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HUNTER MILL ROAD CORRIDOR ANALYSIS REPORT

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EXECUTIVE SUMMARY

This report details the operational analyses performed to evaluate the existing and future year conditions along Hunter Mill Road between Sunrise Valley Drive and Lake Fairfax Park. Hunter Mill Road experiences recurring congestion with failing conditions during peak hours, which is heavily concentrated at Sunset Hills Road and Dulles Toll Road Westbound (WB) Ramps. With new development expected in future years, vehicular traffic along Hunter Mill Road is predicted to rise.

The Hunter Mill Road Study included extensive community involvement in the development of alternatives and goals for the project. Six community meetings were held throughout the two-year process, which began in December 2014. Their input was of critical importance in the decision to put the project on hold in July 2015 to allow for new capacity analysis methodologies for roundabouts to be adopted by the Transportation Research Board in January 2016. Community meetings were held at critical junctures of the project to review existing and no build conditions, provide input on potential alternatives, to review the analysis results of the alternatives analysis, and to provide feedback on the preferred alternative.

Six build alternatives were developed to address transportation needs along Hunter Mill Road; these alternatives incorporate design changes to the five existing intersections along the corridor including additional turn lanes, roundabouts, and signal upgrades. In addition, several alternatives include the realignment of Sunset Hills Road. From these six alternatives, a final Preferred Alternative was developed based on anticipated development in the surrounding area, forecasted traffic volumes, and community input.

Level of service (LOS) was evaluated at each intersection along the study corridor using traffic analysis software for the existing year (2014) and future years (2030 and 2050). Signalized intersections were analyzed using Synchro, while roundabouts were analyzed using SIDRA. Alternatives were evaluated in terms of their expected performance defined by LOS during AM and PM peak hours in the future years. Results show that in several cases, the volume in the peak direction exceeds the capacity of the proposed improvements, especially during the 2050 AM Peak.

Five comparative metrics were used to evaluate each alternative: level of service, right-of-way, cost, community input, and constructability. These metrics were chosen to ensure the Preferred Alternative was selected using more than just level of service and capacity as a deciding factor. The qualitative comparison of all alternatives is highlighted in the table on the following page. Findings suggest that Alternative 2 would result in the best performance in terms of LOS. Right-of-way impacts would be greatest for Alternatives 1B and 4B which include construction of roundabouts with larger footprints and the realignment of Sunset Hills Road. Due to these right-of-way impacts and roundabout construction, Alternative 1B would have the greatest associated costs, while signalization in Alternatives 2 and 3 would be more cost-effective. Alternatives 1A and 1B are rated most highly in terms of community input for their inclusion of roundabout designs, but are not as feasible in terms of constructability, especially as it would be difficult to obtain construction approval for the five-leg roundabout included in Alternative 1A.

The analyses show that no one alternative would clearly provide better operations than another in future years 2030 and 2050. To balance the desire of the community to see roundabouts implemented in the corridor, as well as the need to accommodate future travel demand in the corridor, a new alternative was developed. The Preferred Alternative includes a realignment of Sunset Hills Road to Crowell Road with a 4-leg roundabout, while the existing signals would remain at Sunrise Valley Drive, Dulles Toll Road WB Ramps, and Dulles Toll Road EB Ramps. The Preferred Alternative was selected to provide the greatest balance among the level of service, right-of-way, cost, community input, and constructability. It is expected to provide similar levels of service as the highest rated alternative during future years, depending on the period analyzed. Associated costs will be higher than for signalized Alternatives 2 and 3, but it addresses the community desire for roundabout implementation along the corridor. This alternative addresses the congestion concentrated at Sunset Hills Road and Dulles Toll Road WB Ramps by realigning Sunset Hills Road to Crowell Road and includes a roundabout that would serve as a traffic-calming transition from the segment of Hunter Mill Road in proximity to the Dulles Toll Road to neighborhood and

communities to the north. Thus, the Preferred Alternative is recommended to be incorporated into Fairfax County's Transportation Master Plan.

Comparative Metric	Roundabouts		Signals		Mix & Match		Pref. Alt.
	Alt. 1A	Alt. 1B	Alt. 2	Alt. 3	Alt. 4A	Alt. 4B	
Level of Service	*	**	***	**	*	**	**
Right-of-Way	**	*	**	**	**	*	**
Cost	**	*	***	***	**	**	**
Community Input	***	***	*	**	**	**	**
Constructability	*	**	***	***	**	**	***

Each element rated as follows:
* Worst
** Average
*** Best

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1.0 INTRODUCTION

As part of RK&K's 2012 On-Call for Transportation and Urban Planning with Fairfax County, existing and future year conditions along Hunter Mill Road between Sunrise Valley Drive and Lake Fairfax Park were evaluated. As part of this study, alternatives to the existing configuration were developed, detailed roundabout geometric feasibility studies were performed, and operational analyses of the existing conditions and all future year alternatives were completed. This report includes a recommendation of a preferred alternative which was developed based on the analyses performed and feedback from the public.

2.0 PROJECT BACKGROUND

Hunter Mill Road serves as a connection between the Dulles Toll Road and residential areas east of Reston. In the study area, Hunter Mill Road is designated as a Virginia Byway. Currently, vehicular traffic along Hunter Mill Road from Sunrise Valley Drive to the Colvin Run Bridge experiences recurring congestion and failing conditions during peak hours. The congestion is heavily concentrated at the intersections of Sunset Hills Road and the Dulles Toll Road Westbound (WB) Ramps with Hunter Mill Road, in part due to their proximity – the two intersections are approximately 150 feet apart. Additionally, with new development expected in Reston and an associated increase in background traffic, it is anticipated that vehicular traffic along Hunter Mill Road will continue to rise. Therefore, Fairfax County Department of Transportation (FCDOT) initiated a study to develop viable transportation improvements which address traffic and community concerns along Hunter Mill Road.

Proposed alternatives incorporated design changes to intersections in the study area including additional turn lanes, roundabouts, and signal upgrades. In addition to these intersection modifications, most alternatives include the realignment of Sunset Hills Road. The purpose of this report is to present existing and future year operational analyses for the intersections along the corridor, to provide a summary of the development and analysis of the alternatives, and to designate a preferred alternative to be incorporated into Fairfax County's Transportation Master Plan.

3.0 PROJECT PROCESS

The Hunter Mill Road Study included extensive community involvement in the development of alternatives and goals for the project. The Preferred Alternative documented in this report is the product of a two-year long community process, with extensive meetings and input. Six community meetings were held throughout the two-year process, which began in December 2014. This process can be seen in **Figure 3-1**. The following community meetings were held to ensure the project responded to and integrated the considerations of the community:

- December 8, 2014: Kick-Off Meeting
- February 24, 2015: Existing & No-Build conditions and community input on alternatives
- May 20, 2015: Analysis Findings
- July 2015: Project put on hold at request of community to allow for new capacity analysis methodologies for roundabouts to be adopted by the Transportation Research Board in January 2016
- June 30, 2016: Roundabout capacity results
- September 15, 2016: Alternatives developed and results presented
- November 17, 2016: Staff Preferred Alternative presented and discussed

After each public meeting, the presentations were made available on the project website so that the community could review the presentation in detail and submit any comments or questions to the project manager.

Community input was of critical importance in the decision to put the project on hold in July 2015. Due to the strong community desire to see the roundabout alternatives perform as well as possible, a request was made that staff put the project on hold to allow for new capacity analysis methodologies for roundabouts to be adopted by the Transportation Research Board (TRB) in January 2016. The TRB work resulted in a re-assessment of roundabout capacity models for the Highway Capacity Manual. The new methodology resulted in an approximate 10 to 12 percent increase in roundabout capacity when analyzed. This capacity difference was due to the way the

new capacity tool prioritizes movements with higher volumes, which results in improved levels of service for heavier movement and the overall intersection LOS.

Once the new capacity methodology was approved and integrated into an analysis tool, the study was reinitiated in May 2016. Results of the analysis with the new capacity were shared with the community in June 2016. At this meeting, there was a strong desire vocalized to see more variation between the alternatives developed. This led to the development of more alternatives, which were presented to the community in September 2016. The Preferred Alternative was presented to the community in November 2016, after which there was a month long open comment period.

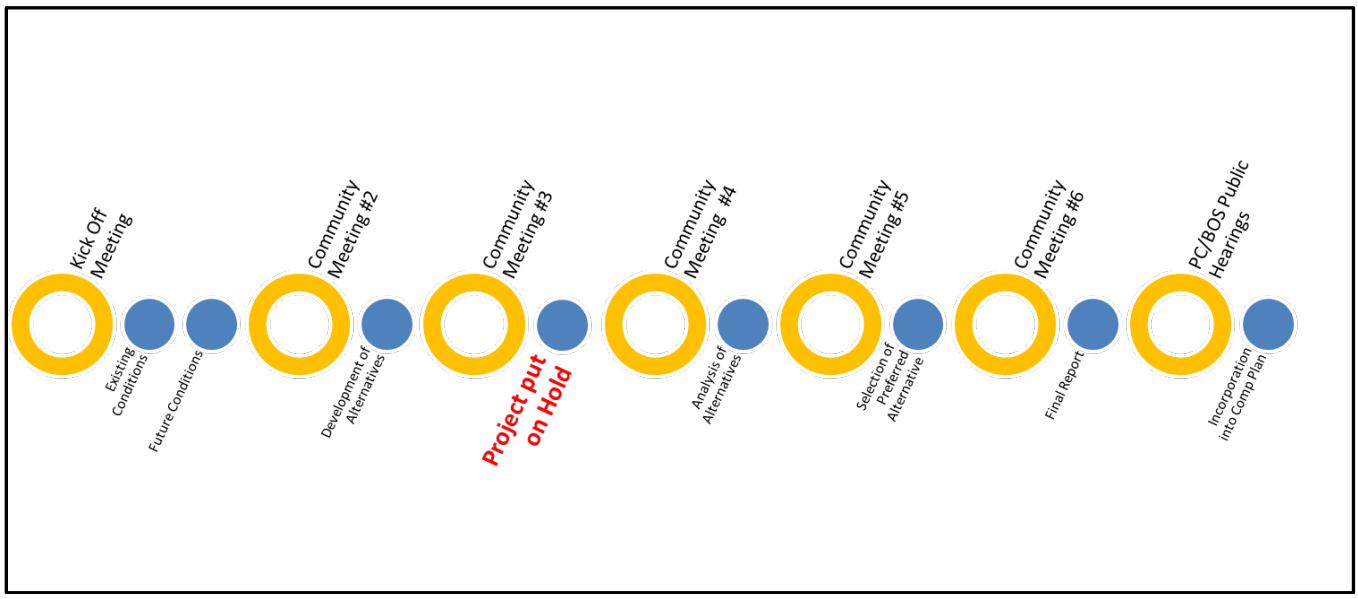


Figure 3-1. Public Outreach Process

4.0 EXISTING CONDITIONS

The study area for the analysis is shown in **Figure 4-1** while **Table 4-1** shows the analyzed intersections and their existing control types. In 2015, the Virginia Department of Transportation (VDOT) recorded Average Annual Daily Traffic (AADT) along the facility ranging from 21,000 vehicles per day between Sunrise Valley Drive and Dulles Toll Road to 7,200 vehicles per day north of Crowell Road. Per the Functional Classification Tables within Fairfax County Comprehensive Plan, Hunter Mill Road is currently a Type B Minor Arterial with one continuous lane in each direction and a 35 mile per hour (mph) speed limit.

Sunrise Valley Drive is currently classified as an Urban Minor Arterial with one lane in each direction east of Hunter Mill Road and two lanes in each direction west of Hunter Mill Road. It has a 35-mph speed limit. Dulles Toll Road is currently classified as a Freeway/Expressway with four lanes per direction within the study area and a 55-mph speed limit. Sunset Hills Road is currently classified as a Type B Minor Arterial with one lane in each direction and a 35-mph speed limit. Crowell Road is currently classified as an Urban Minor Arterial with one lane in each direction and a 35-mph speed limit.

4.1 Existing Year (2014) Traffic Volumes

Peak hour turning movement counts used in the operational analysis of existing conditions were collected at the seven (7) study intersections on November 5, 6, and 12, 2014. Data collection took place on a non-holiday Wednesday or Thursday; thus, volumes were not seasonally adjusted. The counts for each intersection were then balanced proportionally to ensure no volume loss along the corridor and that the differences from the collected counts were less than 10 percent. Existing peak hour turning movement volumes for each intersection are shown in **Figure 4-2.**

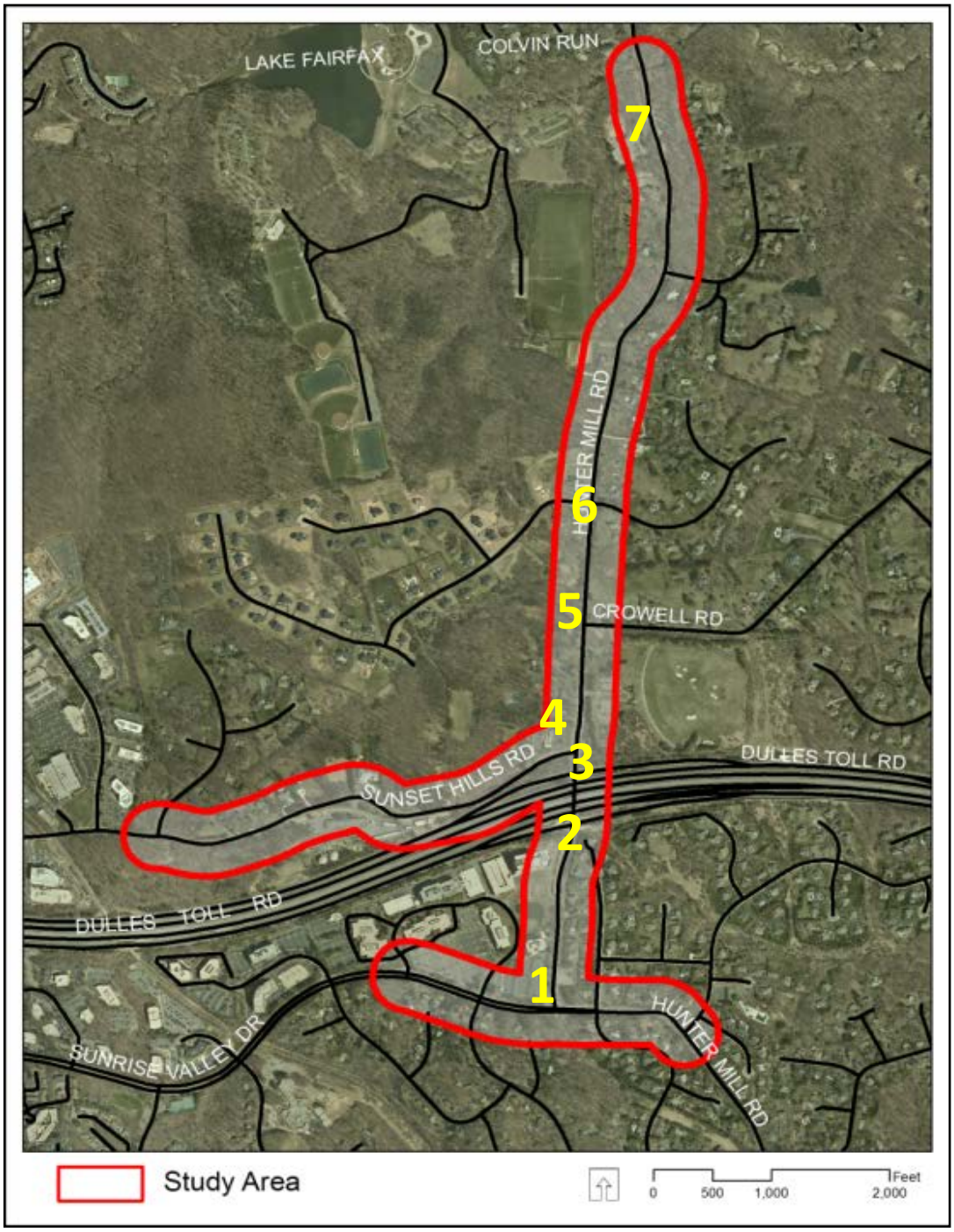


Figure 4-1. Study Area

Table 4-1. Existing Intersection Control

Number (in Fig. 4-1)	Intersection	Intersection Control Type
1	Hunter Mill Road at Sunrise Valley Drive	Signalized
2	Hunter Mill Road at DTR EB Ramps	Signalized
3	Hunter Mill Road at DTR WB Ramps	Signalized
4	Hunter Mill Road at Sunset Hills Road	Signalized
5	Hunter Mill Road at Crowell Road	Unsignalized (All-Way Stop)
6	Hunter Mill Road at Hunting Crest Lane	Unsignalized (Two-Way Stop)
7	Hunter Mill Road at Lake Fairfax Park	Unsignalized (Two-Way Stop)

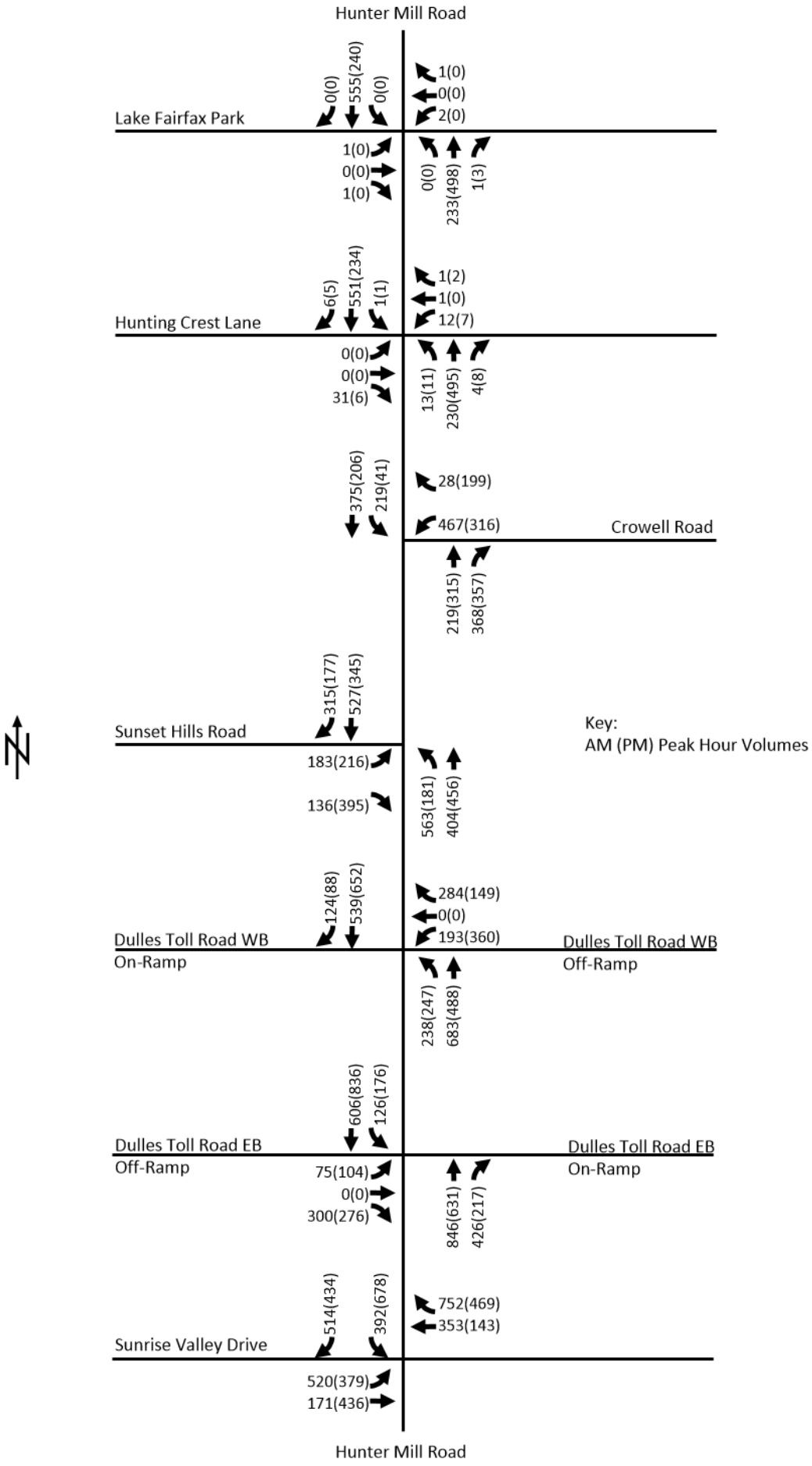


Figure 4-2. 2014 Existing Peak Hour Traffic Volumes

4.2 Existing Year (2014) Measures of Effectiveness

The measures of effectiveness (MOEs) used to evaluate the existing year (2014) conditions include delay (in seconds per vehicle), level of service (LOS), and 95th percentile queue length (in feet). The LOS thresholds for signalized and unsignalized intersections as defined by the Highway Capacity Manual (HCM) 2010 are presented in **Table 4-2**.

Table 4-2. Intersection LOS Thresholds based on Highway Capacity Manual 2010

LOS	Delay Threshold (seconds per vehicle)	
	Signalized	Unsignalized
A	≤10	≤10
B	10-20	10-15
C	20-35	15-25
D	35-55	25-35
E	55-80	35-50
F	≥80	≥50

Peak hour operational analyses for existing conditions were performed using the HCM module within *Synchro*, with microsimulation performed in accompanying software *SimTraffic*. *Synchro*/*SimTraffic* Version 8 was used to perform the analyses for existing conditions. All *SimTraffic* results are based on the average of 15 one-hour runs with a preceding 15-minute seeding period. The seeding period fills the traffic network with vehicles prior to simulation and 15 runs were completed to ensure consistent results. LOS and delay results are reported from *Synchro* and 95th percentile queue lengths are reported from *SimTraffic*.

The results of the operational analysis for existing conditions from Sunrise Valley Drive to Crowell Road, presented in **Table 4-3**, indicate acceptable (LOS D) or better operations at all signalized intersections and two of the three unsignalized intersections. While the overall operations are acceptable, many individual movements and approaches, particularly those with heavy turning volumes, experience unacceptable (LOS E or F) operations during one or both peaks. Of the unsignalized intersections, Hunter Mill Road and Crowell Road experiences unacceptable operations, where the all-way stop control results in LOS F for the northbound and westbound approaches during both peak hours and for the southbound approach during the AM peak hour.

Multiple intersections along Hunter Mill Road experience queuing during one or both peak hours. The queue on northbound Hunter Mill Road extends from the intersection with the Dulles Toll Road Eastbound (EB) Ramps to Sunrise Valley Drive during the AM peak. This extended queue also impacts the eastbound left at the Sunrise Valley intersection and causes queues to develop on eastbound Sunrise Valley Drive. Although not presented in **Table 4-3**, the results for the intersections at Hunting Crest Lane and Lake Fairfax Park are shown within the existing year *Synchro*/*SimTraffic* reports in **Appendix B**. These two intersections, while included as count locations, were determined to be adequately designed for the future. The results show that all approaches at both intersections operate at LOS C or better during both peak periods, with more extensive queueing at the southbound approach at Hunting Crest Lane during the AM Peak.

Table 4-3. Existing Year (2014) MOE Results

Intersection	Movement	2014 AM Peak				2014 PM Peak			
		Volumes	Delay (s/veh.)	LOS	95th % Queue (ft.)	Volumes	Delay (s/veh.)	LOS	95th % Queue (ft.)
Hunter Mill Road at Sunrise Valley Drive 	SBL	392	52.9	*D*	485	678	25.7	*C*	490
	SBR	514	0.6	*A*	300	434	0.4	A	290
	SB	-	***22.8***	***C***	-	-	***15.6***	***B***	-
	EBL	520	52.5	*D*	2,420	379	46.2	D	185
	EBT	171	10.1	*B*	1,885	436	29.5	C	435
	EB	-	***42.3***	***D***	-	-	***36.9***	***D***	-
	WBT	353	36.7	*D*	1,165	143	41.0	D	245
	WBR	752	38.6	*D*	820	469	37.8	D	100
	WB	-	***38.0***	***D***	-	-	***38.6***	***D***	-
	Overall	-	**33.9**	***C***	-	-	**28.2**	**C**	-
Hunter Mill Road at Dulles Toll Road EB Ramps 	NB T/R	846	22.5	C	1,690	631	13.2	B	415
	NBR	426	3.2	A	1,835	217	0.5	A	160
	NB	-	***16.6***	***B***	-	-	***10.2***	***B***	-
	SBL	126	42.9	D	155	176	60.6	E	180
	SBT	606	5.6	A	200	836	7.0	A	270
	SB	-	***13.1***	***B***	-	-	***17.7***	***B***	-
	EBL	75	52.0	D	695	104	42.7	D	870
	EBR	300	51.7	D	110	276	46.9	D	125
	EB	-	***51.8***	***D***	-	-	***45.8***	***D***	-
	Overall	-	**21.9**	**C**	-	-	**20.0**	**B**	-
Hunter Mill Road at Dulles Toll Road WB Ramps 	NBL	238	20.3	C	190	488	64.0	E	165
	NBT	683	11.6	B	430	247	30.7	C	470
	NB	-	***13.8***	***B***	-	-	***41.8***	***D***	-
	SBT	539	3.5	A	80	652	23.5	C	115
	SBR	124	0.0	A	20	88	0.6	A	30
	SB	-	***2.9***	***A***	-	-	***20.7***	***C***	-
	WBL	193	69.3	E	250	360	71.0	E	470
	WBR	284	43.1	D	230	149	30.8	C	130
	WB	-	***54.9***	***D***	-	-	***59.1***	***E***	-
	Overall	-	**20.8**	**C**	-	-	**38.2**	**D**	-
Hunter Mill Road at Sunset Hills Road 	NBL	563	44.4	D	135	181	30.8	C	115
	NBT	404	2.5	A	55	456	3.0	A	85
	NB	-	***25.5***	***C***	-	-	***12.1***	***B***	-
	SBT	527	50.0	D	395	345	46.1	D	780
	SBR	315	21.1	C	290	177	20.6	C	335
	SB	-	***39.0***	***D***	-	-	***37.2***	***D***	-
	EBL	183	111.0	F	335	216	159.2	F	530
	EBR	136	47.7	D	175	395	40.7	D	430
	EB	-	***82.3***	***F***	-	-	***85.6***	***F***	-
	Overall	-	**39.2**	**D**	-	-	**43.9**	**D**	-
Hunter Mill Road at Crowell Road 	NB T/R	219/368	64.4	F	320	315/357	62.1	F	375
	SB L/T	219/375	66.6	F	1,310	41/206	19.5	C	110
	WB L/R	467/28	67.1	F	620	316/199	63.2	F	275
	Overall	-	**66.0**	**F**	-	-	**54.6**	**F**	-

5.0 FUTURE YEAR NO BUILD ALTERNATIVE ANALYSIS

When compared to existing conditions, the No Build alternative, shown in **Figure 5-1**, includes the widening of Sunset Hills Road to four lanes (two per direction), as recommended in the Fairfax County Comprehensive Plan, and the signalization of the intersection of Hunter Mill Road and Crowell Road with dedicated southbound left and northbound right turn lanes, which were proposed as a condition of the Oakcrest School rezoning. These improvements are included in the No Build alternative as they have been identified as necessary improvements in the future; the recommendations of this study are meant to build on the previously identified improvements. The existing signalized intersections retain the same configuration as in the existing conditions. The No Build scenario has a total of five signalized intersections within the study area: at Sunrise Valley Drive, Dulles Toll Road EB Ramps, Dulles Toll Road WB Ramps, Sunset Hills Road, and Crowell Road. The intersections at Hunting Crest Lane and Lake Fairfax Park are unchanged from existing conditions.

5.1 Future Year No Build Traffic Volumes

Forecasted traffic volume data for the study intersections were provided by FCDOT. Balanced network volumes for 2030 and 2050 were used to perform the analysis. **Figure 5-2** and **Figure 5-3** show the 2030 and 2050 No Build volumes for the network, respectively. The 2030 volumes were developed as part of the Reston Phase I Comprehensive Plan amendment, and the plan assumed that many new transportation facilities necessary to support new development around the Reston Metrorail Stations would not yet be in place. The 2050 volumes are from the Reston Network Analysis which account for additional crossings of the Dulles Toll Road.

5.2 Future Year No Build Measures of Effectiveness

The MOEs used to evaluate the No Build alternative included delay (in seconds per vehicle), level of service (LOS), and the 95th percentile queue length (in feet). The LOS thresholds for signalized and unsignalized intersections as defined by the Highway Capacity Manual (HCM) 2010 were presented in **Table 4-2** in Section 4.2.

Peak hour operational analyses for the No Build alternative were performed using the HCM module within *Synchro*, with microsimulation performed in accompanying software *SimTraffic*. *Synchro*/*SimTraffic* Version 8 was used to perform analyses for the 2030 No Build alternative while *Synchro*/*SimTraffic* Version 9 was used to perform the analyses for the 2050 No Build alternative. The difference in Version utilized is due to the project schedule during which the 2030 analysis was performed prior to the release of Version 9. As each of the versions utilize the same HCM methodology, there is no difference in results between the two. For signalized intersections, network cycle lengths and network offsets were optimized in *Synchro*. All *SimTraffic* results are based on the average of 15 one-hour runs with a preceding 15-minute seeding period. Delay and LOS results are reported from *Synchro* while 95th percentile queue lengths are reported from *SimTraffic*.

Results for the intersections at Hunting Crest Lane and Lake Fairfax Park are not presented within the tables in the following subsections, but are shown in the *Synchro*/*SimTraffic* reports for the No Build alternative in **Appendix C**. The results indicate that both two-way stop-controlled intersections operate at LOS C or above during both peak periods in 2030. During the 2050 AM Peak, the eastbound and westbound approaches at Hunting Crest lane show LOS E and F, respectively. This is a condition of the high southbound through volume on Hunter Mill Road, which creates few acceptable gap opportunities for eastbound and westbound traffic. The eastbound approach at Lake Fairfax Park shows LOS D, again a condition of the high southbound through volume on Hunter Mill Road during this period. During the 2050 PM Peak, the eastbound and westbound approaches at Hunting Crest lane show LOS D and E, respectively, this time a condition of the high northbound through volume. The intersection at Lake Fairfax Park is not expected to have any delay or queuing on the minor street because there is no expected volume on the eastbound and westbound approaches during this period.

Figure 5-1 HUNTER MILL ROAD AND SUNSET HILLS ROAD - NO BUILD WITH PROFFERS MAP

Date: February 25, 2015

FAIRFAX COUNTY, VA

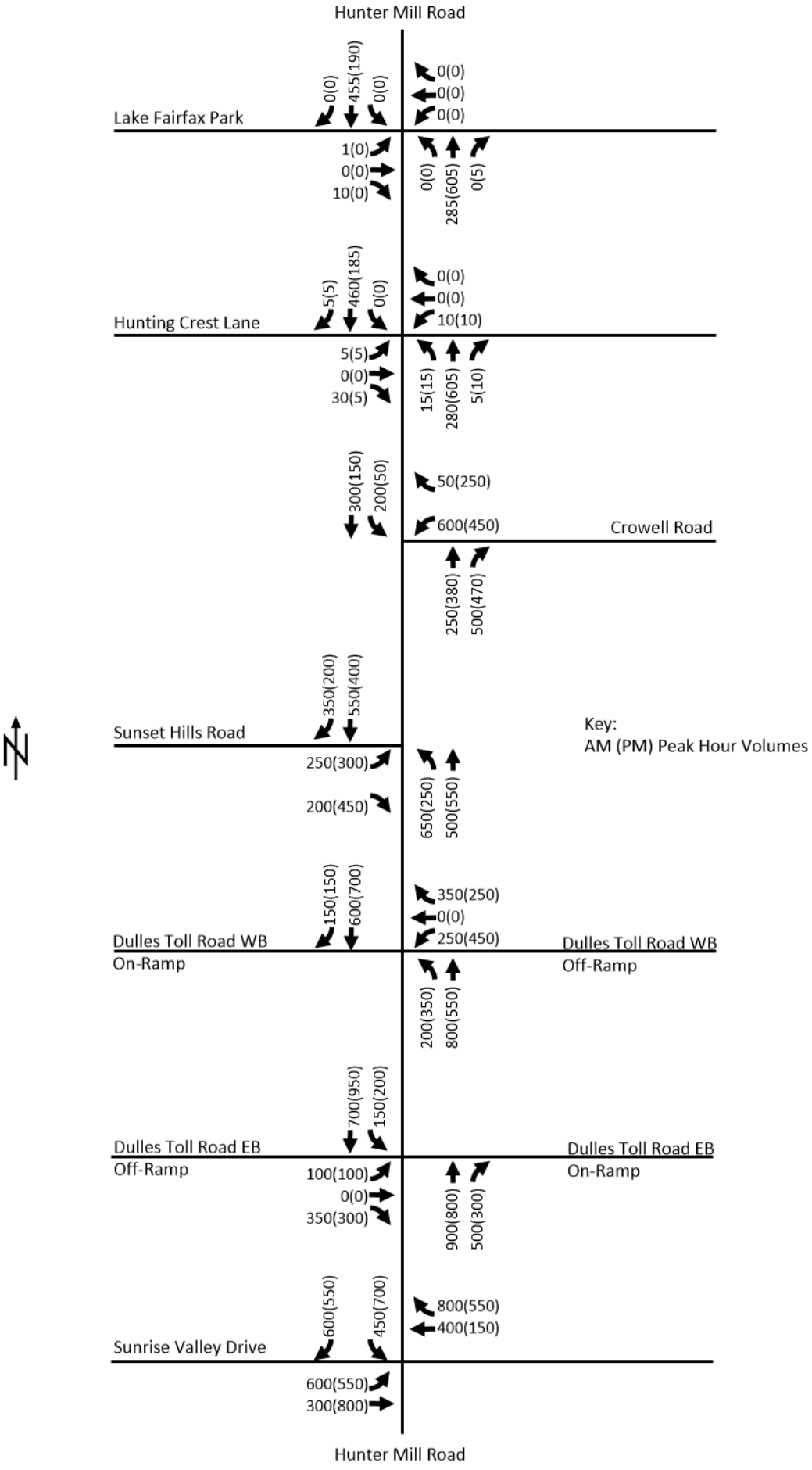


Figure 5-2. 2030 No Build Peak Hour Traffic Volumes

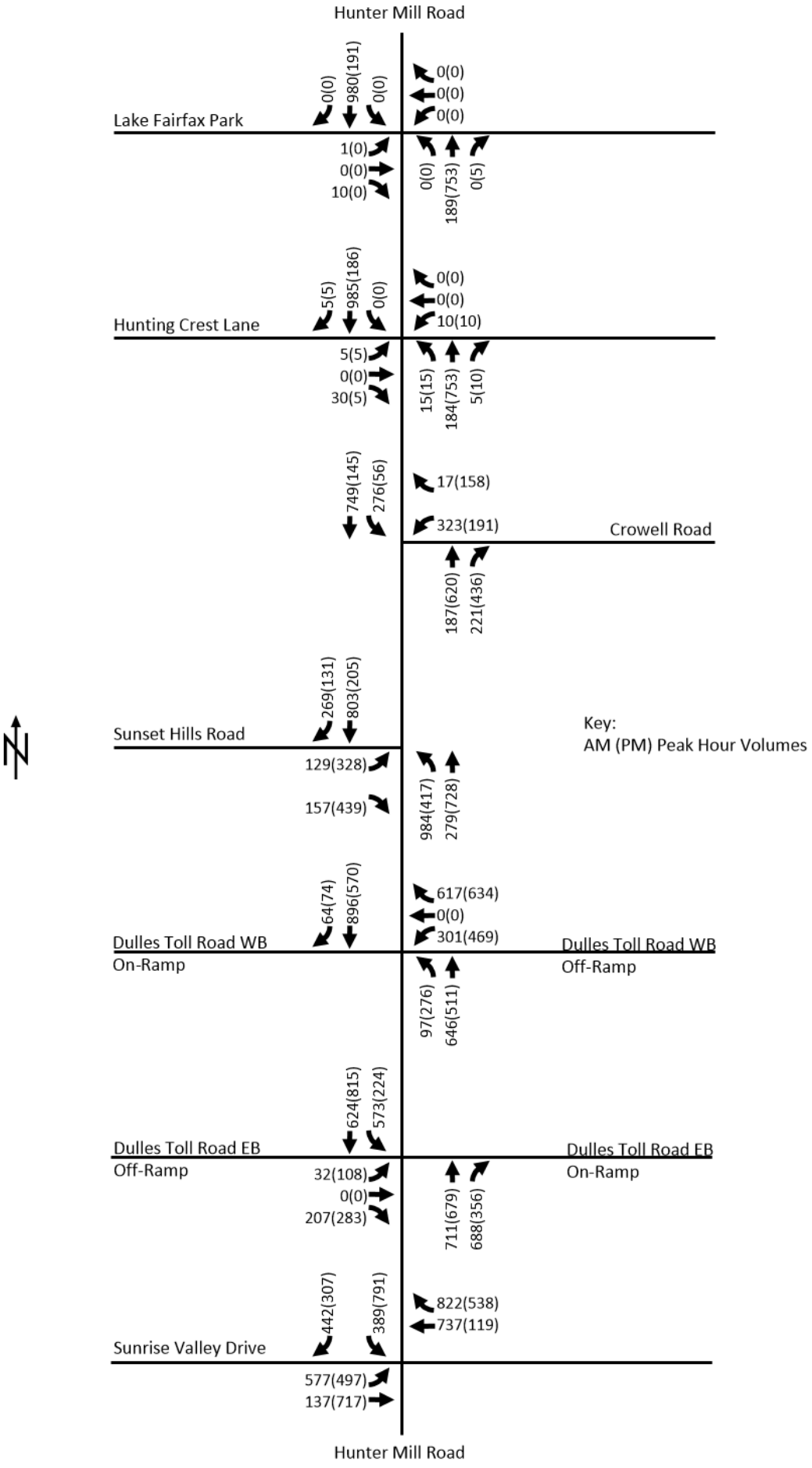


Figure 5-3. 2050 No Build Peak Hour Traffic Volumes

2030 No Build Operational Analysis

During the **2030 AM Peak**, the No Build results indicate acceptable operations (LOS D or better) at all intersections from Sunrise Valley Drive to Crowell Road. While overall operations are acceptable, 3 of 15 (20 percent) approaches and 7 of 29 (24 percent) turning movements operate at LOS E or F. Conversion of Hunter Mill Road and Crowell Road to a signalized intersection is expected to provide acceptable levels of service for all movements and approaches during this period.

During the **2030 PM Peak**, acceptable operations are provided at four out of five intersections from Sunrise Valley Drive to Crowell Road, with only the intersection at Dulles Toll Road WB Ramps operating at LOS E. Throughout this period, 6 of 15 (21 percent) approaches and 8 of 29 (28 percent) turning movements operate at LOS E or F. The intersection at Hunter Mill Road and Crowell Road is again expected to provide acceptable levels of service for all movements and approaches.

Results of the 2030 operational analysis for intersections within the No Build scenario from Sunrise Valley Drive to Crowell Road are shown in **Table 5-1**.

2050 No Build Operational Analysis

During the **2050 AM Peak**, acceptable operations (LOS D or better) are expected at three out of five intersections from Sunrise Valley Drive to Crowell Road. Overall operations are acceptable only at Hunter Mill Road and its intersections with Dulles Toll Road WB Ramps and Crowell Road. The latter intersection is expected to provide acceptable levels of service for all movements and approaches during this period. Throughout this period, 6 of 15 (21 percent) approaches and 11 of 29 (38 percent) movements show LOS E or F.

During the **2050 PM Peak**, acceptable operations are provided at all intersections from Sunrise Valley Drive to Crowell Road. Throughout this period, 3 of 15 (20 percent) approaches and 4 of 29 (14 percent) movements operate at LOS E, with none at LOS F. Two intersections – at Dulles Toll Road WB Ramps and Sunset Hills Road – are not expected to have any movements or approaches operating below LOS D.

Results of the 2050 operational analysis for intersections within the No Build scenario from Sunrise Valley Drive to Crowell Road are shown in **Table 5-2**.

Table 5-1. 2030 No Build MOE Results

Intersection	Movement	2030 AM Peak				2030 PM Peak			
		Volumes	Delay (s/veh.)	LOS	95th % Queue (ft.)	Volumes	Delay (s/veh.)	LOS	95th % Queue (ft.)
Hunter Mill Road at Sunrise Valley Drive 	SBL	450	56.7	E	1,010	700	69.7	E	390
	SBR	600	0.6	A	355	550	0.5	A	265
	SB	-	*24.2*	*C*	-	-	*38.7*	*D*	-
	EBL	600	63.4	E	2,910	550	54.5	D	735
	EBT	300	12.4	B	2,700	800	71.0	E	1,115
	EB	-	*46.8*	*D*	-	-	*64.6*	*E*	-
	WBT	400	44.8	D	1,140	150	34.6	C	875
	WBR	800	43.5	D	825	550	34.2	C	780
	WB	-	*44.0*	*D*	-	-	*34.3*	*C*	-
	Overall	**-**	**38.1**	**D**	**-**	**-**	**48.8**	**D**	**-**
Hunter Mill Road at Dulles Toll Road EB Ramps 	NBT	900	29.2	C	1,690	800	22.5	C	1,985
	NBR	500	2.4	A	1,880	300	0.8	A	2,240
	NB	-	*20.5*	*C*	-	-	*16.9*	*B*	-
	SBL	150	75.2	E	195	200	66.4	E	180
	SBT	700	5.5	A	240	950	7.9	A	180
	SB	-	*19.8*	*B*	-	-	*19.5*	*B*	-
	EBL	100	51.8	D	2,100	100	42.2	D	3,865
	EBR	350	81.7	F	125	300	72.6	E	100
	EB	-	*74.8*	*E*	-	-	*65.1*	*E*	-
	Overall	**-**	**30.6**	**C**	**-**	**-**	**25.9**	**C**	**-**
Hunter Mill Road at Dulles Toll Road WB Ramps 	NBL	200	20.1	C	180	350	192.9	F	145
	NBT	800	29.1	C	430	550	37.4	D	425
	NB	-	*27.3*	*C*	-	-	*97.4*	*F*	-
	SBT	600	4.3	A	100	700	26.0	C	115
	SBR	150	0.0	A	30	150	0.1	A	45
	SB	-	*3.5*	*A*	-	-	*21.3*	*C*	-
	WBL	250	86.1	F	530	450	147.1	F	1,000
	WBR	350	41.9	D	740	250	31.4	C	1,150
	WB	-	*62.4*	*E*	-	-	*105.2*	*F*	-
	Overall	**-**	**29.8**	**C**	**-**	**-**	**73.1**	**E**	**-**
Hunter Mill Road at Sunset Hills Road 	NBL	650	56.2	E	120	250	33.9	C	105
	NBT	500	3.3	A	45	550	3.8	A	110
	NB	-	*31.5*	*C*	-	-	*14.6*	*B*	-
	SBT	550	44.1	D	1,125	400	81.3	F	1,175
	SBR	350	11.3	B	345	200	18.0	B	350
	SB	-	*31.2*	*C*	-	-	*59.4*	*E*	-
	EBL	250	119.7	F	555	300	168.2	F	1,345
	EBR	200	44.7	D	190	450	37.7	D	1,615
	EB	-	*84.4*	*F*	-	-	*93.3*	*F*	-
	Overall	**-**	**41.1**	**D**	**-**	**-**	**53.4**	**D**	**-**
Hunter Mill Road at Crowell Road 	NBT	250	25.6	C	190	380	27.5	C	210
	NBR	500	6.7	A	135	470	4.5	A	125
	NB	-	*13.2*	*B*	-	-	*14.9*	*B*	-
	SBL	200	21.0	C	190	50	20.0	B	80
	SBT	300	21.2	C	240	150	19.5	B	140
	SB	-	*21.1*	*C*	-	-	*19.6*	*B*	-
	WBL	600	-	-	-	450	-	-	-
	WBR	50	-	-	-	250	-	-	-
	WB	-	*42.1*	*D*	*900*	-	*40.9*	*D*	*4,220*
	Overall	**-**	**24.7**	**C**	**-**	**-**	**26.1**	**C**	**-**

Table 5-2. 2050 No Build MOE Results

Intersection	Movement	2050 AM Peak				2050 PM Peak			
		Volumes	Delay (s/veh.)	LOS	95th % Queue (ft.)	Volumes	Delay (s/veh.)	LOS	95th % Queue (ft.)
Hunter Mill Road at Sunrise Valley Drive 	SBL	389	94.6	F	455	791	54.2	D	410
	SBR	442	0.4	A	0	307	0.2	A	0
	SB	-	*43.8*	*D*	-	-	*3.8*	*D*	-
	EBL	577	102.0	F	3,970	497	58.5	E	480
	EBT	137	8.0	A	4,210	717	65.0	E	815
	EB	-	*84.5*	*F*	-	-	*62.3*	*E*	-
	WBT	737	68.6	E	1,130	119	37.0	D	125
	WBR	822	36.0	D	840	538	35.8	D	170
	WB	-	*52.6*	*D*	-	-	*36.0*	*D*	-
	Overall	**-**	**57.6**	**E**	**-**	**-**	**47.8**	**D**	**-**
Hunter Mill Road at Dulles Toll Road EB Ramps 	NBT	711	74.0	E	1,740	679	17.9	B	870
	NBR	688	32.1	C	1,840	356	1.7	A	590
	NB	-	*55.2*	*E*	-	-	*12.8*	*B*	-
	SBL	573	114.6	F	235	224	44.1	D	175
	SBT	624	2.8	A	460	815	5.0	A	120
	SB	-	*61.5*	*E*	-	-	*14.7*	*B*	-
	EBL	32	76.5	E	375	108	44.4	D	305
	EBR	207	69.9	E	120	283	60.2	E	125
	EB	-	*70.8*	*E*	-	-	*55.7*	*E*	-
	Overall	**-**	**59.4**	**E**	**-**	**-**	**21.4**	**C**	**-**
Hunter Mill Road at Dulles Toll Road WB Ramps 	NBL	97	72.4	E	195	276	13.7	B	170
	NBT	646	7.2	A	430	511	7.2	A	495
	NB	-	*15.7*	*B*	-	-	*9.5*	*A*	-
	SBT	896	33.7	C	115	570	31.9	C	120
	SBR	64	15.8	B	10	74	27.0	C	35
	SB	-	*32.5*	*C*	-	-	*31.3*	*C*	-
	WBL	301	48.8	D	650	469	51.3	D	550
	WBR	617	82.9	F	555	634	45.8	D	555
	WB	-	*71.7*	*E*	-	-	*48.1*	*D*	-
	Overall	**-**	**41.5**	**D**	**-**	**-**	**31.9**	**C**	**-**
Hunter Mill Road at Sunset Hills Road 	NBL	984	40.0	D	135	417	5.1	A	120
	NBT	279	1.9	A	115	728	8.4	A	130
	NB	-	*31.6*	*C*	-	-	*7.2*	*A*	-
	SBT	803	3.5	A	240	205	6.3	A	175
	SBR	269	3.4	A	215	131	6.5	A	100
	SB	-	*3.5*	*A*	-	-	*6.4*	*A*	-
	EBL	129	86.1	F	1,100	328	44.3	D	870
	EBR	157	62.3	E	945	439	28.8	D	815
	EB	-	*73.0*	*E*	-	-	*35.4*	*D*	-
	Overall	**-**	**24.6**	**C**	**-**	**-**	**16.7**	**B**	**-**
Hunter Mill Road at Crowell Road 	NBT	187	13.4	B	85	620	20.4	C	160
	NBR	221	3.1	A	60	436	6.4	A	80
	NB	-	*7.9*	*A*	-	-	*14.8*	*B*	-
	SBL	276	7.7	A	305	56	11.5	B	70
	SBT	749	14.8	B	1,080	145	6.9	A	80
	SB	-	*12.8*	*B*	-	-	*8.3*	*A*	-
	WBL	323	-	-	-	191	-	-	-
	WBR	17	-	-	-	158	-	-	-
	WB	-	*44.6*	*D*	*2,855*	-	*56.8*	*E*	*325*
	Overall	**-**	**17.3**	**B**	**-**	**-**	**23.1**	**C**	**-**

6.0 DEVELOPMENT OF BUILD ALTERNATIVES

To address existing deficiencies and expected future travel demand within the study area, multiple improvement options were developed. The developed alternatives considered the needs and concerns of both the drivers utilizing the corridor and the community living along it and incorporated several possible changes to existing intersections, including adding new turn lanes, roundabouts, and signal upgrades. Additionally, these adjustments were developed in consideration of expected traffic volumes and future development. Several alternatives included the realignment of Sunset Hills Road, described in Section 6.2, to create a new four-leg intersection with Hunter Mill Road and Crowell Road. Two alternatives included a five-leg roundabout incorporating approaches for Sunset Hills Road, Dulles Toll Road WB Ramps, and Hunter Mill Road, described in Section 6.3.

6.1 Description of Alternatives

Table 6-1 displays a summary of the intersection control types for each alternative. At the beginning of the process, alternatives with only roundabouts (Alternatives 1A and 1B) and alternatives with only signals (Alternatives 2 and 3) were developed and analyzed. Later, after receiving community input on the initial alternatives, "mix and match" alternatives (Alternatives 4A and 4B) were developed and analyzed; these included both signalized intersections and roundabouts. Initial analyses included an Alternative 2A, which was the same as Alternative 2 except it included an all-way stop-controlled intersection at Hunter Mill Road and Crowell Road. The analyses showed that during every studied period, Alternative 2A produced a failing intersection at Hunter Mill Road and Crowell Road. The all-way stop condition (which is over-capacity in the current condition) is only expected to degrade further because of future traffic growth. This is especially true when compared to the signalization at this intersection in Alternative 2 that is expected to provide an acceptable level of service during all time periods. Therefore, Alternative 2A was removed from consideration as a design possibility after discussion with FCDOT. **Figures 7-3** through **7-8** show each alternative.

Table 6-1. Intersection Control Type by Alternative

Intersection	No Build	Alt. 1A	Alt. 1B	Alt. 2*	Alt. 3	Alt. 4A	Alt. 4B
Hunter Mill Road at Sunrise Valley Drive							
Hunter Mill Road at Dulles Toll Road EB Ramps							
Hunter Mill Road at Dulles Toll Road WB Ramps		-				-	
Hunter Mill Road at Dulles Toll Road WB Ramps at Sunset Hills Road	-		-	-	-		-
Hunter Mill Road at Sunset Hills Road		-	-		-	-	-
Hunter Mill Road at Crowell Road			-		-		-
Hunter Mill Road at Crowell Road / Sunset Hills Road	-	-		-		-	

*Includes the realignment of Sunset Hills Road to a point between Dulles Toll Road WB Ramps and Crowell Road

6.2 Realignment of Sunset Hills Road

As discussed elsewhere in this report, one of the key bottlenecks along the corridor is at the intersections of Hunter Mill Road at Sunset Hills Road and the Dulles Toll Road, which are approximately 150 feet apart. To move traffic more efficiently through the corridor and improve intersection safety, the realignment of Sunset Hills Road further north to increase the distance between Sunset Hills Road and the Dulles Toll Road WB Ramps was examined. Multiple alternatives examined a realignment to Crowell Road, while one alignment considered moving the intersection of Sunset Hills Road to a midpoint between Crowell Road and the Dulles Toll Road WB Ramps. The realignment of Sunset Hills Road to Crowell Road underwent a more detailed design process, and two designs were initially developed, both of which included converting the intersection at Crowell Road to a four-way intersection. Later, a preferred realignment was identified after it was determined that the soccer field at Fairfax Christian School was no longer a control point for the realignment.

Design Criteria

The study area serves as a gateway between the urban/commercialized area of Reston to the west and the more rural/residential land to the north and east. For this reason, this section of Sunset Hills Road is classified as an Urban Collector with a design speed of 40 mph and a posted speed limit of 35 mph. Therefore, the geometric design standard used is GS-7 with rolling terrain from VDOT's Roadway Design Manual. **Table 6-2** highlights some of the design criteria adhered to in the development of these alternatives.

Table 6-2. Sunset Hills Road Design Criteria

Criterion	Value
Design Speed	40 mph
Minimum Curve Radius	536 feet
Maximum Superelevation Rate	4.0%
Maximum Vertical Grade	10%
Minimum K Value (crest/sag)	44/64

The rolling nature of the topography in this heavily wooded area presents a constraint that was considered in the development of these alternatives. From a cost standpoint, an effective strategy is to try and minimize the earthwork needed for the roadway; however, it is important to minimize impacts to the natural flow of water and avoid blocking natural channels, so the inclusion of box culverts and other drainage systems could be necessary to properly drain the roadway to maintain existing drainage networks. These challenges can be visualized in the conceptual profiles included in **Figure 6-1** and **Figure 6-2**.

Realignment Option A

Option A proposes to relocate Sunset Hills Road to the west of the existing soccer field at the Fairfax Christian School, as shown in **Figure 6-1**. This alignment avoids impacts to several properties west of Hunter Mill Road, including the Reston Presbyterian Church and Fairfax Christian School.

This option seeks to provide more separation between Sunset Hills Road and the Dulles Toll Road WB Off-Ramp, which are presently separated by only 35 feet at their closest point. This alignment would encroach on the existing parking lot for the Edlin School, which would need to be relocated. However, this alignment avoids impacts to the two structures on the properties immediately east of the Edlin School.

Realignment Option B

Option B, shown in **Figure 6-2**, seeks to avoid impacting the Edlin School and its parking lot while providing better access to the Reston Presbyterian Church. By shifting the proposed alignment of Sunset Hills Road further to the east, this option allows for a closer connection to the Church without requiring a long driveway.

By shifting the point of realignment along Sunset Hills Road further east, the alignment maintains Sunset Hills Road's existing proximity to the Dulles Toll Road WB On-Ramp (approximately 35 feet), but avoids any impacts to the Edlin School parking lot. There would not be impacts on the driveway locations for the properties east of the Edlin School in this alternative.

Preferred Realignment

The preferred realignment, shown in **Figure 6-3**, provides a greater clearance between Sunset Hills Road and the Dulles Toll Road WB On-Ramp and avoids impacts to Reston Presbyterian Church and Fairfax Christian School, as in Option A, and avoids impacts to the Edlin School and its parking lot, as in Option B. It was determined through community input considering the long-range planning horizon for the study that the soccer fields within the study area do not need to be used as a control point for the design. The preferred realignment still adheres to the design criteria listed in **Table 6-2** and the horizontal curves included in the design would provide a traffic calming measure that does not exist in the prior two realignment options.

SUNSET HILLS RD REALIGNMENT OPTION A

LEGEND

- EXIST. PROPERTY LINE
- PROP. EDGE OF PAVEMENT
- PROP. CURB

NOTES:
1. Existing property lines and contours are approximate.
2. The designs are conceptual in nature and should not be used for any level of construction.

Figure 6-1

0 100' 200'

Provides for Convenient Roadway Extension

Provides Access to Soccer Field

Requires School Parking Lot Relocation

Provides Greater Clearance between Sunset Hills & DTR

POT 41+08.27

S 86° 48' 31" E

PT 35+74.81

Curve SUNSET A2
PI = 32+78.83
DELTA = 78° 12' 35.06" (RT)
D = 10° 41' 22"
T = 435.67'
L = 731.65'
R = 536.00'
PC = 28+43.16
PT = 35+74.81

PC 28+43.16

N 14° 58' 54" E

PT 21+94.27

Curve SUNSET A1
PI = 18+69.39
DELTA = 59° 01' 27.63" (LT)
D = 8° 11' 06"
T = 396.24'
L = 721.12'
R = 700.00'
PC = 14+73.15
PT = 21+94.27

POT 10+00.00

N 74° 00' 21" E

PC 14+73.15

Crowell Road (Route 675)

Hunter Mill Road (Route 674)

Golf Park at Hunter Mill

Fairfax Christian School

Reston Presbyterian Church

Dulles Toll Rd. Off Ramp

Sunset Hills Road (Route 675)

Dulles Toll Rd. On Ramp

Metrorail Silver Line

Dulles Toll Rd.

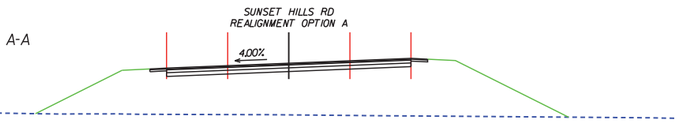
Dulles Access Rd.

Dulles Access Rd.

Dulles Toll Rd.

Dulles Toll Rd. Off Ramp

SECTION A-A



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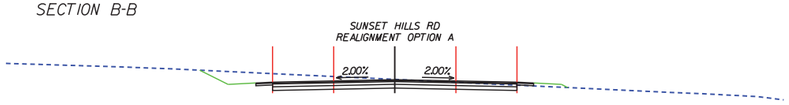

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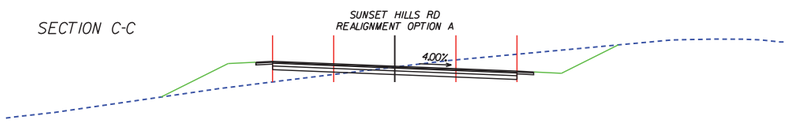


SUNSET HILLS RD REALIGNMENT OPTION B

LEGEND

- EXIST. PROPERTY LINE
- PROP. EDGE OF PAVEMENT
- PROP. CURB

NOTES:
1. Existing property lines and contours are approximate.
2. The designs are conceptual in nature and should not be used for any level of construction.

Figure 6-2

0 100' 200'

POT 36+28.05

S 86° 48' 31" E 35

PT 34+44.78

C

30

C

Curve SUNSETB2
PI = 31+39.02
DELTA = 9° 28' 41.98" (RT)
D = 10° 41' 22"
T = 550.01'
L = 855.78'
R = 536.00'
PC = 25+89.01
PT = 34+44.78

PC 25+89.01

25

B

B

Provides Access to Soccer Field

N 1° 42' 47" E

20

A

PT 19+45.90

A

Smooth Connection to Church Parking Lot

Avoids Impacts to School Parking Lot

Curve SUNSETB1
PI = 16+52.78
DELTA = 76° 30' 30.77" (LT)
D = 10° 41' 22"
T = 422.61'
L = 715.73'
R = 536.00'
PC = 12+30.17
PT = 19+45.90

15

POT 10+00.00

N 78° 13' 17" E

PC 12+30.17

Crowell Road (Route 675)

Hunter Mill Road (Route 674)

Golf Park at Hunter Mill

Fairfax Christian School

Reston Presbyterian Church

Sunset Hills Road (Route 675)

Dulles Toll Rd. On Ramp

Metrorail Silver Line

Dulles Toll Rd.

Dulles Access Rd.

Dulles Access Rd.

Dulles Toll Rd.

Dulles Toll Rd. Off Ramp

Dulles Toll Rd. Off Ramp

SUNSET HILLS RD
REALIGNMENT OPTION B

4.00%

SECTION A-A

SUNSET HILLS RD
REALIGNMENT OPTION B

2.00% 2.00%

SECTION B-B

SUNSET HILLS RD
REALIGNMENT OPTION B

4.00%

SECTION C-C

SUNSET HILLS RD PREFERRED REALIGNMENT

LEGEND

- EXIST. PROPERTY LINE
- PROP. EDGE OF PAVEMENT
- PROP. CURB

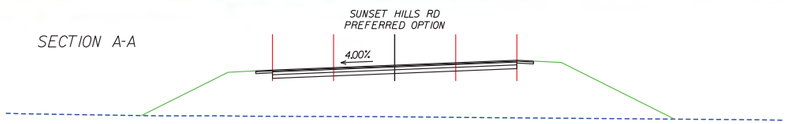
NOTES:
1. Exlsting property lines and contours are approximate.
2. The designs are conceptual in nature and should not be used for any level of construction.

Figure 6-3

SCALE
0 100' 200'

POT 46+85.28
45
C
40
C
PT 43+06.30
Crowell Road (Route 675)
Curve SUNSET PREF 3
PI = 40+00.49
DELTA = 88° 41' 30.79" (RT)
D = 10° 41' 22"
T = 523.90'
L = 829.71'
R = 536.00'
PC = 34+76.59
PT = 43+06.30
35
PC 34+76.59
B
B
Golf Park at Hunter Mill
Fairfax Christian School
Reston Presbyterian Church
Hunter Mill Road (Route 674)
30
PT 28+81.81
Curve SUNSET PREF 2
PI = 25+79.79
DELTA = 82° 46' 23.00" (LT)
D = 10° 41' 22"
T = 472.32'
L = 774.34'
R = 536.00'
PC = 21+07.47
PT = 28+81.81
Avoids School Parking Lot Impacts
Provides Greater Clearance between Sunset Hills & DTR
A
25
A
20
PC 21+07.47
15
PT 16+85.23
POT 8+00.00
PC 10+65.81
Curve SUNSET PREF 1
PI = 13+80.88
DELTA = 25° 50' 54.91" (RT)
D = 4° 10' 23"
T = 315.07'
L = 619.42'
R = 1,373.00'
PC = 10+65.81
PT = 16+85.23
Sunset Hills Road (Route 675)
Dulles Toll Rd. On Ramp
Dulles Toll Rd.
Dulles Access Rd.
Dulles Access Rd.
Dulles Toll Rd.
Metrorail Silver Line
Dulles Toll Rd. Off Ramp
Dulles Toll Rd. Off Ramp

SECTION A-A



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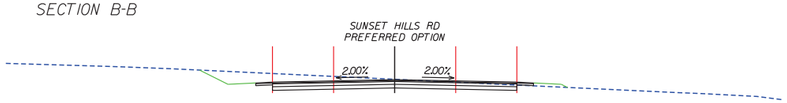
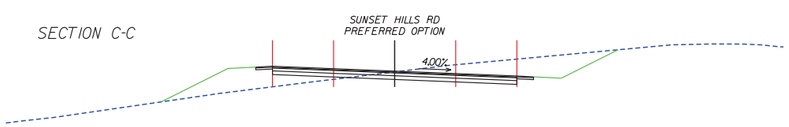


SECTION C-C



6.3 Dulles Toll Road/Sunset Hills Road 5-Leg Roundabout

The design process laid out by the Federal Highway Administration (FHWA) for roundabout planning and design details steps and the thought process behind the development of a 5-legged roundabout option at the intersection of Hunter Mill Road, Sunset Hills Road, and the Dulles Toll Road WB Ramps.

Background – NCHRP 672

In 2010, the Transportation Research Board (TRB) published the Second Edition of Roundabouts: An Informational Guide, also known as NCHRP 672. The research for this guide was sponsored by the American Association of State Highway and Transportation Officials (AASHTO) in cooperation with the FHWA, and it serves as the primary design tool for the development of roundabouts in the United States. While the report serves as more of a guide than as a book of standards, it details the planning and design phases of roundabout development, including suggested geometric features and performance specifications for different scenarios. The information in the report is based primarily on the analysis of prevalent and emerging practices in the United States.

The first steps in the conceptual roundabout design process involve traffic analysis that will lay the framework for many of the design decisions. After collecting traffic data and assigning an appropriate design vehicle, analysis must be done to determine how many entry and exit lanes are needed for each approach to/from the roundabout. Once the lane requirements are set, the next step is to determine the size requirement to handle the traffic traversing the roundabout as well as the design vehicle selected. Some of the key metrics used to make these determinations include the ratio of peak-hour to daily traffic volumes, the directional distribution of traffic, and the ratio of traffic volumes entering the intersection from a minor street to the total volumes for the roundabout. Using these and other inputs, one can estimate the number of circulatory lanes needed in the roundabout and determine an appropriate diameter of the circle. **Table 6-3** below from page 6-18 of NCHRP 672 lists ranges of common inscribed circle diameters (ICD), the diameter of the outside of the outermost circulatory lane, for different sizes and different design vehicles.

Table 6-3. ICD Recommendation Based on Lanes and Design Vehicles

Roundabout Configuration	Typical Design Vehicle	Common Inscribed Circle Diameter Range*	
Mini-Roundabout	SU-30 (SU-9)	45 to 90 ft	(14 to 27 m)
Single-Lane Roundabout	B-40 (B-12)	90 to 150 ft	(27 to 46 m)
	WB-50 (WB-15)	105 to 150 ft	(32 to 46 m)
	WB-67 (WB-20)	130 to 180 ft	(40 to 55 m)
Multilane Roundabout (2 lanes)	WB-50 (WB-15)	150 to 220 ft	(46 to 67 m)
	WB-67 (WB-20)	165 to 220 ft	(50 to 67 m)
Multilane Roundabout (3 lanes)	WB-50 (WB-15)	200 to 250 ft	(61 to 76 m)
	WB-67 (WB-20)	220 to 300 ft	(67 to 91 m)

* Assumes 90° angles between entries and no more than four legs. List of possible design vehicles is not all-inclusive.

Once an appropriate size is selected for the roundabout, the iterative process of placing the roundabout begins. The preface of NCHRP 672 states that there is no “absolutely optimum design” for every roundabout, but rather a range of competing objectives that must be accounted for during the planning and design phase. These objectives can vary from project to project and often present unique challenges for each situation. The challenge in developing a quality roundabout design is recognizing and balancing these competing objectives to arrive at appropriate compromises that promote increased safety and functionality at the intersection and along the corridor.

The position of the circulatory roadway relative to the entry alignments for each approach has a large role in the functionality of a roundabout. The greatest impact the approach alignments have on the traffic operations within the roundabout is their effect on entry and exit speeds. There are essentially three basic alignments that a roadway can follow as it approaches a roundabout as defined in NCHRP 672:

- Through the center of the roundabout
- Offset left of center
- Offset right of center

Each variation has its own pros and cons, but alignments offset right of center have the biggest drawbacks due to their impact on speed control. When approaching the roundabout right of center, a vehicle's path is going to be closer to tangent with the circulatory roadway making it easy for the driver to maintain a higher speed when entering. With centered or offset left alignments, it is easier and more natural to introduce the deflection needed to slow down vehicles, thus improving the safety of the roundabout.

Another factor when locating a roundabout and its approaches is sight distance and the provision of adequate view angles for drivers to identify potential conflicts. If the deflection provided at the entrance is too steep or angular, it can result in an awkward angle for the driver to turn his/her head and observe all the potential conflicts within the circulatory roadway. It becomes a finely tuned balancing act to provide adequate deflection in the roadway and suppress vehicle speeds while not deflecting the vehicles so much that drivers don't have a clear enough sight-line to enter the roundabout safely.

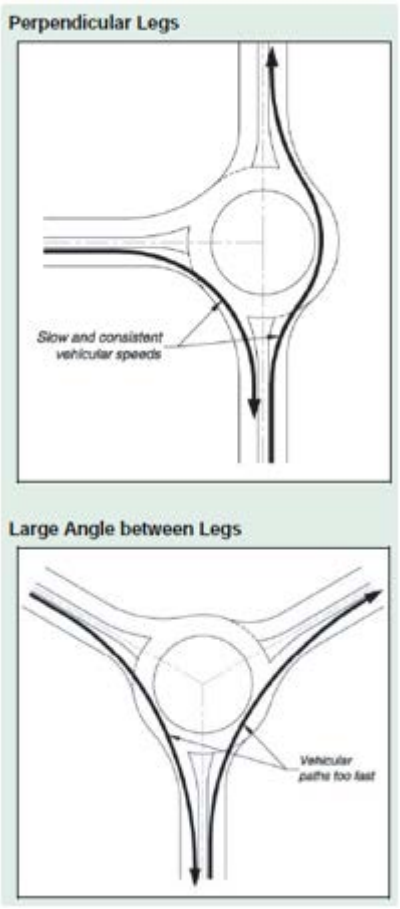


Figure 6-4. Angle Between Approach Legs

As with all intersections, the angle between approach legs is an important consideration in the design of roundabouts. Perpendicular intersecting angles are preferable to encourage proper deflection for the drivers entering/exiting the roundabout. If the angle is less than 90 degrees, trucks and other larger vehicles will struggle to make a tight right turn, and it may necessitate a slip lane or widened roadway. Angles greater than 90 degrees also cause design problems, as it becomes more difficult to achieve adequate deflection in the fastest vehicle path, meaning higher speeds and a less safe circulatory roadway. **Figure 6-4**, taken from Exhibit 6-11 of NCHRP 672, depicts these conditions graphically to represent the path problems created by different angled approaches.

To appropriately analyze the safety of a roundabout, NCHRP 672 recommends determining the design vehicle's "fastest path" for each thru movement and turning movement and calculating the maximum speed at various points along that path. **Figure 6-5**, taken from Exhibit 6-46 of NCHRP 672, shows the three primary movements that must be analyzed for each approach and the typical nomenclature associated with the critical areas. The blue line (R1, R2, R3) represents the fastest through movement, red (R4) is the fastest left turn movement and green (R5) is the fastest right turn movement. Determining these paths can be done "freehand" using the AASHTO's A Policy on Geometric Design of Highways and Streets for guidance on vehicle turning movements or by using any number of CAD programs and tools as an aid. Once the critical radii are determined, one can reverse engineer a potential maximum speed for the design vehicle at each critical point (there are design programs to help with this as well).

NCHRP 672 recommends designing roundabouts with the intention of keeping entry speeds between 25 and 30 mph for multi-lane roundabouts. Maintaining a degree of speed consistency throughout the circulatory roadway is also important as it relates to keeping the crash rate down, both for conflicting traffic movements and rear-end collisions. NCHRP 672 recommends keeping relative speeds between movements below 10 to 15 mph.

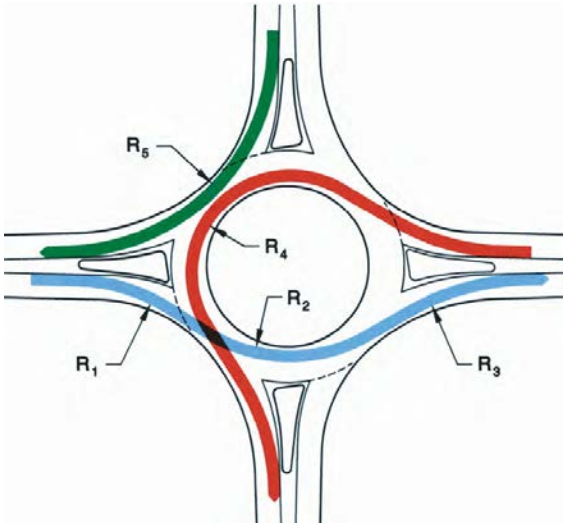


Figure 6-5. Vehicle Fastest Path Radii

Hunter Mill Road/Dulles Toll Road WB Ramps/Sunset Hills Road Roundabout

The proposed design for a 5-legged roundabout incorporating Hunter Mill Road, Sunset Hills Road, and the Dulles Toll Road WB Ramps was developed in accordance with NCHRP 672 guidelines. Due to the high traffic volumes on all the approaches and the need for a 5th approach, the roundabout needed to be large to accommodate all the traffic forecasted for the intersection. **Table 6-3** from NCHRP 672 notes a range of recommended ICDs for various circumstances, but states the following: "Assumes 90° angles between entries and no more than four legs". This situation violates both assumptions, which is the first indication that this interchange may need a larger roundabout with some non-traditional geometry. The extra leg in the roundabout makes providing adequate spacing between approaches more difficult, so to maximize the circumference available, the analysis began with a 300 feet ICD.

Figure 6-6 shows a generic 300 feet diameter roundabout centrally located between the five roadways in their existing condition. With this initial approach, the alignments of both Dulles Toll Road On-Ramp and Sunset Hills Road are too tangential to the circulatory roadway, prohibiting the entry/exit deflection necessary to keep vehicle speeds down throughout the roundabout. Another issue apparent in **Figure 6-6** is the proximity of the Dulles Toll Road bridge over Hunter Mill Road just south of the roundabout. The existing bridge piers prevent the roundabout from moving any farther south, limiting the potential locations for the center of the inscribed circle. The Reston Presbyterian Church also serves as a constraint to the roundabout location, as the circulatory roadway cannot shift further north or west without impacting the Church. The ramps to and from the DTR also come together with Hunter Mill Drive very close to the edge of the roundabout drawn in **Figure 6-6**, indicating that these ramp terminals will need to be reconfigured to provide more space between roundabout legs.

Figure 6-6. Centralized 300 feet ICD Roundabout

The Dulles Toll Road WB On-Ramp and the approach of Sunset Hills Road are also problematic at this interchange. The two roadways approach the interchange area at nearly identical angles, even slightly diverging from one another rather than approaching a common point. Additionally, the roads are only separated by a maximum of about 150 feet, another constraint to consider when determining how best to reconfigure the termini of these roads to achieve an implementable l roundabout. Due to the diverging nature of the two approaches, altering the terminus of either Sunset Hills Road or the DTR WB On-Ramp will also reduce the distance between the two legs. This will make it more difficult to accommodate a movement from Sunset Hills to the DTR WB On-Ramp with a reduced radius that can fit between them as the approaches come closer together.

Due to the diverging nature of Sunset Hills Road and the DTR WB On-Ramp, the first consideration in developing a roundabout was to shift the center of the roundabout farther east to provide more space to reconfigure the approaches. There is also more unoccupied land to the east of the current intersection, where the roundabout could avoid impacting buildings. However, **Figure 6-7** shows that while this works from a spatial standpoint, this would also crowd the western side of the roundabout with 4 legs coming into this portion, while only the DTR WB Off-Ramp on the eastern half. The two Hunter Mill Road legs are also approaching the roundabout offset right of center, creating higher speeds for entry/exit. Conversely, shifting the roundabout farther to the west would severely impact the approaches of Sunset Hills Road and DTR WB Off-Ramp, since the two roads get closer together as you move west from this intersection.

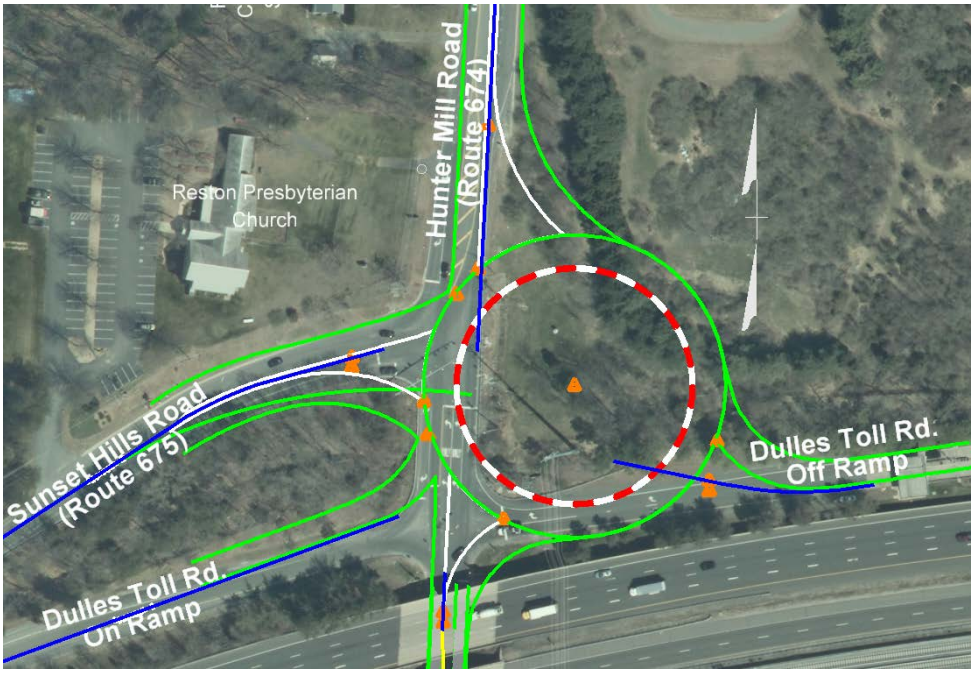


Figure 6-7. Roundabout Shifted East with Crowded West Side

To explore more configurations despite these constraints, an elongated and rotated roundabout was evaluated. While this helped geometrically by creating more separation between the approaching legs of Sunset Hills Road and the DTR WB Off-Ramp, the elongated section provides for higher speeds within the circulatory roadway, and awkward sight angles for entering drivers. The additional space required also increased the encroachment on the Reston Presbyterian Church property to the northwest of the roundabout. **Figure 6-8** presents one iteration of the elongated roundabout option rotated in a way to maximize the space between Sunset Hills Road and the DTR WB Off-Ramp. The vehicle speeds along the straightaway sections are not constrained since the roadway is not curved, and several entry angles are much higher than 40 degrees, making this a non-implementable design on the guidance of NCHRP 672.

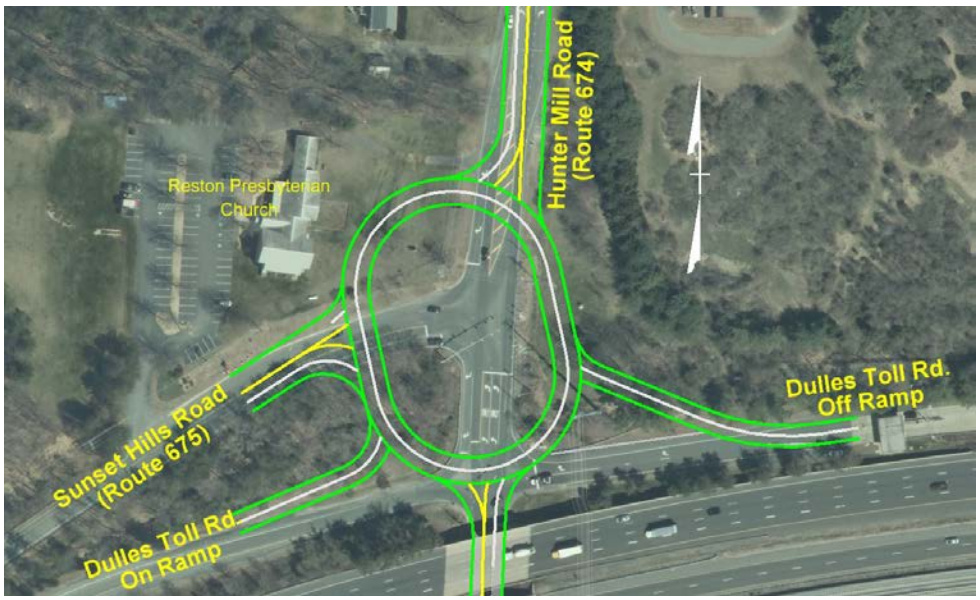


Figure 6-8. Elongated Roundabout Skewed to Optimize Approach Geometry

The design iteration that results in the best geometry from both a safety and operational perspective is one that would ultimately require the relocation of the Reston Presbyterian Church to provide more space for the Sunset Hills Road approach. As depicted in **Figure 6-9**, reconfiguring the approach of Sunset Hills Road in this way allows the roundabout to be shifted further north. This provides for optimal spacing between the five legs of the roundabout, simplifying the entries and exits of the circulatory roadway.

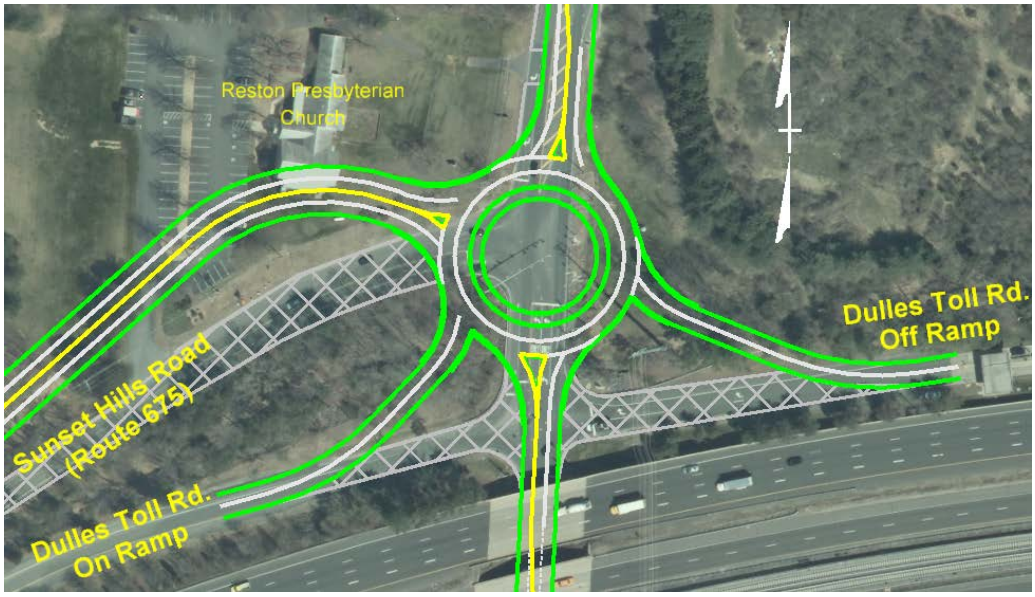


Figure 6-9. Preferred Roundabout Design

Ultimately, the safety and mobility of the interchange are the most important factors in selecting an appropriate design. From a mobility standpoint, the traffic analysis shows that these configurations can work, but balancing the safety factors while accounting for the physical constraints of the area remains a concern. While multiple options exist for a roundabout at this location, the layout of the existing roadways approaching the roundabout are limited in the amount they can change due to the proximity of the Dulles Toll Road Bridge and Reston Presbyterian Church.

7.0 FUTURE YEAR BUILD ALTERNATIVES ANALYSIS

7.1 Future Year Build Traffic Volumes

For alternatives in which Sunset Hills Road was relocated to Crowell Road, network volumes were adjusted to reflect this relocation. Therefore, depending on the alternative, either balanced No Build or Sunset Hills Relocation network volumes were used to perform the analyses. **Figure 7-1** and **Figure 7-2** show the 2030 and 2050 Sunset Hills Relocation volumes for the network, respectively.

7.2 Future Year Build Measures of Effectiveness

Operational analyses were carried out in the same manner as for the Future Year No Build scenario, as described in Section 5.2. Roundabout alternatives were evaluated in *SIDRA* (Version 7) using the updated formulae shown in **Table 7-1** for roundabout capacity analysis adopted by the Transportation Research Board in January 2016. These revised formulae utilize parameters which assume drivers are more comfortable navigating roundabouts, leading to greater capacity, and in many cases, an improved roundabout performance.

Table 7-1. Revised Roundabout Capacity Models (adapted from FHWA-SA-15-070)

Roundabout Type	Roundabout Configuration	Entry Lane	Model Equation
Single Lane	n/a	n/a	$v_e = 1380e^{-0.00012v_c}$
Multilane	1x2	n/a	2x2 right lane model
Multilane	2x2	Right	$v_e = 1420e^{-0.00085v_c}$
Multilane	2x2	Left	$v_e = 1350e^{-0.00092v_c}$
Multilane	2x1	Both	$v_e = 1420e^{-0.00091v_c}$

Note: v_e = entry capacity (pc/h); v_c = conflicting flow (pc/h)

In each Build Alternative, the intersections of Hunter Mill Road with Hunting Crest Lane and Lake Fairfax Park are left the same as existing conditions. Results presented in the following subsections exclude these intersections, although these intersections were modeled in *Synchro*/*SimTraffic*. *Synchro*/*SimTraffic* reports for the intersections at Hunting Crest Lane and Lake Fairfax Park as analyzed within the Build Alternatives are included in **Appendix D**. Because HCM methodology was used for the analyses, delay and LOS results for these intersections will be the same for each alternative during a given year and period. Queueing results may differ for these two intersections among alternatives, but due to the low volume on the minor streets, queuing will generally be influenced by the function of the redesigned intersections and the volume along Hunter Mill Road.

The worst operations at Hunter Mill Road and Hunting Crest Lane were shown at the westbound approach during the 2050 AM Peak, which showed LOS F because of few acceptable gap opportunities created by the southbound through volume. This poor LOS would affect the forecasted volume of 10 vehicles per hour (during the AM and PM peaks) at this approach in 2050. The intersection of Hunter Mill Road and Lake Fairfax Park is expected to operate acceptably during all future year peak periods.

Synchro/*SimTraffic* reports for all other intersections included in the Build Alternatives are included in **Appendix D** and *SIDRA* reports for roundabout alternatives are included in **Appendix E**.

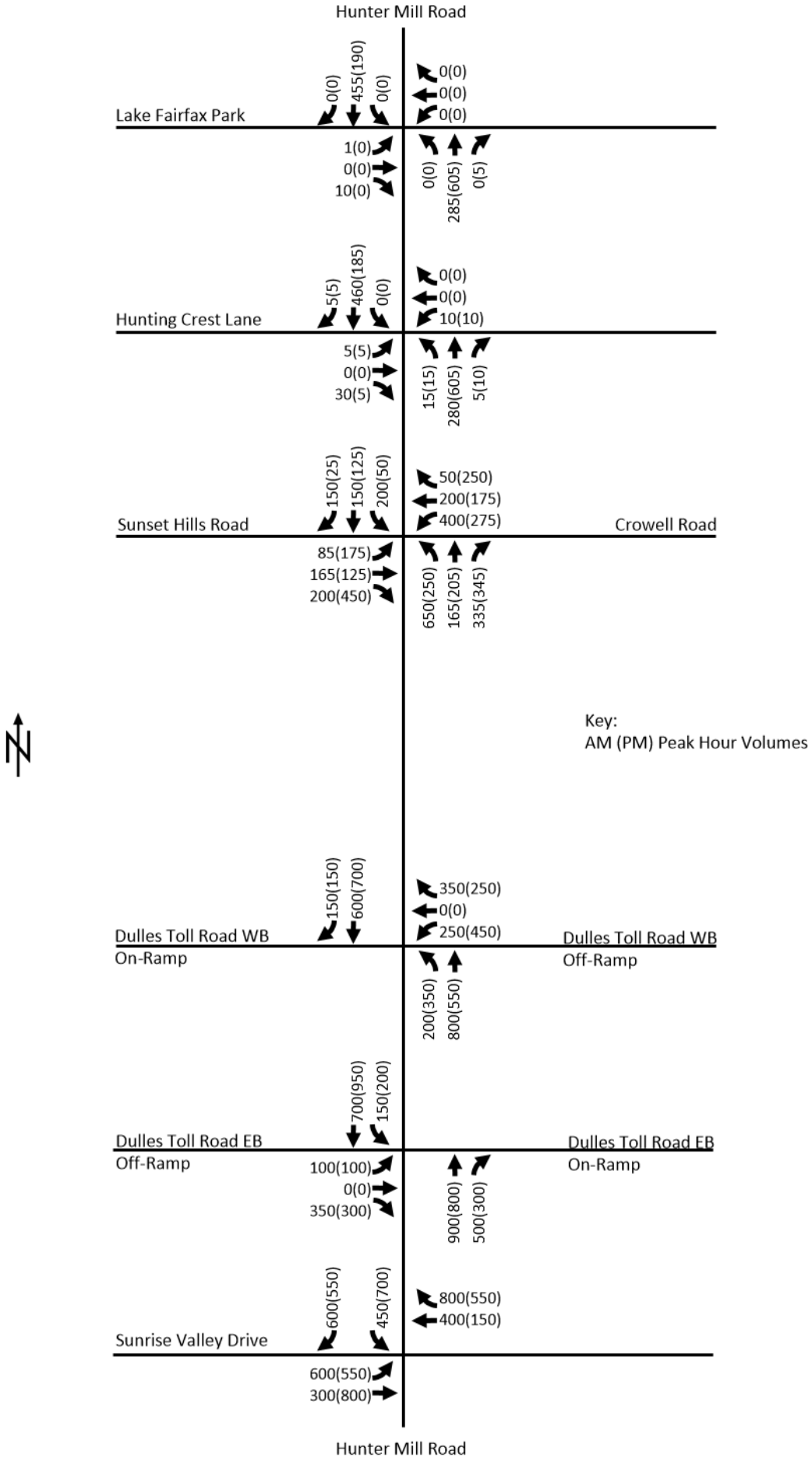


Figure 7-1. 2030 Sunset Hills Relocation Peak Hour Volumes

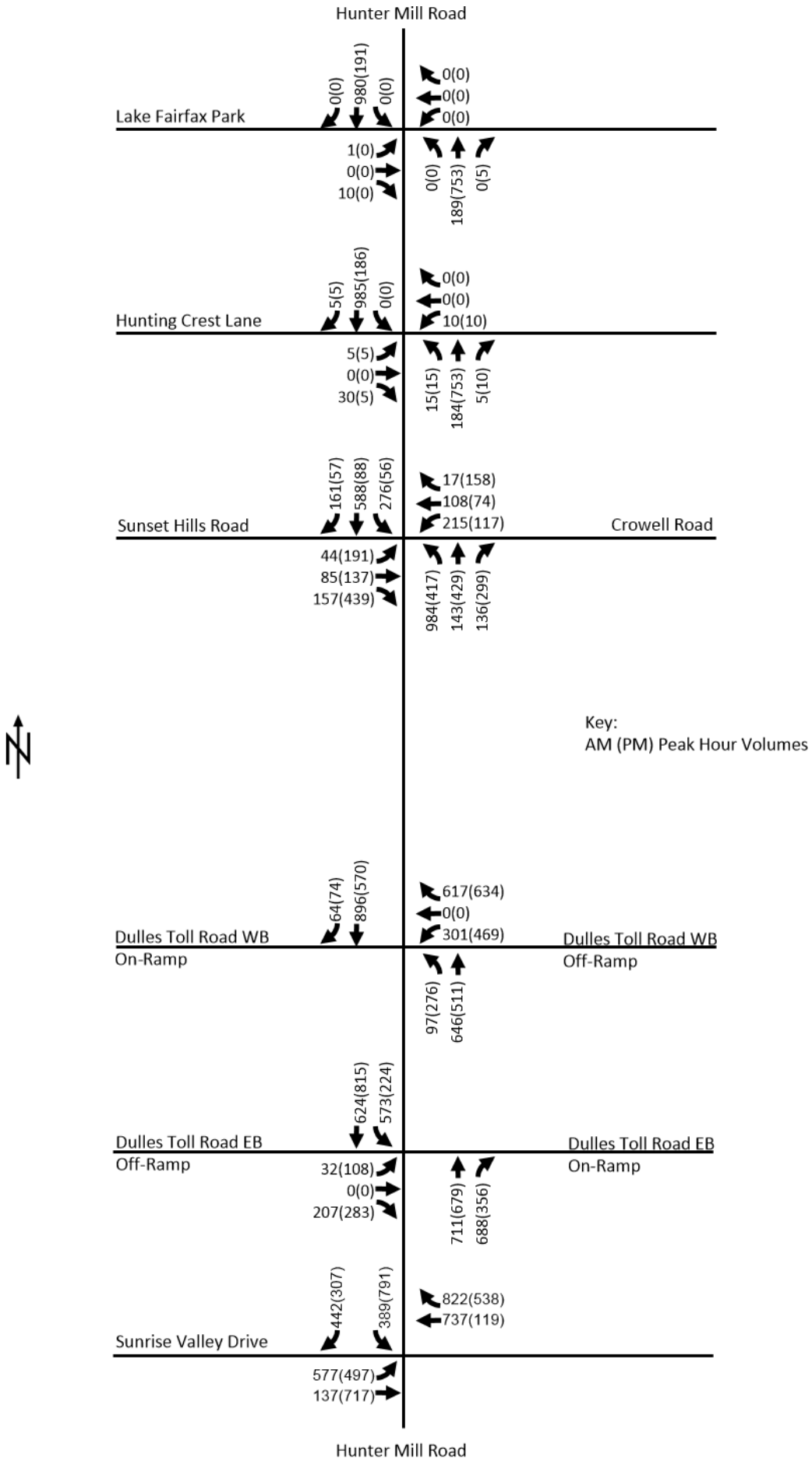


Figure 7-2. 2050 Sunset Hills Relocation Peak Hour Volumes

7.3 Alternative 1A

Alternative 1A, shown in **Figure 7-3**, includes roundabouts at all intersections. This alternative includes the five-leg roundabout at Dulles Toll Road WB Ramps, Sunset Hills Road, and Hunter Mill Road, as described in Section 6.2. The roundabout designs include increases in number of entry and exit lanes and vehicle storage compared to existing intersections to account for expected increases in traffic volume. **Appendix A** includes an extended description of Alternative 1A and the results of the operational analysis.

2030 Operational Analysis of Alternative 1A

During the **2030 AM Peak**, results for Alternative 1A indicate acceptable operations (LOS D or better) at three out of four redesigned intersections, with the roundabout at Hunter Mill Road and Crowell Road expected to operate at overall intersection LOS E. Throughout this period, 4 of 13 (31 percent) approaches and 5 of 25 (20 percent) of movements operate at LOS E or F.

During the **2030 PM Peak**, results for Alternative 1A indicate acceptable operations at all redesigned intersections. Throughout this period, 3 of 13 (23 percent) approaches and 3 of 25 (12 percent) of movements operate at LOS E or F. No northbound or southbound movements or approaches throughout the corridor were shown to have unacceptable levels of delay, meaning Hunter Mill Road would be expected to operate more efficiently than its intersecting roadways.

Results of the 2030 operational analyses for intersections within Alternative 1A are included in **Table 7-2**.

2050 Operational Analysis of Alternative 1A

During the **2050 AM Peak**, acceptable operations are provided at two out of four redesigned intersections. Throughout this period, 4 of 13 (31 percent) approaches and 7 of 25 (28 percent) movements operate at LOS E or F. Results indicate that overall operations at each intersection are expected to degrade further compared to the 2030 AM Peak.

During the **2050 PM Peak**, results indicate acceptable operations at two out of four redesigned intersections. Throughout this period, 2 of 13 (15 percent) approaches and 4 of 25 (16 percent) movements operate at LOS E or F. When compared to the 2030 PM Peak, overall intersection operations improve at Sunrise Valley Drive and at Dulles Toll Road EB Ramps, but degrade from LOS D to LOS F at Dulles Toll Road Ramps/Sunset Hills Road and from LOS C to LOS F at Crowell Road.

Results of the 2050 operational analysis for intersections within Alternative 1A are included in **Table 7-3**.

Table 7-2. 2030 Alternative 1A MOE Results

Intersection	Movement	2030 AM Peak				2030 PM Peak			
		Volumes	Delay (s/veh.)	LOS	95th % Queue (ft.)	Volumes	Delay (s/veh.)	LOS	95th % Queue (ft.)
Hunter Mill Road at Sunrise Valley Drive 	SBL	450	10.5	B	75	700	12.9	B	155
	SBR	600	0.1	A	0	550	0.1	A	0
	SB	-	*4.5*	*A*	-	-	*7.2*	*A*	-
	EBL	600	12.6	B	90	550	47.2	D	335
	EBT	300	12.0	B	90	800	135.1	F	1,615
	EB	-	*12.4*	*B*	-	-	*99.3*	*F*	-
	WBT	400	16.0	B	100	150	7.3	A	20
	WBR	800	90.7	F	1,130	550	19.1	B	155
	WB	-	*65.8*	*E*	-	-	*16.6*	*B*	-
	Overall	**-**	**28.6**	**C**	**-**	**-**	**46.9**	**D**	**-**
Hunter Mill Road at Dulles Toll Road EB Ramps 	NBT	900	28.5	C	430	800	22.8	C	295
	NBR	500	10.3	B	85	300	7.4	A	40
	NB	-	*22.0*	*C*	-	-	*18.6*	*B*	-
	SBL	150	3.8	A	0	200	4.1	A	0
	SBT	700	8.5	A	0	950	13.7	B	0
	SB	-	*7.7*	*A*	-	-	*12.0*	*B*	-
	EBL	100	9.2	A	20	100	13.6	B	25
	EBR	350	18.1	B	90	300	28.2	C	100
	EB	-	*16.1*	*B*	-	-	*24.6*	*C*	-
	Overall	**-**	**16.5**	**B**	**-**	**-**	**16.6**	**B**	**-**
Hunter Mill Road at Dulles Toll Road WB Ramps at Sunset Hills Road 	NBL (DTR)	200	12.5	B	135	250	10.3	B	85
	NBL (SH)	450	12.5	B	135	170	10.3	B	85
	NBT	350	7.6	A	45	380	8.7	A	55
	NB	-	*10.8*	*B*	-	-	*9.6*	*A*	-
	SBT	440	116.3	F	700	330	23.2	C	100
	SBR (SH)	350	79.5	F	455	200	23.2	C	85
	SBR (DTR)	110	79.5	F	455	70	23.2	C	85
	SB	-	*97.5*	*F*	-	-	*23.2*	*C*	-
	WBL	250	48.7	D	140	480	134.0	F	890
	WBR (SH)	200	44.3	D	145	80	33.4	C	95
	WBR (HM)	150	43.6	D	145	170	33.4	C	95
	WB	-	*46.0*	*D*	-	-	*99.6*	*F*	-
	SEL (HM NB)	250	14.7	B	55	80	42.8	D	140
	SER (HM SB)	160	15.0	B	50	370	90.4	F	520
	SER (DTR)	40	15.0	B	50	80	90.4	F	520
	SEB	-	*14.9*	*B*	-	-	*71.4*	*E*	-
	Overall	**-**	**45.0**	**D**	**-**	**-**	**49.9**	**D**	**-**
Hunter Mill Road at Crowell Road 	NBT	250	-	-	-	380	-	-	-
	NBR	500	-	-	-	470	-	-	-
	NB	-	*37.3*	*E*	*485*	-	*28.0*	*C*	*410*
	SBL	200	-	-	-	50	-	-	-
	SBT	300	-	-	-	150	-	-	-
	SB	-	*57.9*	*F*	*375*	-	*9.7*	*A*	*30*
	WBL	600	22.2	C	215	450	18.5	C	130
	WBR	50	0.0	A	0	250	0.0	A	0
	WB	-	*20.5*	*C*	-	-	*11.9*	*B*	-
	Overall	**-**	**37.0**	**E**	**-**	**-**	**18.2**	**C**	**-**

Table 7-3. 2050 Alternative 1A MOE Results

Intersection	Movement	2050 AM Peak				2050 PM Peak			
		Volumes	Delay (s/veh.)	LOS	95th % Queue (ft.)	Volumes	Delay (s/veh.)	LOS	95th % Queue (ft.)
Hunter Mill Road at Sunrise Valley Drive 	SBL	389	14.3	B	85	791	12.9	B	155
	SBR	442	0.0	A	0	307	0.0	A	0
	SB	-	*6.7*	*A*	-	-	*9.3*	*A*	-
	EBL	577	9.0	A	55	497	18.7	B	95
	EBT	137	8.7	A	55	717	17.7	B	95
	EB	-	*8.9*	*A*	-	-	*18.5*	*B*	-
	WBT	737	89.5	F	1,030	119	7.0	A	15
	WBR	822	92.2	F	1,190	538	19.6	B	150
	WB	-	*90.9*	*F*	-	-	*17.3*	*B*	-
	Overall	**-**	**49.5**	**D**	**-**	**-**	**14.1**	**B**	**-**
Hunter Mill Road at Dulles Toll Road EB Ramps 	NBT	711	63.3	E	685	679	16.5	B	180
	NBR	688	66.0	E	685	356	8.7	A	50
	NB	-	*64.6*	*E*	-	-	*13.8*	*B*	-
	SBL	573	7.6	A	0	224	4.3	A	0
	SBT	624	7.6	A	0	815	10.4	B	0
	SB	-	*7.6*	*A*	-	-	*9.1*	*A*	-
	EBL	32	10.8	B	5	108	12.1	B	25
	EBR	207	19.0	B	55	283	20.1	C	75
	EB	-	*17.9*	*B*	-	-	*17.9*	*B*	-
	Overall	**-**	**36.6**	**D**	**-**	**-**	**12.5**	**B**	**-**
Hunter Mill Road at Dulles Toll Road WB Ramps at Sunset Hills Road 	NBL (DTR)	97	7.0	A	55	276	9.0	A	65
	NBL (SH)	362	7.0	A	55	158	9.0	A	65
	NBT	284	5.6	A	30	353	8.6	A	50
	NB	-	*6.5*	*A*	-	-	*8.8*	*A*	-
	SBT	642	241.1	F	1,985	169	11.0	B	30
	SBR (SH)	269	112.7	F	655	131	13.0	B	35
	SBR (DTR)	161	112.7	F	655	36	13.0	B	35
	SB	-	*189.6*	*F*	-	-	*12.0*	*B*	-
	WBL	301	42.4	D	215	469	197.1	F	95
	WBR (SH)	352	40.3	D	220	203	193.7	F	140
	WBR (HM)	265	39.1	D	220	431	192.7	F	140
	WB	-	*40.7*	*D*	-	-	*194.7*	*F*	-
	SEL (HM NB)	129	12.1	B	30	328	20.4	C	1,365
	SER (HM SB)	126	11.3	B	30	360	25.7	C	1,540
	SER (DTR)	31	11.3	B	30	79	25.7	C	1,540
	SEB	-	*11.7*	*B*	-	-	*23.4*	*C*	-
	Overall	-	**82.4**	**F**	-	-	81.5	F	-
Hunter Mill Road at Crowell Road 	NBT	187	-	-	-	620	-	-	-
	NBR	221	-	-	-	436	-	-	-
	NB	-	*10.5*	*B*	*70*	-	*83.2*	*F*	*2,585*
	SBL	276	-	-	-	56	-	-	-
	SBT	749	-	-	-	145	-	-	-
	SB	-	*229.8*	*F*	*3,280*	-	*6.6*	*A*	*25*
	WBL	323	8.6	A	45	191	11.2	B	35
	WBR	17	4.2	A	0	158	10.1	B	25
	WB	-	*8.4*	*A*	-	-	*10.7*	*B*	-
	Overall	-	**136.9**	**F**	-	**-**	**57.9**	**F**	**-**

Figure 7-3 HUNTER MILL ROAD AND SUNSET HILLS ROAD - ALTERNATIVE 1A

Date: September 12, 2016

FAIRFAX COUNTY, VA

7.4 Alternative 1B

Alternative 1B, shown in **Figure 7-4**, incorporates roundabouts at all intersections and realigns Sunset Hills Road to Crowell Road. As in Alternative 1A, increases in number of entry and exit lanes and vehicle storage are included in the roundabout designs for Alternative 1B to account for future traffic demand. **Appendix A** includes an extended description of Alternative 1B and the results of the operational analysis.

2030 Operational Analysis of Alternative 1B

During the **2030 AM Peak**, acceptable operations are expected at all intersections. Throughout this period, 1 of 13 (8 percent) approaches and 1 of 25 (4 percent) movements operate at LOS E or F. Only the westbound right-turn movement of the roundabout at Hunter Mill Road and Sunrise Valley Drive operates at LOS F, which causes the westbound approach to operate at LOS E.

During the **2030 PM Peak**, all intersections operate at acceptable levels of service. Throughout this period, 2 of 13 (15 percent) approaches and 2 of 25 (8 percent) movements operate at LOS F. The eastbound through movement at Hunter Mill Road and Sunrise Valley Drive and the southbound through movement at Hunter Mill Road and Dulles Toll Road WB Ramps each showed LOS F, causing each of the associated approaches to operate at.

Results for the 2030 operational analysis of Alternative 1B are shown in **Table 7-4**.

2050 Operational Analysis of Alternative 1B

During the **2050 AM Peak**, results indicate acceptable operations at three of the four intersections. Throughout this period, 3 of 13 (23 percent) approaches and 6 of 25 (24 percent) movements experience LOS E or F. Each of the intersections showed at least one approach operating at LOS E or F, each of these degrading from the 2030 AM Peak. The southbound approach at Hunter Mill Road and Crowell Road/Sunset Hills Road shows the most significant increase in delay from 2030 to 2050, from approximately 30 seconds per vehicle to 270 seconds per vehicle – a 900 percent increase.

During the **2050 PM Peak**, results indicate acceptable operations at all intersections. Throughout this period, 1 of 13 (8 percent) approaches and 1 of 25 (4 percent) movements show LOS E or F. Overall intersection operations are expected to remain the same or improve when compared to the 2030 PM Peak. However, the westbound approach at Hunter Mill Road and Dulles Toll Road WB Ramps degrades from LOS C to LOS E.

Results for the 2050 operational analysis of Alternative 1B are shown in **Table 7-5**.

Table 7-4. 2030 Alternative 1B MOE Results

Intersection	Movement	2030 AM Peak				2030 PM Peak			
		Volumes	Delay (s/veh.)	LOS	95th % Queue (ft.)	Volumes	Delay (s/veh.)	LOS	95th % Queue (ft.)
Hunter Mill Road at Sunrise Valley Drive 	SBL	450	10.5	B	75	700	12.9	B	155
	SBR	600	0.1	A	0	550	0.1	A	0
	SB	-	*4.5*	*A*	-	-	*7.2*	*A*	-
	EBL	600	12.6	B	90	550	47.2	D	335
	EBT	300	12.0	B	90	800	135.1	F	1,615
	EB	-	*12.4*	*B*	-	-	*99.3*	*F*	-
	WBT	400	16.0	B	100	150	7.3	A	20
	WBR	800	90.7	F	1,130	550	19.1	B	155
	WB	-	*65.8*	*E*	-	-	*16.6*	*B*	-
	Overall	**-**	**28.6**	**C**	**-**	**-**	**46.9**	**D**	**-**
Hunter Mill Road at Dulles Toll Road EB Ramps 	NBT	900	28.5	C	430	800	22.8	C	295
	NBR	500	10.3	B	85	300	7.4	A	40
	NB	-	*22.0*	*C*	-	-	*18.6*	*B*	-
	SBL	150	3.8	A	0	200	4.1	A	0
	SBT	700	8.5	A	0	950	13.7	B	0
	SB	-	*7.7*	*A*	-	-	*12.0*	*B*	-
	EBL	100	9.2	A	20	100	13.6	B	25
	EBR	350	18.1	B	90	300	28.2	C	100
	EB	-	*16.1*	*B*	-	-	*24.6*	*C*	-
	Overall	**-**	**16.5**	**B**	**-**	**-**	**16.6**	**B**	**-**
Hunter Mill Road at Dulles Toll Road WB Ramps 	NBL	200	6.6	A	0	350	6.1	A	0
	NBT	800	6.5	A	0	550	5.9	A	0
	NB	-	*6.5*	*A*	-	-	*6.0*	*A*	-
	SBT	600	17.5	B	160	700	109.2	F	1,130
	SBR	150	6.4	A	20	150	10.6	B	30
	SB	-	*15.3*	*B*	-	-	*91.8*	*F*	-
	WBL	250	20.7	C	75	450	34.0	C	180
	WBR	350	25.6	C	110	250	17.0	B	65
	WB	-	*23.6*	*C*	-	-	*27.9*	*C*	-
	Overall	**-**	**13.7**	**B**	**-**	**-**	**42.0**	**D**	**-**
Hunter Mill Road at Crowell Road / Sunset Hills Road 	NBL	650	18.4	B	160	250	7.1	A	35
	NBT	165	17.4	B	160	205	12.1	B	110
	NBR	335	17.4	B	160	345	12.1	B	110
	NB	-	*18.0*	*B*	-	-	*10.5*	*B*	-
	SBL	200	33.3	C	90	50	7.5	A	15
	SBT	150	30.3	C	90	125	7.1	A	15
	SBR	150	29.5	C	90	25	6.9	A	15
	SB	-	*31.2*	*C*	-	-	*7.2*	*A*	-
	EBL	85	7.8	A	15	175	6.8	A	25
	EBT	165	15.6	B	85	125	16.1	B	145
	EBR	200	15.6	B	85	450	16.1	B	145
	EB	-	*14.1*	*B*	-	-	*13.9*	*B*	-
	WBL	400	25.5	C	125	275	13.6	B	75
	WBT	200	16.9	B	65	175	12.9	B	75
	WBR	50	16.9	B	65	250	12.6	B	75
	WB	-	*22.2*	*C*	-	-	*13.1*	*B*	-
	Overall	**-**	**20.8**	**C**	**-**	**-**	**12.0**	**B**	**-**

Table 7-5. 2050 Alternative 1B MOE Results

Intersection	Movement	2050 AM Peak				2050 PM Peak			
		Volumes	Delay (s/veh.)	LOS	95th % Queue (ft.)	Volumes	Delay (s/veh.)	LOS	95th % Queue (ft.)
Hunter Mill Road at Sunrise Valley Drive 	SBL	389	14.3	B	85	791	12.9	B	155
	SBR	442	0.0	A	0	307	0.0	A	0
	SB	-	*6.7*	*A*	-	-	*9.3*	*A*	-
	EBL	577	9.0	A	55	497	18.7	B	95
	EBT	137	8.7	A	55	717	17.7	B	95
	EB	-	*8.9*	*A*	-	-	*18.5*	*B*	-
	WBT	737	89.5	F	1,030	119	7.0	A	15
	WBR	822	92.2	F	1,190	538	19.6	B	150
	WB	-	*90.9*	*F*	-	-	*17.3*	*B*	-
	Overall	**-**	**49.5**	**D**	**-**	**-**	**14.1**	**B**	**-**
Hunter Mill Road at Dulles Toll Road EB Ramps 	NBT	711	63.3	E	685	679	16.5	B	180
	NBR	688	66.0	E	685	356	8.7	A	50
	NB	-	*64.6*	*E*	-	-	*13.8*	*B*	-
	SBL	573	7.6	A	0	224	4.3	A	0
	SBT	624	7.6	A	0	815	10.4	B	0
	SB	-	*7.6*	*A*	-	-	*9.1*	*A*	-
	EBL	32	10.8	B	5	108	12.1	B	25
	EBR	207	19.0	B	55	283	20.1	C	75
	EB	-	*17.9*	*B*	-	-	*17.9*	*B*	-
	Overall	**-**	**36.6**	**D**	**-**	**-**	**12.5**	**B**	**-**
Hunter Mill Road at Dulles Toll Road WB Ramps 	NBL	97	5.4	A	0	276	5.6	A	0
	NBT	646	5.3	A	0	511	5.5	A	0
	NB	-	*5.3*	*A*	-	-	*5.5*	*A*	-
	SBT	896	26.3	C	340	570	28.3	C	195
	SBR	64	6.6	A	25	74	8.7	A	20
	SB	-	*25.0*	*C*	-	-	*26.0*	*C*	-
	WBL	301	15.2	B	70	469	39.2	D	225
	WBR	617	56.2	E	455	634	76.7	F	690
	WB	-	*42.8*	*D*	-	-	*60.8*	*E*	-
	Overall	-	**25.6**	**C**	-	**-**	**34.8**	**C**	**-**
Hunter Mill Road at Crowell Road / Sunset Hills Road 	NBL	984	15.1	B	160	417	10.9	B	75
	NBT	143	14.6	B	155	429	23.0	C	255
	NBR	136	14.6	B	155	299	23.0	C	255
	NB	-	*15.0*	*B*	-	-	*18.6*	*B*	-
	SBL	276	272.3	F	1585	56	6.8	A	15
	SBT	588	268.9	F	1825	88	6.5	A	15
	SBR	161	267.2	F	1825	57	6.2	A	15
	SB	-	*269.6*	*F*	-	-	*6.5*	*A*	-
	EBL	44	7.1	A	5	191	5.6	A	20
	EBT	85	11.2	B	45	137	10.8	B	100
	EBR	157	11.2	B	45	439	10.8	B	100
	EB	-	*10.3*	*B*	-	-	*9.5*	*A*	-
	WBL	215	18.7	B	55	117	15.0	B	40
	WBT	108	15.7	B	35	74	14.4	B	40
	WBR	17	15.7	B	35	158	13.4	B	40
	WB	-	17.6	*B*	-	-	14.2	*B*	-
	Overall	-	**104.4**	**F**	**-**	**-**	**14.1**	**B**	**-**

Figure 7-4 HUNTER MILL ROAD AND SUNSET HILLS ROAD - ALTERNATIVE 1B

Date: March 24, 2017

FAIRFAX COUNTY, VA

7.5 Alternative 2

Alternative 2, shown in **Figure 7-5**, includes signalization of all five intersections, the relocation of Sunset Hills Road to a location along Hunter Mill Road equidistant between the eastbound Dulles Toll Road Ramps and Crowell Road, and the widening of Sunset Hills Road to four lanes (two per direction). In addition, increased storage lengths and turn lanes are provided at several locations to mitigate expected traffic demand. **Appendix A** includes an extended description of Alternative 2 and the results of the operational analysis.

2030 Operational Analysis of Alternative 2

During the **2030 AM Peak**, Alternative 2 results indicate acceptable overall operations at all intersections. Throughout this period, 3 of 15 (20 percent) approaches and 10 of 30 (33 percent) movements operate at LOS E or F. The intersection of Hunter Mill Road and Crowell Road is the only intersection in this scenario that has acceptable levels of service at all movements and approaches.

During the **2030 PM Peak**, all intersections operate at acceptable level of service. Throughout this period, 2 of 15 (13 percent) approaches and 6 of 30 (20 percent) movements operate at LOS E or F. As in the 2030 AM Peak, the intersection of Hunter Mill Road and Crowell Road is the only intersection that has acceptable LOS for all movements and approaches.

Results for the 2030 operational analysis of Alternative 2 are shown in **Table 7-6**.

2050 Operational Analysis of Alternative 2

During the **2050 AM Peak**, acceptable operations are provided at two out of five redesigned intersections. Throughout this period, 9 of 15 (60 percent) of approaches and 14 of 30 (47 percent) of movements operate at LOS E or F. All the intersections experience deteriorated operations at one or more approaches and movements compared to the 2030 AM Peak.

During the **2050 PM Peak**, acceptable operations are provided at all redesigned intersections. Throughout this period, 2 of 15 (13 percent) approaches and 4 of 30 (13 percent) movements operate at LOS E, with no operations at LOS F. Compared to the 2030 PM Peak, operations are improved at Hunter Mill Road and Dulles Toll Road Ramps and at Hunter Mill Road and Crowell Road.

Results for the 2050 operational analysis of Alternative 2 are shown in **Table 7-7**.

Table 7-6. 2030 Alternative 2 MOE Results

Intersection	Movement	2030 AM Peak				2030 PM Peak			
		Volumes	Delay (s/veh.)	LOS	95th % Queue (ft.)	Volumes	Delay (s/veh.)	LOS	95th % Queue (ft.)
Hunter Mill Road at Sunrise Valley Drive 	SBL	450	61.0	E	430	700	61.2	E	1,155
	SBR	600	0.6	A	0	550	0.4	A	670
	SB	-	*26.0*	*C*	-	-	*33.9*	*C*	-
	EBL	600	66.4	E	2,550	550	62.8	E	1,585
	EBT	300	13.1	B	2,230	800	51.2	D	1,440
	EB	-	*49.0*	*D*	-	-	*56.0*	*D*	-
	WBT	400	43.5	D	1,220	150	37.8	D	790
	WBR	800	43.4	D	915	550	37.3	D	740
	WB	-	*43.4*	*D*	-	-	*37.4*	*D*	-
	Overall	**-**	**39.3**	**D**	**-**	**-**	**43.7**	**D**	**-**
Hunter Mill Road at Dulles Toll Road EB Ramps 	NBT	900	27.0	C	2,035	800	28.9	C	2,015
	NBR	500	2.4	A	2,295	300	0.6	A	2,295
	NB	-	*19.0*	*B*	-	-	*24.8*	*C*	-
	SBL	150	104.9	F	235	200	72.1	E	210
	SBT	700	6.9	A	350	950	3.8	A	195
	SB	-	*27.0*	*C*	-	-	*17.6*	*C*	-
	EBL	100	55.8	E	210	100	43.2	D	370
	EBR	350	88.4	F	270	300	85.1	F	390
	EB	-	*81.0*	*F*	-	-	*74.3*	*E*	-
	Overall	**-**	**33.2**	**C**	**-**	**-**	**30.7**	**C**	**-**
Hunter Mill Road at Dulles Toll Road WB Ramps 	NBL	200	3.6	A	180	350	52.6	D	160
	NBT	800	3.7	A	465	550	23.7	C	450
	NB	-	*3.6*	*A*	-	-	*34.9*	*C*	-
	SBT	600	15.9	B	360	700	45.4	D	355
	SBR	150	10.5	B	250	150	41.0	D	300
	SB	-	*14.8*	*B*	-	-	*44.6*	*D*	-
	WBL	250	64.9	E	685	450	70.6	E	665
	WBR	350	52.7	D	690	250	31.0	C	685
	WB	-	*57.8*	*E*	-	-	*56.5*	*E*	-
	Overall	**-**	**21.0**	**C**	**-**	**-**	**44.5**	**D**	**-**
Hunter Mill Road at Sunset Hills Road 	NBL	650	60.6	E	240	250	20.4	C	290
	NBT	500	57.5	E	420	550	29.8	C	460
	NB	-	*59.0*	*E*	-	-	*27.1*	*C*	-
	SBT	550	76.6	E	620	400	52.6	D	600
	SBR	350	16.2	B	320	200	0.2	A	345
	SB	-	*53.1*	*D*	-	-	*35.1*	*D*	-
	EBL	250	56.5	E	245	300	65.6	E	330
	EBR	200	32.1	C	110	450	38.2	D	345
	EB	-	*45.6*	*D*	-	-	*49.2*	*D*	-
	Overall	**-**	**54.5**	**D**	**-**	**-**	**37.0**	**D**	**-**
Hunter Mill Road at Crowell Road 	NBT	250	25.2	C	175	380	18.8	B	195
	NBR	500	5.7	A	155	470	21.2	C	100
	NB	-	*12.4*	*B*	-	-	*20.1*	*C*	-
	SBL	200	15.9	B	165	50	11.3	B	70
	SBT	300	13.7	B	215	150	10.6	B	105
	SB	-	*14.6*	*B*	-	-	*10.8*	*B*	-
	WBL	600	41.7	D	305	450	49.7	D	315
	WBR	50	13.1	B	2,260	250	28.6	C	825
	WB	-	*39.1*	*D*	-	-	*41.1*	*D*	-
	Overall	**-**	**21.6**	**C**	**-**	**-**	**27.3**	**C**	**-**

Table 7-7. 2050 Alternative 2 MOE Results

Intersection	Movement	2050 AM Peak				2050 PM Peak			
		Volumes	Delay (s/veh.)	LOS	95th % Queue (ft.)	Volumes	Delay (s/veh.)	LOS	95th % Queue (ft.)
Hunter Mill Road at Sunrise Valley Drive 	SBL	389	98.3	F	355	791	53.0	D	1,225
	SBR	442	0.4	A	0	307	0.2	A	775
	SB	-	*45.4*	*D*	-	-	*37.9*	*D*	-
	EBL	577	98.4	F	340	497	58.5	E	700
	EBT	137	7.4	A	85	717	65.0	E	1,100
	EB	-	*81.4*	*F*	-	-	*62.3*	*E*	-
	WBT	737	71.1	E	710	119	37.0	D	125
	WBR	822	33.2	D	520	538	35.8	D	170
	WB	-	*52.6*	*D*	-	-	*36.0*	*D*	-
	Overall	**-**	**57.3**	**E**	**-**	**-**	**47.5**	**D**	**-**
Hunter Mill Road at Dulles Toll Road EB Ramps 	NBT	711	76	E	670	679	19.0	B	385
	NBR	688	30.6	C	395	356	1.4	A	140
	NB	-	*55.7*	*E*	-	-	*13.4*	*B*	-
	SBL	573	109.1	F	260	224	42.9	D	210
	SBT	624	4.8	A	495	815	5.8	A	240
	SB	-	*59.6*	*E*	-	-	*15.0*	*B*	-
	EBL	32	49.2	E	80	108	44.4	D	185
	EBR	207	61.8	E	100	283	60.2	E	270
	EB	-	*64.3*	*E*	-	-	*55.7*	*E*	-
	Overall	**-**	**58.2**	**E**	**-**	**-**	**21.8**	**C**	**-**
Hunter Mill Road at Dulles Toll Road WB Ramps 	NBL	97	78.6	E	160	276	14.9	B	170
	NBT	646	22.8	C	445	511	5.7	A	395
	NB	-	*30.1*	*C*	-	-	*8.9*	*A*	-
	SBT	896	22.0	C	350	570	22.5	C	215
	SBR	64	1.6	A	215	74	2.8	A	190
	SB	-	*20.6*	*C*	-	-	*20.2*	*C*	-
	WBL	301	43.2	D	680	469	51.3	D	685
	WBR	617	79.5	E	735	634	45.8	D	695
	WB	-	*67.6*	*E*	-	-	*48.1*	*D*	-
	Overall	-	**39.8**	**D**	-	**-**	**28.9**	**C**	**-**
Hunter Mill Road at Sunset Hills Road 	NBL	984	72.2	E	245	417	21.8	C	280
	NBT	279	67.0	E	470	728	49.7	D	440
	NB	-	*69.6*	*E*	-	-	*40.5*	*D*	-
	SBT	803	94.3	F	540	205	33.9	C	225
	SBR	269	15.4	B	355	131	0.0	A	90
	SB	-	*74.5*	*E*	-	-	*20.7*	*C*	-
	EBL	129	68.4	E	100	328	58.0	E	375
	EBR	157	53.2	D	80	439	30.2	C	190
	EB	-	*60.0*	*E*	-	-	*42.1*	*D*	-
	Overall	-	**70.6**	**E**	-	**-**	**38.1**	**D**	**-**
Hunter Mill Road at Crowell Road 	NBT	187	23.9	C	130	620	11.8	B	210
	NBR	221	0.4	A	40	436	0.0	A	90
	NB	-	*11.4*	*B*	-	-	*7.1*	*A*	-
	SBL	276	8.3	A	295	56	7.5	A	65
	SBT	749	14.1	B	1,290	145	4.2	A	75
	SB	-	*12.4*	*B*	-	-	*5.2*	*A*	-
	WBL	323	66.1	E	280	191	44.9	D	180
	WBR	17	39.8	D	3,020	158	33.1	C	95
	WB	-	*64.4*	*E*	-	-	*38.9*	*D*	-
	Overall	-	**21.4**	**C**	-	**-**	**13.8**	**B**	**-**

Figure 7-5 HUNTER MILL ROAD AND SUNSET HILLS ROAD - ALTERNATIVE 2

Date: September 12, 2016

FAIRFAX COUNTY, VA

7.6 Alternative 3

Alternative 3, shown in **Figure 7-6**, includes signalization at all intersections and the relocation of Sunset Hills Road to Crowell Road, and the widening of Sunset Hills Road to four lanes (two per direction). Additional storage and turn lanes would be provided at several locations to account for expected increases in traffic demand. **Appendix A** includes an extended description of Alternative 3 and the results of the operational analysis.

2030 Operational Analysis of Alternative 3

During the **2030 AM Peak**, Alternative 3 analysis showed acceptable operations at all intersections. Throughout this period, 1 of 13 (8 percent) approaches and 5 of 28 (18 percent) movements operate at unacceptable LOS. The intersection of Hunter Mill Road and Dulles Toll Road WB Ramps is the only intersection with no approaches or movements at LOS E or F.

During the **2030 PM Peak**, acceptable operations are provided at all intersections. Throughout this period, 2 of 13 (15 percent) approaches and 7 of 28 (25 percent) movements operate at LOS E or F. The analysis showed the intersection of Hunter Mill Road and Crowell Road/Sunset Hills Road performing the best in terms of overall intersection delay and approach delay, with only one movement operating at LOS E.

Results for the 2030 operational analysis of Alternative 3 are shown in **Table 7-8**.

2050 Operational Analysis of Alternative 3

During the **2050 AM Peak**, results indicate acceptable operations at one out of four intersections. Throughout this period, 7 of 13 (54 percent) approaches and 15 of 28 (54 percent) movements operate at LOS E or F. Compared to the 2030 AM Peak, operations are expected to be much worse throughout the corridor. The intersection of Hunter Mill Road and Dulles Toll Road WB Ramps is the only intersection that has an acceptable overall LOS, though the westbound right movement operates at LOS F resulting in LOS E for the approach.

During the **2050 PM Peak**, results indicate acceptable operations at all intersections. Throughout this period, 2 of 13 (15 percent) approaches and 3 of 28 (11 percent) movements operate at LOS E, with none operating at LOS F. In general, operations are improved throughout the corridor when compared to the 2030 PM Peak with both the intersection of Hunter Mill Road and Dulles Toll Road EB Ramps and the intersection of Hunter Mill Road and Crowell Road/Sunset Hills Road have all approaches and movements operating at acceptable LOS.

Results for the 2050 operational analysis of Alternative 3 are shown in **Table 7-9**.

Table 7-8. 2030 Alternative 3 MOE Results

Intersection	Movement	2030 AM Peak				2030 PM Peak			
		Volumes	Delay (s/veh.)	LOS	95th % Queue (ft.)	Volumes	Delay (s/veh.)	LOS	95th % Queue (ft.)
Hunter Mill Road at Sunrise Valley Drive	SBL	450	48.8	D	430	700	58.1	E	705
	SBR	600	0.6	A	0	550	0.4	A	175
	SB	-	*20.9*	*C*	-	-	*32.2*	*C*	-
	EBL	600	61.0	E	285	550	66.7	E	625
	EBT	300	11.3	B	160	800	55.5	E	955
	EB	-	*44.8*	*D*	-	-	*60.2*	*E*	-
	WBT	400	40.3	D	325	150	35.8	D	165
	WBR	800	37.9	D	355	550	35.0	C	260
	WB	-	*38.8*	*D*	-	-	*35.2*	*D*	-
	Overall	**-**	**34.5**	**C**	**-**	**-**	**44.3**	**D**	**-**
Hunter Mill Road at Dulles Toll Road EB Ramps	NBT	900	40.5	D	810	800	32.0	C	1,770
	NBR	500	3.3	A	480	300	0.6	A	1,675
	NB	-	*28.4*	*C*	-	-	*24.2*	*C*	-
	SBL	150	96.1	F	190	200	96.2	E	210
	SBT	700	8.3	A	255	950	6.6	A	255
	SB	-	*26.3*	*C*	-	-	*24.7*	*B*	-
	EBL	100	43.3	D	240	100	40.6	D	1,395
	EBR	350	80.0	E	325	300	97.4	F	540
	EB	-	*71.6*	*E*	-	-	*82.8*	*F*	-
	Overall	**-**	**36.0**	**D**	**-**	**-**	**34.5**	**C**	**-**
Hunter Mill Road at Dulles Toll Road WB Ramps	NBL	200	7.5	A	170	350	66.5	E	155
	NBT	800	6.5	A	475	550	20.7	C	475
	NB	-	*6.7*	*A*	-	-	*38.5*	*D*	-
	SBT	600	17.2	B	325	700	40.0	D	355
	SBR	150	10.8	B	200	150	8.5	A	305
	SB	-	*15.9*	*B*	-	-	*34.5*	*C*	-
	WBL	250	48.3	D	245	450	66.5	E	675
	WBR	350	40.6	D	275	250	28.2	C	735
	WB	-	*43.8*	*D*	-	-	*52.8*	*D*	-
	Overall	**-**	**19.1**	**B**	**-**	**-**	**41.2**	**D**	**-**
Hunter Mill Road at Crowell Road / Sunset Hills Road	NBL	650	51.5	D	260	250	15.3	B	125
	NBT	165	52.1	D	675	205	15.3	B	200
	NBR	335	12.0	B	290	345	19.2	B	130
	NB	-	*39.6*	*D*	-	-	*17.0*	*B*	-
	SBL	200	40.7	D	290	50	24.6	C	65
	SBT	150	56.3	E	955	125	31.6	C	145
	SBR	150	56.3	E	955	25	31.6	C	145
	SB	-	*49.5*	*D*	-	-	*29.7*	*C*	-
	EBL	85	36.3	D	110	175	56.5	E	215
	EBT	165	42.2	D	175	125	43.0	D	230
	EBR	200	34.5	C	105	450	40.2	D	230
	EB	-	*37.7*	*D*	-	-	*44.5*	*D*	-
	WBL	400	52.7	D	315	275	29.4	C	310
	WBT	200	27.4	C	520	175	49.8	D	820
	WBR	50	27.4	C	520	250	49.8	D	820
	WB	-	*42.8*	*D*	-	-	*42.4*	*D*	-
	Overall	**-**	**42.0**	**D**	**-**	**-**	**33.5**	**C**	**-**

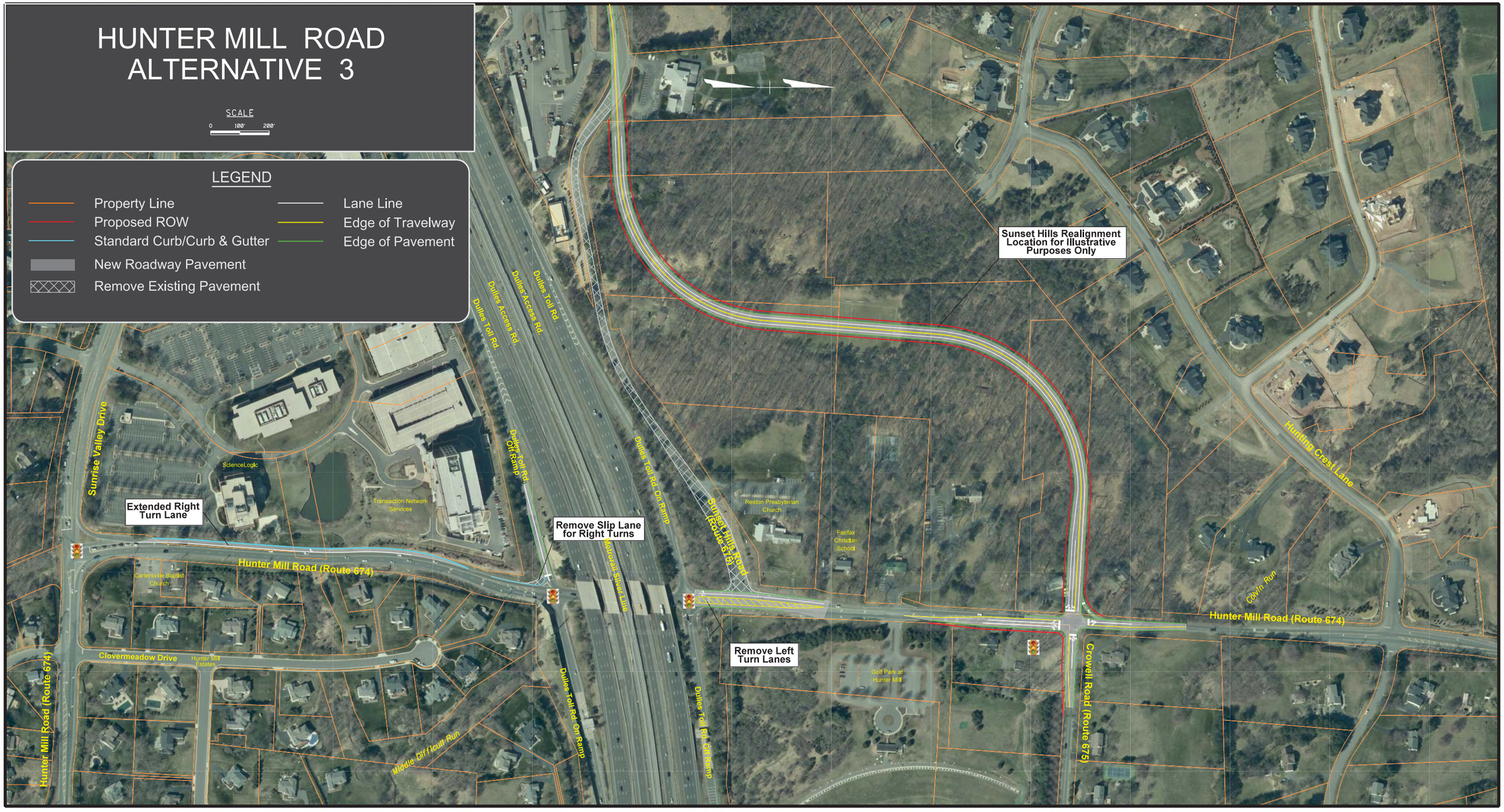
Table 7-9. 2050 Alternative 3 MOE Results

Intersection	Movement	2050 AM Peak				2050 PM Peak			
		Volumes	Delay (s/veh.)	LOS	95th % Queue (ft.)	Volumes	Delay (s/veh.)	LOS	95th % Queue (ft.)
Hunter Mill Road at Sunrise Valley Drive 	SBL	389	112.0	F	395	791	53.6	D	1,310
	SBR	442	0.4	A	0	307	0.2	A	860
	SB	-	*51.7*	*D*	-	-	*38.3*	*D*	-
	EBL	577	99.9	F	435	497	58.5	E	750
	EBT	137	7.5	A	110	717	65.0	E	1,100
	EB	-	*82.7*	*F*	-	-	*62.3*	*E*	-
	WBT	737	67.1	E	705	119	37.0	D	125
	WBR	822	34.2	C	520	538	35.8	D	155
	WB	-	*51.0*	*D*	-	-	*36.0*	*D*	-
	Overall	**-**	**58.5**	**E**	**-**	**-**	**47.7**	**D**	**-**
Hunter Mill Road at Dulles Toll Road EB Ramps 	NBT	711	76.4	E	855	679	18.4	B	335
	NBR	688	26.2	C	615	356	1.5	A	110
	NB	-	*54.0*	*D*	-	-	*13.1*	*B*	-
	SBL	573	100.3	F	240	224	43.2	D	125
	SBT	624	2.3	A	520	815	5.5	A	95
	SB	-	*53.8*	*D*	-	-	*14.8*	*B*	-
	EBL	32	75.9	E	65	108	44.4	D	175
	EBR	207	65.8	E	115	283	60.2	E	280
	EB	-	*67.2*	*E*	-	-	*55.7*	*E*	-
	Overall	**-**	**55.1**	**E**	**-**	**-**	**21.5**	**C**	**-**
Hunter Mill Road at Dulles Toll Road WB Ramps 	NBL	97	46.5	D	155	276	14.4	B	170
	NBT	646	0.7	A	480	511	6.0	A	380
	NB	-	*6.7*	*A*	-	-	*8.9*	*A*	-
	SBT	896	21.2	C	335	570	32.1	C	360
	SBR	64	7.4	A	250	74	17.1	B	225
	SB	-	*20.3*	*C*	-	-	*30.4*	*C*	-
	WBL	301	46.2	D	685	469	51.3	D	515
	WBR	617	81.7	F	570	634	45.8	D	535
	WB	-	*70.1*	*E*	-	-	*48.1*	*D*	-
	Overall	-	**33.9**	**C**	-	**-**	**31.4**	**C**	**-**
Hunter Mill Road at Crowell Road / Sunset Hills Road 	NBL	984	162.6	F	225	417	14.6	B	270
	NBT	143	211.0	F	1,060	429	15.2	B	765
	NBR	136	14.7	B	320	299	10.9	B	285
	NB	-	*168.1*	*F*	-	-	*13.9*	*B*	-
	SBL	276	39.2	D	305	56	20.2	C	65
	SBT	588	110.2	F	1,025	88	26.3	C	130
	SBR	161	110.2	F	1,025	57	26.3	C	130
	SB	-	*89.4*	*F*	-	-	*24.4*	*C*	-
	EBL	44	61.9	E	90	191	42.4	D	175
	EBT	85	66.2	E	140	137	33.9	C	135
	EBR	157	60.1	E	145	439	31.4	C	170
	EB	-	*62.2*	*E*	-	-	*34.6*	*C*	-
	WBL	215	76.4	E	330	117	30.3	C	115
	WBT	108	53.4	D	1,535	74	33.9	C	185
	WBR	17	53.4	D	1,535	158	33.9	C	185
	WB	-	*67.9*	*E*	-	-	*32.8*	*C*	-
	Overall	-	**117.5**	**F**	-	**-**	**23.7**	**C**	**-**

Figure 7-6 HUNTER MILL ROAD AND SUNSET HILLS ROAD - ALTERNATIVE 3

Date: March 24, 2017

FAIRFAX COUNTY, VA



7.7 Alternative 4A

Alternative 4A, shown in **Figure 7-7**, is a "mix and match" alternative that includes signalization at Sunrise Valley Drive and Crowell Road and their intersections with Hunter Mill Road. In addition, the 5-leg Sunset Hills/Dulles Toll Road WB Ramps roundabout was incorporated into this alternative, which also includes a roundabout at Hunter Mill Road and Dulles Toll Road EB Ramps. Like other alternatives, increased storage and the addition of dedicated turn lanes would be provided at several locations. **Appendix A** includes an extended description of Alternative 4A and the results of the operational analysis.

2030 Operational Analysis of Alternative 4A

During the **2030 AM Peak**, results indicate acceptable operations at three out of four intersections. Throughout this period, 3 of 13 (23 percent) approaches and 4 of 27 (15 percent) movements operate at LOS E or F. Only the roundabout at Hunter Mill Road and Dulles Toll Road EB Ramps provides acceptable operations for all approaches and movements. The most significant delay within the corridor is found at the eastbound left turn movement at the intersection of Hunter Mill Road and Sunrise Valley Drive. This is due to the signal's inability to handle the steady volumes coming from the roundabout at Hunter Mill Road and the Dulles Toll Road EB Ramps.

During the **2030 PM Peak**, results indicate acceptable operations at three out of four intersections. Throughout this period, 4 of 13 (31 percent) approaches and 5 of 27 (19 percent) movements operate at LOS E or F. Only the roundabout at Hunter Mill Road and Dulles Toll Road EB Ramps provides acceptable operations for all approaches and movements. As in the 2030 AM Peak, the most significant delay within the corridor is found at the eastbound left turn movement at the intersection of Hunter Mill Road and Sunrise Valley Drive.

Results for the 2030 operational analysis of Alternative 4A are shown in **Table 7-10**.

2050 Operational Analysis of Alternative 4A

During the **2050 AM Peak**, results indicate acceptable operations at two out of four intersections. Throughout this period, 5 of 13 (38 percent) approaches and 7 of 27 (26 percent) movements operate at LOS E or F. At each of the locations that had unacceptable operations during the 2030 AM Peak, operations are further degraded during the 2050 AM Peak. In addition, the northbound turning movements of the roundabout at Hunter Mill Road and Dulles Toll Road EB Ramps operate at LOS E.

During the **2050 PM Peak**, results indicate acceptable operations at two out of four intersections. Throughout this period, 3 of 13 (23 percent) approaches and 7 of 27 (26 percent) movements operate at LOS E or F. Overall, operations throughout the corridor are expected to improve when compared to the 2030 PM Peak.

Results for the 2050 operational analysis of Alternative 4A are shown in **Table 7-11**.

Table 7-10. 2030 Alternative 4A MOE Results

Intersection	Movement	2030 AM Peak				2030 PM Peak			
		Volumes	Delay (s/veh.)	LOS	95th % Queue (ft.)	Volumes	Delay (s/veh.)	LOS	95th % Queue (ft.)
Hunter Mill Road at Sunrise Valley Drive 	SBL	450	46.7	D	220	700	246.0	F	600
	SBR	600	0.8	A	0	550	0.7	A	0
	SB	-	*20.1*	*C*	-	-	*136.1*	*F*	-
	EBL	600	547.6	F	3,810	550	467.7	F	3,660
	EBT	300	9.7	A	4,110	800	31.7	C	3,785
	EB	-	*372.1*	*F*	-	-	*212.8*	*F*	-
	WBT	400	36.8	D	1,285	150	16.9	B	105
	WBR	800	20.4	C	945	550	17.6	B	125
	WB	-	*26.4*	*C*	-	-	*17.4*	*B*	-
	Overall	**-**	**123.6**	**F**	**-**	**-**	**143.1**	**F**	**-**
Hunter Mill Road at Dulles Toll Road EB Ramps 	NBT	900	28.5	C	430	800	22.8	C	295
	NBR	500	10.3	B	85	300	7.4	A	40
	NB	-	*22.0*	*C*	-	-	*18.6*	*B*	-
	SBL	150	3.8	A	0	200	4.1	A	0
	SBT	700	8.5	A	0	950	13.7	B	0
	SB	-	*7.7*	*A*	-	-	*12.0*	*B*	-
	EBL	100	9.2	A	20	100	13.6	B	25
	EBR	350	18.1	B	90	300	28.2	C	100
	EB	-	*16.1*	*B*	-	-	*24.6*	*C*	-
	Overall	**-**	**16.5**	**B**	**-**	**-**	**16.6**	**B**	**-**
Hunter Mill Road at Dulles Toll Road WB Ramps at Sunset Hills Road 	NBL (DTR)	200	12.5	B	135	250	10.3	B	85
	NBL (SH)	450	12.5	B	135	170	10.3	B	85
	NBT	350	7.6	A	45	380	8.7	A	55
	NB	-	*10.8*	*B*	-	-	*9.6*	*A*	-
	SBT	440	116.3	F	700	330	23.2	C	100
	SBR (SH)	350	79.5	F	455	200	23.2	C	85
	SBR (DTR)	110	79.5	F	455	70	23.2	C	85
	SB	-	*97.5*	*F*	-	-	*23.2*	*C*	-
	WBL	250	48.7	D	140	480	134.0	F	890
	WBR (SH)	200	44.3	D	145	80	33.4	C	95
	WBR (HM)	150	43.6	D	145	170	33.4	C	95
	WB	-	*46.0*	*D*	-	-	*99.6*	*F*	-
	SEL (HM NB)	250	14.7	B	55	80	42.8	D	140
	SER (HM SB)	160	15.0	B	50	370	90.4	F	520
	SER (DTR)	40	15.0	B	50	80	90.4	F	520
	SEB	-	*14.9*	*B*	-	-	*71.4*	*E*	-
	Overall	**-**	**45.0**	**D**	**-**	**-**	**49.9**	**D**	**-**
Hunter Mill Road at Crowell Road 	NBT	250	31.2	C	215	380	19.7	B	180
	NBR	500	5.7	A	140	470	2.9	A	65
	NB	-	*14.5*	*B*	-	-	*10.6*	*B*	-
	SBL	200	17.5	B	255	50	11.1	B	60
	SBT	300	17.8	B	610	150	10.3	B	105
	SB	-	*17.7*	*B*	-	-	*10.5*	*B*	-
	WBL	600	58.3	E	280	450	62.6	E	310
	WBR	50	25.1	C	3,050	250	33.3	C	505
	WB	-	*55.2*	*E*	-	-	*50.6*	*D*	-
	Overall	**-**	**28.5**	**C**	**-**	**-**	**26.5**	**C**	**-**

Table 7-11. 2050 Alternative 4A MOE Results

Intersection	Movement	2050 AM Peak				2050 PM Peak			
		Volumes	Delay (s/veh.)	LOS	95th % Queue (ft.)	Volumes	Delay (s/veh.)	LOS	95th % Queue (ft.)
Hunter Mill Road at Sunrise Valley Drive 	SBL	389	32.5	C	195	791	62.4	E	390
	SBR	442	0.5	A	0	307	0.3	A	0
	SB	-	*15.2*	*B*	-	-	*44.6*	*D*	-
	EBL	577	495.4	F	3,665	497	76.7	E	1,910
	EBT	137	7.7	A	3,670	717	67.6	E	1,830
	EB	-	*404.4*	*F*	-	-	*71.4*	*E*	-
	WBT	737	292.5	F	1,040	119	50.5	D	410
	WBR	822	20.4	C	855	538	50.4	D	430
	WB	-	*159.4*	*F*	-	-	*50.4*	*D*	-
	Overall	**-**	**177.1**	**F**	**-**	**-**	**56.9**	**E**	**-**
Hunter Mill Road at Dulles Toll Road EB Ramps 	NBT	711	63.3	E	685	679	16.5	B	180
	NBR	688	66.0	E	685	356	8.7	A	50
	NB	-	*64.6*	*E*	-	-	*13.8*	*B*	-
	SBL	573	7.6	A	0	224	4.3	A	0
	SBT	624	7.6	A	0	815	10.4	B	0
	SB	-	*7.6*	*A*	-	-	*9.1*	*A*	-
	EBL	32	10.8	B	5	108	12.1	B	25
	EBR	207	19.0	B	55	283	20.1	C	75
	EB	-	*17.9*	*B*	-	-	*17.9*	*B*	-
	Overall	**-**	**36.6**	**D**	**-**	**-**	**12.5**	**B**	**-**
Hunter Mill Road at Dulles Toll Road WB Ramps at Sunset Hills Road 	NBL (DTR)	97	7.0	A	55	276	9.0	A	65
	NBL (SH)	362	7.0	A	55	158	9.0	A	65
	NBT	284	5.6	A	30	353	8.6	A	50
	NB	-	*6.5*	*A*	-	-	*8.8*	*A*	-
	SBT	642	241.1	F	1,985	169	11.0	B	30
	SBR (SH)	269	112.7	F	655	131	13.0	B	35
	SBR (DTR)	161	112.7	F	655	36	13.0	B	35
	SB	-	*189.6*	*F*	-	-	*12.0*	*B*	-
	WBL	301	42.4	D	215	469	197.1	F	95
	WBR (SH)	352	40.3	D	220	203	193.7	F	140
	WBR (HM)	265	39.1	D	220	431	192.7	F	140
	WB	-	*40.7*	*D*	-	-	*194.7*	*F*	-
	SEL (HM NB)	129	12.1	B	30	328	20.4	C	1,365
	SER (HM SB)	126	11.3	B	30	360	25.7	C	1,540
	SER (DTR)	31	11.3	B	30	79	25.7	C	1,540
	SEB	-	*11.7*	*B*	-	-	*23.4*	*C*	-
	Overall	**-**	**82.4**	**F**	**-**	**-**	**81.5**	**F**	**-**
Hunter Mill Road at Crowell Road 	NBT	187	16.0	B	135	620	12.1	B	190
	NBR	221	4.2	A	60	436	2.5	A	70
	NB	-	*9.7*	*A*	-	-	*8.3*	*A*	-
	SBL	276	8.2	A	275	56	6.9	A	60
	SBT	749	13.9	B	1,175	145	4.0	A	75
	SB	-	*12.3*	*B*	-	-	*4.9*	*A*	-
	WBL	323	71.4	E	295	191	73.8	E	230
	WBR	17	42.3	D	2,560	158	52.4	D	100
	WB	-	*69.6*	*E*	-	-	*63.0*	*E*	-
	Overall	**-**	**21.8**	**C**	**-**	**-**	**19.8**	**B**	**-**

Figure 7-7 HUNTER MILL ROAD AND SUNSET HILLS ROAD - ALTERNATIVE 4A

Date: September 12, 2016

FAIRFAX COUNTY, VA

7.8 Alternative 4B

Alternative 4B, shown in **Figure 7-8**, is a "mix and match" alternative that includes signals at the intersections of Hunter Mill Road with Dulles Toll Road EB Ramps and Hunter Mill Road with Dulles Toll Road WB Ramps. In this alternative, Sunset Hills Road would be relocated to Hunter Mill Road at Crowell Road, creating a new four-leg intersection. Hunter Mill Road at Crowell Road/Sunset Hills Road and Hunter Mill Road at Sunrise Valley Drive would be designed as roundabouts. **Appendix A** includes an extended description of Alternative 4B and the results of the operational analysis.

2030 Operational Analysis of Alternative 4B

During the **2030 AM Peak**, all intersections operate at acceptable levels of service. Throughout this period, 3 of 13 (38 percent) approaches and 6 of 25 (28 percent) movements operate at LOS E or F. Only the roundabout at Hunter Mill Road and Crowell Road/Sunset Hills Road has all approaches and movements operating at acceptable levels (with none operating below LOS C).

During the **2030 PM Peak**, three out of four intersections operate at acceptable level of service. Throughout this period, 5 of 13 (38 percent) approaches and 7 of 25 (28 percent) movements operate at LOS E or F. The intersection of Hunter Mill Road and Dulles Toll Road EB Ramps shows significantly increased delay compared to the 2030 AM Peak. Only the roundabout at Hunter Mill Road and Crowell Road/Sunset Hills Road has all approaches and movements operating at acceptable levels (with none operating below LOS B).

Results for the 2030 operational analysis of Alternative 4B are shown in **Table 7-12**.

2050 Operational Analysis of Alternative 4B

During the **2050 AM Peak**, results indicate acceptable operations at three of four intersections. Throughout this period, 5 of 13 (38 percent) approaches and 8 of 25 (31 percent) movements operate at LOS E or F. Corridor operations degrade compared to the 2030 AM Peak, with the southbound approach at Hunter Mill Road and Crowell Road/Sunset Hills Road operating at LOS F.

During the **2050 PM Peak**, results indicate acceptable operations at all intersections. Throughout this period 1 of 13 (8 percent) approaches and 1 of 25 (4 percent) movements operate at LOS E, with no approaches or movements operating at LOS F. Compared to the 2030 PM Peak, operations throughout the corridor are improved, with only the eastbound right movement and eastbound approach at Hunter Mill Road and Dulles Toll Road EB Ramps operating at LOS E.

Results for the 2050 operational analysis of Alternative 4B are shown in **Table 7-13**.

Table 7-12. 2030 Alternative 4B MOE Results

Intersection	Movement	2030 AM Peak				2030 PM Peak			
		Volumes	Delay (s/veh.)	LOS	95th % Queue (ft.)	Volumes	Delay (s/veh.)	LOS	95th % Queue (ft.)
Hunter Mill Road at Sunrise Valley Drive 	SBL	450	10.5	B	75	700	12.9	B	155
	SBR	600	0.1	A	0	550	0.1	A	0
	SB	-	*4.5*	*A*	-	-	*7.2*	*A*	-
	EBL	600	12.6	B	90	550	47.2	D	335
	EBT	300	12.0	B	90	800	135.1	F	1,615
	EB	-	*12.4*	*B*	-	-	*99.3*	*F*	-
	WBT	400	16.0	B	100	150	7.3	A	20
	WBR	800	90.7	F	1,130	550	19.1	B	155
	WB	-	*65.8*	*E*	-	-	*16.6*	*B*	-
	Overall	**-**	**28.6**	**C**	**-**	**-**	**46.9**	**D**	**-**
Hunter Mill Road at Dulles Toll Road EB Ramps 	NBT	900	35.1	D	1,800	800	230.4	F	1,960
	NBR	500	13.1	B	1,985	300	36.5	D	2,110
	NB	-	*27.9*	*C*	-	-	*182.1*	*F*	-
	SBL	150	110.0	F	175	200	284.6	F	330
	SBT	700	7.4	A	255	950	1.5	A	475
	SB	-	*23.2*	*C*	-	-	*242.4*	*F*	-
	EBL	100	57.6	E	320	100	241.3	F	1,800
	EBR	350	85.9	F	365	300	68.6	E	600
	EB	-	*79.4*	*E*	-	-	*113.0*	*F*	-
	Overall	**-**	**36.5**	**D**	**-**	**-**	**198.1**	**F**	**-**
Hunter Mill Road at Dulles Toll Road WB Ramps 	NBL	200	4.4	A	200	350	59.5	E	200
	NBT	800	4.3	A	430	550	0.2	A	550
	NB	-	*4.3*	*A*	-	-	*23.3*	*C*	-
	SBT	600	15.7	B	295	700	46.7	D	335
	SBR	150	10.5	B	205	150	25.0	C	295
	SB	-	*14.6*	*B*	-	-	*42.9*	*D*	-
	WBL	250	70.1	E	735	450	81.7	F	625
	WBR	350	56.5	E	675	250	42.9	D	735
	WB	-	*62.2*	*E*	-	-	*67.9*	*E*	-
	Overall	**-**	**22.4**	**C**	**-**	**-**	**42.8**	**D**	**-**
Hunter Mill Road at Crowell Road / Sunset Hills Road 	NBL	650	18.4	B	160	250	7.1	A	35
	NBT	165	17.4	B	160	205	12.1	B	110
	NBR	335	17.4	B	160	345	12.1	B	110
	NB	-	*18.0*	*B*	-	-	*10.5*	*B*	-
	SBL	200	33.3	C	90	50	7.5	A	25
	SBT	150	30.3	C	90	125	7.1	A	25
	SBR	150	29.5	C	90	25	6.9	A	5
	SB	-	*31.2*	*C*	-	-	*7.2*	*A*	-
	EBL	85	7.8	A	15	175	6.8	A	25
	EBT	165	15.6	B	85	125	16.1	B	145
	EBR	200	15.6	B	85	450	16.1	B	145
	EB	-	*14.1*	*B*	-	-	*13.9*	*B*	-
	WBL	400	25.5	C	125	275	13.6	B	55
	WBT	200	16.9	B	65	175	12.9	B	95
	WBR	50	16.9	B	65	250	12.6	B	95
	WB	-	*22.2*	*C*	-	-	*13.1*	*B*	-
	Overall	**-**	**20.8**	**C**	**-**	**-**	**12.0**	**B**	**-**

Table 7-13. 2050 Alternative 4B MOE Results

Intersection	Movement	2050 AM Peak				2050 PM Peak			
		Volumes	Delay (s/veh.)	LOS	95th % Queue (ft.)	Volumes	Delay (s/veh.)	LOS	95th % Queue (ft.)
Hunter Mill Road at Sunrise Valley Drive 	SBL	389	14.3	B	85	791	12.9	B	155
	SBR	442	0.0	A	0	307	0.0	A	0
	SB	-	*6.7*	*A*	-	-	*9.3*	*A*	-
	EBL	577	9.0	A	55	497	18.7	B	95
	EBT	137	8.7	A	55	717	17.7	B	95
	EB	-	*8.9*	*A*	-	-	*18.5*	*B*	-
	WBT	737	89.5	F	1,030	119	7.0	A	15
	WBR	822	92.2	F	1,190	538	19.6	B	150
	WB	-	*90.9*	*F*	-	-	*17.3*	*B*	-
	Overall	**-**	**49.5**	**D**	**-**	**-**	**14.1**	**B**	**-**
Hunter Mill Road at Dulles Toll Road EB Ramps 	NBT	711	98.1	F	2,020	679	33.3	C	2,090
	NBR	688	49.4	D	2,155	356	13.6	B	2,200
	NB	-	*76.3*	*E*	-	-	*27.1*	*C*	-
	SBL	573	101.7	F	255	224	43.5	D	305
	SBT	624	2.2	A	545	815	5.0	A	565
	SB	-	*54.5*	*D*	-	-	*14.5*	*B*	-
	EBL	32	79.2	E	110	108	44.4	D	1,530
	EBR	207	61.8	E	95	283	60.2	E	615
	EB	-	*64.3*	*E*	-	-	*55.7*	*E*	-
	Overall	**-**	**65.7**	**E**	**-**	**-**	**27.1**	**C**	**-**
Hunter Mill Road at Dulles Toll Road WB Ramps 	NBL	97	53.1	D	435	276	13.6	B	205
	NBT	646	0.5	A	340	511	7.2	A	475
	NB	-	*7.4*	*A*	-	-	*9.4*	*A*	-
	SBT	896	36.7	D	340	570	32.1	C	375
	SBR	64	13.8	B	160	74	17.1	B	270
	SB	-	*35.2*	*D*	-	-	*30.4*	*C*	-
	WBL	301	43.2	D	685	469	51.3	D	705
	WBR	617	79.5	E	580	634	45.8	D	580
	WB	-	*67.6*	*E*	-	-	*48.1*	*D*	-
	Overall	-	38.7	D	-	**-**	**31.6**	**C**	**-**
Hunter Mill Road at Crowell Road / Sunset Hills Road 	NBL	984	15.1	B	160	417	10.9	B	75
	NBT	143	14.6	B	155	429	23.0	C	255
	NBR	136	14.6	B	155	299	23.0	C	255
	NB	-	*15.0*	*B*	-	-	*18.6*	*B*	-
	SBL	276	272.3	F	1585	56	6.8	A	15
	SBT	588	268.9	F	1825	88	6.5	A	15
	SBR	161	267.2	F	1825	57	6.2	A	15
	SB	-	*269.6*	*F*	-	-	*6.5*	*A*	-
	EBL	44	7.1	A	5	191	5.6	A	20
	EBT	85	11.2	B	45	137	10.8	B	100
	EBR	157	11.2	B	45	439	10.8	B	100
	EB	-	*10.3*	*B*	-	-	*9.5*	*A*	-
	WBL	215	18.7	B	55	117	15.0	B	40
	WBT	108	15.7	B	35	74	14.4	B	40
	WBR	17	15.7	B	35	158	13.4	B	40
	WB	-	17.6	*B*	-	-	14.2	*B*	-
	Overall	-	**104.4**	**F**	**-**	**-**	**14.1**	**B**	**-**

Figure 7-8 HUNTER MILL ROAD AND SUNSET HILLS ROAD - ALTERNATIVE 4B

Date: March 24, 2017

FAIRFAX COUNTY, VA

7.9 Comparison of Build Alternatives

The six developed alternatives were qualitatively considered using criteria deemed important in choosing a viable alternative. These criteria included level of service, the potential right-of-way necessary to implement the alternatives, qualitative understanding of cost, community input, and the constructability of the alternative. The alternatives were ranked against each other to provide an understanding of the variation between alternatives. For cost, right-of-way, and constructability, the most impactful alternatives were identified at a non-detailed level, and the remaining alternatives were considered in comparison to the other developed alternatives. **Table 7-14** summarizes the results of this analysis, with more detail provided on the metrics in the following sections.

Table 7-14. Comparison of Build Alternatives

Comparative Metric	Roundabouts		Signals		Mix & Match	
	Alt. 1A	Alt. 1B	Alt. 2	Alt. 3	Alt. 4A	Alt. 4B
Level of Service	*	**	***	**	*	**
Right-of-Way	**	*	**	**	**	*
Cost	**	*	***	***	**	**
Community Input	***	***	*	**	**	**
Constructability	*	**	***	***	**	**

Each element rated as follows:
* Worst
** Average
*** Best

Level of Service

The 2030 and 2050 traffic analyses for the No Build scenario and each alternative are summarized in **Table 7-15** and **Table 7-16**, respectively. Levels of service in 2030 are shown in **Figure 7-9**, **Figure 7-10**, and **Figure 7-11**. Levels of service in 2050 are shown in **Figure 7-12**, **Figure 7-13**, and **Figure 7-14**. Overall levels of service for each intersection are acceptable during each peak period for Alternative 1B, Alternative 2, Alternative 3, and Alternative 4 in 2030. In 2050, two or more intersections per alternative are expected to operate at LOS E or F during the AM Peak. During the 2050 PM Peak, only Alternative 1A and Alternative 4A are expected to have any intersections operating at LOS E or lower.

Table 7-15. 2030 Traffic Analysis Summary

Intersection		Roundabouts		Signals		Mix & Match	
	No Build	Alt. 1A	Alt. 1B	Alt. 2	Alt. 3	Alt. 4A	Alt. 4B
	OVERALL LOS AM (PM)						
Hunter Mill Rd. @ Sunrise Valley Dr.	D (D)	C (D)	C (D)	D (D)	C (D)	F (F)	C (D)
Hunter Mill Rd. @ DTR EB Ramps	C (C)	B (B)	B (B)	C (C)	D (C)	B (B)	D (F)
Hunter Mill Rd. @ DTR WB Ramps	C (E)	-	B (D)	C (D)	B (D)	-	C (D)
Hunter Mill Rd. @ DTR WB Ramps & Sunset Hills Rd.	-	D (D)	-	-	-	D (D)	-
Hunter Mill Rd. @ Sunset Hills Rd.	D (D)	-	-	D (D)	-	-	-
Hunter Mill Rd. @ Crowell Rd.	C (C)	E (C)	-	C (C)	-	C (C)	-
Hunter Mill Rd. @ Crowell Rd. / Sunset Hills Rd.	-	-	C (B)	-	D (C)	-	C (B)

Table 7-16. 2050 Traffic Analysis Summary

Intersection		Roundabouts		Signals		Mix & Match	
	No Build	Alt. 1A	Alt. 1B	Alt. 2	Alt. 3	Alt. 4A	Alt. 4B
	OVERALL LOS AM (PM)						
Hunter Mill Rd. @ Sunrise Valley Dr.	E (D)	D (B)	D (B)	E (D)	E (D)	F (E)	D (B)
Hunter Mill Rd. @ DTR EB Ramps	E (C)	D (B)	D (B)	E (C)	E (C)	D (B)	E (C)
Hunter Mill Rd. @ DTR WB Ramps	D (C)	-	C (C)	D (C)	C (C)	-	D (C)
Hunter Mill Rd. @ DTR WB Ramps & Sunset Hills Rd.	-	F (F)	-	-	-	F (F)	-
Hunter Mill Rd. @ Sunset Hills Rd.	C (B)	-	-	E (D)	-	-	-
Hunter Mill Rd. @ Crowell Rd.	B (C)	F (F)	-	C (B)	-	C (B)	-
Hunter Mill Rd. @ Crowell Rd. / Sunset Hills Rd.	-	-	F (B)	-	F (C)	-	F (B)

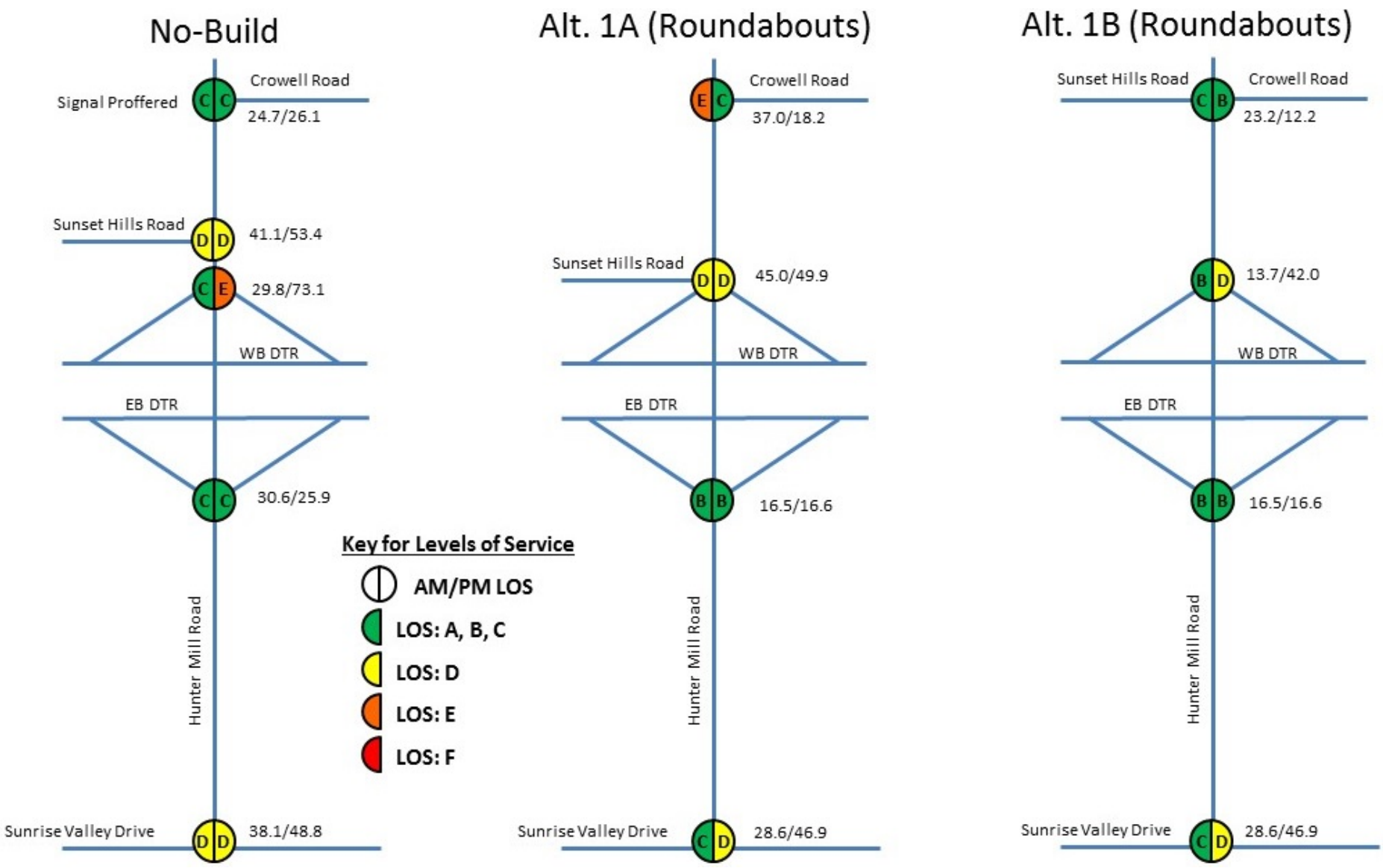


Figure 7-9. 2030 Traffic Analysis Results Comparing the No Build to Alternative 1A and Alternative 1B

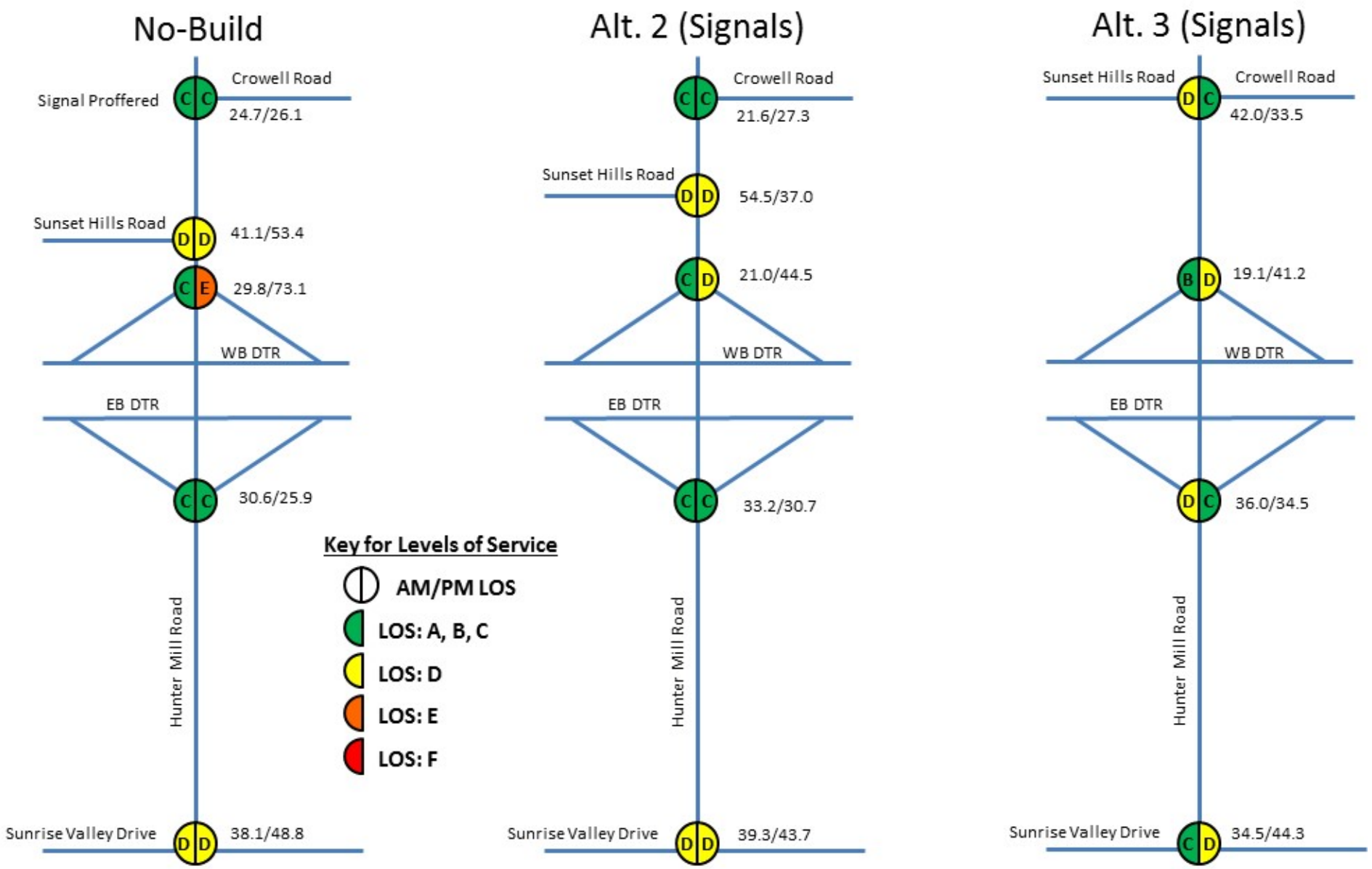


Figure 7-10. 2030 Traffic Analysis Results Comparing the No Build to Alternative 2 and Alternative 3

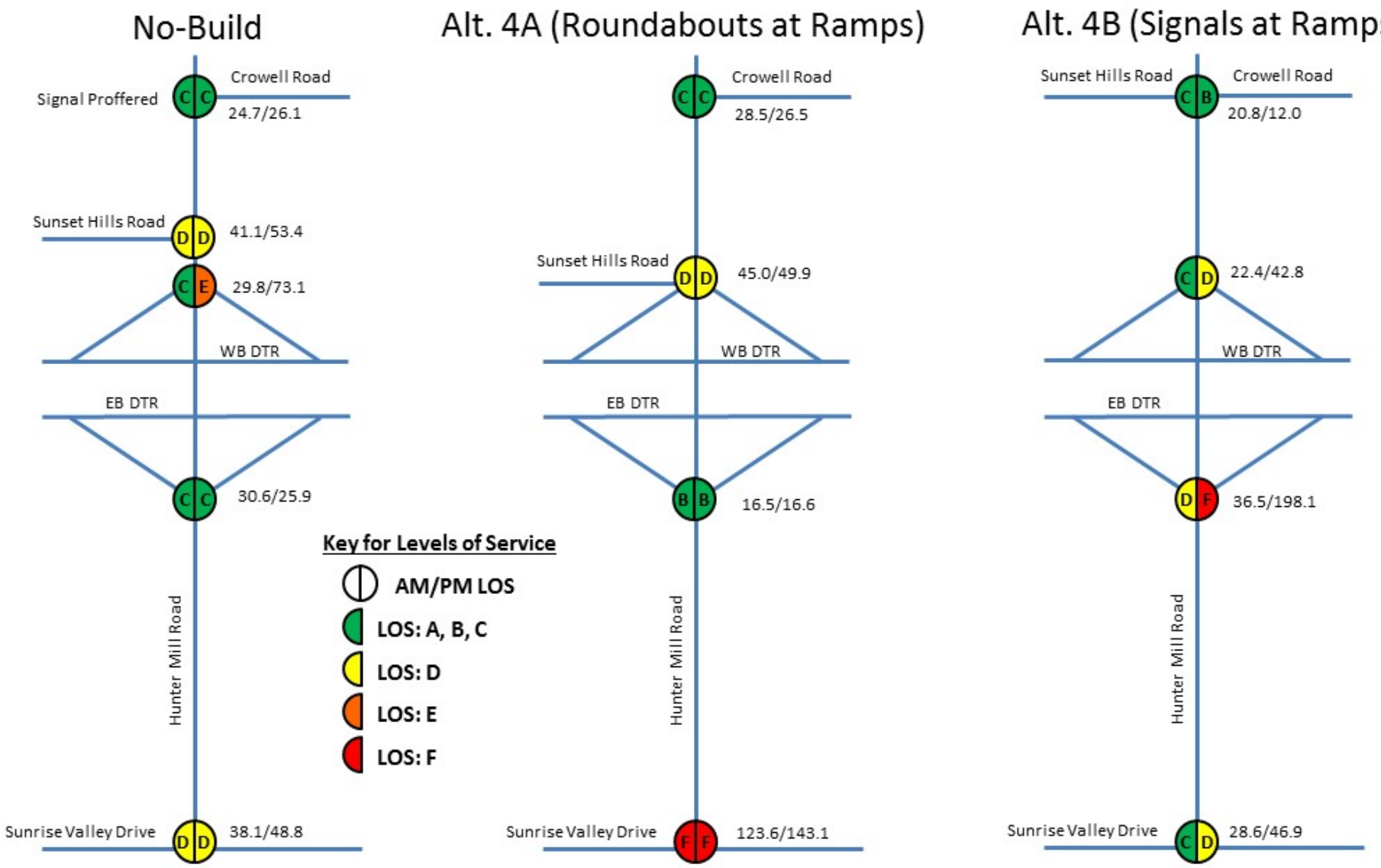


Figure 7-11. 2030 Traffic Analysis Results Comparing the No Build to Alternative 4A and Alternative 4B

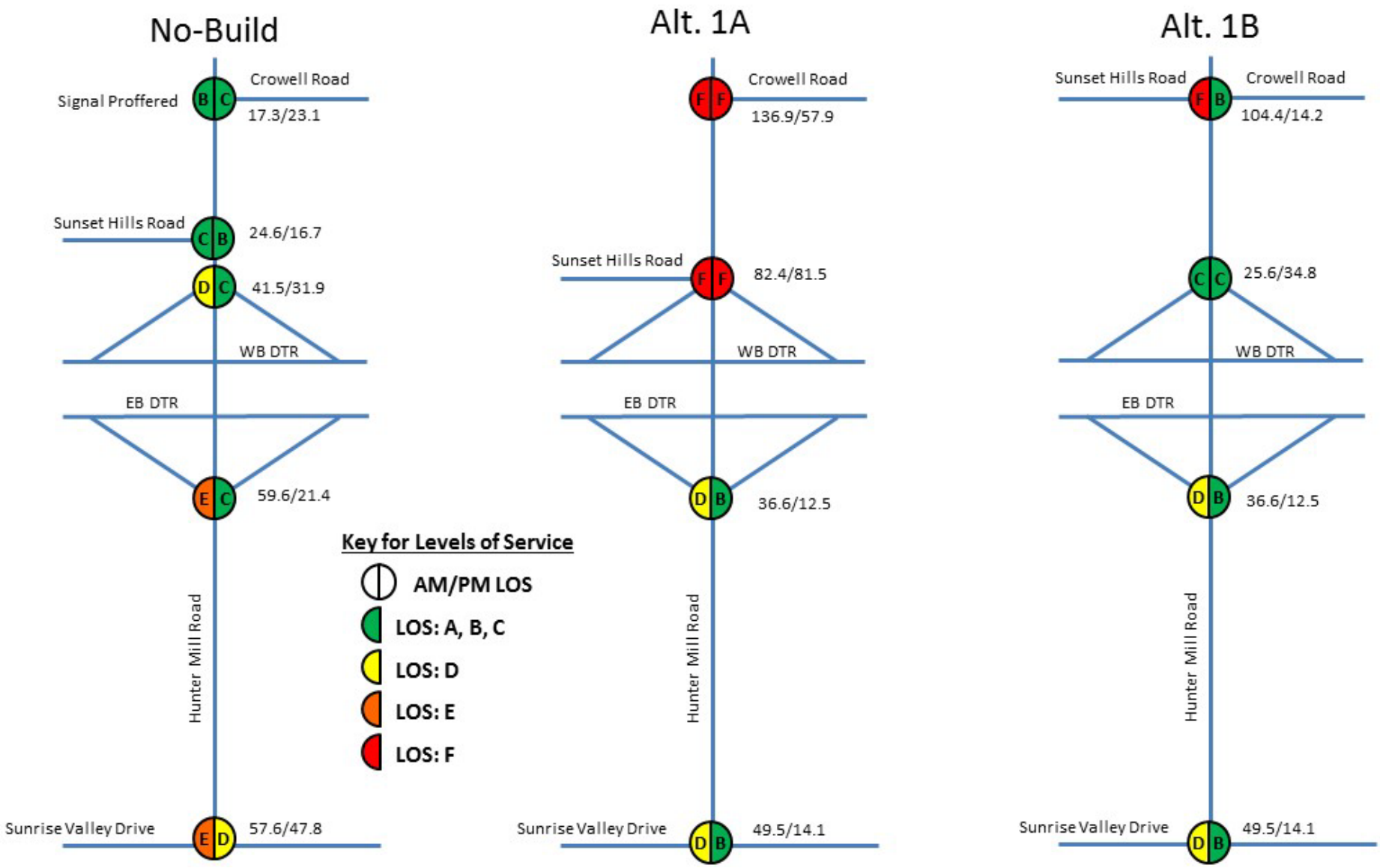


Figure 7-12. 2050 Traffic Analysis Results Comparing the No Build to Alternative 1A and Alternative 1B

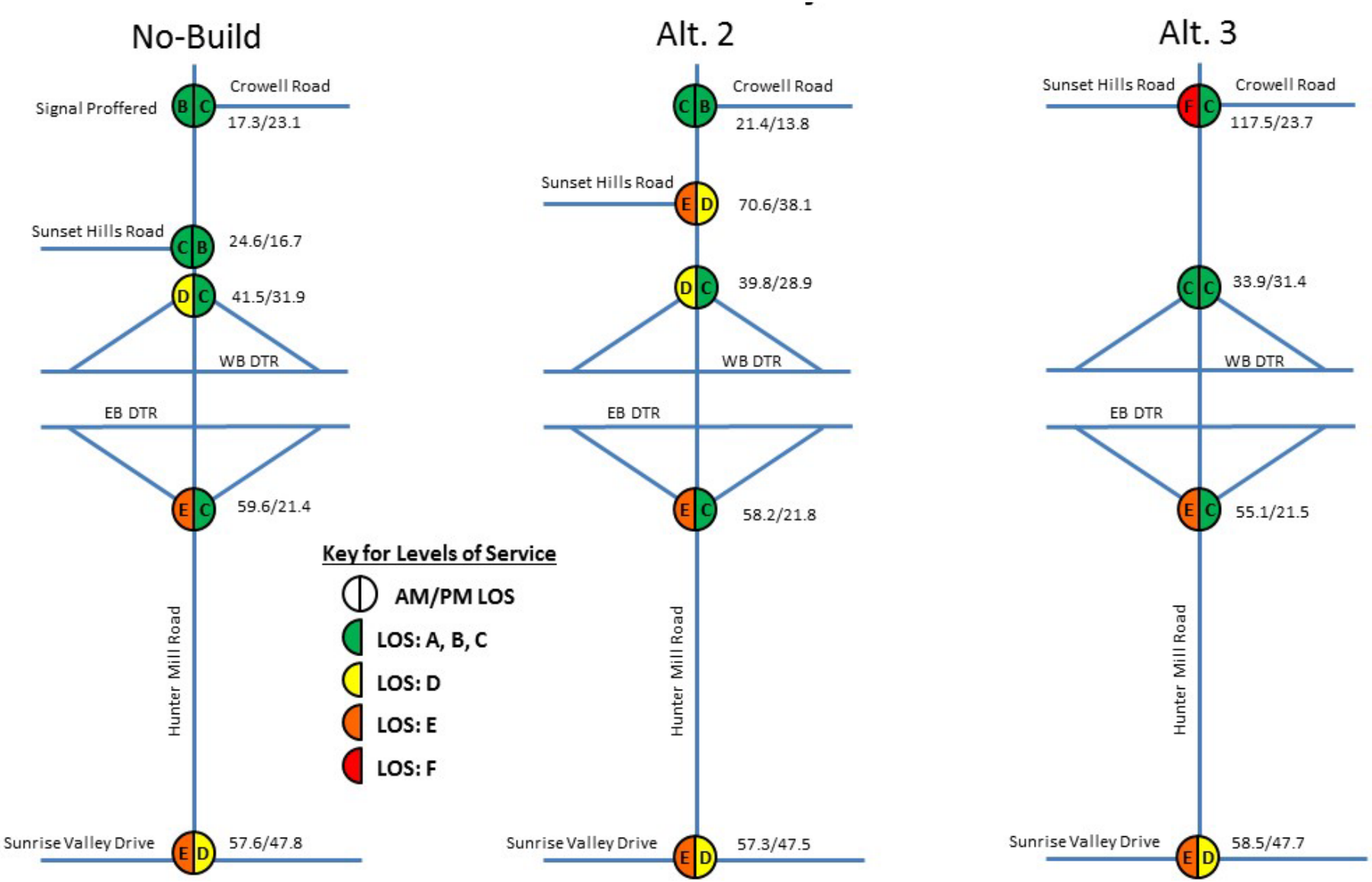


Figure 7-13. 2050 Traffic Analysis Results Comparing the No Build to Alternative 2 and Alternative 3

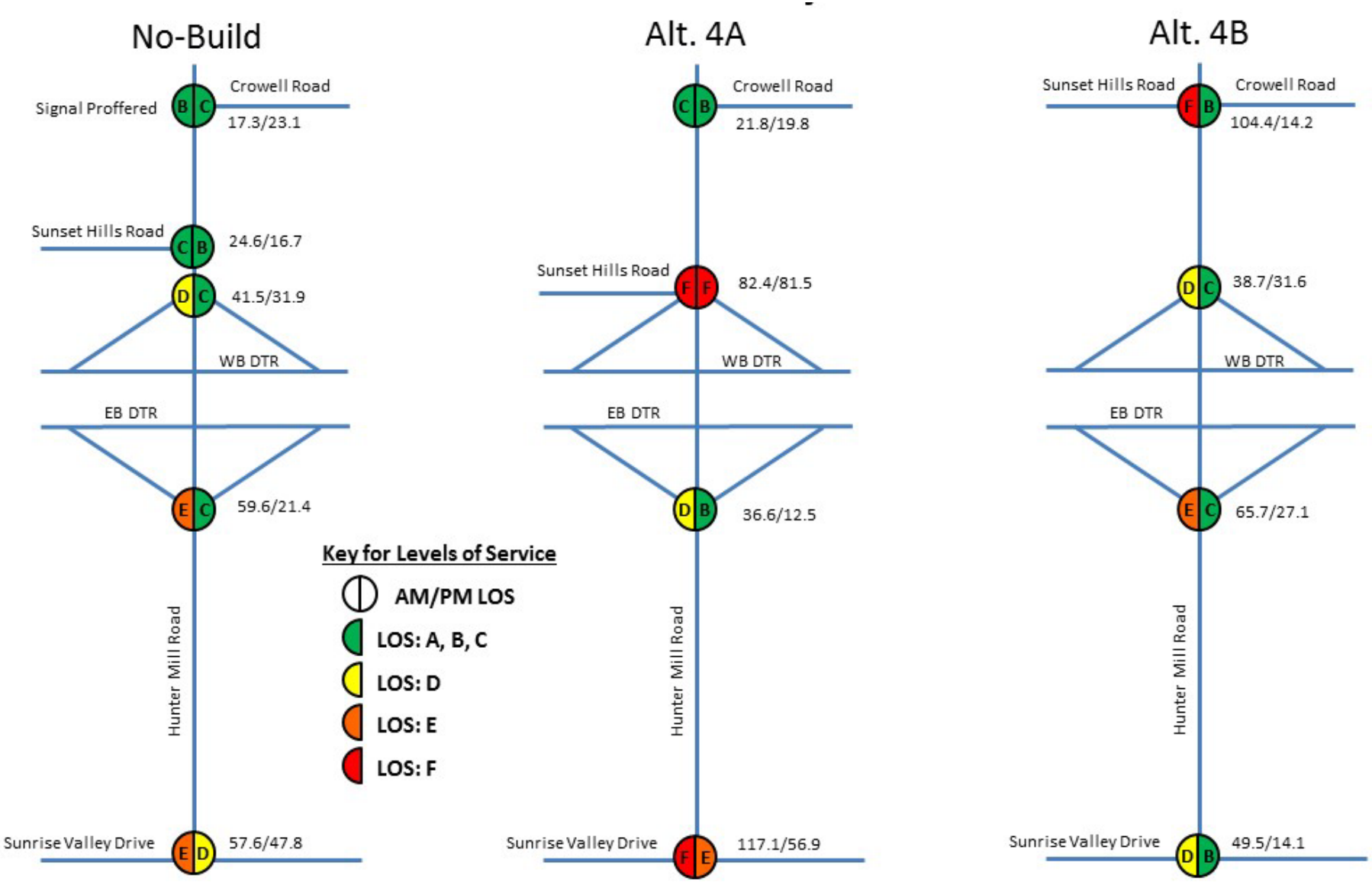


Figure 7-14. 2050 Traffic Analysis Results Comparing the No Build to Alternative 4A and Alternative 4B

Right-of-Way

The major right-of-way concerns are related to the realignment of Sunset Hills Road, whether it is realigned to Crowell Road or remains in its current alignment, and the construction of roundabouts, which have a much larger footprint than existing intersections. Right-of-way may also be necessary to add turn lanes and additional storage, which will be required in all alternatives. In terms of right-of-way impact, Alternative 1B and Alternative 4B are deemed to be more significant as these both require the realignment of Sunset Hills Road and include multiple roundabouts. However, there is no "best" alternative in terms of right-of-way impact.

Cost

In terms of cost, Alternative 2 and Alternative 3 are the highest rated, as signalization will generally be less costly than construction of roundabouts. Alternative 1B is deemed to be the "worst" in terms of cost, as it requires the most right-of-way in terms of roundabout construction and the realignment of Sunset Hills Road.

Community Input

There has been significant community outreach and input into the project. Throughout the process there was significant community interest in seeing roundabouts included in the preferred alternative selected for the corridor. There was also concern voiced about the need to find a solution that worked for the corridor that could manage the transportation needs while maintaining Hunter Mill Road's character. This desire coupled with multiple comments in support of a realignment of Sunset Hills Road to Crowell Road. Alternatives 1A and 1B had significant community support, due to the high number of roundabouts in the Alternatives. Alternative 3 and 4B also had support from differing groups to the realignment of Sunset Hill's Road to Crowell Road. There was not community support received for Alternative 2. Multiple statements were made in support of a mix and match alternative for the corridor, incorporating both signals and roundabouts along Hunter Mill Road.

Constructability

In terms of constructability, Alternative 1A is deemed unfeasible due to the five-leg roundabout at Dulles Toll Road WB Ramps and Sunset Hills Road. The roundabout would require unsafe entry angles, would likely result in high entry and exit speeds, and/or require the relocation of Reston Presbyterian Church, none of which would be feasible. The most feasible options are deemed to be Alternative 2 and Alternative 3, which would require minimal redesign of intersections and interruption of traffic during construction.

8.0 PREFERRED ALTERNATIVE

The analyses show that no one alternative would clearly provide better operations than another in future years 2030 and 2050. Alternative 2 and "mix and match" Alternative 4A showed more promise from an operational standpoint than other considered alternatives, but still do not provide acceptable operations at all intersections during the 2050 AM Peak. The operational results showed that in several cases, the volume in the peak direction exceeded the capacity of the proposed improvements, resulting in poor performance. In addition, these may not be the most viable alternatives in terms of the other comparative metrics discussed in Section 7.9.

To balance the desire of the community to see roundabouts implemented in the corridor, as well as the need to accommodate future travel demand in the corridor, a new alternative was developed. The Preferred Alternative, shown in **Figure 8-1**, includes signals at Sunrise Valley Drive, Dulles Toll Road WB Ramps, and Dulles Toll Road EB Ramps as in Alternatives 2 and 3.

Sunset Hills Road is realigned to Crowell Road, and this intersection is designed as a two-lane roundabout with two-lane entries and one-lane exits at the north and east legs. The two-lane southbound approach is intended to alleviate expected congestion exacerbated by the high southbound through volume and high northbound left turn volume during the 2050 AM Peak. Analysis also assumed a dual-left northbound approach for this roundabout.

The north and east legs of the roundabout are designed with one lane exits and all other entries and exits are designed with two lanes. This roundabout will serve as a transition from the segment of Hunter Mill Road in proximity to the Dulles Toll Road and the neighborhoods and communities to the north, helping to transition vehicle speeds and create a traffic calming tool for the neighborhood.

In the Preferred Alternative, the preferred realignment of Sunset Hills Road as described in Section 6.2 is utilized. In contrast to other alternatives, Hunter Mill Road is converted to four continuous lanes (two per direction) from Crowell Road and realigned Sunset Hills Road to Dulles Toll Road WB Ramps. This four-lane section would utilize the existing right-of-way and pavement along Hunter Mill Road. At Hunting Crest Lane and Lake Fairfax Park, two-way stop controlled intersections remain as in the existing conditions and all other alternatives. As such, delay and LOS results for these intersections will be the same as in all other alternatives.

8.1 2030 Operational Analysis of the Preferred Alternative

During the **2030 AM Peak**, acceptable operations are expected at all intersections. Throughout this period, 1 of 13 (8 percent) approaches and 5 of 30 (17 percent) movements operate LOS E or F. The roundabout at Hunter Mill Road and Crowell Road/Sunset Hills Road is expected to operate at LOS C.

During the **2030 PM Peak**, acceptable operations are expected at all intersections. Throughout this period, 3 of 13 (23 percent) approaches and 5 of 30 (17 percent) movements operate LOS E or F. The roundabout at Hunter Mill Road and Crowell Road/Sunset Hills Road is expected to operate at LOS B. These results show similar operations between the two peak periods.

Results for the 2030 operational analysis of the Preferred Alternative are shown in **Table 8-1**.

8.2 2050 Operational Analysis of the Preferred Alternative

During the **2050 AM Peak**, acceptable operations are expected at two of four intersections. Throughout this period, 6 of 13 (46 percent) approaches and 11 of 30 (37 percent) movements operate at LOS E or F. Despite a degradation in operations throughout the corridor compared to the 2030 AM Peak, the Preferred Alternative provides better operations for the corridor than Alternative 2.

During the **2050 PM Peak**, acceptable operations are expected at all intersections. Throughout this period, 2 of 13 (16 percent) approaches and 3 of 30 (10 percent) movements operate at LOS E, with none operating at LOS F. Both the intersection of Hunter Mill Road and Dulles Toll Road WB Ramps and the intersection of Hunter Mill Road and Crowell Road/Sunset Hills Road have no movements or approaches expected to operate below LOS D.

Results for the 2050 operational analysis of the Preferred Alternative are shown in **Table 8-2**.

Table 8-1. 2030 Preferred Alternative

Intersection	Movement	2030 AM Peak				2030 PM Peak			
		Volumes	Delay	LOS	95th % Queue (ft.)	Volumes	Delay	LOS	95th % Queue (ft.)
Hunter Mill Road at Sunrise Valley Drive 	SBL	450	56.0	E	460	700	51.0	D	945
	SBR	600	0.6	A	0	550	0.4	A	365
	SB	-	*23.9*	*C*	-	-	*28.3*	*C*	-
	EBL	600	62.0	E	295	550	62.5	E	1,955
	EBT	300	12.7	B	170	800	57.3	E	1,880
	EB	-	*45.9*	*D*	-	-	*59.4*	*E*	-
	WBT	400	43.4	D	340	150	42.0	D	1,090
	WBR	800	42.4	D	345	550	41.2	D	860
	WB	-	*42.8*	*D*	-	-	*41.4*	*D*	-
	Overall	**-**	**37.3**	**D**	**-**	**-**	**43.8**	**D**	**-**
Hunter Mill Road at Dulles Toll Road EB Ramps 	NBT	900	29.5	C	610	800	30.4	C	1,950
	NBR	500	2.7	A	265	300	0.4	A	2,225
	NB	-	*20.8*	*C*	-	-	*22.9*	*C*	-
	SBL	150	107.4	F	220	200	71.7	E	215
	SBT	700	8.1	A	315	950	4.9	A	255
	SB	-	*28.4*	*C*	-	-	*18.4*	*B*	-
	EBL	100	51.4	D	310	100	47.7	D	425
	EBR	350	84.1	F	365	300	92.1	F	420
	EB	-	*76.6*	*E*	-	-	*80.7*	*F*	-
	Overall	**-**	**33.8**	**C**	**-**	**-**	**31.0**	**C**	**-**
Hunter Mill Road at Dulles Toll Road WB Ramps 	NBL	200	7.1	A	165	350	46.9	D	165
	NBT	800	6.0	A	455	550	24.5	C	490
	NB	-	*6.2*	*A*	-	-	*33.2*	*C*	-
	SBT	600	16.2	B	335	700	50.1	D	755
	SBR	150	10.5	B	45	150	22.2	C	125
	SB	-	*15.1*	*B*	-	-	*45.2*	*D*	-
	WBL	250	59.5	E	290	450	71.4	E	625
	WBR	350	48.7	D	140	250	33.6	C	575
	WB	-	*53.2*	*D*	-	-	*57.9*	*E*	-
	Overall	**-**	**21.1**	**C**	**-**	**-**	**44.4**	**D**	**-**
Hunter Mill Road at Crowell Road / Sunset Hills Road 	NBL	650	18.4	B	160	250	7.1	A	35
	NBT	165	17.4	B	160	205	12.1	B	110
	NBR	335	17.4	B	160	345	12.1	B	110
	NB	-	*18.0*	*B*	-	-	*10.5*	*B*	-
	SBL	200	33.3	C	90	50	7.5	A	15
	SBT	150	30.3	C	90	125	7.1	A	15
	SBR	150	29.5	C	90	25	6.9	A	15
	SB	-	*31.2*	*C*	-	-	*7.2*	*A*	-
	EBL	85	7.8	A	15	175	6.8	A	25
	EBT	165	15.6	B	85	125	16.1	B	145
	EBR	200	15.6	B	85	450	16.1	B	145
	EB	-	*14.1*	*B*	-	-	*13.9*	*B*	-
	WBL	400	25.5	C	125	275	13.6	B	75
	WBT	200	16.9	B	65	175	12.9	B	75
	WBR	50	16.9	B	65	250	12.6	B	75
	WB	-	*22.2*	*C*	-	-	*13.1*	*B*	-
	Overall	**-**	**20.8**	**C**	**-**	**-**	**12.0**	**B**	**-**

Table 8-2. 2050 Preferred Alternative

Intersection	Movement	2050 AM Peak				2050 PM Peak			
		Volumes	Delay	LOS	95th % Queue (ft.)	Volumes	Delay	LOS	95th % Queue (ft.)
Hunter Mill Road at Sunrise Valley Drive 	SBL	389	104.4	F	430	791	53.8	D	1,470
	SBR	442	0.5	A	0	307	0.2	A	985
	SB	-	*48.3*	*D*	-	-	*38.5*	*D*	-
	EBL	577	98.4	F	415	497	58.5	E	1,045
	EBT	137	7.3	A	230	717	65.0	E	1,425
	EB	-	*81.4*	*F*	-	-	*62.3*	*E*	-
	WBT	737	71.1	E	725	119	37.0	D	120
	WBR	822	31.4	C	520	538	35.8	D	155
	WB	-	*51.7*	*D*	-	-	*36.0*	*D*	-
	Overall	**-**	**57.6**	**E**	**-**	**-**	**47.7**	**D**	**-**
Hunter Mill Road at Dulles Toll Road EB Ramps 	NBT	711	98.9	F	585	679	18.4	B	325
	NBR	688	51.0	D	360	356	1.5	A	80
	NB	-	*77.4*	*E*	-	-	*13.1*	*B*	-
	SBL	573	102.7	F	235	224	43.3	D	220
	SBT	624	2.6	A	490	815	5.2	A	255
	SB	-	*55.2*	*E*	-	-	*14.7*	*B*	-
	EBL	32	76.5	E	75	108	44.4	D	410
	EBR	207	69.9	E	125	283	60.2	E	345
	EB	-	*70.8*	*E*	-	-	*55.7*	*E*	-
	Overall	**-**	**67.2**	**E**	**-**	**-**	**21.5**	**C**	**-**
Hunter Mill Road at Dulles Toll Road WB Ramps 	NBL	97	22.8	C	145	276	13.9	B	165
	NBT	646	10.8	B	460	511	6.6	A	360
	NB	-	*12.4*	*B*	-	-	*9.1*	*A*	-
	SBT	896	45.5	D	1,325	570	32.1	C	530
	SBR	64	11.4	B	1,530	74	17.1	B	50
	SB	-	*43.2*	*D*	-	-	*30.4*	*C*	-
	WBL	301	31.8	C	665	469	51.3	D	470
	WBR	617	77.3	E	720	634	45.8	D	370
	WB	-	*62.4*	*E*	-	-	*48.1*	*D*	-
	Overall	-	**41.2**	**D**	**-**	**-**	**31.5**	**C**	**-**
Hunter Mill Road at Crowell Road / Sunset Hills Road 	NBL	984	15.1	B	155	417	10.9	B	75
	NBT	143	14.6	B	155	429	23.0	C	255
	NBR	136	14.6	B	155	299	23.0	C	255
	NB	-	*15.0*	*B*	-	-	*18.6*	*B*	-
	SBL	276	272.3	F	1,585	56	6.8	A	15
	SBT	588	268.9	F	1,825	88	6.5	A	15
	SBR	161	267.2	F	1,825	57	6.2	A	15
	SB	-	*269.6*	*F*	-	-	*6.5*	*A*	-
	EBL	44	7.1	A	5	191	5.6	A	20
	EBT	85	11.2	B	45	137	10.8	B	100
	EBR	157	11.2	B	45	439	10.8	B	100
	EB	-	*10.3*	*B*	-	-	*9.5*	*A*	-
	WBL	215	18.7	B	55	117	15.0	B	40
	WBT	108	15.7	B	35	74	14.4	B	40
	WBR	17	15.7	B	35	158	13.4	B	40
	WB	-	17.6	*B*	-	-	14.2	*B*	-
	Overall	**-**	**104.4**	**F**	**-**	**-**	**14.1**	**B**	**-**

Figure 8-1 HUNTER MILL ROAD AND SUNSET HILLS ROAD - PREFERRED ALTERNATIVE

Date: November 17, 2016

FAIRFAX COUNTY, VA

9.0 CONCLUSIONS AND RECOMMENDATIONS

The Preferred Alternative was developed in consideration of expected development, forecasted traffic volumes, and the input received from the community. This report includes discussion of proposed improvements along the Hunter Mill corridor that were designed and evaluated from an operational standpoint. A 5-leg roundabout at Hunter Mill Road, Dulles Toll Road WB Ramps, and Sunset Hills Road was evaluated, as well as multiple roundabout concepts along the corridor. The realignment of Sunset Hills Road to Crowell Road was evaluated in terms of surrounding property and safety.

Table 9-1 shows the comparison of all alternatives.

Table 9-1. Comparison of All Alternatives

Comparative Metric	Roundabouts		Signals		Mix & Match		Pref. Alt.
	Alt. 1A	Alt. 1B	Alt. 2	Alt. 3	Alt. 4A	Alt. 4B	
Level of Service	*	**	***	**	*	**	**
Right-of-Way	**	*	**	**	**	*	**
Cost	**	*	***	***	**	**	**
Community Input	***	***	*	**	**	**	**
Constructability	*	**	***	***	**	**	***

Each element rated as follows:
* Worst
** Average
*** Best

The Preferred Alternative is expected to provide acceptable levels of service at all intersections during both peak periods in 2030. During the 2050 AM Peak, the Preferred Alternative shows similar levels of service at each intersection as other alternatives. However, compared to a roundabout with a one lane southbound entrance, the redesigned roundabout with two southbound approach lanes at Crowell Road and realigned a Sunset Hills Road decreases expected delay at the southbound approach by over 500 seconds, and the longest queue by approximately 70 percent.

Associated costs will be higher than for signalized Alternatives 2 and 3, but the alternative does appeal to community desire for roundabout implementation along the corridor. This alternative addresses the congestion concentrated at Sunset Hills Road and Dulles Toll Road WB Ramps by realigning Sunset Hills Road to Crowell Road. The roundabout at Crowell Road/Sunset Hills Road realigned would serve as a traffic-calming transition from the segment of Hunter Mill Road in proximity to the Dulles Toll Road to neighborhoods and communities to the north. The final preferred realignment of Sunset Hills Road was developed to balance safety and impacts to existing property. Soccer fields near the alignment were deemed not to be constraints, thus allowing the proposed design which includes two horizontal curves with short straightaway sections to maintain low speeds and safe entry and exit of the roundabout.

Overall, the Preferred Alternative was selected to provide the greatest balance among level of service, right-of-way, cost, community input, and constructability. Thus, the Preferred Alternative is recommended to be incorporated into Fairfax County's Transportation Master Plan.