



REPORT

**Crossroads IGA  
8001 Smyrna Parkway  
Louisville, KY**

**Traffic Impact Study**

Louisville Metro Planning

March 8, 2016

*Revised May 2, 2016*

**CDM  
Smith**



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# Introduction

The proposed Crossroads IGA in Louisville, KY is located on Smyrna Parkway east of Applegate Lane (west) intersection and north of Highview Fire Station Number 2. Crossroads IGA is proposing a 14,532 square foot neighborhood grocery with eight fueling positions. The building will also house a hardware store and a fast-food restaurant. **Figure 1** displays a map of the site. Access to the tract will be from two entrances on Smyrna Parkway. The purpose of this study is to examine the traffic impacts of the proposed development upon the adjacent highway system. For this study the impact area was defined to be the intersection of Applegate Lane (west) and Smyrna Parkway.

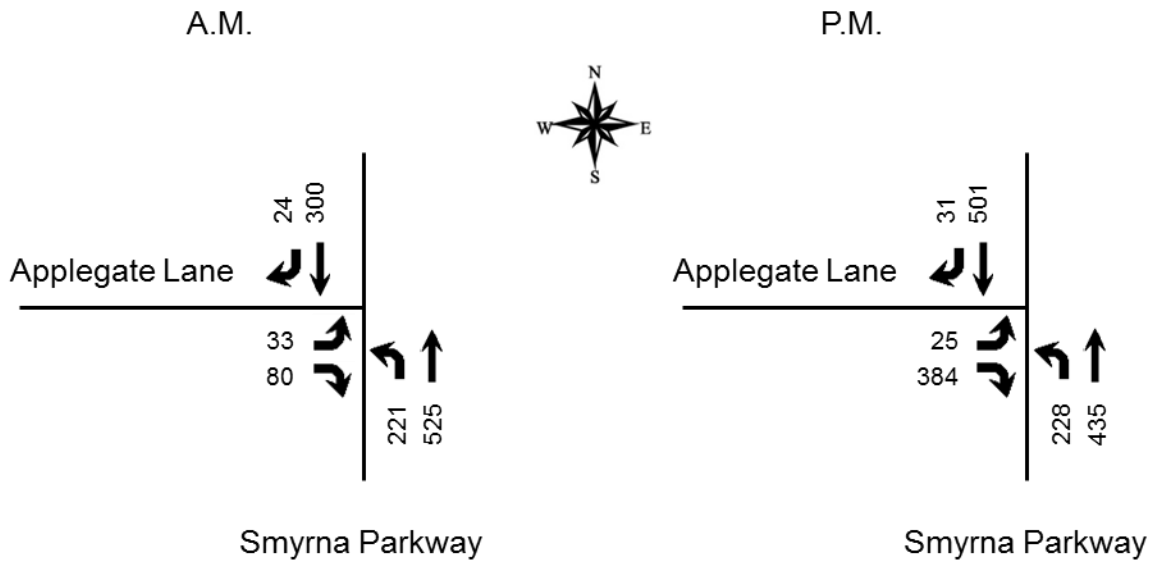


**Figure 1**  
Site Location

## Existing Conditions

Smyrna Parkway is maintained by Metro Louisville with an estimated 2015 ADT of 12,200 vehicles per day between Outer Loop (KY 1065) and Manslick Road (KY 2845), as estimated from the Kentucky Transportation Cabinet 2014 count at station 402. The road is a three lane road with ten-foot lanes a two-way left turn lane and curb and gutter. The posted speed limit is 35 mph. There are sidewalks on the west side. The intersection with Applegate Lane is controlled with a stop sign. There are no turn lanes on Applegate Lane.

A.m. and p.m. peak hour traffic counts were obtained at the intersection on December 17, 2015 (see Appendix A). The a.m. peak hour occurred between 7:00 and 8:00 and the p.m. peak hour occurred between 5:00 and 6:00 p.m. **Figure 2** illustrates the existing peak hour traffic volumes.

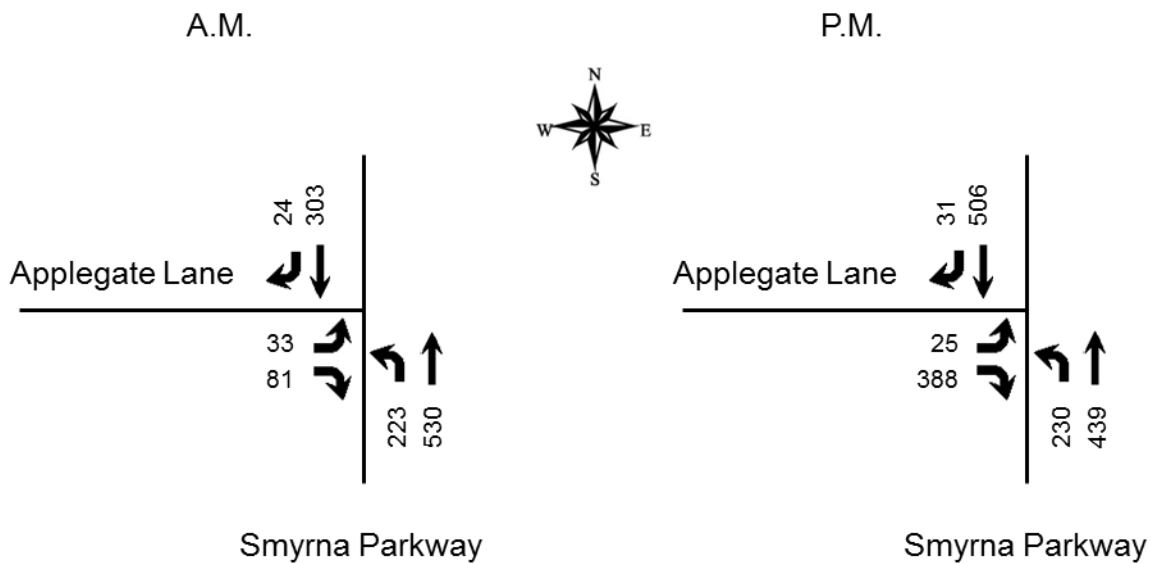


**Figure 2**  
2015 Peak Hour Counts

### Future Conditions

The projected completion year for this development is 2017, so the analysis year for this study is 2017. To predict traffic conditions in 2017, one percent annual growth in traffic was added. This growth is based upon a review of the historical growth at KYTC count stations 401 and 402.

**Figure 3** displays the 2017 No Build volumes.



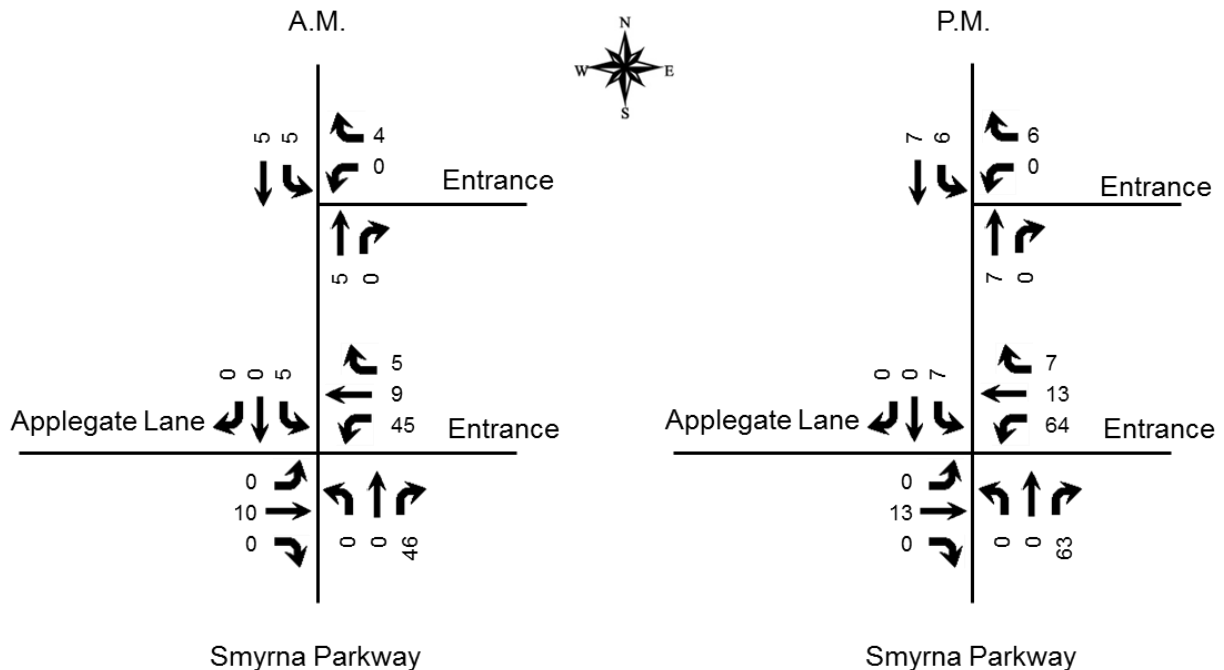
**Figure 3**  
2017 No Build Peak Hour Volumes

## Trip Generation

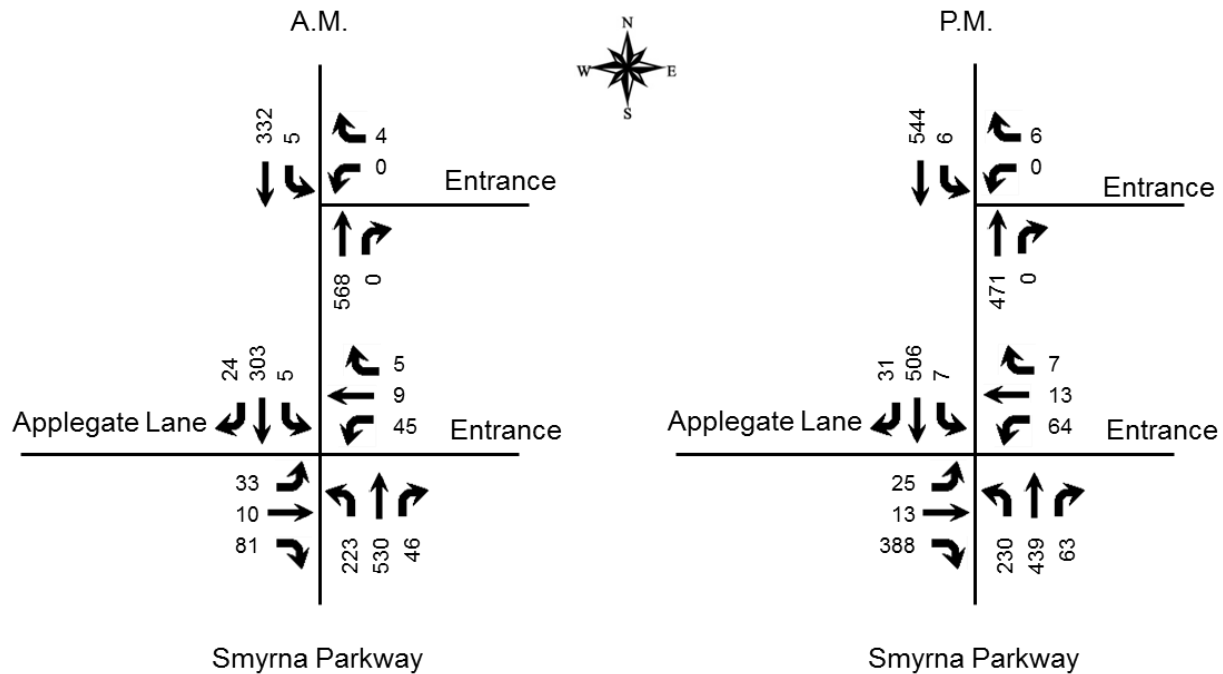
The Institute of Transportation Engineers Trip Generation Manual, 9<sup>th</sup> Edition contains trip generation rates for a wide range of developments. The land uses of “Gasoline/Service Station with Convenience Market (945)”, “Fast-Food with Drive-Through Window (934)” and “Hardware Store (816)” best describes this development. The trip generation results were compared with existing Crossroads IGA sites to confirm this as the best match. The trip generation results are listed in **Table 1**. The results of the trip generation analysis are that this development will generate 129 a.m. peak hour trips and 179 p.m. peak hour trips. The trips were assigned to the highway network with 70 percent to/from the south, 15 percent to/from the north and 15 percent to/from the west. This is based upon the residential density in the vicinity. **Figure 4** shows the trips generated by this development and distributed throughout the road network for the year 2017 during the peak hours. **Figure 5** displays the individual turning movements for the year 2017 for the peak hours when the development is completed.

**Table 1 – Trip Generation**

	AM Peak Hour			PM Peak Hour		
	Total	Enter	Exit	Total	Enter	Exit
Gasoline/Service Station with Conv Market (8 fueling positions)	81	41	40	108	54	54
Hardware Store (3,000 square feet)	3	2	1	38	18	20
Fast-Food with Drive-Through Window (1,000 square feet)	45	23	22	33	17	16
<b>TOTAL</b>	<b>129</b>	<b>66</b>	<b>63</b>	<b>179</b>	<b>89</b>	<b>90</b>



**Figure 4**  
Trip Distribution for Site



**Figure 5**  
2017 Build Peak Hour Volumes

## Analysis

The qualitative measure of operation for a roadway facility or intersection is evaluated by assigning a “Level of Service” or LOS. Level of Service is a ranking scale from A through F with each level representing a range. LOS results depend upon the type of facility that is analyzed. In this case, the LOS is based upon the average vehicle delay each movement experiences at an intersection.

To evaluate the impact of the proposed development, the vehicle delays at the intersection were determined using procedures detailed in the Highway Capacity Manual, 2010 edition. Future delay and Level of Service were determined for the intersection using HCS 2010 TWSC and Streets software (version 6.70). **Table 2** shows the results of the analysis for the three scenarios analyzed. The full printouts are included in Appendix B.



**Table 2 - Level of Service Results**

	AM Peak Hour				PM Peak Hour				Traffic Signal	
	2015 Existing	2017 No Build	2017 Build	2017 Build EB R	2015 Existing	2017 No Build	2017 Build	2017 Build EB R	2017 AM Build	2017 PM Build
<b>Smyrna Parkway at Applegate Lane</b>									<b>C</b> <b>25.4</b>	<b>C</b> <b>32.8</b>
Applegate Lane Eastbound	A 9.7	A 9.7	F 213.9	F 87.8	F 50.7	F 54.3	F 158.6	D 32.0	D 37.5	D 39.5
Crossroads IGA Westbound	NA	NA	F 377.8	F 377.8	NA	NA	F 1537.8	F 1537.8	D 54.7	E 55.9
Smyrna Parkway Southbound	A 9.2	A 9.2	A 9.2	A 9.2	A 9.6	A 9.6	A 9.5	A 9.5	C 21.9	C 25.8
Smyrna Parkway Northbound	NA	NA	A 9.1	A 9.1	NA	NA	A 8.4	A 8.4	C 24.2	C 33.7

*Note: Level of Service, delay in seconds*

Because the intersection currently experiences Level of Service F during the current p.m. peak hour and during both build peak hours, two options were evaluated. The first option is to construct an eastbound right turn lane and the second was the installation of a traffic signal. The addition of an eastbound right turn lane does not eliminate Level of Service F conditions in both peak hours.

The Manual on Uniform Traffic Control Device Warrants for installing a traffic signal were reviewed. A speed study was conducted on Smyrna Parkway on April 26, 2016. The 85<sup>th</sup> percentile speed was 46 mph. Therefore, the speed reduction has been applied to the signal warrants. Using only the volumes from the existing count, Warrant 1A is satisfied for all twelve hours. The speed study and warrant chart are included in Appendix B. The full volume on the minor street approach includes the right turn volume due to the single lane approach on Applegate Lane. Additionally, the signal meets the recommendation for installing protected left turn movement for northbound Smyrna Parkway. Installing a traffic signal will improve the overall operation of the intersection.

In order to achieve the level of service results shown in the table above, an eastbound right turn lane will also be constructed on Applegate Lane.

## Conclusions

Based upon the volume of traffic generated by the development and the amount of traffic forecasted for the year 2017, there will be an impact to the existing highway network. Due to the delays currently experienced on Applegate Lane at Smyrna Parkway, a traffic signal with an eastbound right turn lane is recommended for the intersection. The installation of the traffic signal will improve the overall operation of the intersection.



# Appendix A

## Traffic Counts

Study Name <b>Smyrna Rd &amp; Applegate Ln</b>													
Start Date <b>12/17/2015</b>													
Start Time <b>7:00 AM</b>													
Site Code													
Start Time	Southbound Approach Southbound			Northbound Approach Northbound			Mainline		Eastbound Approach Eastbound			Side street	
	Right	Thru	U-Turn	Thru	Left	U-Turn	Total	Hourly	Right	Left	U-Turn	Total	Hourly
7:00 AM	3	55	0	140	31	0	229		14	6	0	20	
7:15 AM	4	67	0	179	58	0	308		20	11	0	31	
7:30 AM	12	110	0	141	85	0	348		22	9	0	31	
7:45 AM	5	68	0	65	47	0	185	1070	24	7	0	31	113
8:00 AM	2	51	0	65	33	0	151		21	5	0	26	
8:15 AM	1	61	0	76	35	0	173		21	7	0	28	
8:30 AM	3	70	0	103	40	0	216		31	2	0	33	
8:45 AM	3	76	0	93	44	0	216	756	26	5	0	31	118
9:00 AM	4	70	0	69	31	0	174		29	6	0	35	
9:15 AM	5	60	0	69	24	0	158		18	2	0	20	
9:30 AM	3	39	0	79	35	0	156		21	2	0	23	
9:45 AM	4	51	0	65	35	0	155	643	26	3	0	29	107
10:00 AM	3	61	0	73	37	0	174		15	3	0	18	
10:15 AM	0	50	0	66	39	0	155		29	1	0	30	
10:30 AM	6	46	0	63	23	0	138		23	4	0	27	
10:45 AM	3	51	0	53	37	0	144	611	30	3	0	33	108
11:00 AM	2	44	0	64	35	0	145		23	7	0	30	
11:15 AM	4	60	0	77	43	0	184		21	6	0	27	
11:30 AM	2	67	0	84	45	0	198		27	5	0	32	
11:45 AM	2	73	0	74	35	0	184	711	38	9	0	47	136
12:00 PM	7	55	0	80	33	0	175		31	7	0	38	
12:15 PM	4	57	0	72	35	0	168		33	3	0	36	
12:30 PM	6	65	0	80	34	0	185		27	6	0	33	
12:45 PM	6	77	0	90	40	0	213	741	40	5	0	45	152
1:00 PM	0	77	0	97	35	0	209		55	9	0	64	
1:15 PM	5	89	0	73	48	0	215		50	2	0	52	
1:30 PM	5	81	0	91	45	0	222		57	3	0	60	
1:45 PM	5	87	0	102	45	0	239	885	60	2	0	62	238
2:00 PM	5	58	0	109	41	0	213		60	7	0	67	
2:15 PM	6	94	0	129	55	0	284		57	9	0	66	
2:30 PM	10	112	0	106	62	0	290		70	6	0	76	
2:45 PM	7	126	0	112	32	0	277	1064	99	6	0	105	314
3:00 PM	6	113	0	82	40	0	241		94	5	0	99	
3:15 PM	4	90	0	116	44	0	254		68	10	0	78	
3:30 PM	6	120	0	86	45	0	257		68	6	0	74	
3:45 PM	6	105	0	96	51	0	258	1010	75	4	0	79	330
4:00 PM	2	148	0	115	54	0	319		82	8	0	90	
4:15 PM	5	116	0	106	46	0	273		80	5	0	85	
4:30 PM	10	136	0	107	52	0	305		87	5	0	92	
4:45 PM	6	124	0	97	64	0	291	1188	90	7	0	97	364
5:00 PM	7	135	0	100	57	0	299		80	7	0	87	
5:15 PM	6	127	0	100	57	0	290		103	6	0	109	
5:30 PM	9	114	0	122	47	0	292		111	7	0	118	
5:45 PM	9	125	0	113	67	0	314	1195	90	5	1	96	410
6:00 PM	4	116	0	106	56	0	282		96	4	0	100	
6:15 PM	10	98	0	115	40	0	263		66	6	0	72	
6:30 PM	2	104	0	94	53	0	253		75	11	0	86	
6:45 PM	5	87	0	110	52	0	254	1052	71	4	0	75	333



# Appendix B

## HCS Reports

HCS 2010 Two-Way Stop Control Summary Report																
General Information								Site Information								
Analyst	DBZ							Intersection	Smyrna Pkw at Applegate							
Agency/Co.	CDM Smith							Jurisdiction								
Date Performed	2/17/2016							East/West Street	Applegate Lane							
Analysis Year	2015							North/South Street	Smyrna Pkwy							
Time Analyzed	AM Peak							Peak Hour Factor	0.78							
Intersection Orientation	North-South							Analysis Time Period (hrs)	0.25							
Project Description	Crossroads IGA															
Lanes																
<p>Major Street: North-South</p>																
Vehicle Volumes and Adjustments																
Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	0	0	1	1	0	0	0	1	0
Configuration			LR							L	T					TR
Volume (veh/h)		33		80						221	525				300	24
Percent Heavy Vehicles		6		1						3						
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Left Only															
Median Storage	1															
Delay, Queue Length, and Level of Service																
Flow Rate (veh/h)			145							283						
Capacity			918							1136						
v/c Ratio			0.16							0.25						
95% Queue Length			0.6							1.0						
Control Delay (s/veh)			9.7							9.2						
Level of Service (LOS)			A							A						
Approach Delay (s/veh)	9.7								2.7							
Approach LOS	A								A							

HCS 2010 Two-Way Stop Control Summary Report																
General Information								Site Information								
Analyst	DBZ							Intersection	Smyrna Pkw at Applegate							
Agency/Co.	CDM Smith							Jurisdiction								
Date Performed	2/17/2016							East/West Street	Applegate Lane							
Analysis Year	2017							North/South Street	Smyrna Pkwy							
Time Analyzed	AM Peak No Build							Peak Hour Factor	0.78							
Intersection Orientation	North-South							Analysis Time Period (hrs)	0.25							
Project Description	Crossroads IGA															
Lanes																
<p>Major Street: North-South</p>																
Vehicle Volumes and Adjustments																
Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	0	0	1	1	0	0	0	1	0
Configuration			LR							L	T					TR
Volume (veh/h)		33		81						223	530				303	24
Percent Heavy Vehicles		6		1						3						
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Left Only															
Median Storage	1															
Delay, Queue Length, and Level of Service																
Flow Rate (veh/h)			146							286						
Capacity			911							1134						
v/c Ratio			0.16							0.25						
95% Queue Length			0.6							1.0						
Control Delay (s/veh)			9.7							9.2						
Level of Service (LOS)			A							A						
Approach Delay (s/veh)	9.7								2.7							
Approach LOS	A								A							



HCS 2010 Two-Way Stop Control Summary Report																
General Information								Site Information								
Analyst	DBZ							Intersection	Smyrna Pkwy at Applegate							
Agency/Co.	CDM Smith							Jurisdiction								
Date Performed	2/17/2016							East/West Street	Applegate Lane							
Analysis Year	2017							North/South Street	Smyrna Parkway							
Time Analyzed	AM Peak Build							Peak Hour Factor	0.78							
Intersection Orientation	North-South							Analysis Time Period (hrs)	0.25							
Project Description	Smyrna Pkwy Crossroads IGA															
Lanes																
<p>Major Street: North-South</p>																
Vehicle Volumes and Adjustments																
Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		1	1	0	0	1	1	0	0	1	1	0
Configuration			LTR			L		TR		L		TR		L		TR
Volume (veh/h)		33	10	81		45	9	5		223	530	46		5	303	24
Percent Heavy Vehicles		6	0	1		0	0	0		1				0		
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																
Delay, Queue Length, and Level of Service																
Flow Rate (veh/h)			159			58		18		286				6		
Capacity			131			39		95		1145				877		
v/c Ratio			1.22			1.49		0.19		0.25				0.01		
95% Queue Length			9.7			6.0		0.7		1.0				0.0		
Control Delay (s/veh)			213.9			479.0		51.6		9.2				9.1		
Level of Service (LOS)			F			F		F		A				A		
Approach Delay (s/veh)	213.9				377.8				2.6				0.1			
Approach LOS	F				F				A				A			

HCS 2010 Two-Way Stop Control Summary Report																
General Information								Site Information								
Analyst	DBZ							Intersection	Smyrna Pkw at Applegate							
Agency/Co.	CDM Smith							Jurisdiction								
Date Performed	2/17/2016							East/West Street	Applegate Lane							
Analysis Year	2015							North/South Street	Smyrna Pkwy							
Time Analyzed	PM Peak							Peak Hour Factor	0.98							
Intersection Orientation	North-South							Analysis Time Period (hrs)	0.25							
Project Description	Crossroads IGA															
Lanes																
<p>Major Street: North-South</p>																
Vehicle Volumes and Adjustments																
Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	0	0	1	1	0	0	0	1	0
Configuration			LR							L	T					TR
Volume (veh/h)		25		384						228	435				501	31
Percent Heavy Vehicles		6		1						3						
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Left Only															
Median Storage	1															
Delay, Queue Length, and Level of Service																
Flow Rate (veh/h)			418							233						
Capacity			464							1020						
v/c Ratio			0.90							0.23						
95% Queue Length			10.0							0.9						
Control Delay (s/veh)			50.7							9.6						
Level of Service (LOS)			F							A						
Approach Delay (s/veh)	50.7								3.3							
Approach LOS	F								A							

HCS 2010 Two-Way Stop Control Summary Report																
General Information								Site Information								
Analyst	DBZ							Intersection	Smyrna Pkw at Applegate							
Agency/Co.	CDM Smith							Jurisdiction								
Date Performed	2/17/2016							East/West Street	Applegate Lane							
Analysis Year	2017							North/South Street	Smyrna Pkwy							
Time Analyzed	PM Peak No Build							Peak Hour Factor	0.98							
Intersection Orientation	North-South							Analysis Time Period (hrs)	0.25							
Project Description	Crossroads IGA															
Lanes																
<p style="text-align: center;">Major Street: North-South</p>																
Vehicle Volumes and Adjustments																
Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	0	0	1	1	0	0	0	1	0
Configuration			LR							L	T					TR
Volume (veh/h)		25		388						230	439				506	31
Percent Heavy Vehicles		6		1						3						
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Left Only															
Median Storage	1															
Delay, Queue Length, and Level of Service																
Flow Rate (veh/h)			422							235						
Capacity			459							1015						
v/c Ratio			0.92							0.23						
95% Queue Length			10.5							0.9						
Control Delay (s/veh)			54.3							9.6						
Level of Service (LOS)			F							A						
Approach Delay (s/veh)	54.3								3.3							
Approach LOS	F								A							

HCS 2010 Two-Way Stop Control Summary Report																
General Information								Site Information								
Analyst	DBZ							Intersection	Smyrna Pkwy at Applegate							
Agency/Co.	CDM Smith							Jurisdiction								
Date Performed	2/17/2016							East/West Street	Applegate Lane							
Analysis Year	2017							North/South Street	Smyrna Parkway							
Time Analyzed	PM Peak Build							Peak Hour Factor	0.98							
Intersection Orientation	North-South							Analysis Time Period (hrs)	0.25							
Project Description	Smyrna Pkwy Crossroads IGA															
Lanes																
<p>Major Street: North-South</p>																
Vehicle Volumes and Adjustments																
Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		1	1	0	0	1	1	0	0	1	1	0
Configuration			LTR			L		TR		L		TR		L		TR
Volume (veh/h)		25	13	388		64	13	7		230	439	63		7	506	31
Percent Heavy Vehicles		6	0	1		0	0	0		1				0		
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																
Delay, Queue Length, and Level of Service																
Flow Rate (veh/h)			435			65		20		235				7		
Capacity			353			15		132		1026				1064		
v/c Ratio			1.23			4.31		0.15		0.23				0.01		
95% Queue Length			18.9			9.0		0.5		0.9				0.0		
Control Delay (s/veh)			158.6			1999.6		37.2		9.5				8.4		
Level of Service (LOS)			F			F		E		A				A		
Approach Delay (s/veh)	158.6				1537.8				3.0				0.1			
Approach LOS	F				F				A				A			

HCS 2010 Two-Way Stop Control Summary Report																
General Information								Site Information								
Analyst	DBZ							Intersection	Smyrna Pkwy at Applegate							
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Date Performed	2/17/2016							East/West Street	Applegate Lane							
Analysis Year	2017							North/South Street	Smyrna Parkway							
Time Analyzed	AM Peak Build EB right							Peak Hour Factor	0.78							
Intersection Orientation	North-South							Analysis Time Period (hrs)	0.25							
Project Description	Smyrna Pkwy Crossroads IGA															
Lanes																
<p>Major Street: North-South</p>																
Vehicle Volumes and Adjustments																
Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	1		1	1	0	0	1	1	0	0	1	1	0
Configuration		LT		R		L		TR		L		TR		L		TR
Volume (veh/h)		33	10	81		45	9	5		223	530	46		5	303	24
Percent Heavy Vehicles		6	0	1		0	0	0		1				0		
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																
Delay, Queue Length, and Level of Service																
Flow Rate (veh/h)		55		104		58		18		286				6		
Capacity		52		649		39		95		1145				877		
v/c Ratio		1.06		0.16		1.49		0.19		0.25				0.01		
95% Queue Length		4.7		0.6		6.0		0.7		1.0				0.0		
Control Delay (s/veh)		269.0		11.6		479.0		51.6		9.2				9.1		
Level of Service (LOS)		F		B		F		F		A				A		
Approach Delay (s/veh)	87.8				377.8				2.6				0.1			
Approach LOS	F				F				A				A			

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HCS 2010 Two-Way Stop Control Summary Report																
General Information								Site Information								
Analyst	DBZ							Intersection	Smyrna Pkwy at Applegate							
Agency/Co.	CDM Smith							Jurisdiction								
Date Performed	2/17/2016							East/West Street	Applegate Lane							
Analysis Year	2017							North/South Street	Smyrna Parkway							
Time Analyzed	PM Peak Build eb right							Peak Hour Factor	0.98							
Intersection Orientation	North-South							Analysis Time Period (hrs)	0.25							
Project Description	Smyrna Pkwy Crossroads IGA															
Lanes																
<p style="text-align: center;">Major Street: North-South</p>																
Vehicle Volumes and Adjustments																
Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	1		1	1	0	0	1	1	0	0	1	1	0
Configuration		LT		R		L		TR		L		TR		L		TR
Volume (veh/h)		25	13	388		64	13	7		230	439	63		7	506	31
Percent Heavy Vehicles		6	0	1		0	0	0		1				0		
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																
Delay, Queue Length, and Level of Service																
Flow Rate (veh/h)		39		396		65		20		235				7		
Capacity		76		549		15		132		1026				1064		
v/c Ratio		0.51		0.72		4.31		0.15		0.23				0.01		
95% Queue Length		2.1		5.9		9.0		0.5		0.9				0.0		
Control Delay (s/veh)		93.5		26.7		1999.6		37.2		9.5				8.4		
Level of Service (LOS)		F		D		F		E		A				A		
Approach Delay (s/veh)	32.0				1537.8				3.0				0.1			
Approach LOS	D				F				A				A			

TRAFFIC SIGNAL WARRANT ANALYSIS

COUNTY Jefferson DATE December 17, 2015 DAY OF WEEK Thurs  
 CITY Louisville MILEPOST \_\_\_\_\_ NO. OF CORRECTIBLE CRASHES IN 12 MONTH PERIOD NA  
 MAJOR STREET NAME Smyrna Parkway NO. OF MAJOR STREET APPROACH LANES 1  
 MINOR STREET NAME Applegate Lane (west) NO. OF MINOR STREET APPROACH LANES 1  
 POSTED SPEED LIMIT MAJOR SREET 45 MPH POPULATION < 10,000  YES  NO  
 POSTED SPEED LIMIT MINOR SREET 35 MPH REDUCED WARRANTS BASED UPON  SPEED  POPULATION

TIME	MAJOR STREET TWO WAY VOLUME	MINOR STREET HIGHEST VOLUME APPROACH  Are Side Street Rights Included? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	Warrant 1 Condition A		Warrant 1 Condition B		Warrant 7 - CRASH EXPERIENCE (Warrant 1 Condition A or B 80% Satisfied) AND (5 or More Correctible Crashes in 12 Month Period)			
			Minimum Vehicular Volume		Interruption of Continuous Traffic		Warrant 1 Condition A - 80%		Warrant 1 Condition B - 80%	
			MAJOR	MINOR	MAJOR	MINOR	MAJOR	MINOR	MAJOR	MINOR
			500 (1) 600 (2)	150 (1) 200 (2)	750 (1) 900 (2)	75 (1) 100 (2)	400 (1) 480 (2)	120 (1) 160 (2)	600 (1) 720 (2)	60 (1) 80 (2)
			<b>REDUCED WARRANTS</b>				<b>REDUCED WARRANTS</b> (56% Reduction)			
			350 (1)	105 (1)	525 (1)	63 (1)	280 (1)	84 (1)	420 (1)	42 (1)
			420 (2)	140 (2)	630 (2)	70 (2)	336 (2)	112 (2)	504 (2)	56 (2)
			(1) = ONE LANE APPROACH			(2) = TWO LANE APPROACH				
7-8 am	1,070	113	X	X	X	X	X	X	X	X
8-9 am	756	118	X	X	X	X	X	X	X	X
9-10 am	643	107	X	X	X	X	X	X	X	X
10-11 am	611	108	X	X	X	X	X	X	X	X
11-12 am	711	136	X	X	X	X	X	X	X	X
12-1 pm	741	152	X	X	X	X	X	X	X	X
1-2 pm	885	238	X	X	X	X	X	X	X	X
2-3 pm	1,064	314	X	X	X	X	X	X	X	X
3-4 pm	1,010	330	X	X	X	X	X	X	X	X
4-5 pm	1,188	364	X	X	X	X	X	X	X	X
5-6 pm	1,195	410	X	X	X	X	X	X	X	X
6-7 pm	1,052	343	X	X	X	X	X	X	X	X
NUMBER OF HOURS			12		12		12		12	
COMPLIANCE			YES		YES		YES			

Volumes are the existing count. Speed reduction due to speed study on the next page.

Date: 4/26/2016 Start Time: 3:10  
 Name: DBZ JW End Time: 3:40  
 Location: Smyrna Pkwy Weather: 81° Cloudy  
 Speed Limit: 35 mph

Seconds	mph for 176	Car		Bus		Truck		TOTAL	Cumm ulative	Cummul ative %
		Record	Number	Record	Number	Record	Number			
4.0	29.9						1	1	1	1%
3.9	30.7							0	1	1%
3.8	31.5							0	1	1%
3.7	32.4							0	1	1%
3.6	33.3							0	1	1%
3.5	34.2							0	1	1%
3.4	35.2		1					1	2	2%
3.3	36.3		1					1	3	3%
3.2	37.4		5					5	8	8%
3.1	38.6		8		1			9	17	17%
3.0	39.9		10				1	11	28	28%
2.9	41.3		12				1	13	41	41%
2.8	42.8		10		1			11	52	52%
2.7	44.3		20		1			21	73	73%
2.6	46.0		7					7	80	80%
2.5	47.9		7					7	87	87%
2.4	49.9		12					12	99	99%
2.2	54.4		1					1	100	100%
2.0	59.9								100	100%
	TOTAL		94		3		3	100		



HCS 2010 Signalized Intersection Results Summary																								
<b>General Information</b>						<b>Intersection Information</b>																		
Agency	CDM Smith					Duration, h	0.25																	
Analyst	DBZ	Analysis Date	Feb 17, 2016			Area Type	Other																	
Jurisdiction		Time Period	AM Peak			PHF	0.78																	
Urban Street	Smyrna Pkwy		Analysis Year	2017 Build		Analysis Period	1> 7:00																	
Intersection	Applegate Lane		File Name	AM rt.xus																				
Project Description	Crossroads IGA																							
<b>Demand Information</b>				EB			WB			NB			SB											
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R									
Demand (v), veh/h	33	10	81	45	9	5	223	530	46	5	303	2												
<b>Signal Information</b>																								
Cycle, s	120.0	Reference Phase	2																					
Offset, s	0	Reference Point	End																					
Uncoordinated	No	Simult. Gap E/W	On	Green	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0									
Force Mode	Fixed	Simult. Gap N/S	On	Yellow	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0									
				Red	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0									
<b>Timer Results</b>				EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT													
Assigned Phase					4					8	5	2	1	6										
Case Number					11.0					10.0	1.1	4.0	1.1	4.0										
Phase Duration, s					26.0					14.0	18.1	72.8	7.2	61.9										
Change Period, (Y+R <sub>c</sub> ), s					6.0					6.0	6.0	6.0	6.0	6.0										
Max Allow Headway (MAH), s					0.0					0.0	0.0	0.0	0.0	0.0										
Queue Clearance Time (g <sub>s</sub> ), s					0.0					0.0	0.0	0.0	0.0	0.0										
Green Extension Time (g <sub>e</sub> ), s					0.0					0.0	0.0	0.0	0.0	0.0										
Phase Call Probability					0.00					0.00	0.00	0.00	0.00	0.00										
Max Out Probability					0.00					0.00	0.00	0.00	0.00	0.00										
<b>Movement Group Results</b>				EB			WB			NB			SB											
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R									
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16												
Adjusted Flow Rate (v), veh/h		0	0	0	0		0	0		0	0		0	0										
Adjusted Saturation Flow Rate (s), veh/h/ln		0	0	0	0		0	0		0	0		0	0										
Queue Service Time (g <sub>s</sub> ), s		0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0										
Cycle Queue Clearance Time (g <sub>c</sub> ), s		0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0										
Green Ratio (g/C)		0.17	0.27	0.07	0.07		0.58	0.56		0.48	0.47		0.48	0.47										
Capacity (c), veh/h		296	430	117	116		529	1013		245	849													
Volume-to-Capacity Ratio (X)		0.186	0.241	0.493	0.155		0.541	0.729		0.026	0.494													
Available Capacity (c <sub>a</sub> ), veh/h		0	0	0	0		0	0		0	0		0	0										
Back of Queue (Q), veh/ln (50 th percentile)		1.4	2.8	1.7	0.5		0.0	13.0		0.0	5.6													
Queue Storage Ratio (RQ) (50 th percentile)		0.18	0.06	0.44	0.13		0.48	0.81		0.02	0.43													
Uniform Delay (d <sub>1</sub> ), s/veh		43.0	34.4	54.0	52.8		15.1	19.8		19.7	22.2													
Incremental Delay (d <sub>2</sub> ), s/veh		0.1	0.1	1.2	0.2		0.3	4.6		0.0	2.1													
Initial Queue Delay (d <sub>3</sub> ), s/veh		0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0													
Control Delay (d), s/veh		43.1	44.9	55.2	53.0		0.0	17.9		0.0	12.4													
Level of Service (LOS)																								
Approach Delay, s/veh / LOS	37.5			D			54.7			D			21.9			C			24.2			C		
Intersection Delay, s/veh / LOS	25.4												C											
<b>Multimodal Results</b>				EB			WB			NB			SB											
Pedestrian LOS Score / LOS	2.3	B		2.3	B		2.2	B		2.2	B		2.2	B										
Bicycle LOS Score / LOS	0.7	A		0.6	A		2.2	B		1.2	A													

### HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information			
Agency	CDM Smith			Duration, h	0.25		
Analyst	DBZ	Analysis Date	Mar 17, 2016	Area Type	Other		
Jurisdiction		Time Period	PM Peak	PHF	0.98		
Urban Street	Smyrna Pkwy	Analysis Year	2017 Build	Analysis Period	1 > 5:00		
Intersection	Applegate Lane	File Name	PM wrt lane pleft.xus				
Project Description	Crossroads IGA						

Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	F
Demand (v), veh/h	25	13	388	64	13	7	230	439	63	7	506	3

Signal Information				Signal Timing											
Cycle, s	120.0	Reference Phase	2												
Offset, s	0	Reference Point	End												
Uncoordinated	No	Simult. Gap E/W	On	Green	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
Force Mode	Fixed	Simult. Gap N/S	On	Yellow	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
				Red	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4		8	5	2	1	6
Case Number		11.0		10.0	1.1	4.0	1.1	4.0
Phase Duration, s		32.6		13.5	17.0	61.8	12.0	56.8
Change Period, (Y+R <sub>c</sub> ), s		6.0		6.0	6.0	6.0	6.0	6.0
Max Allow Headway (MAH), s		0.0		0.0	0.0	0.0	0.0	0.0
Queue Clearance Time (g <sub>s</sub> ), s		0.0		0.0	0.0	0.0	0.0	0.0
Green Extension Time (g <sub>e</sub> ), s		0.0		0.0	0.0	0.0	0.0	0.0
Phase Call Probability		0.00		0.00	0.00	0.00	0.00	0.00
Max Out Probability		0.00		0.00	0.00	0.00	0.00	0.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	11
Adjusted Flow Rate (v), veh/h	0	0	0	0	0	0	0	0	0	0	0	0
Adjusted Saturation Flow Rate (s), veh/h/ln	0	0	0	0	0	0	0	0	0	0	0	0
Queue Service Time (g <sub>s</sub> ), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cycle Queue Clearance Time (g <sub>c</sub> ), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Green Ratio (g/C)	0.22	0.31	0.06	0.06	0.52	0.47	0.47	0.42	0.47	0.42	0.42	0.42
Capacity (c), veh/h	396	505	110	109	370	839	355	773				
Volume-to-Capacity Ratio (X)	0.098	0.724	0.592	0.187	0.634	0.610	0.020	0.709				
Available Capacity (c <sub>a</sub> ), veh/h	0	0	0	0	0	0	0	0				
Back of Queue (Q), veh/ln (50 th percentile)	0.9	9.8	2.0	0.6	3.6	11.3	0.1	13.8				
Queue Storage Ratio (RQ) (50 th percentile)	0.12	0.24	0.50	0.15	0.46	0.58	0.01	0.71				
Uniform Delay (d <sub>1</sub> ), s/veh	37.1	36.6	54.7	53.3	21.1	24.0	18.8	28.5				
Incremental Delay (d <sub>2</sub> ), s/veh	0.0	3.2	1.9	0.3	1.4	3.3	0.0	5.4				
Initial Queue Delay (d <sub>3</sub> ), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0				
Control Delay (d), s/veh	37.2	39.8	56.6	53.6	22.6	27.3	18.8	33.9				
Level of Service (LOS)		D	D	E	D	C	C	B	C			
Approach Delay, s/veh / LOS	39.5	D	55.9	E	25.8	C	33.7	C				
Intersection Delay, s/veh / LOS	32.8						C					

Multimodal Results	EB			WB			NB			SB		
Pedestrian LOS Score / LOS	2.3	B	2.3	B	2.3	B	2.3	B	2.3	B	2.3	B
Bicycle LOS Score / LOS	1.2	A	0.6	A	1.7	A	1.4	A	1.4	A	1.4	A