

# DUTCHTOWN ROAD SUBDIVISION

## Traffic Impact Study

Dutchtown Road

Knoxville, TN

### A Traffic Impact Study for the Proposed Dutchtown Road Subdivision

Submitted to

### Knoxville – Knox County Metropolitan Planning Commission

Revised September 21, 2015

September 1, 2015

FMA Project No. 330.010

Submitted By:



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## Executive Summary

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S & E Properties, LLC proposes a residential development with single family homes. The project is located at east of Pellissippi Parkway (Highway 162) near the intersection of Dutchtown Road and Mabry Hood Road in West Knox County, Tennessee. The development will consist of 95 single family homes. Construction is proposed to take place this year and this study assumes full build out for the development will occur in 2018.

The driveway for the proposed development will tie into Dutchtown Road 385-ft west of the intersection of Dutchtown Road and Rennboro Road. The proposed lane configuration is a single lane out of the development.

In order to maintain or provide an acceptable level-of-service for each of the intersections studied, some recommendations are presented.

### **Dutchtown Road @ Project Entrance**

The nearest road intersection to the project entrance is currently 385-ft east at the intersection of Dutchtown Road and Rennboro Road, which does not meet the recommended minimum separation of 400 feet between roads on an arterial per the "Minimum Subdivision Regulations" for Knoxville and Knox County.

An eastbound left turn lane is warranted at the intersection of Dutchtown Road and the proposed project entrance. FMA recommends the two way left turn lane be restriped to include a break at the intersection of Dutchtown Road and the project entrance.

### **Dutchtown Road @ Mabry Hood**

The eastbound and westbound approach will continue to operate at a LOS B or higher after the completion of the Dutchtown Road Subdivision. The northbound and southbound approach will continue to operate at a LOS F after the completion of the Dutchtown Road Subdivision.

### **Dutchtown Road @ Rennboro Road**

The Unsignalized intersection capacity analyses shows a 95% queue length for the eastbound left turn lane of less than one car length during both the AM and PM peak hours; therefore, the existing left turn lane with a 150-ft storage length entering Rennboro Road will be adequate and will not interfere with the Dutchtown Road Subdivision.

# 1 Introduction

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## 1.1 Project Description

This report provides a summary of a traffic impact study that was performed for the proposed Dutchtown Road Subdivision on Dutchtown Road. The project site is located east of Pellissippi Parkway (Highway 162) near the intersection of Mabry Hood Road and Dutchtown Road in west Knox County. The location of the site is shown in Figure 1.

The proposed Dutchtown Road Subdivision will consist of 95 single family lots. Full Buildout is expected to occur within three years, or by the year 2018. 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.

## 1.2 Existing Site Conditions

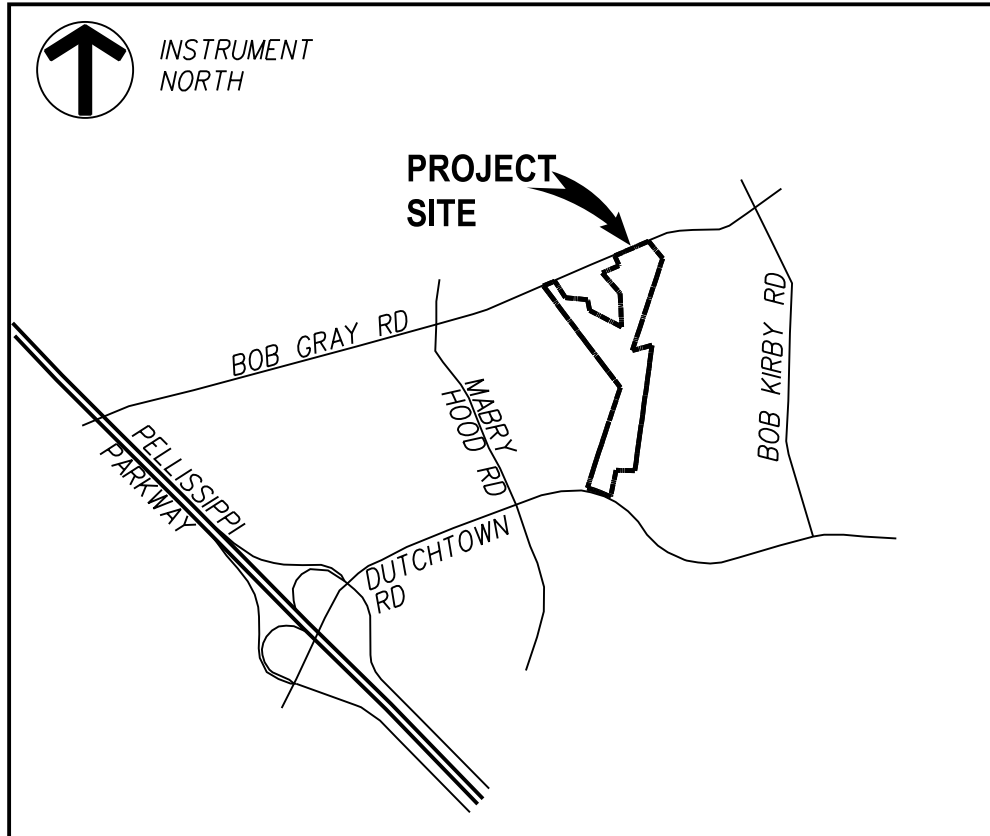
The proposed subdivision site access will tie into Dutchtown Road approximately 871 feet east of the intersection of Dutchtown Road and Mabry Hood Road and approximately 385 feet west of the intersection of Dutchtown Road and Rennboro Road.

During a site visit it was determined that Dutchtown Road is a three-lane road with a two-way left turn lane at the proposed project entrance. The Knoxville-Knox County Metropolitan Planning Commission classifies Dutchtown Road as a minor arterial per the Major Road Plan. The posted speed limit on Dutchtown Road is 40 mph. The grade on Dutchtown Road at the proposed project entrance is approximately 3%. The intersection sight distance at the proposed driveway was measured to be in excess of 400-ft east and west of the intersection.

Mabry Hood Road is a two-lane road and has a posted speed limit of 30 mph. The Knoxville-Knox County Metropolitan Planning Commission classifies Mabry Hood Road as a minor collector per the Major Road Plan. The grade on the southbound approach of Mabry Hood Road is approximately 5%.

Rennboro Road is a two-lane road and has a posted speed limit of 25 mph. The Knoxville-Knox County Metropolitan Planning Commission classifies Rennboro Road as a local street per the Major Road Plan. There is an existing left turn lane with a 150-ft storage length on Dutchtown Road at the intersection of Rennboro Road.

# FIGURE 1

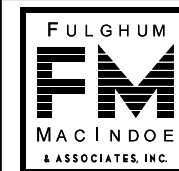


LOCATION MAP  
(NOT TO SCALE)

Project	330.010	Proj. Mgr.	Designed By	Drawn By	Reference
Date	9/1/15	ISSUED FOR REVIEW	9/1/15		
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<b>FIGURE 1</b>		No.	Revision/Issue	Date	

LOCATION MAP

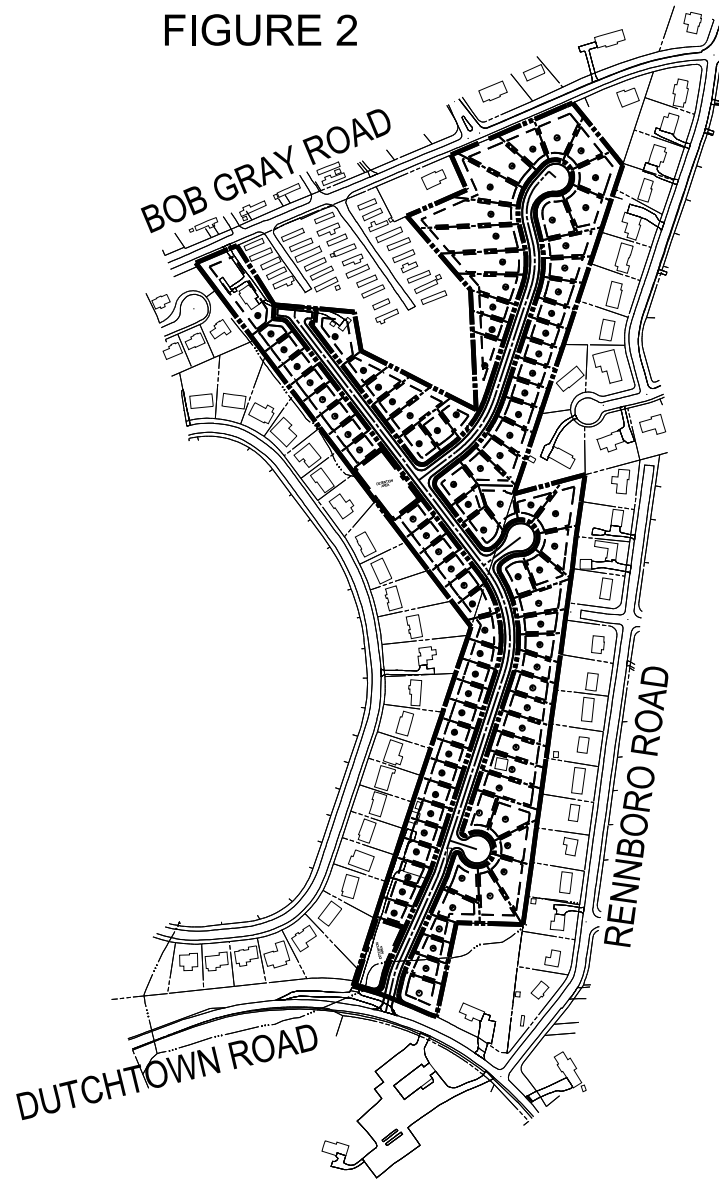
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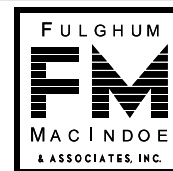
FIGURE 2



Project	330.010	Proj. Mgr.	Designed By	Drawn By	Reference
Date	9/1/15	 ISSUED FOR REVIEW	9/1/15		
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SITE PLAN

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## 2 Existing Traffic Volumes

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FMA conducted an eight-hour turning movement count at the intersection of Dutchtown Road and Mabry Hood Road on Tuesday August 25, 2015. 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 7:15 am and 8:15 am and the PM peak hour occurred between 5:00 pm and 6:00 pm.

Single-Family Detached Housing or Land Use 210 was used to calculate site trips for the existing single family housing on Rennboro Road using the fitted curve equations from *The Trip Generation, 7<sup>th</sup> Edition*, published by the Institute of Transportation Engineers. The land use worksheets are included in Attachment 3.

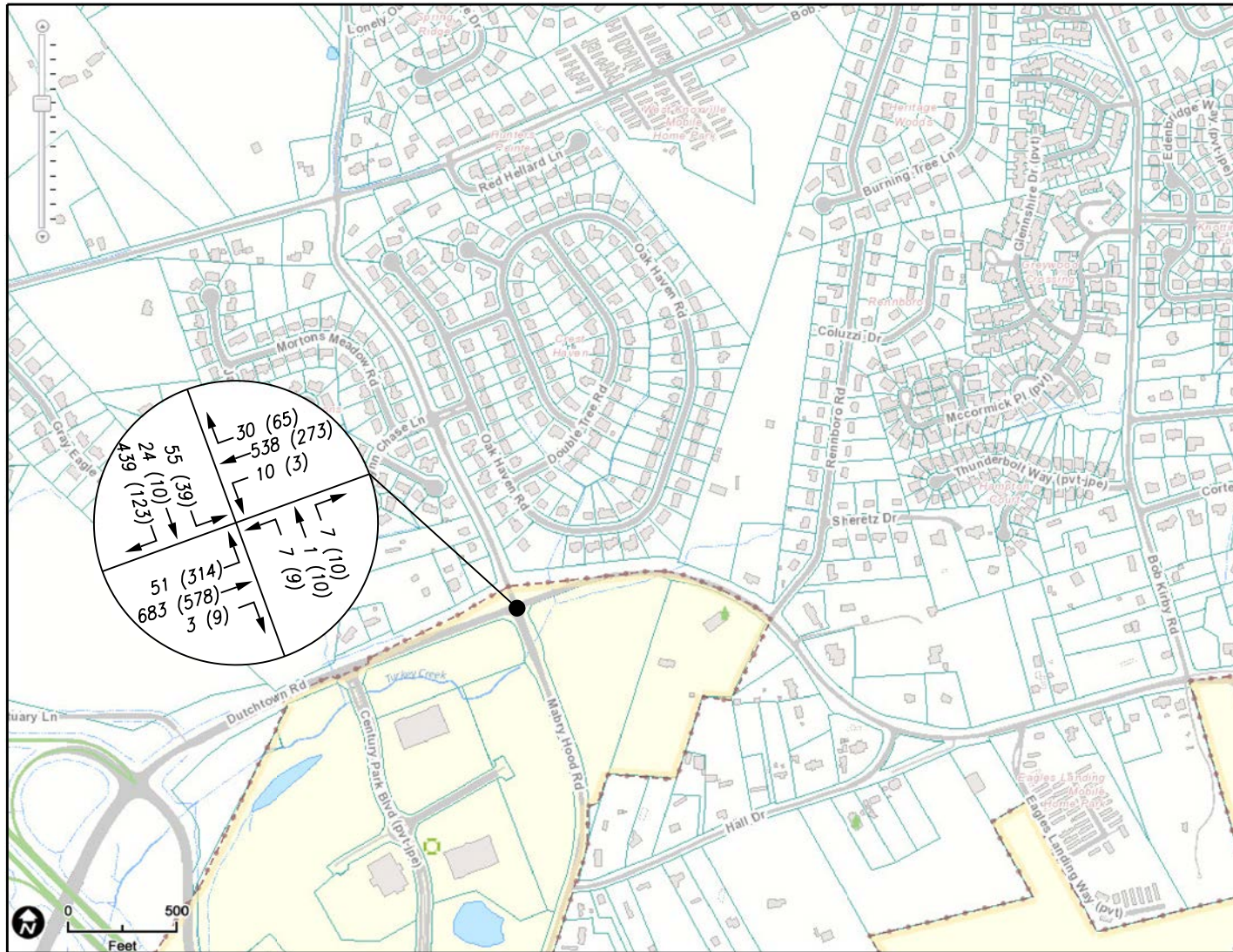
The existing subdivision has 46 lots that enter and exit at the intersection of Dutchtown Road and Rennboro Road. The total number of trips generated by the existing single family housing was estimated to be 509 daily trips. During the peak hour the estimated trips are 42 trips during the AM peak hour and 53 trips during the PM peak hour. A trip generation summary is shown in Table 2-1.

**Table 2-1  
Trip Generation Summary**

Single-Family Detached Housing (Land Use 210)					
	Total Existing Trips	% Entering	% Exiting	Number Entering	Number Exiting
Weekday	509	50	50	255	255
A.M. Peak	42	25	75	11	32
P.M. Peak	53	63	37	33	20

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**LEGEND:**

← 5 (16)

TURNING MOVEMENT VOLUME AM (PM)

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**2015 EXISTING PEAK HOUR TRAFFIC**

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### 3 Background Growth

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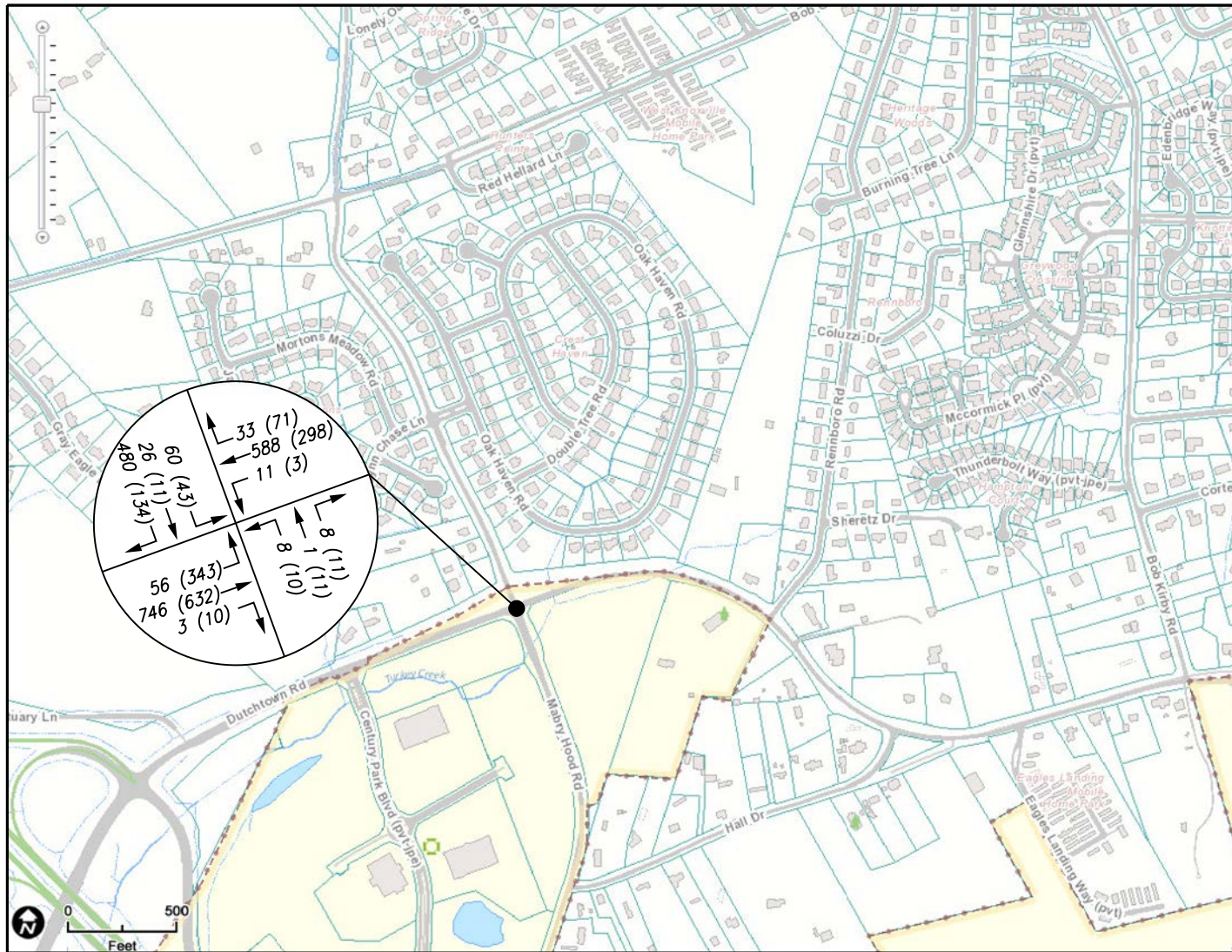
The Tennessee Department of Transportation (TDOT) maintains count Station #000427 on Dutchtown Road near the Christian Academy of Knoxville. The annual traffic growth rate for Station #000427 between 2000 and 2014 is approximately 0.50%.

The Knoxville-Knox County Metropolitan Planning Commission (MPC) and the Transportation Planning Organization (TPO) maintain count station M56 on Dutchtown Road west of Mabry Hood Road. The annual traffic growth rate for Station M56 between 2010 and 2013 is approximately 6.32%.

For the purpose of this study, an annual growth rate of 3% for traffic at the intersection of Dutchtown Road and Mabry Hood Road was assumed until full occupancy is reached in 2018.

Attachment 2 shows the trend line growth charts for the TDOT count stations and for the MPC/TPO count stations. 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)

Project	330.010	Proj. Mgr.	Designed By	Drawn By	Reference
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<b>FIGURE 4</b>	No.	Revision/Issue		Date	

**2018 BACKGROUND  
PEAK HOUR TRAFFIC**

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## **4 Trip Generation and Trip Distribution**

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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, 7<sup>th</sup> Edition*, published by the Institute of Transportation Engineers. The land use worksheets are included in Attachment 3.

The total number of trips generated by the proposed single family housing was estimated to be 992 daily trips. During the peak hour the estimated trips are 76 trips during the AM peak hour and 102 trips during the PM peak hour. A trip generation summary is shown in Table 4-1.

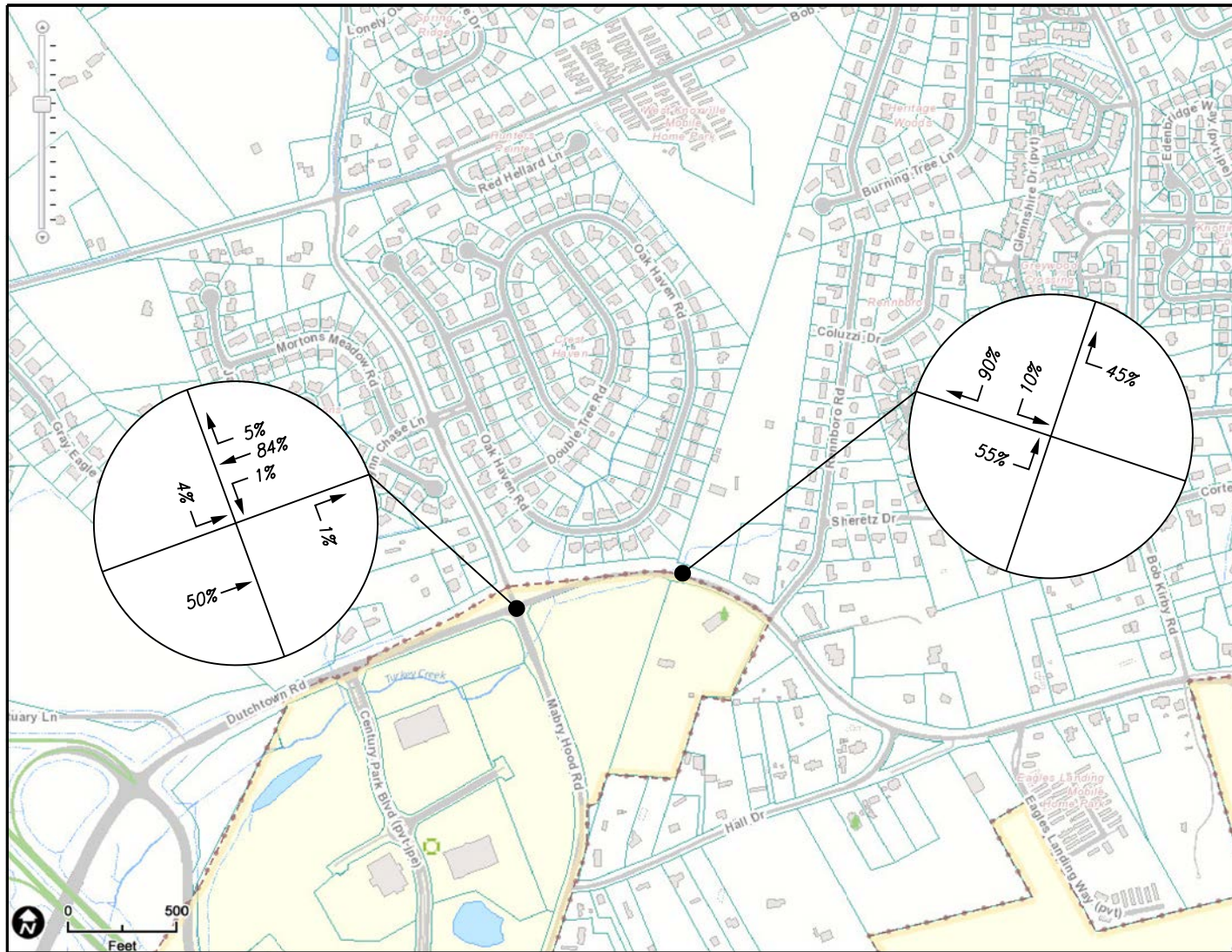
**Table 4-1  
Trip Generation Summary**

Single-Family Detached Housing (Land Use 210)					
	Total New Trips	% Entering	%Exiting	Number Entering	Number Exiting
Weekday	992	50	50	496	496
A.M. Peak	76	25	75	19	57
P.M. Peak	102	63	37	64	38

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The directional distribution of the traffic generated by the proposed Dutchtown Road 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. Dutchtown Road at the proposed Project Entrance had a trip distribution of 55% Eastbound and 45% Westbound during the AM peak hour and 65% Eastbound and 35% Westbound during the PM peak hour. Mabry Hood Road had a trip distribution of 90% Westbound right turns and 10% Eastbound left turns during the AM peak hour and 75% Westbound right turns and 25% Eastbound left turns during the PM peak hour. The trip distribution for the Dutchtown Road Subdivision is shown in Figure 5 and Figure 6.





**LEGEND:**

← 50% (50%)

TRIP DISTRIBUTION AM (PM)

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Scale	N.T.S.				
Sheet	<b>FIGURE 5</b>				
No.	Revision/Issue			Date	

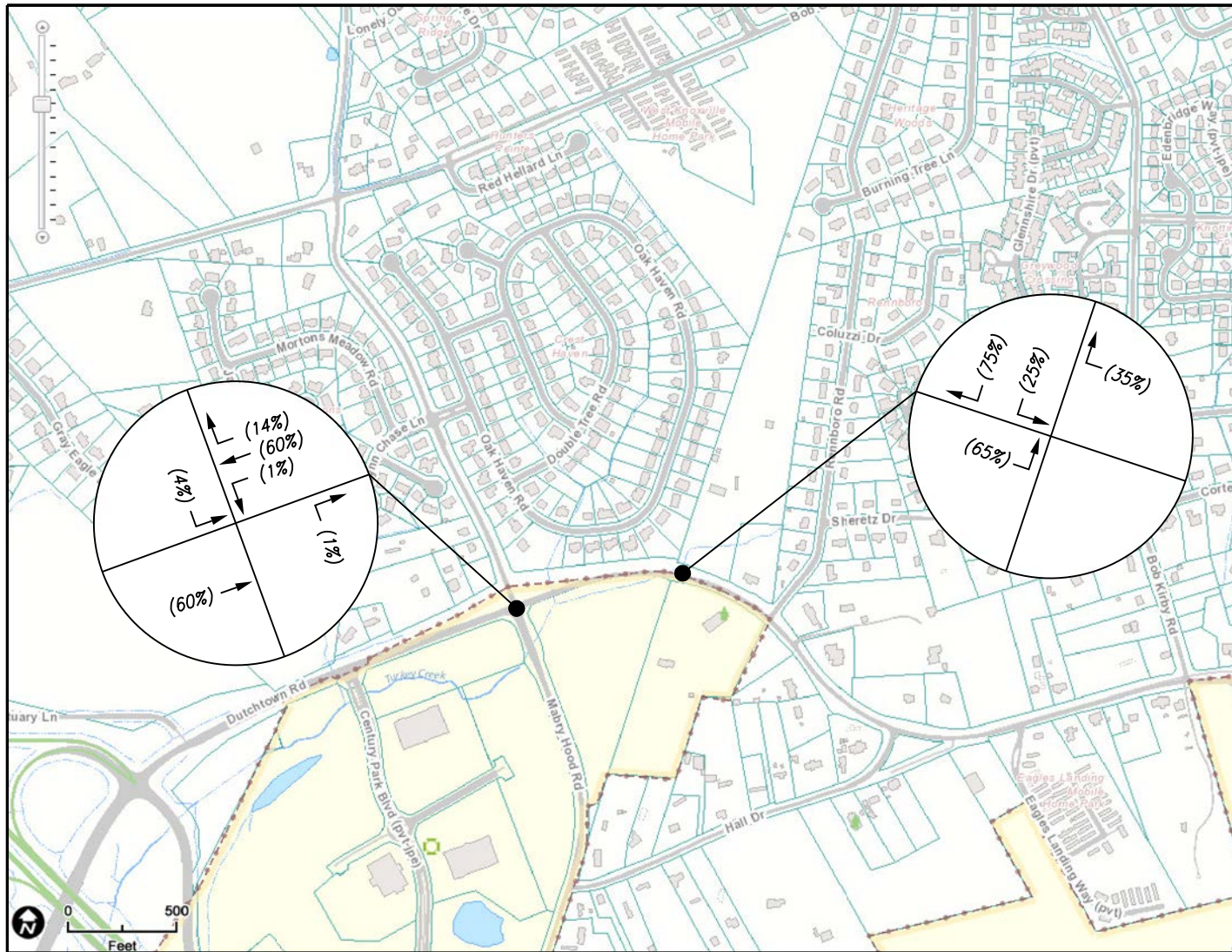
**AM PEAK HOUR  
TRIP DISTRIBUTION**

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**LEGEND:**

← 50% (50%)

TRIP DISTRIBUTION AM (PM)

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Date	9/1/15	ISSUED FOR REVIEW	9/1/15		
Scale	N.T.S.				
Sheet	FIGURE 6				
No.	Revision/Issue			Date	

**PM PEAK HOUR  
TRIP DISTRIBUTION**

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Using the existing trip distribution the trips generated from the Dutchtown Road Subdivision are shown in Figure 7. Figure 8 shows the combined peak hour traffic from the background growth and the full build out of the Dutchtown Road Subdivision.

The existing trip distribution shown in Figure 5 and Figure 6 was used in combination with the trip generation to calculate the proposed traffic at the intersection of Rennboro Road and Dutchtown Road. Figure 9 shows the combined traffic of the Dutchtown Road Subdivision and the Rennboro Road Subdivision.

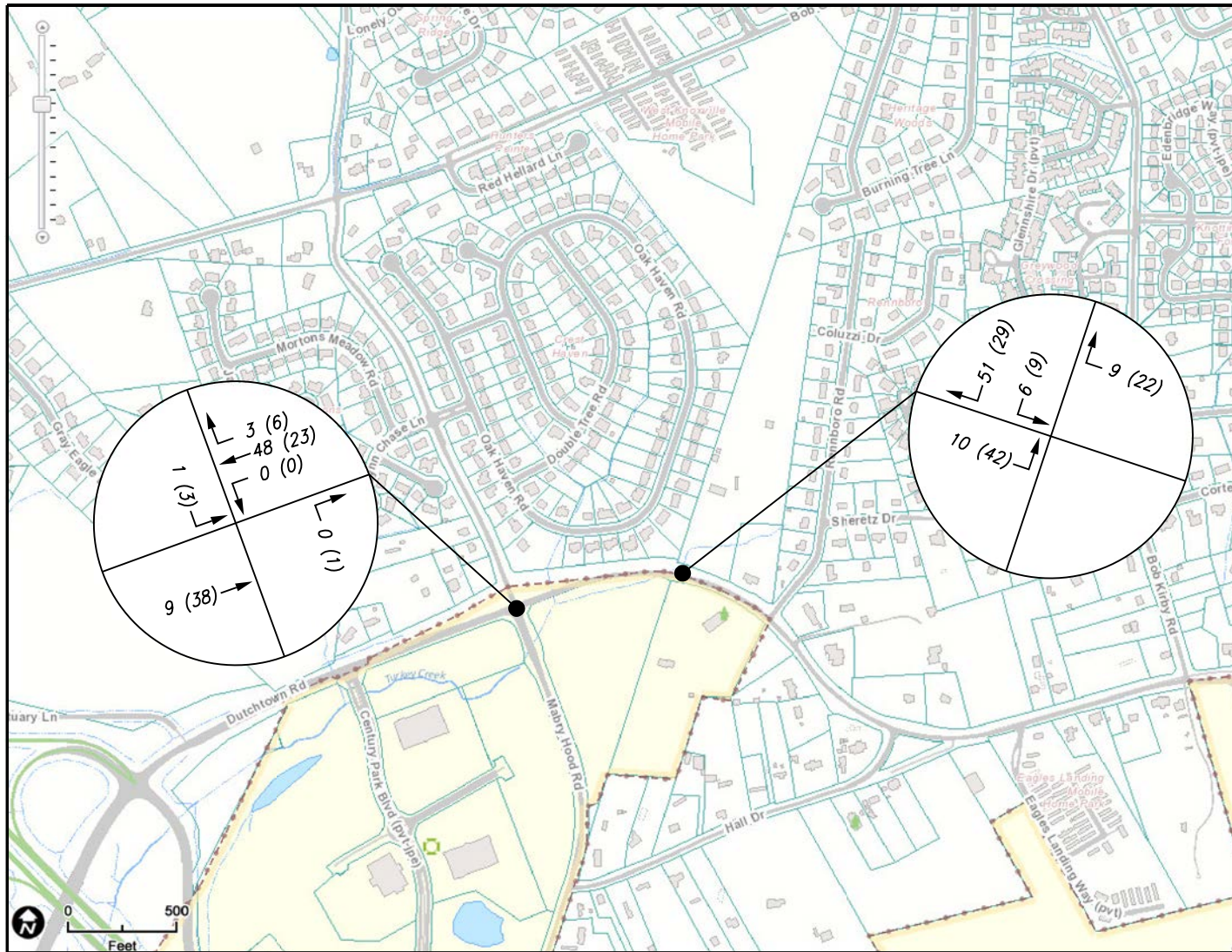
## **5 Projected Capacity and Level of Service**

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Unsignalized intersection capacity analyses were performed for the AM and PM peak hours to evaluate the traffic conditions at the intersections of Dutchtown Road and Mabry Hood Road, the intersection of Dutchtown Road and the proposed project entrance and the intersection of Dutchtown Road and Rennboro Road.

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 capacity analyses.





**LEGEND:**

← 5 (16)

TURNING MOVEMENT VOLUME AM (PM)

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Scale	N.T.S.				
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<b>FIGURE 7</b>		No.	Revision/Issue	Date	

**PEAK HOUR SUBDIVISION TRAFFIC**

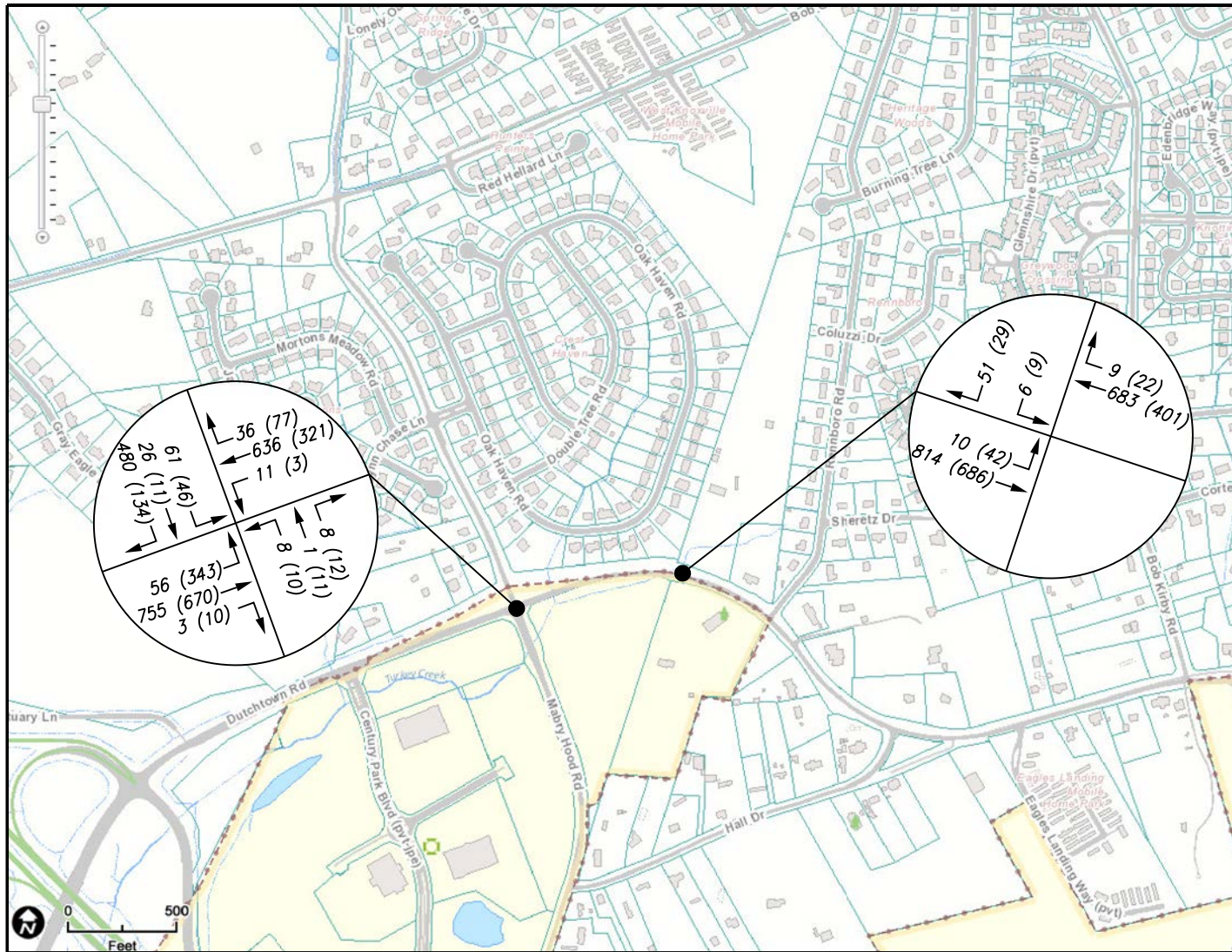
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**LEGEND:**

← 5 (16)

TURNING MOVEMENT VOLUME AM (PM)

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Scale	N.T.S.								
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<b>FIGURE 8</b>		No.		Revision/Issue		Date			

**2018 PEAK HOUR TRAFFIC  
FULL BUILDOUT**

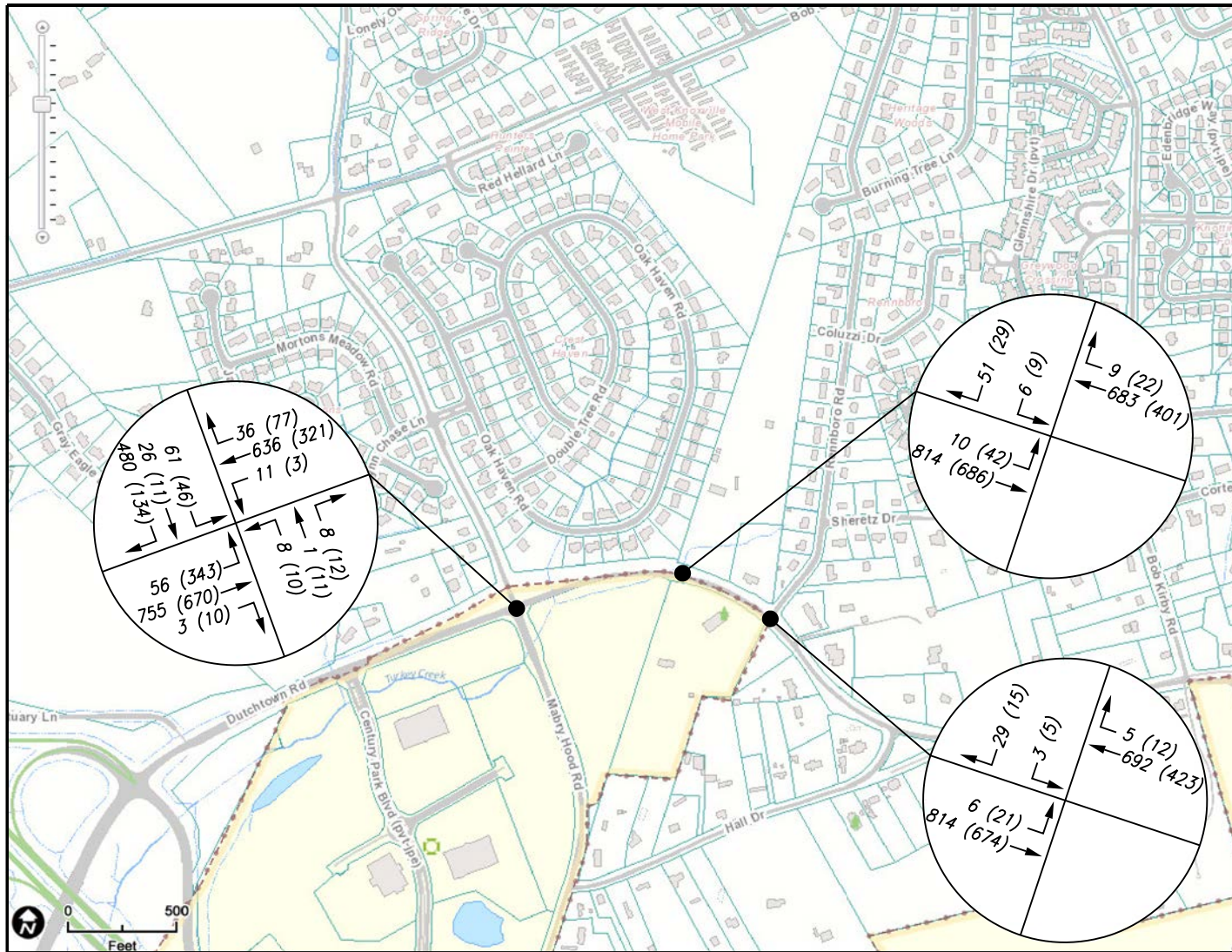
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**LEGEND:**

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TURNING MOVEMENT VOLUME AM (PM)

Project	330.010	Proj. Mgr.	Designed By	Drawn By	Reference
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<b>FIGURE 9</b>					
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**2018 PEAK HOUR TRAFFIC  
RENNBORO RD**

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**Table 5-1**

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

Delay (sec)/LOS		
<b>Dutchtown Road @ Mabry Hood Road (Existing 2015)</b>		
AM Peak	EB L	9.5 / A
	WB L	10.1 / B
	NB	96.2 / F
	SB	132.5 / F
PM Peak	EB L	9.5 / A
	WB L	8.8 / A
	NB	84.5 / F
	SB	189.6 / F
<b>Dutchtown Road @ Mabry Hood Road (Background Growth 2018)</b>		
AM Peak	EB L	9.8 / A
	WB L	10.6 / B
	NB	280.8 / F
	SB	251.9 / F
PM Peak	EB L	10.0 / A
	WB L	9.0 / A
	NB	148.7 / F
	SB	394.9 / F
<b>Dutchtown Road @ Mabry Hood Road (Background Growth + Full Buildout 2018)</b>		
AM Peak	EB L	10.2 / B
	WB L	10.7 / B
	NB	512.5 / F
	SB	327.9 / F
PM Peak	EB L	10.2 / B
	WB L	9.1 / A
	NB	186.9 / F
	SB	539.1 / F

<b>Dutchtown Road @ Project Entrance (Background Growth + Full Buildout 2018)</b>		
AM Peak	EB L SB LTR	9.4 / A 16.9 / C
PM Peak	EB L SB LTR	8.5 / A 13.6 / B
<b>Dutchtown Road @ Rennboro Road (Background Growth + Full Buildout 2018)</b>		
AM Peak	EB L SB LTR	9.4 / A 18.7 / C
PM Peak	EB L SB LTR	8.5 / A 15.4 / C

## **6 Turn Lane Warrant Analysis**

The intersection of Dutchtown Road and the Project Entrance was evaluated to determine if a westbound right turn lane or an eastbound left turn on Dutchtown Road 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 westbound right turn lane on Dutchtown Road is not warranted during the AM or PM peak hour. An eastbound left turn on Dutchtown Road is warranted during the PM peak hour. The turn lane warrant worksheets and analysis are included in Attachment 7.

## **7 Signal Warrant Analysis**

The intersection of Dutchtown Road and the proposed project entrance was evaluated to determine if signalization was warranted for the proposed traffic generated by the Dutchtown Road Subdivision. Warrants for traffic signals can be found in Chapter 4C of the *2003 Manual on Uniform Traffic Control Devices (MUTCD)*, published by the Federal Highway Administration (FHWA). There are three volume-based warrants that were evaluated.

- Warrant 1, Eight-Hour Vehicular Volume
- Warrant 2, Four-Hour Vehicular Volume

- Warrant 3, Peak Hour

Signal Warrants 1 eight-hr vehicular volume, 2 four-hr vehicular volume and 3 peak hour were not met after the full build out of the Dutchtown Road Subdivision. The signal warrant worksheet is included in Attachment 8.

## 8 Conclusions and Recommendations

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### 8.1 Dutchtown Road @ Mabry Hood Road

At the intersection of Dutchtown Road and Mabry Hood Road, all eastbound and westbound approaches currently operate at an acceptable LOS A or B during both the AM and PM peak hour. The eastbound and westbound approach will continue to operate at a LOS B or higher after the completion of the Dutchtown Road Subdivision.

At the intersection of Dutchtown Road and Mabry Hood Road, all northbound and southbound approaches currently operate at a LOS F during both the AM and PM peak hour. The northbound and southbound approach will continue to operate at a LOS F after the completion of the Dutchtown Road Subdivision.

FMA recommends that the crash data at this intersection be monitored.

### 8.2 Dutchtown Road @ Project Entrance

Dutchtown Road is classified as a minor arterial. The minimum intersection spacing required for an arterial is 400 feet per the "Minimum Subdivision Regulations" for Knoxville and Knox County. The nearest road intersection to the project entrance is currently 385 feet east at the intersection of Dutchtown Road and Rennboro Road. This intersection does not meet the recommended minimum separation of 400 feet between roads on an arterial.

An eastbound left turn lane is warranted at the intersection of Dutchtown Road and the proposed project entrance. The Unsignalized intersection capacity analyses shows a 95% queue length for the eastbound left turning movement of less than one car length during both the AM and PM peak hour; therefore, the existing two-way left turn lane has adequate storage. FMA recommends the two way left turn lane be restriped to include a break at the intersection of Dutchtown Road and the project entrance.

A westbound right turn lane is not warranted at the intersection of Dutchtown Road and the proposed project entrance.

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 proposed intersection of Dutchtown Road and the project entrance has a measured sight distance that exceeds 400-ft east and west 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.

The southbound approach of the proposed intersection of Dutchtown Road and the project entrance is expected to operate at a LOS C during the AM peak hour and a LOS B during PM peak hour after the completion of the Dutchtown Road Subdivision. The Unsignalized intersection capacity analyses shows a 95% queue length for the southbound approach of less than one car length during both the AM and PM peak hours; therefore, the proposed geometry of one 13-ft lane exiting the subdivision will be adequate.

A signal is not warranted after the full build out of the Dutchtown Road Subdivision.

### **8.3 Dutchtown Road @ Rennboro Road**

The intersection of Dutchtown Road and Rennboro Road is expected to operate at a LOS C or better during both the AM and PM peak hours after the full build out of the Dutchtown Road Subdivision. The Unsignalized intersection capacity analyses shows a 95% queue length for the eastbound left turn lane of less than one car length during both the AM and PM peak hours; therefore, the existing left turn lane with a 150-ft storage length entering Rennboro Road will be adequate and will not interfere with the Dutchtown Road Subdivision.

**Attachment 1**  
**Traffic Counts**

Project: Dutchtown Road Subdivision  
Date Conducted: 8/25/2015

Start	Dutchtown Road Eastbound				Dutchtown Road Westbound				Mabry Hood Road Northbound				Mabry Hood Road Southbound				Int. Total
	Left	Thru	Right	Total	Left	Thru	Right	Total	Left	Thru	Right	Total	Left	Thru	Right	Total	
7:00 AM	6	52	2	60	0	50	2	52	1	0	1	2	4	2	72	78	192
7:15 AM	7	110	0	117	2	96	5	103	1	0	0	1	17	5	84	106	327
7:30 AM	9	211	2	222	2	116	7	125	3	0	1	4	18	4	123	145	496
7:45 AM	15	241	0	256	5	172	7	184	1	0	6	7	13	6	122	141	588
Total	37	614	4	655	9	434	21	464	6	0	8	14	52	17	401	470	1603
8:00 AM	20	121	1	142	1	154	11	166	2	1	0	3	7	9	110	126	437
8:15 AM	18	101	3	122	2	97	6	105	1	0	1	2	4	7	78	89	318
8:30 AM	14	68	1	83	2	70	5	77	0	0	0	0	4	4	67	75	235
8:45 AM	11	40	0	51	0	84	6	90	2	0	0	2	1	4	45	50	193
Total	63	330	5	398	5	405	28	438	5	1	1	7	16	24	300	340	1183
11:00 AM	13	40	0	53	1	32	3	36	2	2	0	4	1	2	8	11	104
11:15 AM	21	39	0	60	0	26	5	31	0	1	0	1	1	2	20	23	115
11:30 AM	28	56	0	84	1	45	4	50	0	1	1	2	2	5	21	28	164
11:45 AM	21	51	2	74	2	49	6	57	3	3	2	8	1	0	28	29	168
Total	83	186	2	271	4	152	18	174	5	7	3	15	5	9	77	91	551
12:00 PM	32	61	1	94	2	42	6	50	0	0	1	1	4	3	13	20	165
12:15 PM	26	51	1	78	0	39	3	42	1	3	1	5	0	2	31	33	158
12:30 PM	20	45	0	65	0	54	9	63	1	2	3	6	1	3	30	34	168
12:45 PM	13	50	1	64	2	46	7	55	0	0	1	1	3	4	38	45	165
Total	91	207	3	301	4	181	25	210	2	5	6	13	8	12	112	132	656
2:00 PM	19	56	4	79	0	45	4	49	1	1	1	3	5	6	26	37	168
2:15 PM	19	66	2	87	0	45	2	47	3	1	0	4	6	0	24	30	168
2:30 PM	23	90	1	114	0	37	7	44	0	1	1	2	2	4	30	36	196
2:45 PM	24	111	1	136	2	51	10	63	0	0	3	3	4	3	21	28	230
Total	85	323	8	416	2	178	23	203	4	3	5	12	17	13	101	131	762
3:00 PM	30	124	1	155	4	38	10	52	1	0	1	2	4	1	24	29	238
3:15 PM	19	98	2	119	0	116	13	129	3	0	1	4	2	5	22	29	281
3:30 PM	35	83	1	119	1	205	13	219	1	3	3	7	4	0	19	23	368
3:45 PM	35	68	4	107	1	105	12	118	2	2	2	6	9	4	26	39	270
Total	119	373	8	500	6	464	48	518	7	5	7	19	19	10	91	120	1157
4:00 PM	42	71	1	114	1	62	7	70	1	2	2	5	5	7	20	32	221
4:15 PM	36	73	1	110	4	43	12	59	2	6	2	10	7	4	20	31	210
4:30 PM	56	95	4	155	1	59	8	68	0	0	4	4	9	2	32	43	270
4:45 PM	56	108	0	164	0	60	10	70	0	2	1	3	7	1	28	36	273
Total	190	347	6	543	6	224	37	267	3	10	9	22	28	14	100	142	974
5:00 PM	90	151	5	246	1	67	20	88	2	3	4	9	7	5	30	42	385
5:15 PM	83	139	0	222	0	84	16	100	2	1	0	3	15	1	31	47	372
5:30 PM	74	136	2	212	2	77	20	99	2	3	4	9	7	2	35	44	364
5:45 PM	67	152	2	221	0	45	9	54	3	3	2	8	10	2	27	39	322
Total	314	578	9	901	3	273	65	341	9	10	10	29	39	10	123	172	1443
Grand Total	982	2958	45	3985	39	2311	265	2615	41	41	49	131	184	109	1305	1598	8329
Approach %	24.6	74.2	1.1		1.5	88.4	10.1		31.3	31.3	37.4		11.5	6.8	81.7		
Total %	11.8	35.5	0.5	47.8	0.5	27.7	3.2	31.4	0.5	0.5	0.6	1.6	2.2	1.3	15.7	19.2	



**Project: Dutchtown Road Subdivision**

**Date Conducted: 8/25/2015**

AM Peak Hour	7:15-8:15	1848
Lunch Peak Hour	11:45-12:45	659
PM Peak Hour	5:00-6:00	1443

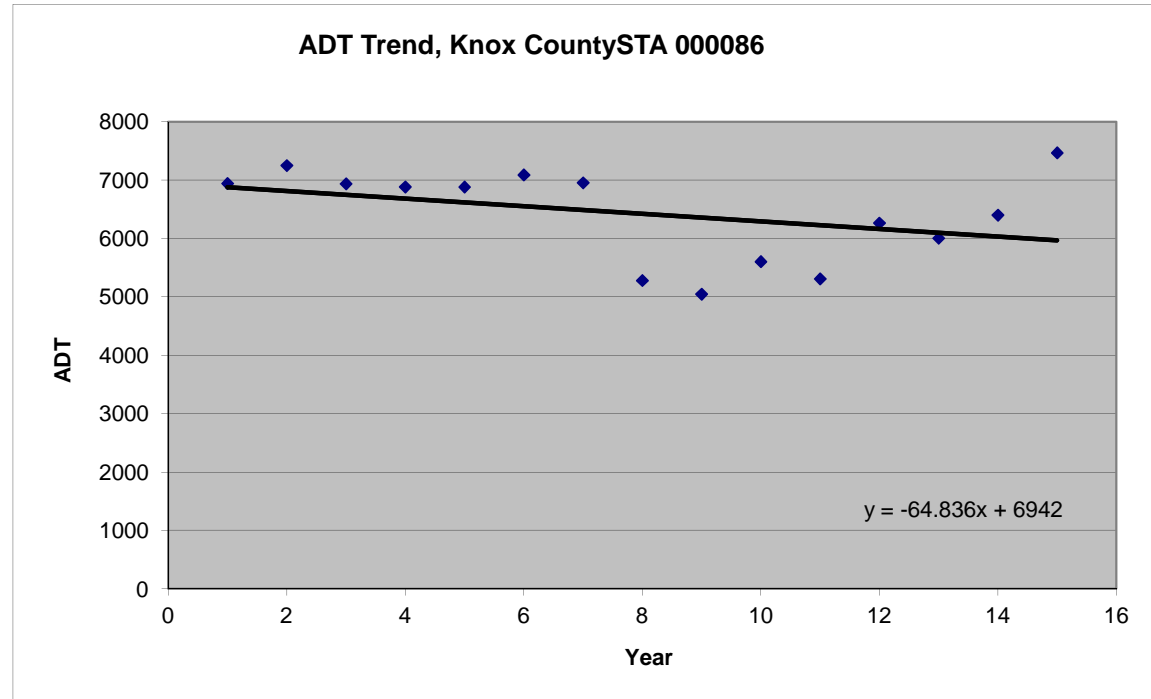
Start	Dutchtown Road Eastbound				Dutchtown Road Westbound				Mabry Hood Road Northbound				Mabry Hood Road Southbound				Int. Total
	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	
Peak Hour Analysis from 7:00 AM to 9:00 AM																	
AM Peak Hour begins at 7:15 AM																	
7:15 AM	7	110	0	117	2	96	5	103	1	0	0	1	17	5	84	106	327
7:30 AM	9	211	2	222	2	116	7	125	3	0	1	4	18	4	123	145	496
7:45 AM	15	241	0	256	5	172	7	184	1	0	6	7	13	6	122	141	588
8:00 AM	20	121	1	142	1	154	11	166	2	1	0	3	7	9	110	126	437
Total Volume	51	683	3	737	10	538	30	578	7	1	7	15	55	24	439	518	1848
Future (3% over 3 yrs)	56	746	3		11	588	33		8	1	8		60	26	480		2019
PHF	0.64	0.71	0.38		0.50	0.78	0.68		0.58	0.25	0.29		0.76	0.67	0.89		0.79
Peak Hour Analysis from 11:00 AM to 1:00 PM																	
Lunch Peak Hour begins at 11:45 AM																	
11:45 AM	21	51	2	74	2	49	6	57	3	3	2	8	1	0	28	29	168
12:00 PM	32	61	1	94	2	42	6	50	0	0	1	1	4	3	13	20	165
12:15 PM	26	51	1	78	0	39	3	42	1	3	1	5	0	2	31	33	158
12:30 PM	20	45	0	65	0	54	9	63	1	2	3	6	1	3	30	34	168
Total Volume	99	208	4	311	4	184	24	212	5	8	7	20	6	8	102	116	659
Future (3% over 3 yrs)	108	227	4		4	201	26		5	9	8		7	9	111		720
PHF	0.77	0.85	0.50		0.50	0.85	0.67		0.42	0.67	0.58		0.38	0.67	0.82		0.98
Peak Hour Analysis from 2:00 PM to 6:00 PM																	
PM Peak Hour begins at 5:00 PM																	
5:00 PM	90	151	5	246	1	67	20	88	2	3	4	9	7	5	30	42	385
5:15 PM	83	139	0	222	0	84	16	100	2	1	0	3	15	1	31	47	372
5:30 PM	74	136	2	212	2	77	20	99	2	3	4	9	7	2	35	44	364
5:45 PM	67	152	2	221	0	45	9	54	3	3	2	8	10	2	27	39	322
Total Volume	314	578	9	901	3	273	65	341	9	10	10	29	39	10	123	172	1443
Future (3% over 3 yrs)	343	632	10		3	298	71		10	11	11		43	11	134		1577
PHF	0.87	0.95	0.45		0.38	0.81	0.81		0.75	0.83	0.63		0.65	0.50	0.88		0.94

**Attachment 2**  
**ADT Trends**

**Attachment 2  
ADT Trends**

	Year	Adjusted Average Daily Traffic
1	2000	6944
2	2001	7253
3	2002	6939
4	2003	6886
5	2004	6884
6	2005	7091
7	2006	6957
8	2007	5282
9	2008	5049
10	2009	5606
11	2010	5311
12	2011	6268
13	2012	6007
14	2013	6403
15	2014	7469

Station # 427 County Knox Location Dutchtown Rd Route # SR 04832 Route Name Dutchtown Rd



**Most Recent Trend Line Growth**

Year	ADT
2000	6944
2014	7469

**Annual Percent Growth 0.50%**

### Annual Average Daily Traffic County Summary

Count Year	Count Station M56 Dutchtown Rd 200' W of Mabry Hood Rd	Count Station M271 Mabry Hood Rd S of Dutchtown Rd
2010	10090	0
2011	10280	450
2012	10290	0
2013	12640	550

Growth Rate

6.32%

7.41%

**Attachment 3  
Trip Generation**

# Single-Family Detached Housing (210)

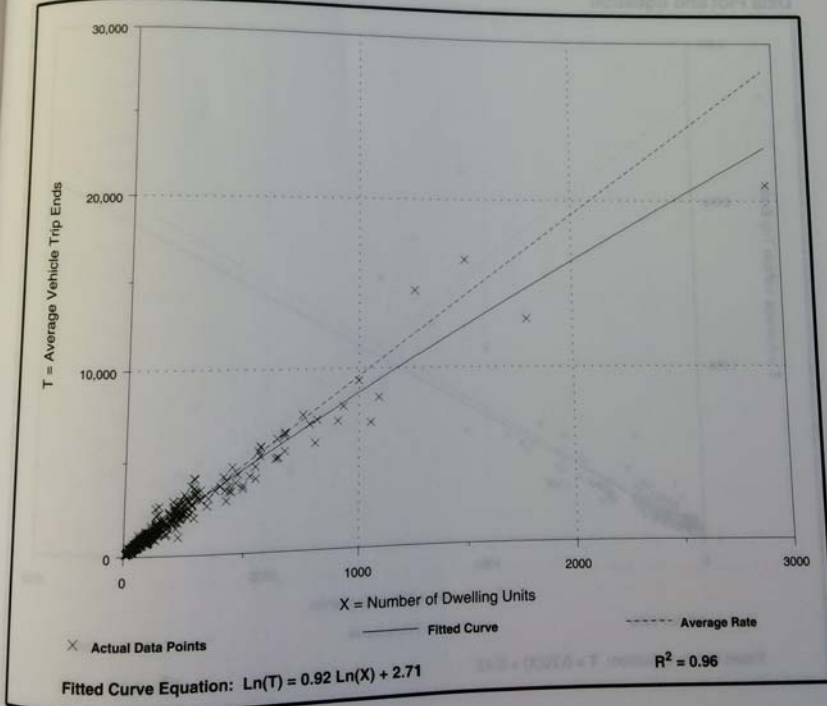
Average Vehicle Trip Ends vs: Dwelling Units  
On a: Weekday

Number of Studies: 350  
Avg. Number of Dwelling Units: 197  
Directional Distribution: 50% entering, 50% exiting

## Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
9.57	4.31 - 21.85	3.69

## Data Plot and Equation



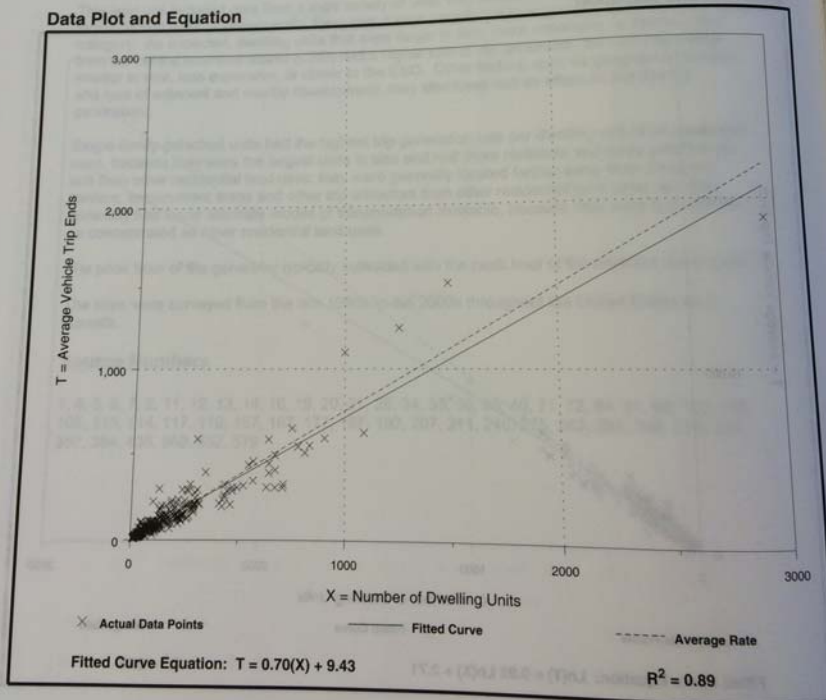
## Single-Family Detached Housing (210)

Average Vehicle Trip Ends vs: Dwelling Units  
 On a: Weekday,  
 Peak Hour of Adjacent Street Traffic,  
 One Hour Between 7 and 9 a.m.

Number of Studies: 274  
 Avg. Number of Dwelling Units: 201  
 Directional Distribution: 25% entering, 75% exiting

Trip Generation per Dwelling Unit			Standard Deviation
Average Rate	Range of Rates		0.90
0.75	0.33 - 2.27		

**Data Plot and Equation**



# Single-Family Detached Housing (210)

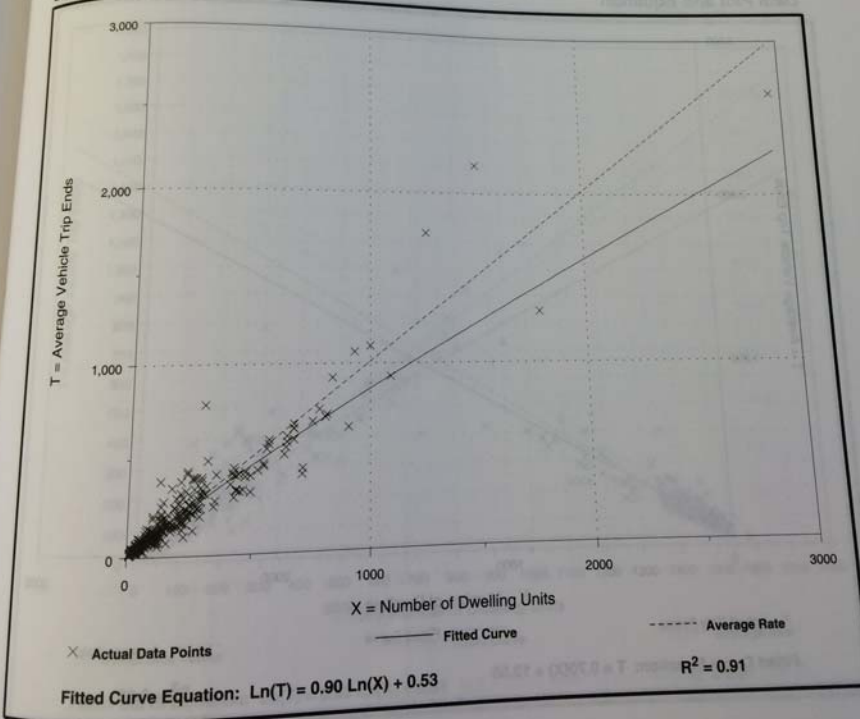
Average Vehicle Trip Ends vs: Dwelling Units  
 On a: Weekday,  
 Peak Hour of Adjacent Street Traffic,  
 One Hour Between 4 and 6 p.m.

Number of Studies: 302  
 Avg. Number of Dwelling Units: 214  
 Directional Distribution: 63% entering, 37% exiting

## Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
1.01	0.42 - 2.98	1.05

## Data Plot and Equation





**Attachment 4**  
**Intersection Worksheet**  
**Existing AM/PM Peaks**

TWO-WAY STOP CONTROL SUMMARY								
General Information				Site Information				
Analyst	Addie Kirkham			Intersection	Dutchtown @ Mabry Hood			
Agency/Co.	FMA			Jurisdiction	Knox County			
Date Performed	8/27/2015			Analysis Year	2015			
Analysis Time Period	AM Peak							
Project Description 330.010 Dutchtown Road Subdivision								
East/West Street: Dutchtown Road				North/South Street: Mabry Hood Road				
Intersection Orientation: East-West				Study Period (hrs): 0.25				
Vehicle Volumes and Adjustments								
Major Street	Eastbound			Westbound				
Movement	1	2	3	4	5	6		
	L	T	R	L	T	R		
Volume (veh/h)	51	683	3	10	538	30		
Peak-Hour Factor, PHF	0.64	0.71	0.38	0.50	0.78	0.68		
Hourly Flow Rate, HFR (veh/h)	79	961	7	20	689	44		
Percent Heavy Vehicles	0	--	--	0	--	--		
Median Type	Undivided							
RT Channelized			0			0		
Lanes	1	2	0	1	1	0		
Configuration	L	T	TR	L		TR		
Upstream Signal		0			0			
Minor Street	Northbound			Southbound				
Movement	7	8	9	10	11	12		
	L	T	R	L	T	R		
Volume (veh/h)	7	1	7	55	24			
Peak-Hour Factor, PHF	0.58	0.25	0.29	0.76	0.67	0.89		
Hourly Flow Rate, HFR (veh/h)	12	4	24	72	35	0		
Percent Heavy Vehicles	0	0	0	0	0	0		
Percent Grade (%)	0			0				
Flared Approach		N			N			
Storage		0			0			
RT Channelized			0			1		
Lanes	1	1	0	1	1	0		
Configuration	L		TR	L	T			
Delay, Queue Length, and Level of Service								
Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L	L	L		TR	L	T	
v (veh/h)	79	20	12		28	72	35	
C (m) (veh/h)	881	720	23		266	86	64	
v/c	0.09	0.03	0.52		0.11	0.84	0.55	
95% queue length	0.29	0.09	1.54		0.35	4.39	2.24	
Control Delay (s/veh)	9.5	10.1	273.7		20.1	141.0	115.0	
LOS	A	B	F		C	F	F	
Approach Delay (s/veh)	--	--	96.2			132.5		
Approach LOS	--	--	F			F		

TWO-WAY STOP CONTROL SUMMARY								
General Information				Site Information				
Analyst	Addie Kirkham			Intersection	Dutchtown @ Mabry Hood			
Agency/Co.	FMA			Jurisdiction	Knox County			
Date Performed	8/27/2015			Analysis Year	2015			
Analysis Time Period	Existing PM Peak							
Project Description 330.010 Dutchtown Road Subdivision								
East/West Street: Dutchtown Road				North/South Street: Mabry Hood Road				
Intersection Orientation: East-West				Study Period (hrs): 0.25				
Vehicle Volumes and Adjustments								
Major Street	Eastbound			Westbound				
Movement	1	2	3	4	5	6		
	L	T	R	L	T	R		
Volume (veh/h)	314	578	9	3	273	65		
Peak-Hour Factor, PHF	0.87	0.95	0.45	0.38	0.81	0.81		
Hourly Flow Rate, HFR (veh/h)	360	608	20	7	337	80		
Percent Heavy Vehicles	0	--	--	0	--	--		
Median Type	Undivided							
RT Channelized			0			0		
Lanes	1	2	0	1	1	0		
Configuration	L	T	TR	L		TR		
Upstream Signal		0			0			
Minor Street	Northbound			Southbound				
Movement	7	8	9	10	11	12		
	L	T	R	L	T	R		
Volume (veh/h)	9	10	10	39	10			
Peak-Hour Factor, PHF	0.75	0.83	0.63	0.65	0.50	0.88		
Hourly Flow Rate, HFR (veh/h)	12	12	15	60	20	0		
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	1	1	0	1	1	0		
Configuration	L		TR	L	T			
Delay, Queue Length, and Level of Service								
Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L	L	L		TR	L	T	
v (veh/h)	360	7	12		27	60	20	
C (m) (veh/h)	1153	964	32		117	61	60	
v/c	0.31	0.01	0.38		0.23	0.98	0.33	
95% queue length	1.34	0.02	1.21		0.84	4.68	1.21	
Control Delay (s/veh)	9.5	8.8	173.8		44.8	222.0	92.5	
LOS	A	A	F		E	F	F	
Approach Delay (s/veh)	--	--	84.5			189.6		
Approach LOS	--	--	F			F		

**Attachment 5**  
**Intersection Worksheet**  
**Background AM/PM Peaks**

TWO-WAY STOP CONTROL SUMMARY								
General Information				Site Information				
Analyst	Addie Kirkham			Intersection	Dutchtown @ Mabry Hood			
Agency/Co.	FMA			Jurisdiction	Knox County			
Date Performed	8/27/2015			Analysis Year	2018			
Analysis Time Period	Background AM Peak							
Project Description 330.010 Dutchtown Road Subdivision								
East/West Street: Dutchtown Road				North/South Street: Mabry Hood Road				
Intersection Orientation: East-West				Study Period (hrs): 0.25				
Vehicle Volumes and Adjustments								
Major Street	Eastbound			Westbound				
Movement	1	2	3	4	5	6		
	L	T	R	L	T	R		
Volume (veh/h)	56	746	3	11	588	33		
Peak-Hour Factor, PHF	0.64	0.71	0.38	0.50	0.78	0.68		
Hourly Flow Rate, HFR (veh/h)	87	1050	7	22	753	48		
Percent Heavy Vehicles	0	--	--	0	--	--		
Median Type	Undivided							
RT Channelized			0			0		
Lanes	1	2	0	1	1	0		
Configuration	L	T	TR	L		TR		
Upstream Signal		0			0			
Minor Street	Northbound			Southbound				
Movement	7	8	9	10	11	12		
	L	T	R	L	T	R		
Volume (veh/h)	8	1	8	60	26			
Peak-Hour Factor, PHF	0.58	0.25	0.29	0.76	0.67	0.89		
Hourly Flow Rate, HFR (veh/h)	13	4	27	78	38	0		
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	1	1	0	1	1	0		
Configuration	L		TR	L	T			
Delay, Queue Length, and Level of Service								
Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L	L	L		TR	L	T	
v (veh/h)	87	22	13		31	78	38	
C (m) (veh/h)	831	667	10		235	66	48	
v/c	0.10	0.03	1.30		0.13	1.18	0.79	
95% queue length	0.35	0.10	2.40		0.45	6.21	3.20	
Control Delay (s/veh)	9.8	10.6	896.3		22.6	275.6	203.2	
LOS	A	B	F		C	F	F	
Approach Delay (s/veh)	--	--	280.8			251.9		
Approach LOS	--	--	F			F		

TWO-WAY STOP CONTROL SUMMARY								
General Information				Site Information				
Analyst	Addie Kirkham			Intersection	Dutchtown @ Mabry Hood			
Agency/Co.	FMA			Jurisdiction	Knox County			
Date Performed	8/27/2015			Analysis Year	2018			
Analysis Time Period	Background PM Peak							
Project Description 330.010 Dutchtown Road Subdivision								
East/West Street: Dutchtown Road				North/South Street: Mabry Hood Road				
Intersection Orientation: East-West				Study Period (hrs): 0.25				
Vehicle Volumes and Adjustments								
Major Street	Eastbound			Westbound				
Movement	1	2	3	4	5	6		
	L	T	R	L	T	R		
Volume (veh/h)	343	632	10	3	298	71		
Peak-Hour Factor, PHF	0.87	0.95	0.45	0.38	0.81	0.81		
Hourly Flow Rate, HFR (veh/h)	394	665	22	7	367	87		
Percent Heavy Vehicles	0	--	--	0	--	--		
Median Type	Undivided							
RT Channelized			0			0		
Lanes	1	2	0	1	1	0		
Configuration	L	T	TR	L		TR		
Upstream Signal		0			0			
Minor Street	Northbound			Southbound				
Movement	7	8	9	10	11	12		
	L	T	R	L	T	R		
Volume (veh/h)	10	11	11	43	11			
Peak-Hour Factor, PHF	0.75	0.83	0.63	0.65	0.50	0.88		
Hourly Flow Rate, HFR (veh/h)	13	13	17	66	22	0		
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	1	1	0	1	1	0		
Configuration	L		TR	L	T			
Delay, Queue Length, and Level of Service								
Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L	L	L		TR	L	T	
v (veh/h)	394	7	13		30	66	22	
C (m) (veh/h)	1117	916	20		92	43	45	
v/c	0.35	0.01	0.65		0.33	1.53	0.49	
95% queue length	1.61	0.02	1.81		1.25	6.62	1.77	
Control Delay (s/veh)	10.0	9.0	348.8		62.0	478.0	145.6	
LOS	A	A	F		F	F	F	
Approach Delay (s/veh)	--	--	148.7			394.9		
Approach LOS	--	--	F			F		

**Attachment 6**  
**Intersection Worksheet**  
**Background AM/PM Peaks + Development**

TWO-WAY STOP CONTROL SUMMARY								
General Information				Site Information				
Analyst	Addie Kirkham			Intersection	Dutchtown @ Mabry Hood			
Agency/Co.	FMA			Jurisdiction	Knox County			
Date Performed	8/27/2015			Analysis Year	2018			
Analysis Time Period	Full Buildout AM Peak							
Project Description 330.010 Dutchtown Road Subdivision								
East/West Street: Dutchtown Road				North/South Street: Mabry Hood Road				
Intersection Orientation: East-West				Study Period (hrs): 0.25				
Vehicle Volumes and Adjustments								
Major Street	Eastbound			Westbound				
Movement	1	2	3	4	5	6		
	L	T	R	L	T	R		
Volume (veh/h)	56	755	3	11	636	36		
Peak-Hour Factor, PHF	0.64	0.71	0.38	0.50	0.78	0.68		
Hourly Flow Rate, HFR (veh/h)	87	1063	7	22	815	52		
Percent Heavy Vehicles	0	--	--	0	--	--		
Median Type	Undivided							
RT Channelized			0			0		
Lanes	1	2	0	1	1	0		
Configuration	L	T	TR	L		TR		
Upstream Signal		0			0			
Minor Street	Northbound			Southbound				
Movement	7	8	9	10	11	12		
	L	T	R	L	T	R		
Volume (veh/h)	8	1	8	61	26			
Peak-Hour Factor, PHF	0.58	0.25	0.29	0.76	0.67	0.89		
Hourly Flow Rate, HFR (veh/h)	13	4	27	80	38	0		
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	1	1	0	1	1	0		
Configuration	L		TR	L	T			
Delay, Queue Length, and Level of Service								
Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L	L	L		TR	L	T	
v (veh/h)	87	22	13		31	80	38	
C (m) (veh/h)	785	659	6		215	58	43	
v/c	0.11	0.03	2.17		0.14	1.38	0.88	
95% queue length	0.37	0.10	2.69		0.49	7.02	3.48	
Control Delay (s/veh)	10.2	10.7	1676		24.5	366.4	246.9	
LOS	B	B	F		C	F	F	
Approach Delay (s/veh)	--	--	512.5			327.9		
Approach LOS	--	--	F			F		



TWO-WAY STOP CONTROL SUMMARY								
General Information				Site Information				
Analyst	Addie Kirkham			Intersection	Dutchtown @ Mabry Hood			
Agency/Co.	FMA			Jurisdiction	Knox County			
Date Performed	8/27/2015			Analysis Year	2018			
Analysis Time Period	Full Buildout PM Peak							
Project Description 330.010 Dutchtown Road Subdivision								
East/West Street: Dutchtown Road				North/South Street: Mabry Hood Road				
Intersection Orientation: East-West				Study Period (hrs): 0.25				
Vehicle Volumes and Adjustments								
Major Street	Eastbound			Westbound				
Movement	1	2	3	4	5	6		
	L	T	R	L	T	R		
Volume (veh/h)	343	670	10	3	321	77		
Peak-Hour Factor, PHF	0.87	0.95	0.45	0.38	0.81	0.81		
Hourly Flow Rate, HFR (veh/h)	394	705	22	7	396	95		
Percent Heavy Vehicles	0	--	--	0	--	--		
Median Type	Undivided							
RT Channelized			0			0		
Lanes	1	2	0	1	1	0		
Configuration	L	T	TR	L		TR		
Upstream Signal		0			0			
Minor Street	Northbound			Southbound				
Movement	7	8	9	10	11	12		
	L	T	R	L	T	R		
Volume (veh/h)	10	11	12	46	11			
Peak-Hour Factor, PHF	0.75	0.83	0.63	0.65	0.50	0.88		
Hourly Flow Rate, HFR (veh/h)	13	13	19	70	22	0		
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	1	1	0	1	1	0		
Configuration	L		TR	L	T			
Delay, Queue Length, and Level of Service								
Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L	L	L		TR	L	T	
v (veh/h)	394	7	13		32	70	22	
C (m) (veh/h)	1083	886	16		87	37	40	
v/c	0.36	0.01	0.81		0.37	1.89	0.55	
95% queue length	1.68	0.02	2.03		1.44	7.59	1.96	
Control Delay (s/veh)	10.2	9.1	477.7		68.7	653.8	174.1	
LOS	B	A	F		F	F	F	
Approach Delay (s/veh)	--	--	186.9			539.1		
Approach LOS	--	--	F			F		

TWO-WAY STOP CONTROL SUMMARY								
<b>General Information</b>				<b>Site Information</b>				
Analyst	Addie Kirkham			Intersection	Dutchtown @ Project Entrance			
Agency/Co.	FMA			Jurisdiction	Knox County			
Date Performed	8/27/2015			Analysis Year	2018			
Analysis Time Period	AM Peak							
Project Description 330.010 Dutchtown Road Subdivision								
East/West Street: Dutchtown Road				North/South Street: Project Entrance				
Intersection Orientation: East-West				Study Period (hrs): 0.25				
<b>Vehicle Volumes and Adjustments</b>								
<b>Major Street</b>	Eastbound			Westbound				
Movement	1	2	3	4	5	6		
	L	T	R	L	T	R		
Volume (veh/h)	10	814			683	9		
Peak-Hour Factor, PHF	0.85	0.85	1.00	1.00	0.85	0.85		
Hourly Flow Rate, HFR (veh/h)	11	957	0	0	803	10		
Percent Heavy Vehicles	0	--	--	0	--	--		
Median Type	Two Way Left Turn Lane							
RT Channelized			0				0	
Lanes	1	1	0	0	1		0	
Configuration	L	T					TR	
Upstream Signal		0			0			
<b>Minor Street</b>	Northbound			Southbound				
Movement	7	8	9	10	11	12		
	L	T	R	L	T	R		
Volume (veh/h)				6		51		
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.85	1.00	0.85		
Hourly Flow Rate, HFR (veh/h)	0	0	0	7	0	59		
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			
<b>Delay, Queue Length, and Level of Service</b>								
Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L						LR	
v (veh/h)	11						66	
C (m) (veh/h)	823						369	
v/c	0.01						0.18	
95% queue length	0.04						0.64	
Control Delay (s/veh)	9.4						16.9	
LOS	A						C	
Approach Delay (s/veh)	--	--					16.9	
Approach LOS	--	--					C	

TWO-WAY STOP CONTROL SUMMARY							
General Information				Site Information			
Analyst	Addie Kirkham			Intersection	Dutchtown @ Project Entrance		
Agency/Co.	FMA			Jurisdiction	Knox County		
Date Performed	8/27/2015			Analysis Year	2018		
Analysis Time Period	PM Peak						
Project Description 330.010 Dutchtown Road Subdivision							
East/West Street: Dutchtown Road				North/South Street: Project Entrance			
Intersection Orientation: East-West				Study Period (hrs): 0.25			
Vehicle Volumes and Adjustments							
Major Street	Eastbound			Westbound			
Movement	1	2	3	4	5	6	
	L	T	R	L	T	R	
Volume (veh/h)	42	868			401	22	
Peak-Hour Factor, PHF	0.85	0.85	1.00	1.00	0.85	0.85	
Hourly Flow Rate, HFR (veh/h)	49	1021	0	0	471	25	
Percent Heavy Vehicles	0	--	--	0	--	--	
Median Type	Two Way Left Turn Lane						
RT Channelized			0				0
Lanes	1	1	0	0	1		0
Configuration	L	T					TR
Upstream Signal		0			0		
Minor Street	Northbound			Southbound			
Movement	7	8	9	10	11	12	
	L	T	R	L	T	R	
Volume (veh/h)				9		29	
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.85	1.00	0.85	
Hourly Flow Rate, HFR (veh/h)	0	0	0	10	0	34	
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	Eastbound	Westbound	Northbound			Southbound	
Movement	1	4	7	8	9	10	11
Lane Configuration	L						LR
v (veh/h)	49						44
C (m) (veh/h)	1078						463
v/c	0.05						0.10
95% queue length	0.14						0.31
Control Delay (s/veh)	8.5						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	Dutchtown @ Rennboro			
Agency/Co.	FMA			Jurisdiction	Knox County			
Date Performed	8/30/2015			Analysis Year	2018			
Analysis Time Period	AM Peak							
Project Description 330.010 - Dutchtown Road Subdivision								
East/West Street: Dutchtown Road				North/South Street: Rennboro Road				
Intersection Orientation: East-West				Study Period (hrs): 0.25				
Vehicle Volumes and Adjustments								
Major Street	Eastbound			Westbound				
Movement	1	2	3	4	5	6		
	L	T	R	L	T	R		
Volume (veh/h)	6	814			692	5		
Peak-Hour Factor, PHF	0.85	0.85	1.00	1.00	0.85	0.85		
Hourly Flow Rate, HFR (veh/h)	7	957	0	0	814	5		
Percent Heavy Vehicles	0	--	--	0	--	--		
Median Type	Undivided							
RT Channelized			0			0		
Lanes	1	1	0	0	1	0		
Configuration	L	T				TR		
Upstream Signal		0			0			
Minor Street	Northbound			Southbound				
Movement	7	8	9	10	11	12		
	L	T	R	L	T	R		
Volume (veh/h)				3		29		
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.85	1.00	0.85		
Hourly Flow Rate, HFR (veh/h)	0	0	0	3	0	34		
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	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L						LR	
v (veh/h)	7						37	
C (m) (veh/h)	818						300	
v/c	0.01						0.12	
95% queue length	0.03						0.42	
Control Delay (s/veh)	9.4						18.7	
LOS	A						C	
Approach Delay (s/veh)	--	--					18.7	
Approach LOS	--	--					C	

TWO-WAY STOP CONTROL SUMMARY							
General Information				Site Information			
Analyst	Addie Kirkham			Intersection	Dutchtown @ Rennboro		
Agency/Co.	FMA			Jurisdiction	Knox County		
Date Performed	8/30/2015			Analysis Year	2018		
Analysis Time Period	PM Peak						
Project Description 330.010 - Dutchtown Road Subdivision							
East/West Street: Dutchtown Road				North/South Street: Rennboro Road			
Intersection Orientation: East-West				Study Period (hrs): 0.25			
Vehicle Volumes and Adjustments							
Major Street	Eastbound			Westbound			
Movement	1	2	3	4	5	6	
	L	T	R	L	T	R	
Volume (veh/h)	21	674			423	12	
Peak-Hour Factor, PHF	0.85	0.85	1.00	1.00	0.85	0.85	
Hourly Flow Rate, HFR (veh/h)	24	792	0	0	497	14	
Percent Heavy Vehicles	0	--	--	0	--	--	
Median Type	Undivided						
RT Channelized			0			0	
Lanes	1	1	0	0	1	0	
Configuration	L	T				TR	
Upstream Signal		0			0		
Minor Street	Northbound			Southbound			
Movement	7	8	9	10	11	12	
	L	T	R	L	T	R	
Volume (veh/h)				5		15	
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.85	1.00	0.85	
Hourly Flow Rate, HFR (veh/h)	0	0	0	5	0	17	
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	Eastbound	Westbound	Northbound			Southbound	
Movement	1	4	7	8	9	10	11
Lane Configuration	L						LR
v (veh/h)	24						22
C (m) (veh/h)	1065						367
v/c	0.02						0.06
95% queue length	0.07						0.19
Control Delay (s/veh)	8.5						15.4
LOS	A						C
Approach Delay (s/veh)	--	--					15.4
Approach LOS	--	--					C

**Attachment 7**  
**Turn Lane Warrant Analysis**

**Attachment 7  
Turn Lane Warrant Analysis**

**Project: Dutchtown Road Subdivision**

**Dutchtown Road  
at Project Entrance**

		VOLUMES				
LEFT TURN		Opposing	Thru	LT	LT MAX	Warrant Met
AM		692	814	10	15	NO
PM		423	686	42	20	YES

**Dutchtown Road  
at Project Entrance**

		VOLUMES				
RIGHT TURN		Thru	RT	RT MAX	Warrant Met	
AM		683	9	24	NO	
PM		401	22	149	NO	

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

PM Peak 42 LT

AM Peak 10 LT

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



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						
100 - 149 150 - 199						
200 - 249 250 - 299					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 22 RT		Yes	Yes Yes	AM Peak 9 RT 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.

**Attachment 8**  
**Signal Warrant Analysis**

**Attachment 8  
Signal Warrant Analysis**

**Project: Dutchtown Road Subdivision**

Dutchtown Road @ Project Entrance  
2018 Peak Hour Traffic Full Buildout

	Dutchtown Road (Both Directions)	Project Entrance (Both Directions)	Warrant 1, Eight-Hr Vehicular Volume			Warrant 2, Four-Hr	Warrant 3, Peak Hour
			Condition A	Condition B	Condition A & B		
7:00 AM	1244	38	NO	NO	NO	NO	NO
8:00 AM	858	38	NO	NO	NO	NO	NO
9:00 AM	-	-	-	-	-	-	-
10:00 AM	-	-	-	-	-	-	-
11:00 AM	402	15*	NO	NO	NO	-	-
12:00 PM	471	15*	NO	NO	NO	-	-
1:00 PM	-	-	-	-	-	-	-
2:00 PM	599	15*	NO	NO	NO	-	-
3:00 PM	1002	15*	NO	NO	NO	-	-
4:00 PM	711	57	NO	NO	NO	NO	NO
5:00 PM	1058	57	NO	NO	NO	NO	NO

\* Estimated Based on Generated ADT Number Exiting  
 ((496 ADT Exiting Full Buildout) - (38 AM Peak)\*2 - (57 PM Peak)\*2)/ 20 hours = 15 Trips/Hr