

AUTUMN WALK SUBDIVISION

Traffic Impact Study

Autumn Path Lane

Knoxville, TN

A Traffic Impact Study for the Proposed Autumn Walk Subdivision

Submitted to

Knoxville – Knox County Metropolitan Planning Commission

April 4, 2016

FMA Project No. 567.001

Submitted By:



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Executive Summary

B & B Builders, Inc proposes an expansion of the existing Autumn Walk Subdivision with additional residential condominium units. The project site is located at the existing intersection of Dry Gap Pike and Autumn Path Lane south of Beaver Creek Dr in Knox County. The development currently consists of 53 planned residential condominiums with a proposed addition of 61 residential condominiums in Phase 3 for a total of 114 units. Construction for Phase 3 is proposed to take place this year and this study assumes full build out for the development will occur in 2019.

In order to maintain or provide an acceptable level-of-service the following recommendations are presented:

Autumn Path Lane

The existing intersection geometry is one 26-ft lane exiting the subdivision. The unsignalized intersection capacity analyses shows a 95% queue length at the full buildout for the westbound traffic of two car lengths during both the AM and PM peak hours; therefore the existing storage at the intersection is adequate and no change is necessary.

Dry Gap Pike @ Autumn Path Lane

At the intersection of Dry Gap Pike and Autumn Path Lane the southbound approach currently operates at an acceptable LOS A during both AM and PM peak hours. Dry Gap Pike southbound will continue to operate at a LOS A during both the AM and PM peak hours after the completion of the Autumn Walk Subdivision.

A southbound left turn lane is warranted at the intersection of Dry Gap Pike and Autumn Path Lane after the full buildout of the Autumn Walk Subdivision. The recommended storage length is 50 feet with a taper length of 100 feet.

A northbound right turn lane is warranted at the intersection of Dry Gap Pike and Autumn Path Lane. The recommended storage length is 50 feet with a taper length of 100 feet.

1 Introduction

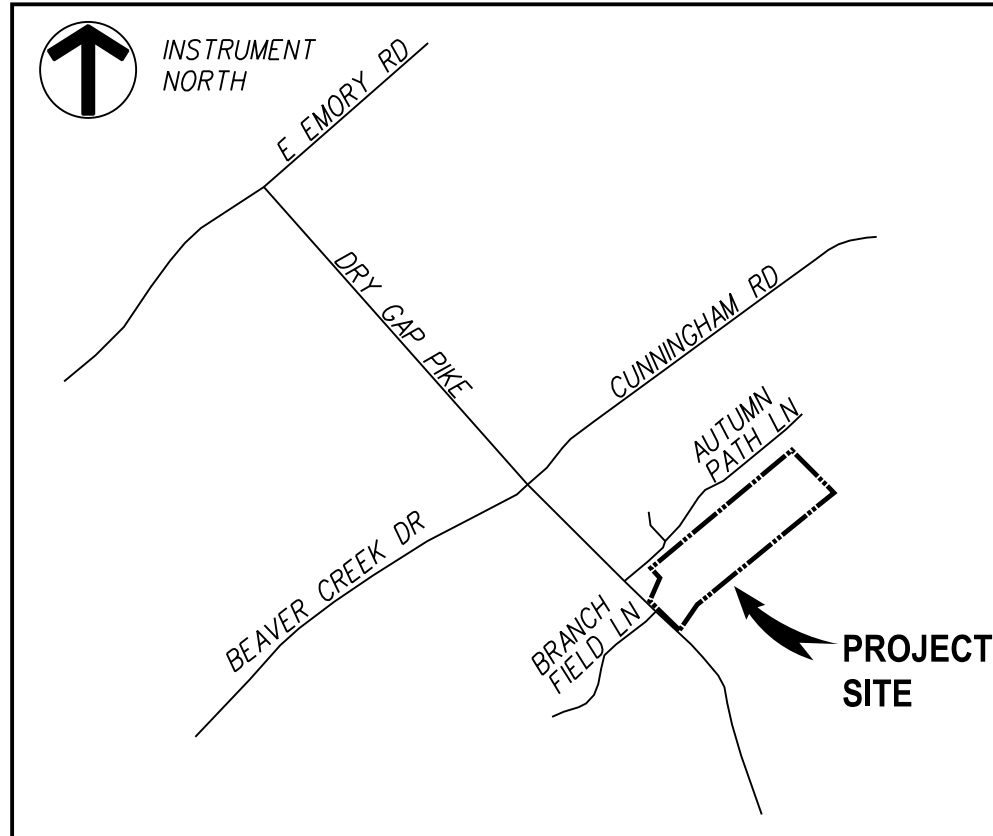
1.1 Project Description

This report provides a summary of a traffic impact study that was performed for the proposed Autumn Walk Subdivision on Dry Gap Pike. The project site is located at the existing intersection of Dry Gap Pike and Autumn Path Lane south of Beaver Creek Drive in Knox County. The location of the site is shown in Figure 1.

The existing Autumn Walk Subdivision has 61 residential condominium units. The proposed expansion of the subdivision will add an additional 53 residential condominium units for a total of 114 lots. Full Buildout is expected to occur within three years, or by the year 2019. The proposed site layout is shown in Figure 2.

The purpose of this study is to evaluate the impacts to the traffic conditions caused by the development of the proposed subdivision.

FIGURE 1



LOCATION MAP
(NOT TO SCALE)

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FIGURE 1		No.	Revision/Issue	Date	

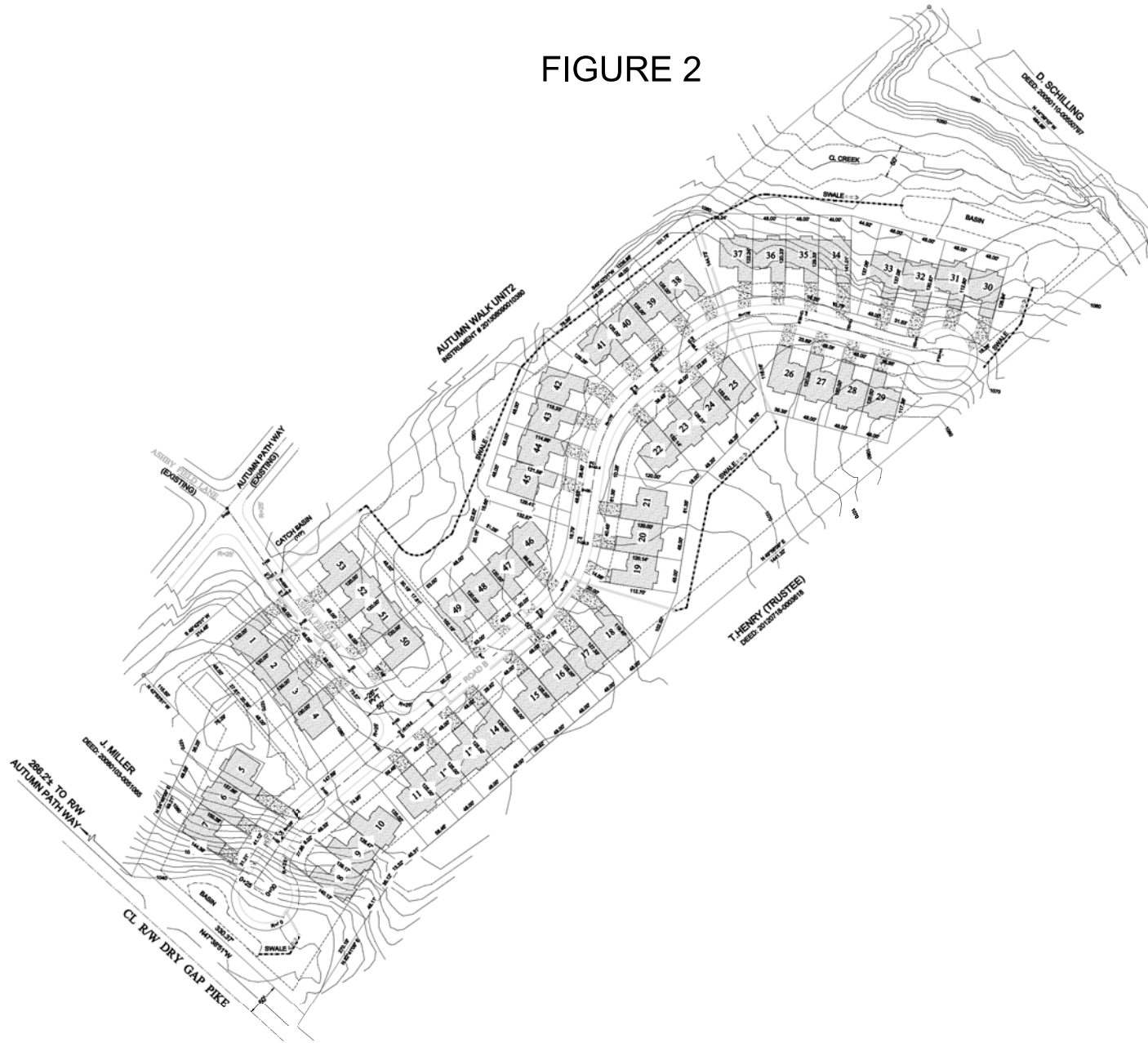
LOCATION MAP

AUTUMN WALK - PHASE 3
KNOX COUNTY, TN



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FIGURE 2



File Name: \\15671567.001\Calculations\Traffic Impact Study\567200_L_crp001.dgn

Project	567.001	Proj. Mgr.	Designed By	Drawn By	Reference
Date	4/4/16	ISSUED FOR REVIEW	4/4/16		
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Sheet	FIGURE 2				
No.	Revision/Issue			Date	

SITE PLAN

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FULGHUM
MACINDOE
& ASSOCIATES, INC.

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1.2 Existing Site Conditions

The existing subdivision site access currently ties into Dry Gap Pike approximately 1,110 feet south of the intersection of Dry Gap Pike and Beaver Creek Dr/Cunningham Road and approximately 375 feet north of the intersection of Dry Gap Pike and Branch Field Lane.

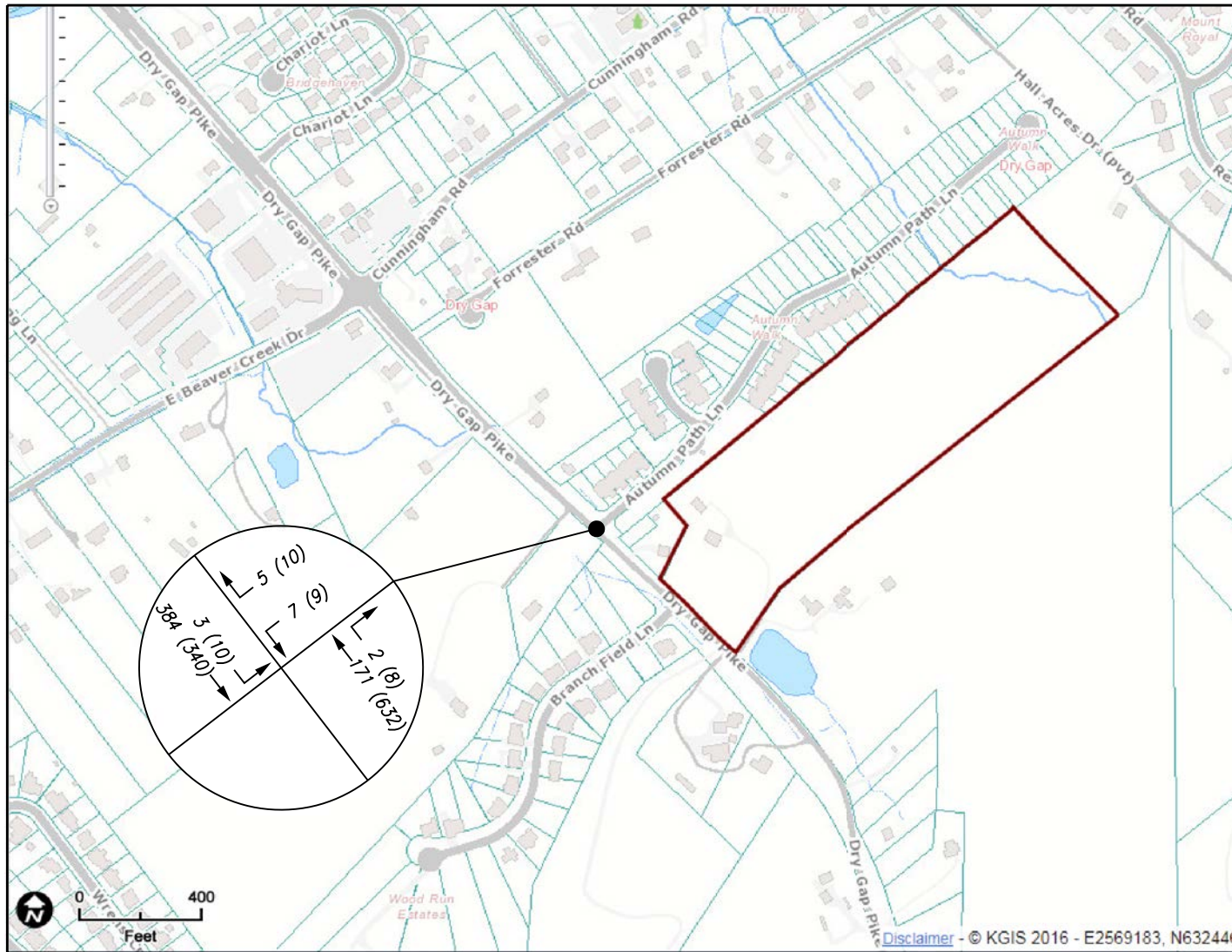
During a site visit it was determined that Autumn Path Lane is a two-lane road with a width of 26-ft at the existing project entrance. The posted speed limit on Autumn Path Lane is 25 mph. The Knoxville-Knox County Metropolitan Planning Commission does not list a classification for Autumn Path Lane per the Major Road Plan; therefore it is considered a local street. The intersection sight distance at the proposed driveway was measured to be in excess of 400-ft north and south of the intersection.

Dry Gap Pike is a two-lane road at the intersection of Autumn Path Lane with a posted speed limit of 40 mph. The Knoxville-Knox County Metropolitan Planning Commission classifies Dry Gap Pike as a Major Collector between E Emory Road and Dante Road with a ROW of 100 feet per the Major Road Plan.

2 Existing Traffic Volumes

FMA conducted an eight-hour turning movement count at the intersection of Dry Gap Pike and Autumn Path Lane on Tuesday March 22, 2016. The existing volume including the AM and PM peak hour traffic volumes at the count locations are shown in Figure 3 and the count data collected is included in Attachment 1.

The current AM peak hour, and PM peak hour were determined using the eight-hour turning movement count that FMA conducted. The AM peak hour occurred between 7:00 am and 8:00 am and the PM peak hour occurred between 5:00 pm and 6:00 pm.



LEGEND:

← 5 (16)

TURNING MOVEMENT VOLUME AM (PM)

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FIGURE 3		No.	Revision/Issue	Date	

2016 EXISTING PEAK HOUR TRAFFIC

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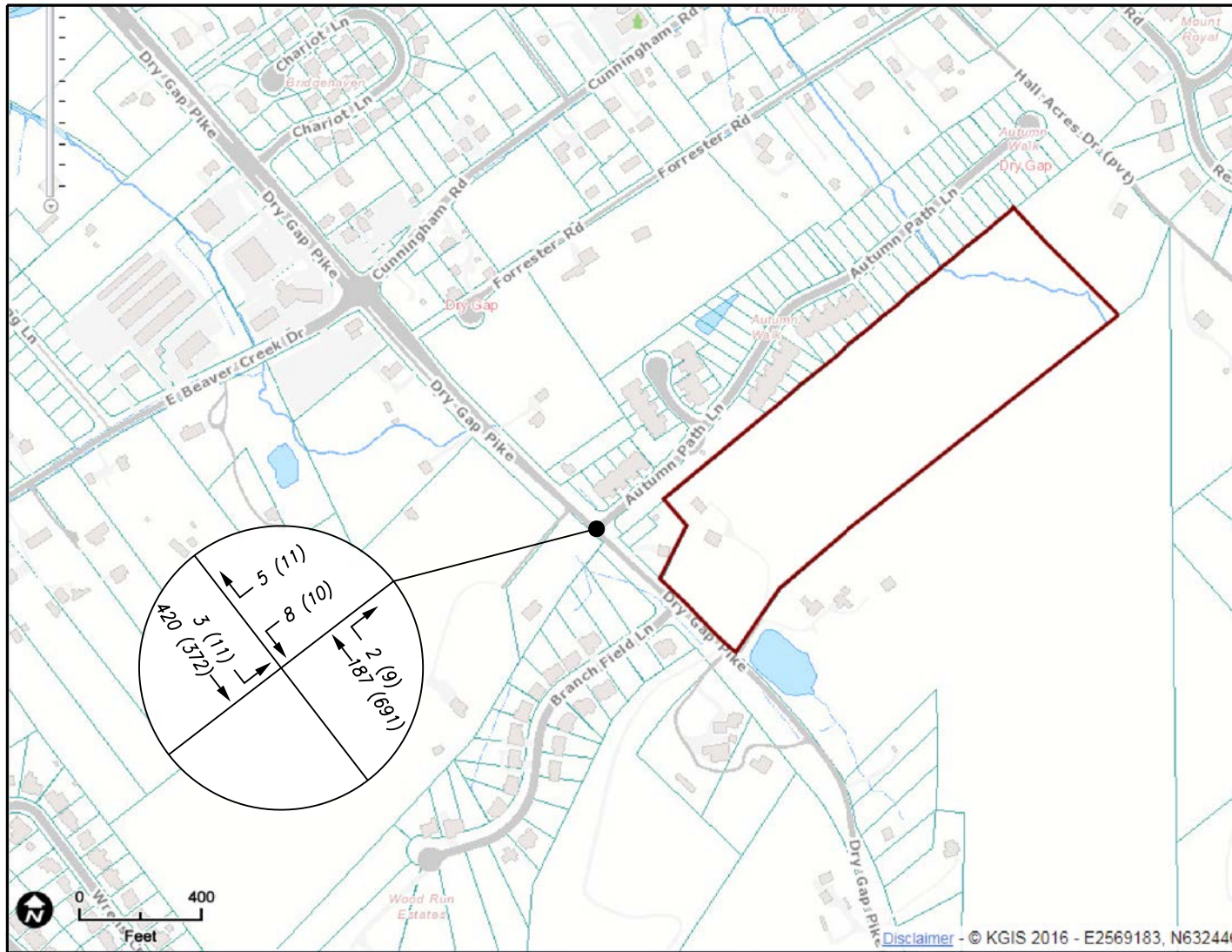
3 Background Growth

The Tennessee Department of Transportation (TDOT) maintains a count station on Dry Gap Pike south of SR-131. The annual traffic growth rate for this station between 2010 and 2014 is approximately 1.46%.

The Transportation Planning Organization (TPO) maintains a count station on Dry Gap Pike south of Beaver Creek Drive. The annual traffic growth rate for this station between 2000 and 2014 is approximately 2.74%.

For the purpose of this study, an annual growth rate of 3.0% for traffic at the intersection of Dry Gap Pike and Autumn Path Lane was assumed until full occupancy is reached in 2019.

Attachment 2 shows the trend line growth charts for the TDOT count station and the TPO count station. Figure 4 demonstrates the projected future peak hour volumes at the intersections after applying this background growth rate to the existing conditions.



LEGEND:

← 5 (16)

TURNING MOVEMENT VOLUME AM (PM)

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FIGURE 4	No.	Revision/Issue		Date	

**2019 BACKGROUND
PEAK HOUR TRAFFIC**

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4 Trip Generation and Trip Distribution

Single-Family Detached Housing or Land Use 210 was used to calculate site trips for the proposed single family housing using the fitted curve equations from *The Trip Generation, 9th Edition*, published by the Institute of Transportation Engineers.

The total number of trips generated by 114 units or the proposed full buildout of the Autumn Walk Subdivision was estimated to be 1185 daily trips. During the peak hours the estimated trips are 90 trips during the AM peak hour and 118 trips during the PM peak hour.

A trip generation summary is shown in Table 4-1.

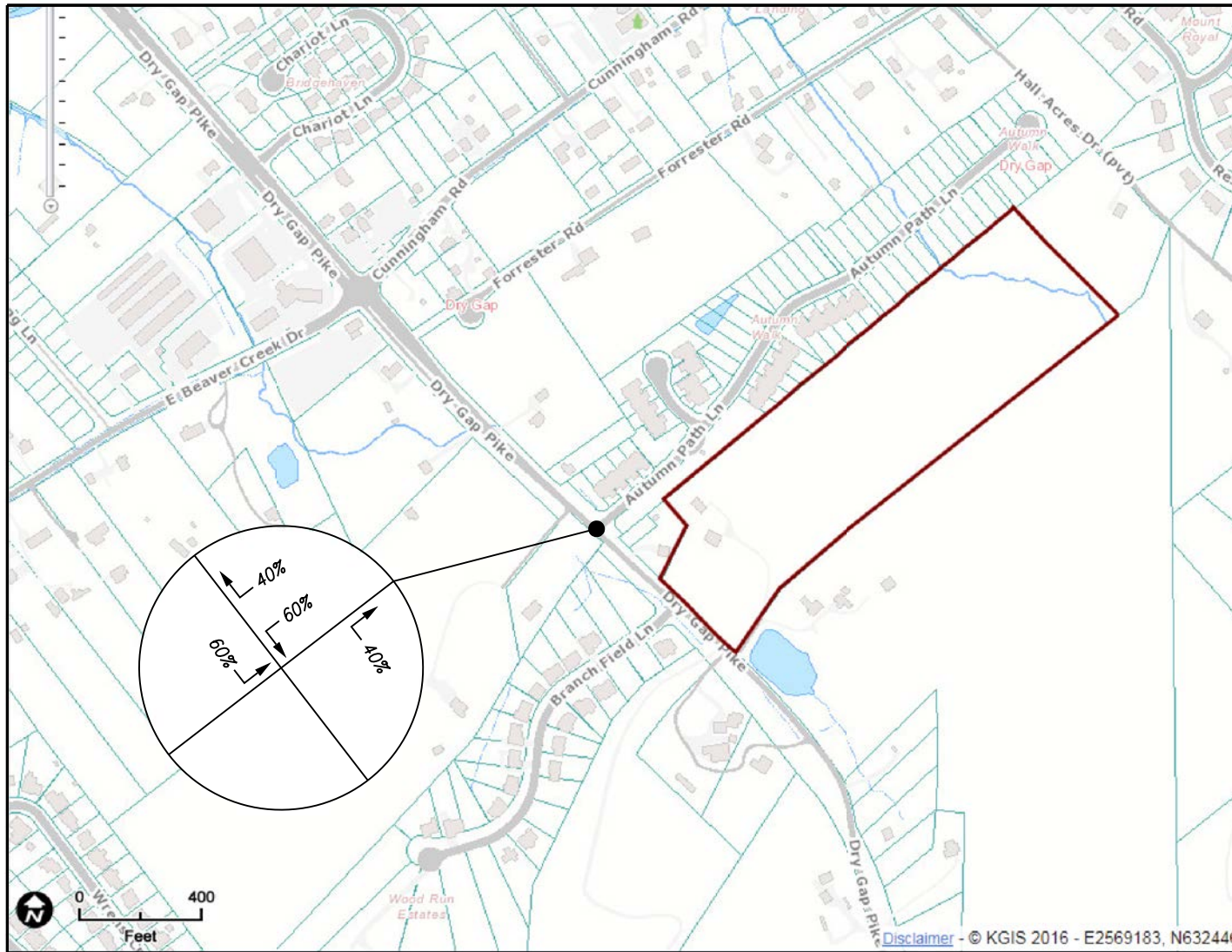
**Table 4-1
Trip Generation Summary**

Autumn Walk Subdivision – Full Buildout Single-Family Detached Housing (Land Use 210)					
	Total New Trips	% Entering	%Exiting	Number Entering	Number Exiting
Weekday	1185	50	50	592	592
A.M. Peak	90	25	75	22	67
P.M. Peak	118	63	37	74	44

The directional distribution of the traffic generated by the proposed Autumn Walk Subdivision was determined using the traffic data collected for the existing conditions. The typical weekday traffic pattern is for traffic to flow heavier in one direction in the morning peak period and then for the traffic to be heavier in the opposite direction during the evening peak period. Dry Gap Pike at the existing Project Entrance has a trip distribution of 30% Northbound and 70% Southbound during the AM peak hour and 65% Northbound and 35% Southbound during the PM peak hour.

Autumn Path Lane has a trip distribution for exiting traffic of 40% right turns and 60% left turns during the AM peak hour and 50% right turns and 50% left turns during the PM peak hour. Dry Gap Pike has a trip distribution for entering traffic onto Autumn Path Lane of 40% Northbound right turns and 60% Southbound left turns during the AM peak hour and 45% Northbound right turns and 55% Southbound left turns during the PM peak hour. The trip distribution for the Autumn Walk Subdivision is shown in Figure 5 and Figure 6.

Using the existing trip distribution the trips generated from the Autumn Walk Subdivision are shown in Figure 7. Figure 8 shows only the background thru traffic on Dry Gap Pike combined with the full buildout from the trip generation of Autumn Walk Subdivision.



LEGEND:

← 50% (50%)

TRIP DISTRIBUTION AM (PM)

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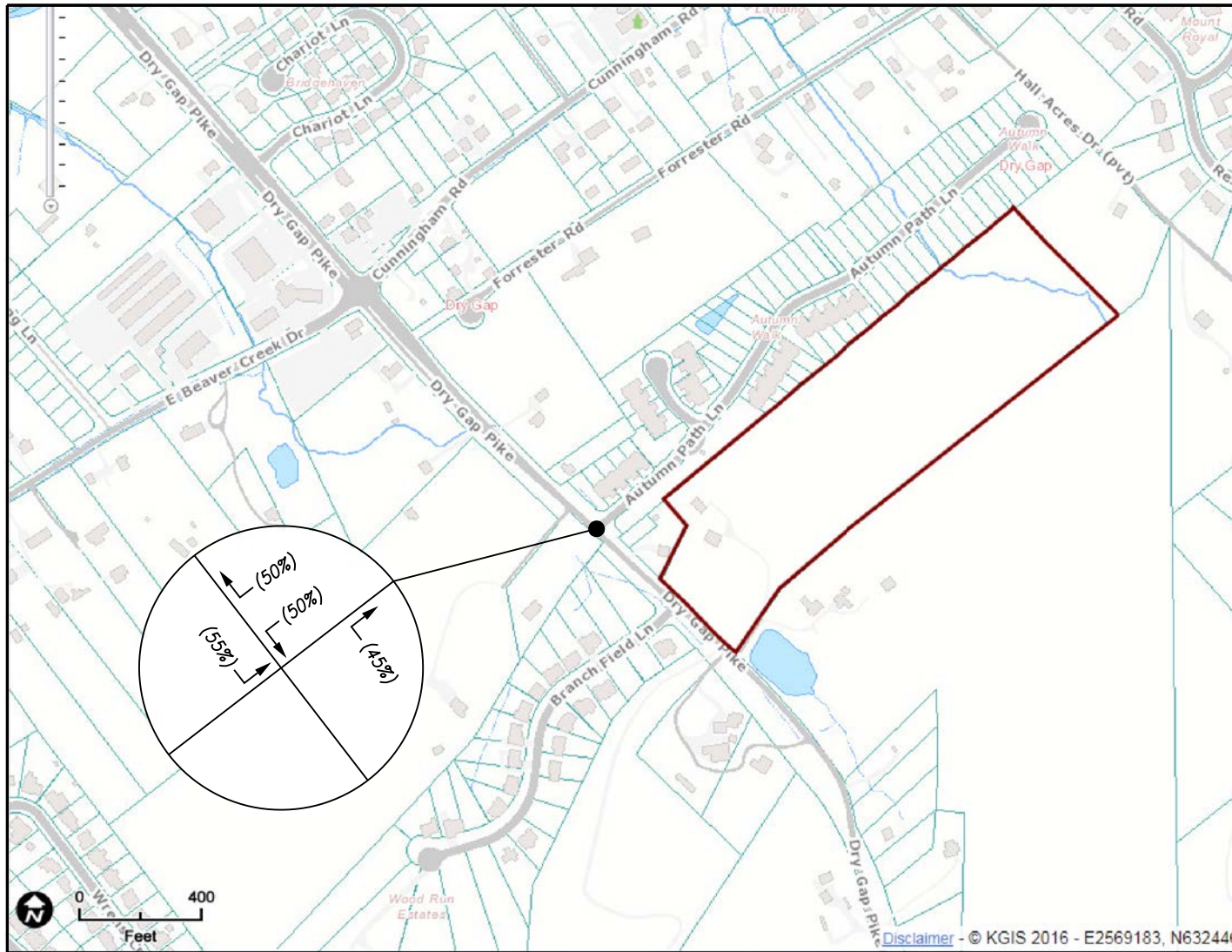
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Date	4/4/16	ISSUED FOR REVIEW	4/4/16		
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FIGURE 5		No.	Revision/Issue	Date	

**AM PEAK HOUR
TRIP DISTRIBUTION**

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LEGEND:

← 50% (50%)

TRIP DISTRIBUTION AM (PM)

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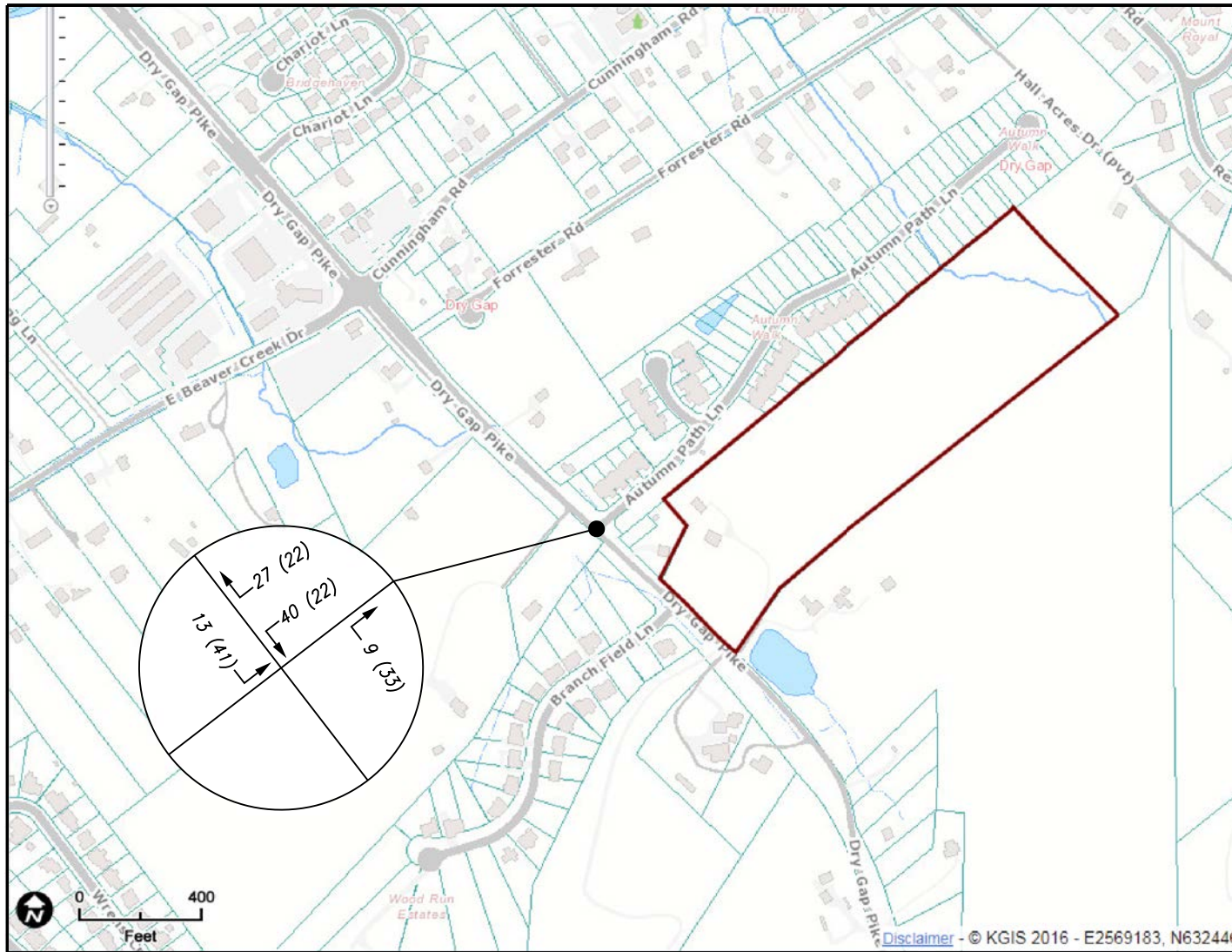
Project	567.001	Proj. Mgr.	Designed By	Drawn By	Reference
Date	4/4/16	ISSUED FOR REVIEW	4/4/16		
Scale	N.T.S.				
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FIGURE 6		No.	Revision/Issue	Date	

**PM PEAK HOUR
TRIP DISTRIBUTION**

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LEGEND:

← 5 (16)

TURNING MOVEMENT VOLUME AM (PM)

File Name: \\15671567.001\Calculations\Traffic Impact Study\1567001_crp001.dgn

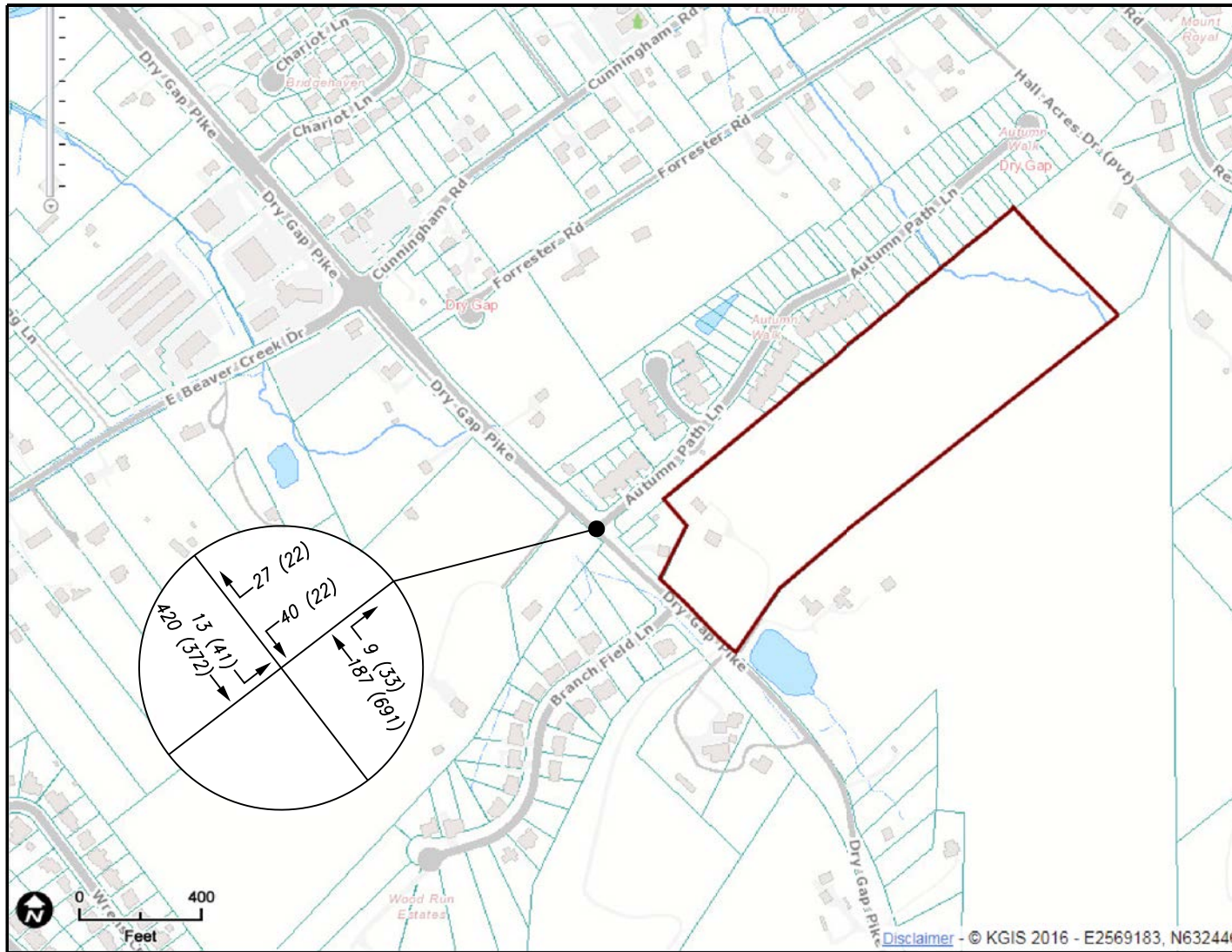
Project	567.001	Proj. Mgr.	Designed By	Drawn By	Reference
Date	4/4/16	ISSUED FOR REVIEW	4/4/16		
Scale	N.T.S.				
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FIGURE 7	No.	Revision/Issue		Date	

PEAK HOUR SUBDIVISION TRAFFIC

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LEGEND:

← 5 (16)

TURNING MOVEMENT VOLUME AM (PM)

File Name: \\15671567001\Calculations\Traffic Impact Study\5672001_crp001.dgn

Project	567.001	Proj. Mgr.	Designed By	Drawn By	Reference
Date	4/4/16	ISSUED FOR REVIEW	4/4/16		
Scale	N.T.S.				
Sheet	FIGURE 8				
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2019 PEAK HOUR TRAFFIC FULL BUILDOUT

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5 Projected Capacity and Level of Service

Unsignalized intersection capacity analyses were performed for the AM and PM peak hours to evaluate the traffic conditions at the intersection of Autumn Path Lane and Dry Gap Pike for existing, background and full buildout conditions. The reports were generated using the 2010 McTrans Highway Capacity Software.

The results from the analyses are measured with a term “level of service” (LOS), which is based on the amount of delay experienced at the intersection. The LOS index ranges from LOS A, indicating excellent traffic conditions with minimal delay, to LOS F indicating very congested conditions with excessive delay. LOS D generally is considered the minimum acceptable condition in urban areas. Table 5-1 shows the results of the intersection capacity analyses.

Table 5-1

**Intersection Analysis
Level of Service (LOS) Summary**

	Approach	Delay (sec)/LOS
Dry Gap Pike @ Autumn Path Lane (Existing 2016)		
AM Peak	SB LT	7.7 / A
	WB LR	12.8 / B
PM Peak	SB LT	9.0 / A
	WB LR	18.2 / C
Dry Gap Pike @ Autumn Path Lane (Background Growth 2019)		
AM Peak	SB LT	7.7 / A
	WB LR	13.6 / B
PM Peak	SB LT	9.2 / A
	WB LR	20.2 / C
Dry Gap Pike @ Autumn Path Lane (Background Growth + Full Buildout 2019)		
AM Peak	SB LT	7.8 / A
	WB LR	17.0 / C
PM Peak	SB LT	9.7 / A
	WB LR	28.7 / D

6 Turn Lane Warrant Analysis

The intersection of Dry Gap Pike and Autumn Path Lane was evaluated to determine if a northbound right turn lane or a southbound left turn on Dry Gap Pike was warranted. The Knox County Department of Engineering and Public Works handbook, "Access Control and Driveway Design Policy," was used to analyze the information. A northbound right turn lane on Dry Gap Pike is warranted during the PM peak hour. A southbound left turn on Dry Gap Pike is warranted during the PM peak hour. The turn lane warrant worksheets and analysis are included in Attachment 6.

7 Conclusions and Recommendations

7.1 Autumn Path Lane

The existing intersection geometry is one 26-ft lane exiting the subdivision. At the intersection of Dry Gap Pike and Autumn Path Lane the westbound approach currently operates at an acceptable LOS B during the AM peak hour and a LOS C during the PM peak hour. Autumn Path Lane westbound will operate at an acceptable LOS C during the AM peak hour and a LOS D during the PM peak hour after the completion of the Autumn Walk Subdivision.

The unsignalized intersection capacity analyses shows a 95% queue length at the full buildout for the westbound traffic of two car lengths during both the AM and PM peak hours; therefore the existing storage at the intersection is adequate and no change is necessary.

7.2 Dry Gap Pike @ Autumn Path Lane

At the intersection of Dry Gap Pike and Autumn Path Lane the southbound approach currently operates at an acceptable LOS A during both AM and PM peak hours. Dry Gap Pike southbound will continue to operate at a LOS A during both the AM and PM peak hours after the completion of the Autumn Walk Subdivision.

A southbound left turn lane is warranted at the intersection of Dry Gap Pike and Autumn Path Lane after the full buildout of the Autumn Walk Subdivision, but only during the PM peak hour. The left turn lane warrant will be met after 50 of the proposed 114 residential condominium units are completed.

The unsignalized intersection capacity analyses shows a 95% queue length at the full buildout for the southbound left turning movement of less than one car length during both the AM and PM peak hours. Per AASHTO "A Policy on Geometric Design of Highways and Streets" the recommended storage length is two car lengths (approximately 50 feet) and the recommended taper length is 100 feet.

A northbound right turn lane is warranted at the intersection of Dry Gap Pike and Autumn Path Lane. This warrant is met only during the PM peak hour due to the high volume of traffic on Dry Gap Pike. The right turn lane warrant will be met after 77 of the proposed 114 residential condominium units are completed. Per AASHTO "A Policy on Geometric Design of Highways and Streets" the recommended storage length is two car lengths (approximately 50 feet) and the recommended taper length is 100 feet.

The minimum intersection spacing required for a collector is 300 feet per the "Minimum Subdivision Regulations" for Knoxville and Knox County. The nearest road intersection to the project entrance is currently 375 feet south at the intersection of Dry Gap Pike and Branch Field Lane. This intersection exceeds the typical minimum separation of 300 feet between roads on a collector street; therefore, no change is necessary.

The minimum required sight distance for a road with a posted speed limit of 40 mph is 400 feet in each direction in accordance with the "Minimum Subdivision Regulations" for Knoxville and Knox County. The existing intersection of Dry Gap Pike and Autumn Path Lane has a measured sight distance that exceeds 400-ft north and south of the intersection, which meets the requirement. FMA recommends any necessary landscaping that may be involved to maintain this sight distance and continue to comply with Knox County Engineering & Public Works.

**Attachment 1
Traffic Counts**

**Attachment 1
Traffic Counts**

**Project: Autumn Walk Phase 3
Date Conducted: Tuesday 3/22/2016**

Start	Dry Gap Pike Northbound			Dry Gap Pike Southbound			Autumn Walk Lane Westbound			Int. Total
	Thru	Right	Total	Left	Thru	Total	Left	Right	Total	
7:00 AM	31	0	31	0	66	66	1	0	1	98
7:15 AM	38	0	38	2	92	94	2	2	4	136
7:30 AM	54	0	54	0	99	99	1	2	3	156
7:45 AM	48	2	50	1	127	128	3	1	4	182
Total	171	2	173	3	384	387	7	5	12	572
8:00 AM	25	2	27	2	58	60	3	2	5	92
8:15 AM	40	1	41	0	61	61	2	3	5	107
8:30 AM	30	0	30	3	56	59	3	3	6	95
8:45 AM	36	0	36	1	23	24	2	2	4	64
Total	131	3	134	6	198	204	10	10	20	358
11:00 AM	25	0	25	2	28	30	1	2	3	58
11:15 AM	41	1	42	2	42	44	2	3	5	91
11:30 AM	33	0	33	3	32	35	0	1	1	69
11:45 AM	39	0	39	3	29	32	2	2	4	75
Total	138	1	139	10	131	141	5	8	13	293
12:00 PM	36	3	39	3	47	50	0	2	2	91
12:15 PM	36	1	37	1	40	41	1	2	3	81
12:30 PM	46	0	46	9	38	47	2	2	4	97
12:45 PM	43	2	45	2	37	39	3	1	4	88
Total	161	6	167	15	162	177	6	7	13	357
2:00 PM	57	1	58	2	47	49	0	4	4	111
2:15 PM	66	0	66	2	36	38	0	0	0	104
2:30 PM	65	3	68	2	46	48	2	2	4	120
2:45 PM	57	2	59	4	57	61	0	2	2	122
Total	245	6	251	10	186	196	2	8	10	457
3:00 PM	59	0	59	2	57	59	1	0	1	119
3:15 PM	58	4	62	5	61	66	1	2	3	131
3:30 PM	76	3	79	0	59	59	2	0	2	140
3:45 PM	97	2	99	3	47	50	3	2	5	154
Total	290	9	299	10	224	234	7	4	11	544
4:00 PM	89	1	90	1	71	72	1	2	3	165
4:15 PM	93	2	95	5	52	57	0	5	5	157
4:30 PM	121	6	127	4	63	67	3	3	6	200
4:45 PM	129	1	130	3	69	72	0	3	3	205
Total	432	10	442	13	255	268	4	13	17	727
5:00 PM	168	4	172	3	79	82	4	3	7	261
5:15 PM	147	2	149	4	92	96	1	1	2	247
5:30 PM	159	2	161	1	89	90	2	3	5	256
5:45 PM	158	0	158	2	80	82	2	3	5	245
Total	632	8	640	10	340	350	9	10	19	1009
Grand Total	2200	45	2245	77	1880	1957	50	65	115	4317
Approach %	98.0	2.0		3.9	96.1		43.5	56.5		
Total %	51.0	1.0	52.0	1.8	43.5	45.3	1.2	1.5	2.7	

Project: Autumn Walk Phase 3
Date Conducted: Tuesday 3/22/2016

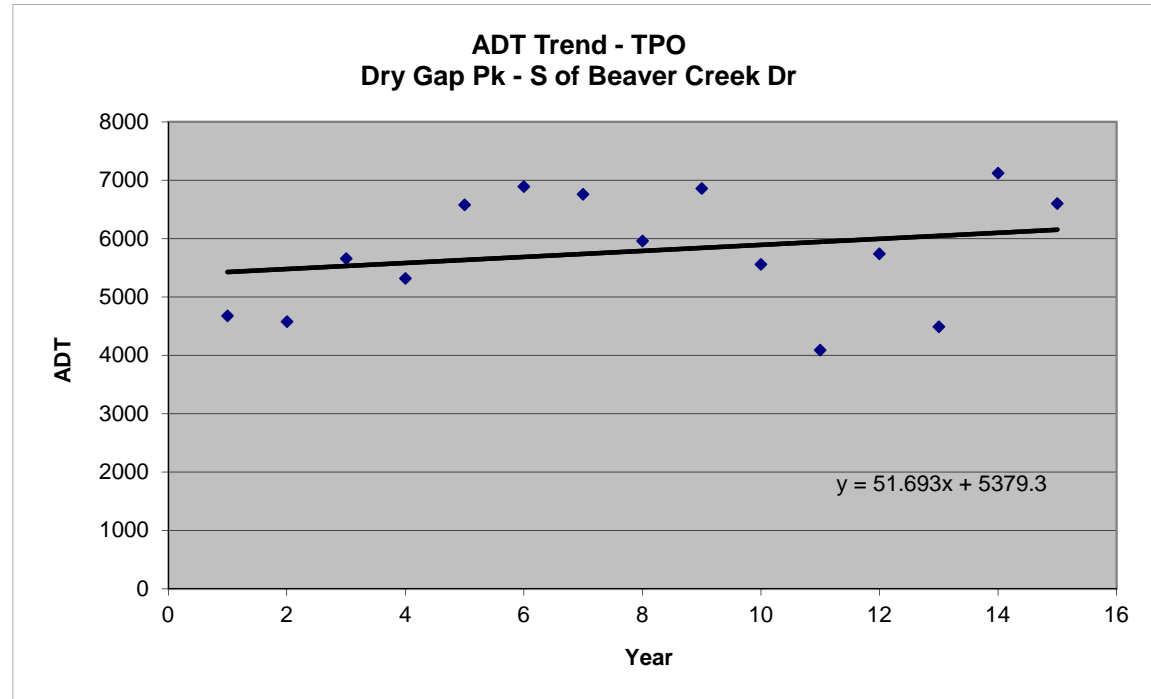
AM Peak Hour	7:00 AM - 8:00 AM	572
Lunch Peak Hour	12:00 PM - 1:00 PM	357
PM Peak Hour	5:00 PM - 6:00 PM	1009

Start	Dry Gap Pike Northbound			Dry Gap Pike Southbound			Autumn Walk Lane Westbound			Int. Total
	Thru	Right	App. Total	Left	Thru	App. Total	Left	Right	App. Total	
Peak Hour Analysis from 7:00 AM to 9:00 AM										
AM Peak Hour begins at 7:15 AM										
7:00 AM	31	0	31	0	66	66	1	0	1	98
7:15 AM	38	0	38	2	92	94	2	2	4	136
7:30 AM	54	0	54	0	99	99	1	2	3	156
7:45 AM	48	2	50	1	127	128	3	1	4	182
Total Volume	171	2	173	3	384	387	7	5	12	572
Future (3% over 3 yrs)	187	2		3	420		8	5		625
PHF	0.79	0.25		0.38	0.76		0.58	0.63		0.79
Peak Hour Analysis from 11:00 AM to 1:00 PM										
Lunch Peak Hour begins at 11:45 PM										
12:00 PM	36	3	39	3	47	50	0	2	2	91
12:15 PM	36	1	37	1	40	41	1	2	3	81
12:30 PM	46	0	46	9	38	47	2	2	4	97
12:45 PM	43	2	45	2	37	39	3	1	4	88
Total Volume	161	6	167	15	162	177	6	7	13	357
Future (3% over 3 yrs)	176	7		16	177		7	8		390
PHF	0.88	0.50		0.42	0.86		0.50	0.88		0.92
Peak Hour Analysis from 2:00 PM to 6:00 PM										
PM Peak Hour begins at 5:00 PM										
5:00 PM	168	4	172	3	79	82	4	3	7	261
5:15 PM	147	2	149	4	92	96	1	1	2	247
5:30 PM	159	2	161	1	89	90	2	3	5	256
5:45 PM	158	0	158	2	80	82	2	3	5	245
Total Volume	632	8	640	10	340	350	9	10	19	1009
Future (3% over 3 yrs)	691	9		11	372		10	11		1103
PHF	0.94	0.50		0.63	0.92		0.56	0.83		0.97

Attachment 2
ADT Trends

**Attachment 2
ADT Trends**

	Year	Adjusted Average Daily Traffic
1	2000	4680
2	2001	4580
3	2002	5660
4	2003	5320
5	2004	6580
6	2005	6893
7	2006	6760
8	2007	5960
9	2008	6860
10	2009	5560
11	2010	4090
12	2011	5740
13	2012	4490
14	2013	7120
15	2014	6600



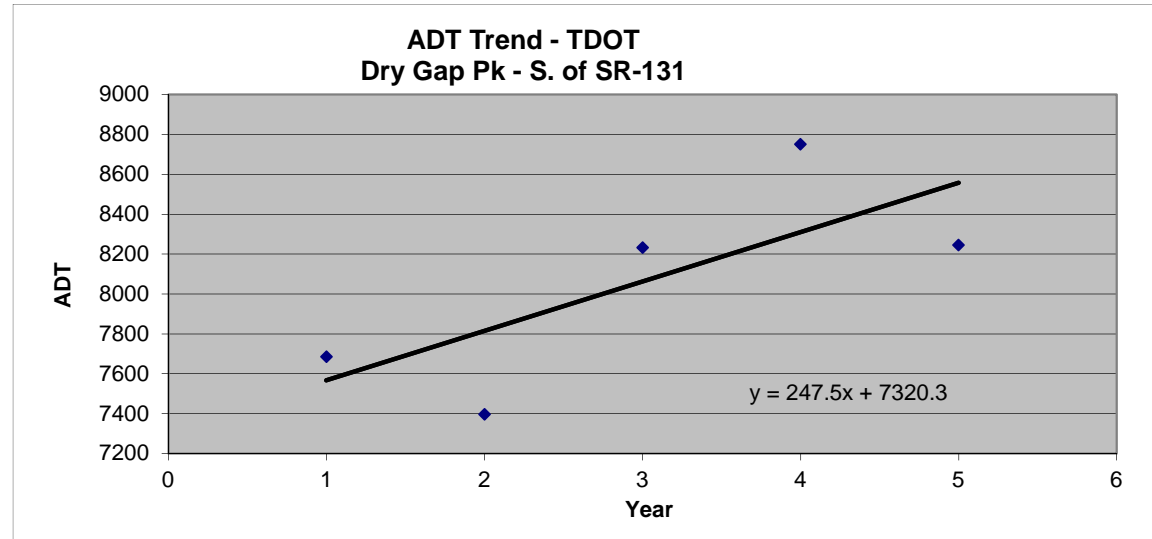
Most Recent Trend Line Growth

Year	ADT
2000	4680
2014	6600

Annual Percent Growth 2.74%

Attachment 2
ADT Trends

	Year	Adjusted Average Daily Traffic
1	2010	7686
2	2011	7397
3	2012	8233
4	2013	8752
5	2014	8246



Most Recent Trend Line Growth

Year	ADT
2010	7686
2014	8246

Annual Percent Growth 1.46%

Attachment 3
Intersection Worksheet
Existing AM/PM Peaks

TWO-WAY STOP CONTROL SUMMARY							
General Information				Site Information			
Analyst	Addie Kirkham			Intersection	Dry Gap Pk @ Autumn Path Ln		
Agency/Co.	FMA			Jurisdiction	Knox County		
Date Performed	3/28/2016			Analysis Year	2016		
Analysis Time Period	Existing AM Peak						
Project Description 567.001 Autumn Walk Subdivision							
East/West Street: Autumn Path Lane				North/South Street: Dry Gap Pike			
Intersection Orientation: North-South				Study Period (hrs): 0.25			
Vehicle Volumes and Adjustments							
Major Street	Northbound			Southbound			
Movement	1	2	3	4	5	6	
	L	T	R	L	T	R	
Volume (veh/h)		171	2	3	384		
Peak-Hour Factor, PHF	1.00	0.79	0.25	0.38	0.76	1.00	
Hourly Flow Rate, HFR (veh/h)	0	216	8	7	505	0	
Percent Heavy Vehicles	0	--	--	0	--	--	
Median Type	Undivided						
RT Channelized			0			0	
Lanes	0	1	0	0	1	0	
Configuration			TR	LT			
Upstream Signal		0			0		
Minor Street	Eastbound			Westbound			
Movement	7	8	9	10	11	12	
	L	T	R	L	T	R	
Volume (veh/h)				7		5	
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.58	1.00	0.63	
Hourly Flow Rate, HFR (veh/h)	0	0	0	12	0	7	
Percent Heavy Vehicles	0	0	0	0	0	0	
Percent Grade (%)		0			0		
Flared Approach		N			N		
Storage		0			0		
RT Channelized			0			0	
Lanes	0	0	0	0	0	0	
Configuration					LR		
Delay, Queue Length, and Level of Service							
Approach	Northbound	Southbound	Westbound			Eastbound	
Movement	1	4	7	8	9	10	11
Lane Configuration		LT		LR			
v (veh/h)		7		19			
C (m) (veh/h)		1357		480			
v/c		0.01		0.04			
95% queue length		0.02		0.12			
Control Delay (s/veh)		7.7		12.8			
LOS		A		B			
Approach Delay (s/veh)	--	--	12.8				
Approach LOS	--	--	B				

TWO-WAY STOP CONTROL SUMMARY							
General Information				Site Information			
Analyst	Addie Kirkham			Intersection	Dry Gap Pk @ Autumn Path Ln		
Agency/Co.	FMA			Jurisdiction	Knox County		
Date Performed	3/28/2016			Analysis Year	2016		
Analysis Time Period	Existing PM Peak						
Project Description 567.001 Autumn Walk Subdivision							
East/West Street: Autumn Path Lane				North/South Street: Dry Gap Pike			
Intersection Orientation: North-South				Study Period (hrs): 0.25			
Vehicle Volumes and Adjustments							
Major Street	Northbound			Southbound			
Movement	1	2	3	4	5	6	
	L	T	R	L	T	R	
Volume (veh/h)		632	8	10	340		
Peak-Hour Factor, PHF	1.00	0.94	0.50	0.63	0.92	1.00	
Hourly Flow Rate, HFR (veh/h)	0	672	16	15	369	0	
Percent Heavy Vehicles	0	--	--	0	--	--	
Median Type	Undivided						
RT Channelized			0			0	
Lanes	0	1	0	0	1	0	
Configuration			TR	LT			
Upstream Signal		0			0		
Minor Street	Eastbound			Westbound			
Movement	7	8	9	10	11	12	
	L	T	R	L	T	R	
Volume (veh/h)				9		10	
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.56	1.00	0.83	
Hourly Flow Rate, HFR (veh/h)	0	0	0	16	0	12	
Percent Heavy Vehicles	0	0	0	0	0	0	
Percent Grade (%)		0			0		
Flared Approach		N			N		
Storage		0			0		
RT Channelized			0			0	
Lanes	0	0	0	0	0	0	
Configuration					LR		
Delay, Queue Length, and Level of Service							
Approach	Northbound	Southbound	Westbound			Eastbound	
Movement	1	4	7	8	9	10	11
Lane Configuration		LT		LR			
v (veh/h)		15		28			
C (m) (veh/h)		916		301			
v/c		0.02		0.09			
95% queue length		0.05		0.30			
Control Delay (s/veh)		9.0		18.2			
LOS		A		C			
Approach Delay (s/veh)	--	--	18.2				
Approach LOS	--	--	C				

Attachment 4
Intersection Worksheet
Background AM/PM Peaks

TWO-WAY STOP CONTROL SUMMARY							
General Information				Site Information			
Analyst	Addie Kirkham			Intersection	Dry Gap Pk @ Autumn Path Ln		
Agency/Co.	FMA			Jurisdiction	Knox County		
Date Performed	3/28/2016			Analysis Year	2019		
Analysis Time Period	Background AM Peak						
Project Description 567.001 Autumn Walk Subdivision							
East/West Street: Autumn Path Lane				North/South Street: Dry Gap Pike			
Intersection Orientation: North-South				Study Period (hrs): 0.25			
Vehicle Volumes and Adjustments							
Major Street	Northbound			Southbound			
Movement	1	2	3	4	5	6	
	L	T	R	L	T	R	
Volume (veh/h)		187	2	3	420		
Peak-Hour Factor, PHF	1.00	0.79	0.25	0.38	0.76	1.00	
Hourly Flow Rate, HFR (veh/h)	0	236	8	7	552	0	
Percent Heavy Vehicles	0	--	--	0	--	--	
Median Type	Undivided						
RT Channelized			0			0	
Lanes	0	1	0	0	1	0	
Configuration			TR	LT			
Upstream Signal		0			0		
Minor Street	Eastbound			Westbound			
Movement	7	8	9	10	11	12	
	L	T	R	L	T	R	
Volume (veh/h)				8		5	
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.58	1.00	0.63	
Hourly Flow Rate, HFR (veh/h)	0	0	0	13	0	7	
Percent Heavy Vehicles	0	0	0	0	0	0	
Percent Grade (%)		0			0		
Flared Approach		N			N		
Storage		0			0		
RT Channelized			0			0	
Lanes	0	0	0	0	0	0	
Configuration					LR		
Delay, Queue Length, and Level of Service							
Approach	Northbound	Southbound	Westbound			Eastbound	
Movement	1	4	7	8	9	10	11
Lane Configuration		LT		LR			
v (veh/h)		7		20			
C (m) (veh/h)		1334		438			
v/c		0.01		0.05			
95% queue length		0.02		0.14			
Control Delay (s/veh)		7.7		13.6			
LOS		A		B			
Approach Delay (s/veh)	--	--		13.6			
Approach LOS	--	--		B			

TWO-WAY STOP CONTROL SUMMARY							
General Information				Site Information			
Analyst	Addie Kirkham			Intersection	Dry Gap Pk @ Autumn Path Ln		
Agency/Co.	FMA			Jurisdiction	Knox County		
Date Performed	3/28/2016			Analysis Year	2019		
Analysis Time Period	Background PM Peak						
Project Description 567.001 Autumn Walk Subdivision							
East/West Street: Autumn Path Lane				North/South Street: Dry Gap Pike			
Intersection Orientation: North-South				Study Period (hrs): 0.25			
Vehicle Volumes and Adjustments							
Major Street	Northbound			Southbound			
Movement	1	2	3	4	5	6	
	L	T	R	L	T	R	
Volume (veh/h)		691	9	11	372		
Peak-Hour Factor, PHF	1.00	0.94	0.50	0.63	0.92	1.00	
Hourly Flow Rate, HFR (veh/h)	0	735	18	17	404	0	
Percent Heavy Vehicles	0	--	--	0	--	--	
Median Type	Undivided						
RT Channelized			0			0	
Lanes	0	1	0	0	1	0	
Configuration			TR	LT			
Upstream Signal		0			0		
Minor Street	Eastbound			Westbound			
Movement	7	8	9	10	11	12	
	L	T	R	L	T	R	
Volume (veh/h)				10		11	
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.56	1.00	0.83	
Hourly Flow Rate, HFR (veh/h)	0	0	0	17	0	13	
Percent Heavy Vehicles	0	0	0	0	0	0	
Percent Grade (%)		0			0		
Flared Approach		N			N		
Storage		0			0		
RT Channelized			0			0	
Lanes	0	0	0	0	0	0	
Configuration					LR		
Delay, Queue Length, and Level of Service							
Approach	Northbound	Southbound	Westbound			Eastbound	
Movement	1	4	7	8	9	10	11
Lane Configuration		LT		LR			
v (veh/h)		17		30			
C (m) (veh/h)		866		266			
v/c		0.02		0.11			
95% queue length		0.06		0.38			
Control Delay (s/veh)		9.2		20.2			
LOS		A		C			
Approach Delay (s/veh)	--	--		20.2			
Approach LOS	--	--		C			

Attachment 5
Intersection Worksheet
Background AM/PM Peaks + Full Buildout

TWO-WAY STOP CONTROL SUMMARY							
General Information				Site Information			
Analyst	Addie Kirkham			Intersection	Dry Gap Pk @ Autumn Path Ln		
Agency/Co.	FMA			Jurisdiction	Knox County		
Date Performed	3/28/2016			Analysis Year	2019		
Analysis Time Period	Full Buildout AM Peak						
Project Description 567.001 Autumn Walk Subdivision							
East/West Street: Autumn Path Lane				North/South Street: Dry Gap Pike			
Intersection Orientation: North-South				Study Period (hrs): 0.25			
Vehicle Volumes and Adjustments							
Major Street	Northbound			Southbound			
Movement	1	2	3	4	5	6	
	L	T	R	L	T	R	
Volume (veh/h)		187	9	13	420		
Peak-Hour Factor, PHF	1.00	0.79	0.25	0.38	0.76	1.00	
Hourly Flow Rate, HFR (veh/h)	0	236	36	34	552	0	
Percent Heavy Vehicles	0	--	--	0	--	--	
Median Type	Undivided						
RT Channelized			0			0	
Lanes	0	1	0	0	1	0	
Configuration			TR	LT			
Upstream Signal		0			0		
Minor Street	Eastbound			Westbound			
Movement	7	8	9	10	11	12	
	L	T	R	L	T	R	
Volume (veh/h)				40		27	
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.58	1.00	0.63	
Hourly Flow Rate, HFR (veh/h)	0	0	0	68	0	42	
Percent Heavy Vehicles	0	0	0	0	0	0	
Percent Grade (%)		0			0		
Flared Approach		N			N		
Storage		0			0		
RT Channelized			0			0	
Lanes	0	0	0	0	0	0	
Configuration					LR		
Delay, Queue Length, and Level of Service							
Approach	Northbound	Southbound	Westbound			Eastbound	
Movement	1	4	7	8	9	10	11
Lane Configuration		LT		LR			
v (veh/h)		34		110			
C (m) (veh/h)		1303		409			
v/c		0.03		0.27			
95% queue length		0.08		1.07			
Control Delay (s/veh)		7.8		17.0			
LOS		A		C			
Approach Delay (s/veh)	--	--		17.0			
Approach LOS	--	--		C			

TWO-WAY STOP CONTROL SUMMARY							
General Information				Site Information			
Analyst	Addie Kirkham			Intersection	Dry Gap Pk @ Autumn Path Ln		
Agency/Co.	FMA			Jurisdiction	Knox County		
Date Performed	3/28/2016			Analysis Year	2019		
Analysis Time Period	Full Buildout PM Peak						
Project Description 567.001 Autumn Walk Subdivision							
East/West Street: Autumn Path Lane				North/South Street: Dry Gap Pike			
Intersection Orientation: North-South				Study Period (hrs): 0.25			
Vehicle Volumes and Adjustments							
Major Street	Northbound			Southbound			
Movement	1	2	3	4	5	6	
	L	T	R	L	T	R	
Volume (veh/h)		691	33	41	372		
Peak-Hour Factor, PHF	1.00	0.94	0.50	0.63	0.92	1.00	
Hourly Flow Rate, HFR (veh/h)	0	735	66	65	404	0	
Percent Heavy Vehicles	0	--	--	0	--	--	
Median Type	Undivided						
RT Channelized			0			0	
Lanes	0	1	0	0	1	0	
Configuration			TR	LT			
Upstream Signal		0			0		
Minor Street	Eastbound			Westbound			
Movement	7	8	9	10	11	12	
	L	T	R	L	T	R	
Volume (veh/h)				22		22	
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.56	1.00	0.83	
Hourly Flow Rate, HFR (veh/h)	0	0	0	39	0	26	
Percent Heavy Vehicles	0	0	0	0	0	0	
Percent Grade (%)		0			0		
Flared Approach		N			N		
Storage		0			0		
RT Channelized			0			0	
Lanes	0	0	0	0	0	0	
Configuration					LR		
Delay, Queue Length, and Level of Service							
Approach	Northbound	Southbound	Westbound			Eastbound	
Movement	1	4	7	8	9	10	11
Lane Configuration		LT		LR			
v (veh/h)		65		65			
C (m) (veh/h)		831		216			
v/c		0.08		0.30			
95% queue length		0.25		1.21			
Control Delay (s/veh)		9.7		28.7			
LOS		A		D			
Approach Delay (s/veh)	--	--	28.7				
Approach LOS	--	--	D				

Attachment 6
Turn Lane Warrant Analysis

**Attachment 6
Turn Lane Warrant Analysis**

Project: Autumn Walk Phase 3

**Dry Gap Pike
at Autumn Path Lane**

VOLUMES

LEFT TURN	Opposing	Thru	LT	LT MAX	Warrant Met
AM	196	420	13	55	NO
PM	724	372	41	20	YES

**Dry Gap Pike
at Autumn Path Lane**

VOLUMES

RIGHT TURN	Thru	RT	RT MAX	Warrant Met
AM	187	9	449	NO
PM	691	33	24	YES

TABLE 5A

LEFT-TURN LANE VOLUME THRESHOLDS
FOR TWO-LANE ROADWAYS WITH A PREVAILING SPEED OF 36 TO 45 MPH

(If the left-turn volume exceeds the table value a left -turn lane is needed)

OPPOSING VOLUME	THROUGH VOLUME PLUS RIGHT-TURN VOLUME *					
	100 - 149	150 - 199	200 - 249	250 - 299	300 - 349	350 - 399
100 - 149	250	180	140	110	80	70
150 - 199	200	140	105	90	70	60
200 - 249	160	115	85	75	65	55
250 - 299	130	100	75	65	60	50
300 - 349	110	90	70	60	55	45
350 - 399	100	80	65	55	50	40
400 - 449	90	70	60	50	45	35
450 - 499	80	65	55	45	40	30
500 - 549	70	60	45	35	35	25
550 - 599	65	55	40	35	30	25
600 - 649	60	45	35	30	25	25
650 - 699	55	35	35	30	25	20
700 - 749	50	35	30	25	20	20
750 or More	45	35	25	25	20	20

OPPOSING VOLUME	THROUGH VOLUME PLUS RIGHT-TURN VOLUME *					
	350 - 399	400 - 449	450 - 499	500 - 549	550 - 599	= / > 600
100 - 149	70	60	50	45	40	35
150 - 199	60	55	45	40	35	30
200 - 249	55	50	40	35	30	30
250 - 299	50	45	35	30	30	30
300 - 349	45	40	35	30	25	25
350 - 399	40	35	30	25	25	20
400 - 449	35	30	30	25	20	20
450 - 499	30	25	25	20	20	20
500 - 549	25	25	20	20	20	15
550 - 599	25	20	20	20	20	15
600 - 649	25	20	20	20	20	15
650 - 699	20	20	20	20	20	15
700 - 749	20	20	20	15	15	15
750 or More	20	20	20	15	15	15

* Or through volume only if a right-turn lane exists

AM Peak 13 LT

PM Peak 41 LT

TABLE 5B

RIGHT-TURN LANE VOLUME THRESHOLDS
FOR TWO-LANE ROADWAYS WITH A PREVAILING SPEED OF 36 TO 45 MPH

RIGHT-TURN VOLUME	THROUGH VOLUME PLUS LEFT-TURN VOLUME *					
	<100	100 - 199	200 - 249	250 - 299	300 - 349	350 - 399
Fewer Than 25 25 - 49 50 - 99		AM Peak 9 RT				
100 - 149 150 - 199						
200 - 249 250 - 299					Yes	Yes Yes
300 - 349 350 - 399			Yes	Yes Yes	Yes Yes	Yes Yes
400 - 449 450 - 499		Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
500 - 549 550 - 599	Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
600 or More	Yes	Yes	Yes	Yes	Yes	Yes

RIGHT-TURN VOLUME	THROUGH VOLUME PLUS LEFT-TURN VOLUME *					
	350 - 399	400 - 449	450 - 499	500 - 549	550 - 600	+ / > 600
Fewer Than 25 25 - 49 50 - 99				PM Peak 33 RT Yes	Yes Yes	Yes Yes
100 - 149 150 - 199		Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
200 - 249 250 - 299	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
300 - 349 350 - 399	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
400 - 449 450 - 499	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
500 - 549 550 - 599	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
600 or More	Yes	Yes	Yes	Yes	Yes	Yes

* Or through volume only if a left-turn lane exists.