FRETZ ROAD SUBDIVISION (905 FRETZ ROAD)

TRAFFIC IMPACT STUDY

FRETZ ROAD SUBDIVISION AT 905 FRETZ ROAD

KNOX COUNTY, TN

CCI PROJECT NO. 00545-0011



PREPARED FOR: W. Scott Williams and Associates 4530 Annalee Way Knoxville, TN 37921

SUBMITTED BY Cannon & Cannon, Inc. 8550 Kingston Pike Knoxville, TN 37919 865.670.8555

> REVISED DECEMBER 21

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REVISION 1 (12/21/17)

This report replaces the original traffic impact study dated 11/27/17 prepared for this project in its entirety. The associated changes are a result of MPC comments.

PREPARED FOR: W. Scott Williams & Associates 4530 Annalee Way Knoxville, TN 37921 SUBMITTED BY Cannon & Cannon, Inc. 8550 Kingston Pike Knoxville, TN 37919 865.670.8555

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EXECUTIVE SUMMARY

This report provides a summary of a traffic impact study that was performed for a proposed residential subdivision development to be located off Fretz Road in west Knox County, just north of the Town of Farragut. The project site is located approximately one thousand feet north of Interstate 40/75 and is typically accessed from the I-40/75 interchange with N. Campbell Station Road via N. Campbell Station Road and Fretz Road. The current plans for this proposed subdivision development provide for a maximum of 112 single family lots at full build-out. The development entrance will be a new three-leg intersection located on Fretz Road approximately 1500 feet south of the N. Campbell Station Road/Fretz Road intersection.

The purpose of this study was to provide a thorough evaluation of the traffic operational and safety impacts of the proposed development upon the adjacent portion of Fretz Road, as well as the intersection of Fretz Road with N. Campbell Station Road. This evaluation was performed assuming full build-out of all units of the subdivision with existing and background growth conditions also evaluated for purposes of comparison.

The primary conclusion of this study is that the traffic generated by the proposed development will not result in significant traffic operational impacts in the project area. However, the increase in left-turn traffic at the study intersection of N. Campbell Station Road and Fretz Road will in all likelihood create warranting conditions for construction of a northbound left-turn lane on N. Campbell Station Road. Regarding the timing of when the northbound left-turn lane would be expected to be warranted, analyses using trip generation data indicate that when 47 housing units are constructed and occupied, the left-turn lane warranting value of 50 left-turns would be satisfied.

The improvement recommendations that resulted from this study are summarized below:

- 1. Widen the existing Fretz Road pavement between Woodhollow Lane and the proposed site entrance to match the existing pavement north of the project entrance. The length of this widening would be approximately 200 feet, and the minimum width would be 20 feet.
- 2. Construct a northbound left-turn lane on N. Campbell Station Road at Fretz Road to be open no later than when the forty-seventh housing unit is built and occupied. This lane should have a minimum of 75 feet of turn lane storage and bay and approach taper lengths consistent with Knox County and T.D.O.T. standard procedures based on actual prevailing (85th percentile) traffic speeds.
- 3. Maintain corner sight distance at the proposed site entrance intersection by eliminating any obstructing vegetation and ensuring that new site signage and landscaping is properly positioned to not impede lines of sight.



INTRODUCTION & PURPOSE OF STUDY

This report provides a summary of a traffic impact study that was performed for a proposed residential subdivision development to be located off Fretz Road in west Knox County, just north of the Town of Farragut. The project site is located approximately one thousand feet north of Interstate 40/75 and is typically accessed from the I-40/75 interchange with N. Campbell Station Road via N. Campbell Station Road and Fretz Road. FIGURE 1 is a location map that identifies the project site in relation to the roadways in the vicinity of the proposed development.



FIGURE 1 LOCATION MAP

The current plans for this proposed subdivision development provide for a maximum of 112 single family lots at full build-out. FIGURE 2 is a conceptual site plan showing the proposed site layout, which will have one access point onto Fretz Road. The development entrance will be a new three-leg intersection located on Fretz Road approximately 1500 feet south of the Campbell Station Road/Fretz Road intersection.

The purpose of this study was to provide a thorough evaluation of the traffic operational and safety impacts of the proposed development upon the adjacent portion of Fretz Road, as well as the intersection of Fretz Road with N. Campbell Station Road. This evaluation was performed assuming full build-out of all units of the subdivision with existing and background growth conditions also evaluated for purposes of comparison.



SECTION 2 INTRODUCTION & PURPOSE OF STUDY

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FIGURE 2 CONCEPTUAL SITE PLAN



EXISTING CONDITIONS

EXISTING ROADWAY CONDITIONS

Fretz Road is classified as a Local roadway and is maintained by Knox County, although the first three hundred feet south of N. Campbell Station Road is maintained by the Town of Farragut. The roadway pavement varies in width, although the Brandywine at Turkey Creek development adjacent to the proposed development performed widening that provided approximately 22 feet of pavement from N. Campbell Station Road to within two hundred feet of the proposed project entrance. This widened pavement is striped with a double solid yellow centerline delineating two traffic lanes of approximately 11 feet each. The posted speed limit on Fretz Road is 30 mph, although a southbound sign between N. Campbell Station Road and the project entrance is missing.

N. Campbell Station Road is also a two lane roadway, and at the study intersection with Fretz Road, it is maintained by the Town of Farragut. It is classified as a Minor Arterial roadway, and the posted speed limit is 35 mph. There are no separate right or left turn lanes at the study intersection, but the roadway pavement of approximately 22 feet is striped with a double yellow solid centerline and white edgelines.

EXISTING TRAFFIC DATA

A traffic count station for collecting annual average daily traffic data (AADT) is located on N. Campbell Station Road, just south of Yarnell Road and approximately 0.9 miles north of the study intersection. The most recent data from this station was provided by the Tennessee Department of Transportation with resulting AADTs shown in TABLE 1.

TABLE 1: ANNUAL AVERAGE DAILY TRAFFIC COUNT

	SUMMARY									
COUNT YEAR	TDOT COUNT STATION 0303 N. CAMPBELL STATION ROAD SOUTH OF YARNELL ROAD									
2016	5583									
2015	4779									
2014	4332									
2013	4271									
2012	4385									
2011	4256									
2010	3759									
2009	4176									



In order to collect more refined data for analyses and to establish a basis for trip distribution patterns, turning movement traffic counts were collected at the study intersection of N. Campbell Station Road and Fretz Road. These counts were conducted during the AM and PM peak traffic periods of a typical weekday, and the peak hours were found to be 7:30 to 8:30 AM and 4:45 to 5:45 PM. Raw data count summaries of this data are contained in APPENDIX A along with additional TDOT AADT data for Count Station 0303. In addition to helping establish trip distribution patterns, these turning movement counts were used to establish the existing traffic volumes for this study, as displayed in FIGURE 3. They were also used to determine the peak hour factors for the counts as 0.92 for the AM peak and 0.93 for the PM peak.

EXISTING CAPACITY ANALYSES / LEVELS-OF-SERVICE

Intersection capacity analyses employing the methods of the latest edition of the Highway Capacity Manual and companion software (HCS7) were used to evaluate the study intersection of N. Campbell Station Road and Fretz Road for the existing roadway, existing traffic control, and existing (2017) traffic conditions, as shown on FIGURE 3. The results indicate that the critical Fretz Road side street approach is currently operating at level-of-service (LOS) "B" during both the AM and PM peak traffic hours. These results are summarized in detail on the "HCS7 Two-Way Stop-Control Report" printouts contained in APPENDIX C. Also see APPENDIX C for a discussion of Intersection Capacity and Level of Service Concepts.



SECTION 3 EXISTING CONDITIONS

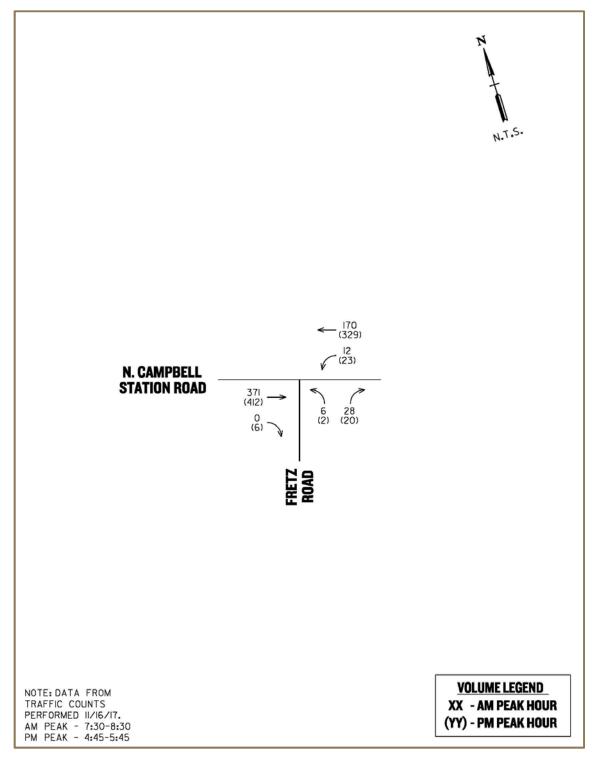


FIGURE 3 **2017 EXISTING TRAFFIC VOLUMES**



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BACKGROUND CONDITIONS

BACKGROUND TRAFFIC GROWTH

The anticipated time for full build-out of the proposed Fretz Road subdivision project is estimated as three years. Therefore, year 2020 was established as the appropriate design/analysis year for this study. In order to determine traffic volumes resulting solely from background traffic growth to year 2020, it was necessary to establish an annual growth rate for existing traffic. The ADT values given previously in TABLE 1, along with engineering judgment, were used to arrive at a rate of 3.0 percent per year for this development. FIGURE 4 contains the background traffic volumes that would result from this 3.0 percent annual growth rate to year 2020.

BACKGROUND CAPACITY ANALYSES / LEVELS-OF-SERVICE

Intersection Capacity Analyses employing the methods of the Highway Capacity Manual and companion software (HCS7) were used to evaluate the study intersection of N. Campbell Station Road and Fretz Road for the existing roadway, existing traffic control, and background (2020) traffic conditions, as shown on FIGURE 4. The results indicate that the critical Fretz Road side street approach will be expected to continue to operate at level-of-service (LOS) "B" during both the AM and PM peak traffic hours. These results are summarized in detail on the "HCS7 Two-Way Stop-Control Report" printouts contained in APPENDIX C. Also see APPENDIX C for a discussion of Intersection Capacity and Level-of-Service Concepts.



SECTION 4 BACKGROUND CONDITIONS

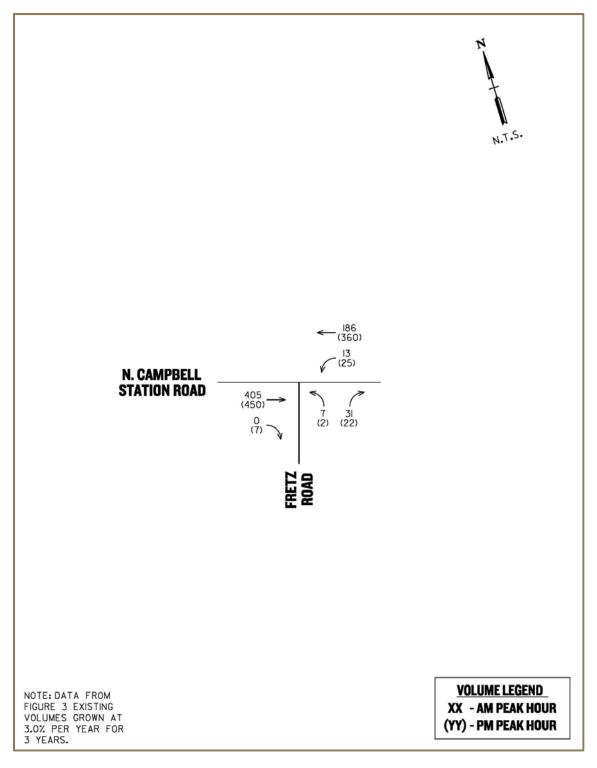


FIGURE 4 2020 BACKGROUND TRAFFIC VOLUMES



FUTURE CONDITIONS

TRIP GENERATION

In order to estimate the expected traffic volumes to be generated by full build-out of the proposed development, the data and procedures of *Trip Generation, Tenth Edition* (Institute of Transportation Engineers, 2017) were utilized. The generated traffic volumes were determined based on the total weekday morning and evening peak hour of adjacent street traffic trip generation rates for single-family detached housing (Land Use Code 210). As noted earlier in this report, the anticipated maximum number of units upon full build-out is 112, which was used to determine the number of new trips generated. TABLE 2 summarizes the number and directional split of entering and exiting trips for the proposed development.

TABLE 2: TRIP GENERATION SUMMARY

LAND USE	ITE CODE	SIZE	WEEKDAY (TRIPS/DAY)	AM PEAK HOUR (TRIPS/HR)	PM PEAK HOUR (TRIPS/HR)
Single-Family Detached Housing					
Entering Trips	210	112 units	577	21	71
Exiting Trips			577	63	42
TOTAL					
Entering Trips	-	-	577	21	71
Exiting Trips			577	63	42

TRIP DISTRIBUTION AND ASSIGNMENT

FIGURE 5 provides a summary of the trip distribution patterns developed for the study intersection, which were derived from the existing traffic counts. In addition, FIGURE 6 provides the generated traffic volumes as assigned to the local roadway network in accordance with these distribution patterns. FIGURE 7 shows the combined year 2020 volumes reflecting the existing traffic, the background traffic growth, and the newly generated traffic from the proposed Fretz Road subdivision development. These are the volumes used in the analysis of full build-out conditions.

FUTURE CAPACITY ANALYSES / LEVELS-OF-SERVICE

Intersection Capacity Analyses employing the methods of the Highway Capacity Manual and companion software (HCS7) were used to evaluate the study intersection of N. Campbell Station Road and Fretz Road for the existing roadway, existing traffic control, and combined (2020) traffic conditions, as shown on FIGURE 5. The results indicate that the critical Fretz Road side street approach will be expected to continue to operate at level-of-service (LOS) "B" during both the AM and PM peak traffic hours. These results are summarized in detail on the "HCS7 Two-Way Stop-Control Report" printouts contained in APPENDIX C. Also see APPENDIX C for a discussion of Intersection Capacity and Level of Service Concepts.



SECTION 5 FUTURE CONDITIONS

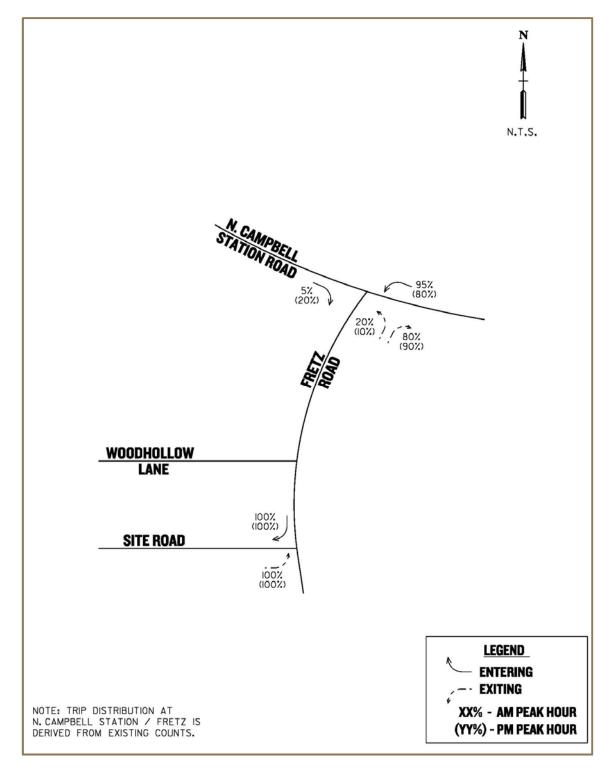


FIGURE 5 **TRIP DISTRIBUTION PATTERNS (%)**



SECTION 5 FUTURE CONDITIONS

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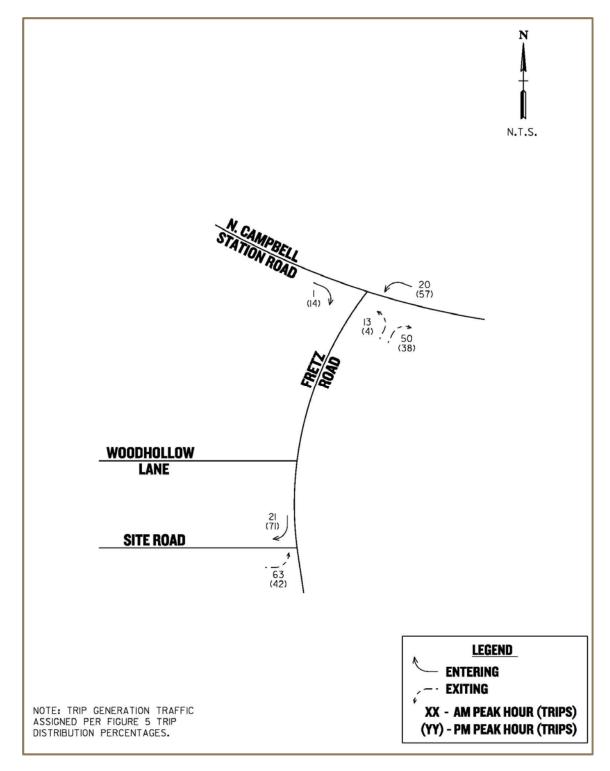


FIGURE 6 TRIP ASSIGNMENT



SECTION 5 FUTURE CONDITIONS

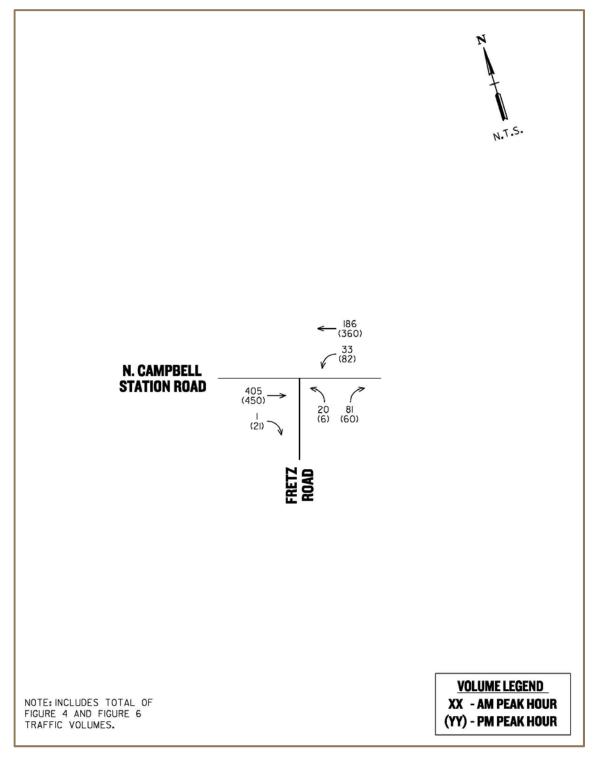


FIGURE 7 **2020 COMBINED TRAFFIC VOLUMES**



EVALUATIONS

INTERSECTION CAPACITY ANALYSES

As discussed in the preceding sections of this report, capacity analyses employing the methods of the Highway Capacity Manual and companion software (HCS7) were conducted for the study intersection of N. Campbell Station Road and Fretz Road. These analyses were performed for existing, background, and combined traffic conditions using existing geometry and existing traffic control. In addition, the intersection was also evaluated with the addition of a northbound left-turn lane on N. Campbell Station Road for the combined 2020 traffic conditions. A summary of the capacity analyses results is shown in TABLE 3.

	LEVEL-OF-SERVICE (AV	G. DELAY IN SECONDS)*
EVALUATION CONDITION	FRETZ ROAD APPROACH (LEFT AND RIGHT TURNS)	N. CAMPBELL STA. ROAD NORTHBOUND APPROACH (LEFT AND THROUGH)
Existing (2017) – AM	B (11.9)	A (0.6)
Existing (2017) – PM	B (12.1)	A (0.8)
Background (2020) – AM	B (12.5)	A (0.6)
Background (2020) – PM	B (12.7)	A (0.8)
Combined w/ Existing Lanes (2020) – AM	B (14.1)	A (1.5)
Combined w/ Existing Lanes (2020) - PM	B (14.2)	A (2.4)
Combined w/ added NBLT Lane (2020) – AM	B (14.1)	A (1.3)
Combined w/ added NBLT Lane (2020) – PM	B (14.2)	A (1.6)

TABLE 3: CAPACITY ANALYSES SUMMARY

* Side Street Stop Control – Level-of-Service and Average Vehicular Delay (seconds) for side street movements and main street left-turn and through movements utilizing HCM methodology.

As shown in TABLE 3, all levels-of-service are expected to remain the same in all evaluated conditions. The addition of a northbound left-turn lane will improve the average delay on the northbound approach to a small degree.

SIGHT DISTANCE ASSESSMENT

The proposed project development entrance on Fretz Road was evaluated for corner sight distance. Based on the posted 30 mph speed limit, the required minimum sight distance in accordance with Knox County regulations would be 300 feet. Field reviews indicate that this requirement will be met at this intersection, as available sight distance was measured in excess of 400 feet looking north and in excess of 350 feet looking south. The photos in FIGURE 8 present the measured sight distances to the north and south along Fretz Road from the proposed development entrance.



SECTION 6 EVALUATIONS

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Sight distance looking north along Fretz Road is in excess of 400 feet.



Sight distance looking south along Fretz Road is in excess of 350 feet.

FIGURE 8 SIGHT DISTANCE ASSESSMENT

TURN LANE ASSESSMENT

Turn lane warrant analyses were conducted for the study intersection of N. Campbell Station Road and Fretz Road under proposed combined development conditions. These analyses employed Tables 4A and 4B from the Knox County Access Control and Driveway Design Policy, which are based on turn lane warrants developed by Harmelink. The results are that a northbound left-turn lane on N. Campbell Station Road is expected to be warranted during the PM peak traffic hour. A southbound right-turn lane on N. Campbell Station Road was also evaluated and found to not be warranted. Regarding the timing of when the northbound left-turn lane would be expected to be warranted, analyses using trip generation data indicate that when 47 housing units are constructed and occupied, the left-turn lane warranting value of 50 left-turns would be satisfied. Copies of Knox County Tables 4A and 4B are located in APPENDIX C for review, and a sheet documenting how the 47 unit threshold was determined is located in APPENDIX D.



CONCLUSIONS & RECOMMENDATIONS

The primary conclusion of this study is that the traffic generated by the proposed development will not result in significant traffic operational impacts in the project area. However, the increase in left-turn traffic at the study intersection of N. Campbell Station Road and Fretz Road will in all likelihood create warranting conditions for construction of a northbound left-turn lane on N. Campbell Station Road. Regarding the timing of when the northbound left-turn lane would be expected to be warranted, analyses using trip generation data indicate that when 47 housing units are constructed and occupied, the left-turn lane warranting value of 50 left-turns would be satisfied.

The improvement recommendations that resulted from this study are summarized below:

- 1. Widen the existing Fretz Road pavement between Woodhollow Lane and the proposed site entrance to match the existing pavement north of the project entrance. The length of this widening would be approximately 200 feet, and the minimum width would be 20 feet.
- 2. Construct a northbound left-turn lane on N. Campbell Station Road at Fretz Road to be open no later than when the forty-seventh housing unit is built and occupied. This lane should have a minimum of 75 feet of turn lane storage and bay and approach taper lengths consistent with Knox County and T.D.O.T. standard procedures based on actual prevailing (85th percentile) traffic speeds.
- 3. Maintain corner sight distance at the proposed site entrance intersection by eliminating any obstructing vegetation and ensuring that new site signage and landscaping is properly positioned to not impede lines of sight.



SECTION 8 APPENDIX

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APPENDIX

APPENDIX A - TRAFFIC DATA

APPENDIX B - TRIP GENERATION

APPENDIX C - ANALYSES

APPENDIX D - COMMENT LETTER AND RESPONSES



APPENDIX A TRAFFIC DATA

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APPENDIX A - TRAFFIC DATA



ADT on Campell Station South of Yarnell	AUT	00	Lampell	Station	South	ot	Yarnell
---	-----	----	---------	---------	-------	----	---------

Station #	County	Location	Route #
000303	Knox	NEAR LOUDON CO LINE	01277

Record	Year	AADT
1	2016	5583
2	2015	4779
3	2014	4332
4	2013	4271
5	2012	4385
6	2011	4256
7	2010	3759
8	2009	4176
9	2008	3860
10	2007	3436
11	2006	3169
12	2005	2978
13	2004	2623
14	2003	2907
15	2002	3067
16	2001	2367
17	2000	3378
18	1999	1940
19	1998	2103
20	1997	2599
21	1996	2550
22	1995	2048
23	1994	1742
24	1993	2819
25	1992	1721
26	1991	1694
27	1990	1960
28	1989	1742

CCI Project Name: Fretz Subdivision TIS CCI Project Number: 545-0011 Intersection: Camp Sta at Fretz Counted By: CCI

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File Name : Campbell Station_Fretz_11-16-17 Site Code : 00000001 Start Date : 11/16/2017 Page No : 1

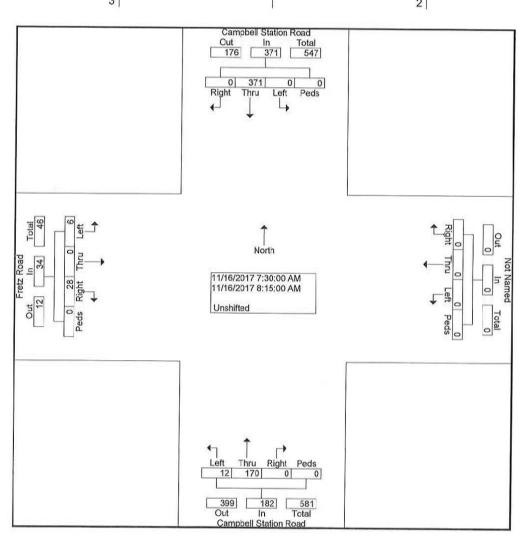
								(Groups	Printe	d- Uns	shifted									
	C	S	outhbc	and the state of the local division of the l				estbo	und			ampb	ell Sta orthbo	tion Ro ound	bad	Fretz Road Eastbound					2 14
Start Time	Left	Thr u	Rig ht	Ped s	App. Total	Left	Thr u	Rig ht	Ped s	App. Total	Left	Thr u	Rig ht	Ped s	App. Total	Left	Thr u	Rig ht	Ped s	App. Total	Int Tota
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0	Total	1010
07:30 AM	0	93	0	0	93	0	0	0	0	0	4	43	0	0	47	3	0	8	0	11	15
07:45 AM	0	97	0	0	97	0	0	0	0	0	5	46	0	0	51	1	0	6	õ	7	15
Total	0	190	0	0	190	0	0	0	0	0	9	89	0	0	98	4	Ő	14	Ő	18	306
08:00 AM	0	110	0	0	110	0	0	0	0	0	2	43	0	0	45	0	0	5	0	5	160
08:15 AM	0	71	0	0	71	0	0	0	0	0	1	38	0	0	39	2	Ō	9	õ	11	12
08:30 AM	0	71	1	0	72	0	0	0	0	0	3	45	0	0	48	1	ō	5	Ő	6	12
08:45 AM	0	57	0	0	57	0	0	0	0	0	4	54	0	0	58	1	0	4	ō	5	12
Total	0	309	1	0	310	0	0	0	0	0	10	180	0	0	190	4	0	23	0	27	52
** BREAK *	**																				
04:30 PM	0	120	0	0	120	0	0	0	0	0	6	69	0	0	75	0	0	5	0	5	200
04:45 PM	0	113	1	0	114	0	0	0	0	0	3	76	ō	õ	79	õ	ŏ	5 2	ŏ	2	19
Total	0	233	1	0	234	0	0	0	0	0	9	145	0	0	154	0	Ő	7	Ö	7	39
05:00 PM	0	98	0	0	98	0	0	0	D	0	6	71	0	0	77	1	0	3	0	4	179
05:15 PM	0	90	4	0	94	0	0	0	0	0	6	96	õ	Ö	102	1	ŏ	8	õ	9	20
05:30 PM	0	111	1	0	112	0	0	0	0	0	8	86	ō	õ	94	Ó	ŏ	7	õ	7	213
05:45 PM	0	76	2	0	78	0	0	0	0	0	11	69	Ő	õ	80	õ	ŏ	5	õ	5	163
Total	0	375	7	0	382	0	0	0	0	0	31	322	0	0	353	2	Ő	23	0	25	760
Grand Total	0	110 7	9	0	1116	0	0	0	0	0	59	736	0	0	795	10	0	67	0	77	1988
Apprch %	0.0	99. 2	0.8	0.0		0.0	0.0	0.0	0.0		7.4	92. 6	0.0	0.0		13. 0	0.0	87. 0	0.0		
Total %	0.0	55. 7	0.5	0.0	56.1	0.0	0.0	0.0	0.0	0.0	3.0	37. 0	0.0	0.0	40.0	0.5	0.0	3.4	0.0	3.9	

Fretz (G) (HIZ) Fretz (G) (HIZ) Fretz (G) (HIZ) Fretz (G) (HIZ) (G) (HIZ) (G) (HIZ) (G) (HIZ) (G) (HIZ) (HI

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File Name : Campbell Station_Fretz_11-16-17 Site Code : 00000001 Start Date : 11/16/2017 Page No : 2

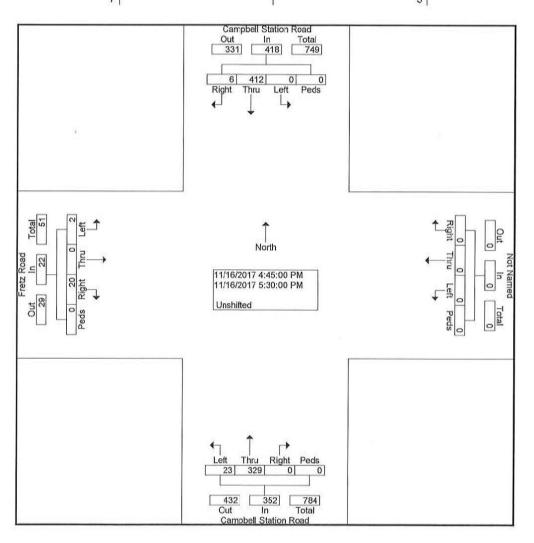
	С	ampbe Sc				Campbell Station Road Northbound					Fretz Road Eastbound										
Start Time	Left	Thr u	Rig ht	Ped s	App. Total	Left	Thr u	Rig ht	Ped s	App. Total	Left	Thr u	Rig ht	Ped	App. Total	Left	Thr u	Rig ht	Ped s	App. Total	Int. Total
eak Hour F	From C)7:30 A	AM to	08:45	AM - P	eak 1 c	of 1									-				10101	Total
Intersecti on	07:30	MA C																			
Volume	0	371	0	0	371	0	0	0	0	0	12	170	0	0	182	6	0	28	0	34	587
Percent	0.0	100 .0	0.0	0.0		0.0	0.0	0.0	0.0		6.6	93. 4	0.0	0.0	100000	17. 6	0.0	82. 4	0.0	0.	007
08:00 Volume Peak	0	110	0	0	110	0	0	0	0	0	2	43	0	0	45	0	0	5	0	5	160 0.9
Factor	00.00										12000-000	0.28450.0									
High Int.	08:00			-		7:15:0				120425	07:45	AM			Value	07:30	AM				
Volume Peak Factor	0	110	0	0	110 0.84 3	0	0	0	0	0	5	46	0	0	51 0.89 2	3	0	8	0	11 0.77 3	



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File Name : Campbell Station_Fretz_11-16-17 Site Code : 00000001 Start Date : 11/16/2017 Page No : 3

	Campbell Station Road Southbound					Westbound					Campbell Station Road Northbound					Fretz Road Eastbound					
Start Time	Left	Thr u	Rig ht	Ped s	App. Total	Left	Thr u	Rig ht	Ped s	App. Total	Left	Thr u	Rig ht	Ped s	App. Total	Left	Thr u	Rig ht	Ped s	App. Total	Int. Total
Peak Hour I	From C	04:00 F	PM to	05:45	PM - Pe	eak 1 d	of 1														
Intersecti on	04:48	5 PM			685.0																
Volume	0	412	6	0	418	0	0	0	0	0	23	329	0	0	352	2	0	20	0	22	792
Percent	0.0	98. 6	1.4	0.0		0.0	0.0	0.0	0.0		6.5	93. 5	0.0	0.0		9.1	0.0	90. 9	0.0		1.111
05:30 Volume Peak	0	111	1	0	112	0	0	0	0	0	8	86	0	0	94	0	0	7	0	7	213 0.9
Factor High Int.	04:45	5 PM									05:15	5 PM				05:15	PM				0.8
Volume Peak Factor	0		1	0	114 0.91 7	0	0	0	0	0	6	96	0	0	102 0.86 3	1	0	8	0	9 0.61 1	1



A-5

APPENDIX B - TRIP GENERATION



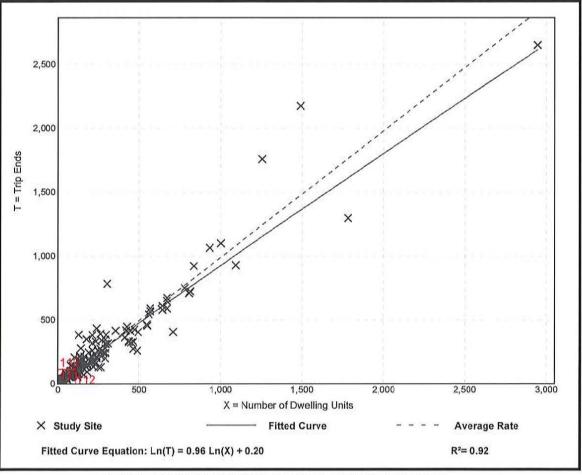
Vehicle Trip Ends vs:	Dwelling Units
On a:	Weekday,
	Peak Hour of Adjacent Street Traffic
	One Hour Between 4 and 6 p.m.
Setting/Location:	General Urban/Suburban
Number of Studies:	190
Avg. Num. of Dwelling Units:	242
Directional Distribution:	63% entering, 37% exiting

Single-Family Detached Housing

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.99	0.44 - 2.98	0.31

Data Plot and Equation



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Trips = 113 Enter - 71 Exit - 42

B-2

https://itetripgen.org/PrintGraph.htm?code=210&ivlabel=UNITS210&timeperiod=TPSI... 11/20/2017

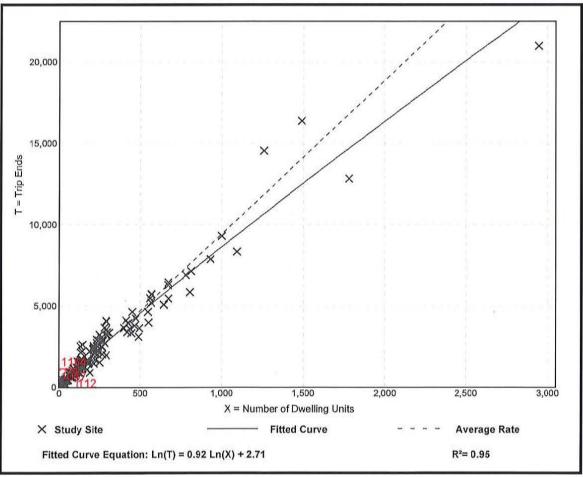
Single-Family Detached Housing

Vehicle Trip Ends vs:	Dwelling Units
On a:	Weekday
Setting/Location:	General Urban/Suburban
Number of Studies:	159
Avg. Num. of Dwelling Units:	264
Directional Distribution:	50% entering, 50% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
9.44	4.81 - 19.39	2.10

Data Plot and Equation



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Trips = 1154 Enter - 577 Exit - 577

B-3

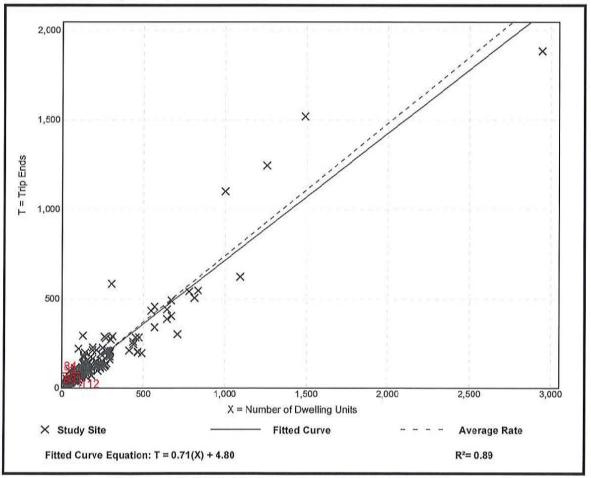
https://itetripgen.org/PrintGraph.htm?code=210&ivlabel=UNITS210&timeperiod=AWD... 11/20/2017

Vehicle Trip Ends vs:	Dwelling Units
On a:	Weekday,
	Peak Hour of Adjacent Street Traffic
	One Hour Between 7 and 9 a.m.
Setting/Location:	General Urban/Suburban
Number of Studies:	173
Avg. Num. of Dwelling Units:	219
Directional Distribution:	25% entering, 75% exiting

Single-Family Detached Housing

Vehicle Trip Generation per Dwelling Unit

Data Plot and Equation



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Trips = 84 Enter - 21 Exit - 63

B-4

APPENDIX C ANALYSES

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APPENDIX C - ANALYSES



CAPACITY AND LEVEL-OF-SERVICE CONCEPTS

In a general sense, a roadway is similar to a pipeline or other material carrying conduit in that it has a certain capacity for the amount of material (vehicles) that it can efficiently carry. As the number of vehicles in a given time period gradually increases, the quality of traffic flow gradually decreases. On roadway sections this results in increasing turbulence in the traffic stream, and at intersections it results in increasing stops and delay. As the volumes begin to approach the capacity of the facility, these problems rapidly magnify, with resulting serious levels of congestion, stops, delay, excess fuel consumption, pollutant emissions, etc.

The Transportation Research Board has published the <u>Year 2010 Highway Capacity Manual</u> (HCM2010), which establishes theoretical techniques to quantify the capacity conditions on all types of roadways, intersections, ramps, pedestrian facilities, etc. A basic concept that is applicable to most of these techniques is the idea of level of service (LOS). This concept establishes a rating system that quantifies the quality of traffic flow, as perceived by motorists and/or passengers. The general system is similar to a school grade scale, and is outlined as follows:

Level of Service (LOS)	General Quality of Traffic Flow	Description of Corresponding Conditions
A	Excellent	Roadways – Free flow, high maneuverability Intersections – Very few stops, very low delay
В	Very Good	Roadways – Free flow, slightly lower maneuverability Intersections – Minor stops, low delay
С	Good	Roadways – Stable flow, restricted maneuverability Intersections – Significant stops, significant delay
D	Fair	Roadways – Marginally stable flow, congestion seriously restricts maneuverability Intersections – High stops, long but tolerable delay
E	Poor	Roadways – Unstable flow*, lower operating speeds, congestion severely restricts maneuverability Intersections – All vehicles stop, very long queues and very long intolerable delay
F	Very Poor	Roadways – Forced flow, stoppages may be lengthy, congestion severely restricts maneuverability Intersections – All vehicles stop, extensive queues and extremely long intolerable delay

*Unstable flow is such that minor fluctuations or disruptions can result in rapid degradation to LOS F.

1.00	CONTROL DELAY (S/VEH)										
LOS	SIGNALIZED	UNSIGNALIZED	ROUNDABOUT								
А	≤10	≤10	≤10								
В	>10-20	>10-15	>10-15								
С	>20-35	>15-25	>15-25								
D	>35-55	>25-35	>25-35								
E	>55-80	>35-50	>35-50								
F	>80	>50	>50								

LOS CRITERIA: SIGNALIZED & UNSIGNALIZED INTERSECTIONS

Another measure of intersection capacity that is often used in the evaluation of intersection operations is the volume to capacity (V/C) ratio. This ratio is defined as "the ratio of flow rate to capacity", and is a good measure of how much of an intersection's available capacity has been used up by the analysis volumes. Conversely, it also provides an indication of the reserve capacity available for future growth in traffic volumes.

The Intersection Capacity Utilization (ICU) is another measure that expresses a value similar to the V/C ratio. Specifically, the ICU method "sums the amount of the time required to serve all movements at saturation for a given cycle length and divides by that reference cycle length." The ICU is considered a more accurate measure of volume to capacity conditions for a signalized intersection, primarily because it accounts for the effects of the signal timing on intersection capacity.

C-3

		Н	CS7	Two-	Way	Sto	p-Co	ntrol	Rep	ort									
General Information							Site	Inform	natio	n									
Analyst	ALC						Inters	ection			CSR @	P Fretz I	Rd.						
Agency/Co.	CCI		1.1.1		-		Jurisd				Town	of Farra	agut						
Date Performed	11/20	/2017					East/	West Str	eet		Fretz	Road							
Analysis Year	2017		1				North	/South	Street		Camp	bell Sta	ation Road						
Time Analyzed	AM P	eak					Peak	Hour Fa	ctor		0.92								
Intersection Orientation	North	-South	1105				Analy	sis Time	Period (hrs)	0.25								
Project Description	Fretz	Road Su	ıbd. @ 9	05 Fretz	Rd.														
Lanes									14			UE I.							
				1417451		* 1 1 * 4* ** Street: No	1 1× I												
Vehicle Volumes and Ad	ljustme	nts										nnk				T a t			
Approach		East	bound			West	bound			North	bound			Sout	bound				
Movement	U	L	Т	R	U	L	Т	R	U	L	Т	R	U	L	Т	R			
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6			
Number of Lanes		0	1	0		0	0	0	0	0	1	0	0	0	1	0			
Configuration			LR							LT						TR			
Volume, V (veh/h)		6		28						12	170				371	0			
Percent Heavy Vehicles (%)		3		3						3									
Proportion Time Blocked															1				
Percent Grade (%)			4																
Right Turn Channelized		1	No			No					10				No				
Median Type/Storage				Undi	ivided														
Critical and Follow-up H	leadwa	ys																	
Base Critical Headway (sec)		7.1		6.2						4.1									
Critical Headway (sec)		7.23		6.63						4.13									
Base Follow-Up Headway (sec)		3.5		3.3						2.2									
Follow-Up Headway (sec)		3.53		3.33					1	2.23									
Delay, Queue Length, ar	nd Leve	l of S	ervice							SILAD									
Flow Rate, v (veh/h)			37							13									
Capacity, c (veh/h)			556							1149									
v/c Ratio			0.07							0.01									
95% Queue Length, Q95 (veh)			0.2							0.0					1				
Control Delay (s/veh)			11.9							8.2									
Level of Service, LOS		1011	В							A									
Approach Delay (s/veh)		1	1.9		e a ser ann			-7- B		C	0.6								
Approach LOS			В								1.11								

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		H	CS7	Two-	Way	Sto	p-Co	ntro	Rep	ort									
General Information		-					Site	Inform	natio	n						32			
Analyst	ALC				States		Inters	ection			CSR @) Fretz I	Rd.						
Agency/Co.	CCI						Jurisc	liction			Town of Farragut								
Date Performed	11/20	/2017					East/	West Str	eet		Fretz Road								
Analysis Year	2017						North	/South	Street		Camp	bell Sta	ation Road						
Time Analyzed	PM Pe	eak					Peak	Hour Fa	ctor		0.93								
Intersection Orientation	North	-South					Analy	sis Time	Period (_							
Project Description	Fretz	Road Su	ıbd. @ 9	05 Fretz	Rd.														
Lanes																			
				JATAAN		1 1 4 4 1 Street: No													
Vehicle Volumes and Ad	ljustme	nts			intijor	under inte													
Approach		East	oound			West	bound			North	bound			Sout	bound	-			
Movement	U	L	Т	R	U	L	T	R	U	L	Т	R	U	L	Т	R			
Priority		10	11	12		7	8	9	10	1	2	3	4U	4	5	6			
Number of Lanes		0	1	0		0	0	0	0	0	1	0	0	0	1	0			
Configuration			LR							LT						TF			
Volume, V (veh/h)		2		20						23	329				412	6			
Percent Heavy Vehicles (%)		3		3						3									
Proportion Time Blocked																			
Percent Grade (%)		_	4																
Right Turn Channelized		1	No			4	١o			Ν	10				No				
Median Type/Storage				Undi	vided									_		_			
Critical and Follow-up H	leadwa	ys																	
Base Critical Headway (sec)		7.1		6.2						4.1									
Critical Headway (sec)		7.23		6.63						4.13						-			
Base Follow-Up Headway (sec)		3.5		3.3						2.2									
Follow-Up Headway (sec)		3.53		3.33						2.23									
Delay, Queue Length, ar	nd Leve	l of S	ervice))															
Flow Rate, v (veh/h)			24		1	1				25						1			
Capacity, c (veh/h)			529			Î	1			1105									
v/c Ratio			0.05							0.02									
95% Queue Length, Q ₉₅ (veh)			0.1							0.1									
Control Delay (s/veh)			12.1							8.3									
CONTRACTOR AND A	-		В		1	1	A												
Level of Service, LOS			D		CTUT II			in the second second		and the second	1	A CONTRACTOR		1000	ALC: NOT THE REPORT OF				
Level of Service, LOS Approach Delay (s/veh)		1	2.1					5).8								

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General Information		301-53		-	The		Contractor and a	den er openskinne	natior	land on the				-	L.H.					
Analyst	ALC							ection			CSR @ Fretz Rd. Town of Farragut									
Agency/Co.	CCI						Jurisd		_				gut	-						
Date Performed	11/20	/2017						Nest Str			Fretz Road									
Analysis Year	2020		_		_			/South !	1000		Campbell Station Road									
Time Analyzed	-		ground					Hour Fa		h and h	0.92	-								
Intersection Orientation	A STATE	-South		DF Faata	Dul	1.1	Analy	sis time	Period (nrs)	0.25			-						
Project Description	Fretz	Road Su	bd. @ 90	5 Fretz	Ka.				10-10-11		The second		1999							
Vehicle Volumes and Ad Approach		Easth	bound	JA TAABU	A T Major	۲ ۲ Street: No	bound			1.000	bound				nbound					
Movement	U	L	т	R	U	L	LTR			L	Т	R	U	L	Т	R				
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6				
Number of Lanes		0	1	0		0	0	0	0	0	1	0	0	0	1	0				
Configuration			LR							LT						TF				
Volume, V (veh/h)		7		31						13	186				405	0				
Percent Heavy Vehicles (%)		3		3						3						-				
Proportion Time Blocked		4																		
Proportion Time Blocked Percent Grade (%)		1	4							_	_		_							
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Percent Grade (%) Right Turn Channelized Median Type/Storage Critical and Follow-up H Base Critical Headway (sec) Critical Headway (sec)	leadwa	ys 7.1 7.23	-	6.2 6.63	vided	N				4.1 4.13					No					
Percent Grade (%) Right Turn Channelized Median Type/Storage Critical and Follow-up H Base Critical Headway (sec) Critical Headway (sec) Base Follow-Up Headway (sec) Follow-Up Headway (sec)		▼ ys 7.1 7.23 3.5 3.53		6.2 6.63 3.3 3.33	vided	1				4.1 4.13 2.2					No					
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Percent Grade (%) Right Turn Channelized Median Type/Storage Critical and Follow-up H Base Critical Headway (sec) Critical Headway (sec) Base Follow-Up Headway (sec) Follow-Up Headway (sec) Delay, Queue Length, an Flow Rate, v (veh/h) Capacity, c (veh/h)		▼ ys 7.1 7.23 3.5 3.53	No ervice 42 522	6.2 6.63 3.3 3.33	vided					4.1 4.13 2.2 2.23 14 1113										
Percent Grade (%) Right Turn Channelized Median Type/Storage Critical and Follow-up H Base Critical Headway (sec) Critical Headway (sec) Base Follow-Up Headway (sec) Follow-Up Headway (sec) Delay, Queue Length, an Flow Rate, v (veh/h) Capacity, c (veh/h) v/c Ratio		▼ ys 7.1 7.23 3.5 3.53	No ervice 42 522 0.08	6.2 6.63 3.3 3.33	vided					4.1 4.13 2.2 2.23										
Percent Grade (%) Right Turn Channelized Median Type/Storage Critical and Follow-up H Base Critical Headway (sec) Critical Headway (sec) Base Follow-Up Headway (sec) Follow-Up Headway (sec) Delay, Queue Length, an Flow Rate, v (veh/h) Capacity, c (veh/h) v/c Ratio 95% Queue Length, Q ₉₅ (veh)		▼ ys 7.1 7.23 3.5 3.53	ervice 42 522 0.08 0.3	6.2 6.63 3.3 3.33	vided					4.1 4.13 2.2 2.23 14 1113 0.01 0.0										
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Percent Grade (%) Right Turn Channelized Median Type/Storage Critical and Follow-up H Base Critical Headway (sec) Critical Headway (sec) Base Follow-Up Headway (sec) Follow-Up Headway (sec) Delay, Queue Length, an Flow Rate, v (veh/h) Capacity, c (veh/h) v/c Ratio		7.1 7.23 3.5 3.53 I of S	ervice 42 522 0.08 0.3	6.2 6.63 3.3 3.33	vided					4.1 4.13 2.2 2.23 14 1113 0.01 0.0 8.3 A										

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General Information			1 - L						natior	1	14416	And			NO.	1.00
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Agency/Co.	CCI						Jurisd					of Farra	gut			
Date Performed	11/20	/2017						West Stre			Fretz					
Analysis Year	2020		_	1			1000 C C C C C C C C C C C C C C C C C C	/South S				bell Sta	tion Road	9		1. I.I.
Time Analyzed		eak Back	ground					Hour Fac	(21/2)		0.93					
Intersection Orientation	To de transmissione	-South					Analy	sis Time	Period (hrs)	0.25		-		-	
Project Description	Fretz	Road Su	bd. @ 90)5 Fretz	Rd.				1				-			1.12
Lanes		1314		10.10	1		11000	1000		1				Li non	den't	
				URTINERU A		1 1 + Y Street: No	th-South									
Vehicle Volumes and Ad	justme				Wejor								1	Carat		
and the second	Eastbound Westbound					Northbound				Southbound						
Approach		1				West	1							1		1
Movement	U	L	Т	R	U	L	Т	R	U	L	Т	R	U	L	Т	R
Movement Priority	U	L 10	T 11	12	U	L 7	Т 8	9	1U	L 1	T 2	3	4U	L 4	Т 5	6
Movement Priority Number of Lanes	U	L	T 11 1		U	L	Т		-	L 1 0	Т		-	L	T	6
Movement Priority Number of Lanes Configuration	U	L 10 0	T 11	12 0	U	L 7	Т 8	9	1U	L 1 0 LT	T 2 1	3	4U	L 4	T 5 1	((
Movement Priority Number of Lanes Configuration Volume, V (veh/h)	U	L 10 0 2	T 11 1	12 0 22	U	L 7	Т 8	9	1U	L 1 0 LT 25	T 2	3	4U	L 4	Т 5	6
Movement Priority Number of Lanes Configuration Volume, V (veh/h) Percent Heavy Vehicles (%)		L 10 0	T 11 1	12 0	U	L 7	Т 8	9	1U	L 1 0 LT	T 2 1	3	4U	L 4	T 5 1	6 C T
Movement Priority Number of Lanes Configuration Volume, V (veh/h) Percent Heavy Vehicles (%) Proportion Time Blocked		L 10 0 2 3	T 11 1 LR	12 0 22	U	L 7	Т 8	9	1U	L 1 0 LT 25	T 2 1	3	4U	L 4	T 5 1	6 C T
Movement Priority Number of Lanes Configuration Volume, V (veh/h) Percent Heavy Vehicles (%) Proportion Time Blocked Percent Grade (%)		L 10 0 2 3	T 11 1	12 0 22	U	L 7 0	Т 8	9	1U	L 1 0 LT 25 3	T 2 1	3	4U	L 4 0	T 5 1	((
Movement Priority Number of Lanes Configuration Volume, V (veh/h) Percent Heavy Vehicles (%) Proportion Time Blocked		L 10 0 2 3	T 11 1 LR 4	12 0 22 3	U	L 7 0	T 8 0	9	1U	L 1 0 LT 25 3	T 2 1 360	3	4U	L 4 0	T 5 1 450	6 C T
Movement Priority Number of Lanes Configuration Volume, V (veh/h) Percent Heavy Vehicles (%) Proportion Time Blocked Percent Grade (%) Right Turn Channelized Median Type/Storage		L 10 0 2 3	T 11 1 LR 4	12 0 22 3		L 7 0	T 8 0	9	1U	L 1 0 LT 25 3	T 2 1 360	3	4U	L 4 0	T 5 1 450	e (
Movement Priority Number of Lanes Configuration Volume, V (veh/h) Percent Heavy Vehicles (%) Proportion Time Blocked Percent Grade (%) Right Tum Channelized Median Type/Storage Critical and Follow-up H		L 10 0 2 3	T 11 1 LR 4	12 0 22 3		L 7 0	T 8 0	9	1U	L 1 0 LT 25 3	T 2 1 360	3	4U	L 4 0	T 5 1 450	((
Movement Priority Number of Lanes Configuration Volume, V (veh/h) Percent Heavy Vehicles (%) Proportion Time Blocked Percent Grade (%) Right Tum Channelized		L 10 2 3 N	T 11 1 LR 4	12 0 22 3 Undi		L 7 0	T 8 0	9	1U	L 1 0 LT 25 3	T 2 1 360	3	4U	L 4 0	T 5 1 450	e (
Movement Priority Number of Lanes Configuration Volume, V (veh/h) Percent Heavy Vehicles (%) Proportion Time Blocked Percent Grade (%) Right Turn Channelized Median Type/Storage Critical and Follow-up H Base Critical Headway (sec)		L 10 2 3 N ys 7.1	T 11 1 LR 4	12 0 22 3 Undi		L 7 0	T 8 0	9	1U	L 1 0 LT 25 3 N	T 2 1 360	3	4U	L 4 0	T 5 1 450	e (
Movement Priority Number of Lanes Configuration Volume, V (veh/h) Percent Heavy Vehicles (%) Proportion Time Blocked Percent Grade (%) Right Turn Channelized Median Type/Storage Critical and Follow-up H Base Critical Headway (sec) Critical Headway (sec)		L 10 2 3 7.1 7.23	T 11 1 LR 4	12 0 22 3 Undi		L 7 0	T 8 0	9	1U	L 1 0 LT 25 3 N 4.1 4.13	T 2 1 360	3	4U	L 4 0	T 5 1 450	T
Movement Priority Number of Lanes Configuration Volume, V (veh/h) Percent Heavy Vehicles (%) Proportion Time Blocked Percent Grade (%) Right Turn Channelized Median Type/Storage Critical and Follow-up H Base Critical Headway (sec) Critical Headway (sec) Base Follow-Up Headway (sec)	eadwa	L 10 0 2 3 3 5 7.1 7.23 3.5 3.53	T 11 LR 4 No	12 0 22 3 Undi 6.2 6.63 3.3 3.33		L 7 0	T 8 0	9	1U	L 1 0 LT 25 3	T 2 1 360	3	4U	L 4 0	T 5 1 450	((
Movement Priority Number of Lanes Configuration Volume, V (veh/h) Percent Heavy Vehicles (%) Proportion Time Blocked Percent Grade (%) Right Turn Channelized Median Type/Storage Critical and Follow-up H Base Critical Headway (sec) Critical Headway (sec) Base Follow-Up Headway (sec) Follow-Up Headway (sec) Delay, Queue Length, ar	eadwa	L 10 0 2 3 3 5 7.1 7.23 3.5 3.53	T 11 LR 4 No	12 0 22 3 Undi 6.2 6.63 3.3 3.33		L 7 0	T 8 0	9	1U	L 1 0 LT 25 3	T 2 1 360	3	4U	L 4 0	T 5 1 450	T
Movement Priority Number of Lanes Configuration Volume, V (veh/h) Percent Heavy Vehicles (%) Proportion Time Blocked Percent Grade (%) Right Turn Channelized Median Type/Storage Critical and Follow-up H Base Critical Headway (sec) Critical Headway (sec) Base Follow-Up Headway (sec) Follow-Up Headway (sec) Delay, Queue Length, ar Flow Rate, v (veh/h)	eadwa	L 10 0 2 3 3 5 7.1 7.23 3.5 3.53	T 11 1 LR 4 No ervice	12 0 22 3 Undi 6.2 6.63 3.3 3.33		L 7 0	T 8 0	9	1U	L 1 0 LT 25 3	T 2 1 360	3	4U	L 4 0	T 5 1 450	((T
Movement Priority Number of Lanes Configuration Volume, V (veh/h) Percent Heavy Vehicles (%) Proportion Time Blocked Percent Grade (%) Right Turn Channelized Median Type/Storage Critical and Follow-up H Base Critical Headway (sec) Critical Headway (sec) Base Follow-Up Headway (sec) Follow-Up Headway (sec) Delay, Queue Length, ar	eadwa	L 10 0 2 3 3 5 7.1 7.23 3.5 3.53	T 11 1 LR 4 4 No ervice 26	12 0 22 3 Undi 6.2 6.63 3.3 3.33		L 7 0	T 8 0	9	1U	L 1 0 LT 25 3	T 2 1 360	3	4U	L 4 0	T 5 1 450	((T
Movement Priority Number of Lanes Configuration Volume, V (veh/h) Percent Heavy Vehicles (%) Proportion Time Blocked Percent Grade (%) Right Turn Channelized Median Type/Storage Critical and Follow-up H Base Critical Headway (sec) Critical Headway (sec) Gritical Headway (sec) Base Follow-Up Headway (sec) Follow-Up Headway (sec) Critical Follow-Up Headway (sec) Critical Company (sec) Critical Company (sec) Critical Company (sec) Follow-Up Headway (sec) Capacity, c (veh/h)	eadwa	L 10 0 2 3 3 5 7.1 7.23 3.5 3.53	T 11 1 LR 4 4 No ervice 26 496	12 0 22 3 Undi 6.2 6.63 3.3 3.33		L 7 0	T 8 0	9	1U	L 1 0 LT 25 3	T 2 1 360	3	4U	L 4 0	T 5 1 450	T
Movement Priority Number of Lanes Configuration Volume, V (veh/h) Percent Heavy Vehicles (%) Proportion Time Blocked Percent Grade (%) Right Turn Channelized Median Type/Storage Critical and Follow-up H Base Critical Headway (sec) Critical Headway (sec) Base Follow-Up Headway (sec) Follow-Up Headway (sec) Delay, Queue Length, an Flow Rate, v (veh/h) Capacity, c (veh/h) v/c Ratio	eadwa	L 10 0 2 3 3 5 7.1 7.23 3.5 3.53	T 11 1 LR 4 4 4 ervice 26 496 0.05	12 0 22 3 Undi 6.2 6.63 3.3 3.33		L 7 0	T 8 0	9	1U	L 1 0 LT 25 3	T 2 1 360	3	4U	L 4 0	T 5 1 450	((T
Movement Priority Number of Lanes Configuration Volume, V (veh/h) Percent Heavy Vehicles (%) Proportion Time Blocked Percent Grade (%) Right Turn Channelized Median Type/Storage Critical and Follow-up He Base Critical Headway (sec) Critical Headway (sec) Critical Headway (sec) Base Follow-Up Headway (sec) Follow-Up Headway (sec) Delay, Queue Length, an Flow Rate, v (veh/h) Capacity, c (veh/h) v/c Ratio 95% Queue Length, Q ₉₅ (veh)	eadwa	L 10 0 2 3 3 5 7.1 7.23 3.5 3.53	T 11 1 LR 4 4 No 26 496 0.05 0.2	12 0 22 3 Undi 6.2 6.63 3.3 3.33		L 7 0	T 8 0	9	1U	L 1 0 LT 25 3	T 2 1 360	3	4U	L 4 0	T 5 1 450	((

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General Information								and the second data	natior							
Analyst	ALC						Inters	ection			CSR @) Fretz F	Rd.			
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Date Performed	11/20	/2017					East/V	Vest Stre	eet		Fretz	Road		-		
Analysis Year	2020						North	/South S	Street		Camp	bell Sta	tion Road	Ч		
Time Analyzed	AM P	eak Com	bined				Peak	Hour Fac	ctor		0.92					
Intersection Orientation	North	-South		-			Analy	sis Time	Period (hrs)	0.25					
Project Description	Fretz	Road Su	bd. @ 90)5 Fretz	Rd.									1.74 ()		
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Priority		10	11	12		7	8	9	1U	1	2	3	40	4	5	6
Number of Lanes		0	1	0		0	0	0	0	0	1	0	0	0	1	0
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Percent Heavy Vehicles (%)		3		3						3			-			_
Proportion Time Blocked													-			
Percent Grade (%)			4													
Right Turn Channelized		٢	10			١	No			N	10				No	-
Median Type/Storage				Undi	vided											
Critical and Follow-up H	leadwa	ys								-	-		-	-	-	
Base Critical Headway (sec)		7.1		6.2						4.1						_
Critical Headway (sec)		7.23		6.63						4.13						
Base Follow-Up Headway (sec)		3.5		3.3						2.2						
Follow-Up Headway (sec)		3.53		3.33						2.23			1	1	1	
Delay, Queue Length, an	nd Leve	l of S	ervice									_				
Flow Rate, v (veh/h)			110							36						
Capacity, c (veh/h)			506							1113						
v/c Ratio			0.22							0.03						L
95% Queue Length, Qss (veh)			0.8							0.1		1				
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Approach Delay (s/veh)		1	4.1							1	5					
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Priority		10	11	12		7	8	9	10	1	2	3	40	4	5	0	
Number of Lanes	_	0	1	0		0	0	0	0	0	1	0	0	0	1	Т	
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General Information							Site	Inform	natior	1				-			
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Agency/Co.	CCI						Jurisd	liction			Town	of Farra	gut				
Date Performed	11/20	/2017		-			East/\	Nest Stre	eet		Fretz						
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Vehicle Volumes and Ad	ljustme	ents															
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Movement	U	L	Т	R	U	L	Т	R	U	L	Т	R	U	L	Т	R	
Priority		10	11	12		7	8	9	10	1	2	3	40	4	5	6	
Number of Lanes		0	1	0		0	0	0	0	1	1	0	0	0	1	0	
Configuration			LR							L	Т	-				TR	
Volume, V (veh/h)		20		81						33	186				405	1	
Percent Heavy Vehicles (%)		3		3						3						-	
Proportion Time Blocked													-			1	
Percent Grade (%)			4												_		
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Median Type/Storage		-		Undi	vided												
Critical and Follow-up H	leadwa	ys		-			191			-	1			- day			
Base Critical Headway (sec)		7.1		6.2						4.1							
Critical Headway (sec)		7.23		6.63						4.13							
Base Follow-Up Headway (sec)		3.5		3.3						2.2							
Follow-Up Headway (sec)		3.53		3.33						2.23	2						
Delay, Queue Length, ar	nd Leve	l of S	ervice	•												and and	
Flow Rate, v (veh/h)		T	110	T	-	1	-	1		36		1		1	1	1	
Capacity, c (veh/h)			506		1	1				1113			1	T		1	
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95% Queue Length, Q ₉₅ (veh)		1	0.8			1	1			0.1	1			1000		T	
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Time Analyzed	PM Pe	eak Com	bined +	NBLT			Peak	Hour Fac	ctor		0.93					
Intersection Orientation	North	-South					Analy	sis Time	Period (hrs)	0.25					
Project Description	Fretz	Road Su	bd. @ 90	05 Fretz	Rd.					_						
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Vehicle Volumes and Ad	justme				Widjor					North			T	Courth	bound	
Approach		-	bound	D	U		bound T	R	U	L	T	R	Southbound			
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Priority Number of Lanes		0	1	0		0	0	0	0	1	1	0	0	0	1	0
Configuration	-	-	LR	-						L	т				1	TF
Volume, V (veh/h)		6		60						82	360				450	23
Percent Heavy Vehicles (%)	-	3		3						3						
Proportion Time Blocked												Le ma				
Percent Grade (%)		1	4				A									
Right Turn Channelized		١	٩o			4	10	and the		Ν	lo				No	
Median Type/Storage				Undi	vided											-
Critical and Follow-up H	leadwa	ys														
Base Critical Headway (sec)	T	7.1		6.2	1					4.1						
Critical Headway (sec)		7.23		6.63						4.13						
Base Follow-Up Headway (sec)		3.5		3.3						2.2						
Follow-Up Headway (sec)		3.53		3.33						2.23						
Delay, Queue Length, ar	nd Leve	l of S	ervice								A. Martin					
Flow Rate, v (veh/h)	1	1	71							88						
Capacity, c (veh/h)			462							1052						
v/c Ratio			0.15			an an an Araa				0.08						
95% Queue Length, Q95 (veh)			0.5							0.3						
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the second se		1	В 4.2							-	6					-

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TABLE 4A	Project No: 00545 - 0011
KNOX COUNTY LEFT-TURN LANE VOLUME THRESHOLDS	Project Name: Fretz Rd, Subd, @ 905 Fretz Rd
FOR 2-LANE ROADWAYS WITH A PREVAILING SPEED OF 0 TO 35 MPH	Notes:

(If the left-turn volume exceeds th	e table value a	left-turn lane i	is needed)
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OPPOSING		THRO	UGH VOLUME PLUS	S RIGHT-TURN VOLU	ME *	
VOLUME	100 - 149	(150 - 199)	200 - 249	250 - 299	300 - 349	350 - 399
100 - 149	300	235	185	145	120	100
150 - 199	245	200	160	130	110	90
200 - 249	205	170	140	115	100	80
250 - 299	175	150	125	105	90	70
300 - 349	155	135	110	95	80	65
350 - 399	135	120	100	85	70	60
400 - 449	120	(105)	90	75	65	55
450 - 499	105	90	80	70	60	(50)
500 - 549	95	80	70	65	55	50
550 - 599	85	70	65	60	50	45
600 - 649	75	65	60	55	45	40
650 - 699	70	60	55	50	40	35
700 - 749	65	55	50	45	35	30
750 or More	60	50	45	40	35	30

OPPOSING		THROUGH VOLUME PLUS RIGHT-TURN VOLUME *								
VOLUME	350 - 399	400 - 449	450 - 499	500 - 549	550 - 599	= / > 600				
100 - 149	100	80	70	60	55	50				
150 - 199	90	75	65	55	50	45				
200 - 249	80	72	60	55	50	45				
250 - 299	70	65	55	50	45	40				
300 - 349	65	60	50	50	45	40				
350 - 399	60	55	50	45	40	40				
400 - 449	55	50	45	45	40	35				
450 - 499	50	45	45	40	35	35				
500 - 549	50	45	40	40	35	35				
550 - 599	45	40	40	35	35	35				
600 - 649	40	35	35	35	35	30				
650 - 699	35	35	35	30	30	30				
700 - 749	30	30	30	30	30	30				
750 or More	30	30	30	30	30	30				

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

Time Period	Opposing Volume	Through Volume	Left-Turn Volume	Warrant Threshold	Left-Turn Lane Warranted (Yes / No)
AM Peak	406	186	33	105	No
PM Peak	471	360	82	50	Yes
	AM Peak	Time Period Volume	Time Period Volume Volume AM Perk 406 186	Time PeriodVolumeVolumeVolumeAMPegk40618633AMPegk40618633	Time PeriodVolumeVolumeVolumeThresholdAMPeak40618633105AMPeak4061863350

Source: Knox County Department of Engineering and Public Works "Access Control and Driveway Design Policy"

TABLE 4B	Project No: 00545-0011
KNOX COUNTY RIGHT-TURN LANE VOLUME THRESHOLDS	Project Name: Fretz Rd. Subd. @ 905 Fretz Rd.
FOR 2-LANE ROADWAYS WITH A PREVAILING SPEED OF 0 TO 35 MPH	Notes:

RIGHT-TURN		THROUGH VOLUME PLUS LEFT-TURN VOLUME *											
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							
300 - 349					Yes	Yes							
350 - 399				Yes	Yes	Yes							
400 - 449			Yes	Yes	Yes	Yes							
450 - 499			Yes	Yes	Yes	Yes							
500 - 549		Yes	Yes	Yes	Yes	Yes							
550 - 599		Yes	Yes	Yes	Yes	Yes							
600 or More	Yes	Yes	Yes	Yes	Yes	Yes							

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

Intersection	Time Period	Through Volume	Right-Turn Volume	Right-Turn Lane Warranted (Yes / No)
CSR/Fretz	AM Peak	405	1 .	No
	PM Peak	450	21	No

Source: Knox County Department of Engineering and Public Works "Access Control and Driveway Design Policy"

APPENDIX D

COMMENT LETTER AND RESPONSES

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APPENDIX D - COMMENT LETTER AND RESPONSES





Comment Responses are Shown in RED below (by ALC dated 12/20/17)

December 20, 2017

Alan Childers, P.E. Cannon & Cannon, Inc. 8550 Kingston Pike Knoxville, TN 37919

SUBJECT: Fretz Road Subdivision - Traffic Impact Study Review

Dear Mr. Childers:

The Traffic Impact Study (TIS) submitted on November 27, 2017 for the referenced proposed development has been reviewed by staff from the Town of Farragut Engineering Department, Knox County Engineering Department, and MPC. We have identified the following issues related to the TIS that need to be further addressed or corrected.

- Please provide documentation to show how the number of 47 units was derived for triggering the need for a northbound left turn lane on Campbell Station Road at Fretz Road. This analysis showing the calculations can be provided in the appendix of the report. A copy of the documentation is attached and will also be provided in the appendix of the revised report.
- 2. Please provide additional clarification regarding the determination of the recommended storage and bay taper lengths for the northbound left turn lane on Campbell Station Road.
 - a) The bay taper length should be based on the prevailing (85th percentile) speed on Campbell Station Road rather than the posted 35 mph limit. A speed study to be conducted at some point prior to submittal of final design plans will be required in order to verify the sufficient taper length required.

A Speed Study will be conducted and used in design. The study will be provided later.

b) Provide additional documentation regarding how the 75' minimum storage length was determined and verify whether adequate storage is provided based on the projected vehicle queues from your capacity analysis.

The recommended 75 foot storage length is the minimum that CCI recommends. This would provide for one school bus and one passenger vehicle stored at the same time. The capacity analyses 95% queue lengths were 0.1 vehicle and 0.3 vehicle respectively for the AM and PM peak hours, for the Combined Analyses. Thus, the storage recommended is more than adequate.

Page 1 of 2

3. The turning movement count data provided in the appendix shows that the AM period count was begun at 7:30 a.m. – please provide justification for not beginning the count at 7:00 a.m. instead in order to capture the entirety of the peak morning elementary school traffic period.

A previous traffic count at this intersection dated 2/23/16 (copy attached), which was taken from another traffic impact study dated 2/29/16 (Fulghum MacIndoe), showed very clearly that AM peak volumes do not begin until 7:30 AM.

 There are various minor grammatical corrections needed that will be provided in a separate correspondence of scanned individual marked-up pages. These will be addressed in the revised traffic impact study that will be submitted.

Please submit three hard copies and one electronic version of a revised TIS based on the above noted issues by Wednesday, December 27, 2017 so that adequate time is available for review prior to the January MPC meeting. Please also either provide a written statement below each item above using the original Word document sent via email or in a separate memorandum format in order to indicate how they have been addressed. If you have any questions, please do not hesitate to contact me at 215-3813.

Sincerely,

2/0/

Michael D. Conger, P.E. Senior Transportation Engineer

C: Tom Brechko, MPC

Tarren Barrett, MPC

Cindy Pionke, Knox County Engineering & Public Works John Sexton, Knox County Engineering & Public Works Darryl Smith, Town of Farragut Engineering Scott Williams, W. Scott Williams & Associates Terry Patton, Cascade Falls LLC

Sheet No. 1 of 1 CANNON & CANNON IN Project Fretz Rd. Subdivision T.I.S. INC Subject Determination of L.T. lane Triager Project Number 00545-0001 CONSULTING ENGINEE Date 12/20/17 Designed By ULE FIELD SURVEYORS Checked By_ Date (7) + 405 (450) $\frac{7}{(2)}$ Background: Volumes Fretz Rol. 31 (186 (22) (25) (360) (25) (From report) Per T.I.S. report, after development, there will be 82 NB leftturns in the PM Peak. The number to satisfy the Left-turn lane volume threshold is 50. The background year number of LTS 15 25, so 25 more are needed to meet the threshold. *> Key Question - How many units will generate 25 NB left-turns ? < * -In P.M., per Trip Distribution, 80% of Entering generated trips are NBLT - Also, 6.3 % of generated trips are Entering in PM peak Using Filled Curve equation for Single Family Detached Housing (Code 210): [Ln(T) = 0.96 Ln (X) + 0.20 $Ln\left(\frac{2.5}{0.80\times0.63}\right) = 0.96 Ln(X) + 0.20$ Ln(x) = 3.8584X = 47.4 units Use 47 units as Left-turn love trigger enhancing community life by design

Project: Towering Oaks Village Date Conducted: Tuesday 2/23/2016

	٢	N Campbell Station Rd Eastbound			N Campbell Station Rd Westbound		Fretz Road Northbound			ĺ		
Start		Г hru	Right	Total	Left	Thru	Total	Left	Right	Total	Int. Total	
		47	Kight 1	48	1	22	23	0	7	70121	78	
7:15 AM		54	÷	55	3	25	28	1	7	8	91	
7:30 AM		85		86	4	31	35	3	8	11	132	
		90		92	3	54	57	2	6	8	157	m m a di
			2			132		6	28	34		- 7:30 75
Tota	1 1	276	5	281	11	132	143	6	20	34	430	- 7:30 ts 9:00
8:00 AM	ĩ	54		55	1	68	69	0	7	7	131	7:00
8:15 AM		67	1 1	68	o	52	52	0 2	7 2	4	124	
				58	1	52	52	0	2	2	124	
8:30 AM		58 52	0	50	2	61	63	0	23	23	120/	
8:45 AM Tota	1	231	2	235	4	231	235	2	14	16		-
TOLA	. 1	231		255	*	251	255	4	14.	10	400	
11:00 AM	Ť	33	0	33	2	41	43	1	7	8	84	
11:15 AM		47	0	47	4	32	36	1	3	4	87	
11:30 AM		35	1	36	0	36	36	0	3	3	75	
11:45 AM		47	ò	47	Ő	46	46	0	3	3	96	
Tota	1	162	1	163	6	155	161	2	16	18		_
	÷.						(i) 1997				VENDAL	
12:00 PM		61	0	61	1	55	56	0	0	0	117	
12:15 PM		56	1	57	5	47	52	0	7	7	116	
12:30 PM		43	2	45	1	39	40	1	2	3	88	
12:45 PM		39	0	39	3	44	47	0	2	2	88	_
Tota		199	3	202	10	185	195	1	11	12	409	
2:00 PM	1	47		48	7	ED	59	1	1	2	109	47
		47	1		7	52 46	59	2	1 3	2 5	99	
2:15 PM		42	2 0	44 43		52	57	2 0	3	3	103	
2:30 PM		43			5 6				3	661.	98	
2:45 PM		35 167	0	35 1 <i>7</i> 0	22	<u>53</u> 203	59 225	1 4	10	4		
Tota	· 1	107	3	170]	22	205	225	4	10	1.44	409	
3:00 PM	1	67	2	69	5	61	66	1	5	6	141	
3:15 PM		48	0	48	3	47	50	0	1	1	99	
3:30 PM		74	0	74	2	60	62	0	5	5	141	
3:45 PM		80	1	81	15	54	69	0	7	7	157	
Total		269	3	272	25	222	247	1	18	19	538	
12.222 2015	T	1000	-		6			12		10	100	
4:00 PM		45	2	47	1	56	57	1	3	4	108	
4:15 PM		52	0	52	5	71	76	0	3	3	131	
4:30 PM		66	2	68	9	65	74	1	5	6	148	
4:45 PM		66	0	66	22	72 264	79	0	6 17	6 19	151 538	- 4:30 to
Total	I	229	4	233	22	264	286	2	17	19	530	- 4:30 to 6:00
5:00 PM	- Î	59	3	62	8	85	93	1	5	6	161	0.000
5:15 PM		90	1	91	6	78	84	1	3	4	179	
5:30 PM		66	0	66	3	91	94	0	3	3	163	
5:45 PM		64	2	66	3	85	88	1	4	5	159	
Total		279	6	285	20	339	359	3	15	18	662	
Grand Total	I	1812	29	1841	120	1731	1851	21	129	150	3842	
Approach %		98.4	1.6	district of the	6.5	93.5	10000	14.0	86.0	1000	179778 (1977)	
Total %		47.2	0.8	47.9	3.1	45.1	48.2	0.5	3.4	3.9		
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