ 62,000
Total Construction Phase (in FY2020 Dollars)					\$ 462,000

Item Comments/Assumptions

(Project Total-200,000)*7.5%+20,000 of all items + 20% unaccounted for items less mobilization
 2% of all items + 20% unaccounted for items less mobilization

10% of Roadway Items, hydraulics, traffic, earthwork, and other items

1242 District Avg
 588 District Avg

5% of Roadway Items, hydraulics, traffic, earthwork, and other items

See Utilities Tab

54075 Painting TY B CI VI 4"
 50434 - States Average
 50486 District Average
 50108 District Average

120
 140

State Average - 111

20% of all items less mobilization and MOT
 25% of Construction Contract Subtotal
 5% of Construction Contract Subtotal
 20% of Construction Contract Subtotal

Quantities from Microstation

2 inch Surface
 2 inch Surface Overlay != Planning SY due to MS-1 area includes potential additional mill/overlay for approaches
 3.5 inch Intermediate
 4 inch base material
 8 inch Subbase for Truck Apron and Pavement

Estimated
 Microstation Quantities / CG-6
 Microstation Quantity / CG-3
 Microstation Quantity / CG-2
 Assumed Concrete Travel Lane 9"
 Assumed MS-1
 This includes milling for median area (as necessary), roundedup to account for potential additional mill/overlay for approaches
 Demolition of Existing Pavement under proposed truck aprons and area north of roundabout

Estimated at 2 times length of roundabout
 Estimated at 75' x 1.25% for additional structures
 Underdrain + Median Strip
 Estimated small-to-moderate in size

Estimated
 Estimated
 Estimated
 Estimated
 Estimated

New pavement areas assumed to be excavated at average depth of 2' plus 3' x 3' x length of stormwater length x 3' length of curb and gutter x 5 for truck apron
 Regular Excavation less volume of Proposed Pavement
 100% of Regular Excavation (assumed all unsuitable soils)

Fort Collier Rd to Atwell Ave
Opinion of Probable Project Costs - 12/09/2020
Non-inflated Costs are in FY2020 Dollars

Item	Description	Unit	Quantity	Unit Cost	Extension
Mobilization Items					
Mobilization	LS	1	\$	33,646	\$ 33,646
CN Surveying	LS	1	\$	7,639	\$ 7,639
MOBILIZATION SUB-TOTAL					
\$ 41,285					
Maintenance of Traffic (MOT) Items					
Maintenance of Traffic	LS	1	\$	42,384	\$ 42,384
MAINTENANCE OF TRAFFIC (MOT) SUB-TOTAL					
\$ 42,384					
Roadway Items					
SM-12.5D	TON	100	\$	150.00	\$ 15,000
SM-12.5D (Overlay)	TON	100	\$	150.00	\$ 15,000
IM-19.0D	TON	100	\$	115.00	\$ 11,500
BM-25.0D	TON	100	\$	107.00	\$ 10,700
Stone 21B	TON	200	\$	36.00	\$ 7,200
Saw Cutting	LF	1,000	\$	50.00	\$ 50,000
Curb and Gutter (CG-6)	LF	0	\$	33.66	\$ -
Curb (Truck Apron, Mod. CG-3)	LF	0	\$	25.00	\$ -
Curb (Central Island, CG-2)	LF	0	\$	135.71	\$ -
Truck Apron	SY	0	\$	200.00	\$ -
Splitter Islands	SY	500	\$	90.00	\$ 45,000
Flexible Pavement Planning 0"-2"	SY	1,000	\$	10.00	\$ 10,000
Pavement Demolition	SY	800	\$	10.00	\$ 8,000
ROADWAY SUB-TOTAL					
\$ 172,400					
Hydraulics Items					
Storm Sewer Pipe (assume 24" avg size)	LF	0	\$	105.49	\$ -
Storm Structures	EA	0	\$	5,500.00	\$ -
Underdrain UD-4	LF	0	\$	10.19	\$ -
SWM/BMP	LS	0	\$	100,000.00	\$ -
E&S Controls	LS	1	\$	13,455	\$ 13,455
HYDRAULICS SUB-TOTAL					
\$ 13,455					
In-Plan Utilities Items					
IN-PLAN UTILITIES SUB-TOTAL					
\$ -					
Traffic Items					
Paint/Striping	LF	2,700	\$	2.85	\$ 7,695
Pavement Messages / Arrows / Stop Bars	EA	13	\$	300.00	\$ 3,900
SIGN POST STP-1, 2 1/2", 10 GAUGE	LF	45	\$	27.28	\$ 1,228
CONC. SIGN FDN. STP-1 TY.B	EA	3	\$	590.03	\$ 1,770
SignPanel	EA	4	\$	28.01	\$ 112
Remove existing heads on SB approach, Reuse Sign and Camera	EA	1	\$	10,000.00	\$ 10,000
New Signal Heads on SB approach	EA	2	\$	2,500.00	\$ 5,000
Mast Arm Replacement 60' + conduit	EA	1	\$	24,000.00	\$ 24,000
Retime Traffic Signal	EA	1	\$	30,000.00	\$ 30,000
TRAFFIC SUB-TOTAL					
\$ 83,705					
Structures/Bridges Items					
STRUCTURES/BRIDGES SUB-TOTAL					
\$ -					
Earthwork/Materials Items					
Regular Excavation	CY	200	\$	25.00	\$ 5,000
Borrow Excavation	CY	100	\$	40.00	\$ 4,000
Unsuitable Materials	CY	200	\$	20.00	\$ 4,000
EARTHWORK/MATERIALS SUB-TOTAL					
\$ 13,000					
Sound Wall Items					
SOUND WALL SUB-TOTAL					
\$ -					
Other Items					
Clear and Grubbing	ACRE	0.00	\$	15,807	\$ -
Landscaping	LS	0	\$	50,000	\$ -
OTHER SUB-TOTAL					
\$ -					
MAJOR ITEMS SUBTOTAL					
\$ 366,000					
Construction Totals					
Unaccounted for Items (20%)	LS	1	\$	57,000	\$ 57,000
Construction Contract Total					
\$ 423,000					
Construction Contingency (25%)	LS	1	\$	106,000	\$ 106,000
Contract Contingency (5%)	LS	1	\$	22,000	\$ 22,000
Construction Engineering & Inspection (20%)	LS	1	\$	85,000	\$ 85,000
Total Construction Phase (in FY2020 Dollars)					
\$ 636,000					

Item Comments/Assumptions

(Project Total-200,000)*7.5%+20,000 of all items + 20% unaccounted for items less mobilization
2% of all items + 20% unaccounted for items less mobilization

15% of Roadway Items, hydraulics, traffic, earthwork, and other items

District Avg Microstation Quantities

District Avg Microstation Quantities

District Avg Microstation Quantities

District Avg Microstation Quantities

Estimated

Estimated

5% of Roadway Items, hydraulics, traffic, earthwork, and other items

See Utilities Tab Estimated

State Avg Estimated

Left-turn arrows, stop bars Estimated

District Average Estimated

District Average Estimated

District Average Estimated

120 New pavement areas assumed to be excavated at average depth of 2' plus 3' x 3' x length of stormwater length x 3' length of curb and gutter x 5 for truck apron

140 Regular Excavation less volume of Proposed Pavement

19.5 100% of Regular Excavation (assumed all unsuitable soils)

State Average - 111

20% of all items less mobilization and MOT

25% of Construction Contract Subtotal

5% of Construction Contract Subtotal

20% of Construction Contract Subtotal

Quantities from Microstation

- 2 inch Surface
- 2 inch Surface Overlay =/= Planning SY due to MS-1 area includes potential additional mill/overlay for approaches
- 3.5 inch Intermediate
- 4 inch base material
- 8 inch Subbase for Truck Apron and Pavement

Estimated

Microstation Quantities / CG-6

Microstation Quantity / CG-3

Microstation Quantity / CG-2

Assumed Concrete Travel Lane 9"

Assumed MS-1

This includes milling for median area (as necessary), roundedup to account for potential additional mill/overlay for approaches

Demolition of Existing Pavement under proposed truck aprons and area north of roundabout

Estimated

Estimated

Estimated

Estimated

Estimated

Estimated

Estimated

Estimated

Estimated

Estimated

Estimated

Estimated

Estimated

Estimated

Estimated

Estimated

Estimated

Estimated

Estimated

Estimated

Estimated

I-815B Ramp
Opinion of Probable Project Costs - 12/09/2020
Non-inflated Costs are in FY2020 Dollars

Item	Description	Unit	Quantity	Unit Cost	Extension
Mobilization Items					
Mobilization	LS	1	\$	19,979	\$ 19,979
CN Surveying	LS	1	\$	3,995	\$ 3,995
MOBILIZATION SUB-TOTAL					\$ 23,974
Maintenance of Traffic (MOT) Items					
Maintenance of Traffic	LS	1	\$	22,138	\$ 22,138
MAINTENANCE OF TRAFFIC (MOT) SUB-TOTAL					\$ 22,138
Roadway Items					
SM-12.5D	TON	100	\$	150.00	\$ 15,000
SM-12.5D (Overlay)	TON	0	\$	150.00	\$ -
IM-19.0D	TON	100	\$	115.00	\$ 11,500
BM-25.0D	TON	100	\$	107.00	\$ 10,700
Stone 21B	TON	200	\$	36.00	\$ 7,200
Saw Cutting	LF	500	\$	50.00	\$ 25,000
Curb and Gutter (CG-6)	LF	0	\$	33.66	\$ -
Curb (Truck Apron, Mod. CG-3)	LF	0	\$	25.00	\$ -
Curb (Central Island, CG-2)	LF	0	\$	135.71	\$ -
Truck Apron	SY	0	\$	200.00	\$ -
Splitter Islands	SY	200	\$	90.00	\$ 18,000
Flexible Pavement Planning 0"-2"	SY	0	\$	10.00	\$ -
Pavement Demolition	SY	200	\$	10.00	\$ 2,000
ROADWAY SUB-TOTAL					\$ 89,400
Hydraulics Items					
Storm Sewer Pipe (assume 24" avg size)	LF	0	\$	105.49	\$ -
Storm Structures	EA	0	\$	5,500.00	\$ -
Underdrain UD-4	LF	0	\$	10.19	\$ -
SWM/BMP	LS	0	\$	100,000.00	\$ -
E&S Controls	LS	1	\$	13,417	\$ 13,417
HYDRAULICS SUB-TOTAL					\$ 13,417
In-Plan Utilities Items					
IN-PLAN UTILITIES SUB-TOTAL					\$ -
Traffic Items					
Paint/Striping	LF	200	\$	2.85	\$ 570
Pavement Messages / Arrows / Stop Bars	EA	4	\$	300.00	\$ 1,200
SIGN POST STP-1, 2 1/2", 10 GAUGE	LF	0	\$	27.28	\$ -
CONC. SIGN FDN. STP-1 TY.B	EA	0	\$	590.03	\$ -
SignPanel	EA	0	\$	28.01	\$ -
Remove existing heads on SB approach, Reuse Sign and Camera	EA	0	\$	10,000.00	\$ -
New Signal Heads on SB approach	EA	0	\$	2,500.00	\$ -
Mast Arm Replacement 60'	EA	0	\$	12,000.00	\$ -
Retime Traffic Signal	EA	1	\$	30,000.00	\$ 30,000
TRAFFIC SUB-TOTAL					\$ 31,770
Structures/Bridges Items					
STRUCTURES/BRIDGES SUB-TOTAL					\$ -
Earthwork/Materials Items					
Regular Excavation	CY	200	\$	25.00	\$ 5,000
Borrow Excavation	CY	100	\$	40.00	\$ 4,000
Unsuitable Materials	CY	200	\$	20.00	\$ 4,000
EARTHWORK/MATERIALS SUB-TOTAL					\$ 13,000
Sound Wall Items					
SOUND WALL SUB-TOTAL					\$ -
Other Items					
Clear and Grubbing	ACRE	0.00	\$	15,807	\$ -
Landscaping	LS	0	\$	50,000	\$ -
OTHER SUB-TOTAL					\$ -
MAJOR ITEMS SUBTOTAL					\$ 194,000
Construction Totals					
Unaccounted for Items (20%)	LS	1	\$	30,000	\$ 30,000
Construction Contract Total					\$ 224,000
Construction Contingency (25%)	LS	1	\$	56,000	\$ 56,000
Contract Contingency (5%)	LS	1	\$	12,000	\$ 12,000
Construction Engineering & Inspection (20%)	LS	1	\$	45,000	\$ 45,000
Total Construction Phase (in FY2020 Dollars)					\$ 337,000

Item Comments/Assumptions

(Project Total-200,000)*7.5%+20,000 of all items + 20% unaccounted for items less mobilization
2% of all items + 20% unaccounted for items less mobilization

15% of Roadway Items, hydraulics, traffic, earthwork, and other items

10% of Roadway Items, hydraulics, traffic, earthwork, and other items

See Utilities Tab

54075 Painting TY B CI VI 4"
Estimated
50434 - States Average
50486
50108

State Avg
Left-turn arrows, stop bars
District Average
District Average
District Average

State Average - 111

20% of all items less mobilization and MOT

25% of Construction Contract Subtotal
5% of Construction Contract Subtotal
20% of Construction Contract Subtotal

Quantities from Microstation

2 inch Surface
2 inch Surface Overlay != Planning SY due to MS-1 area includes potential additional mill/overlay for approaches
3.5 inch Intermediate
4 inch base material
8 inch Subbase for Truck Apron and Pavement

Estimated
Microstation Quantities / CG-6
Microstation Quantity / CG-3
Microstation Quantity / CG-2
Assumed Concrete Travel Lane 9"
Assumed MS-1
This includes milling for median area (as necessary), roundedup to account for potential additional mill/overlay for approaches
Demolition of Existing Pavement under proposed truck aprons and area north of roundabout

Estimated at 2 times length of roundabout
Estimated at 75' x 1.25% for additional structures
Underdrain + Median Strip
Estimated small-to-moderate in size

Estimated
Estimated
Estimated
Estimated
Estimated

120
140
19.5

New pavement areas assumed to be excavated at average depth of 2' plus 3' x 3' x length of stormwater length x 3' length of curb and gutter x 5 for truck apron
Regular Excavation less volume of Proposed Pavement
100% of Regular Excavation (assumed all unsuitable soils)

Conway Street Extension
Opinion of Probable Project Costs - 12/09/2020
Non-inflated Costs are in FY2020 Dollars

Item	Description	Unit	Quantity	Unit Cost	Extension
Mobilization Items					
	Mobilization	LS	1	\$ 84,090	\$ 84,090
	CN Surveying	LS	1	\$ 21,636	\$ 21,636
	MOBILIZATION SUB-TOTAL				\$ 105,726
Maintenance of Traffic (MOT) Items					
	Maintenance of Traffic	LS	1	\$ 83,164	\$ 83,164
	MAINTENANCE OF TRAFFIC (MOT) SUB-TOTAL				\$ 83,164
Roadway Items					
	SM-12.5D	TON	300	\$ 150.00	\$ 45,000
	SM-12.5D (Overlay)	TON	0	\$ 150.00	\$ -
	IM-19.0D	TON	400	\$ 115.00	\$ 46,000
	BM-25.0D	TON	500	\$ 107.00	\$ 53,500
	Stone 21B	TON	900	\$ 36.00	\$ 32,400
	Saw Cutting	LF	300	\$ 50.00	\$ 15,000
	Curb and Gutter (CG-6)	LF	900	\$ 33.66	\$ 30,294
	Curb (Truck Apron, Mod. CG-3)	LF	0	\$ 25.00	\$ -
	Curb (Central Island, CG-2)	LF	0	\$ 135.71	\$ -
	Truck Apron	SY	0	\$ 200.00	\$ -
	Splitter Islands	SY	0	\$ 90.00	\$ -
	Flexible Pavement Planning 0"-2"	SY	0	\$ 10.00	\$ -
	Pavement Demolition	SY	900	\$ 10.00	\$ 9,000
	ROADWAY SUB-TOTAL				\$ 231,194
Hydraulics Items					
	Storm Sewer Pipe (assume 24" avg size)	LF	800	\$ 105.49	\$ 84,392
	Storm Structures	EA	10	\$ 5,500.00	\$ 55,000
	Underdrain UD-4	LF	900	\$ 10.19	\$ 9,171
	SWM/BMP	LS	1	\$ 100,000.00	\$ 100,000
	E&S Controls	LS	1	\$ 39,602	\$ 39,602
	HYDRAULICS SUB-TOTAL				\$ 288,165
In-Plan Utilities Items					
		LS		\$ -	\$ -
	IN-PLAN UTILITIES SUB-TOTAL				\$ -
Traffic Items					
	Paint/Striping	LF	2,300	\$ 2.85	\$ 6,555
	Pavement Messages / Arrows / Stop Bars	EA	1	\$ 300.00	\$ 300
	SIGN POST STP-1, 2 1/2", 10 GAUGE	LF	0	\$ 27.28	\$ -
	CONC. SIGN FDN. STP-1 TY.B	EA	0	\$ 590.03	\$ -
	SignPanel	EA	0	\$ 28.01	\$ -
	Remove existing heads on SB approach, Reuse Sign and Camera	EA	1	\$ 10,000.00	\$ 10,000
	New Signal Heads on SB approach	EA	2	\$ 2,500.00	\$ 5,000
	Mast Arm Replacement 60'	EA	1	\$ 12,000.00	\$ 12,000
	Retime Traffic Signal	EA	3	\$ 30,000.00	\$ 90,000
	TRAFFIC SUB-TOTAL				\$ 123,855
Structures/Bridges Items					
	STRUCTURES/BRIDGES SUB-TOTAL				\$ -
Earthwork/Materials Items					
	Regular Excavation	CY	2,000	\$ 25.00	\$ 50,000
	Borrow Excavation	CY	1,100	\$ 40.00	\$ 44,000
	Unsuitable Materials	CY	2,000	\$ 20.00	\$ 40,000
	EARTHWORK/MATERIALS SUB-TOTAL				\$ 134,000
Sound Wall Items					
	SOUND WALL SUB-TOTAL				\$ -
Other Items					
	Clear and Grubbing	ACRE	0.28	\$ 15,807	\$ 4,426
	Landscaping	LS	1	\$ 50,000	\$ 50,000
	OTHER SUB-TOTAL				\$ 54,426
	MAJOR ITEMS SUBTOTAL				\$ 1,021,000
Construction Totals					
	Unaccounted for Items (20%)	LS	1	\$ 167,000	\$ 167,000
	Construction Contract Total				\$ 1,188,000
	Construction Contingency (25%)	LS	1	\$ 297,000	\$ 297,000
	Contract Contingency (5%)	LS	1	\$ 60,000	\$ 60,000
	Construction Engineering & Inspection (20%)	LS	1	\$ 238,000	\$ 238,000
	Total Construction Phase (in FY2020 Dollars)				\$ 1,783,000

Item Comments/Assumptions

(Project Total-1,000,000)*5%+80,000 of all items + 20% unaccounted for items less mobilization
 2% of all items + 20% unaccounted for items less mobilization

10% of Roadway Items, hydraulics, traffic, earthwork, and other items

1242 District Avg
 588 District Avg

5% of Roadway Items, hydraulics, traffic, earthwork, and other items

See Utilities Tab

54075 Painting TY B CI VI 4"
 50434 - States Average
 50486 District Average
 50108 District Average

State Average - 111

20% of all items less mobilization and MOT

25% of Construction Contract Subtotal
 5% of Construction Contract Subtotal
 20% of Construction Contract Subtotal

Quantities from Microstation

2 inch Surface
 2 inch Surface Overlay =/= Planning SY due to MS-1 area includes potential additional mill/overlay for approaches
 3.5 inch Intermediate
 4 inch base material
 8 inch Subbase for Truck Apron and Pavement

Estimated
 Microstation Quantities / CG-6
 Microstation Quantity / CG-3
 Microstation Quantity / CG-2
 Assumed Concrete Travel Lane 9"
 Assumed MS-1
 This includes milling for median area (as necessary), roundedup to account for potential additional mill/overlay for approaches
 Demolition of Existing Pavement under proposed truck aprons and area north of roundabout

Estimated at 2 times length of roundabout
 Estimated at 75' x 1.25% for additional structures
 Underdrain + Median Strip
 Estimated small-to-moderate in size

Estimated
 Estimated
 Estimated
 Estimated
 Estimated

New pavement areas assumed to be excavated at average depth of 2' plus 3' x 3' x length of stormwater length x 3' length of curb and gutter x 5 for truck apron
 Regular Excavation less volume of Proposed Pavement
 100% of Regular Excavation (assumed all unsuitable soils)

Millbrook and Route 7 Thru Cut
Opinion of Probable Project Costs - 12/09/2020
Non-inflated Costs are in FY2020 Dollars

Item	Description	Unit	Quantity	Unit Cost	Extension
Mobilization Items					
	Mobilization	LS	1	\$ 13,498	\$ 13,498
	CN Surveying	LS	1	\$ 2,266	\$ 2,266
	MOBILIZATION SUB-TOTAL				\$ 15,764
Maintenance of Traffic (MOT) Items					
	Maintenance of Traffic	LS	1	\$ 19,462	\$ 19,462
	MAINTENANCE OF TRAFFIC (MOT) SUB-TOTAL				\$ 19,462
Roadway Items					
	SM-12.5D	TON	10	\$ 150.00	\$ 1,500
	IM-19.0D	TON	10	\$ 115.00	\$ 1,150
	BM-25.0D	TON	10	\$ 107.00	\$ 1,070
	Stone 21B	TON	30	\$ 36.00	\$ 1,080
	Saw Cutting	LF	200	\$ 50.00	\$ 10,000
	Splitter Islands	SY	40	\$ 90.00	\$ 3,600
	Pavement Demolition	SY	90	\$ 10.00	\$ 900
	ROADWAY SUB-TOTAL				\$ 19,300
Hydraulics Items					
	E&S Controls	LS	1	\$ 7,077	\$ 7,077
	HYDRAULICS SUB-TOTAL				\$ 7,077
In-Plan Utilities Items					
	IN-PLAN UTILITIES SUB-TOTAL				\$ -
Traffic Items					
	Paint/Striping	LF	1,900	\$ 3.00	\$ 5,700
	Pavement Messages / Arrows / Stop Bars	EA	10	\$ 300.00	\$ 3,000
	Pavement Marking Eradication	LF	400	\$ 10.00	\$ 4,000
	Sign Panel	EA	9	\$ 30.00	\$ 270
	Retime Traffic Signal	EA	1	\$ 30,000.00	\$ 30,000
	TRAFFIC SUB-TOTAL				\$ 42,970
Structures/Bridges Items					
	STRUCTURES/BRIDGES SUB-TOTAL				\$ -
Earthwork/Materials Items					
	Regular Excavation	CY	100	\$ 25.00	\$ 2,500
	Borrow Excavation	CY	100	\$ 40.00	\$ 4,000
	Unsuitable Materials	CY	100	\$ 20.00	\$ 2,000
	EARTHWORK/MATERIALS SUB-TOTAL				\$ 8,500
Sound Wall Items					
	SOUND WALL SUB-TOTAL				\$ -
Other Items					
	OTHER SUB-TOTAL				\$ -
	MAJOR ITEMS SUBTOTAL				\$ 113,000
Construction Totals					
	Unaccounted for Items (20%)	LS	1	\$ 16,000	\$ 16,000
	Construction Contract Total				\$ 129,000
	Construction Contingency (25%)	LS	1	\$ 33,000	\$ 33,000
	Contract Contingency (5%)	LS	1	\$ 7,000	\$ 7,000
	Construction Engineering & Inspection (20%)	LS	1	\$ 26,000	\$ 26,000
	Total Construction Phase (in FY2020 Dollars)				\$ 195,000

Item Comments/Assumptions

(Project Total-200,000)*7.5%+20,000 of all items + 20% unaccounted for items less mobilization
 2% of all items + 20% unaccounted for items less mobilization

25% of Roadway Items, hydraulics, traffic, earthwork, and other items

10607 District Avg Microstation Quantities
 10610
 10643
 10128 District Avg Microstation Quantities
 68576 District Avg
 MS-1A - 21020
 Estimated

Quantities from Microstation
 2 inch Surface
 3.5 inch Intermediate
 4 inch base material
 8 inch Subbase for Truck Apron and Pavement
 Estimated
 Assumed MS-1

10% of Roadway Items, hydraulics, traffic, earthwork, and other items

54075 Painting TY B CI VI 4"
 Estimated
 Left-turn arrows, stop bars

State Avg
 Estimated
 Estimated

50108 District Average

Estimated

120
 140 19.5
 New pavement areas assumed to be excavated at average depth of 2' plus 3' x 3' x length of stormwater length x 3' length of curb and gutter x 5 for truck apron
 Regular Excavation less volume of Proposed Pavement
 100% of Regular Excavation (assumed all unsuitable soils)

20% of all items less mobilization and MOT

25% of Construction Contract Subtotal

5% of Construction Contract Subtotal

20% of Construction Contract Subtotal

First Woods Drive and Route 7 Lane Extension
 Opinion of Probable Project Costs - 12/09/2020
 Non-inflated Costs are in FY2020 Dollars

Item	Description	Unit	Quantity	Unit Cost	Extension
Mobilization Items					
	Mobilization	LS	1	\$ 16,327	\$ 16,327
	CN Surveying	LS	1	\$ 3,020	\$ 3,020
	MOBILIZATION SUB-TOTAL				\$ 19,347
Maintenance of Traffic (MOT) Items					
	Maintenance of Traffic	LS	1	\$ 26,004	\$ 26,004
	MAINTENANCE OF TRAFFIC (MOT) SUB-TOTAL				\$ 26,004
Roadway Items					
	SM-12.5D	TON	30	\$ 150.00	\$ 4,500
	SM-12.5D (Overlay)	TON	50	\$ 150.00	\$ 7,500
	IM-19.0D	TON	40	\$ 115.00	\$ 4,600
	BM-25.0D	TON	50	\$ 107.00	\$ 5,350
	Stone 21B	TON	90	\$ 36.00	\$ 3,240
	Saw Cutting	LF	350	\$ 50.00	\$ 17,500
	Splitter Islands	SY	0	\$ 90.00	\$ -
	Pavement Demolition	SY	40	\$ 10.00	\$ 400
	ROADWAY SUB-TOTAL				\$ 43,090
Hydraulics Items					
	E&S Controls	LS	1	\$ 9,456	\$ 9,456
	HYDRAULICS SUB-TOTAL				\$ 9,456
In-Plan Utilities Items					
	IN-PLAN UTILITIES SUB-TOTAL				\$ -
Traffic Items					
	Paint/Striping	LF	1,100	\$ 3.00	\$ 3,300
	Pavement Messages / Arrows / Stop Bars	EA	3	\$ 300.00	\$ 900
	Pavement Marking Eradication	LF	400	\$ 10.00	\$ 4,000
	Sign Panel	EA	9	\$ 30.00	\$ 270
	Retime Traffic Signal	EA	1	\$ 30,000.00	\$ 30,000
	TRAFFIC SUB-TOTAL				\$ 38,470
Structures/Bridges Items					
	STRUCTURES/BRIDGES SUB-TOTAL				\$ -
Earthwork/Materials Items					
	Regular Excavation	CY	200	\$ 25.00	\$ 5,000
	Borrow Excavation	CY	100	\$ 40.00	\$ 4,000
	Unsuitable Materials	CY	200	\$ 20.00	\$ 4,000
	EARTHWORK/MATERIALS SUB-TOTAL				\$ 13,000
Sound Wall Items					
	SOUND WALL SUB-TOTAL				\$ -
Other Items					
	OTHER SUB-TOTAL				\$ -
	MAJOR ITEMS SUBTOTAL				\$ 149,000
Construction Totals					
	Unaccounted for Items (20%)	LS	1	\$ 21,000	\$ 21,000
	Construction Contract Total				\$ 170,000
	Construction Contingency (25%)	LS	1	\$ 43,000	\$ 43,000
	Contract Contingency (5%)	LS	1	\$ 9,000	\$ 9,000
	Construction Engineering & Inspection (20%)	LS	1	\$ 34,000	\$ 34,000
	Total Construction Phase (in FY2020 Dollars)				\$ 256,000

Item Comments/Assumptions

(Project Total-200,000)*7.5%+20,000 of all items + 20% unaccounted for items less mobilization
 2% of all items + 20% unaccounted for items less mobilization

25% of Roadway Items, hydraulics, traffic, earthwork, and other items

10% of Roadway Items, hydraulics, traffic, earthwork, and other items

54075 Painting TY B CI VI 4"
 Estimated
 Left-turn arrows, stop bars

50108
 District Average
 Estimated

120
 140
 19.5

20% of all items less mobilization and MOT

25% of Construction Contract Subtotal
 5% of Construction Contract Subtotal
 20% of Construction Contract Subtotal

Quantities from Microstation

2 inch Surface
 2 inch Surface Overlay +/- Planning SY due to MS-1 area includes potential additional mill/overlay for approaches
 3.5 inch Intermediate
 4 inch base material
 8 inch Subbase for Truck Apron and Pavement

Estimated
 Assumed MS-1

New pavement areas assumed to be excavated at average depth of 2' plus 3' x 3' x length of stormwater length x 3' length of curb and gutter x 5 for truck apron
 Regular Excavation less volume of Proposed Pavement
 100% of Regular Excavation (assumed all unsuitable soils)