

F i s c h b a c h
Transportation Group, LLC
Traffic Engineering and Planning

Traffic Impact Study

Ashcroft Valley Residential Development
Highway 96E and S. Carothers Road
Franklin, TN

Prepared September 2016
For Land Solutions Company

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Ashcroft Valley Residential Development Highway 96E and S. Carothers Road

Franklin, Tennessee

Prepared September 2016

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1. INTRODUCTION

This traffic study has been prepared in order to identify the traffic impacts of a single-family residential development that is proposed to be constructed between Highway 96E and S. Carothers Road in Franklin, Tennessee.

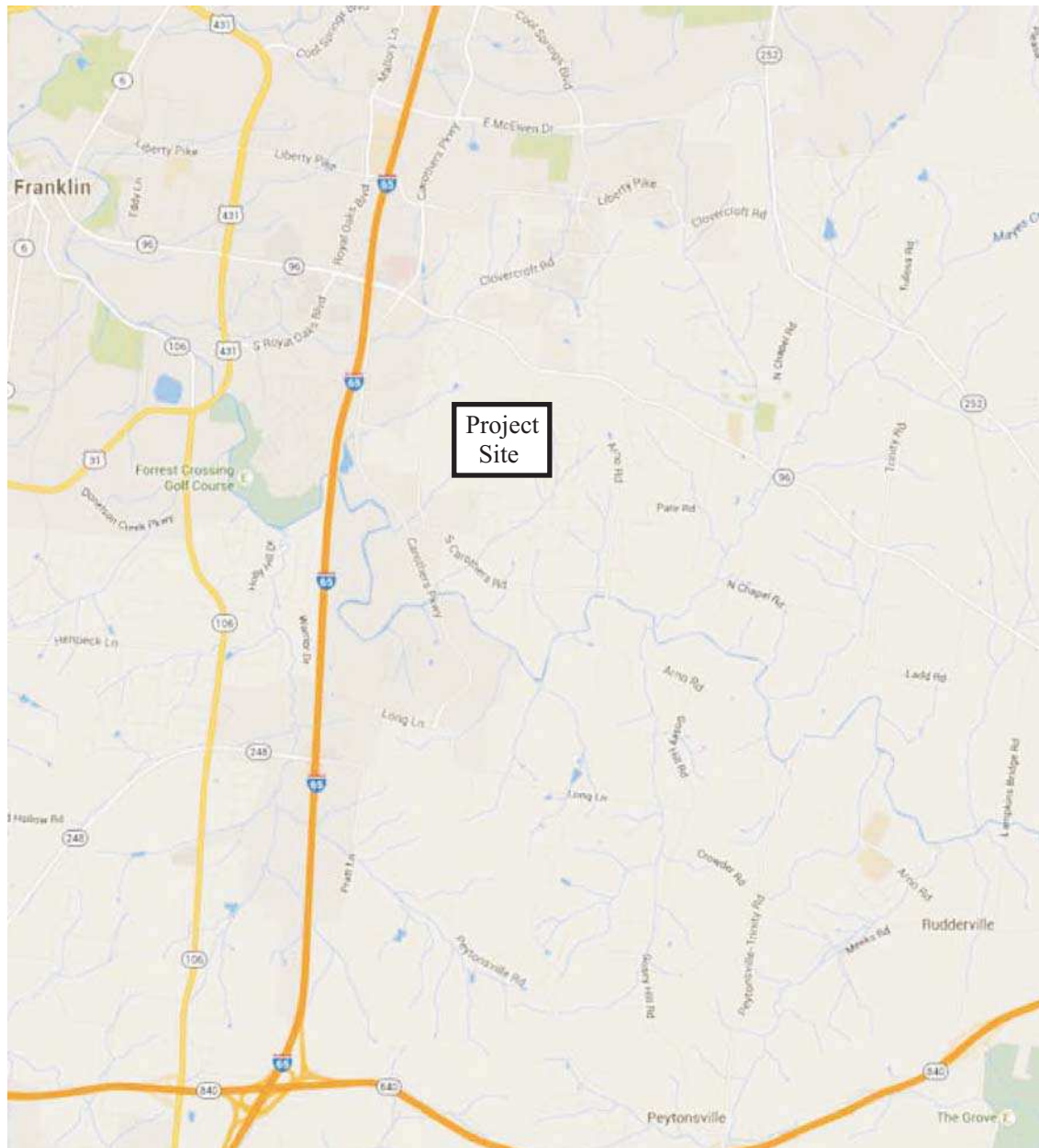
For the purposes of this study, existing and background traffic volumes were established, and capacity analyses were conducted for these conditions. Also, trip generation calculations were performed, and the trips which are expected to be generated by the proposed project were distributed to the roadway system and added to the background traffic volumes. The roadways and intersections which provide access to the site were then re-evaluated to determine the traffic impacts of the proposed project. Access needs for the project were evaluated, and the necessary roadway and/or traffic control improvements were identified. This report presents the results of these analyses and the subsequent recommendations.

2. PROJECT DESCRIPTION

The location of the proposed project is shown in [Figure 1](#). As shown, the project site is located between Highway 96E and S. Carothers Road in Franklin, Tennessee. The current project site plans are shown in [Figures 2A and 2B](#).

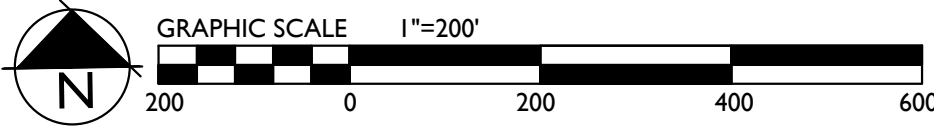
As shown, the northern portion of the project site includes 70 single-family homes. Access for the proposed project will be provided by extending Stanford Drive into the project site. The southern portion of the project site includes 306 single-family homes, and access for the proposed project will be provided at two locations on S. Carothers Road. Also, minor access will be provided by extending Upland Drive and Meandering Way east into the project site.

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Transportation Group, LLC
Traffic Engineering and Planning



No Scale

Figure 1.
Location of the Project Site



BUILDABLE LOTS:	
AREA	
31,744 SF	
37,036 SF	
36,085 SF	

TOTAL NON-BUILDABLE LOT AREA: 2.41 AC
 TOTAL OPEN SPACE PROVIDED: 121.47 AC (54%)
 TOTAL FORMAL OPEN SPACE PROVIDED: 12.65 AC
 TOTAL INFORMAL OPEN SPACE PROVIDED: 108.82 AC

STREAM BUFFER

 60' STREAM BUFFER

MODIFICATION OF DESIGN STANDARDS REQUEST

RESTRICTIVE COVENANTS: A HOME OWNER'S ASSOCIATION WILL BE ESTABLISHED PRIOR TO THE FIRST OCCUPANCY OF RESIDENTS. THE HOA WILL REGULATE ARCHITECTURAL STANDARDS AND THE MAINTENANCE OF THE COMMUNITY. THE HOA WILL MAINTAIN ALL COMMON OPEN SPACE AND RECREATIONAL AREAS. THE HOA WILL MAINTAIN ALL STREETS AND SIDEWALKS WITHIN THE GATED NEIGHBORHOOD WHERE THE STREETS WILL BE PRIVATE.

OVERALL DENSITY: 1,67 UNITS/AC
 NET DENSITY (MINUS ROW AND STREAM BUFFERS): 1,90 UNITS/AC
 NET DENSITY (MINUS ROW AND STREAM BUFFERS): 2,035 UNITS/AC
 NUMBER OF RESIDENTIAL UNITS BY USE TYPE:

376 SINGLE FAMILY HOMES	22
40 LOTS:	22
50' LOTS:	158
60'-70' LOTS:	72
90 LOTS:	83
ESTATE:	1
NA	
89.7 AC RESIDENTIAL	
108.4 AC OPEN SPACE	
2.41 AC NON-BUILDABLE LOTS	
SECTION 1	
10.8 AC RESIDENTIAL (44 UNITS)	
9.7 AC OPEN SPACE	
SECTION 2	
14.6 AC RESIDENTIAL (84 UNITS)	
7.2 AC OPEN SPACE	
SECTION 3	
5.2 AC RESIDENTIAL (36 UNITS)	
2.9 AC OPEN SPACE	
SECTION 4	
8.0 AC RESIDENTIAL (33 UNITS)	
4.5 AC OPEN SPACE	
SECTION 5	
13.3 AC RESIDENTIAL (72 UNITS)	
9.1 AC OPEN SPACE	
SECTION 6	
9.4 AC RESIDENTIAL (37 UNITS)	
36.3 AC OPEN SPACE	
SECTION 7	
20.5 AC RESIDENTIAL (48 UNITS)	
22.8.3 AC OPEN SPACE	
SECTION 8	
7.9 AC RESIDENTIAL (22 UNITS)	
15.9 AC OPEN SPACE	

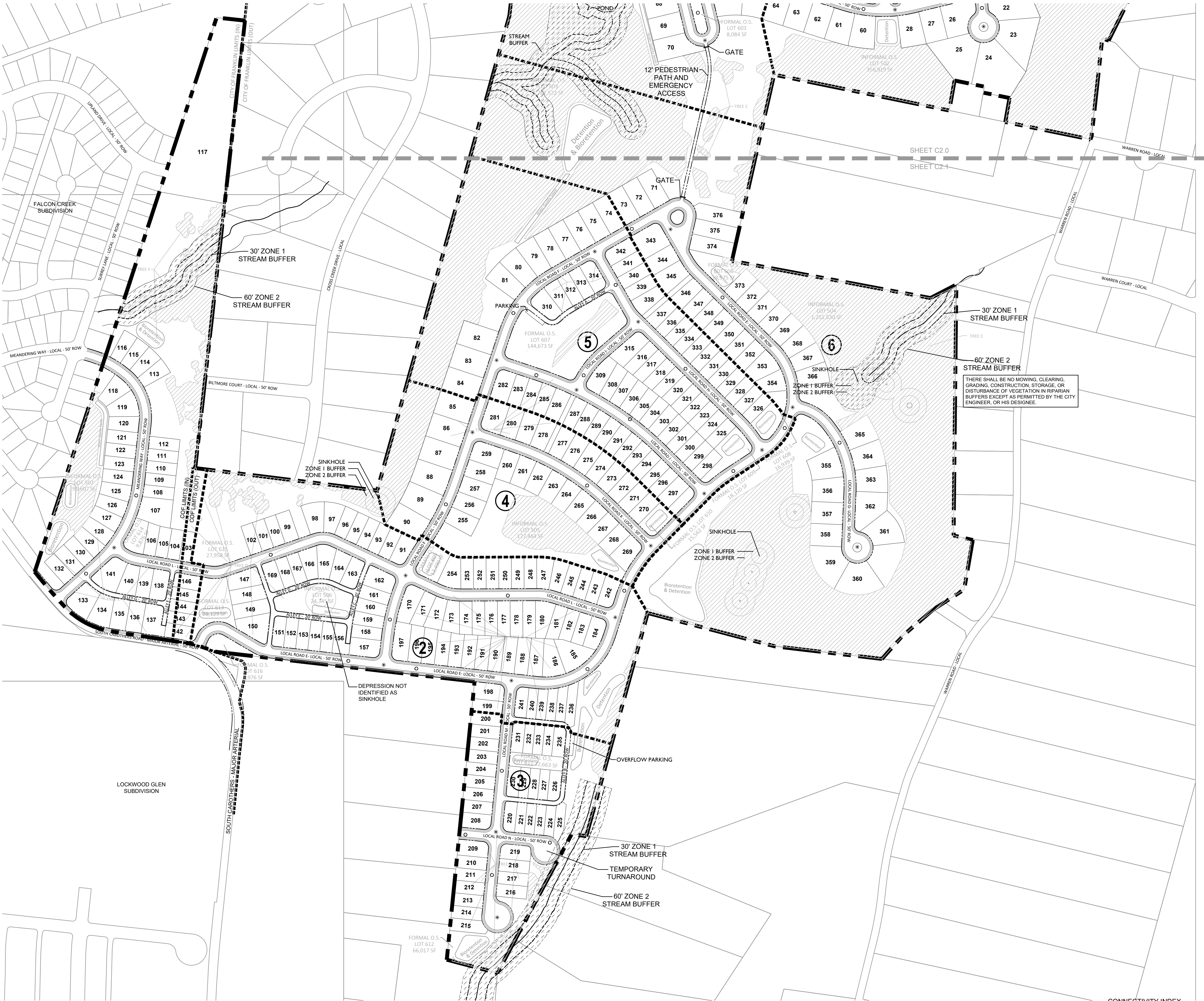
TOTAL ACREAGE BY USE, PER SECTION:

SOFT VALLEY PUD SUBDIVISION DEVELOPMENT PLAN

Franklin, Williamson County, Tennessee



C 2.0



SITE DATA:

PROJECT NAME:
PROJECT NUMBER:
SUBDIVISION:
LOT NUMBER:
ADDRESS:

CITY:
COUNTY:
STATE:
CIVIL DISTRICT:
MAP, GROUP, PARCEL NUMBERS:

ASHCROFT VALLEY PUD SUBDIVISION
6189
NA
1-376, 501-507, 601-616
1101 RIDGEWAY DRIVE,
MURFREESBORO ROAD
FRANKLIN
TENNESSEE
14TH CIVIL DISTRICT
079 MB 002800
079 MB 002900
089 03000
089 03000
089 03001
089 04302
089 04303
089 04304
WILLIAMSON COUNTY
NC (079079 MB 002800, 079 MB 002900),
MGA-1 (079 05500, 089 04302, 089 04303,
089 04304)
CITY OF FRANKLIN
R-1 (089 03000, 089 03001)
SD-R (1.67)
MECO-6
NONE
CONVENTIONAL
226.01 AC
9,844,942.09 SF

EXISTING ZONING:

PROPOSED ZONING:
CHARACTER AREA OVERLAY:
OTHER APPLICABLE OVERLAYS:
APPLICABLE DEVELOPMENT STANDARD:
TOTAL ACRES:
TOTAL SQUARE FOOTAGE:

MINIMUM REQUIRED SETBACKS:
FRONT YARD:
REAR YARD:
SIDE YARD:

APPLICANT:
ADDRESS:

OFFICE PHONE
EMAIL ADDRESS
CONTACT

BUILDING SQUARE FOOTAGE:
BUILDING HEIGHT:
LANDSCAPE SURFACE RATIO:
MINIMUM LANDSCAPE SURFACE RATIO:
MINIMUM PARKING REQUIREMENT:
EXISTING PARKING:
RESIDENTIAL DENSITY:
TREE CANOPY:
PARKLAND DEDICATION:

SEE LOT DIAGRAMS - SHEET C2.3
MINIMUM SETBACKS
NONE
CONVENTIONAL
226.01 AC
9,844,942.09 SF

GAMBLE DESIGN COLLABORATIVE
144 SOUTHEAST PARKWAY
SUITE 200
FRANKLIN, TN 37064
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GREG GAMBLE

OPEN SPACE:

OVERALL DENSITY:
NET DENSITY (MINUS ROW):
NET DENSITY (MINUS ROW AND STREAM BUFFERS):
NUMBER OF RESIDENTIAL UNITS BY USE TYPE:

1.67 UNITS/AC
1.90 UNITS/AC
2.03 UNITS/AC
376 SINGLE FAMILY HOMES
40' LOTS: 22
50' LOTS: 198
60'-70' LOTS: 72
90' LOTS: 83
ESTATE: 1
N/A
89.7 AC RESIDENTIAL
108.4 AC OPEN SPACE
2.41 AC NON-BUILDABLE LOTS
SECTION 1
10.8 AC RESIDENTIAL (44 UNITS)
9.7 AC OPEN SPACE
SECTION 2
14.6 AC RESIDENTIAL (84 UNITS)
7.2 AC OPEN SPACE
SECTION 3
5.2 AC RESIDENTIAL (36 UNITS)
2.9 AC OPEN SPACE
SECTION 4
8.0 AC RESIDENTIAL (33 UNITS)
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13.3 AC RESIDENTIAL (72 UNITS)
9.1 AC OPEN SPACE
SECTION 6
9.4 AC RESIDENTIAL (37 UNITS)
36.3 AC OPEN SPACE
SECTION 7
20.5 AC RESIDENTIAL (48 UNITS)
22.8 AC OPEN SPACE
SECTION 8
17.9 AC RESIDENTIAL (22 UNITS)
15.9 AC OPEN SPACE

NONRESIDENTIAL SQUARE FOOTAGE:
TOTAL ACRES BY USE, ENTIRE SITE:

TOTAL ACRES BY USE, PER SECTION:

OPEN SPACE REQUIREMENT CHART:

MINIMUM OPEN SPACE REQUIREMENT: 15%
SITE AREA: 226.01 AC
OPEN SPACE ACRES REQUIRED: 33.90 AC
FORMAL OPEN SPACE REQUIRED: 34% (11.53 AC)
INFORMAL OPEN SPACE REQUIRED: 66% (22.37 AC)

OPEN SPACE PROVIDED:

KEY CLASSIFICATION	TYPE	AREA OF OPEN SPACE
501	INFORMAL GREEN BELT	1,086,703 SF
502	INFORMAL GREEN BELT	356,919 SF
503	INFORMAL GREEN BELT	1,781,272 SF
504	INFORMAL GREEN BELT	1,251,830 SF
505	INFORMAL GREEN BELT	139,078 SF
506	INFORMAL GREEN BELT	33,880 SF
507	INFORMAL GREEN BELT	90,802 SF
601	FORMAL ENTRY	117,895 SF
602	FORMAL PARK	25,543 SF
603	FORMAL PARK	8,084 SF
604	FORMAL ENTRY	24,746 SF
605	FORMAL PARK	13,589 SF
606	FORMAL PARK	18,975 SF
607	FORMAL PARK	144,673 SF
608	FORMAL PARK	22,185 SF
609	FORMAL PARK	10,423 SF
610	FORMAL PARK	10,362 SF
611	FORMAL PARK	12,693 SF
612	FORMAL PARK	66,017 SF
613	FORMAL PARK	28,129 SF
614	FORMAL PARK	9,876 SF
615	FORMAL PARK	27,858 SF
616	FORMAL PARK	9,976 SF

NON-BUILDABLE LOTS:

KEY AREA	AREA
1	31,744 SF
2	37,036 SF
3	36,085 SF

TOTAL NON-BUILDABLE LOT AREA: 2.41 AC
TOTAL OPEN SPACE PROVIDED: 121.47 AC (54%)
TOTAL FORMAL OPEN SPACE PROVIDED: 12.65 AC
TOTAL INFORMAL OPEN SPACE PROVIDED: 108.82 AC

TREE CANOPY RETENTION:

TREE AREA	EXISTING	REMOVED	RETAINED
TREE A	20,201 SF	0 SF	20,201 SF
TREE B	184,596 SF	53,921 SF	130,675 SF
TREE C	5,961,646 SF	3,943,325 SF	2,018,320 SF
TREE D	221,073 SF	169,300 SF	51,773 SF
TREE E	491,876 SF	329,599 SF	162,277 SF
TOTAL	6,579,691 SF	3,596,145 SF	2,983,546 SF

TREE CANOPY DATA

EXISTING TREE CANOPY: 6,579,691 SF
6,579,691 SF/9,844,942.09 SF = .668 (66.8%) OF TOTAL SITE

REQUIRED CANOPY PRESERVATION =
36% OF TOTAL CANOPY
6,579,691 SF * 36% = 2,368,689 SF

PROVIDED CANOPY PRESERVED =
2,983,546 SF (45.3%) OF TOTAL EXISTING CANOPY

TREE PRESERVATION AREA

STREAM BUFFER

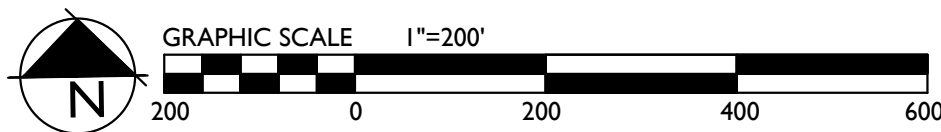
60' STREAM BUFFER

CONNECTIVITY INDEX

○ LINKS 44
* NODES 30
44 / 30 = 1.47 INDEX

MODIFICATION OF DESIGN STANDARDS REQUEST

THE APPLICANT REQUESTS A REDUCED CONNECTIVITY INDEX AS A RESULT OF THE ENVIRONMENTAL AND TOPOGRAPHICAL CONSTRAINTS OF THE NEIGHBORING PROPERTIES, AS WELL AS A LACK OF CONNECTION LOCATIONS TO EXISTING NEIGHBORHOODS ON THE REMAINING NEIGHBORING PROPERTIES.



Revisions:

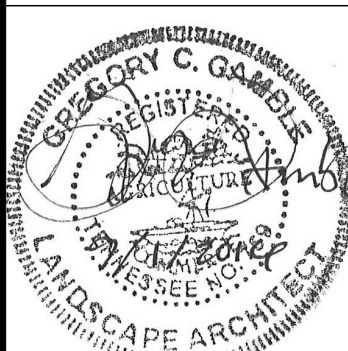
Drawing Notes:



GAMBLE
DESIGN COLLABORATIVE

DESIGN PLANNING AND
LANDSCAPE ARCHITECTURE
Date: JUNE 10, 2016

**ASHCROFT VALLEY PUD SUBDIVISION
DEVELOPMENT PLAN**
Franklin, Williamson County, Tennessee



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**DEVELOPEMENT
PLAN**

C 2.1

COF 6189

3. EXISTING CONDITIONS

3.1 PEAK HOUR TRAFFIC VOLUMES

In order to provide data for the traffic impact analysis, peak hour traffic volumes were counted at the following locations:

1. Highway 96E and Carothers Parkway
2. Highway 96E and Clovercroft Road
3. Highway 96E and Cross Creek Drive
4. Highway 96E and Ridgeway Drive / Chester Stevens Road
5. Highway 96E and Arno Road
6. Carothers Parkway and S. Carothers Road
7. S. Carothers Road in the vicinity of the project site.

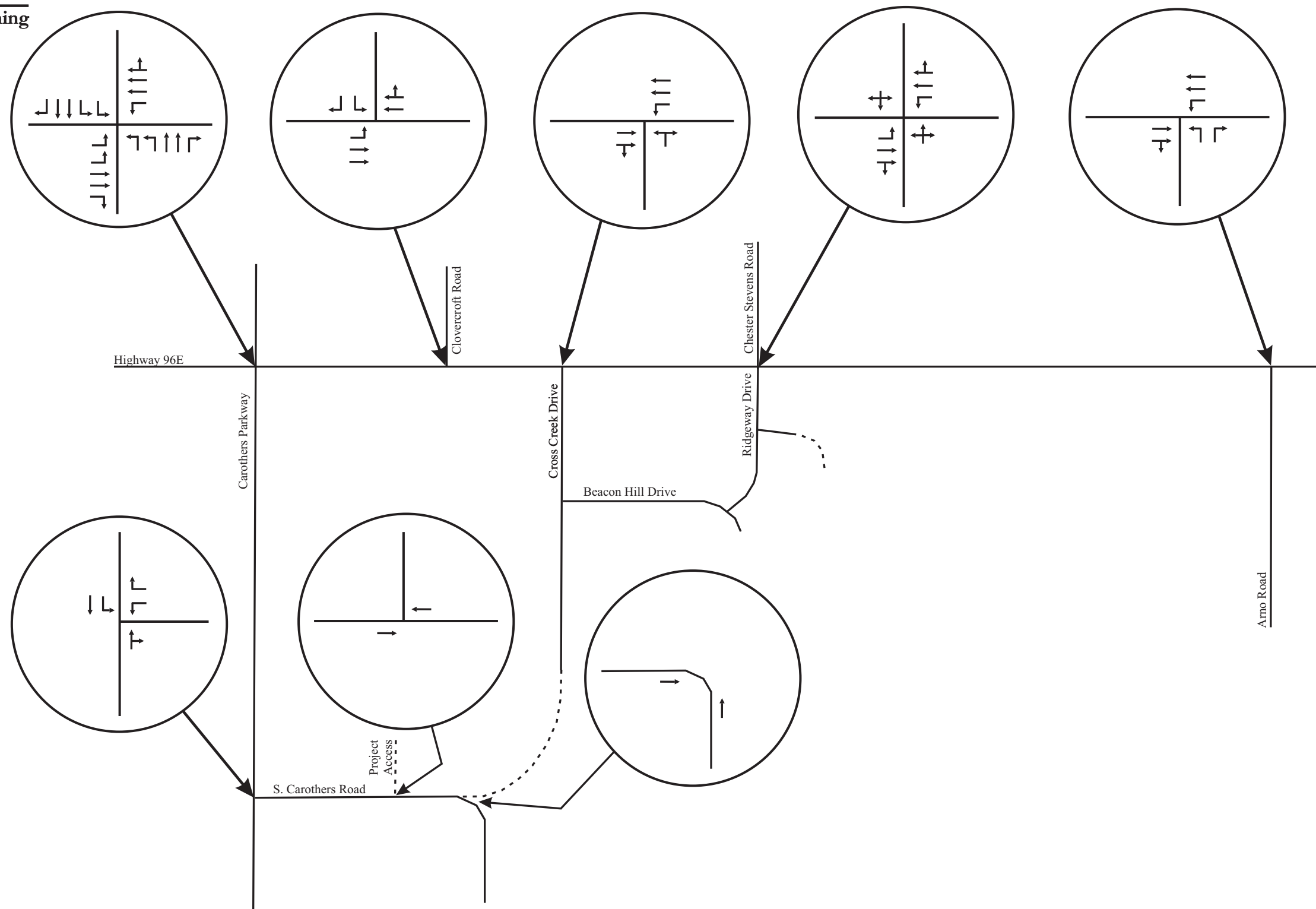
This data was collected during the morning and afternoon peak hours on typical weekdays in March 2015 and February 2016 when schools were in session. The raw traffic volumes are included in [Appendix A](#). The existing laneage at the intersections within the study area is shown in [Figure 3](#), and the existing peak hour traffic volumes are shown in [Figure 4](#).

Using the existing peak hour traffic volumes shown in [Figure 4](#), capacity analyses were conducted for the intersections counted. Specifically, in order to identify current peak hour levels of operation within the study area, the capacity calculations were performed according to the methods outlined in the [Highway Capacity Manual 2010](#) (HCM2010). These analyses result in the determination of a Level of Service (LOS), which is a measure of evaluation is used to describe how well an intersection or roadway operates. LOS A represents free flow traffic operations, and LOS F suggests that the traffic demand exceeds the available capacity. In an urbanized area, LOS D is typically considered to be the minimum acceptable LOS. [Table 1](#) presents the descriptions of LOS for signalized intersections, and [Table 2](#) presents the descriptions of LOS for unsignalized intersections.

The results of the capacity analyses for the existing peak hour traffic volumes are shown in [Table 3](#), and [Appendix B](#) includes the capacity analyses worksheets. These analyses indicate that the existing operations at the signalized intersections within the study area are dominated by the significant westbound through volumes on Highway 96E during the AM peak hour and reciprocal eastbound through volumes during the PM peak hour. For the signalized intersection of Highway 96E and Arno Road, the analyses and field observations indicate that the northbound left turn queue is significantly long during the AM peak hour, and the eastbound through and right turn queues are significantly long during the PM peak hour. Also, it is important to note that the significant eastbound and westbound volumes on Highway 96E, west of Arno Road, are split approximately evenly at the intersection with Arno Road. Specifically, during the AM peak hour, the westbound through volume and the northbound right turn volume are approximately equal. Reciprocally, during the PM peak hour, the eastbound through volume and right turn volume are approximately equal.

At the unsignalized intersections with Cross Creek Drive and Ridgeway Drive / Chester Stevens Road, most of the critical turning movements operate at acceptable LOS during both peak hours. Because of the significant traffic volumes on Highway 96E, the turning movements from the side streets operate at poor LOS, although the northbound and southbound vehicle queues are relatively short.

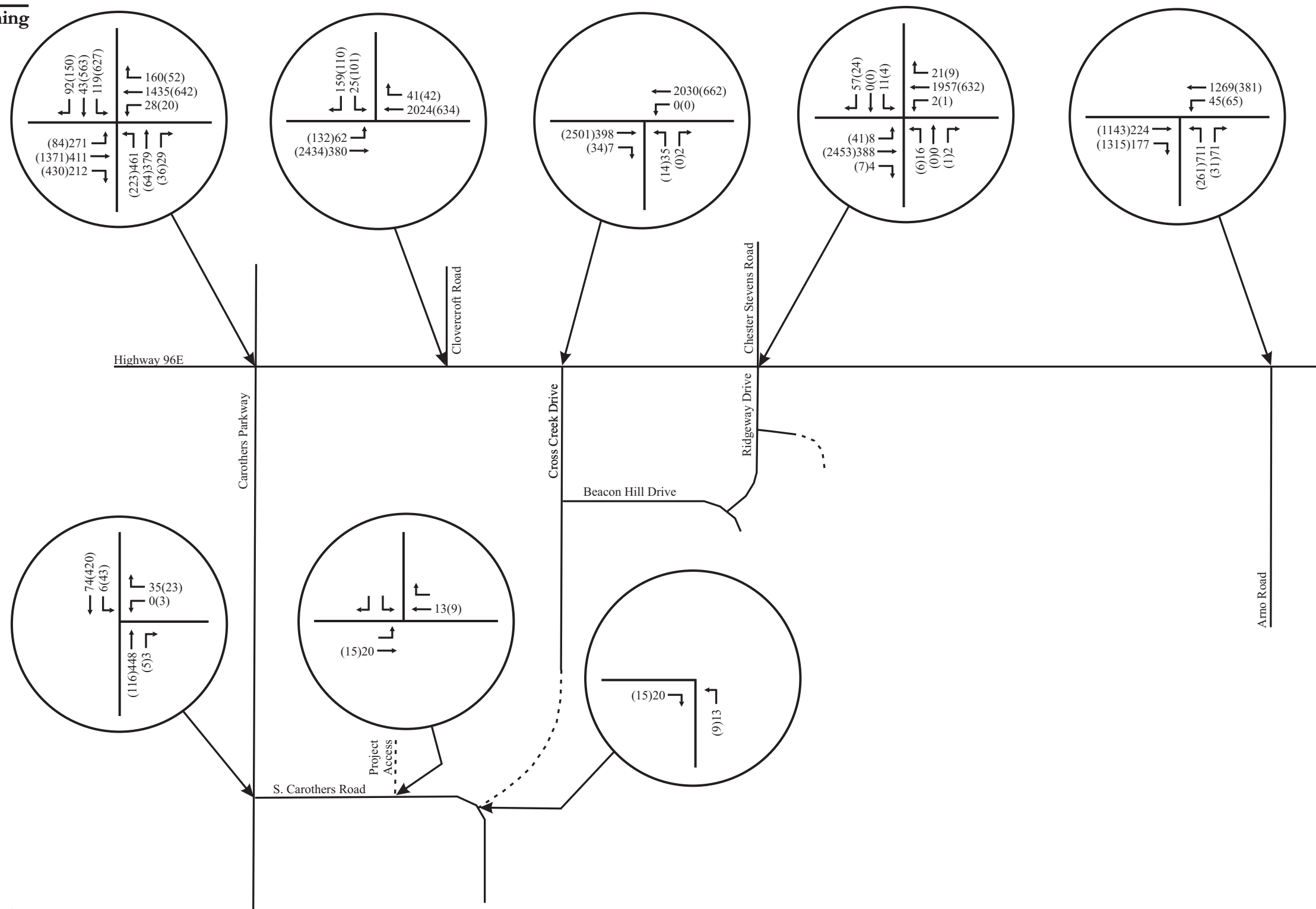
At the unsignalized intersection of Carothers Parkway and S. Carothers Road, all of the critical turning movements operate at acceptable LOS during both peak hours.



No Scale

Figure 3.
Existing Laneage within the Study Area

F i s c h b a c h
Transportation Group, LLC
Traffic Engineering and Planning



No Scale

XX - AM Peak Hour Volumes
 (XX) - PM Peak Hour Volumes

Figure 4.
Existing Peak Hour Traffic Volumes

TABLE 1. DESCRIPTIONS OF LOS FOR SIGNALIZED INTERSECTIONS

Level of Service	Description	Average Control Delay per Vehicle (sec)
A	Operations with very low control delay. Progression is extremely favorable, and most vehicles arrive during the green phase. Most vehicles do not stop at all. Short cycle lengths may also contribute to low delay.	≤ 10
B	Operations with stable flows. This generally occurs with good progression, short cycle lengths, or both. More vehicles stop than for LOS A, causing higher levels of average delay.	> 10 and ≤ 20
C	Operations with stable flow. Occurs with fair progression, longer cycle lengths, or both. Individual cycle failures may begin to appear at this level. The number of vehicles stopping is significant, although many still pass through the intersection without stopping.	> 20 and ≤ 35
D	Approaching unstable flow. The influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths, or high v/c ratios. Many vehicles stop.	> 35 and ≤ 55
E	Unstable flow. In many cases, this is considered to be the limit for acceptable delay. These high delays generally indicate poor progression, long cycle lengths, and high v/c ratios.	> 55 and ≤ 80
F	Unacceptable delay. This condition often occurs with oversaturation or with high v/c ratios. Poor progression and long cycle lengths may also cause such delay levels.	> 80

Source: Highway Capacity Manual 2010 (HCM2010)

TABLE 2. DESCRIPTIONS OF LOS FOR UNSIGNALIZED INTERSECTIONS

Level of Service	Description	Average Control Delay (sec/veh)
A	Minimal delay	≤ 10
B	Brief delay	> 10 and ≤ 15
C	Average delay	> 15 and ≤ 25
D	Significant delay	> 25 and ≤ 35
E	Long delay	> 35 and ≤ 50
F	Extreme delay	> 50

Source: Highway Capacity Manual 2010 (HCM 2010)

TABLE 3. EXISTING PEAK HOUR LEVELS OF SERVICE

INTERSECTION	TURNING MOVEMENT	AM PEAK HOUR		PM PEAK HOUR	
		LEVEL OF SERVICE	95TH %-ILE QUEUE	LEVEL OF SERVICE	95TH %-ILE QUEUE
Highway 96E and Carothers Parkway (signalized)	Eastbound Left Turns	LOS F	111 feet	LOS A	18 feet
	Eastbound Thrus	LOS A	64 feet	LOS C	346 feet
	Eastbound Right Turns	LOS A	28 feet	LOS B	142 feet
	Westbound Left Turns	LOS A	7 feet	LOS A	9 feet
	Westbound Thru/Right Turns	LOS B	267 feet	LOS A	49 feet
	Northbound Left Turns	LOS B	93 feet	LOS B	54 feet
	Northbound Thrus	LOS B	71 feet	LOS B	16 feet
	Northbound Right Turns	LOS A	13 feet	LOS A	15 feet
	Southbound Left Turns	LOS B	27 feet	LOS B	136 feet
	Southbound Thrus	LOS B	12 feet	LOS B	106 feet
	Southbound Right Turns	LOS A	37 feet	LOS A	33 feet
	Overall Intersection	LOS B		LOS B	
Highway 96E and Clovercroft Road (signalized)	Eastbound Left Turns	LOS F	131 feet	LOS A	37 feet
	Eastbound Thrus	LOS A	70 feet	LOS B	1065 feet
	Westbound Thrus/Right Turns	LOS B	650 feet	LOS A	44 feet
	Southbound Left Turn Lane	LOS D	38 feet	LOS D	117 feet
	Southbound Right Turn Lane	LOS D	160 feet	LOS B	49 feet
	Overall Intersection	LOS B		LOS B	

Highway 96E and Cross Creek Drive (unsignalized)	Westbound Left Turn Lane	LOS A	1 veh	LOS D	1 veh
	Northbound Left / Right Turn Lane	LOS D	1 veh	LOS F	2 veh
Highway 96E and Ridgeway Drive / Chester Stevens Drive (unsignalized)	Eastbound Left Turn Lane	LOS C	1 veh	LOS A	1 veh
	Westbound Left Turn Lane	LOS A	1 veh	LOS C	1 veh
	Northbound Lane	LOS D	1 veh	LOS F	1 veh
	Southbound Lane	LOS E	2 veh	LOS B	1 veh
Highway 96E and Arno Road (signalized)	Eastbound Thrus / Right Turns	LOS B	82 feet	LOS C	1020 feet
	Westbound Left Turns	LOS B	43 feet	LOS F	90 veh
	Westbound Thrus	LOS D	575 feet	LOS A	53 veh
	Northbound Left Turns	LOS D	684 feet	LOS E	312 veh
	Northbound Right Turns	LOS A	24 feet	LOS B	26 veh
	Overall Intersection	LOS C		LOS C	
Carothers Parkway and S. Carothers Road (unsignalized)	Southbound Left Turns	LOS A	1 veh	LOS A	1 veh
	Westbound Left Turns	LOS B	1 veh	LOS B	1 veh
	Westbound Right Turns	LOS B	1 veh	LOS A	1 veh

3.2 TRAFFIC SIGNAL WARRANT ANALYSES

For the purposes of this study, traffic signal warrant analyses were conducted for the intersection of Carothers Parkway and S. Carothers Road. For these analyses, hourly turning movement counts were collected at this intersection in August 2016 when schools were in session. The raw traffic volumes are included in [Appendix A](#), and the hourly traffic volumes are shown in [Table 4](#).

The Federal Highway Administration has published the Manual on Uniform Traffic Control Devices (MUTCD 2010), which includes traffic signal warrants that help traffic engineering professionals to identify when a traffic signal installation is justified at a particular location. The warrants include minimum conditions that are compared to existing or projected traffic conditions, and typically, traffic signals should not be installed unless at least one of the MUTCD warrants, as described in [Appendix C](#), is met.

The Manual on Uniform Traffic Control Devices (MUTCD 2010) stipulates that the signal warrant thresholds may be reduced by 30% "...if the posted or statutory speed limit or the 85th percentile speed on the major street exceeds 40 mph..." Since a 40 mph speed limit is currently posted on Carothers Parkway, full traffic signal warrant thresholds were considered appropriate for the intersection of Carothers Parkway and S. Carothers Road.

The hourly traffic volumes at the intersection of Carothers Parkway and S. Carothers Road were compared to the full signal warrant thresholds, and the results of these analyses are included in [Table 4](#). These results indicate that the existing traffic volumes do not satisfy any of the volume-related traffic signal warrants.

TABLE 4. TRAFFIC SIGNAL WARRANT ANALYSIS

HOUR	TOTAL VEHICLES BOTH DIRECTIONS OF CAROTHERS PARKWAY	WESTBOUND VEHICLES ON S. CAROTHERS ROAD	SATISFY FULL WARRANTS?		
			Warrant 1 Condition A	Warrant 1 Condition B	Warrant 2
6:00 - 7:00 AM	233	25	---	---	---
7:00 - 8:00 AM	588	41	---	---	---
8:00 - 9:00 AM	552	38	---	---	---
9:00 - 10:00 AM	299	20	---	---	---
10:00 - 11:00 AM	305	20	---	---	---
11:00 - 12:00 N	355	22	---	---	---
12:00 - 1:00 PM	348	30	---	---	---
1:00 - 2:00 PM	334	12	---	---	---
2:00 - 3:00 PM	335	19	---	---	---
3:00 - 4:00 PM	338	18	---	---	---
4:00 - 5:00 PM	496	31	---	---	---
5:00 - 6:00 PM	621	14	---	---	---
6:00 - 7:00 PM	430	23	---	---	---

4. PROJECTION OF BACKGROUND TRAFFIC VOLUMES

In order to account for the traffic growth which will occur within the study area because of typical growth, as well as other approved developments, background traffic volumes were established for the intersections within the study area.

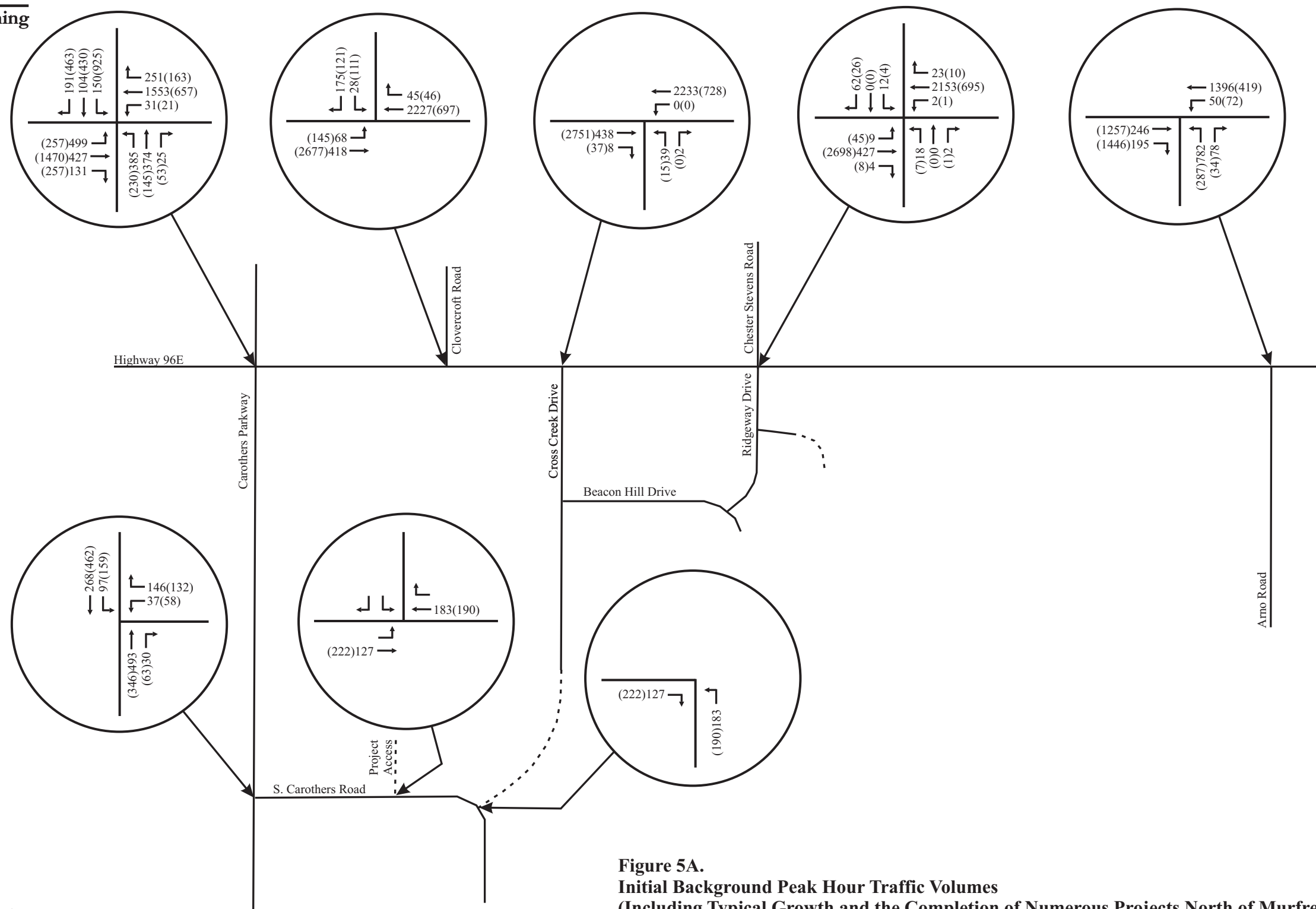
Specifically, in order to account for typical growth within the study area, consideration was given to the historical traffic volumes near the project site. The Tennessee Department of Transportation (TDOT) conducts an annual count program throughout the state. This count program includes the annual collection of average daily traffic (ADT) counts at numerous fixed locations. As shown in [Table 5](#), the daily traffic volumes within the study area have increased marginally since 2004. Based on this information, for the purposes of this study, the existing traffic volumes at the following intersections were increased by 10% to represent initial background traffic volumes, as shown in [Figure 5A](#):

1. Highway 96E and Cross Creek Drive
2. Highway 96E and Ridgeway Drive / Chester Stevens Drive
3. Carothers Parkway and S. Carothers Road

TABLE 5. HISTORICAL TRAFFIC VOLUMES IN THE STUDY AREA

Year	Station 40 Highway 96E ADT	Annual Growth	Overall Growth
2007	19,283		
2008	21,519	11.60%	
2009	19,501	-9.38%	
2010	22,312	14.41%	
2011	23,459	5.14%	
2012	23,343	-0.49%	
2013	23,968	2.68%	4.05%
Year	Station 41 Clovercroft Rd ADT	Annual Growth	Overall Growth
2007	2,570		
2008	2,862	11.36%	
2009	2,554	-10.76%	
2010	2,891	13.19%	
2011	3,092	6.95%	
2012	3,155	2.04%	
2013	3,151	-0.13%	3.77%

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No Scale

XX - AM Peak Hour Volumes
 (XX) - PM Peak Hour Volumes

Figure 5A.
Initial Background Peak Hour Traffic Volumes
(Including Typical Growth and the Completion of Numerous Projects North of Murfreesboro Road,
as well as Nichols Bend/Lockwood Glen and Simmon's Ridge, south of Murfreesboro Road)

Also, it is important to note that background traffic volumes for the intersection of Highway 96E and Carothers Parkway were identified from the Traffic Impact Study that was prepared for the Carothers Crossing project in November 2015 by Fischbach Transportation Group (FTG, LLC). Similarly, background traffic volumes for the intersection of Carothers Parkway and S. Carothers Road were identified from the Traffic Impact Study that was prepared for the Simmons Ridge project in July 2012 by Fischbach Transportation Group (FTG, LLC). These traffic volumes are shown in [Figure 5A](#).

In addition, it is important to note that the following other projects are under construction within the study area:

1. Echelon Residential Development, located on the east side of Carothers Parkway, south of S. Carothers Road
2. Water's Edge Residential Development, located on the west side of Carothers Parkway, south of S. Carothers Road
3. October Woods Residential Development, located on the south side of Highway 96E and the west side of Ridgeway Drive
4. Silver Grace Assisted Living Facility, which is located on the north side of Highway 96E, east of Chester Stevens Road.

[Figures 5B, 5C, 5D, and 5E](#) include the peak hour traffic volumes that are expected to be generated by these other residential projects. Information about these other projects is included in [Appendix D](#).

The peak hour traffic volumes shown in [Figures 5B, 5C, 5D, and 5E](#) were added to the traffic volumes shown in [Figure 5A](#) in order to establish the final background traffic volumes shown in [Figure 5F](#). Using the final background peak hour traffic volumes, capacity analyses were conducted for the intersections within the study area. For these analyses, it was assumed that all existing laneage and traffic control will be maintained and no improvements will be provided.

The results of the capacity analyses for the background peak hour traffic volumes are shown in [Table 6](#), and [Appendix B](#) includes the capacity analyses worksheets. These analyses indicate that decreased levels of service are expected at the signalized intersections within the study area. However, the dominant traffic patterns are expected to remain consistent with the existing conditions within the study area.

At the unsignalized intersection of Carothers Parkway and S. Carothers Road, the westbound left and right turns are expected to operate at poor LOS and with moderate vehicle queues during both peak hours.

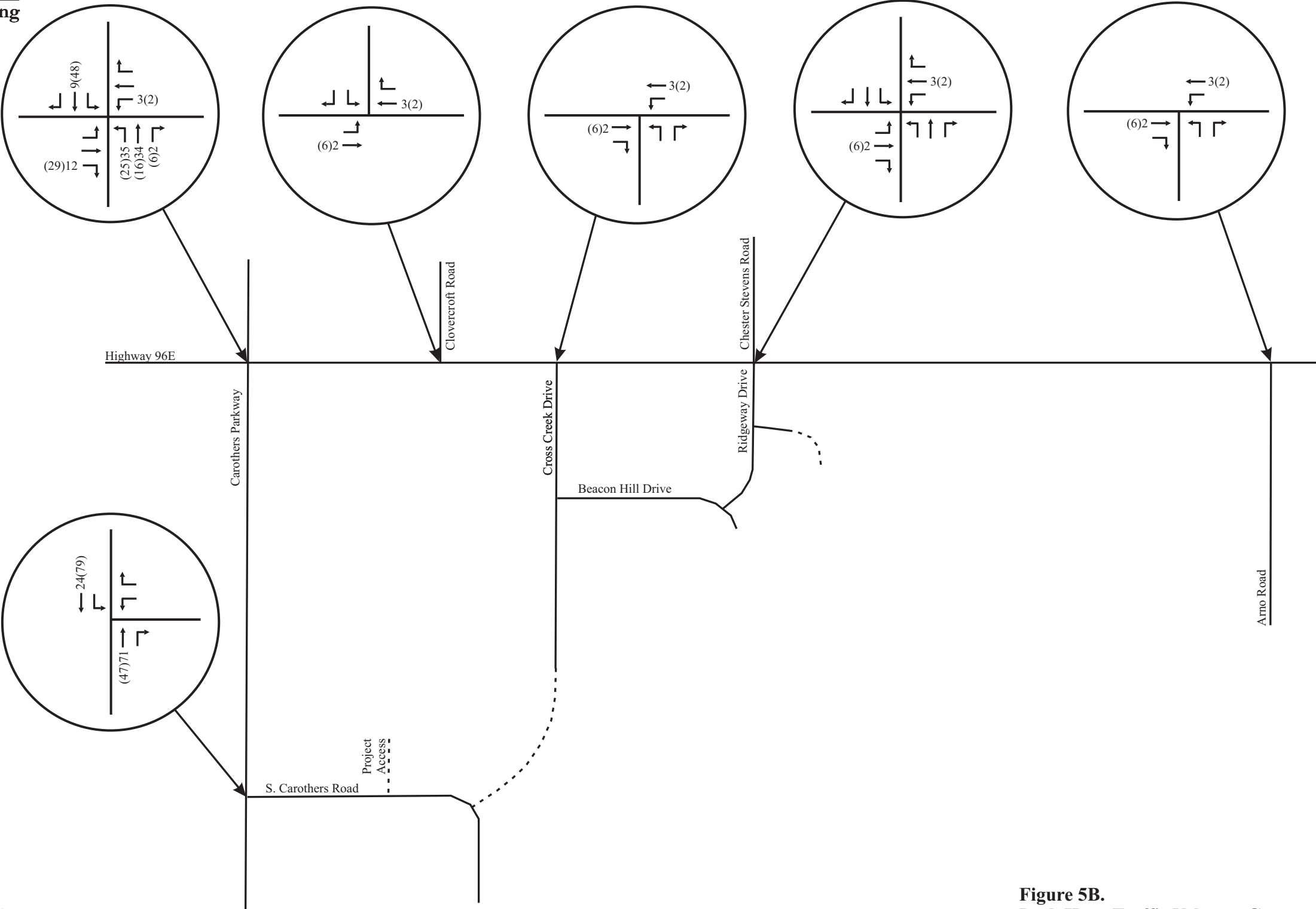
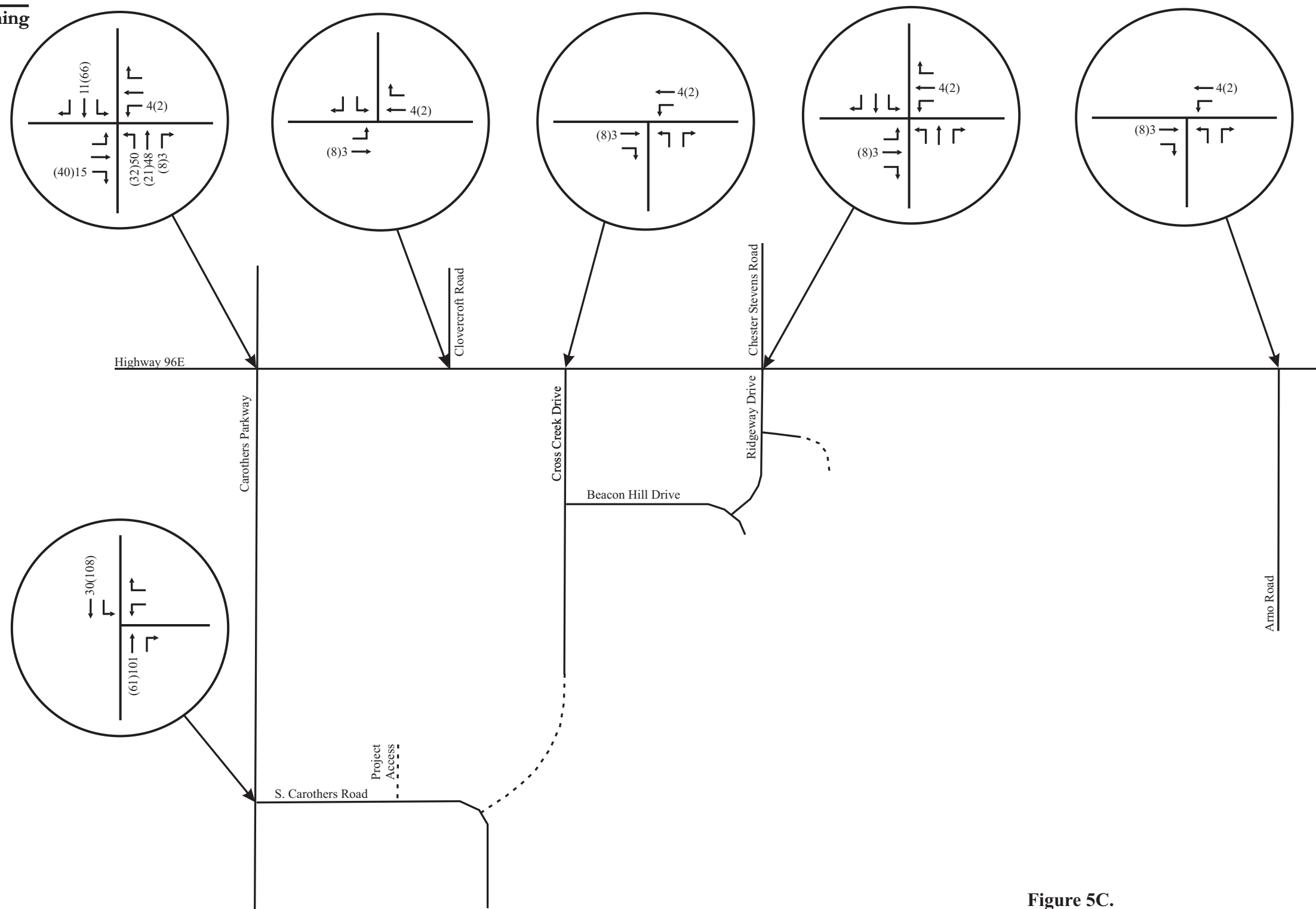


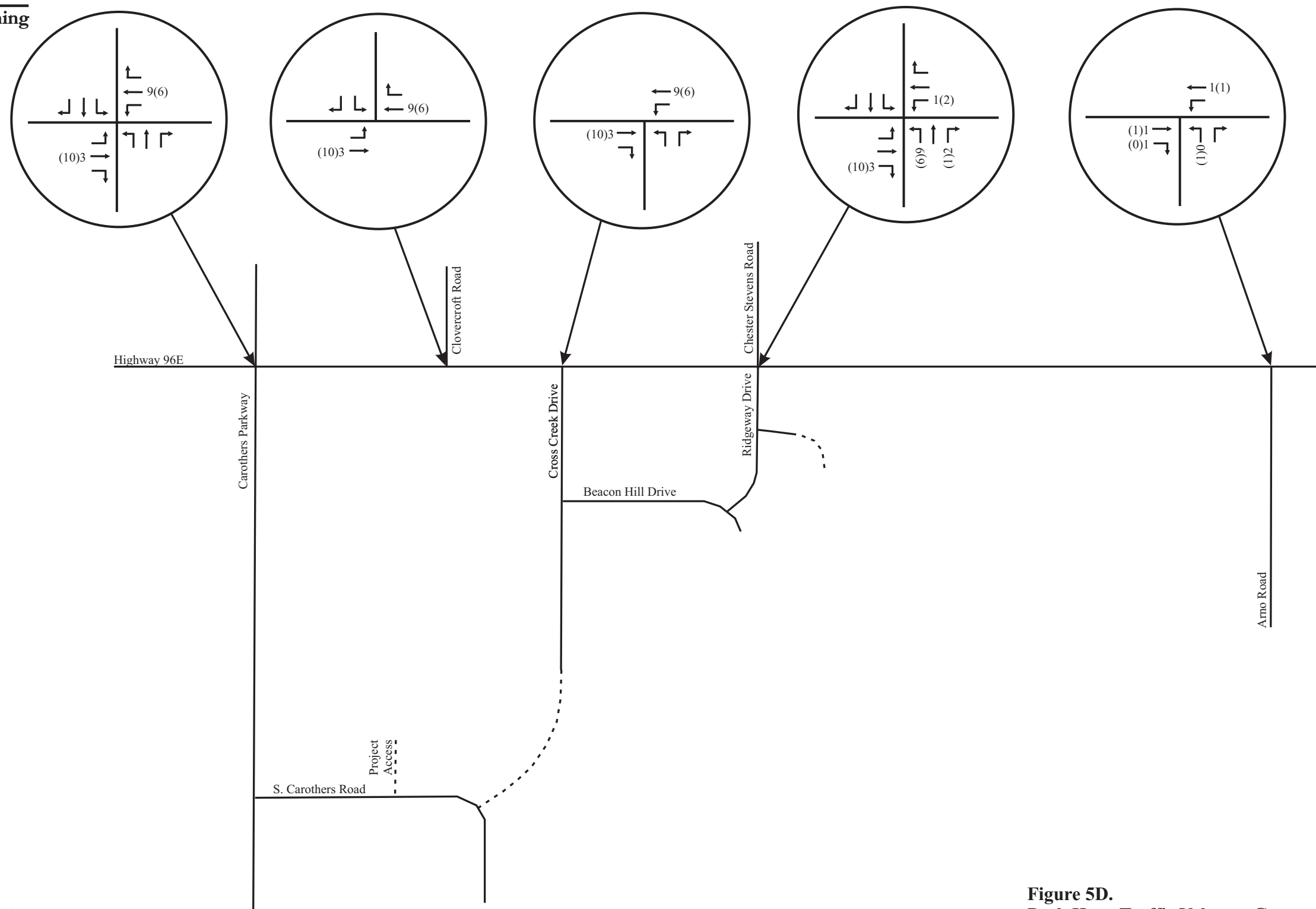
Figure 5B.
 Peak Hour Traffic Volumes Generated by the
 Echelon Residential Development



No Scale

XX - AM Peak Hour Volumes
 (XX) - PM Peak Hour Volumes

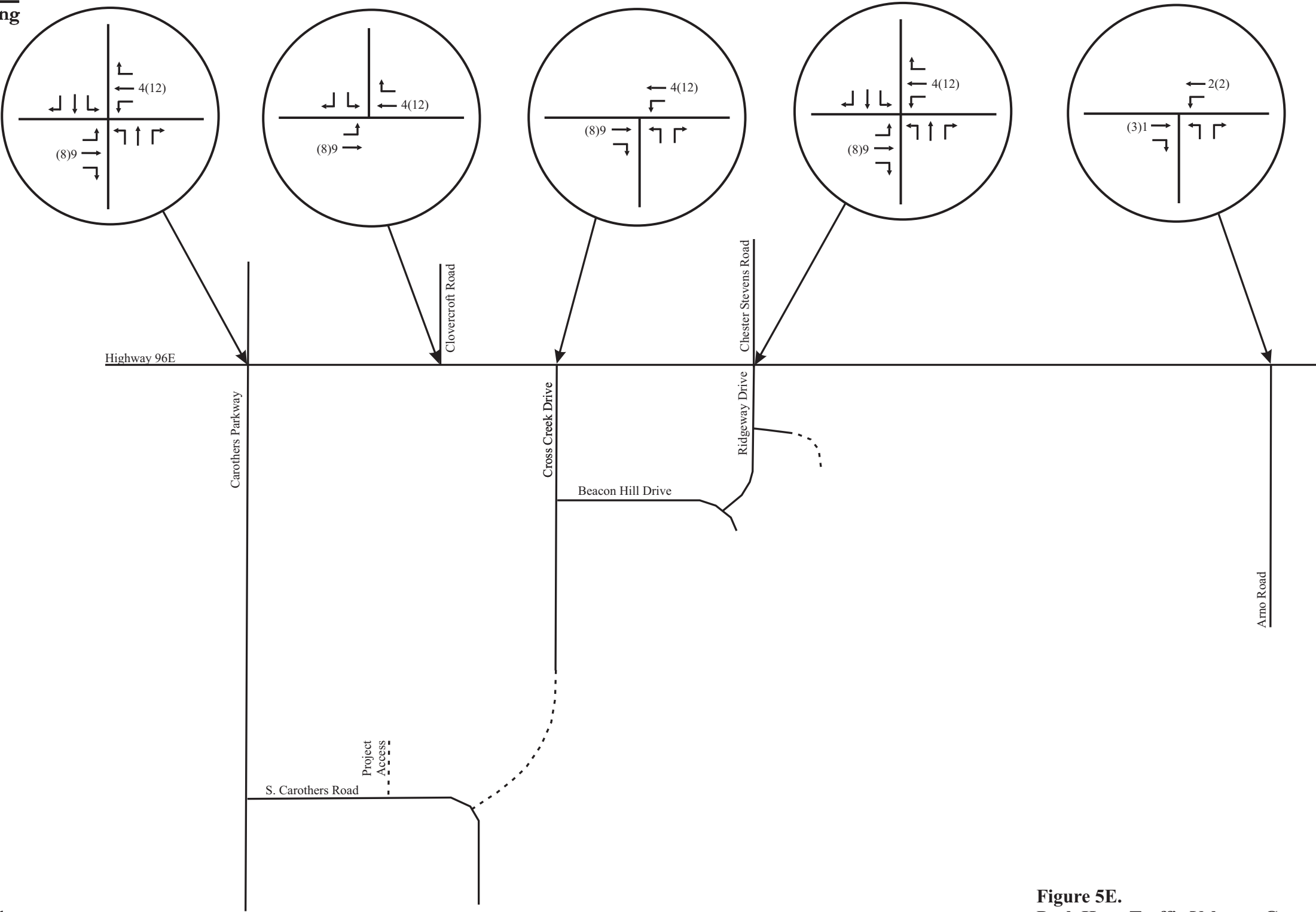
Figure 5C.
Peak Hour Traffic Volumes Generated by the
Water's Edge Residential Development



No Scale

XX - AM Peak Hour Volumes
(XX) - PM Peak Hour Volumes

Figure 5D.
Peak Hour Traffic Volumes Generated by the
October Woods Residential Development



No Scale

XX - AM Peak Hour Volumes
(XX) - PM Peak Hour Volumes

Figure 5E.
Peak Hour Traffic Volumes Generated by the
Silver Grace Assisted Living Development

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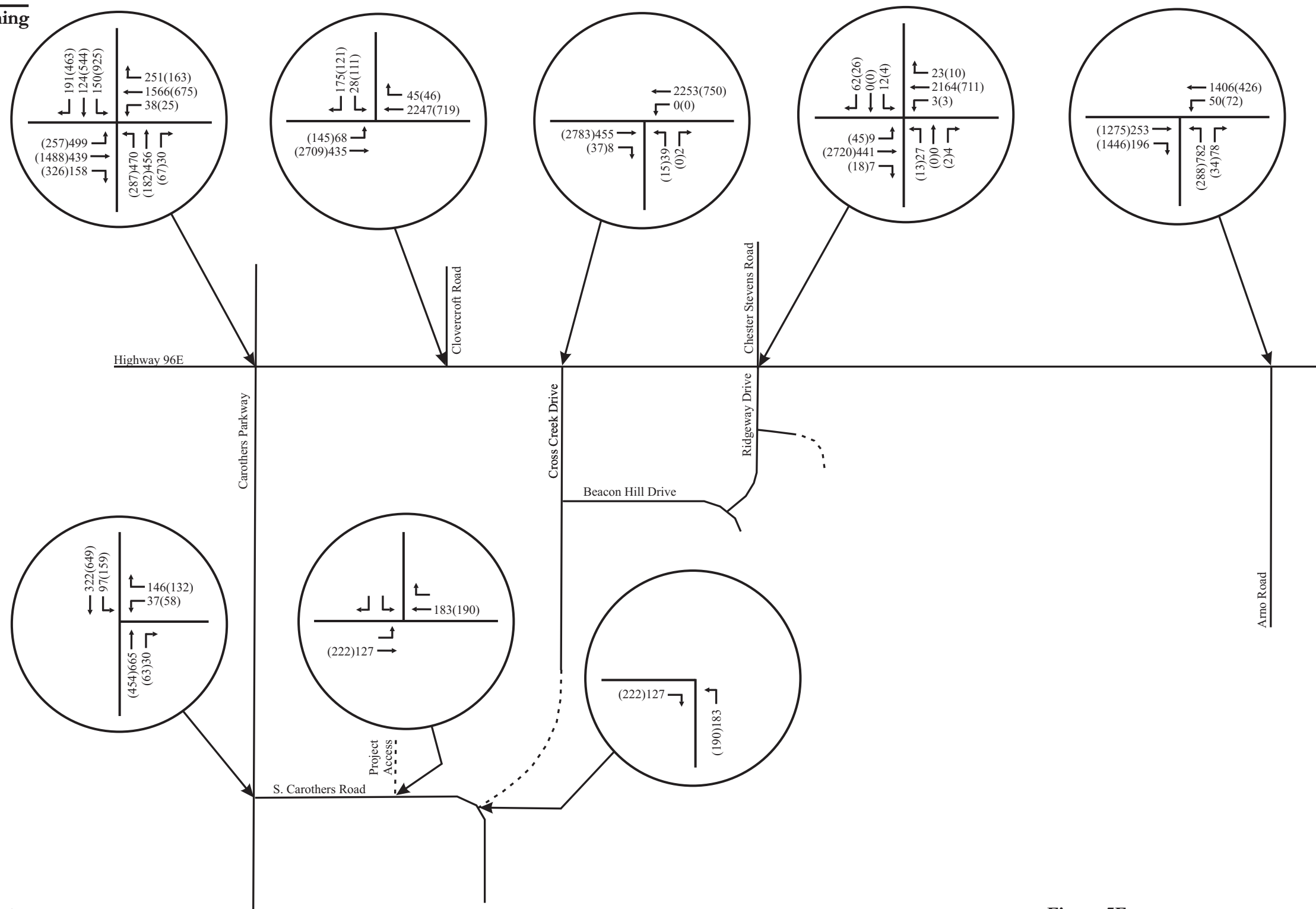


Figure 5F.
Final Background Peak Hour Traffic Volumes

TABLE 6. BACKGROUND PEAK HOUR LEVELS OF SERVICE

INTERSECTION	TURNING MOVEMENT	AM PEAK HOUR		PM PEAK HOUR	
		LEVEL OF SERVICE	95 TH %-ILE QUEUE	LEVEL OF SERVICE	95 TH %-ILE QUEUE
Highway 96E and Carothers Parkway (signalized)	Eastbound Left Turns	LOS F	187 feet	LOS C	129 feet
	Eastbound Thrus	LOS B	68 feet	LOS D	745 feet
	Eastbound Right Turns	LOS A	26 feet	LOS A	137 feet
	Westbound Left Turns	LOS A	9 feet	LOS C	30 feet
	Westbound Thru/Right Turns	LOS C	229 feet	LOS B	80 feet
	Northbound Left Turns	LOS B	83 feet	LOS C	126 feet
	Northbound Thrus	LOS B	72 feet	LOS B	65 feet
	Northbound Right Turns	LOS A	11 feet	LOS B	51 feet
	Southbound Left Turns	LOS B	29 feet	LOS E	506 feet
	Southbound Thrus	LOS A	22 feet	LOS C	186 feet
	Southbound Right Turns	LOS A	64 feet	LOS C	313 feet
	Overall Intersection	LOS D		LOS C	
Highway 96E and Clovercroft Road (signalized)	Eastbound Left Turns	LOS F	132 feet	LOS A	27 feet
	Eastbound Thrus	LOS A	34 feet	LOS C	1303 feet
	Westbound Thrus/Right Turns	LOS B	811 feet	LOS A	50 feet
	Southbound Left Turn Lane	LOS C	37 feet	LOS E	137 feet
	Southbound Right Turn Lane	LOS D	161 feet	LOS B	53 feet
	Overall Intersection	LOS B		LOS C	

Highway 96E and Cross Creek Drive (unsignalized)	Westbound Left Turn Lane	LOS A	1 veh	LOS D	1 veh
	Northbound Left / Right Turn Lane	LOS D	1 veh	LOS F	2 veh
Highway 96E and Ridgeway Drive / Chester Stevens Drive (unsignalized)	Eastbound Left Turn Lane	LOS C	1 veh	LOS A	1 veh
	Westbound Left Turn Lane	LOS A	1 veh	LOS D	1 veh
	Northbound Lane	LOS E	1 veh	LOS F	2 veh
	Southbound Lane	LOS F	3 veh	LOS C	1 veh
Highway 96E and Arno Road (signalized)	Eastbound Thrus / Right Turns	LOS B	101 feet	LOS E	1137 veh
	Westbound Left Turns	LOS B	44 feet	LOS F	118 veh
	Westbound Thrus	LOS E	629 feet	LOS A	56 veh
	Northbound Left Turns	LOS E	732 feet	LOS F	416 veh
	Northbound Right Turns	LOS A	23 feet	LOS B	29 veh
	Overall Intersection	LOS D		LOS E	
Carothers Parkway and S. Carothers Road (unsignalized)	Southbound Left Turns	LOS A	1 veh	LOS A	1 veh
	Westbound Left Turns	LOS E	1 veh	LOS F	3 veh
	Westbound Right Turns	LOS C	2 veh	LOS B	1 veh

5. IMPACTS OF PROPOSED DEVELOPMENT

5.1 TRIP GENERATION

Trip generation calculations were conducted in order to identify how much traffic will be generated by the proposed project. Trip generation data for daily and peak hour trips were identified from Trip Generation, Ninth Edition, which was published by the Institute of Transportation Engineers (ITE) in 2012. [Table 7](#) presents the daily and peak hour trip generations for the proposed homes, and these calculations are included in [Appendix E](#).

TABLE 7. TRIP GENERATION

LAND USE	SIZE	DAILY TRAFFIC	GENERATED TRAFFIC			
			AM PEAK HOUR		PM PEAK HOUR	
			ENTER	EXIT	ENTER	EXIT
Single-Family (LUC 210) Northern Portion	70 homes	756	15	44	48	28
Single-Family (LUC 210) Southern Portion	306 homes	2,938	56	168	181	106
TOTAL	376 homes	3,694	71	212	229	134

5.2 TRIP DISTRIBUTION AND TRAFFIC ASSIGNMENT

For the purposes of this study, it was estimated that the trips generated by the proposed project will access the project site according to the directional distributions shown in [Figures 6A and 6B](#). The development of these distributions was based on the following factors:

- existing land use characteristics,
- the directions of approach of the existing traffic,
- the access proposed for the project, and
- the locations of population centers in the area.

The peak hour trip generations and directional distributions were used to add the site-generated trips to the roadway system. [Figures 7A and 7B](#) include the peak hour traffic volumes that are expected to be generated by the proposed project.

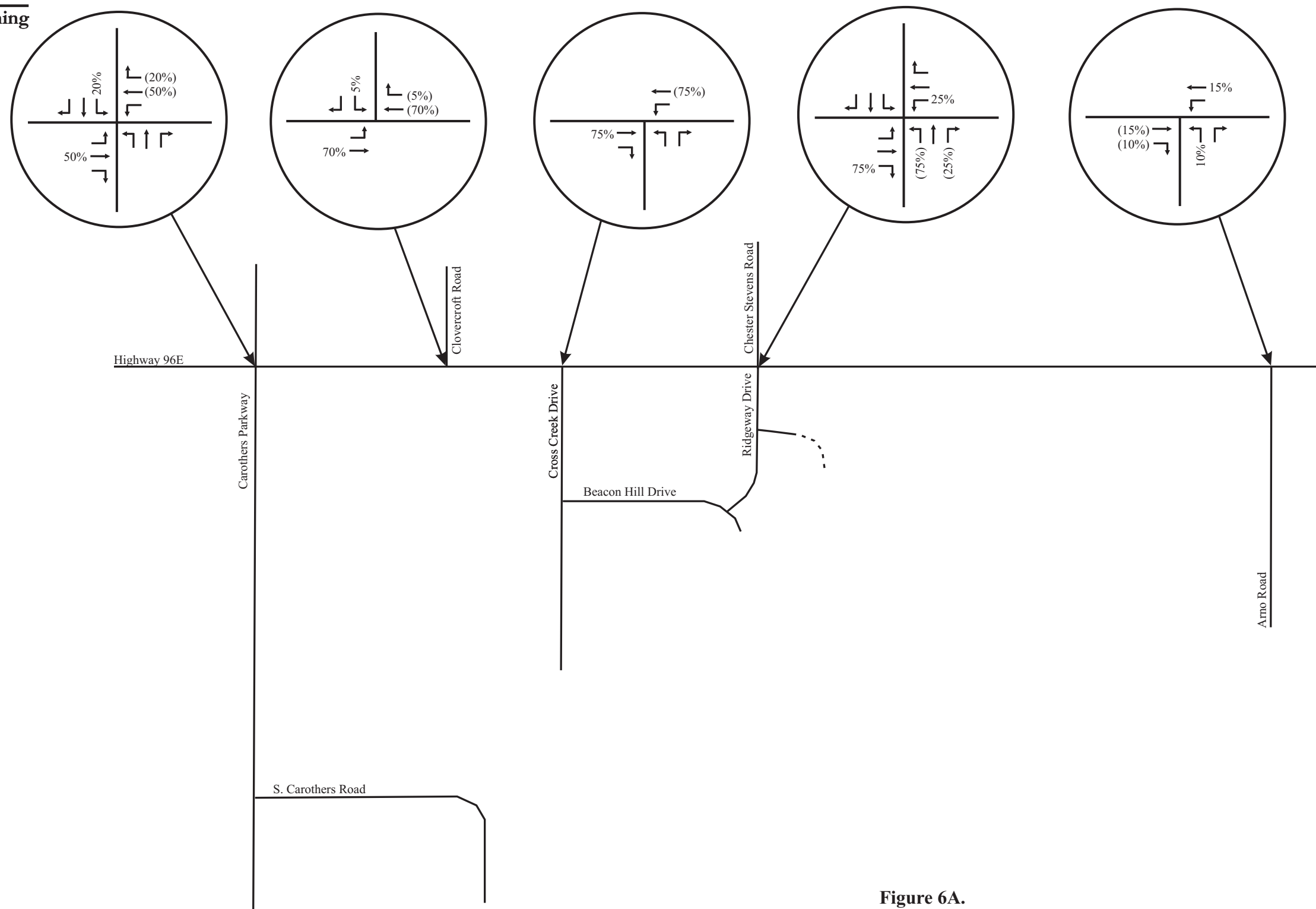


Figure 6A.
Directional Distribution of Peak Hour Traffic Volumes Generated
by the NORTHERN Portion of the Proposed Residential Project



No Scale

XX - Entering Volumes
(XX) - Exiting Volumes



No Scale

XX - Entering Volumes
(XX) - Exiting Volumes

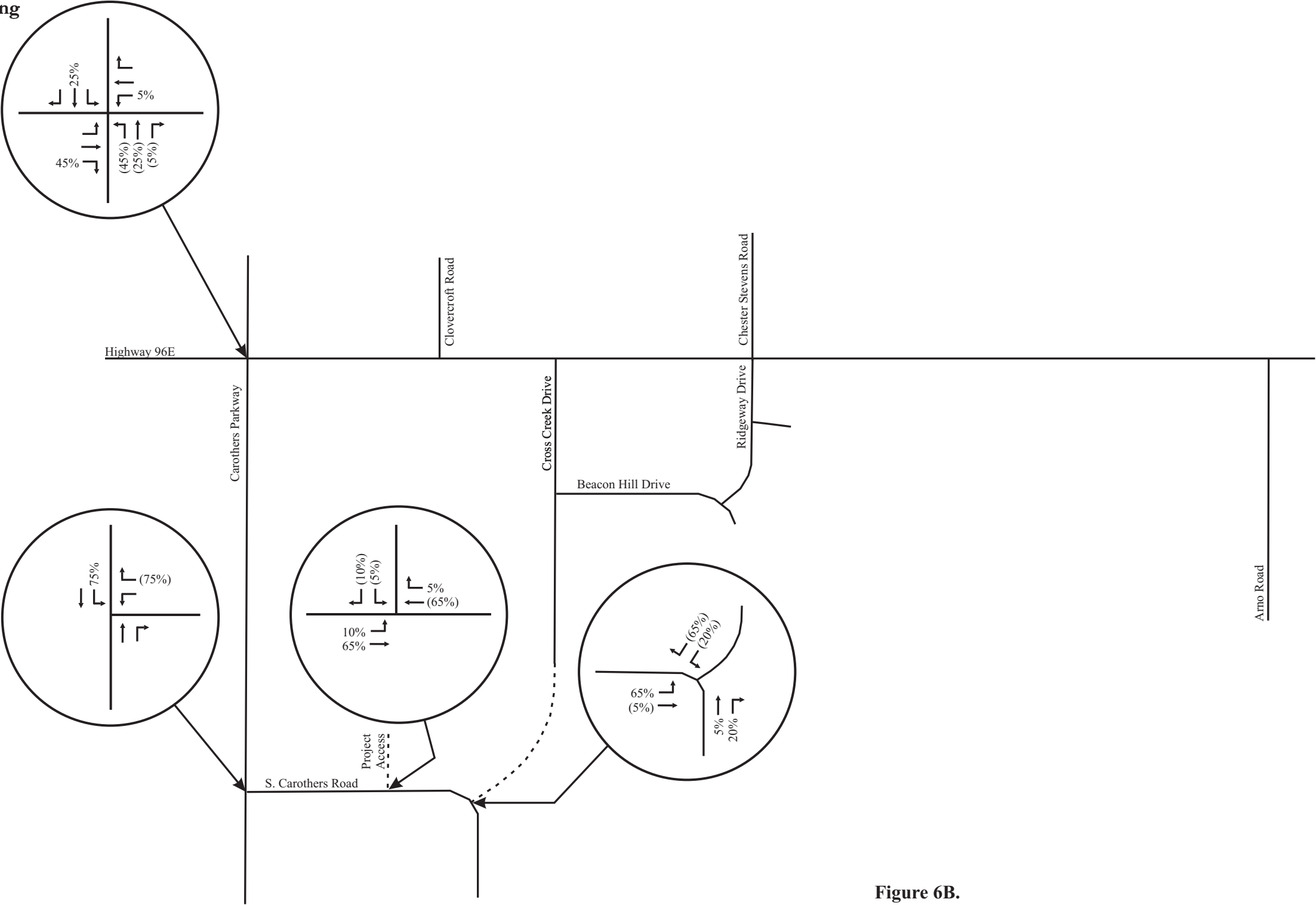
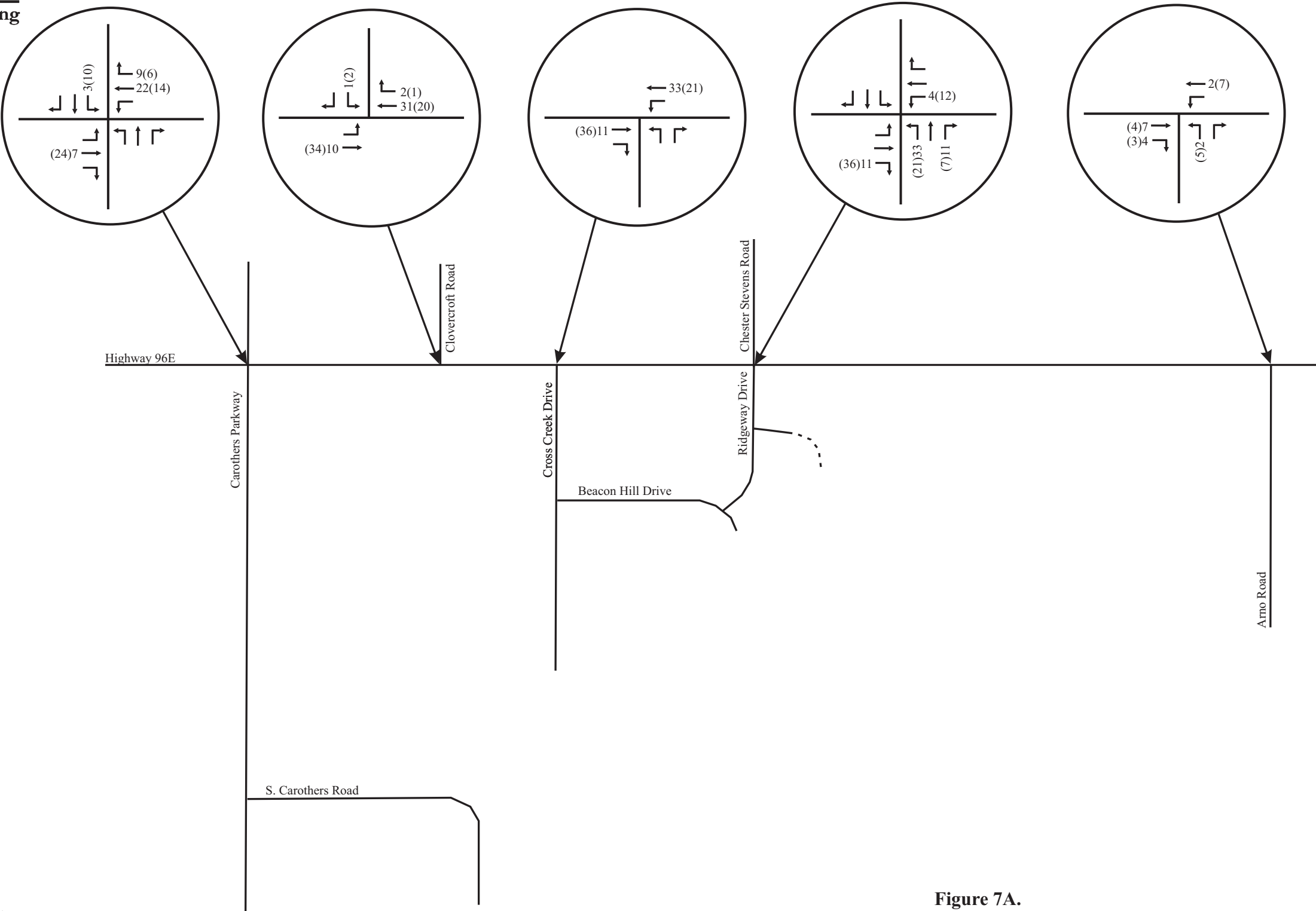


Figure 6B.
Directional Distribution of Peak Hour Traffic Volumes Generated
by the SOUTHERN Portion of the Proposed Residential Project

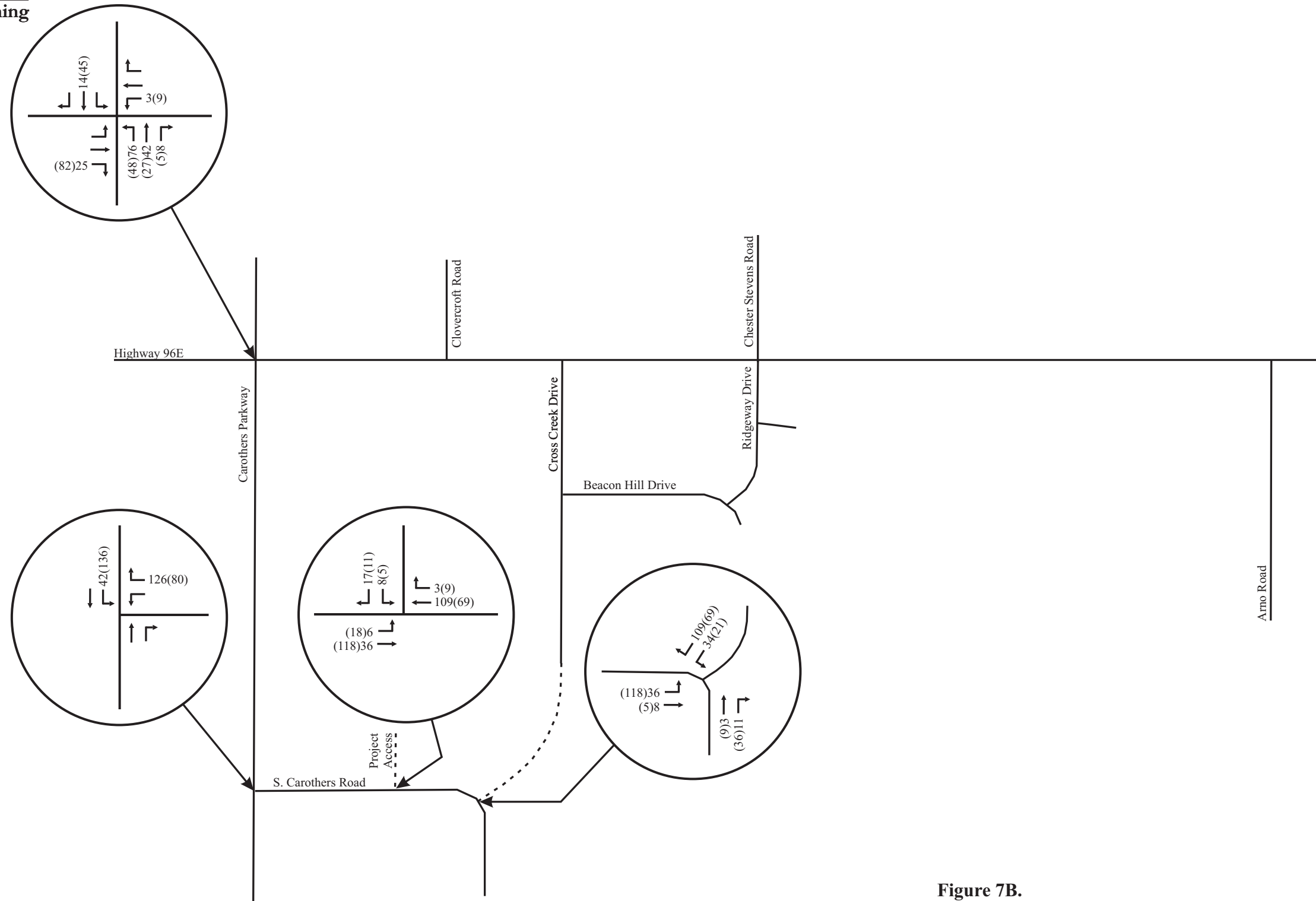


No Scale

XX - AM Peak Hour Volumes
(XX) - PM Peak Hour Volumes

Figure 7A.
 Peak Hour Traffic Volumes Generated by the
 NORTHERN Portion of the Proposed Residential Project

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No Scale

XX - AM Peak Hour Volumes
(XX) - PM Peak Hour Volumes

Figure 7B.
Peak Hour Traffic Volumes Generated by the
SOUTHERN Portion of the Proposed Residential Project

5.3 CAPACITY ANALYSES

In order to identify the projected peak hour traffic volumes at the completion of the proposed project, the trips generated by the project were added to the background peak hour traffic volumes. The resulting peak hour volumes are shown in [Figure 8](#).

Using the total projected peak hour traffic volumes, capacity analyses were conducted in order to determine the impact of the project on the roadway system. Specifically, these capacity analyses were used to evaluate the need for roadway and traffic control improvements within the study area. For these analyses, the following assumptions were made:

- All existing laneage and traffic control will be maintained and no improvements will be provided.
- Stanford Drive will be extended as a two-lane local roadway.
- Each of the project accesses on S. Carothers Road will be constructed to include one entering lane and one exiting lane.

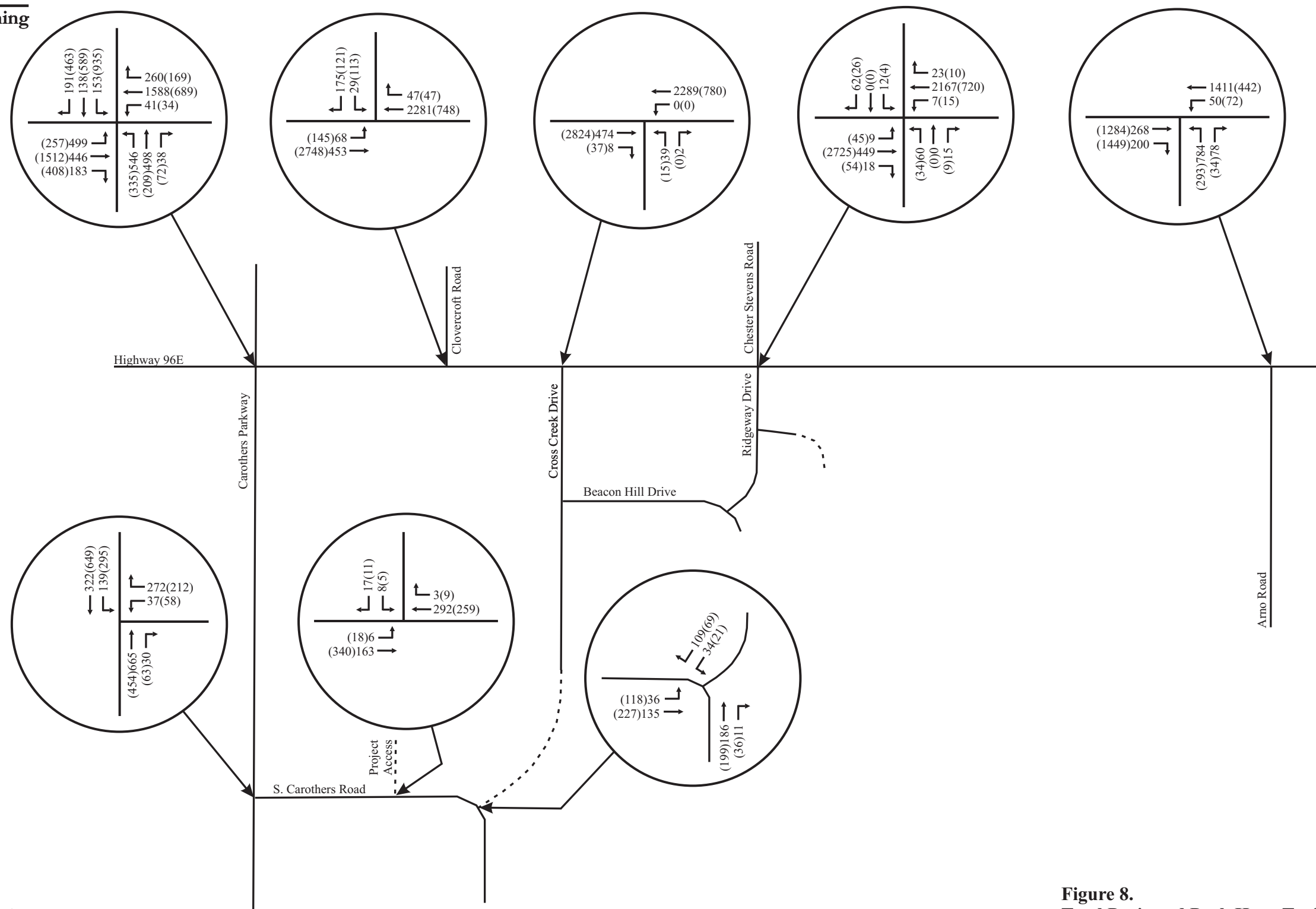
The results of the capacity analyses for the total projected peak hour traffic volumes are shown in [Table 8](#), and [Appendix B](#) includes the capacity analyses worksheets. These analyses indicate that the total projected conditions with full build-out of the project are consistent with the background conditions within the study area. Also, these analyses indicate that all of the critical turning movements at the intersections of S. Carothers Road and the project accesses will operate acceptably during both peak hours.

Further analyses were conducted to determine the need for the following dedicated turn lanes within the study area:

- A dedicated left turn lane on S. Carothers Road at the eastern (main) project access.
- A dedicated right turn lane on S. Carothers Road at the eastern (main) project access.
- A dedicated northbound right turn lane on Carothers Parkway at S. Carothers Road.
- A dedicated eastbound right turn lane on Highway 96E at Ridgeway Drive.

These analyses were based on the method outlined in *NCHRP Report 457: Engineering Study Guide for Evaluating Intersection Improvements*. The relevant charts are included in [Appendix F](#). The results of these analyses indicate that a dedicated right turn lane is not warranted for construction on S. Carothers Road at the eastern (main) project access. However, the other three dedicated turn lanes are warranted.

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Traffic Engineering and Planning



No Scale

XX - AM Peak Hour Volumes
 (XX) - PM Peak Hour Volumes

Figure 8.
Total Projected Peak Hour Traffic Volumes
at the Completion of the Proposed Project

TABLE 8. PROJECTED PEAK HOUR LEVELS OF SERVICE

INTERSECTION	TURNING MOVEMENT	AM PEAK HOUR		PM PEAK HOUR	
		LEVEL OF SERVICE	95 TH %-ILE QUEUE	LEVEL OF SERVICE	95 TH %-ILE QUEUE
Highway 96E and Carothers Parkway (signalized)	Eastbound Left Turns	LOS F	187 feet	LOS D	168 feet
	Eastbound Thrus	LOS B	70 feet	LOS E	980 feet
	Eastbound Right Turns	LOS A	27 feet	LOS B	278 feet
	Westbound Left Turns	LOS A	10 feet	LOS F	108 feet
	Westbound Thru/Right Turns	LOS C	234 feet	LOS B	156 feet
	Northbound Left Turns	LOS B	100 feet	LOS D	209 feet
	Northbound Thrus	LOS B	78 feet	LOS C	94 feet
	Northbound Right Turns	LOS A	12 feet	LOS C	70 feet
	Southbound Left Turns	LOS B	30 feet	LOS E	681 feet
	Southbound Thrus	LOS A	24 feet	LOS C	267 feet
	Southbound Right Turns	LOS A	64 feet	LOS C	397 feet
	Overall Intersection	LOS D		LOS D	
Highway 96E and Clovercroft Road (signalized)	Eastbound Left Turns	LOS F	131 feet	LOS A	28 feet
	Eastbound Thrus	LOS A	35 feet	LOS C	1681 feet
	Westbound Thrus/Right Turns	LOS B	823 feet	LOS A	55 feet
	Southbound Left Turn Lane	LOS C	39 feet	LOS F	187 feet
	Southbound Right Turn Lane	LOS D	163 feet	LOS B	65 feet
	Overall Intersection	LOS B		LOS B	

Highway 96E and Cross Creek Drive (unsignalized)	Westbound Left Turn Lane	LOS A	0 veh	LOS D	0 veh
	Northbound Left / Right Turn Lane	LOS E	1 veh	LOS F	2 veh
Highway 96E and Ridgeway Drive / Chester Stevens Drive (unsignalized)	Eastbound Left Turn Lane	LOS C	1 veh	LOS A	1 veh
	Westbound Left Turn Lane	LOS A	1 veh	LOS D	1 veh
	Northbound Lane	LOS F	3 veh	LOS F	6 veh
	Southbound Lane	LOS F	3 veh	LOS C	1 veh
Highway 96E and Arno Road (signalized)	Eastbound Thrus / Right Turns	LOS B	102 feet	LOS E	1671 veh
	Westbound Left Turns	LOS B	44 feet	LOS F	173 veh
	Westbound Thrus	LOS E	631 feet	LOS A	74 veh
	Northbound Left Turns	LOS E	735 feet	LOS F	539 veh
	Northbound Right Turns	LOS A	24 feet	LOS B	34 veh
	Overall Intersection	LOS D		LOS E	
Carothers Parkway and S. Carothers Road (unsignalized)	Southbound Left Turns	LOS B	1 veh	LOS B	1 veh
	Westbound Left Turns	LOS F	1 veh	LOS F	6 veh
	Westbound Right Turns	LOS E	7 veh	LOS C	2 veh
S. Carothers Road and Western Project Access (unsignalized)	Eastbound Left Turns/Thrus	LOS A	1 veh	LOS A	1 veh
	Southbound Left and Right Turns	LOS B	1 veh	LOS B	1 veh
S. Carothers Road and Eastern Project Access (unsignalized)	Eastbound/Southbound Left Turns/Thrus	LOS A	1 veh	LOS A	1 veh
	Southbound/Westbound Left and Right Turns	LOS B	1 veh	LOS B	1 veh
S. Carothers Road and Eastern Project Access (unsignalized) FUTURE	Eastbound/Southbound Left Turns/Thrus	LOS A	1 veh	LOS A	1 veh
	Southbound/Westbound	LOS B	1 veh	LOS C	1 veh

	Left and Right Turns				
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5.4 FUTURE GROWTH ON S. CAROTHERS ROAD

This eastern (main) project access could be constructed by reconstructing the existing 90-degree curve as a conventional three-legged or four-legged intersection. Alternatively, the free-flowing nature of the traffic on S. Carothers Road could be preserved, and the project access could be constructed at the apex of the horizontal curve. Based on comments provided by the City of Franklin Engineering Department, the developer of the proposed project plans to preserve the free-flowing nature of the traffic on S. Carothers Road and construct the project access at the apex of the horizontal curve.

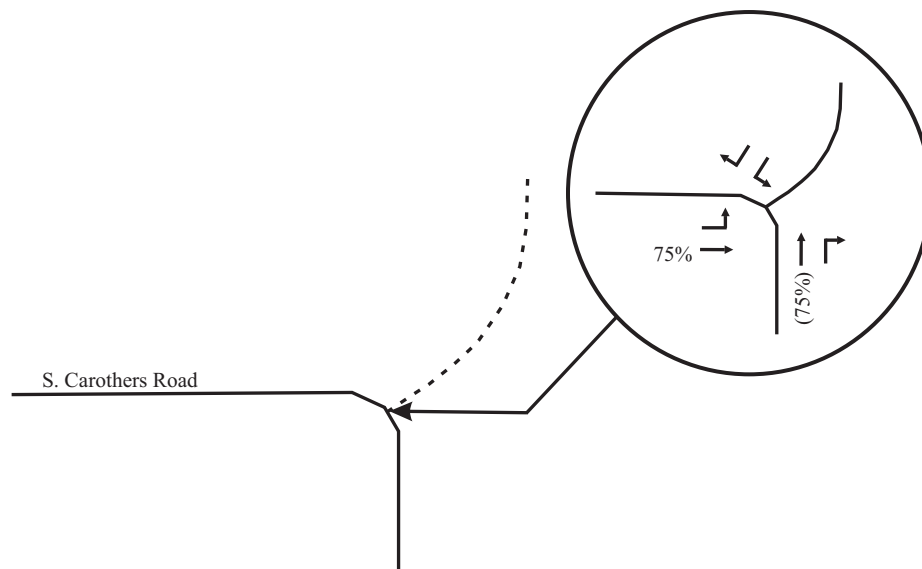
For the purposes of this study, additional analyses were conducted in order to identify how well the intersection of S. Carothers Road and the eastern (main) project access would operate if another 100 single-family homes were constructed on S. Carothers Road in the future. These 100 homes would be in addition to the approved residential projects of Simmon's Ridge, Lockwood Glen, Echelon, and Water's Edge. Trip generation data for daily and peak hour trips were identified from Trip Generation, Ninth Edition, which was published by the Institute of Transportation Engineers (ITE) in 2012. [Table 9](#) presents the daily and peak hour trip generations for 100 single-family homes that could be constructed on S. Carothers Road in the future.

TABLE 9. TRIP GENERATION (FUTURE HOMES)

LAND USE	SIZE	DAILY TRAFFIC	GENERATED TRAFFIC			
			AM PEAK HOUR		PM PEAK HOUR	
			ENTER	EXIT	ENTER	EXIT
Single-Family (LUC 210) Future Development	100 homes	1,050	20	60	66	39

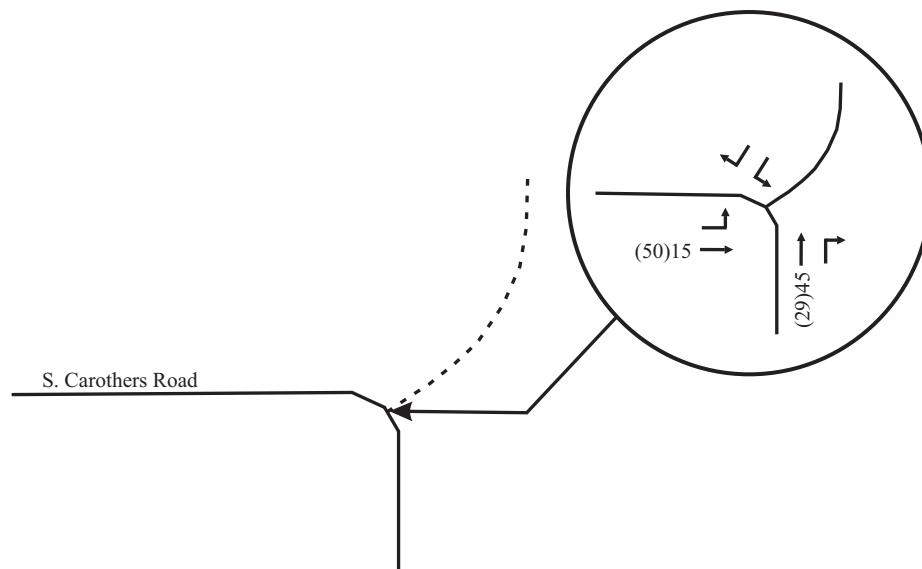
For the purposes of this study, it was estimated that the trips generated by the 100 future homes will travel through the intersection of S. Carothers Road and the eastern (main) project access for Ashcroft Valley according to the directional distribution shown in [Figure 9A](#). The peak hour trip generations and directional distribution were used to add the future trips to this intersection, and [Figure 9B](#) includes the peak hour traffic volumes that are expected to be generated by the future homes. These trips were added to the peak hour traffic volumes shown in [Figure 8](#), and the resulting peak hour volumes are shown in [Figure 9C](#).

Revised capacity analyses were conducted in order to determine the impact of 100 future homes on the intersection of S. Carothers Road and the eastern (main) project access. The results of the revised capacity analyses are shown in [Table 8](#), and [Appendix B](#) includes the capacity analyses worksheets. These analyses indicate that all of the critical turning movements at the intersection of S. Carothers Road and the eastern (main) project access will operate acceptably during both peak hours.



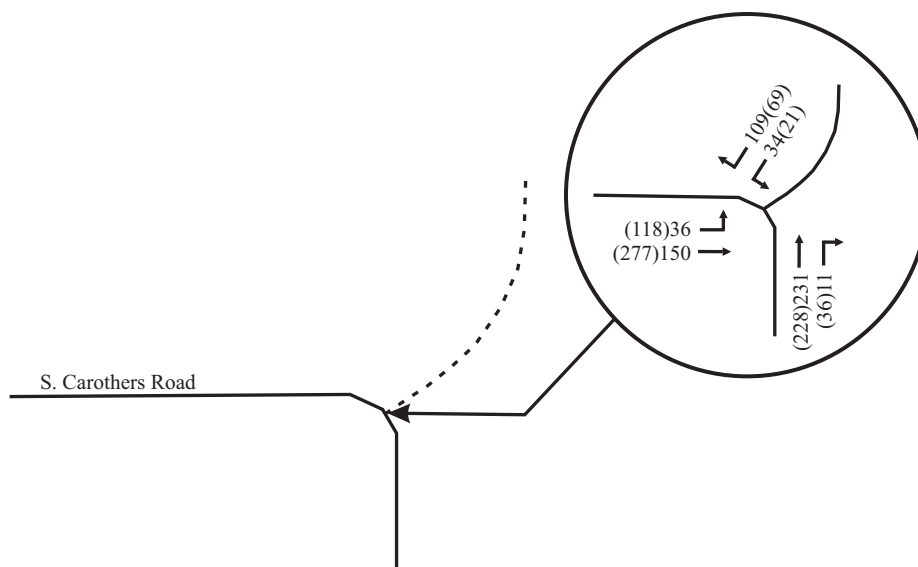
No Scale

Figure 9A.
Peak Hour Traffic Volumes Generated by 100 Future
Single-Family Homes Constructed on S. Carothers Road



No Scale

Figure 9B.
Peak Hour Traffic Volumes Generated by 100 Future
Single-Family Homes Constructed on S. Carothers Road



No Scale

Figure 9C.
Total Peak Hour Traffic Volumes with Ashcroft Valley
and 100 Future Single-Family Homes

5.5 TRAFFIC SIGNAL WARRANT ANALYSES

Based on the total projected conditions with the proposed project, as well as the residential projects that have already been approved for construction, updated traffic signal warrant analyses were conducted for the intersection of Carothers Parkway and S. Carothers Road.

Specifically, for the purposes of this study, it was estimated that the proposed Ashcroft Valley project and the approved residential projects (Simmon's Ridge, Lockwood Glen, Echelon, and Water's Edge) will include a total of 998 single-family homes, 613 townhomes, and 240 apartments, as shown below:

Ashcroft Valley (south) – 306 single-family homes

Simmons Ridge – 421 townhomes

Lockwood Glen – 347 single-family homes, 32 townhomes, and 240 apartments

Water's Edge – 211 single-family homes and 126 townhomes

Echelon – 134 single-family homes and 34 townhomes

Trip generation data for daily and peak hour trips were identified from Trip Generation, Ninth Edition, which was published by the Institute of Transportation Engineers (ITE) in 2012. [Table 10](#) presents the daily and peak hour trip generations for the homes that have been approved for construction on Carothers Parkway and S. Carothers Road.

TABLE 10. TRIP GENERATION (APPROVED AND PROPOSED HOMES)

LAND USE	SIZE	DAILY TRAFFIC	GENERATED TRAFFIC			
			AM PEAK HOUR		PM PEAK HOUR	
			ENTER	EXIT	ENTER	EXIT
Single-Family (LUC 210)	998 homes	9,500	187	561	628	340
Townhomes (LUC 230)	613 homes	3,562	46	224	214	105
Multi-Family (LUC 220)	240 homes	1,596	24	98	97	52
TOTAL	1,851 homes	14,658	257	883	939	527

Based on the daily trip generations shown in [Table 10](#), hourly traffic volumes entering and exiting the project sites were estimated as shown in [Table 11](#).

For the purposes of this study, it was assumed that 70% of the total traffic entering the project sites and 50% of the total traffic exiting the project sites will travel northbound and southbound on Carothers Parkway. Also, it was assumed that 20% of the total traffic exiting the project sites will travel westbound on S. Carothers Road. Based on these assumptions, the hourly traffic volumes on Carothers Parkway and S. Carothers Road were added to the existing traffic volumes in [Table 4](#) in order to establish the projected traffic volumes shown in [Table 12](#).

The results of these updated traffic signal warrant analyses are included in [Table 12](#). These results indicate that the projected traffic volumes will satisfy all of the volume-related signal warrants.

**TABLE 11. HOURLY TRAFFIC VOLUMES
EXPECTED TO BE GENERATED BY APPROVED AND PROPOSED HOMES**

HOURLY	% OF DAILY TRAFFIC	TOTAL TRAFFIC	% ENTER	ENTERING TRAFFIC	% EXIT	EXITING TRAFFIC
12:00 - 1:00 AM	0.5%	73	50%	37	50%	37
1:00 - 2:00 AM	0.5%	73	45%	33	55%	40
2:00 - 3:00 AM	1.0%	147	40%	59	60%	88
3:00 - 4:00 AM	2.0%	293	35%	103	65%	191
4:00 - 5:00 AM	3.0%	440	30%	132	70%	308
5:00 - 6:00 AM	4.0%	586	25%	147	75%	440
6:00 - 7:00 AM	5.0%	733	25%	183	75%	550
7:00 - 8:00 AM	7.8%	1,141	23%	257	77%	883
8:00 - 9:00 AM	6.0%	880	35%	308	65%	572
9:00 - 10:00 AM	5.0%	733	40%	293	60%	440
10:00 - 11:00 AM	5.0%	733	50%	366	50%	366
11:00 - 12:00 N	5.0%	733	50%	366	50%	366
12:00 - 1:00 PM	5.0%	733	50%	366	50%	366
1:00 - 2:00 PM	5.0%	733	50%	366	50%	366
2:00 - 3:00 PM	5.0%	733	50%	366	50%	366
3:00 - 4:00 PM	5.0%	733	55%	403	45%	330
4:00 - 5:00 PM	7.0%	1,026	60%	616	40%	410
5:00 - 6:00 PM	10.0%	1,466	64%	939	36%	527
6:00 - 7:00 PM	8.0%	1,173	70%	821	30%	352
7:00 - 8:00 PM	5.0%	733	80%	586	20%	147
8:00 - 9:00 PM	3.0%	440	80%	352	20%	88
9:00 - 10:00 PM	1.0%	147	75%	110	25%	37
10:00 - 11:00 PM	0.6%	88	70%	62	30%	26
11:00 - 12:00 M	0.6%	88	65%	57	35%	31

TABLE 12. TRAFFIC SIGNAL WARRANT ANALYSIS

HOURL	TOTAL VEHICLES BOTH DIRECTIONS OF CAROTHERS PARKWAY	WESTBOUND VEHICLES ON S. CAROTHERS ROAD	SATISFY FULL WARRANTS?		
			Warrant 1 Condition A	Warrant 1 Condition B	Warrant 2
6:00 - 7:00 AM	636	135	Yes	Yes	---
7:00 - 8:00 AM	1,210	218	Yes	Yes	Yes
8:00 - 9:00 AM	1,053	152	Yes	Yes	Yes
9:00 - 10:00 AM	724	108	Yes	Yes	---
10:00 - 11:00 AM	745	93	Yes	Yes	---
11:00 - 12:00 N	795	95	Yes	Yes	---
12:00 - 1:00 PM	788	103	Yes	Yes	---
1:00 - 2:00 PM	774	85	Yes	Yes	---
2:00 - 3:00 PM	775	92	Yes	Yes	---
3:00 - 4:00 PM	785	84	Yes	Yes	---
4:00 - 5:00 PM	1,132	113	Yes	Yes	Yes
5:00 - 6:00 PM	1,542	119	Yes	Yes	Yes
6:00 - 7:00 PM	1,181	93	Yes	Yes	Yes

6. CONCLUSIONS AND RECOMMENDATIONS

The analyses presented in this study indicate that the following infrastructure improvements should be provided in order to accommodate the existing, background, and total projected traffic volumes with the completion of the proposed project:

In conjunction with the northern portion of the proposed project:

1. At the intersection with Highway 96E, the northbound approach of Ridgeway Drive should be widened to include two northbound turn lanes. Specifically, the existing northbound lane should be retained as left turn lane, and a separate through/right turn lane with at least 75 feet of storage should be constructed to the east.
2. At the intersection with Ridgeway Drive, an eastbound right turn lane should be provided on Highway 96E. This turn lane should include at least 150 feet of storage and should be designed and constructed according to AASHTO standards.

In conjunction with the southern portion of the proposed project:

3. A northbound right turn lane should be provided on Carothers Parkway at the intersection with S. Carothers Road. This turn lane should include at least 100 feet of storage and should be designed and constructed according to AASHTO standards.
4. A traffic signal will likely be warranted at the intersection of Carothers Parkway and S. Carothers Road as all of the approved residential projects on Carothers Parkway and S. Carothers Road are developed. If constructed, this traffic signal should be designed and constructed to include protected and permissive signal phases for southbound motorists, as well as right turn overlap signal phases for northbound and westbound approaches.
5. The western project access on S. Carothers Road should be constructed to include one entering lane and one exiting lane, striped as a shared left and right turn lane.
6. The eastern (main) project access on S. Carothers Road should be constructed to include one entering lane and two exiting lanes, striped as separate left and right turn lanes.

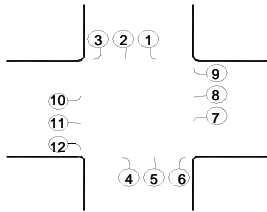
This project access could be constructed by reconstructing the existing 90-degree curve as a conventional three-legged or four-legged intersection. Alternatively, the free-flowing nature of the traffic on S. Carothers Road could be preserved, and the project access could be constructed at the apex of the horizontal curve. Based on comments provided by the City of Franklin Engineering Department, the developer of the proposed project plans to preserve the free-flowing nature of the traffic on S. Carothers Road and construct the project access at the apex of the horizontal curve. In conjunction with this configuration, a southbound/eastbound left turn lane should be provided on S. Carothers Road at the project access. This turn lane should include at least 100 feet of storage and should be designed and constructed according to AASHTO standards.

Finally, in conjunction with the preparation of final construction documents for the proposed project, sight triangles should be provided to identify the sight distances which will be available, based on the specific location of the project access and its design parameters. These sight triangles should be developed based on guidelines that are included in A Policy on Geometric Design of Highways and Streets, which is published by the American Association of State Highway and Transportation Officials (AASHTO) and commonly known as The Green Book. Specifically, The Green Book indicates that for a speed of 40 mph, the minimum stopping sight distance is 305 feet. This is the distance that motorists on S. Carothers Road will need to come to a stop if a vehicle turning from the project access creates a conflict. Also, based on The Green Book, the minimum intersection sight distance is 445 feet. This is the distance that motorists on the project access will need to safely complete a turn onto S. Carothers Road.

In conclusion, implementation of the above recommendations will facilitate safe and efficient traffic operations with the completion of the proposed project. However, it is important to note, that these recommendations may need to be updated if the development plan for the proposed project is modified as it is considered by the City of Franklin Staff, Planning Commission, and Board of Mayor and Aldermen.

**APPENDIX A
EXISTING TRAFFIC COUNTS**

INTERSECTION TRAFFIC VOLUME COUNTS

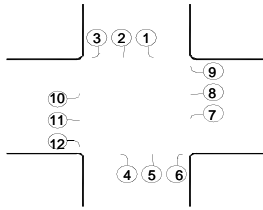


LOCATION: Highway 96 and Carothers Parkway
DATE: 29-Oct-15 Thu
RECORDER: Burns
NOTES: signalized

LOCATION	S/B Carothers Parkway			N/B Carothers Parkway			W/B Highway 96			E/B Highway 96		
TIME	1	2	3	4	5	6	7	8	9	10	11	12
6:30-6:45	27	4	4	73	25	9	2	364	21	48	75	10
6:45-7:00	21	9	16	107	48	7	4	371	24	43	101	26
7:00-7:15	40	7	25	84	60	5	8	392	21	41	96	39
7:15-7:30	25	8	29	114	83	6	6	394	45	65	105	35
7:30-7:45	35	9	17	116	93	11	12	346	39	65	97	57
7:45-8:00	31	11	21	120	103	5	5	379	39	89	116	70
8:00-8:15	28	15	25	111	100	7	5	316	37	52	93	50
8:15-8:30	27	15	22	98	53	14	6	362	39	56	137	41
4:30-4:45	187	109	53	53	17	11	8	149	25	30	350	81
4:45-5:00	167	146	29	45	14	10	7	152	16	17	337	91
5:00-5:15	158	151	42	64	26	8	5	168	12	28	342	112
5:15-5:30	135	142	27	57	10	7	3	168	11	22	348	98
5:30-5:45	167	124	52	57	14	11	5	154	13	17	344	129
5:45-6:00	143	142	27	72	18	4	8	128	19	29	323	88
6:00-6:15	108	79	25	69	23	7	2	114	11	38	289	96
6:15-6:30	95	54	33	50	20	8	8	137	19	37	296	70
TOTAL	1,394	1,025	447	1,290	707	130	94	4,094	391	677	3,449	1,093
AM PK HR	119	43	92	461	379	29	28	1,435	160	271	411	212
PM PK HR	627	563	150	223	64	36	20	642	52	84	1,371	430

AM PK PHF	0.85	0.72	0.79	0.96	0.92	0.66	0.58	0.91	0.89	0.76	0.89	0.76	0.92
PM PK PHF	0.94	0.93	0.72	0.87	0.62	0.82	0.71	0.96	0.81	0.75	0.98	0.83	0.95

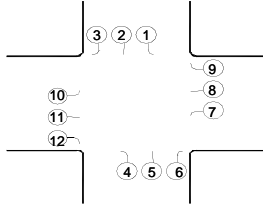
INTERSECTION TRAFFIC VOLUME COUNTS



LOCATION: Murfreesboro Road and Clovercroft Road
DATE: 3-Mar-15 Tue
RECORDER: Burns
NOTES: signalized

LOCATION	S/B Clovercroft Rd			N/B			W/B Murfreesboro Rd			E/B Murfreesboro Rd				
TIME	1	2	3	4	5	6	7	8	9	10	11	12		
7:00-7:15	14		31					560	11	14	88		2,691	718
7:15-7:30	8		34					524	10	16	103		2,523	695
7:30-7:45	1		39					495	14	13	82		2,359	644
7:45-8:00	2		55					445	6	19	107		2,276	634
8:00-8:15	3		37					390	4	12	104		2,210	550
8:15-8:30	3		40					344	6	14	124			531
8:30-8:45	6		35					393	10	17	100			561
8:45-9:00	6		42					361	12	29	118			568
4:00-4:15	10		18					158	5	36	395		3,062	622
4:15-4:30	14		27					179	1	44	539		3,285	804
4:30-4:45	18		24					147	9	34	577		3,319	809
4:45-5:00	23		19					160	13	38	574		3,308	827
5:00-5:15	30		34					119	8	30	624		3,244	845
5:15-5:30	30		33					150	12	30	583			838
5:30-5:45	20		27					150	5	43	553			798
5:45-6:00	16		20					179	5	26	517			763
TOTAL	204		515					4,754	131	415	5,188			
AM PK HR	25		159					2,024	41	62	380		7:00-8:00	
PM PK HR	101		110					576	42	132	2,358		4:30-5:30	
AM PK PHF	0.45		0.72					0.90	0.73	0.82	0.89		0.94	
PM PK PHF	0.84		0.81					0.90	0.81	0.87	0.94		0.98	

INTERSECTION TRAFFIC VOLUME COUNTS



LOCATION: Murfreesboro Road and Cross Creek Drive
DATE: 3-Mar-15 Tue
RECORDER: Burns
NOTES: unsignalized

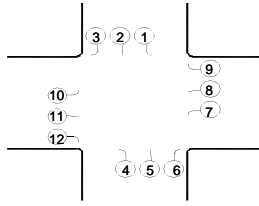
LOCATION	S/B			N/B Cross Creek Drive			W/B Murfreesboro Rd			E/B Murfreesboro Rd		
TIME	1	2	3	4	5	6	7	8	9	10	11	12
7:00-7:15				9				479			105	3
7:15-7:30				9				541			91	
7:30-7:45				7		1		476			78	2
7:45-8:00				10		1		523			95	2
8:00-8:15				4				423			101	1
8:15-8:30				3				381			88	3
8:30-8:45				3				394			82	2
8:45-9:00				4				410			110	1
4:00-4:15				2				148			450	8
4:15-4:30				5				130			561	6
4:30-4:45				3				146			534	10
4:45-5:00				1				140			576	6
5:00-5:15				6				128			572	6
5:15-5:30				4				139			577	12
5:30-5:45				1				110			545	9
5:45-6:00				1		1	1	90			529	7
TOTAL				72		3	1	4,658			5,094	78
AM PK HR				35		2		2,019			369	7
PM PK HR				14				553			2,259	34

AM PK PHF				0.88		0.50		0.93			0.88	0.58
PM PK PHF				0.58				0.95			0.98	0.71

2,432 596
2,365 641
2,199 564
2,116 631
2,010 529
475
481
525
2,726 608
2,830 702
2,860 693
2,832 723
2,738 712
732
665
629
7:00-8:00
4:30-5:30

0.95
0.98

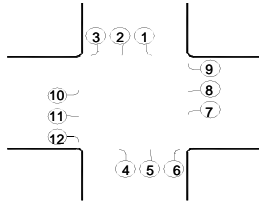
INTERSECTION TRAFFIC VOLUME COUNTS



LOCATION: Murfreesboro Road and Chester Stevens Rd / Ridgeway Dr
DATE: 3-Mar-15 Tue
RECORDER: Burns
NOTES: unsignalized

LOCATION	S/B Chester Stevens Rd			N/B Ridgeway Dr			W/B Murfreesboro Rd			E/B Murfreesboro Rd				
TIME	1	2	3	4	5	6	7	8	9	10	11	12		
7:00-7:15	8		12	3		2		490	1		116		2,465	632
7:15-7:30	1		11	4				476	12	1	107	1	2,333	613
7:30-7:45	1		12	4				486	2	3	91	2	2,204	601
7:45-8:00	1		22	5			2	495	6	4	83	1	2,118	619
8:00-8:15	2		11					384		5	97	1	1,982	500
8:15-8:30	3		20	2		2		351	1	6	99			484
8:30-8:45			11	2			1	402	2	6	90	1		515
8:45-9:00			13	1		1		363	2	7	95	1		483
4:00-4:15	4	1	3	1				130		9	410	1	2,617	559
4:15-4:30			6	1				130	1	9	513	1	2,823	661
4:30-4:45	1		9	1			1	152	4	8	512	2	2,895	690
4:45-5:00	1		6	1				129	1	7	559	3	2,921	707
5:00-5:15			4	2				151	3	9	595	1	2,887	765
5:15-5:30	1		7					135	3	12	573	2		733
5:30-5:45	2		7	3		1	1	119	2	13	567	1		716
5:45-6:00	2		10					135	2	17	507			673
TOTAL	27	1	164	30		6	5	4,528	42	116	5,014	18		
AM PK HR	11		57	16		2	2	1,947	21	8	397	4	7:00-8:00	
PM PK HR	4		24	6		1	1	534	9	41	2,294	7	4:45-5:45	
AM PK PHF	0.34		0.65	0.80		0.25	0.25	0.98	0.44	0.50	0.86	0.50	0.98	
PM PK PHF	0.50		0.86	0.50		0.25	0.25	0.88	0.75	0.79	0.96	0.58	0.95	

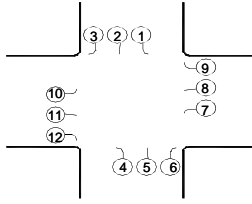
INTERSECTION TRAFFIC VOLUME COUNTS



LOCATION: Murfreesboro Road and Arno Road
DATE: 3-Mar-15 Tue
RECORDER: Burns
NOTES: signalized

LOCATION	S/B			N/B Arno Road			W/B Murfreesboro Rd			E/B Murfreesboro Rd				
TIME	1	2	3	4	5	6	7	8	9	10	11	12		
7:00-7:15				174		12	30	295			47	73	2,444	631
7:15-7:30				164		25	8	340			49	29	2,321	615
7:30-7:45				206		19	4	287			47	33	2,205	596
7:45-8:00				167		15	3	322			65	30	2,096	602
8:00-8:15				163		12	5	221			72	35	2,010	508
8:15-8:30				186		18	12	184			75	24		499
8:30-8:45				177		7	7	202			63	31		487
8:45-9:00				152		3	2	264			65	30		516
4:00-4:15				67		7	6	80			251	204	2,747	615
4:15-4:30				64		10	10	91			267	225	2,920	667
4:30-4:45				50		15	10	86			274	250	3,082	685
4:45-5:00				57		15	18	93			281	316	3,158	780
5:00-5:15				59		5	22	90			289	323	3,077	788
5:15-5:30				74		8	12	96			282	357		829
5:30-5:45				71		3	13	102			273	299		761
5:45-6:00				79		3	13	104			265	235		699
TOTAL				1,910		177	175	2,857			2,665	2,494		
AM PK HR				711		71	45	1,244			208	165	7:00-8:00	
PM PK HR				261		31	65	381			1,125	1,295	4:45-5:45	
AM PK PHF				0.86		0.71	0.38	0.91			0.80	0.57	0.97	
PM PK PHF				0.88		0.52	0.74	0.93			0.97	0.91	0.95	

INTERSECTION TRAFFIC VOLUME COUNTS

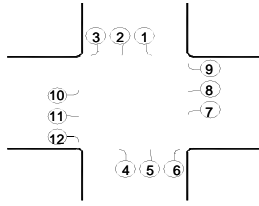


LOCATION: Carothers Parkway and S. Carothers Road
DATE: 2-Feb-16 Tue
RECORDER: Burns
NOTES: unsignalized

LOCATION	S/B Carothers Parkway			N/B Carothers Parkway			W/B S. Carothers Road			E/B				
TIME	1	2	3	4	5	6	7	8	9	10	11	12		
6:30-6:45	2	15			30	1	1		10				361	59
6:45-7:00	5	10			61				7				463	83
7:00-7:15	3	19			70				5				526	97
7:15-7:30	1	22			90	1	1		7				550	122
7:30-7:45	3	22			127	1			8				566	161
7:45-8:00	2	16			118				10					146
8:00-8:15	1	16			98	1			5					121
8:15-8:30		20			105	1			12					138
4:30-4:45	8	74			23	1			3				572	109
4:45-5:00	11	90			39	1			5				610	146
5:00-5:15	7	111			24	1			7				573	150
5:15-5:30	9	118			29	2	3		6				516	167
5:30-5:45	16	101			24	1			5				432	147
5:45-6:00	8	69			30	1			1					109
6:00-6:15	7	65			17	1			3					93
6:15-6:30	9	49			19		1		5					83
TOTAL	92	817			904	13	6		99					
AM PK HR	6	74			448	3			35				7:30-8:30	
PM PK HR	43	420			116	5	3		23				4:45-5:45	

AM PK PHF	0.50	0.84			0.88	0.75			0.73				0.88
PM PK PHF	0.67	0.89			0.74	0.63	0.25		0.82				0.91

INTERSECTION TRAFFIC VOLUME COUNTS

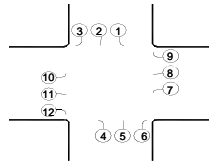


LOCATION: S. Carothers Road and Swanson Lane
DATE: 2-Feb-16 Tue
RECORDER: Burns
NOTES: unsignalized

LOCATION	S/B S. Carothers Road			N/B S. Carothers Road			W/B			E/B Swanson Lane			
TIME	1	2	3	4	5	6	7	8	9	10	11	12	
6:30-6:45		3	1		1								30
6:45-7:00		8			1								35
7:00-7:15		1	3		2					1			32
7:15-7:30		3		1	4					1			33
7:30-7:45		5			4							1	33
7:45-8:00		2	1		1					2			
8:00-8:15		2	1		4					1			
8:15-8:30					5					4			
4:30-4:45		1	1	1	2					1			27
4:45-5:00		2			1								26
5:00-5:15		1	3		2								26
5:15-5:30		6	1	1	2					1		1	23
5:30-5:45		4	1										14
5:45-6:00		1	1		1								
6:00-6:15			2		1								
6:15-6:30			2							1			
TOTAL		39	17	3	31					12		2	
AM PK HR		17	3	1	11					2		1	6:45-7:45
PM PK HR		10	5	2	7					2		1	4:30-5:30

AM PK PHF		0.53	0.25	0.25	0.69					0.50		0.25	0.88
PM PK PHF		0.42	0.42	0.50	0.88					0.50		0.25	0.56

INTERSECTION TRAFFIC VOLUME COUNTS



LOCATION: Carothers Parkway and S. Carothers Road
 DATE: 23-Aug-16 Tue
 RECORDER: Burns
 NOTES: unsignalized

LOCATION	S/B Carothers Parkway			N/B Carothers Parkway			W/B S. Carothers Road			E/B		
TIME	1	2	3	4	5	6	7	8	9	10	11	12
6:00-6:15	3	23			17				1			
6:15-6:30	2	9			29				7			
6:30-6:45	1	23			45	2	1		8			
6:45-7:00		21			58		1		7			
7:00-7:15		26			87	2			5			
7:15-7:30	4	36			91		1		10			
7:30-7:45	2	29			120				9			
7:45-8:00	3	42			146		1		15			
8:00-8:15	1	24			161	1			7			
8:15-8:30	5	32			98	2			10			
8:30-8:45	3	35			76				8			
8:45-9:00	3	38			72	1			13			
9:00-9:15	1	36			39				1			
9:15-9:30	5	34			44	2			9			
9:30-9:45	1	27			37				5			
9:45-10:00	5	27			41				5			
10:00-10:15	5	28			41				5			
10:15-10:30	5	30			42				5			
10:30-10:45	4	31			42	2			5			
10:45-11:00	4	41			30				5			
11:00-11:15	10	41			42				7			
11:15-11:30	3	42			33				5			
11:30-11:45	8	39			45				5			
11:45-12:00	4	50			37	1	1		4			
12:00-12:15	3	28			50	1			6			
12:15-12:30	4	50			40				7			
12:30-12:45	7	57			32	1			7			
12:45-1:00	7	38			30				10			
1:00-1:15	9	56			33	2			2			
1:15-1:30	4	34			40		1		3			
1:30-1:45	7	39			33		1		1			
1:45-2:00	9	31			36	1			4			
2:00-2:15	8	32			32				7			
2:15-2:30	9	48			35	1			4			
2:30-2:45	9	46			32	1			4			
2:45-3:00	8	45			30	1			4			
3:00-3:15	8	43			27				4			
3:15-3:30	7	41			24				4			
3:30-3:45	12	55			39				7			
3:45-4:00	8	48			27				3			
4:00-4:15	5	57			24	2			9			
4:15-4:30	5	88			31	1			6			
4:30-4:45	11	89			29	2	1		6			
4:45-5:00	15	93			44		2		7			
5:00-5:15	7	112			39				3			
5:15-5:30	11	110			47	2			6			
5:30-5:45	16	99			45	1			2			
5:45-6:00	11	92			29				3			
6:00-6:15	13	89			34	1			7			
6:15-6:30	6	72			36				6			
6:30-6:45	9	44			39				6			
6:45-7:00	8	40			37	2	1		3			
TOTAL	317	2,440			2,447	31	11		302			
AM PK HR	11	127			525	3	1		41			
PM PK HR	49	414			175	3	2		18			

258 44
 334 47
 429 80
 509 87
 629 120
 703 142
 708 160
 670 207
 590 194
 473 147
 420 122
 368 127
 319 77
 321 94
 309 70
 323 78
 325 79
 346 82
 347 84
 360 80
 377 100
 365 83
 383 97
 390 97
 378 88
 392 101
 373 104
 350 85
 346 102
 323 82
 338 81
 349 81
 354 79
 356 97
 335 92
 357 87
 356 81
 372 76
 427 113
 452 86
 527 97
 591 131
 636 138
 661 161
 635 161
 618 176
 562 163
 497 135
 453 144
 120
 98
 91

7:30-8:30
 4:45-5:45

AM PK PHF	0.55	0.76			0.82	0.38	0.25		0.68			
PM PK PHF	0.77	0.92			0.93	0.38	0.25		0.64			

0.86
 0.94
























**APPENDIX B
CAPACITY ANALYSES**

EXISTING CONDITIONS

Lanes, Volumes, Timings

1: Carothers Parkway & Murfreesboro Road

7/12/2016

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	271	411	212	28	1435	160	461	379	29	119	43	92
Future Volume (vph)	271	411	212	28	1435	160	461	379	29	119	43	92
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12	12	12	12	12	12	12
Grade (%)		0%			0%			0%			0%	
Storage Length (ft)	0		0	0		0	0		0	0		0
Storage Lanes	2		1	1		0	2		1	2		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	0.97	0.95	1.00	1.00	0.91	0.91	0.97	0.95	1.00	0.97	0.95	1.00
Ped Bike Factor												
Frt			0.850		0.985				0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	3433	3539	1583	1770	5009	0	3433	3539	1583	3433	3539	1583
Flt Permitted	0.176			0.493			0.725			0.510		
Satd. Flow (perm)	636	3539	1583	918	5009	0	2620	3539	1583	1843	3539	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			230		50				33			33
Link Speed (mph)		45			45			35			40	
Link Distance (ft)		150			1130			3000			147	
Travel Time (s)		2.3			17.1			58.4			2.5	
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	295	447	230	30	1560	174	501	412	32	129	47	100
Shared Lane Traffic (%)												
Lane Group Flow (vph)	295	447	230	30	1734	0	501	412	32	129	47	100
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		24			24			24			24	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2		1	2	1	1	2	1
Detector Template	Left	Thru	Right	Left	Thru		Left	Thru	Right	Left	Thru	Right
Leading Detector (ft)	20	100	20	20	100		20	100	20	20	100	20
Trailing Detector (ft)	0	0	0	0	0		0	0	0	0	0	0
Turn Type	Perm	NA	Perm	Perm	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8			2		2	6		6
Detector Phase	4	4	4	8	8		2	2	2	6	6	6
Switch Phase												

Lanes, Volumes, Timings

1: Carothers Parkway & Murfreesboro Road

7/12/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	22.5		22.5	22.5	22.5	22.5	22.5	22.5
Total Split (s)	27.2	27.2	27.2	27.2	27.2		22.8	22.8	22.8	22.8	22.8	22.8
Total Split (%)	54.4%	54.4%	54.4%	54.4%	54.4%		45.6%	45.6%	45.6%	45.6%	45.6%	45.6%
Maximum Green (s)	22.7	22.7	22.7	22.7	22.7		18.3	18.3	18.3	18.3	18.3	18.3
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5		3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5		4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Minimum Gap (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Time Before Reduce (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Time To Reduce (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Recall Mode	None	None	None	None	None		C-Max	C-Max	C-Max	C-Max	C-Max	C-Max
Walk Time (s)	7.0	7.0	7.0	7.0	7.0		7.0	7.0	7.0	7.0	7.0	7.0
Flash Dont Walk (s)	11.0	11.0	11.0	11.0	11.0		11.0	11.0	11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	0	0	0	0	0		0	0	0	0	0	0
Act Effect Green (s)	22.7	22.7	22.7	22.7	22.7		18.3	18.3	18.3	18.3	18.3	18.3
Actuated g/C Ratio	0.45	0.45	0.45	0.45	0.45		0.37	0.37	0.37	0.37	0.37	0.37
v/c Ratio	1.02	0.28	0.27	0.07	0.75		0.52	0.32	0.05	0.19	0.04	0.17
Control Delay	80.8	9.1	2.5	7.0	11.5		14.9	12.2	4.8	11.8	10.3	8.7
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	80.8	9.1	2.5	7.0	11.5		14.9	12.2	4.8	11.8	10.3	8.7
LOS	F	A	A	A	B		B	B	A	B	B	A
Approach Delay		29.3			11.4			13.4			10.4	
Approach LOS		C			B			B			B	
90th %ile Green (s)	22.7	22.7	22.7	22.7	22.7		18.3	18.3	18.3	18.3	18.3	18.3
90th %ile Term Code	Max	Max	Max	Max	Max		Coord	Coord	Coord	Coord	Coord	Coord
70th %ile Green (s)	22.7	22.7	22.7	22.7	22.7		18.3	18.3	18.3	18.3	18.3	18.3
70th %ile Term Code	Max	Max	Max	Max	Max		Coord	Coord	Coord	Coord	Coord	Coord
50th %ile Green (s)	22.7	22.7	22.7	22.7	22.7		18.3	18.3	18.3	18.3	18.3	18.3
50th %ile Term Code	Max	Max	Max	Max	Max		Coord	Coord	Coord	Coord	Coord	Coord
30th %ile Green (s)	22.7	22.7	22.7	22.7	22.7		18.3	18.3	18.3	18.3	18.3	18.3
30th %ile Term Code	Max	Max	Max	Max	Max		Coord	Coord	Coord	Coord	Coord	Coord
10th %ile Green (s)	22.7	22.7	22.7	22.7	22.7		18.3	18.3	18.3	18.3	18.3	18.3
10th %ile Term Code	Max	Max	Max	Hold	Hold		Coord	Coord	Coord	Coord	Coord	Coord
Stops (vph)	198	234	24	13	1053		340	252	9	77	28	44
Fuel Used(gal)	7	4	1	0	29		14	11	1	1	0	1
CO Emissions (g/hr)	502	285	43	28	1995		974	772	51	81	29	48
NOx Emissions (g/hr)	98	55	8	6	388		190	150	10	16	6	9
VOC Emissions (g/hr)	116	66	10	7	462		226	179	12	19	7	11
Dilemma Vehicles (#)	0	41	0	0	148		0	38	0	0	4	0
Queue Length 50th (ft)	~43	40	0	6	185		56	43	0	12	4	13
Queue Length 95th (ft)	#111	64	28	m7	267		93	71	13	27	12	37
Internal Link Dist (ft)		70			1050			2920			67	
Turn Bay Length (ft)												
Base Capacity (vph)	288	1606	844	416	2301		958	1295	600	674	1295	600













Baseline

Synchro 9 Light Report
Page 2

Lanes, Volumes, Timings

1: Carothers Parkway & Murfreesboro Road

7/12/2016

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Starvation Cap Reductn	0	0	0	0	0		0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0		0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0		0	0	0	0	0	0
Reduced v/c Ratio	1.02	0.28	0.27	0.07	0.75		0.52	0.32	0.05	0.19	0.04	0.17

Intersection Summary

Area Type: Other

Cycle Length: 50

Actuated Cycle Length: 50

Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green, Master Intersection

Natural Cycle: 45

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 1.02

Intersection Signal Delay: 16.2

Intersection LOS: B

Intersection Capacity Utilization 71.3%

ICU Level of Service C

Analysis Period (min) 15

Description: Hwy 96 and Carothers Pkwy

~ Volume exceeds capacity, queue is theoretically infinite.





Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

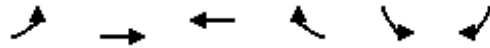
Splits and Phases: 1: Carothers Parkway & Murfreesboro Road

 Ø2 (R)	 Ø4
22.8 s	27.2 s
 Ø6 (R)	 Ø8
22.8 s	27.2 s

Lanes, Volumes, Timings

2: Murfreesboro Road/Murfreesboro Rd & Clovercroft Road

7/12/2016

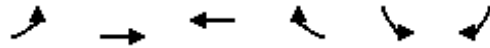


Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	62	380	2024	41	25	159
Future Volume (vph)	62	380	2024	41	25	159
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12
Grade (%)		0%	0%		0%	
Storage Length (ft)	0			0	0	0
Storage Lanes	1			0	1	1
Taper Length (ft)	25				25	
Lane Util. Factor	1.00	0.95	0.95	0.95	1.00	1.00
Ped Bike Factor						
Frt			0.997			0.850
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1770	3539	3529	0	1770	1583
Flt Permitted	0.054				0.950	
Satd. Flow (perm)	101	3539	3529	0	1770	1583
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)			5			16
Link Speed (mph)		45	45		40	
Link Distance (ft)		1130	160		355	
Travel Time (s)		17.1	2.4		6.1	
Confl. Peds. (#/hr)						
Confl. Bikes (#/hr)						
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0
Parking (#/hr)						
Mid-Block Traffic (%)		0%	0%		0%	
Adj. Flow (vph)	67	413	2200	45	27	173
Shared Lane Traffic (%)						
Lane Group Flow (vph)	67	413	2245	0	27	173
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(ft)		12	12		12	
Link Offset(ft)		0	0		0	
Crosswalk Width(ft)		16	16		16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15			9	15	9
Number of Detectors	1	2	2		1	1
Detector Template	Left	Thru	Thru		Left	Right
Leading Detector (ft)	20	100	100		20	20
Trailing Detector (ft)	0	0	0		0	0
Turn Type	Perm	NA	NA		Prot	Perm
Protected Phases		4	8		6	
Permitted Phases	4					6
Detector Phase	4	4	8		6	6
Switch Phase						

Lanes, Volumes, Timings

2: Murfreesboro Road/Murfreesboro Rd & Clovercroft Road

7/12/2016



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Minimum Initial (s)	5.0	5.0	5.0		5.0	5.0
Minimum Split (s)	22.5	22.5	22.5		22.5	22.5
Total Split (s)	76.0	76.0	76.0		24.0	24.0
Total Split (%)	76.0%	76.0%	76.0%		24.0%	24.0%
Maximum Green (s)	71.5	71.5	71.5		19.5	19.5
Yellow Time (s)	3.5	3.5	3.5		3.5	3.5
All-Red Time (s)	1.0	1.0	1.0		1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0		0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5		4.5	4.5
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Minimum Gap (s)	3.0	3.0	3.0		3.0	3.0
Time Before Reduce (s)	0.0	0.0	0.0		0.0	0.0
Time To Reduce (s)	0.0	0.0	0.0		0.0	0.0
Recall Mode	None	None	None		C-Min	C-Min
Walk Time (s)	7.0	7.0	7.0		7.0	7.0
Flash Dont Walk (s)	11.0	11.0	11.0		11.0	11.0
Pedestrian Calls (#/hr)	0	0	0		0	0
Act Effect Green (s)	73.8	73.8	73.8		17.2	17.2
Actuated g/C Ratio	0.74	0.74	0.74		0.17	0.17
v/c Ratio	0.91	0.16	0.86		0.09	0.61
Control Delay	103.6	4.9	14.3		35.2	44.3
Queue Delay	0.0	0.0	0.0		0.0	0.0
Total Delay	103.6	4.9	14.3		35.2	44.3
LOS	F	A	B		D	D
Approach Delay		18.6	14.3		43.1	
Approach LOS		B	B		D	
90th %ile Green (s)	71.5	71.5	71.5		19.5	19.5
90th %ile Term Code	Max	Max	Max		Coord	Coord
70th %ile Green (s)	73.3	73.3	73.3		17.7	17.7
70th %ile Term Code	Max	Max	Max		Coord	Coord
50th %ile Green (s)	75.8	75.8	75.8		15.2	15.2
50th %ile Term Code	Max	Max	Max		Coord	Coord
30th %ile Green (s)	74.8	74.8	74.8		16.2	16.2
30th %ile Term Code	Gap	Gap	Hold		Coord	Coord
10th %ile Green (s)	73.7	73.7	73.7		17.3	17.3
10th %ile Term Code	Hold	Hold	Gap		Coord	Coord
Stops (vph)	43	136	1370		22	131
Fuel Used(gal)	2	5	25		0	3
CO Emissions (g/hr)	161	339	1762		32	217
NOx Emissions (g/hr)	31	66	343		6	42
VOC Emissions (g/hr)	37	79	408		7	50
Dilemma Vehicles (#)	0	6	95		0	0
Queue Length 50th (ft)	24	46	410		15	96
Queue Length 95th (ft)	#131	70	650		38	160
Internal Link Dist (ft)		1050	80		275	
Turn Bay Length (ft)						
Base Capacity (vph)	74	2612	2606		345	321

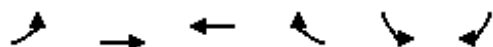
Baseline

Synchro 9 Light Report
Page 5

Lanes, Volumes, Timings

2: Murfreesboro Road/Murfreesboro Rd & Clovercroft Road

7/12/2016



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Starvation Cap Reductn	0	0	0		0	0
Spillback Cap Reductn	0	0	0		0	0
Storage Cap Reductn	0	0	0		0	0
Reduced v/c Ratio	0.91	0.16	0.86		0.08	0.54

Intersection Summary

Area Type: Other

Cycle Length: 100

Actuated Cycle Length: 100

Offset: 84 (84%), Referenced to phase 2: and 6:SBL, Start of Green

Natural Cycle: 90

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.91

Intersection Signal Delay: 17.0

Intersection LOS: B

Intersection Capacity Utilization 74.6%

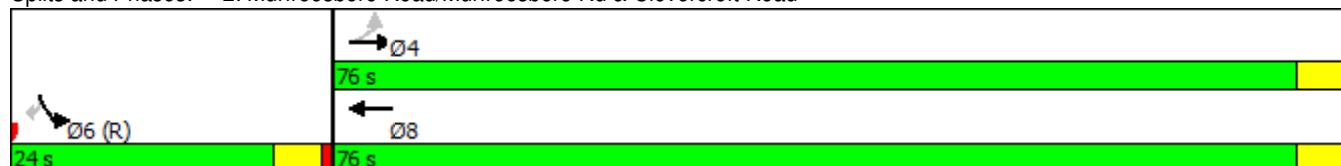
ICU Level of Service D

Analysis Period (min) 15

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 2: Murfreesboro Road/Murfreesboro Rd & Clovercroft Road



Lanes, Volumes, Timings
5: Arno Road & Murfreesboro Rd

7/12/2016

	→	↘	↙	←	↖	↗
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↘	↑↑	↘	↗
Traffic Volume (vph)	224	177	45	1269	711	71
Future Volume (vph)	224	177	45	1269	711	71
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12
Grade (%)	0%			0%	0%	
Storage Length (ft)		0	0		0	0
Storage Lanes		0	1		1	1
Taper Length (ft)			25		25	
Lane Util. Factor	0.95	0.95	1.00	0.95	1.00	1.00
Ped Bike Factor						
Frt	0.934					0.850
Flt Protected			0.950		0.950	
Satd. Flow (prot)	3306	0	1770	3539	1770	1583
Flt Permitted			0.459		0.950	
Satd. Flow (perm)	3306	0	855	3539	1770	1583
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)	192					77
Link Speed (mph)	45			45	50	
Link Distance (ft)	1550			63	683	
Travel Time (s)	23.5			1.0	9.3	
Confl. Peds. (#/hr)						
Confl. Bikes (#/hr)						
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0
Parking (#/hr)						
Mid-Block Traffic (%)	0%			0%	0%	
Adj. Flow (vph)	243	192	49	1379	773	77
Shared Lane Traffic (%)						
Lane Group Flow (vph)	435	0	49	1379	773	77
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			12	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Number of Detectors	2		1	2	1	1
Detector Template	Thru		Left	Thru	Left	Right
Leading Detector (ft)	100		20	100	20	20
Trailing Detector (ft)	0		0	0	0	0
Turn Type	NA		Perm	NA	Prot	Perm
Protected Phases	4			8	2	
Permitted Phases			8			2
Detector Phase	4		8	8	2	2
Switch Phase						

Baseline

Synchro 9 Light Report
Page 9

Lanes, Volumes, Timings
5: Arno Road & Murfreesboro Rd

7/12/2016

	→	↘	↙	←	↖	↗
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Minimum Initial (s)	5.0		5.0	5.0	5.0	5.0
Minimum Split (s)	22.5		22.5	22.5	22.5	22.5
Total Split (s)	47.0		47.0	47.0	53.0	53.0
Total Split (%)	47.0%		47.0%	47.0%	53.0%	53.0%
Maximum Green (s)	42.5		42.5	42.5	48.5	48.5
Yellow Time (s)	3.5		3.5	3.5	3.5	3.5
All-Red Time (s)	1.0		1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0		0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5		4.5	4.5	4.5	4.5
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Minimum Gap (s)	3.0		3.0	3.0	3.0	3.0
Time Before Reduce (s)	0.0		0.0	0.0	0.0	0.0
Time To Reduce (s)	0.0		0.0	0.0	0.0	0.0
Recall Mode	None		None	None	Min	Min
Walk Time (s)	7.0		7.0	7.0	7.0	7.0
Flash Dont Walk (s)	11.0		11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	0		0	0	0	0
Act Effect Green (s)	40.4		40.4	40.4	44.1	44.1
Actuated g/C Ratio	0.43		0.43	0.43	0.47	0.47
v/c Ratio	0.28		0.13	0.90	0.93	0.10
Control Delay	10.3		18.7	35.1	42.6	3.7
Queue Delay	0.0		0.0	0.0	0.0	0.0
Total Delay	10.3		18.7	35.1	42.6	3.7
LOS	B		B	D	D	A
Approach Delay	10.3			34.6	39.1	
Approach LOS	B			C	D	
90th %ile Green (s)	42.5		42.5	42.5	48.5	48.5
90th %ile Term Code	Hold		Max	Max	Max	Max
70th %ile Green (s)	42.5		42.5	42.5	48.5	48.5
70th %ile Term Code	Hold		Max	Max	Max	Max
50th %ile Green (s)	42.5		42.5	42.5	48.5	48.5
50th %ile Term Code	Hold		Max	Max	Max	Max
30th %ile Green (s)	42.5		42.5	42.5	43.6	43.6
30th %ile Term Code	Hold		Max	Max	Gap	Gap
10th %ile Green (s)	31.9		31.9	31.9	32.1	32.1
10th %ile Term Code	Hold		Gap	Gap	Gap	Gap
Stops (vph)	134		28	1087	602	9
Fuel Used(gal)	7		1	23	18	0
CO Emissions (g/hr)	456		38	1616	1293	35
NOx Emissions (g/hr)	89		7	314	251	7
VOC Emissions (g/hr)	106		9	374	300	8
Dilemma Vehicles (#)	17		0	63	0	0
Queue Length 50th (ft)	49		19	425	434	0
Queue Length 95th (ft)	82		43	#575	#684	24
Internal Link Dist (ft)	1470			1	603	
Turn Bay Length (ft)						
Base Capacity (vph)	1626		394	1631	930	869

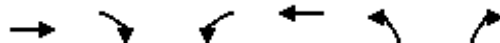
Baseline

Synchro 9 Light Report
Page 10

Lanes, Volumes, Timings

5: Arno Road & Murfreesboro Rd

7/12/2016



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Starvation Cap Reductn	0		0	0	0	0
Spillback Cap Reductn	0		0	0	0	0
Storage Cap Reductn	0		0	0	0	0
Reduced v/c Ratio	0.27		0.12	0.85	0.83	0.09

Intersection Summary

Area Type: Other

Cycle Length: 100

Actuated Cycle Length: 93.6

Natural Cycle: 70

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.93

Intersection Signal Delay: 32.1

Intersection LOS: C

Intersection Capacity Utilization 82.0%

ICU Level of Service D

Analysis Period (min) 15

90th %ile Actuated Cycle: 100

70th %ile Actuated Cycle: 100

50th %ile Actuated Cycle: 100




30th %ile Actuated Cycle: 95.1

10th %ile Actuated Cycle: 73

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.
































Splits and Phases: 5: Arno Road & Murfreesboro Rd

 Ø2	 Ø4
53 s	47 s
	 Ø8
	47 s

Lanes, Volumes, Timings

1: Carothers Parkway & Murfreesboro Road

7/12/2016

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 			  		 	 		 	 	
Traffic Volume (vph)	84	1371	430	20	642	52	223	64	36	627	563	150
Future Volume (vph)	84	1371	430	20	642	52	223	64	36	627	563	150
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12	12	12	12	12	12	12
Grade (%)		0%			0%			0%			0%	
Storage Length (ft)	0		0	0		0	0		0	0		0
Storage Lanes	2		1	1		0	2		1	2		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	0.97	0.95	1.00	1.00	0.91	0.91	0.97	0.95	1.00	0.97	0.95	1.00
Ped Bike Factor												
Frt			0.850		0.989				0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	3433	3539	1583	1770	5029	0	3433	3539	1583	3433	3539	1583
Flt Permitted	0.346			0.178			0.366			0.709		
Satd. Flow (perm)	1250	3539	1583	332	5029	0	1323	3539	1583	2562	3539	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			123		34				33			141
Link Speed (mph)		45			45			35			40	
Link Distance (ft)		150			1130			3000			147	
Travel Time (s)		2.3			17.1			58.4			2.5	
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	91	1490	467	22	698	57	242	70	39	682	612	163
Shared Lane Traffic (%)												
Lane Group Flow (vph)	91	1490	467	22	755	0	242	70	39	682	612	163
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		24			24			24			24	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2		1	2	1	1	2	1
Detector Template	Left	Thru	Right	Left	Thru		Left	Thru	Right	Left	Thru	Right
Leading Detector (ft)	20	100	20	20	100		20	100	20	20	100	20
Trailing Detector (ft)	0	0	0	0	0		0	0	0	0	0	0
Turn Type	Perm	NA	Perm	Perm	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8			2		2	6		6
Detector Phase	4	4	4	8	8		2	2	2	6	6	6
Switch Phase												

Lanes, Volumes, Timings

1: Carothers Parkway & Murfreesboro Road

7/12/2016















Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	22.5		22.5	22.5	22.5	22.5	22.5	22.5
Total Split (s)	27.0	27.0	27.0	27.0	27.0		23.0	23.0	23.0	23.0	23.0	23.0
Total Split (%)	54.0%	54.0%	54.0%	54.0%	54.0%		46.0%	46.0%	46.0%	46.0%	46.0%	46.0%
Maximum Green (s)	22.5	22.5	22.5	22.5	22.5		18.5	18.5	18.5	18.5	18.5	18.5
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5		3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5		4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Minimum Gap (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Time Before Reduce (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Time To Reduce (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Recall Mode	None	None	None	None	None		C-Max	C-Max	C-Max	C-Max	C-Max	C-Max
Walk Time (s)	7.0	7.0	7.0	7.0	7.0		7.0	7.0	7.0	7.0	7.0	7.0
Flash Dont Walk (s)	11.0	11.0	11.0	11.0	11.0		11.0	11.0	11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	0	0	0	0	0		0	0	0	0	0	0
Act Effect Green (s)	22.5	22.5	22.5	22.5	22.5		18.5	18.5	18.5	18.5	18.5	18.5
Actuated g/C Ratio	0.45	0.45	0.45	0.45	0.45		0.37	0.37	0.37	0.37	0.37	0.37
v/c Ratio	0.16	0.94	0.60	0.15	0.33		0.49	0.05	0.06	0.72	0.47	0.24
Control Delay	9.1	27.0	11.3	7.3	5.8		16.4	10.3	5.4	19.0	13.5	4.3
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	9.1	27.0	11.3	7.3	5.8		16.4	10.3	5.4	19.0	13.5	4.3
LOS	A	C	B	A	A		B	B	A	B	B	A
Approach Delay		22.6			5.8			14.0			15.0	
Approach LOS		C			A			B			B	
90th %ile Green (s)	22.5	22.5	22.5	22.5	22.5		18.5	18.5	18.5	18.5	18.5	18.5
90th %ile Term Code	Max	Max	Max	Hold	Hold		Coord	Coord	Coord	Coord	Coord	Coord
70th %ile Green (s)	22.5	22.5	22.5	22.5	22.5		18.5	18.5	18.5	18.5	18.5	18.5
70th %ile Term Code	Max	Max	Max	Hold	Hold		Coord	Coord	Coord	Coord	Coord	Coord
50th %ile Green (s)	22.5	22.5	22.5	22.5	22.5		18.5	18.5	18.5	18.5	18.5	18.5
50th %ile Term Code	Max	Max	Max	Hold	Hold		Coord	Coord	Coord	Coord	Coord	Coord
30th %ile Green (s)	22.5	22.5	22.5	22.5	22.5		18.5	18.5	18.5	18.5	18.5	18.5
30th %ile Term Code	Max	Max	Max	Hold	Hold		Coord	Coord	Coord	Coord	Coord	Coord
10th %ile Green (s)	22.5	22.5	22.5	22.5	22.5		18.5	18.5	18.5	18.5	18.5	18.5
10th %ile Term Code	Max	Max	Max	Hold	Hold		Coord	Coord	Coord	Coord	Coord	Coord
Stops (vph)	49	1102	234	10	347		167	40	13	506	398	31
Fuel Used(gal)	1	23	4	0	10		7	2	1	8	6	1
CO Emissions (g/hr)	59	1578	302	21	715		478	127	64	560	420	41
NOx Emissions (g/hr)	12	307	59	4	139		93	25	12	109	82	8
VOC Emissions (g/hr)	14	366	70	5	166		111	30	15	130	97	10
Dilemma Vehicles (#)	0	130	0	0	34		0	6	0	0	56	0
Queue Length 50th (ft)	7	202	66	3	46		27	6	1	85	68	4
Queue Length 95th (ft)	18	#346	142	9	49		54	16	15	136	106	33
Internal Link Dist (ft)		70			1050			2920			67	
Turn Bay Length (ft)												
Base Capacity (vph)	562	1592	780	149	2281		489	1309	606	947	1309	674

Lanes, Volumes, Timings

1: Carothers Parkway & Murfreesboro Road

7/12/2016

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Starvation Cap Reductn	0	0	0	0	0		0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0		0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0		0	0	0	0	0	0
Reduced v/c Ratio	0.16	0.94	0.60	0.15	0.33		0.49	0.05	0.06	0.72	0.47	0.24

Intersection Summary

Area Type: Other

Cycle Length: 50

Actuated Cycle Length: 50

Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green, Master Intersection

Natural Cycle: 55

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.94

Intersection Signal Delay: 16.8

Intersection LOS: B

Intersection Capacity Utilization 71.2%

ICU Level of Service C













Analysis Period (min) 15

Description: Hwy 96 and Carothers Pkwy

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

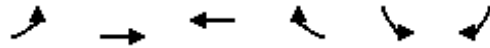
Splits and Phases: 1: Carothers Parkway & Murfreesboro Road

					
Ø2 (R)			Ø4		
23 s			27 s		
					
Ø6 (R)			Ø8		
23 s			27 s		

Lanes, Volumes, Timings

2: Murfreesboro Road/Murfreesboro Rd & Clovercroft Road

7/12/2016

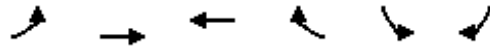


Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	132	2434	634	42	101	110
Future Volume (vph)	132	2434	634	42	101	110
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12
Grade (%)		0%	0%		0%	
Storage Length (ft)	0			0	0	0
Storage Lanes	1			0	1	1
Taper Length (ft)	25				25	
Lane Util. Factor	1.00	0.95	0.95	0.95	1.00	1.00
Ped Bike Factor						
Frt			0.991			0.850
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1770	3539	3507	0	1770	1583
Flt Permitted	0.367				0.950	
Satd. Flow (perm)	684	3539	3507	0	1770	1583
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)			18			120
Link Speed (mph)		45	45		40	
Link Distance (ft)		1130	160		355	
Travel Time (s)		17.1	2.4		6.1	
Confl. Peds. (#/hr)						
Confl. Bikes (#/hr)						
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0
Parking (#/hr)						
Mid-Block Traffic (%)		0%	0%		0%	
Adj. Flow (vph)	143	2646	689	46	110	120
Shared Lane Traffic (%)						
Lane Group Flow (vph)	143	2646	735	0	110	120
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(ft)		12	12		12	
Link Offset(ft)		0	0		0	
Crosswalk Width(ft)		16	16		16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15			9	15	9
Number of Detectors	1	2	2		1	1
Detector Template	Left	Thru	Thru		Left	Right
Leading Detector (ft)	20	100	100		20	20
Trailing Detector (ft)	0	0	0		0	0
Turn Type	Perm	NA	NA		Prot	Perm
Protected Phases		4	8		6	
Permitted Phases	4					6
Detector Phase	4	4	8		6	6
Switch Phase						

Lanes, Volumes, Timings

2: Murfreesboro Road/Murfreesboro Rd & Clovercroft Road

7/12/2016



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Minimum Initial (s)	5.0	5.0	5.0		5.0	5.0
Minimum Split (s)	22.5	22.5	22.5		22.5	22.5
Total Split (s)	77.0	77.0	77.0		23.0	23.0
Total Split (%)	77.0%	77.0%	77.0%		23.0%	23.0%
Maximum Green (s)	72.5	72.5	72.5		18.5	18.5
Yellow Time (s)	3.5	3.5	3.5		3.5	3.5
All-Red Time (s)	1.0	1.0	1.0		1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0		0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5		4.5	4.5
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Minimum Gap (s)	3.0	3.0	3.0		3.0	3.0
Time Before Reduce (s)	0.0	0.0	0.0		0.0	0.0
Time To Reduce (s)	0.0	0.0	0.0		0.0	0.0
Recall Mode	None	None	None		C-Min	C-Min
Walk Time (s)	7.0	7.0	7.0		7.0	7.0
Flash Dont Walk (s)	11.0	11.0	11.0		11.0	11.0
Pedestrian Calls (#/hr)	0	0	0		0	0
Act Effect Green (s)	79.5	79.5	79.5		11.5	11.5
Actuated g/C Ratio	0.80	0.80	0.80		0.12	0.12
v/c Ratio	0.26	0.94	0.26		0.54	0.42
Control Delay	3.8	16.0	1.8		51.0	11.9
Queue Delay	0.0	0.0	0.0		0.0	0.0
Total Delay	3.8	16.0	1.8		51.0	11.9
LOS	A	B	A		D	B
Approach Delay		15.3	1.8		30.6	
Approach LOS		B	A		C	
90th %ile Green (s)	75.0	75.0	75.0		16.0	16.0
90th %ile Term Code	Max	Max	Hold		Coord	Coord
70th %ile Green (s)	77.7	77.7	77.7		13.3	13.3
70th %ile Term Code	Max	Max	Hold		Coord	Coord
50th %ile Green (s)	79.5	79.5	79.5		11.5	11.5
50th %ile Term Code	Max	Max	Hold		Coord	Coord
30th %ile Green (s)	81.3	81.3	81.3		9.7	9.7
30th %ile Term Code	Max	Max	Hold		Coord	Coord
10th %ile Green (s)	84.0	84.0	84.0		7.0	7.0
10th %ile Term Code	Max	Max	Hold		Coord	Coord
Stops (vph)	36	1623	86		92	19
Fuel Used(gal)	2	46	2		2	1
CO Emissions (g/hr)	106	3212	141		153	50
NOx Emissions (g/hr)	21	625	27		30	10
VOC Emissions (g/hr)	25	744	33		36	12
Dilemma Vehicles (#)	0	79	17		0	0
Queue Length 50th (ft)	14	496	26		67	0
Queue Length 95th (ft)	m37	m#1065	m44		117	49
Internal Link Dist (ft)		1050	80		275	
Turn Bay Length (ft)						
Base Capacity (vph)	543	2813	2791		327	390

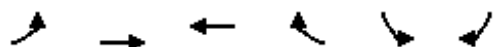
Baseline

Synchro 9 Light Report
Page 5

Lanes, Volumes, Timings

2: Murfreesboro Road/Murfreesboro Rd & Clovercroft Road

7/12/2016



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Starvation Cap Reductn	0	0	0		0	0
Spillback Cap Reductn	0	0	0		0	0
Storage Cap Reductn	0	0	0		0	0
Reduced v/c Ratio	0.26	0.94	0.26		0.34	0.31

Intersection Summary

Area Type: Other

Cycle Length: 100

Actuated Cycle Length: 100

Offset: 34 (34%), Referenced to phase 2: and 6:SBL, Start of Green

Natural Cycle: 110

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.94

Intersection Signal Delay: 13.6

Intersection LOS: B

Intersection Capacity Utilization 80.4%

ICU Level of Service D

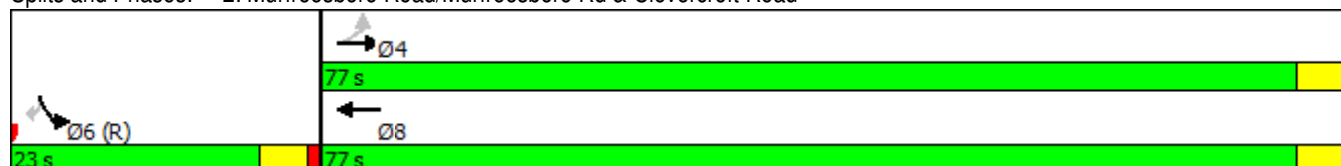
Analysis Period (min) 15

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.












m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 2: Murfreesboro Road/Murfreesboro Rd & Clovercroft Road



Lanes, Volumes, Timings
5: Arno Road & Murfreesboro Rd

7/12/2016

						
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	1143	1315	65	381	261	31
Future Volume (vph)	1143	1315	65	381	261	31
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12
Grade (%)	0%			0%	0%	
Storage Length (ft)		0	0		0	0
Storage Lanes		0	1		1	1
Taper Length (ft)			25		25	
Lane Util. Factor	0.95	0.95	1.00	0.95	1.00	1.00
Ped Bike Factor						
Frt	0.920					0.850
Flt Protected			0.950		0.950	
Satd. Flow (prot)	3256	0	1770	3539	1770	1583
Flt Permitted			0.055		0.950	
Satd. Flow (perm)	3256	0	102	3539	1770	1583
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)	733					34
Link Speed (mph)	45			45	50	
Link Distance (ft)	1550			63	683	
Travel Time (s)	23.5			1.0	9.3	
Confl. Peds. (#/hr)						
Confl. Bikes (#/hr)						
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0
Parking (#/hr)						
Mid-Block Traffic (%)	0%			0%	0%	
Adj. Flow (vph)	1242	1429	71	414	284	34
Shared Lane Traffic (%)						
Lane Group Flow (vph)	2671	0	71	414	284	34
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			12	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Number of Detectors	2		1	2	1	1
Detector Template	Thru		Left	Thru	Left	Right
Leading Detector (ft)	100		20	100	20	20
Trailing Detector (ft)	0		0	0	0	0
Turn Type	NA		Perm	NA	Prot	Perm
Protected Phases	4			8	2	
Permitted Phases			8			2
Detector Phase	4		8	8	2	2
Switch Phase						

Lanes, Volumes, Timings
5: Arno Road & Murfreesboro Rd

7/12/2016

	→	↘	↙	←	↖	↗
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Minimum Initial (s)	5.0		5.0	5.0	5.0	5.0
Minimum Split (s)	22.5		22.5	22.5	22.5	22.5
Total Split (s)	76.2		76.2	76.2	23.8	23.8
Total Split (%)	76.2%		76.2%	76.2%	23.8%	23.8%
Maximum Green (s)	71.7		71.7	71.7	19.3	19.3
Yellow Time (s)	3.5		3.5	3.5	3.5	3.5
All-Red Time (s)	1.0		1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0		0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5		4.5	4.5	4.5	4.5
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Minimum Gap (s)	3.0		3.0	3.0	3.0	3.0
Time Before Reduce (s)	0.0		0.0	0.0	0.0	0.0
Time To Reduce (s)	0.0		0.0	0.0	0.0	0.0
Recall Mode	None		None	None	C-Min	C-Min
Walk Time (s)	7.0		7.0	7.0	7.0	7.0
Flash Dont Walk (s)	11.0		11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	0		0	0	0	0
Act Effect Green (s)	72.5		72.5	72.5	18.5	18.5
Actuated g/C Ratio	0.72		0.72	0.72	0.18	0.18
v/c Ratio	1.04		0.96	0.16	0.87	0.11
Control Delay	30.9		118.8	4.6	66.0	12.3
Queue Delay	0.0		0.0	0.0	0.0	0.0
Total Delay	30.9		118.8	4.6	66.0	12.3
LOS	C		F	A	E	B
Approach Delay	30.9			21.3	60.3	
Approach LOS	C			C	E	
90th %ile Green (s)	71.7		71.7	71.7	19.3	19.3
90th %ile Term Code	Max		Max	Max	Coord	Coord
70th %ile Green (s)	71.7		71.7	71.7	19.3	19.3
70th %ile Term Code	Max		Max	Max	Coord	Coord
50th %ile Green (s)	71.7		71.7	71.7	19.3	19.3
50th %ile Term Code	Max		Max	Max	Coord	Coord
30th %ile Green (s)	71.7		71.7	71.7	19.3	19.3
30th %ile Term Code	Max		Max	Max	Coord	Coord
10th %ile Green (s)	75.8		75.8	75.8	15.2	15.2
10th %ile Term Code	Max		Hold	Hold	Coord	Coord
Stops (vph)	1022		41	110	235	9
Fuel Used(gal)	53		2	2	8	0
CO Emissions (g/hr)	3698		147	131	576	24
NOx Emissions (g/hr)	719		29	26	112	5
VOC Emissions (g/hr)	857		34	30	134	6
Dilemma Vehicles (#)	104		0	19	0	0
Queue Length 50th (ft)	~906		36	38	176	0
Queue Length 95th (ft)	m#1020		#90	53	#312	26
Internal Link Dist (ft)	1470			1	603	
Turn Bay Length (ft)						
Base Capacity (vph)	2562		74	2566	341	332

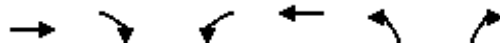
Baseline

Synchro 9 Light Report
Page 10

Lanes, Volumes, Timings

5: Arno Road & Murfreesboro Rd

7/12/2016



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Starvation Cap Reductn	0		0	0	0	0
Spillback Cap Reductn	0		0	0	0	0
Storage Cap Reductn	0		0	0	0	0
Reduced v/c Ratio	1.04		0.96	0.16	0.83	0.10

Intersection Summary

Area Type: Other

Cycle Length: 100

Actuated Cycle Length: 100

Offset: 64 (64%), Referenced to phase 2:NBL and 6:, Start of Green

Natural Cycle: 120

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 1.04

Intersection Signal Delay: 32.3

Intersection LOS: C

Intersection Capacity Utilization 95.8%

ICU Level of Service F

Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

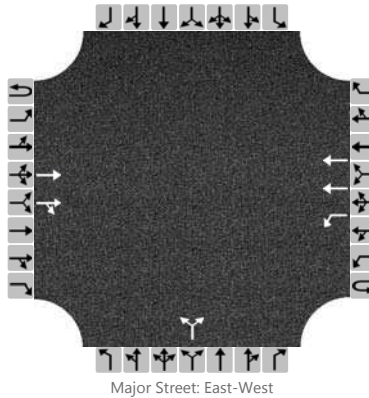
Splits and Phases: 5: Arno Road & Murfreesboro Rd

 Ø2 (L)	 Ø4
23.8 s	76.2 s
 Ø8	
	76.2 s

HCS 2010 Two-Way Stop Control Summary Report

General Information		Site Information	
Analyst	FTG	Intersection	Hwy 96E and Cross Creek
Agency/Co.	FTG	Jurisdiction	Franklin, TN
Date Performed	9/16/2015	East/West Street	Highway 96E
Analysis Year	2015	North/South Street	Cross Creek Drive
Time Analyzed	AM Peak Hour	Peak Hour Factor	0.95
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	10647		

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	2	0	0	1	2	0		0	0	0		0	0	0
Configuration			T	TR		L	T				LR					
Volume (veh/h)			398	7		0	2030			35		2				
Percent Heavy Vehicles						0				0		0				
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Left Only															
Median Storage	1															

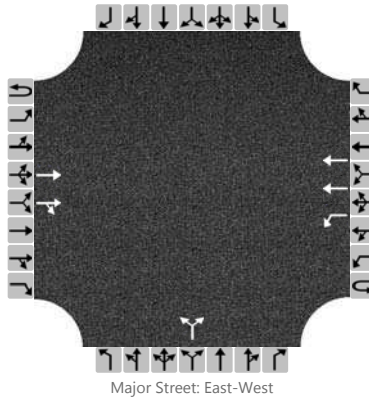
Delay, Queue Length, and Level of Service

Flow Rate (veh/h)											39					
Capacity						1144					194					
v/c Ratio											0.20					
95% Queue Length											0.7					
Control Delay (s/veh)						8.1					28.1					
Level of Service (LOS)						A					D					
Approach Delay (s/veh)									28.1							
Approach LOS									D							

HCS 2010 Two-Way Stop Control Summary Report

General Information		Site Information	
Analyst	FTG	Intersection	Hwy 96E and Cross Creek
Agency/Co.	FTG	Jurisdiction	Franklin, TN
Date Performed	9/16/2015	East/West Street	Highway 96E
Analysis Year	2015	North/South Street	Cross Creek Drive
Time Analyzed	PM Peak Hour	Peak Hour Factor	0.98
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	10647		

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	2	0	0	1	2	0		0	0	0		0	0	0
Configuration			T	TR		L	T				LR					
Volume (veh/h)			2501	34		0	662			14		0				
Percent Heavy Vehicles						0				0		0				
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Left Only															
Median Storage	1															

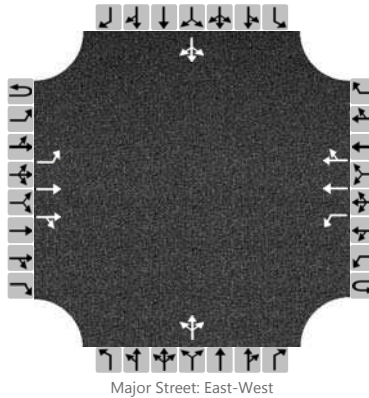
Delay, Queue Length, and Level of Service

Flow Rate (veh/h)											14					
Capacity						171					24					
v/c Ratio											0.58					
95% Queue Length											1.7					
Control Delay (s/veh)						26.0					278.1					
Level of Service (LOS)						D					F					
Approach Delay (s/veh)									278.1							
Approach LOS									F							

HCS 2010 Two-Way Stop Control Summary Report

General Information		Site Information	
Analyst	FTG	Intersection	Highway 96E and Ridgeway
Agency/Co.	FTG	Jurisdiction	Franklin, TN
Date Performed	9/16/2015	East/West Street	Highway 96E
Analysis Year	2015	North/South Street	Chester Stevens/Ridgeway
Time Analyzed	AM Peak Hour	Peak Hour Factor	0.98
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	10647		

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	1	2	0	0	1	2	0		0	1	0		0	1	0
Configuration		L	T	TR		L	T	TR			LTR				LTR	
Volume (veh/h)		8	388	4		2	1957	21		16	0	2		11	0	57
Percent Heavy Vehicles		0				0				0	0	0		0	0	0
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Left Only															
Median Storage	1															

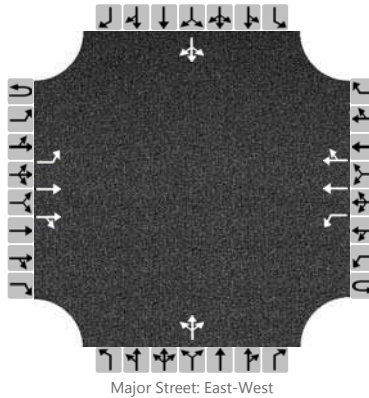
Delay, Queue Length, and Level of Service

Flow Rate (veh/h)		8				2					18				69	
Capacity		286				1170					170				157	
v/c Ratio		0.03				0.00					0.11				0.44	
95% Queue Length		0.1				0.0					0.3				2.0	
Control Delay (s/veh)		17.9				8.1					28.7				45.0	
Level of Service (LOS)		C				A					D				E	
Approach Delay (s/veh)	0.4				0.0				28.7				45.0			
Approach LOS	A				A				D				E			

HCS 2010 Two-Way Stop Control Summary Report

General Information		Site Information	
Analyst	FTG	Intersection	Highway 96E and Ridgeway
Agency/Co.	FTG	Jurisdiction	Franklin, TN
Date Performed	9/16/2015	East/West Street	Highway 96E
Analysis Year	2015	North/South Street	Chester Stevens/Ridgeway
Time Analyzed	PM Peak Hour	Peak Hour Factor	0.98
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	10647		

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	1	2	0	0	1	2	0		0	1	0		0	1	0
Configuration		L	T	TR		L	T	TR			LTR				LTR	
Volume (veh/h)		41	2453	7		1	632	9		6	0	1		4	0	24
Percent Heavy Vehicles		0				0				0	0	0		0	0	0
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Left Only															
Median Storage	1															

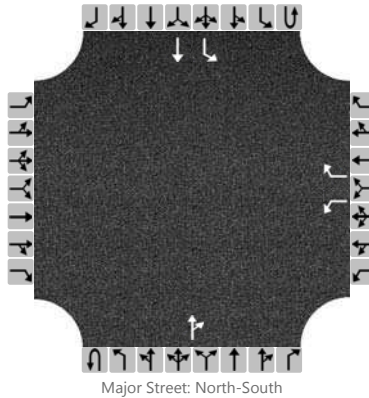
Delay, Queue Length, and Level of Service

Flow Rate (veh/h)		42				1					7					28
Capacity		943				184					26					400
v/c Ratio		0.04				0.01					0.27					0.07
95% Queue Length		0.1				0.0					0.8					0.2
Control Delay (s/veh)		9.0				24.7					192.5					14.7
Level of Service (LOS)		A				C					F					B
Approach Delay (s/veh)	0.1				0.0				192.5				14.7			
Approach LOS	A				A				F				B			

HCS 2010 Two-Way Stop Control Summary Report

General Information		Site Information	
Analyst	FTG	Intersection	Carothers and S. Carother
Agency/Co.	FTG	Jurisdiction	Franklin, TN
Date Performed	2016	East/West Street	S. Carothers Road
Analysis Year	2016	North/South Street	Carothers Parkway
Time Analyzed	AM Peak Hour	Peak Hour Factor	0.88
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	10647 (Existing)		

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		1	0	1	0	0	1	0	0	1	1	0
Configuration						L		R				TR		L	T	
Volume (veh/h)						0		35			448	3		6	74	
Percent Heavy Vehicles						0		0						0		
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

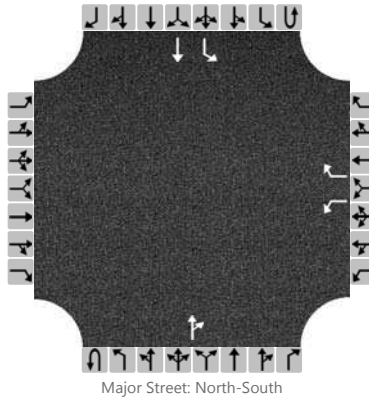
Delay, Queue Length, and Level of Service

Flow Rate (veh/h)								40						7		
Capacity						459		561						1064		
v/c Ratio								0.07						0.01		
95% Queue Length								0.2						0.0		
Control Delay (s/veh)						12.8		11.9						8.4		
Level of Service (LOS)						B		B						A		
Approach Delay (s/veh)						11.9								0.6		
Approach LOS						B								A		

HCS 2010 Two-Way Stop Control Summary Report

General Information		Site Information	
Analyst	FTG	Intersection	Carothers and S. Carother
Agency/Co.	FTG	Jurisdiction	Franklin, TN
Date Performed	2016	East/West Street	S. Carothers Road
Analysis Year	2016	North/South Street	Carothers Parkway
Time Analyzed	PM Peak Hour	Peak Hour Factor	0.91
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	10647 (Existing)		

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		1	0	1	0	0	1	0	0	1	1	0
Configuration						L		R				TR		L	T	
Volume (veh/h)						3		23			116	5		43	420	
Percent Heavy Vehicles						0		0						0		
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

























Flow Rate (veh/h)						3		25						47		
Capacity						403		925						1466		
v/c Ratio						0.01		0.03						0.03		
95% Queue Length						0.0		0.1						0.1		
Control Delay (s/veh)						14.0		9.0						7.5		
Level of Service (LOS)						B		A						A		
Approach Delay (s/veh)					9.5								0.7			
Approach LOS					A								A			

BACKGROUND CONDITIONS

Lanes, Volumes, Timings

1: Carothers Parkway & Murfreesboro Road

7/12/2016

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	499	439	158	38	1566	251	470	456	30	150	124	191
Future Volume (vph)	499	439	158	38	1566	251	470	456	30	150	124	191
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12	12	12	12	12	12	12
Grade (%)	0%				0%				0%			
Storage Length (ft)	0			0	0			0	0			0
Storage Lanes	2			1	1			2	1			2
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	0.97	0.95	1.00	1.00	0.91	0.91	0.97	0.95	1.00	0.97	0.95	1.00
Ped Bike Factor												
Frt			0.850		0.979				0.850		0.850	
Flt Protected	0.950				0.950		0.950				0.950	
Satd. Flow (prot)	3433	3539	1583	1770	4979	0	3433	3539	1583	3433	3539	1583
Flt Permitted	0.222				0.479		0.666				0.468	
Satd. Flow (perm)	802	3539	1583	892	4979	0	2407	3539	1583	1691	3539	1583
Right Turn on Red			Yes				Yes		Yes			
Satd. Flow (RTOR)			172		81				36		36	
Link Speed (mph)			45		45		35				40	
Link Distance (ft)			150		1130		3000				147	
Travel Time (s)			2.3		17.1		58.4				2.5	
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)	0%				0%		0%				0%	
Adj. Flow (vph)	542	477	172	41	1702	273	511	496	33	163	135	208
Shared Lane Traffic (%)												
Lane Group Flow (vph)	542	477	172	41	1975	0	511	496	33	163	135	208
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)	24				24		24				24	
Link Offset(ft)	0				0		0				0	
Crosswalk Width(ft)	16				16		16				16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9		15	9		15	9		15	9	
Number of Detectors	1	2	1	1	2	1		2	1	1	2	1
Detector Template	Left	Thru	Right	Left	Thru	Left		Thru	Right	Left	Thru	Right
Leading Detector (ft)	20	100	20	20	100	20		100	20	20	100	20
Trailing Detector (ft)	0	0	0	0	0	0		0	0	0	0	0
Turn Type	Perm	NA	Perm	Perm	NA	Perm		NA	Perm	Perm	NA	Perm
Protected Phases	4				8		2				6	
Permitted Phases	4	4		8			2	2		6	6	
Detector Phase	4	4	4	8	8	2		2	2	6	6	6
Switch Phase												

Lanes, Volumes, Timings

1: Carothers Parkway & Murfreesboro Road

7/12/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	22.5		22.5	22.5	22.5	22.5	22.5	22.5
Total Split (s)	22.5	22.5	22.5	22.5	22.5		22.5	22.5	22.5	22.5	22.5	22.5
Total Split (%)	50.0%	50.0%	50.0%	50.0%	50.0%		50.0%	50.0%	50.0%	50.0%	50.0%	50.0%
Maximum Green (s)	18.0	18.0	18.0	18.0	18.0		18.0	18.0	18.0	18.0	18.0	18.0
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5		3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5		4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Minimum Gap (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Time Before Reduce (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Time To Reduce (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Recall Mode	None	None	None	None	None		C-Max	C-Max	C-Max	C-Max	C-Max	C-Max
Walk Time (s)	7.0	7.0	7.0	7.0	7.0		7.0	7.0	7.0	7.0	7.0	7.0
Flash Dont Walk (s)	11.0	11.0	11.0	11.0	11.0		11.0	11.0	11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	0	0	0	0	0		0	0	0	0	0	0
Act Effct Green (s)	18.0	18.0	18.0	18.0	18.0		18.0	18.0	18.0	18.0	18.0	18.0
Actuated g/C Ratio	0.40	0.40	0.40	0.40	0.40		0.40	0.40	0.40	0.40	0.40	0.40
v/c Ratio	1.69	0.34	0.23	0.12	0.97		0.53	0.35	0.05	0.24	0.10	0.32
Control Delay	345.0	10.2	2.9	8.6	21.5		12.8	10.3	3.8	10.2	8.7	9.3
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	345.0	10.2	2.9	8.6	21.5		12.8	10.3	3.8	10.2	8.7	9.3
LOS	F	B	A	A	C		B	B	A	B	A	A
Approach Delay	161.5				21.2		11.3				9.4	
Approach LOS	F				C		B				A	
90th %ile Green (s)	18.0	18.0	18.0	18.0	18.0		18.0	18.0	18.0	18.0	18.0	18.0
90th %ile Term Code	Max	Max	Max	Max	Max		Coord	Coord	Coord	Coord	Coord	Coord
70th %ile Green (s)	18.0	18.0	18.0	18.0	18.0		18.0	18.0	18.0	18.0	18.0	18.0
70th %ile Term Code	Max	Max	Max	Max	Max		Coord	Coord	Coord	Coord	Coord	Coord
50th %ile Green (s)	18.0	18.0	18.0	18.0	18.0		18.0	18.0	18.0	18.0	18.0	18.0
50th %ile Term Code	Max	Max	Max	Max	Max		Coord	Coord	Coord	Coord	Coord	Coord
30th %ile Green (s)	18.0	18.0	18.0	18.0	18.0		18.0	18.0	18.0	18.0	18.0	18.0
30th %ile Term Code	Max	Max	Max	Max	Max		Coord	Coord	Coord	Coord	Coord	Coord
10th %ile Green (s)	18.0	18.0	18.0	18.0	18.0		18.0	18.0	18.0	18.0	18.0	18.0
10th %ile Term Code	Max	Max	Max	Max	Max		Coord	Coord	Coord	Coord	Coord	Coord
Stops (vph)	418	278	23	25	1497		333	291	9	93	70	103
Fuel Used(gal)	41	5	1	1	40		14	13	1	1	1	2
CO Emissions (g/hr)	2847	335	37	46	2789		972	910	52	96	72	109
NOx Emissions (g/hr)	554	65	7	9	543		189	177	10	19	14	21
VOC Emissions (g/hr)	660	78	9	11	646		225	211	12	22	17	25
Dilemma Vehicles (#)	0	49	0	0	162		0	51	0	0	14	0
Queue Length 50th (ft)	~112	42	0	8	199		48	44	0	13	10	28
Queue Length 95th (ft)	#187	68	26	m9	m#229		83	72	11	29	22	64
Internal Link Dist (ft)	70				1050		2920				67	
Turn Bay Length (ft)												
Base Capacity (vph)	320	1415	736	356	2040		962	1415	654	676	1415	654













Baseline

Synchro 9 Light Report
Page 2

Lanes, Volumes, Timings

1: Carothers Parkway & Murfreesboro Road

7/12/2016

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Starvation Cap Reductn	0	0	0	0	0		0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0		0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0		0	0	0	0	0	0
Reduced v/c Ratio	1.69	0.34	0.23	0.12	0.97		0.53	0.35	0.05	0.24	0.10	0.32

Intersection Summary

Area Type: Other

Cycle Length: 45

Actuated Cycle Length: 45

Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green, Master Intersection

Natural Cycle: 45

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 1.69

Intersection Signal Delay: 53.0

Intersection LOS: D

Intersection Capacity Utilization 82.7%

ICU Level of Service E

Analysis Period (min) 15

Description: Hwy 96 and Carothers Pkwy

~ Volume exceeds capacity, queue is theoretically infinite.













Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

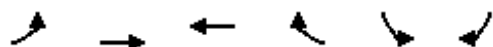
Splits and Phases: 1: Carothers Parkway & Murfreesboro Road

					
Ø2 (R)			Ø4		
22.5 s			22.5 s		
					
Ø6 (R)			Ø8		
22.5 s			22.5 s		

Lanes, Volumes, Timings

2: Murfreesboro Road/Murfreesboro Rd & Clovercroft Road

7/12/2016

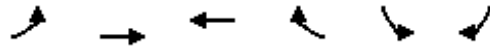


Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	68	435	2247	45	28	175
Future Volume (vph)	68	435	2247	45	28	175
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12
Grade (%)		0%	0%		0%	
Storage Length (ft)	0			0	0	0
Storage Lanes	1			0	1	1
Taper Length (ft)	25				25	
Lane Util. Factor	1.00	0.95	0.95	0.95	1.00	1.00
Ped Bike Factor						
Frt			0.997			0.850
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1770	3539	3529	0	1770	1583
Flt Permitted	0.061				0.950	
Satd. Flow (perm)	114	3539	3529	0	1770	1583
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)			5			8
Link Speed (mph)		45	45		40	
Link Distance (ft)		1130	160		355	
Travel Time (s)		17.1	2.4		6.1	
Confl. Peds. (#/hr)						
Confl. Bikes (#/hr)						
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0
Parking (#/hr)						
Mid-Block Traffic (%)		0%	0%		0%	
Adj. Flow (vph)	74	473	2442	49	30	190
Shared Lane Traffic (%)						
Lane Group Flow (vph)	74	473	2491	0	30	190
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(ft)		12	12		12	
Link Offset(ft)		0	0		0	
Crosswalk Width(ft)		16	16		16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15			9	15	9
Number of Detectors	1	2	2		1	1
Detector Template	Left	Thru	Thru		Left	Right
Leading Detector (ft)	20	100	100		20	20
Trailing Detector (ft)	0	0	0		0	0
Turn Type	Perm	NA	NA		Prot	Perm
Protected Phases		4	8		6	
Permitted Phases	4					6
Detector Phase	4	4	8		6	6
Switch Phase						

Lanes, Volumes, Timings

2: Murfreesboro Road/Murfreesboro Rd & Clovercroft Road

7/12/2016



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Minimum Initial (s)	5.0	5.0	5.0		5.0	5.0
Minimum Split (s)	22.5	22.5	22.5		22.5	22.5
Total Split (s)	66.0	66.0	66.0		24.0	24.0
Total Split (%)	73.3%	73.3%	73.3%		26.7%	26.7%
Maximum Green (s)	61.5	61.5	61.5		19.5	19.5
Yellow Time (s)	3.5	3.5	3.5		3.5	3.5
All-Red Time (s)	1.0	1.0	1.0		1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0		0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5		4.5	4.5
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Minimum Gap (s)	3.0	3.0	3.0		3.0	3.0
Time Before Reduce (s)	0.0	0.0	0.0		0.0	0.0
Time To Reduce (s)	0.0	0.0	0.0		0.0	0.0
Recall Mode	None	None	None		C-Min	C-Min
Walk Time (s)	7.0	7.0	7.0		7.0	7.0
Flash Dont Walk (s)	11.0	11.0	11.0		11.0	11.0
Pedestrian Calls (#/hr)	0	0	0		0	0
Act Effect Green (s)	65.9	65.9	65.9		15.1	15.1
Actuated g/C Ratio	0.73	0.73	0.73		0.17	0.17
v/c Ratio	0.89	0.18	0.96		0.10	0.70
Control Delay	96.9	2.7	13.2		30.5	47.1
Queue Delay	0.0	0.0	0.0		0.0	0.0
Total Delay	96.9	2.7	13.2		30.5	47.1
LOS	F	A	B		C	D
Approach Delay		15.4	13.2		44.8	
Approach LOS		B	B		D	
90th %ile Green (s)	61.5	61.5	61.5		19.5	19.5
90th %ile Term Code	Max	Max	Max		Coord	Coord
70th %ile Green (s)	62.9	62.9	62.9		18.1	18.1
70th %ile Term Code	Max	Max	Max		Coord	Coord
50th %ile Green (s)	65.4	65.4	65.4		15.6	15.6
50th %ile Term Code	Max	Max	Max		Coord	Coord
30th %ile Green (s)	68.0	68.0	68.0		13.0	13.0
30th %ile Term Code	Hold	Hold	Max		Coord	Coord
10th %ile Green (s)	71.7	71.7	71.7		9.3	9.3
10th %ile Term Code	Hold	Hold	Max		Coord	Coord
Stops (vph)	49	70	1064		25	154
Fuel Used(gal)	2	4	22		0	4
CO Emissions (g/hr)	171	301	1523		34	253
NOx Emissions (g/hr)	33	58	296		7	49
VOC Emissions (g/hr)	40	70	353		8	59
Dilemma Vehicles (#)	0	17	36		0	0
Queue Length 50th (ft)	33	22	257		14	98
Queue Length 95th (ft)	#132	34	m#811		37	161
Internal Link Dist (ft)		1050	80		275	
Turn Bay Length (ft)						
Base Capacity (vph)	83	2591	2585		383	349

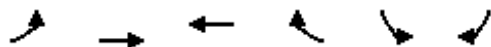
Baseline

Synchro 9 Light Report
Page 5

Lanes, Volumes, Timings

2: Murfreesboro Road/Murfreesboro Rd & Clovercroft Road

7/12/2016



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Starvation Cap Reductn	0	0	0		0	0
Spillback Cap Reductn	0	0	0		0	0
Storage Cap Reductn	0	0	0		0	0
Reduced v/c Ratio	0.89	0.18	0.96		0.08	0.54

Intersection Summary

Area Type: Other

Cycle Length: 90

Actuated Cycle Length: 90

Offset: 14 (16%), Referenced to phase 2: and 6:SBL, Start of Green

Natural Cycle: 90

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.96

Intersection Signal Delay: 15.7

Intersection LOS: B

Intersection Capacity Utilization 81.9%

ICU Level of Service D

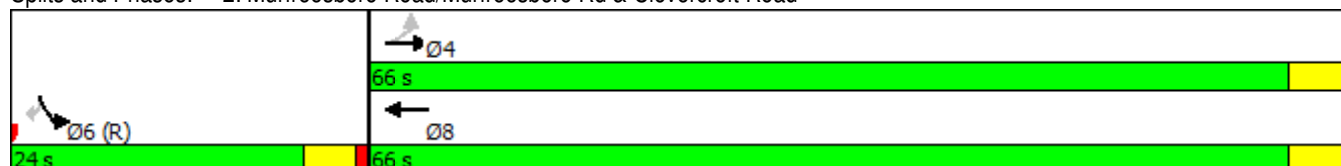
Analysis Period (min) 15

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 2: Murfreesboro Road/Murfreesboro Rd & Clovercroft Road



Lanes, Volumes, Timings
5: Arno Road & Murfreesboro Rd

7/12/2016

	→	↘	↙	←	↖	↗
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↘	↑↑	↘	↗
Traffic Volume (vph)	253	196	50	1406	782	78
Future Volume (vph)	253	196	50	1406	782	78
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12
Grade (%)	0%			0%	0%	
Storage Length (ft)		0	0		0	0
Storage Lanes		0	1		1	1
Taper Length (ft)			25		25	
Lane Util. Factor	0.95	0.95	1.00	0.95	1.00	1.00
Ped Bike Factor						
Frt	0.935					0.850
Flt Protected			0.950		0.950	
Satd. Flow (prot)	3309	0	1770	3539	1770	1583
Flt Permitted			0.421		0.950	
Satd. Flow (perm)	3309	0	784	3539	1770	1583
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)	213					85
Link Speed (mph)	45			45	50	
Link Distance (ft)	1550			63	683	
Travel Time (s)	23.5			1.0	9.3	
Confl. Peds. (#/hr)						
Confl. Bikes (#/hr)						
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0
Parking (#/hr)						
Mid-Block Traffic (%)	0%			0%	0%	
Adj. Flow (vph)	275	213	54	1528	850	85
Shared Lane Traffic (%)						
Lane Group Flow (vph)	488	0	54	1528	850	85
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			12	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Number of Detectors	2		1	2	1	1
Detector Template	Thru		Left	Thru	Left	Right
Leading Detector (ft)	100		20	100	20	20
Trailing Detector (ft)	0		0	0	0	0
Turn Type	NA		Perm	NA	Prot	Perm
Protected Phases	4			8	2	
Permitted Phases			8			2
Detector Phase	4		8	8	2	2
Switch Phase						

Lanes, Volumes, Timings
5: Arno Road & Murfreesboro Rd

7/12/2016

	→	↘	↙	←	↖	↗
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Minimum Initial (s)	5.0		5.0	5.0	5.0	5.0
Minimum Split (s)	22.5		22.5	22.5	22.5	22.5
Total Split (s)	42.2		42.2	42.2	47.8	47.8
Total Split (%)	46.9%		46.9%	46.9%	53.1%	53.1%
Maximum Green (s)	37.7		37.7	37.7	43.3	43.3
Yellow Time (s)	3.5		3.5	3.5	3.5	3.5
All-Red Time (s)	1.0		1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0		0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5		4.5	4.5	4.5	4.5
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Minimum Gap (s)	3.0		3.0	3.0	3.0	3.0
Time Before Reduce (s)	0.0		0.0	0.0	0.0	0.0
Time To Reduce (s)	0.0		0.0	0.0	0.0	0.0
Recall Mode	None		None	None	C-Min	C-Min
Walk Time (s)	7.0		7.0	7.0	7.0	7.0
Flash Dont Walk (s)	11.0		11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	0		0	0	0	0
Act Effect Green (s)	37.7		37.7	37.7	43.3	43.3
Actuated g/C Ratio	0.42		0.42	0.42	0.48	0.48
v/c Ratio	0.32		0.16	1.03	1.00	0.11
Control Delay	18.1		18.1	58.9	55.7	3.4
Queue Delay	0.0		0.0	0.0	0.0	0.0
Total Delay	18.1		18.1	58.9	55.7	3.4
LOS	B		B	E	E	A
Approach Delay	18.1			57.5	50.9	
Approach LOS	B			E	D	
90th %ile Green (s)	37.7		37.7	37.7	43.3	43.3
90th %ile Term Code	Hold		Max	Max	Coord	Coord
70th %ile Green (s)	37.7		37.7	37.7	43.3	43.3
70th %ile Term Code	Hold		Max	Max	Coord	Coord
50th %ile Green (s)	37.7		37.7	37.7	43.3	43.3
50th %ile Term Code	Hold		Max	Max	Coord	Coord
30th %ile Green (s)	37.7		37.7	37.7	43.3	43.3
30th %ile Term Code	Hold		Max	Max	Coord	Coord
10th %ile Green (s)	37.7		37.7	37.7	43.3	43.3
10th %ile Term Code	Hold		Max	Max	Coord	Coord
Stops (vph)	328		31	1216	654	10
Fuel Used(gal)	10		1	33	22	1
CO Emissions (g/hr)	716		41	2276	1558	38
NOx Emissions (g/hr)	139		8	443	303	7
VOC Emissions (g/hr)	166		10	528	361	9
Dilemma Vehicles (#)	13		0	72	0	0
Queue Length 50th (ft)	58		19	~494	463	0
Queue Length 95th (ft)	101		44	#629	#732	23
Internal Link Dist (ft)	1470			1	603	
Turn Bay Length (ft)						
Base Capacity (vph)	1509		328	1482	851	805

Baseline

Synchro 9 Light Report
Page 10

Lanes, Volumes, Timings

5: Arno Road & Murfreesboro Rd

7/12/2016

	→	↘	↙	←	↖	↗
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Starvation Cap Reductn	0		0	0	0	0
Spillback Cap Reductn	0		0	0	0	0
Storage Cap Reductn	0		0	0	0	0
Reduced v/c Ratio	0.32		0.16	1.03	1.00	0.11

Intersection Summary

Area Type: Other

Cycle Length: 90

Actuated Cycle Length: 90

Offset: 68 (76%), Referenced to phase 2:NBL and 6:, Start of Green

Natural Cycle: 110

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 1.03

Intersection Signal Delay: 49.1

Intersection LOS: D

Intersection Capacity Utilization 89.7%

ICU Level of Service E

Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.
























Splits and Phases: 5: Arno Road & Murfreesboro Rd

↖ Ø2 (R)	→ Ø4
47.8 s	42.2 s
	← Ø8
	42.2 s

Lanes, Volumes, Timings

1: Carothers Parkway & Murfreesboro Road

7/12/2016

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	257	1488	326	25	675	163	287	182	67	925	544	463
Future Volume (vph)	257	1488	326	25	675	163	287	182	67	925	544	463
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12	12	12	12	12	12	12
Grade (%)		0%			0%			0%			0%	
Storage Length (ft)	0		0	0		0	0		0	0		0
Storage Lanes	2		1	1		0	2		1	2		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	0.97	0.95	1.00	1.00	0.91	0.91	0.97	0.95	1.00	0.97	0.95	1.00
Ped Bike Factor												
Frt			0.850		0.971				0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	3433	3539	1583	1770	4938	0	3433	3539	1583	3433	3539	1583
Flt Permitted	0.250			0.077			0.357			0.627		
Satd. Flow (perm)	903	3539	1583	143	4938	0	1290	3539	1583	2266	3539	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			192		70				15			140
Link Speed (mph)		45			45			35			40	
Link Distance (ft)		150			1130			3000			147	
Travel Time (s)		2.3			17.1			58.4			2.5	
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	279	1617	354	27	734	177	312	198	73	1005	591	503
Shared Lane Traffic (%)												
Lane Group Flow (vph)	279	1617	354	27	911	0	312	198	73	1005	591	503
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		24			24			24			24	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2		1	2	1	1	2	1
Detector Template	Left	Thru	Right	Left	Thru		Left	Thru	Right	Left	Thru	Right
Leading Detector (ft)	20	100	20	20	100		20	100	20	20	100	20
Trailing Detector (ft)	0	0	0	0	0		0	0	0	0	0	0
Turn Type	Perm	NA	Perm	Perm	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8			2		2	6		6
Detector Phase	4	4	4	8	8		2	2	2	6	6	6
Switch Phase												

Lanes, Volumes, Timings

1: Carothers Parkway & Murfreesboro Road

7/12/2016















Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	22.5		22.5	22.5	22.5	22.5	22.5	22.5
Total Split (s)	56.4	56.4	56.4	56.4	56.4		53.6	53.6	53.6	53.6	53.6	53.6
Total Split (%)	51.3%	51.3%	51.3%	51.3%	51.3%		48.7%	48.7%	48.7%	48.7%	48.7%	48.7%
Maximum Green (s)	51.9	51.9	51.9	51.9	51.9		49.1	49.1	49.1	49.1	49.1	49.1
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5		3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5		4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Minimum Gap (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Time Before Reduce (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Time To Reduce (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Recall Mode	None	None	None	None	None		C-Max	C-Max	C-Max	C-Max	C-Max	C-Max
Walk Time (s)	7.0	7.0	7.0	7.0	7.0		7.0	7.0	7.0	7.0	7.0	7.0
Flash Dont Walk (s)	11.0	11.0	11.0	11.0	11.0		11.0	11.0	11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	0	0	0	0	0		0	0	0	0	0	0
Act Effect Green (s)	51.9	51.9	51.9	51.9	51.9		49.1	49.1	49.1	49.1	49.1	49.1
Actuated g/C Ratio	0.47	0.47	0.47	0.47	0.47		0.45	0.45	0.45	0.45	0.45	0.45
v/c Ratio	0.65	0.97	0.42	0.40	0.39		0.54	0.13	0.10	0.99	0.37	0.64
Control Delay	31.2	44.6	9.9	32.0	10.5		26.6	18.2	14.7	58.0	21.1	21.0
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	31.2	44.6	9.9	32.0	10.5		26.6	18.2	14.7	58.0	21.1	21.0
LOS	C	D	A	C	B		C	B	B	E	C	C
Approach Delay		37.5			11.1			22.3			38.7	
Approach LOS		D			B			C			D	
90th %ile Green (s)	51.9	51.9	51.9	51.9	51.9		49.1	49.1	49.1	49.1	49.1	49.1
90th %ile Term Code	Max	Max	Max	Max	Max		Coord	Coord	Coord	Coord	Coord	Coord
70th %ile Green (s)	51.9	51.9	51.9	51.9	51.9		49.1	49.1	49.1	49.1	49.1	49.1
70th %ile Term Code	Max	Max	Max	Hold	Hold		Coord	Coord	Coord	Coord	Coord	Coord
50th %ile Green (s)	51.9	51.9	51.9	51.9	51.9		49.1	49.1	49.1	49.1	49.1	49.1
50th %ile Term Code	Max	Max	Max	Hold	Hold		Coord	Coord	Coord	Coord	Coord	Coord
30th %ile Green (s)	51.9	51.9	51.9	51.9	51.9		49.1	49.1	49.1	49.1	49.1	49.1
30th %ile Term Code	Max	Max	Max	Hold	Hold		Coord	Coord	Coord	Coord	Coord	Coord
10th %ile Green (s)	51.9	51.9	51.9	51.9	51.9		49.1	49.1	49.1	49.1	49.1	49.1
10th %ile Term Code	Max	Max	Max	Hold	Hold		Coord	Coord	Coord	Coord	Coord	Coord
Stops (vph)	199	1302	96	15	301		206	102	29	801	348	266
Fuel Used(gal)	4	31	2	1	12		9	5	2	20	6	5
CO Emissions (g/hr)	305	2178	151	37	816		652	376	131	1378	440	353
NOx Emissions (g/hr)	59	424	29	7	159		127	73	25	268	86	69
VOC Emissions (g/hr)	71	505	35	9	189		151	87	30	319	102	82
Dilemma Vehicles (#)	0	65	0	0	44		0	8	0	0	25	0
Queue Length 50th (ft)	75	566	65	8	83		80	42	23	355	142	194
Queue Length 95th (ft)	129	#745	137	#30	80		126	65	51	#506	186	313
Internal Link Dist (ft)		70			1050			2920			67	
Turn Bay Length (ft)												
Base Capacity (vph)	426	1669	848	67	2366		575	1579	714	1011	1579	784

Lanes, Volumes, Timings

1: Carothers Parkway & Murfreesboro Road

7/12/2016

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Starvation Cap Reductn	0	0	0	0	0		0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0		0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0		0	0	0	0	0	0
Reduced v/c Ratio	0.65	0.97	0.42	0.40	0.39		0.54	0.13	0.10	0.99	0.37	0.64

Intersection Summary

Area Type: Other

Cycle Length: 110

Actuated Cycle Length: 110

Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green, Master Intersection

Natural Cycle: 80

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.99

Intersection Signal Delay: 32.2

Intersection LOS: C

Intersection Capacity Utilization 91.7%

ICU Level of Service F





Analysis Period (min) 15

Description: Hwy 96 and Carothers Pkwy

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

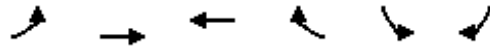
Splits and Phases: 1: Carothers Parkway & Murfreesboro Road

 Ø2 (R)	 Ø4
53.6 s	56.4 s
 Ø6 (R)	 Ø8
53.6 s	56.4 s

Lanes, Volumes, Timings

2: Murfreesboro Road/Murfreesboro Rd & Clovercroft Road

7/12/2016

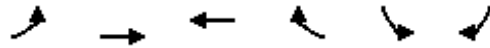


Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	145	2709	719	46	111	121
Future Volume (vph)	145	2709	719	46	111	121
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12
Grade (%)		0%	0%		0%	
Storage Length (ft)	0			0	0	0
Storage Lanes	1			0	1	1
Taper Length (ft)	25				25	
Lane Util. Factor	1.00	0.95	0.95	0.95	1.00	1.00
Ped Bike Factor						
Frt			0.991			0.850
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1770	3539	3507	0	1770	1583
Flt Permitted	0.329				0.950	
Satd. Flow (perm)	613	3539	3507	0	1770	1583
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)			17			132
Link Speed (mph)		45	45		40	
Link Distance (ft)		1130	160		355	
Travel Time (s)		17.1	2.4		6.1	
Confl. Peds. (#/hr)						
Confl. Bikes (#/hr)						
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0
Parking (#/hr)						
Mid-Block Traffic (%)		0%	0%		0%	
Adj. Flow (vph)	158	2945	782	50	121	132
Shared Lane Traffic (%)						
Lane Group Flow (vph)	158	2945	832	0	121	132
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(ft)		12	12		12	
Link Offset(ft)		0	0		0	
Crosswalk Width(ft)		16	16		16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15			9	15	9
Number of Detectors	1	2	2		1	1
Detector Template	Left	Thru	Thru		Left	Right
Leading Detector (ft)	20	100	100		20	20
Trailing Detector (ft)	0	0	0		0	0
Turn Type	Perm	NA	NA		Prot	Perm
Protected Phases		4	8		6	
Permitted Phases	4					6
Detector Phase	4	4	8		6	6
Switch Phase						

Lanes, Volumes, Timings

2: Murfreesboro Road/Murfreesboro Rd & Clovercroft Road

7/12/2016

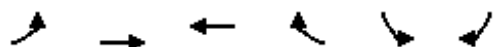


Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Minimum Initial (s)	5.0	5.0	5.0		5.0	5.0
Minimum Split (s)	22.5	22.5	22.5		22.5	22.5
Total Split (s)	87.4	87.4	87.4		22.6	22.6
Total Split (%)	79.5%	79.5%	79.5%		20.5%	20.5%
Maximum Green (s)	82.9	82.9	82.9		18.1	18.1
Yellow Time (s)	3.5	3.5	3.5		3.5	3.5
All-Red Time (s)	1.0	1.0	1.0		1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0		0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5		4.5	4.5
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Minimum Gap (s)	3.0	3.0	3.0		3.0	3.0
Time Before Reduce (s)	0.0	0.0	0.0		0.0	0.0
Time To Reduce (s)	0.0	0.0	0.0		0.0	0.0
Recall Mode	None	None	None		C-Min	C-Min
Walk Time (s)	7.0	7.0	7.0		7.0	7.0
Flash Dont Walk (s)	11.0	11.0	11.0		11.0	11.0
Pedestrian Calls (#/hr)	0	0	0		0	0
Act Effect Green (s)	88.2	88.2	88.2		12.8	12.8
Actuated g/C Ratio	0.80	0.80	0.80		0.12	0.12
v/c Ratio	0.32	1.04	0.30		0.59	0.44
Control Delay	3.5	33.3	1.9		57.1	12.1
Queue Delay	0.0	0.0	0.0		0.0	0.0
Total Delay	3.5	33.3	1.9		57.1	12.1
LOS	A	C	A		E	B
Approach Delay		31.7	1.9		33.6	
Approach LOS		C	A		C	
90th %ile Green (s)	83.3	83.3	83.3		17.7	17.7
90th %ile Term Code	Max	Max	Hold		Coord	Coord
70th %ile Green (s)	86.2	86.2	86.2		14.8	14.8
70th %ile Term Code	Max	Max	Hold		Coord	Coord
50th %ile Green (s)	88.2	88.2	88.2		12.8	12.8
50th %ile Term Code	Max	Max	Hold		Coord	Coord
30th %ile Green (s)	90.2	90.2	90.2		10.8	10.8
30th %ile Term Code	Max	Max	Hold		Coord	Coord
10th %ile Green (s)	93.1	93.1	93.1		7.9	7.9
10th %ile Term Code	Max	Max	Hold		Coord	Coord
Stops (vph)	29	1224	100		102	19
Fuel Used(gal)	2	53	2		3	1
CO Emissions (g/hr)	107	3735	164		179	54
NOx Emissions (g/hr)	21	727	32		35	11
VOC Emissions (g/hr)	25	866	38		41	13
Dilemma Vehicles (#)	0	69	17		0	0
Queue Length 50th (ft)	17	~1186	34		82	0
Queue Length 95th (ft)	m27	m#1303	m50		137	53
Internal Link Dist (ft)		1050	80		275	
Turn Bay Length (ft)						
Base Capacity (vph)	491	2837	2815		291	370

Lanes, Volumes, Timings

2: Murfreesboro Road/Murfreesboro Rd & Clovercroft Road

7/12/2016



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Starvation Cap Reductn	0	0	0		0	0
Spillback Cap Reductn	0	0	0		0	0
Storage Cap Reductn	0	0	0		0	0
Reduced v/c Ratio	0.32	1.04	0.30		0.42	0.36

Intersection Summary

Area Type: Other

Cycle Length: 110

Actuated Cycle Length: 110

Offset: 16 (15%), Referenced to phase 2: and 6:SBL, Start of Green

Natural Cycle: 150

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 1.04

Intersection Signal Delay: 25.9

Intersection LOS: C

Intersection Capacity Utilization 88.5%

ICU Level of Service E

Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.

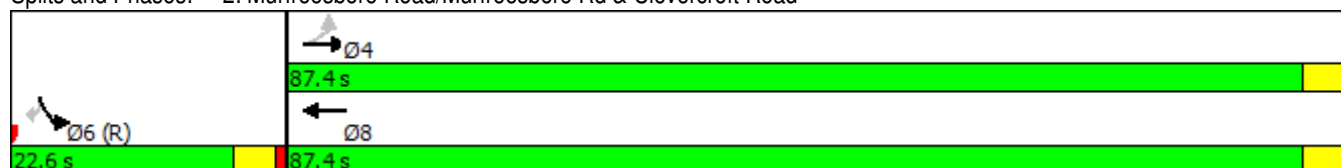
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 2: Murfreesboro Road/Murfreesboro Rd & Clovercroft Road



Lanes, Volumes, Timings
5: Arno Road & Murfreesboro Rd

7/12/2016

	→	↘	↙	←	↖	↗
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↙	↑↑	↙	↗
Traffic Volume (vph)	1275	1446	72	426	288	34
Future Volume (vph)	1275	1446	72	426	288	34
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12
Grade (%)	0%			0%	0%	
Storage Length (ft)		0	0		0	0
Storage Lanes		0	1		1	1
Taper Length (ft)			25		25	
Lane Util. Factor	0.95	0.95	1.00	0.95	1.00	1.00
Ped Bike Factor						
Frt	0.920					0.850
Flt Protected			0.950		0.950	
Satd. Flow (prot)	3256	0	1770	3539	1770	1583
Flt Permitted			0.048		0.950	
Satd. Flow (perm)	3256	0	89	3539	1770	1583
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)	743					37
Link Speed (mph)	45			45	50	
Link Distance (ft)	1550			63	683	
Travel Time (s)	23.5			1.0	9.3	
Confl. Peds. (#/hr)						
Confl. Bikes (#/hr)						
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0
Parking (#/hr)						
Mid-Block Traffic (%)	0%			0%	0%	
Adj. Flow (vph)	1386	1572	78	463	313	37
Shared Lane Traffic (%)						
Lane Group Flow (vph)	2958	0	78	463	313	37
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			12	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Number of Detectors	2		1	2	1	1
Detector Template	Thru		Left	Thru	Left	Right
Leading Detector (ft)	100		20	100	20	20
Trailing Detector (ft)	0		0	0	0	0
Turn Type	NA		Perm	NA	Prot	Perm
Protected Phases	4			8	2	
Permitted Phases			8			2
Detector Phase	4		8	8	2	2
Switch Phase						

Lanes, Volumes, Timings
5: Arno Road & Murfreesboro Rd

7/12/2016

	→	↘	↙	←	↖	↗
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Minimum Initial (s)	5.0		5.0	5.0	5.0	5.0
Minimum Split (s)	22.5		22.5	22.5	22.5	22.5
Total Split (s)	87.0		87.0	87.0	23.0	23.0
Total Split (%)	79.1%		79.1%	79.1%	20.9%	20.9%
Maximum Green (s)	82.5		82.5	82.5	18.5	18.5
Yellow Time (s)	3.5		3.5	3.5	3.5	3.5
All-Red Time (s)	1.0		1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0		0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5		4.5	4.5	4.5	4.5
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Minimum Gap (s)	3.0		3.0	3.0	3.0	3.0
Time Before Reduce (s)	0.0		0.0	0.0	0.0	0.0
Time To Reduce (s)	0.0		0.0	0.0	0.0	0.0
Recall Mode	None		None	None	C-Min	C-Min
Walk Time (s)	7.0		7.0	7.0	7.0	7.0
Flash Dont Walk (s)	11.0		11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	0		0	0	0	0
Act Effect Green (s)	82.5		82.5	82.5	18.5	18.5
Actuated g/C Ratio	0.75		0.75	0.75	0.17	0.17
v/c Ratio	1.13		1.18	0.17	1.05	0.12
Control Delay	68.2		191.5	4.1	111.9	13.6
Queue Delay	0.0		0.0	0.0	0.0	0.0
Total Delay	68.2		191.5	4.1	111.9	13.6
LOS	E		F	A	F	B
Approach Delay	68.2			31.1	101.5	
Approach LOS	E			C	F	
90th %ile Green (s)	82.5		82.5	82.5	18.5	18.5
90th %ile Term Code	Max		Max	Max	Coord	Coord
70th %ile Green (s)	82.5		82.5	82.5	18.5	18.5
70th %ile Term Code	Max		Max	Max	Coord	Coord
50th %ile Green (s)	82.5		82.5	82.5	18.5	18.5
50th %ile Term Code	Max		Max	Max	Coord	Coord
30th %ile Green (s)	82.5		82.5	82.5	18.5	18.5
30th %ile Term Code	Max		Max	Max	Coord	Coord
10th %ile Green (s)	82.5		82.5	82.5	18.5	18.5
10th %ile Term Code	Max		Max	Max	Coord	Coord
Stops (vph)	627		42	111	244	10
Fuel Used(gal)	73		3	2	12	0
CO Emissions (g/hr)	5099		235	134	808	28
NOx Emissions (g/hr)	992		46	26	157	5
VOC Emissions (g/hr)	1182		54	31	187	6
Dilemma Vehicles (#)	136		0	19	0	0
Queue Length 50th (ft)	~1215		~66	42	~242	0
Queue Length 95th (ft)	m#1137		#118	56	#416	29
Internal Link Dist (ft)	1470			1	603	
Turn Bay Length (ft)						
Base Capacity (vph)	2627		66	2654	297	297

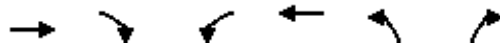
Baseline

Synchro 9 Light Report
Page 10

Lanes, Volumes, Timings

5: Arno Road & Murfreesboro Rd

7/12/2016



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Starvation Cap Reductn	0		0	0	0	0
Spillback Cap Reductn	0		0	0	0	0
Storage Cap Reductn	0		0	0	0	0
Reduced v/c Ratio	1.13		1.18	0.17	1.05	0.12

Intersection Summary

Area Type: Other

Cycle Length: 110

Actuated Cycle Length: 110

Offset: 28 (25%), Referenced to phase 2:NBL and 6:, Start of Green

Natural Cycle: 140

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 1.18

Intersection Signal Delay: 66.0

Intersection LOS: E

Intersection Capacity Utilization 105.2%

ICU Level of Service G

Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

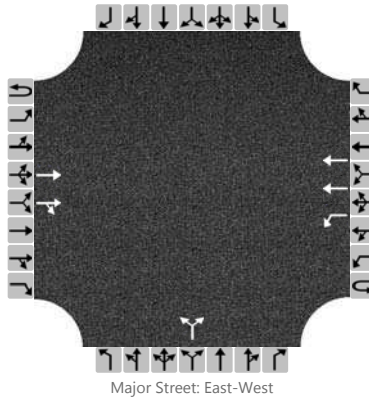
Splits and Phases: 5: Arno Road & Murfreesboro Rd

 Ø2 (L)	 Ø4
23 s	87 s
	 Ø8
	87 s

HCS 2010 Two-Way Stop Control Summary Report

General Information		Site Information	
Analyst	FTG	Intersection	Hwy 96E and Cross Creek
Agency/Co.	FTG	Jurisdiction	Franklin, TN
Date Performed	July 2016	East/West Street	Highway 96E
Analysis Year	2015	North/South Street	Cross Creek Drive
Time Analyzed	AM Peak Hour	Peak Hour Factor	0.95
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	10647 (Background)		

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	2	0	0	1	2	0		0	0	0		0	0	0
Configuration			T	TR		L	T				LR					
Volume (veh/h)			455	8		0	2253			39		2				
Percent Heavy Vehicles						0				0		0				
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Left Only															
Median Storage	1															

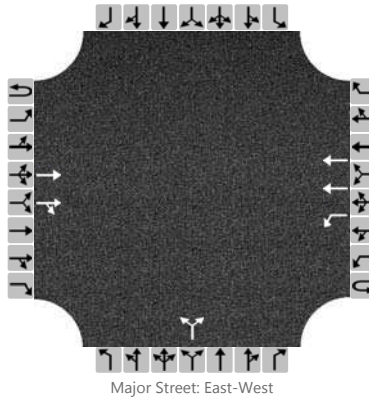
Delay, Queue Length, and Level of Service

Flow Rate (veh/h)											43					
Capacity						1087					163					
v/c Ratio											0.26					
95% Queue Length											1.0					
Control Delay (s/veh)						8.3					34.8					
Level of Service (LOS)						A					D					
Approach Delay (s/veh)									34.8							
Approach LOS									D							

HCS 2010 Two-Way Stop Control Summary Report

General Information		Site Information	
Analyst	FTG	Intersection	Hwy 96E and Cross Creek
Agency/Co.	FTG	Jurisdiction	Franklin, TN
Date Performed	July 2016	East/West Street	Highway 96E
Analysis Year	2015	North/South Street	Cross Creek Drive
Time Analyzed	PM Peak Hour	Peak Hour Factor	0.98
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	10647 (Background)		

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	2	0	0	1	2	0		0	0	0		0	0	0
Configuration			T	TR		L	T				LR					
Volume (veh/h)			2783	37		0	750			15		0				
Percent Heavy Vehicles						0				0		0				
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Left Only															
Median Storage	1															

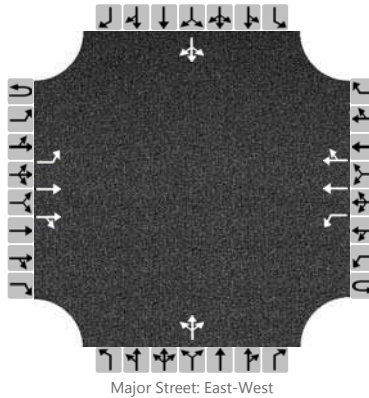
Delay, Queue Length, and Level of Service

Flow Rate (veh/h)											15					
Capacity						131					16					
v/c Ratio											0.96					
95% Queue Length											2.3					
Control Delay (s/veh)						32.4					539.1					
Level of Service (LOS)						D					F					
Approach Delay (s/veh)									539.1							
Approach LOS									F							

HCS 2010 Two-Way Stop Control Summary Report

General Information		Site Information	
Analyst	FTG	Intersection	Highway 96E and Ridgeway
Agency/Co.	FTG	Jurisdiction	Franklin, TN
Date Performed	July 2016	East/West Street	Highway 96E
Analysis Year	2015	North/South Street	Chester Stevens/Ridgeway
Time Analyzed	AM Peak Hour	Peak Hour Factor	0.98
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	10647 (Background		

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	1	2	0	0	1	2	0		0	1	0		0	1	0
Configuration		L	T	TR		L	T	TR			LTR				LTR	
Volume (veh/h)		9	441	7		3	2164	23		27	0	4		12	0	62
Percent Heavy Vehicles		0				0				0	0	0		0	0	0
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Left Only															
Median Storage	1															

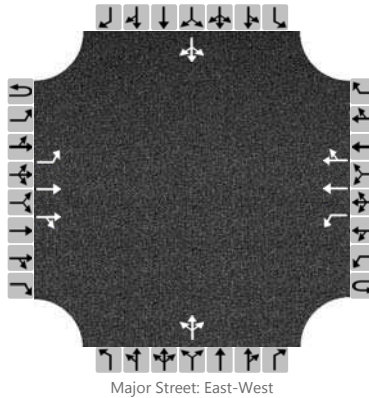
Delay, Queue Length, and Level of Service

Flow Rate (veh/h)		9				3					32				75	
Capacity		236				1115					134				124	
v/c Ratio		0.04				0.00					0.24				0.61	
95% Queue Length		0.1				0.0					0.9				3.1	
Control Delay (s/veh)		20.8				8.2					40.2				71.2	
Level of Service (LOS)		C				A					E				F	
Approach Delay (s/veh)	0.4				0.0				40.2				71.2			
Approach LOS	A				A				E				F			

HCS 2010 Two-Way Stop Control Summary Report

General Information		Site Information	
Analyst	FTG	Intersection	Highway 96E and Ridgeway
Agency/Co.	FTG	Jurisdiction	Franklin, TN
Date Performed	July 2016	East/West Street	Highway 96E
Analysis Year	2015	North/South Street	Chester Stevens/Ridgeway
Time Analyzed	PM Peak Hour	Peak Hour Factor	0.98
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	10647 (Background)		

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	1	2	0	0	1	2	0		0	1	0		0	1	0
Configuration		L	T	TR		L	T	TR			LTR				LTR	
Volume (veh/h)		45	2720	18		3	711	10		13	0	2		4	0	26
Percent Heavy Vehicles		0				0				0	0	0		0	0	0
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Left Only															
Median Storage	1															

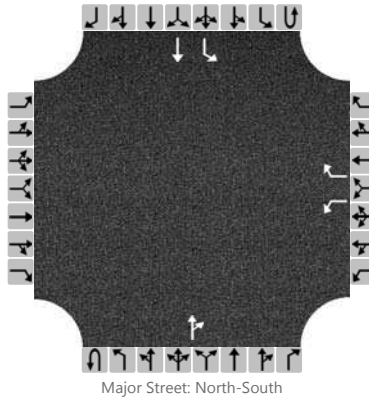
Delay, Queue Length, and Level of Service

Flow Rate (veh/h)		46				3					15				31	
Capacity		879				142					16				360	
v/c Ratio		0.05				0.02					0.91				0.09	
95% Queue Length		0.2				0.1					2.3				0.3	
Control Delay (s/veh)		9.3				31.0					506.7				16.0	
Level of Service (LOS)		A				D					F				C	
Approach Delay (s/veh)	0.2				0.1				506.7				16.0			
Approach LOS	A				A				F				C			

HCS 2010 Two-Way Stop Control Summary Report

General Information		Site Information	
Analyst	FTG	Intersection	Carothers and S. Carother
Agency/Co.	FTG	Jurisdiction	Franklin, TN
Date Performed	2016	East/West Street	S. Carothers Road
Analysis Year	2016	North/South Street	Carothers Parkway
Time Analyzed	AM Peak Hour	Peak Hour Factor	0.88
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	10647 (Background)		

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		1	0	1	0	0	1	0	0	1	1	0
Configuration						L		R				TR		L	T	
Volume (veh/h)						37		146			665	30		97	322	
Percent Heavy Vehicles						0		0						0		
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

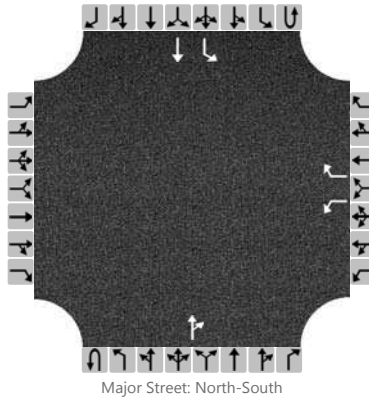
Delay, Queue Length, and Level of Service

Flow Rate (veh/h)						42		166							110		
Capacity						144		397							839		
v/c Ratio						0.29		0.42							0.13		
95% Queue Length						1.1		2.0							0.5		
Control Delay (s/veh)						40.0		20.4							9.9		
Level of Service (LOS)						E		C							A		
Approach Delay (s/veh)					24.4								2.3				
Approach LOS					C								A				

HCS 2010 Two-Way Stop Control Summary Report

General Information		Site Information	
Analyst	FTG	Intersection	Carothers and S. Carother
Agency/Co.	FTG	Jurisdiction	Franklin, TN
Date Performed	2016	East/West Street	S. Carothers Road
Analysis Year	2016	North/South Street	Carothers Parkway
Time Analyzed	PM Peak Hour	Peak Hour Factor	0.91
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	10647 (Background)		

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		1	0	1	0	0	1	0	0	1	1	0
Configuration						L		R				TR		L	T	
Volume (veh/h)						58		132			454	63		159	649	
Percent Heavy Vehicles						0		0						0		
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service
























Flow Rate (veh/h)						64		145						175		
Capacity						98		550						1014		
v/c Ratio						0.65		0.26						0.17		
95% Queue Length						3.2		1.1						0.6		
Control Delay (s/veh)						93.3		13.9						9.3		
Level of Service (LOS)						F		B						A		
Approach Delay (s/veh)						38.2								1.8		
Approach LOS						E								A		

TOTAL PROJECTED CONDITIONS

Lanes, Volumes, Timings

1: Carothers Parkway & Murfreesboro Road

9/1/2016













												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	499	446	183	41	1588	260	546	498	38	153	138	191
Future Volume (vph)	499	446	183	41	1588	260	546	498	38	153	138	191
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12	12	12	12	12	12	12
Grade (%)		0%			0%			0%			0%	
Storage Length (ft)	0		0	0		0	0		0	0		0
Storage Lanes	2		1	1		0	2		1	2		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	0.97	0.95	1.00	1.00	0.91	0.91	0.97	0.95	1.00	0.97	0.95	1.00
Ped Bike Factor												
Frt			0.850		0.979				0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	3433	3539	1583	1770	4979	0	3433	3539	1583	3433	3539	1583
Flt Permitted	0.222			0.476			0.657			0.436		
Satd. Flow (perm)	802	3539	1583	887	4979	0	2374	3539	1583	1576	3539	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			199		83				41			36
Link Speed (mph)		45			45			35			40	
Link Distance (ft)		150			1130			3000			147	
Travel Time (s)		2.3			17.1			58.4			2.5	
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	542	485	199	45	1726	283	593	541	41	166	150	208
Shared Lane Traffic (%)												
Lane Group Flow (vph)	542	485	199	45	2009	0	593	541	41	166	150	208
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		24			24			24			24	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2		1	2	1	1	2	1
Detector Template	Left	Thru	Right	Left	Thru		Left	Thru	Right	Left	Thru	Right
Leading Detector (ft)	20	100	20	20	100		20	100	20	20	100	20
Trailing Detector (ft)	0	0	0	0	0		0	0	0	0	0	0
Turn Type	Perm	NA	Perm	Perm	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8			2		2	6		6
Detector Phase	4	4	4	8	8		2	2	2	6	6	6
Switch Phase												

Baseline

Synchro 9 Light Report
Page 1

Lanes, Volumes, Timings
1: Carothers Parkway & Murfreesboro Road

9/1/2016

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	22.5		22.5	22.5	22.5	22.5	22.5	22.5
Total Split (s)	22.5	22.5	22.5	22.5	22.5		22.5	22.5	22.5	22.5	22.5	22.5
Total Split (%)	50.0%	50.0%	50.0%	50.0%	50.0%		50.0%	50.0%	50.0%	50.0%	50.0%	50.0%
Maximum Green (s)	18.0	18.0	18.0	18.0	18.0		18.0	18.0	18.0	18.0	18.0	18.0
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5		3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5		4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Minimum Gap (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Time Before Reduce (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Time To Reduce (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Recall Mode	None	None	None	None	None		C-Max	C-Max	C-Max	C-Max	C-Max	C-Max
Walk Time (s)	7.0	7.0	7.0	7.0	7.0		7.0	7.0	7.0	7.0	7.0	7.0
Flash Dont Walk (s)	11.0	11.0	11.0	11.0	11.0		11.0	11.0	11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	0	0	0	0	0		0	0	0	0	0	0
Act Effect Green (s)	18.0	18.0	18.0	18.0	18.0		18.0	18.0	18.0	18.0	18.0	18.0
Actuated g/C Ratio	0.40	0.40	0.40	0.40	0.40		0.40	0.40	0.40	0.40	0.40	0.40
v/c Ratio	1.69	0.34	0.26	0.13	0.98		0.62	0.38	0.06	0.26	0.11	0.32
Control Delay	345.0	10.3	2.9	8.7	23.6		14.4	10.6	3.8	10.5	8.8	9.3
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	345.0	10.3	2.9	8.7	23.6		14.4	10.6	3.8	10.5	8.8	9.3
LOS	F	B	A	A	C		B	B	A	B	A	A
Approach Delay	157.0				23.2		12.3				9.5	
Approach LOS	F				C		B				A	
90th %ile Green (s)	18.0	18.0	18.0	18.0	18.0		18.0	18.0	18.0	18.0	18.0	18.0
90th %ile Term Code	Max	Max	Max	Max	Max		Coord	Coord	Coord	Coord	Coord	Coord
70th %ile Green (s)	18.0	18.0	18.0	18.0	18.0		18.0	18.0	18.0	18.0	18.0	18.0
70th %ile Term Code	Max	Max	Max	Max	Max		Coord	Coord	Coord	Coord	Coord	Coord
50th %ile Green (s)	18.0	18.0	18.0	18.0	18.0		18.0	18.0	18.0	18.0	18.0	18.0
50th %ile Term Code	Max	Max	Max	Max	Max		Coord	Coord	Coord	Coord	Coord	Coord
30th %ile Green (s)	18.0	18.0	18.0	18.0	18.0		18.0	18.0	18.0	18.0	18.0	18.0
30th %ile Term Code	Max	Max	Max	Max	Max		Coord	Coord	Coord	Coord	Coord	Coord
10th %ile Green (s)	18.0	18.0	18.0	18.0	18.0		18.0	18.0	18.0	18.0	18.0	18.0
10th %ile Term Code	Max	Max	Max	Max	Max		Coord	Coord	Coord	Coord	Coord	Coord
Stops (vph)	418	283	25	26	1520		409	322	10	96	79	103
Fuel Used(gal)	41	5	1	1	41		17	14	1	1	1	2
CO Emissions (g/hr)	2847	341	42	49	2889		1153	998	65	99	81	109
NOx Emissions (g/hr)	554	66	8	9	562		224	194	13	19	16	21
VOC Emissions (g/hr)	660	79	10	11	669		267	231	15	23	19	25
Dilemma Vehicles (#)	0	49	0	0	161		0	55	0	0	15	0
Queue Length 50th (ft)	~112	43	0	9	203		59	48	0	13	12	28
Queue Length 95th (ft)	#187	70	27	m10	m#234		100	78	12	30	24	64
Internal Link Dist (ft)	70				1050		2920				67	
Turn Bay Length (ft)												
Base Capacity (vph)	320	1415	752	354	2041		949	1415	657	630	1415	654













Baseline

Synchro 9 Light Report
Page 2

Lanes, Volumes, Timings

1: Carothers Parkway & Murfreesboro Road

9/1/2016

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Starvation Cap Reductn	0	0	0	0	0		0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0		0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0		0	0	0	0	0	0
Reduced v/c Ratio	1.69	0.34	0.26	0.13	0.98		0.62	0.38	0.06	0.26	0.11	0.32

Intersection Summary

Area Type: Other

Cycle Length: 45

Actuated Cycle Length: 45

Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green, Master Intersection

Natural Cycle: 45

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 1.69

Intersection Signal Delay: 52.1

Intersection LOS: D

Intersection Capacity Utilization 85.5%

ICU Level of Service E

Analysis Period (min) 15

Description: Hwy 96 and Carothers Pkwy

~ Volume exceeds capacity, queue is theoretically infinite.





Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

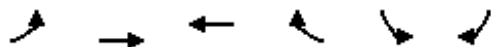
Splits and Phases: 1: Carothers Parkway & Murfreesboro Road

 Ø2 (R)	 Ø4
22.5 s	22.5 s
 Ø6 (R)	 Ø8
22.5 s	22.5 s

Lanes, Volumes, Timings

2: Murfreesboro Road/Murfreesboro Rd & Clovercroft Road

9/1/2016

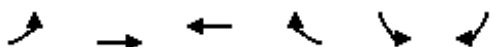


Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	68	453	2281	47	29	175
Future Volume (vph)	68	453	2281	47	29	175
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12
Grade (%)		0%	0%		0%	
Storage Length (ft)	0			0	0	0
Storage Lanes	1			0	1	1
Taper Length (ft)	25				25	
Lane Util. Factor	1.00	0.95	0.95	0.95	1.00	1.00
Ped Bike Factor						
Frt			0.997			0.850
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1770	3539	3529	0	1770	1583
Flt Permitted	0.061				0.950	
Satd. Flow (perm)	114	3539	3529	0	1770	1583
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)			5			8
Link Speed (mph)		45	45		40	
Link Distance (ft)		1130	160		355	
Travel Time (s)		17.1	2.4		6.1	
Confl. Peds. (#/hr)						
Confl. Bikes (#/hr)						
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0
Parking (#/hr)						
Mid-Block Traffic (%)		0%	0%		0%	
Adj. Flow (vph)	74	492	2479	51	32	190
Shared Lane Traffic (%)						
Lane Group Flow (vph)	74	492	2530	0	32	190
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(ft)		12	12		12	
Link Offset(ft)		0	0		0	
Crosswalk Width(ft)		16	16		16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15			9	15	9
Number of Detectors	1	2	2		1	1
Detector Template	Left	Thru	Thru		Left	Right
Leading Detector (ft)	20	100	100		20	20
Trailing Detector (ft)	0	0	0		0	0
Turn Type	Perm	NA	NA		Prot	Perm
Protected Phases		4	8		6	
Permitted Phases	4					6
Detector Phase	4	4	8		6	6
Switch Phase						

Lanes, Volumes, Timings

2: Murfreesboro Road/Murfreesboro Rd & Clovercroft Road

9/1/2016



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Minimum Initial (s)	5.0	5.0	5.0		5.0	5.0
Minimum Split (s)	22.5	22.5	22.5		22.5	22.5
Total Split (s)	67.0	67.0	67.0		23.0	23.0
Total Split (%)	74.4%	74.4%	74.4%		25.6%	25.6%
Maximum Green (s)	62.5	62.5	62.5		18.5	18.5
Yellow Time (s)	3.5	3.5	3.5		3.5	3.5
All-Red Time (s)	1.0	1.0	1.0		1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0		0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5		4.5	4.5
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Minimum Gap (s)	3.0	3.0	3.0		3.0	3.0
Time Before Reduce (s)	0.0	0.0	0.0		0.0	0.0
Time To Reduce (s)	0.0	0.0	0.0		0.0	0.0
Recall Mode	None	None	None		C-Min	C-Min
Walk Time (s)	7.0	7.0	7.0		7.0	7.0
Flash Dont Walk (s)	11.0	11.0	11.0		11.0	11.0
Pedestrian Calls (#/hr)	0	0	0		0	0
Act Effect Green (s)	66.1	66.1	66.1		14.9	14.9
Actuated g/C Ratio	0.73	0.73	0.73		0.17	0.17
v/c Ratio	0.89	0.19	0.98		0.11	0.71
Control Delay	95.3	2.7	14.9		31.0	48.1
Queue Delay	0.0	0.0	0.0		0.0	0.0
Total Delay	95.3	2.7	14.9		31.0	48.1
LOS	F	A	B		C	D
Approach Delay		14.8	14.9		45.7	
Approach LOS		B	B		D	
90th %ile Green (s)	62.5	62.5	62.5		18.5	18.5
90th %ile Term Code	Max	Max	Max		Coord	Coord
70th %ile Green (s)	62.9	62.9	62.9		18.1	18.1
70th %ile Term Code	Max	Max	Max		Coord	Coord
50th %ile Green (s)	65.4	65.4	65.4		15.6	15.6
50th %ile Term Code	Max	Max	Max		Coord	Coord
30th %ile Green (s)	68.0	68.0	68.0		13.0	13.0
30th %ile Term Code	Hold	Hold	Max		Coord	Coord
10th %ile Green (s)	71.7	71.7	71.7		9.3	9.3
10th %ile Term Code	Hold	Hold	Max		Coord	Coord
Stops (vph)	49	72	1070		24	155
Fuel Used(gal)	2	4	23		0	4
CO Emissions (g/hr)	170	312	1593		34	256
NOx Emissions (g/hr)	33	61	310		7	50
VOC Emissions (g/hr)	39	72	369		8	59
Dilemma Vehicles (#)	0	18	38		0	0
Queue Length 50th (ft)	33	23	268		15	98
Queue Length 95th (ft)	#131	35	m#823		39	163
Internal Link Dist (ft)		1050	80		275	
Turn Bay Length (ft)						
Base Capacity (vph)	83	2599	2593		363	331

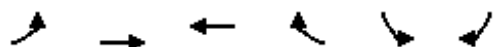
Baseline

Synchro 9 Light Report
Page 5

Lanes, Volumes, Timings

2: Murfreesboro Road/Murfreesboro Rd & Clovercroft Road

9/1/2016



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Starvation Cap Reductn	0	0	0		0	0
Spillback Cap Reductn	0	0	0		0	0
Storage Cap Reductn	0	0	0		0	0
Reduced v/c Ratio	0.89	0.19	0.98		0.09	0.57

Intersection Summary

Area Type: Other

Cycle Length: 90

Actuated Cycle Length: 90

Offset: 14 (16%), Referenced to phase 2: and 6:SBL, Start of Green

Natural Cycle: 140

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.98

Intersection Signal Delay: 16.9

Intersection LOS: B

Intersection Capacity Utilization 82.9%

ICU Level of Service E

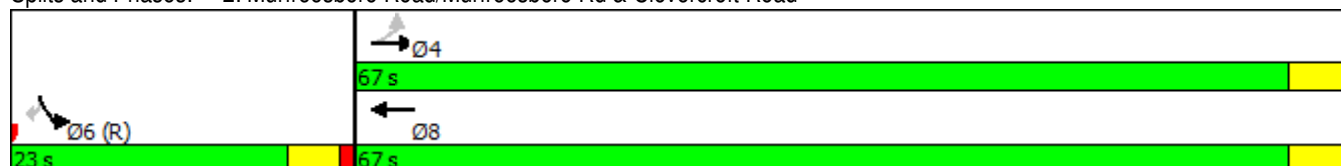
Analysis Period (min) 15

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 2: Murfreesboro Road/Murfreesboro Rd & Clovercroft Road



Lanes, Volumes, Timings
5: Arno Road & Murfreesboro Rd

9/1/2016

	→	↘	↙	←	↖	↗
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↙	↑↑	↙	↗
Traffic Volume (vph)	268	200	50	1411	784	78
Future Volume (vph)	268	200	50	1411	784	78
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12
Grade (%)	0%			0%	0%	
Storage Length (ft)		0	0		0	0
Storage Lanes		0	1		1	1
Taper Length (ft)			25		25	
Lane Util. Factor	0.95	0.95	1.00	0.95	1.00	1.00
Ped Bike Factor						
Frt	0.936					0.850
Flt Protected			0.950		0.950	
Satd. Flow (prot)	3313	0	1770	3539	1770	1583
Flt Permitted			0.408		0.950	
Satd. Flow (perm)	3313	0	760	3539	1770	1583
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)	217					84
Link Speed (mph)	45			45	50	
Link Distance (ft)	1550			63	683	
Travel Time (s)	23.5			1.0	9.3	
Confl. Peds. (#/hr)						
Confl. Bikes (#/hr)						
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0
Parking (#/hr)						
Mid-Block Traffic (%)	0%			0%	0%	
Adj. Flow (vph)	291	217	54	1534	852	85
Shared Lane Traffic (%)						
Lane Group Flow (vph)	508	0	54	1534	852	85
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			12	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Number of Detectors	2		1	2	1	1
Detector Template	Thru		Left	Thru	Left	Right
Leading Detector (ft)	100		20	100	20	20
Trailing Detector (ft)	0		0	0	0	0
Turn Type	NA		Perm	NA	Prot	Perm
Protected Phases	4			8	2	
Permitted Phases			8			2
Detector Phase	4		8	8	2	2
Switch Phase						

Lanes, Volumes, Timings
5: Arno Road & Murfreesboro Rd

9/1/2016

	→	↘	↙	←	↖	↗
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Minimum Initial (s)	5.0		5.0	5.0	5.0	5.0
Minimum Split (s)	22.5		22.5	22.5	22.5	22.5
Total Split (s)	42.3		42.3	42.3	47.7	47.7
Total Split (%)	47.0%		47.0%	47.0%	53.0%	53.0%
Maximum Green (s)	37.8		37.8	37.8	43.2	43.2
Yellow Time (s)	3.5		3.5	3.5	3.5	3.5
All-Red Time (s)	1.0		1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0		0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5		4.5	4.5	4.5	4.5
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Minimum Gap (s)	3.0		3.0	3.0	3.0	3.0
Time Before Reduce (s)	0.0		0.0	0.0	0.0	0.0
Time To Reduce (s)	0.0		0.0	0.0	0.0	0.0
Recall Mode	None		None	None	C-Min	C-Min
Walk Time (s)	7.0		7.0	7.0	7.0	7.0
Flash Dont Walk (s)	11.0		11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	0		0	0	0	0
Act Effect Green (s)	37.8		37.8	37.8	43.2	43.2
Actuated g/C Ratio	0.42		0.42	0.42	0.48	0.48
v/c Ratio	0.33		0.17	1.03	1.00	0.11
Control Delay	18.1		18.2	59.2	56.9	3.5
Queue Delay	0.0		0.0	0.0	0.0	0.0
Total Delay	18.1		18.2	59.2	56.9	3.5
LOS	B		B	E	E	A
Approach Delay	18.1			57.8	52.1	
Approach LOS	B			E	D	
90th %ile Green (s)	37.8		37.8	37.8	43.2	43.2
90th %ile Term Code	Hold		Max	Max	Coord	Coord
70th %ile Green (s)	37.8		37.8	37.8	43.2	43.2
70th %ile Term Code	Hold		Max	Max	Coord	Coord
50th %ile Green (s)	37.8		37.8	37.8	43.2	43.2
50th %ile Term Code	Hold		Max	Max	Coord	Coord
30th %ile Green (s)	37.8		37.8	37.8	43.2	43.2
30th %ile Term Code	Hold		Max	Max	Coord	Coord
10th %ile Green (s)	37.8		37.8	37.8	43.2	43.2
10th %ile Term Code	Hold		Max	Max	Coord	Coord
Stops (vph)	366		31	1220	655	10
Fuel Used(gal)	11		1	33	23	1
CO Emissions (g/hr)	767		41	2290	1575	38
NOx Emissions (g/hr)	149		8	446	306	7
VOC Emissions (g/hr)	178		10	531	365	9
Dilemma Vehicles (#)	13		0	73	0	0
Queue Length 50th (ft)	61		19	~497	~468	0
Queue Length 95th (ft)	102		44	#631	#735	24
Internal Link Dist (ft)	1470			1	603	
Turn Bay Length (ft)						
Base Capacity (vph)	1517		319	1486	849	803

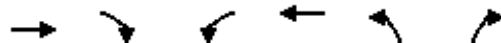
Baseline

Synchro 9 Light Report
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Lanes, Volumes, Timings

5: Arno Road & Murfreesboro Rd

9/1/2016



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Starvation Cap Reductn	0		0	0	0	0
Spillback Cap Reductn	0		0	0	0	0
Storage Cap Reductn	0		0	0	0	0
Reduced v/c Ratio	0.33		0.17	1.03	1.00	0.11

Intersection Summary

Area Type: Other

Cycle Length: 90

Actuated Cycle Length: 90

Offset: 68 (76%), Referenced to phase 2:NBL and 6:, Start of Green

Natural Cycle: 110

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 1.03

Intersection Signal Delay: 49.4

Intersection LOS: D

Intersection Capacity Utilization 89.9%

ICU Level of Service E

Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.
























Splits and Phases: 5: Arno Road & Murfreesboro Rd

Ø2 (R) 47.7 s	Ø4 42.3 s
	Ø8 42.3 s

Lanes, Volumes, Timings

1: Carothers Parkway & Murfreesboro Road

9/1/2016

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	257	1512	408	34	689	169	335	209	72	935	589	463
Future Volume (vph)	257	1512	408	34	689	169	335	209	72	935	589	463
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12	12	12	12	12	12	12
Grade (%)		0%			0%			0%			0%	
Storage Length (ft)	0		0	0		0	0		0	0		0
Storage Lanes	2		1	1		0	2		1	2		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	0.97	0.95	1.00	1.00	0.91	0.91	0.97	0.95	1.00	0.97	0.95	1.00
Ped Bike Factor												
Frt			0.850		0.970				0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	3433	3539	1583	1770	4933	0	3433	3539	1583	3433	3539	1583
Flt Permitted	0.239			0.055			0.324			0.599		
Satd. Flow (perm)	864	3539	1583	102	4933	0	1171	3539	1583	2165	3539	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			173		54				11			142
Link Speed (mph)		45			45			35			40	
Link Distance (ft)		150			1130			3000			147	
Travel Time (s)		2.3			17.1			58.4			2.5	
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	279	1643	443	37	749	184	364	227	78	1016	640	503
Shared Lane Traffic (%)												
Lane Group Flow (vph)	279	1643	443	37	933	0	364	227	78	1016	640	503
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		24			24			24			24	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2		1	2	1	1	2	1
Detector Template	Left	Thru	Right	Left	Thru		Left	Thru	Right	Left	Thru	Right
Leading Detector (ft)	20	100	20	20	100		20	100	20	20	100	20
Trailing Detector (ft)	0	0	0	0	0		0	0	0	0	0	0
Turn Type	Perm	NA	Perm	Perm	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8			2		2	6		6
Detector Phase	4	4	4	8	8		2	2	2	6	6	6
Switch Phase												

Baseline

Synchro 9 Light Report
Page 1

Lanes, Volumes, Timings

1: Carothers Parkway & Murfreesboro Road

9/1/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	22.5		22.5	22.5	22.5	22.5	22.5	22.5
Total Split (s)	77.0	77.0	77.0	77.0	77.0		73.0	73.0	73.0	73.0	73.0	73.0
Total Split (%)	51.3%	51.3%	51.3%	51.3%	51.3%		48.7%	48.7%	48.7%	48.7%	48.7%	48.7%
Maximum Green (s)	72.5	72.5	72.5	72.5	72.5		68.5	68.5	68.5	68.5	68.5	68.5
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5		3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5		4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Minimum Gap (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Time Before Reduce (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Time To Reduce (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Recall Mode	None	None	None	None	None		C-Max	C-Max	C-Max	C-Max	C-Max	C-Max
Walk Time (s)	7.0	7.0	7.0	7.0	7.0		7.0	7.0	7.0	7.0	7.0	7.0
Flash Dont Walk (s)	11.0	11.0	11.0	11.0	11.0		11.0	11.0	11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	0	0	0	0	0		0	0	0	0	0	0
Act Effect Green (s)	72.5	72.5	72.5	72.5	72.5		68.5	68.5	68.5	68.5	68.5	68.5
Actuated g/C Ratio	0.48	0.48	0.48	0.48	0.48		0.46	0.46	0.46	0.46	0.46	0.46
v/c Ratio	0.67	0.96	0.52	0.76	0.39		0.68	0.14	0.11	1.03	0.40	0.63
Control Delay	39.2	51.7	17.8	95.9	14.3		40.1	24.0	20.4	75.9	28.0	25.6
Queue Delay	0.0	5.5	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	39.2	57.2	17.8	95.9	14.3		40.1	24.0	20.4	75.9	28.0	25.6
LOS	D	E	B	F	B		D	C	C	E	C	C
Approach Delay		47.7			17.4			32.3			50.0	
Approach LOS		D			B			C			D	
90th %ile Green (s)	72.5	72.5	72.5	72.5	72.5		68.5	68.5	68.5	68.5	68.5	68.5
90th %ile Term Code	Max	Max	Max	Max	Max		Coord	Coord	Coord	Coord	Coord	Coord
70th %ile Green (s)	72.5	72.5	72.5	72.5	72.5		68.5	68.5	68.5	68.5	68.5	68.5
70th %ile Term Code	Max	Max	Max	Max	Max		Coord	Coord	Coord	Coord	Coord	Coord
50th %ile Green (s)	72.5	72.5	72.5	72.5	72.5		68.5	68.5	68.5	68.5	68.5	68.5
50th %ile Term Code	Max	Max	Max	Max	Max		Coord	Coord	Coord	Coord	Coord	Coord
30th %ile Green (s)	72.5	72.5	72.5	72.5	72.5		68.5	68.5	68.5	68.5	68.5	68.5
30th %ile Term Code	Max	Max	Max	Hold	Hold		Coord	Coord	Coord	Coord	Coord	Coord
10th %ile Green (s)	72.5	72.5	72.5	72.5	72.5		68.5	68.5	68.5	68.5	68.5	68.5
10th %ile Term Code	Max	Max	Max	Hold	Hold		Coord	Coord	Coord	Coord	Coord	Coord
Stops (vph)	199	1351	173	25	326		263	117	34	822	379	260
Fuel Used(gal)	5	34	4	1	13		12	6	2	23	8	5
CO Emissions (g/hr)	334	2390	282	86	898		837	449	148	1640	536	380
NOx Emissions (g/hr)	65	465	55	17	175		163	87	29	319	104	74
VOC Emissions (g/hr)	77	554	65	20	208		194	104	34	380	124	88
Dilemma Vehicles (#)	0	49	0	0	18		0	7	0	0	20	0
Queue Length 50th (ft)	105	802	176	17	124		142	66	37	~545	215	269
Queue Length 95th (ft)	168	#980	278	#108	156		209	94	70	#681	267	397
Internal Link Dist (ft)		70			1050			2920			67	
Turn Bay Length (ft)												
Base Capacity (vph)	417	1710	854	49	2412		534	1616	728	988	1616	800













Baseline

Synchro 9 Light Report
Page 2

Lanes, Volumes, Timings

1: Carothers Parkway & Murfreesboro Road

9/1/2016

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Starvation Cap Reductn	0	0	0	0	0		0	0	0	0	0	0
Spillback Cap Reductn	0	61	0	0	0		0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0		0	0	0	0	0	0
Reduced v/c Ratio	0.67	1.00	0.52	0.76	0.39		0.68	0.14	0.11	1.03	0.40	0.63

Intersection Summary

Area Type: Other

Cycle Length: 150

Actuated Cycle Length: 150

Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green, Master Intersection

Natural Cycle: 90

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 1.03

Intersection Signal Delay: 42.1

Intersection LOS: D

Intersection Capacity Utilization 93.4%

ICU Level of Service F

Analysis Period (min) 15

Description: Hwy 96 and Carothers Pkwy





~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

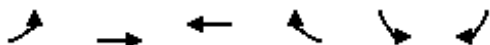
Splits and Phases: 1: Carothers Parkway & Murfreesboro Road

 Ø2 (R)	 Ø4
73 s	77 s
 Ø6 (R)	 Ø8
73 s	77 s

Lanes, Volumes, Timings

2: Murfreesboro Road/Murfreesboro Rd & Clovercroft Road

9/1/2016



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	145	2748	748	47	113	121
Future Volume (vph)	145	2748	748	47	113	121
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12
Grade (%)		0%	0%		0%	
Storage Length (ft)	0			0	0	0
Storage Lanes	1			0	1	1
Taper Length (ft)	25				25	
Lane Util. Factor	1.00	0.95	0.95	0.95	1.00	1.00
Ped Bike Factor						
Frt			0.991			0.850
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1770	3539	3507	0	1770	1583
Flt Permitted	0.318				0.950	
Satd. Flow (perm)	592	3539	3507	0	1770	1583
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)			17			132
Link Speed (mph)		45	45		40	
Link Distance (ft)		1130	160		355	
Travel Time (s)		17.1	2.4		6.1	
Confl. Peds. (#/hr)						
Confl. Bikes (#/hr)						
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0
Parking (#/hr)						
Mid-Block Traffic (%)		0%	0%		0%	
Adj. Flow (vph)	158	2987	813	51	123	132
Shared Lane Traffic (%)						
Lane Group Flow (vph)	158	2987	864	0	123	132
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(ft)		12	12		12	
Link Offset(ft)		0	0		0	
Crosswalk Width(ft)		16	16		16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15			9	15	9
Number of Detectors	1	2	2		1	1
Detector Template	Left	Thru	Thru		Left	Right
Leading Detector (ft)	20	100	100		20	20
Trailing Detector (ft)	0	0	0		0	0
Turn Type	Perm	NA	NA		Prot	Perm
Protected Phases		4	8		6	
Permitted Phases	4					6
Detector Phase	4	4	8		6	6
Switch Phase						

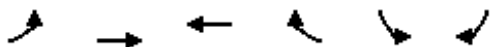
Baseline

Synchro 9 Light Report
Page 4

Lanes, Volumes, Timings

2: Murfreesboro Road/Murfreesboro Rd & Clovercroft Road

9/1/2016



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Minimum Initial (s)	5.0	5.0	5.0		5.0	5.0
Minimum Split (s)	22.5	22.5	22.5		22.5	22.5
Total Split (s)	127.0	127.0	127.0		23.0	23.0
Total Split (%)	84.7%	84.7%	84.7%		15.3%	15.3%
Maximum Green (s)	122.5	122.5	122.5		18.5	18.5
Yellow Time (s)	3.5	3.5	3.5		3.5	3.5
All-Red Time (s)	1.0	1.0	1.0		1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0		0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5		4.5	4.5
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Minimum Gap (s)	3.0	3.0	3.0		3.0	3.0
Time Before Reduce (s)	0.0	0.0	0.0		0.0	0.0
Time To Reduce (s)	0.0	0.0	0.0		0.0	0.0
Recall Mode	None	None	None		C-Min	C-Min
Walk Time (s)	7.0	7.0	7.0		7.0	7.0
Flash Dont Walk (s)	11.0	11.0	11.0		11.0	11.0
Pedestrian Calls (#/hr)	0	0	0		0	0
Act Effect Green (s)	125.9	125.9	125.9		15.1	15.1
Actuated g/C Ratio	0.84	0.84	0.84		0.10	0.10
v/c Ratio	0.32	1.01	0.29		0.69	0.48
Control Delay	3.1	21.9	1.8		84.7	15.0
Queue Delay	0.0	0.0	0.0		0.0	0.0
Total Delay	3.1	21.9	1.8		84.7	15.0
LOS	A	C	A		F	B
Approach Delay		21.0	1.8		48.6	
Approach LOS		C	A		D	
90th %ile Green (s)	122.5	122.5	122.5		18.5	18.5
90th %ile Term Code	Max	Max	Hold		Coord	Coord
70th %ile Green (s)	122.9	122.9	122.9		18.1	18.1
70th %ile Term Code	Max	Max	Hold		Coord	Coord
50th %ile Green (s)	125.3	125.3	125.3		15.7	15.7
50th %ile Term Code	Max	Max	Hold		Coord	Coord
30th %ile Green (s)	127.7	127.7	127.7		13.3	13.3
30th %ile Term Code	Max	Max	Hold		Coord	Coord
10th %ile Green (s)	131.1	131.1	131.1		9.9	9.9
10th %ile Term Code	Max	Max	Hold		Coord	Coord
Stops (vph)	25	1176	87		108	17
Fuel Used(gal)	1	47	2		3	1
CO Emissions (g/hr)	103	3289	153		229	58
NOx Emissions (g/hr)	20	640	30		45	11
VOC Emissions (g/hr)	24	762	36		53	13
Dilemma Vehicles (#)	0	52	14		0	0
Queue Length 50th (ft)	20	~1627	43		118	0
Queue Length 95th (ft)	m28	m#1681	m55		187	65
Internal Link Dist (ft)		1050	80		275	
Turn Bay Length (ft)						
Base Capacity (vph)	496	2970	2946		218	310

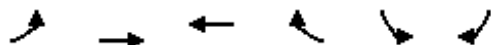
Baseline

Synchro 9 Light Report
Page 5

Lanes, Volumes, Timings

2: Murfreesboro Road/Murfreesboro Rd & Clovercroft Road

9/1/2016



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Starvation Cap Reductn	0	0	0		0	0
Spillback Cap Reductn	0	0	0		0	0
Storage Cap Reductn	0	0	0		0	0
Reduced v/c Ratio	0.32	1.01	0.29		0.56	0.43

Intersection Summary

Area Type: Other

Cycle Length: 150

Actuated Cycle Length: 150

Offset: 16 (11%), Referenced to phase 2: and 6:SBL, Start of Green

Natural Cycle: 150

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 1.01

Intersection Signal Delay: 18.7

Intersection LOS: B

Intersection Capacity Utilization 89.7%

ICU Level of Service E

Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.

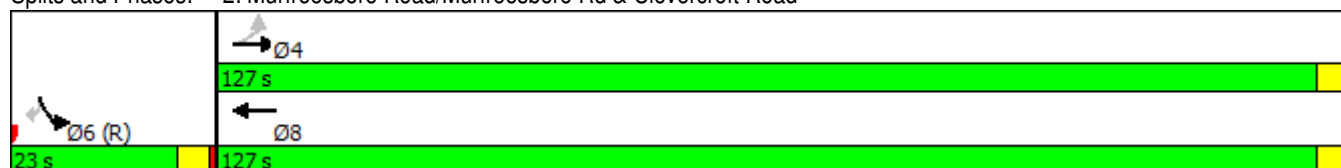
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 2: Murfreesboro Road/Murfreesboro Rd & Clovercroft Road



Lanes, Volumes, Timings
5: Arno Road & Murfreesboro Rd

9/1/2016

	→	↘	↙	←	↖	↗
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↙	↑↑	↙	↗
Traffic Volume (vph)	1284	1449	72	442	293	34
Future Volume (vph)	1284	1449	72	442	293	34
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12
Grade (%)	0%			0%	0%	
Storage Length (ft)		0	0		0	0
Storage Lanes		0	1		1	1
Taper Length (ft)			25		25	
Lane Util. Factor	0.95	0.95	1.00	0.95	1.00	1.00
Ped Bike Factor						
Frt	0.920					0.850
Flt Protected			0.950		0.950	
Satd. Flow (prot)	3256	0	1770	3539	1770	1583
Flt Permitted			0.035		0.950	
Satd. Flow (perm)	3256	0	65	3539	1770	1583
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)	589					37
Link Speed (mph)	45			45	50	
Link Distance (ft)	1550			63	683	
Travel Time (s)	23.5			1.0	9.3	
Confl. Peds. (#/hr)						
Confl. Bikes (#/hr)						
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0
Parking (#/hr)						
Mid-Block Traffic (%)	0%			0%	0%	
Adj. Flow (vph)	1396	1575	78	480	318	37
Shared Lane Traffic (%)						
Lane Group Flow (vph)	2971	0	78	480	318	37
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			12	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Number of Detectors	2		1	2	1	1
Detector Template	Thru		Left	Thru	Left	Right
Leading Detector (ft)	100		20	100	20	20
Trailing Detector (ft)	0		0	0	0	0
Turn Type	NA		Perm	NA	Prot	Perm
Protected Phases	4			8	2	
Permitted Phases			8			2
Detector Phase	4		8	8	2	2
Switch Phase						

Lanes, Volumes, Timings
5: Arno Road & Murfreesboro Rd

9/1/2016

	→	↘	↙	←	↖	↗
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Minimum Initial (s)	5.0		5.0	5.0	5.0	5.0
Minimum Split (s)	22.5		22.5	22.5	22.5	22.5
Total Split (s)	120.0		120.0	120.0	30.0	30.0
Total Split (%)	80.0%		80.0%	80.0%	20.0%	20.0%
Maximum Green (s)	115.5		115.5	115.5	25.5	25.5
Yellow Time (s)	3.5		3.5	3.5	3.5	3.5
All-Red Time (s)	1.0		1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0		0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5		4.5	4.5	4.5	4.5
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Minimum Gap (s)	3.0		3.0	3.0	3.0	3.0
Time Before Reduce (s)	0.0		0.0	0.0	0.0	0.0
Time To Reduce (s)	0.0		0.0	0.0	0.0	0.0
Recall Mode	None		None	None	C-Min	C-Min
Walk Time (s)	7.0		7.0	7.0	7.0	7.0
Flash Dont Walk (s)	11.0		11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	0		0	0	0	0
Act Effect Green (s)	115.5		115.5	115.5	25.5	25.5
Actuated g/C Ratio	0.77		0.77	0.77	0.17	0.17
v/c Ratio	1.15dr		1.56	0.18	1.06	0.12
Control Delay	67.4		351.2	4.8	126.4	16.1
Queue Delay	0.0		0.0	0.0	0.0	0.0
Total Delay	67.4		351.2	4.8	126.4	16.1
LOS	E		F	A	F	B
Approach Delay	67.4			53.2	114.9	
Approach LOS	E			D	F	
90th %ile Green (s)	115.5		115.5	115.5	25.5	25.5
90th %ile Term Code	Max		Max	Max	Coord	Coord
70th %ile Green (s)	115.5		115.5	115.5	25.5	25.5
70th %ile Term Code	Max		Max	Max	Coord	Coord
50th %ile Green (s)	115.5		115.5	115.5	25.5	25.5
50th %ile Term Code	Max		Max	Max	Coord	Coord
30th %ile Green (s)	115.5		115.5	115.5	25.5	25.5
30th %ile Term Code	Max		Max	Max	Coord	Coord
10th %ile Green (s)	115.5		115.5	115.5	25.5	25.5
10th %ile Term Code	Max		Max	Max	Coord	Coord
Stops (vph)	1618		42	108	252	8
Fuel Used(gal)	85		6	2	13	0
CO Emissions (g/hr)	5951		398	136	886	27
NOx Emissions (g/hr)	1158		78	27	172	5
VOC Emissions (g/hr)	1379		92	32	205	6
Dilemma Vehicles (#)	46		0	15	0	0
Queue Length 50th (ft)	~1686		~58	57	~340	0
Queue Length 95th (ft)	m#1671		#173	74	#539	34
Internal Link Dist (ft)	1470			1	603	
Turn Bay Length (ft)						
Base Capacity (vph)	2642		50	2725	300	299

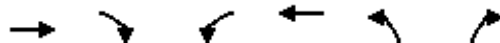
Baseline

Synchro 9 Light Report
Page 10

Lanes, Volumes, Timings

5: Arno Road & Murfreesboro Rd

9/1/2016



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Starvation Cap Reductn	0		0	0	0	0
Spillback Cap Reductn	0		0	0	0	0
Storage Cap Reductn	0		0	0	0	0
Reduced v/c Ratio	1.12		1.56	0.18	1.06	0.12

Intersection Summary

Area Type: Other

Cycle Length: 150

Actuated Cycle Length: 150

Offset: 48 (32%), Referenced to phase 2:NBL and 6:, Start of Green

Natural Cycle: 150

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 1.56

Intersection Signal Delay: 69.7

Intersection LOS: E

Intersection Capacity Utilization 105.8%

ICU Level of Service G

Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

dr Defacto Right Lane. Recode with 1 though lane as a right lane.

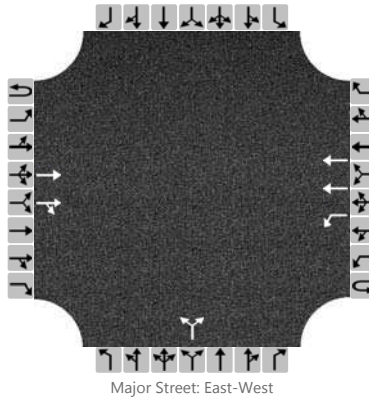
Splits and Phases: 5: Arno Road & Murfreesboro Rd

Ø2 (R)	Ø4
30 s	120 s
	Ø8
	120 s

HCS 2010 Two-Way Stop Control Summary Report

General Information		Site Information	
Analyst	FTG	Intersection	Hwy 96E and Cross Creek
Agency/Co.	FTG	Jurisdiction	Franklin, TN
Date Performed	Aug 2016	East/West Street	Highway 96E
Analysis Year	2015	North/South Street	Cross Creek Drive
Time Analyzed	AM Peak Hour	Peak Hour Factor	0.95
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	10647 (Total)		

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	2	0	0	1	2	0		0	0	0		0	0	0
Configuration			T	TR		L	T				LR					
Volume (veh/h)			474	8		0	2289			39		2				
Percent Heavy Vehicles						0				0		0				
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Left Only															
Median Storage	1															

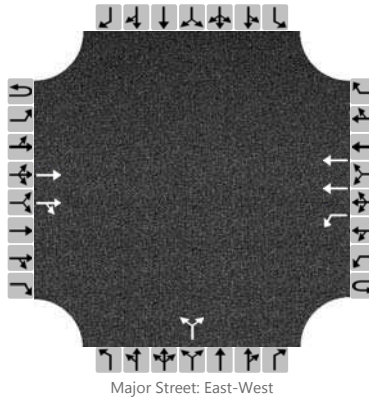
Delay, Queue Length, and Level of Service

Flow Rate (veh/h)											43					
Capacity						1068					158					
v/c Ratio											0.27					
95% Queue Length											1.0					
Control Delay (s/veh)						8.4					36.1					
Level of Service (LOS)						A					E					
Approach Delay (s/veh)									36.1							
Approach LOS									E							

HCS 2010 Two-Way Stop Control Summary Report

General Information		Site Information	
Analyst	FTG	Intersection	Hwy 96E and Cross Creek
Agency/Co.	FTG	Jurisdiction	Franklin, TN
Date Performed	Aug 2016	East/West Street	Highway 96E
Analysis Year	2015	North/South Street	Cross Creek Drive
Time Analyzed	PM Peak Hour	Peak Hour Factor	0.98
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	10647 (Total)		

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	2	0	0	1	2	0		0	0	0		0	0	0
Configuration			T	TR		L	T				LR					
Volume (veh/h)			2824	37		0	780			15		0				
Percent Heavy Vehicles						0				0		0				
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Left Only															
Median Storage	1															

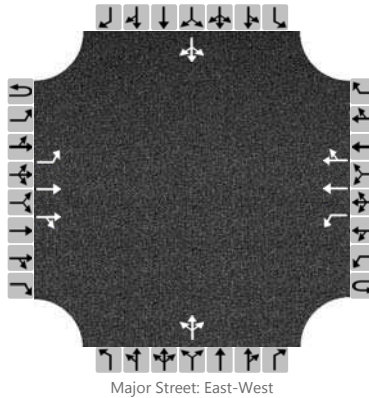
Delay, Queue Length, and Level of Service

Flow Rate (veh/h)											15					
Capacity						126					15					
v/c Ratio											1.02					
95% Queue Length											2.4					
Control Delay (s/veh)						33.5					588.8					
Level of Service (LOS)						D					F					
Approach Delay (s/veh)									588.8							
Approach LOS									F							

HCS 2010 Two-Way Stop Control Summary Report

General Information		Site Information	
Analyst	FTG	Intersection	Highway 96E and Ridgeway
Agency/Co.	FTG	Jurisdiction	Franklin, TN
Date Performed	Aug 2016	East/West Street	Highway 96E
Analysis Year	2015	North/South Street	Chester Stevens/Ridgeway
Time Analyzed	AM Peak Hour	Peak Hour Factor	0.98
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	10647 (Total)		

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	1	2	0	0	1	2	0		0	1	0		0	1	0
Configuration		L	T	TR		L	T	TR			LTR				LTR	
Volume (veh/h)		9	449	18		7	2167	23		60	0	15		12	0	62
Percent Heavy Vehicles		0				0				0	0	0		0	0	0
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Left Only															
Median Storage	1															

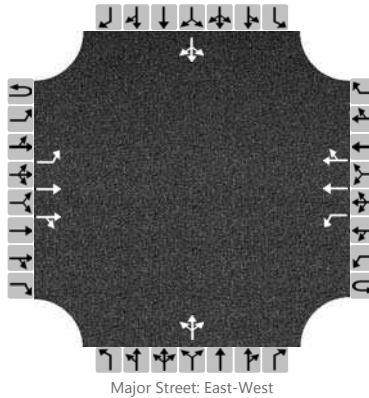
Delay, Queue Length, and Level of Service

Flow Rate (veh/h)		9				7					76				75	
Capacity		236				1097					141				122	
v/c Ratio		0.04				0.01					0.54				0.61	
95% Queue Length		0.1				0.0					2.7				3.1	
Control Delay (s/veh)		20.9				8.3					57.3				72.6	
Level of Service (LOS)		C				A					F				F	
Approach Delay (s/veh)	0.4				0.0				57.3				72.6			
Approach LOS	A				A				F				F			

HCS 2010 Two-Way Stop Control Summary Report

General Information		Site Information	
Analyst	FTG	Intersection	Highway 96E and Ridgeway
Agency/Co.	FTG	Jurisdiction	Franklin, TN
Date Performed	Aug 2016	East/West Street	Highway 96E
Analysis Year	2015	North/South Street	Chester Stevens/Ridgeway
Time Analyzed	PM Peak Hour	Peak Hour Factor	0.98
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	10647 (Total)		

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	1	2	0	0	1	2	0		0	1	0		0	1	0
Configuration		L	T	TR		L	T	TR			LTR				LTR	
Volume (veh/h)		45	2725	54		15	720	10		34	0	9		4	0	26
Percent Heavy Vehicles		0				0				0	0	0		0	0	0
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Left Only															
Median Storage	1															

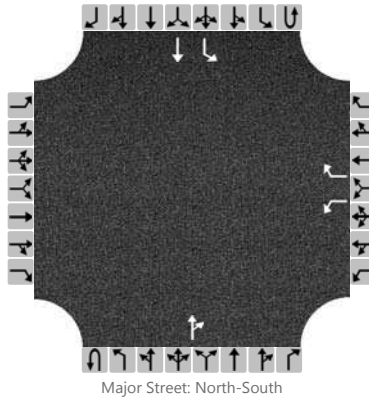
Delay, Queue Length, and Level of Service

Flow Rate (veh/h)		46				15					44				31	
Capacity		872				136					17				328	
v/c Ratio		0.05				0.11					2.59				0.09	
95% Queue Length		0.2				0.4					6.1				0.3	
Control Delay (s/veh)		9.4				34.6					1186.2				17.1	
Level of Service (LOS)		A				D					F				C	
Approach Delay (s/veh)	0.1				0.7				1186.2				17.1			
Approach LOS	A				A				F				C			

HCS 2010 Two-Way Stop Control Summary Report

General Information		Site Information	
Analyst	FTG	Intersection	Carothers and S. Carother
Agency/Co.	FTG	Jurisdiction	Franklin, TN
Date Performed	Aug 2016	East/West Street	S. Carothers Road
Analysis Year	2016	North/South Street	Carothers Parkway
Time Analyzed	AM Peak Hour	Peak Hour Factor	0.88
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	10647 (Total)		

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		1	0	1	0	0	1	0	0	1	1	0
Configuration						L		R				TR		L	T	
Volume (veh/h)						37		272			665	30		139	322	
Percent Heavy Vehicles						0		0						0		
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

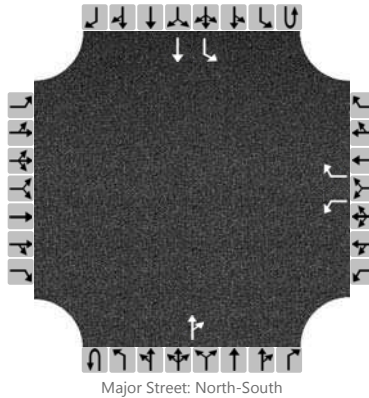
Delay, Queue Length, and Level of Service

Flow Rate (veh/h)						42		309						158		
Capacity						117		397						839		
v/c Ratio						0.36		0.78						0.19		
95% Queue Length						1.4		6.6						0.7		
Control Delay (s/veh)						51.8		39.4						10.3		
Level of Service (LOS)						F		E						B		
Approach Delay (s/veh)					40.9								3.1			
Approach LOS					E								A			

HCS 2010 Two-Way Stop Control Summary Report

General Information		Site Information	
Analyst	FTG	Intersection	Carothers and S. Carother
Agency/Co.	FTG	Jurisdiction	Franklin, TN
Date Performed	Aug 2016	East/West Street	S. Carothers Road
Analysis Year	2016	North/South Street	Carothers Parkway
Time Analyzed	PM Peak Hour	Peak Hour Factor	0.91
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	10647 (Total)		

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		1	0	1	0	0	1	0	0	1	1	0
Configuration						L		R				TR		L	T	
Volume (veh/h)						58		212			454	63		295	649	
Percent Heavy Vehicles						0		0						0		
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

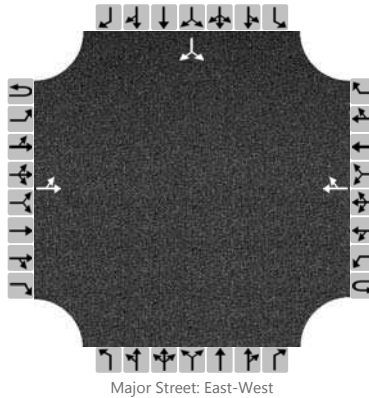
Delay, Queue Length, and Level of Service

Flow Rate (veh/h)						64		233						324		
Capacity						53		550						1014		
v/c Ratio						1.21		0.42						0.32		
95% Queue Length						5.6		2.1						1.4		
Control Delay (s/veh)						318.9		16.3						10.2		
Level of Service (LOS)						F		C						B		
Approach Delay (s/veh)					81.5								3.2			
Approach LOS					F								A			

HCS 2010 Two-Way Stop Control Summary Report

General Information		Site Information	
Analyst	FTG	Intersection	S. Carothers and Project
Agency/Co.	FTG	Jurisdiction	Franklin, TN
Date Performed	Aug 2016	East/West Street	S. Carothers Road
Analysis Year	2016	North/South Street	Western Project Access
Time Analyzed	AM Peak Hour	Peak Hour Factor	0.80
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	10647 (Total)		

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	0	0		0	0	0
Configuration		LT						TR							LR	
Volume (veh/h)		6	163				292	3						8		17
Percent Heavy Vehicles		0												0		0
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

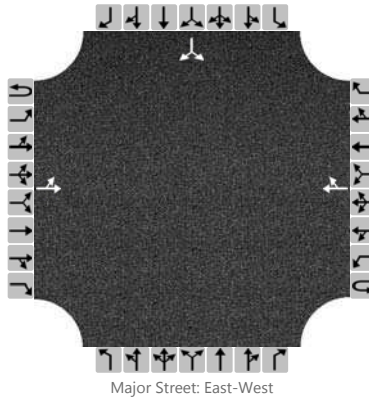
Delay, Queue Length, and Level of Service

Flow Rate (veh/h)		212													31	
Capacity		1201													569	
v/c Ratio		0.18													0.05	
95% Queue Length		0.0													0.2	
Control Delay (s/veh)		8.0													11.7	
Level of Service (LOS)		A													B	
Approach Delay (s/veh)	0.4												11.7			
Approach LOS	A												B			

HCS 2010 Two-Way Stop Control Summary Report

General Information		Site Information	
Analyst	FTG	Intersection	S. Carothers and Project
Agency/Co.	FTG	Jurisdiction	Franklin, TN
Date Performed	Aug 2016	East/West Street	S. Carothers Road
Analysis Year	2016	North/South Street	Western Project Access
Time Analyzed	PM Peak Hour	Peak Hour Factor	0.80
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	10647 (Total)		

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	0	0		0	0	0
Configuration		LT						TR							LR	
Volume (veh/h)		18	340				259	9						5		11
Percent Heavy Vehicles		0												0		0
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

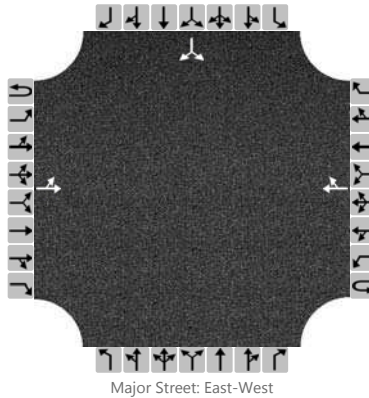
Delay, Queue Length, and Level of Service

Flow Rate (veh/h)		447													20	
Capacity		1236													507	
v/c Ratio		0.36													0.04	
95% Queue Length		0.1													0.1	
Control Delay (s/veh)		8.0													12.4	
Level of Service (LOS)		A													B	
Approach Delay (s/veh)	0.6												12.4			
Approach LOS	A												B			

HCS 2010 Two-Way Stop Control Summary Report

General Information		Site Information	
Analyst	FTG	Intersection	S. Carothers and Project
Agency/Co.	FTG	Jurisdiction	Franklin, TN
Date Performed	Aug 2016	East/West Street	S. Carothers Road
Analysis Year	2016	North/South Street	Main Project Access
Time Analyzed	AM Peak Hour	Peak Hour Factor	0.80
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	10647 (Total)		

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	0	0		0	0	0
Configuration		LT						TR							LR	
Volume (veh/h)		36	135				186	11						34		109
Percent Heavy Vehicles		0												0		0
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

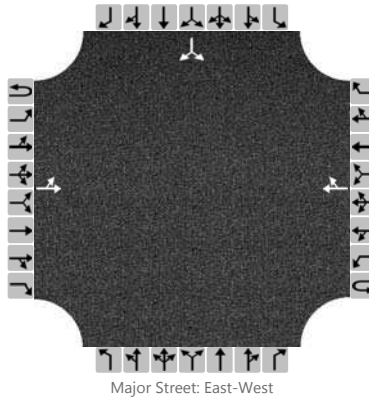
Delay, Queue Length, and Level of Service

Flow Rate (veh/h)		214													178	
Capacity		1332													690	
v/c Ratio		0.16													0.26	
95% Queue Length		0.1													1.0	
Control Delay (s/veh)		7.8													12.0	
Level of Service (LOS)		A													B	
Approach Delay (s/veh)	1.9												12.0			
Approach LOS	A												B			

HCS 2010 Two-Way Stop Control Summary Report

General Information		Site Information	
Analyst	FTG	Intersection	S. Carothers and Project
Agency/Co.	FTG	Jurisdiction	Franklin, TN
Date Performed	Aug 2016	East/West Street	S. Carothers Road
Analysis Year	2016	North/South Street	Main Project Access
Time Analyzed	PM Peak Hour	Peak Hour Factor	0.80
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	10647 (Total)		

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	0	0		0	0	0
Configuration		LT						TR							LR	
Volume (veh/h)		118	227				199	36						21		69
Percent Heavy Vehicles		0												0		0
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

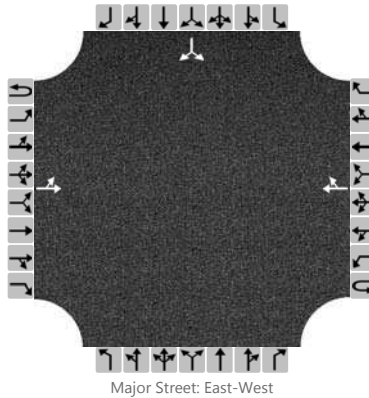
Delay, Queue Length, and Level of Service

Flow Rate (veh/h)		432													112	
Capacity		1279													522	
v/c Ratio		0.34													0.21	
95% Queue Length		0.4													0.8	
Control Delay (s/veh)		8.2													13.8	
Level of Service (LOS)		A													B	
Approach Delay (s/veh)	3.5												13.8			
Approach LOS	A												B			

HCS 2010 Two-Way Stop Control Summary Report

General Information		Site Information	
Analyst	FTG	Intersection	S. Carothers and Project
Agency/Co.	FTG	Jurisdiction	Franklin, TN
Date Performed	Aug 2016	East/West Street	S. Carothers Road
Analysis Year	2016	North/South Street	Main Project Access
Time Analyzed	AM Peak Hour	Peak Hour Factor	0.80
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	10647 (Total)		

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	0	0		0	0	0
Configuration		LT						TR							LR	
Volume (veh/h)		36	150				231	11						34		109
Percent Heavy Vehicles		0												0		0
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

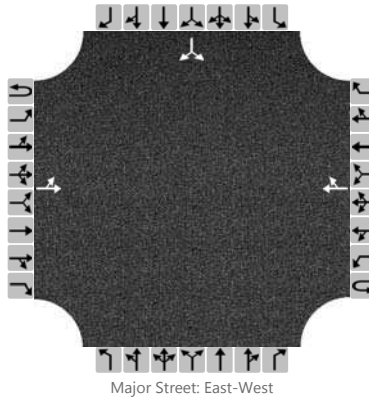
Delay, Queue Length, and Level of Service

Flow Rate (veh/h)		233													178	
Capacity		1270													632	
v/c Ratio		0.18													0.28	
95% Queue Length		0.1													1.2	
Control Delay (s/veh)		7.9													12.9	
Level of Service (LOS)		A													B	
Approach Delay (s/veh)	1.8												12.9			
Approach LOS	A												B			

HCS 2010 Two-Way Stop Control Summary Report

General Information		Site Information	
Analyst	FTG	Intersection	S. Carothers and Project
Agency/Co.	FTG	Jurisdiction	Franklin, TN
Date Performed	Aug 2016	East/West Street	S. Carothers Road
Analysis Year	2016	North/South Street	Main Project Access
Time Analyzed	PM Peak Hour	Peak Hour Factor	0.80
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	10647 (Total)		

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	0	0		0	0	0
Configuration		LT						TR							LR	
Volume (veh/h)		118	277				228	36						21		69
Percent Heavy Vehicles		0												0		0
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)		494													112	
Capacity		1241													471	
v/c Ratio		0.40													0.24	
95% Queue Length		0.4													0.9	
Control Delay (s/veh)		8.3													15.0	
Level of Service (LOS)		A													C	
Approach Delay (s/veh)	3.3												15.0			
Approach LOS	A												C			

APPENDIX C
TRAFFIC SIGNAL WARRANTS

The Federal Highway Administration has published the Manual on Uniform Traffic Control Devices 2010 (MUTCD 2010), which includes eight traffic signal warrants that help traffic engineering professionals to identify when a traffic signal installation is justified at a particular location. These eight warrants include minimum conditions that are compared to existing or projected traffic conditions, and typically, traffic signals should not be installed unless at least one of the MUTCD warrants is met. Of the eight total signal warrants, the following are relevant to the intersection considered as part of this study:

Warrant 1, Eight-Hour Vehicular Volume

The Minimum Vehicular Volume, Condition A, is intended for application where a large volume of intersecting traffic is the principal reason to consider installing a traffic signal. The Interruption of Continuous Traffic, Condition B, is intended for application where the traffic volume on a major street is so heavy that traffic on a minor intersecting street suffers excessive delay or conflict in entering or crossing the major street.

Standard: The need for a traffic control signal shall be considered if an engineering study finds that one of the following conditions exists for each of any eight hours of an average day:

- A. The vehicles per hour given in both of the 100% columns of Condition A in Table C1 exist on the major street and on the higher volume minor-street approaches, respectively, to the intersection, or
- B. The vehicles per hour given in both of the 100% columns of Condition B in Table C1 exist on the major street and on the higher volume minor-street approaches, respectively, to the intersection.

In applying each condition, the major street and minor street volumes shall be for the same eight hours. On the minor street, the higher volume shall not be required to be on the same approach during each of these eight hours.

Option: If the posted or statutory speed limit or the 85th percentile speed on the major street exceeds 40 mph, or if the intersection lies within the built-up area of an isolated community having a population of less than 10,000, the traffic volumes in the 70% columns in Table C1 may be used in place of the 100% columns.

Standard: The need for a traffic control signal shall be considered if an engineering study finds that both of the following conditions exists for each of any eight hours of an average day:

- A. The vehicles per hour given in both of the 80% columns of Condition A in Table C1 exist on the major street and on the higher volume minor-street approaches, respectively, to the intersection, and
- B. The vehicles per hour given in both of the 80% columns of Condition B in Table C1 exist on the major street and on the higher volume minor-street approaches, respectively, to the intersection.

These major street and minor street volumes shall be for the same eight hours for each condition; however, the eight hours satisfied in Condition A shall not be required to be the same eight hours satisfied in Condition B. On the minor street, the higher volume shall not be required to be on the same approach during each of these eight hours.

TABLE C1. WARRANT 1, EIGHT-HOUR VEHICULAR VOLUME

CONDITION A – MINIMUM VEHICULAR VOLUME							
Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)			Vehicles per hour on higher-volume minor street approach (one direction only)		
Major Street	Minor Street	100%	80%	70%	100%	80%	70%
1 lane	1 lane	500	400	350	150	120	105
2 or more lanes	1 lane	600	480	420	150	120	105
2 or more lanes	2 or more lanes	600	480	420	200	160	140
1 lane	2 or more lanes	500	400	350	200	160	140

CONDITION B – INTERRUPTION OF CONTINUOUS TRAFFIC							
Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)			Vehicles per hour on higher-volume minor street approach (one direction only)		
Major Street	Minor Street	100%	80%	70%	100%	80%	70%
1 lane	1 lane	750	600	525	75	60	53
2 or more lanes	1 lane	900	720	630	75	60	53
2 or more lanes	2 or more lanes	900	720	630	100	80	70
1 lane	2 or more lanes	750	600	525	100	80	70

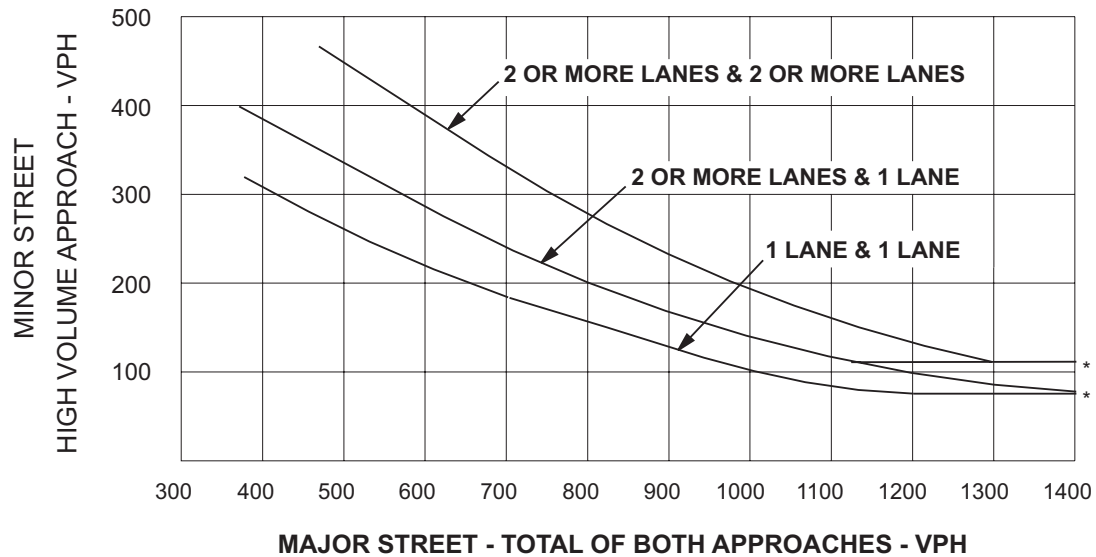
Warrant 2, Four-Hour Vehicular Volume

The Four-Hour Vehicular Volume signal warrant conditions are intended to be applied where the volume of intersecting traffic is the principal reason to consider installing a traffic signal.

Standard: The need for a traffic control signal shall be considered if an engineering study finds that for each of any four hours of an average day, the plotted points representing the vehicles per hour on the major street (total of both approaches) and the corresponding vehicles per hour on the higher volume minor street approach (one direction only) all fall above the applicable curve in Figure C1-Graph A for the existing combination of approach lanes. On the minor street, the higher volume shall not be required to be on the same approach during each of these four hours.

Option: If the posted or statutory speed limit or the 85th percentile speed on the major street exceeds 40 mph, or if the intersection lies within the built-up area of an isolated community having a population of less than 10,000, Figure C1-Graph B may be used in place of Figure C1-Graph A.

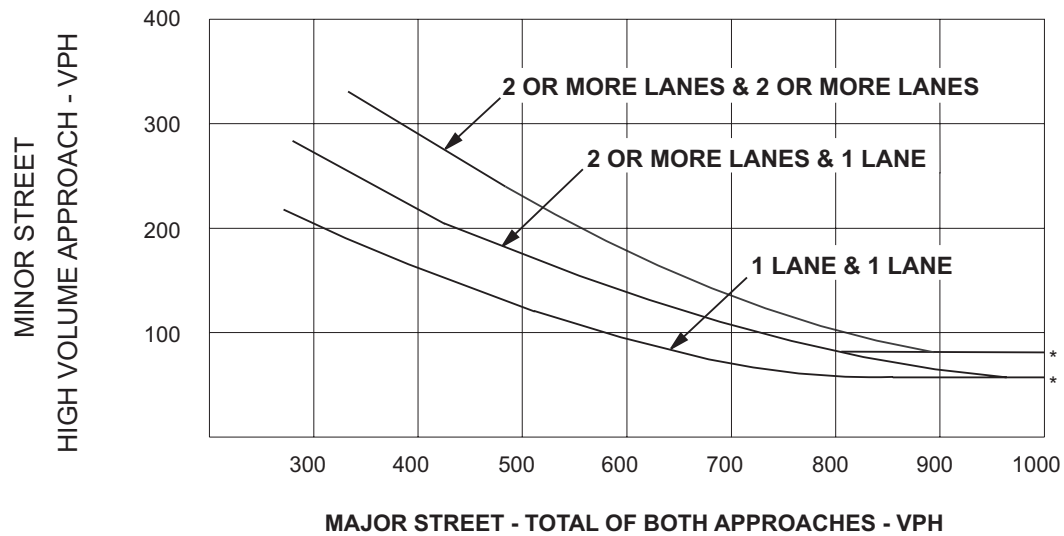
GRAPH A: FOUR HOUR VOLUME WARRANT



*NOTE: 115 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACH WITH TWO OR MORE LANES AND 80 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE.

GRAPH B: FOUR HOUR VOLUME WARRANT

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)



*NOTE: 80 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACH WITH TWO OR MORE LANES AND 60 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE.

**APPENDIX D
INFORMATION ABOUT APPROVED PROJECTS
IN THE VICINITY OF THE PROJECT SITE**

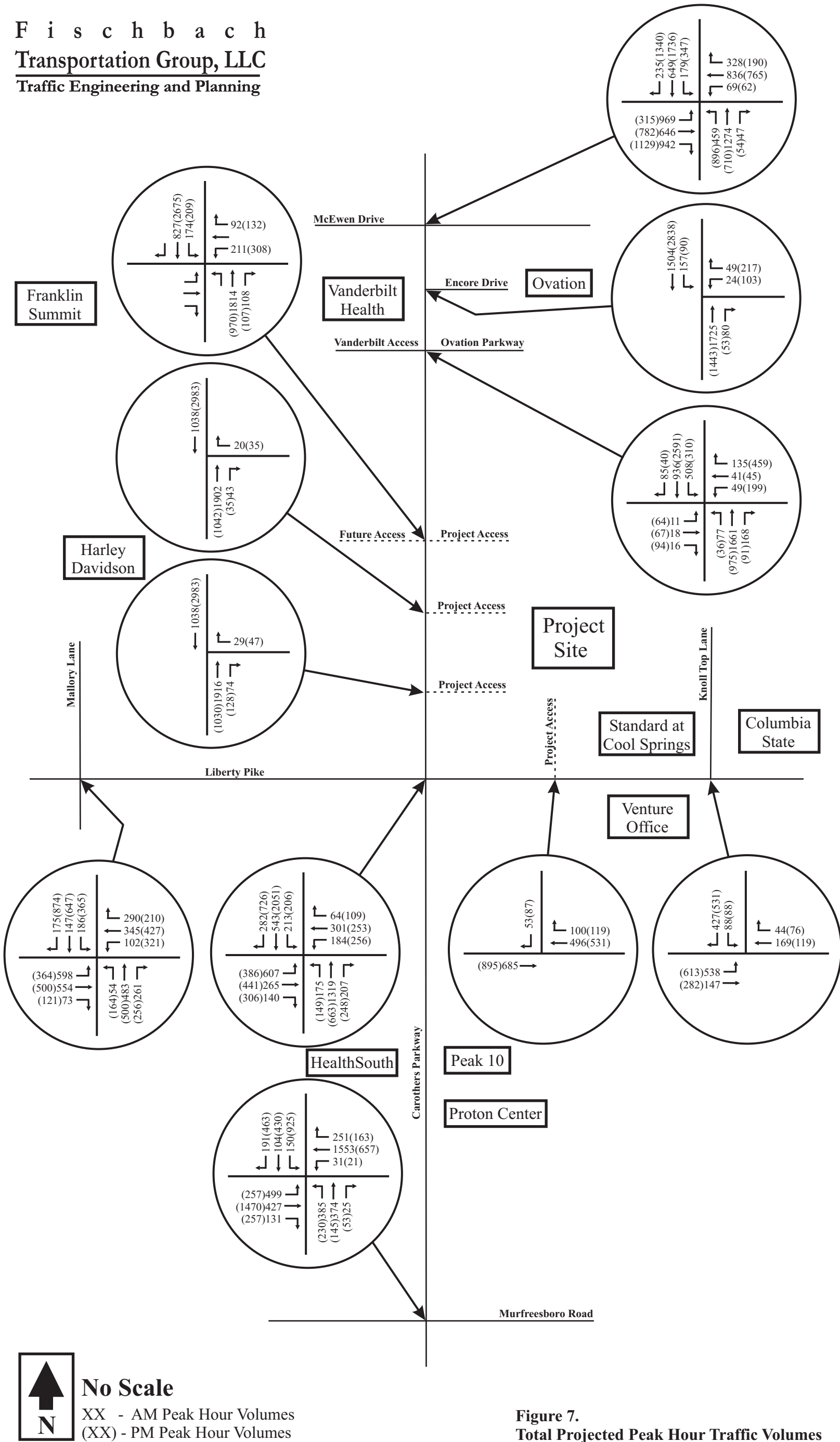
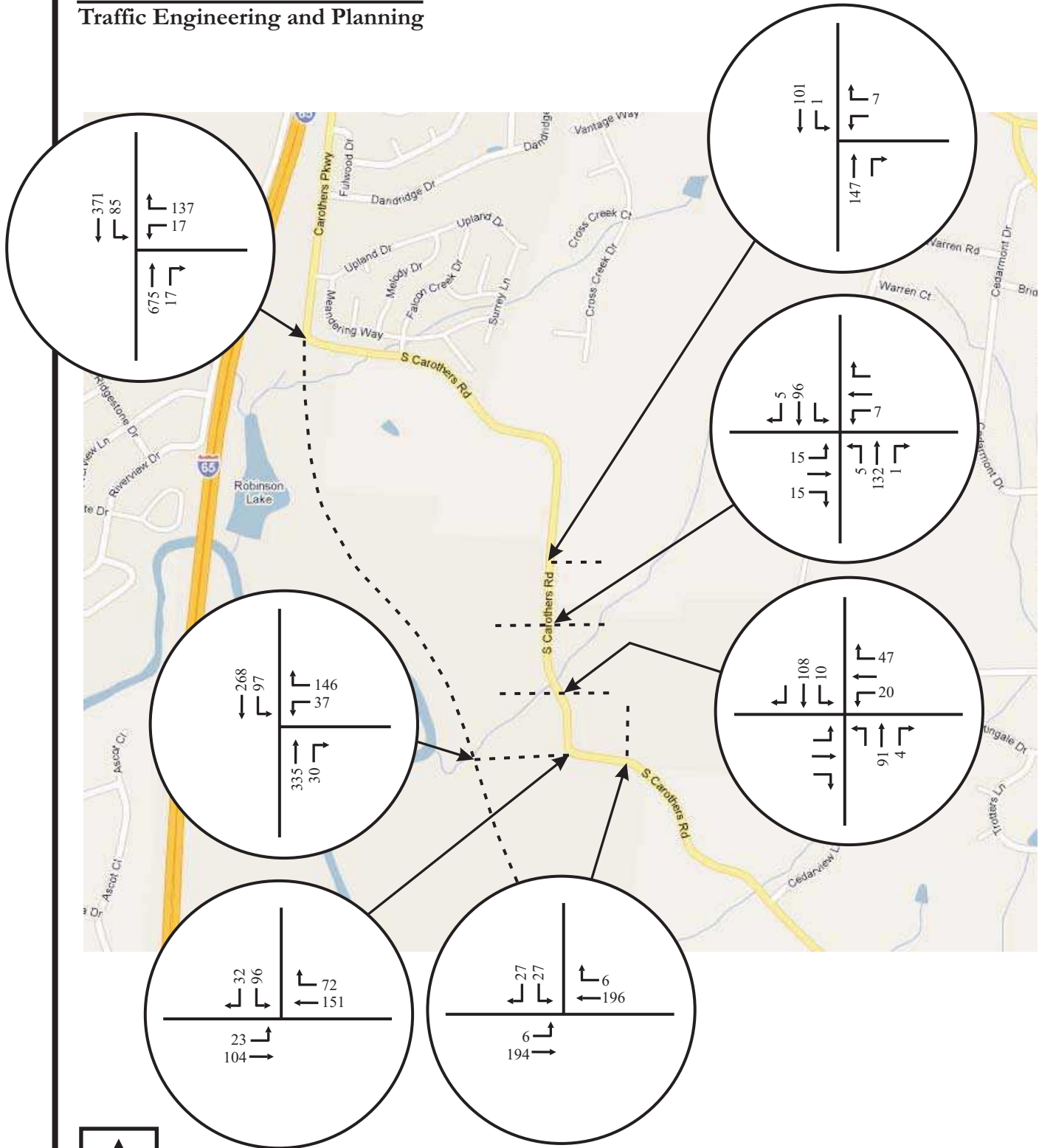


Figure 7.
Total Projected Peak Hour Traffic Volumes

F i s c h b a c h
Transportation Group, Inc.
 Traffic Engineering and Planning



No Scale

Figure 7A.
 Year 2016 AM Peak Hour
 Total Projected Peak Hour Traffic Volumes
 With Carothers Parkway

F i s c h b a c h
Transportation Group, Inc.
 Traffic Engineering and Planning

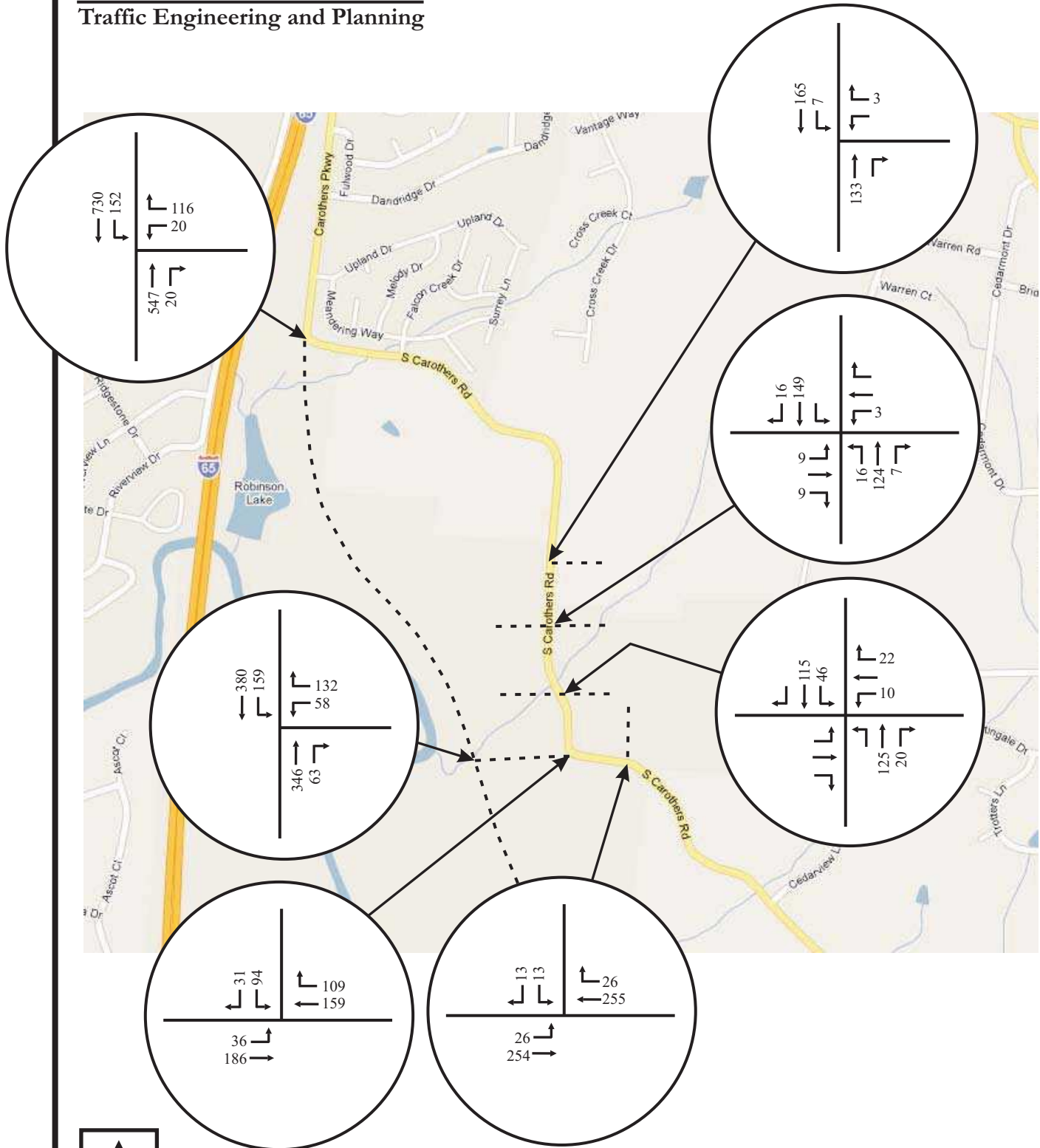
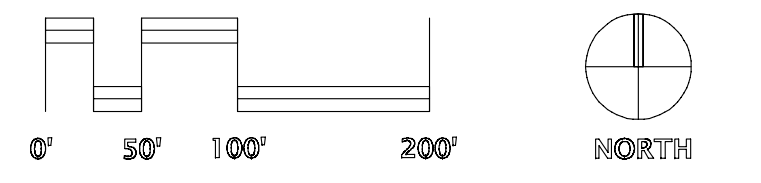
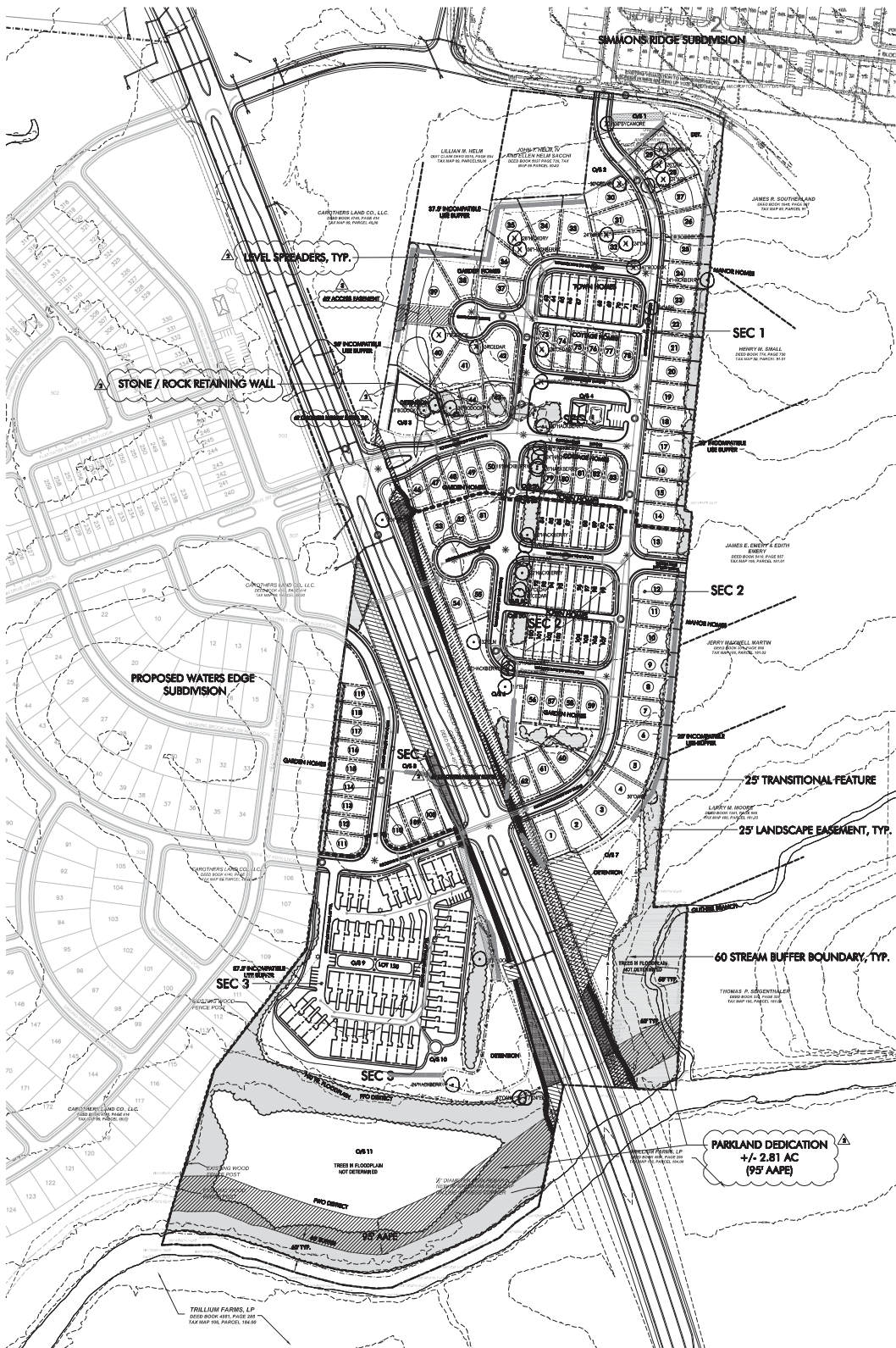


Figure 7C.
 Year 2016 PM Peak Hour
 Total Projected Peak Hour Traffic Volumes
 With Carothers Parkway





LEGEND:

- EXISTING CONTOURS
- PROPOSED CONTOURS
- PARKLAND DEDICATION AREA
- CONNECTIVITY LINK
- CONNECTIVITY NODE
- 60' STREAM BUFFER
- SF SILT FENCE
- TP TREE PROTECTION FENCE
- PRESERVED TREE CANOPY
- STREET LIGHT

PROPOSED SOUTH CAROTHERS PKWY LEGEND:

- SLOPE EASEMENT DEED BOOK 4971 PAGES 322-335
- TEMPORARY. CONSTRUCTION. EASEMENT DEED BOOK 4971 PAGES 322-335
- PERMANENT DRAINAGE EASEMENT DEED BOOK 4971 PAGES 335

- DEVELOPMENT PLAN NOTES:**
- BOUNDARY INFORMATION PROVIDED BY GRESHAM SMITH PARTNERS. TOPOGRAPHIC INFORMATION PROVIDED BY CITY OF FRANKLIN GIS DEPARTMENT.
 - THIS PROPERTY CAN BE REFERENCED AS TAX MAP 89 & 106, PARCELS 05001 & 18121.
 - THERE ARE NO HISTORICAL STRUCTURES ON THIS SITE.
 - THE PUD DEVELOPMENT PLAN WILL RESULT IN A TOTAL OF 168 PROPOSED UNITS. BASED ON AN AVERAGE OF 10 VEHICLE TRIPS PER DAY PER HOUSEHOLD UNIT, THIS WILL GENERATE A TOTAL OF 1,680 TOTAL VEHICLE TRIPS PER DAY.
 - ADEQUATE TURNING MOVEMENTS SHALL BE PROVIDED FOR UTILITY AND SERVICE VEHICLES. ALL STREETS SHALL MEET THE CITY OF FRANKLIN TRANSPORTATION AND STREET TECHNICAL STANDARDS.
 - INITIAL DISCUSSION WITH THE CITY OF FRANKLIN ENGINEERING INDICATES THERE IS ADEQUATE CAPACITY TO SERVE THE PROPOSED DEVELOPMENT WITH SEWER SERVICES.
 - ALL PUBLIC IMPROVEMENTS TO BE LOCATED WITHIN AN EASEMENT
 - THE APPLICANT WILL ENDEAVOR, TO THE EXTENT POSSIBLE, TO PRESERVE EXISTING SUITABLE TREES ALONG THE EDGES AND THE INTERIOR OF THE SITE. EXISTING TREES TO BE SAVED WILL BE FLAGGED PRIOR TO THE COMMENCEMENT OF CONSTRUCTION. DURING THE CONSTRUCTION PHASE, THREE PROTECTION FENCING SHALL BE INSTALLED NEAR THE DRIP LINE OF THE PRESERVED TREES. NO CONSTRUCTION ACTIVITY OR STORAGE SHALL OCCUR WITHIN THE TREE PROTECTION ZONES.
 - LIGHTING WILL BE PEDESTRIAN IN SCALE AND LOCATED TO ENSURE SAFE MOVEMENT OF PEDESTRIAN / VEHICLES AND FOR SECURITY PURPOSES WHILE ADHERING TO THE CITY OF FRANKLIN DESIGN STANDARDS. MIDDLE TENNESSEE ELECTRIC SHALL APPROVE STREET LIGHT STANDARDS. DIRECTIONAL LIGHTING WILL BE DESIGNED SO AS TO MINIMIZE GLARE AND REFLECTION ON ADJACENT PROPERTIES.
 - SIGNS WILL MEET THE REQUIREMENTS OF THE CITY OF FRANKLIN ZONING ORDINANCE, CHAPTER 8.7 SIGNS. SIGN CONTROLS WILL BE ESTABLISHED, FOR THE DEVELOPMENT, TO SAFELY FACILITATE PEDESTRIAN AND VEHICULAR MOVEMENT IN AN ATTRACTIVE AND EFFICIENT MANNER. SIGNAGE WILL BE COMPATIBLE WITH THE SURROUNDINGS, WILL BE APPROPRIATE TO RESIDENTIAL SCALE AND EXPRESS THE IDENTITY OF THE DEVELOPMENT.
 - WATER FACILITIES
WATER SERVICE WILL BE COORDINATED WITH THE CITY OF FRANKLIN TO PROVIDE ADEQUATE FLOW AND CAPACITY. ALL WATER MAINS SHALL BE LOCATED IN A 20' PUBLIC UTILITY EASEMENT.
 - SEWER FACILITIES - SEWER SERVICE WILL BE COORDINATED WITH THE CITY OF FRANKLIN TO PROVIDE ADEQUATE FLOW AND CAPACITY. ALL SEWER LINES SHALL BE LOCATED IN A 20' SANITARY SEWER EASEMENT.
 - A 25' TRANSITIONAL FEATURE HAS BEEN PROVIDED ON THE EASTERN BOUNDARY OF THE PROPERTY.
 - ALL FACILITIES SHALL BE DESIGNED TO MEET ALL CITY OF FRANKLIN ORDINANCE.
 - DEVELOPMENT STANDARDS WITHIN 500' OF THE SITE ARE CONVENTIONAL.
 - SIMMONS RIDGE IS A PLANNED DEVELOPMENT TO THE NORTH OF OUR PROJECT SITE. THERE IS ALSO A FUTURE PROPOSED DEVELOPMENT TO THE WEST OF PROJECT BOUNDARY. MEETINGS HAVE BEEN CONDUCTED WITH THE OWNER REPRESENTATIVES FOR THE ADJACENT PROPOSED DEVELOPMENTS TO COORDINATE ACCESS POINTS AND CONNECTIVITY BETWEEN THE PROPERTIES.
 - WATER, SEWER & REPURIFIED WATER FACILITIES
 - EXISTING FACILITIES
 - SANITARY SEWER SYSTEM
 - UTILITY DISTRICT JURISDICTION: CITY OF FRANKLIN
 - UTILITY DISTRICT ADDITIONAL FLOW IS 168 SFUE.
 - 1 SFUE = 350 GALLONS/UNIT/DAY
 - SFUE - SINGLE FAMILY UNIT EQUIVALENT
 - DOMESTIC WATER SUPPLY
 - UTILITY DISTRICT JURISDICTION: MILCROFTON
 - NATURAL GAS SERVICE
 - UTILITY DISTRICT JURISDICTION: ATMOS ENERGY
 - ELECTRIC SERVICE
 - UTILITY DISTRICT JURISDICTION: MIDDLE TENNESSEE ELECTRIC MEMBERSHIP CORPORATION
 - PROPOSED FACILITIES
 - DEMAND IN GALLONS PER DAY
 - 168 X 350 GPD = 58,800 GPD
 - THERE ARE NO ANTICIPATED IMPACTS ON STREETS SHOWN IN THE MAJOR THOROUGHFARE PLAN, THE LOCAL STREET PLAN, OR THE BIKE PEDESTRIAN PLAN.
 - FROM THIS SITE, IT IS APPROXIMATELY 2.5 MILES TO THE FIRE STATION ON HWY. 96/JORDAN ROAD AND 4 MILES TO THE CITY POLICE DEPARTMENT LOCATED DOWNTOWN AT CITY HALL. THE NEAREST PARK AND RECREATIONAL FACILITIES ARE LOCATED APPROXIMATELY 3.7 MILES WEST OF THE DEVELOPMENT ON HWY. 96 (PINKERTON PARK). CHEEK PARK AND THE WILLIAMSON COUNTY RECREATION CENTER ARE APPROXIMATELY 5.5 MILES FROM THE PROPOSED DEVELOPMENT.
 - THIS DEVELOPMENT WILL RESULT IN AN INCREASE OF 168 HOUSEHOLD UNITS. BASED ON AN AVERAGE OF 0.64 SCHOOL AGE STUDENTS PER SINGLE FAMILY HOUSEHOLD, THIS WILL INCREASE THE CURRENT STUDENT SCHOOL POPULATION BY A TOTAL OF +/- 108 STUDENTS WITHIN THE FOLLOWING CATEGORIES: PAGE HIGH SCHOOL, PAGE MIDDLE SCHOOL, AND TRINITY ELEMENTARY SCHOOL.
 - THE SUBJECT PROPERTY IS CONSISTENT WITH THE McEWEN CHARACTER AREA INCLUDING THE GUIDING PRINCIPALS OF SPECIAL AREA 6:
 - REFLECTS SAME CHARACTER OF CURRENT AND PROPOSED DEVELOPMENT.
 - THE PROPOSED DEVELOPMENT PATTERN CONSISTS OF LOTS WHICH ARE COMPARABLE TO THE EXISTING AND PROPOSED SURROUNDING DEVELOPMENT.
 - ALL PARKING REQUIREMENTS SHALL BE MET WITH GARAGES AND DRIVEWAYS AT EACH RESIDENTIAL UNIT AS WELL AS SUPPLEMENTAL ONSTREET PARKING WHERE VILLA UNITS ARE PLANNED.
 - RESIDENTIAL FIRE SPRINKLER SYSTEMS SHALL BE PROVIDED IF 1,500 GPM / 20 PSI IS NOT AVAILABLE.

SITE DATA	
PROJECT NAME:	ECHOLON
TAX MAP:	89 & 106
PARCEL:	089-05001 & 106-18121
CITY:	FRANKLIN
COUNTY:	WILLIAMSON
STATE:	TENNESSEE
CIVIL DISTRICT:	14
LAND USE/ZONING:	AG (AGRICULTURAL DISTRICT)
ADDRESS:	4419 S CAROTHERS ROAD FRANKLIN, TENNESSEE
DEED BOOK:	
OWNER:	JOHN T. HELM IV & ELLEN HELM SACCHI
EXISTING ZONING AND CHARACTER AREA OVERLAY:	AG - McEWEN-6
PROPOSED ZONING:	PUD RX RESIDENTIAL VARIETY
OTHER APPLICABLE OVERLAYS:	FFO & FWO
APPLICABLE DEVELOPMENT STANDARD:	CONVENTIONAL
ACREAGE OF SITE	+/- 57.23
TOTAL UNITS:	168
DENSITY:	
SECTION 1:	3.55 DU/AC
SECTION 2:	2.91 DU/AC
SECTION 3:	2.02 DU/AC
SECTION 4:	2.55 DU/AC
RESIDENTIAL UNITS:	
MANOR:	32
GARDEN:	43
COTTAGE:	11
VILLA:	48
TOWN HOMES:	34
OPEN SPACE REQUIREMENTS	
FORMAL OPEN SPACE REQUIRED	+/- 2.86 AC.
INFORMAL OPEN SPACE REQUIRED	+/- 5.75 AC.
FORMAL OPEN SPACE PROVIDED	+/- 2.86 AC.
INFORMAL OPEN SPACE PROVIDED	+/- 11.80 AC.
OPEN SPACE CHART	
OPEN SPACE #1: INFORMAL	+/- 0.55 AC.
OPEN SPACE #2: INFORMAL	+/- 0.17 AC.
OPEN SPACE #3: INFORMAL	+/- 0.56 AC.
OPEN SPACE #4: FORMAL	+/- 0.68 AC.
OPEN SPACE #5A-5D: INFORMAL	+/- 0.05 AC.
OPEN SPACE #6: INFORMAL	+/- 1.25 AC.
OPEN SPACE #7: INFORMAL	+/- 1.73 AC.
OPEN SPACE #8: INFORMAL	+/- 0.75 AC.
OPEN SPACE #9: FORMAL	+/- 0.18 AC.
OPEN SPACE #10: FORMAL	+/- 2.00 AC.
OPEN SPACE #11: INFORMAL	+/- 6.74 AC.
PARKLAND DEDICATION PROVIDED (35 UN x 1,200SF)+(134 UN x 600SF) = 122,400SF (+/-2.81 AC)	+/- 2.81 AC. (122,400 SF)
CONNECTIVITY INDEX	1.73 (26 LINKS / x15NODES = 1.73)
PROPOSED BUILDING SETBACKS - MANOR LOTS	
FRONT BUILDING SETBACK:	15' MINIMUM
SIDE BUILDING SETBACK:	5' MINIMUM
REAR BUILDING SETBACK:	10' MINIMUM
PROPOSED BUILDING SETBACKS - GARDEN, COTTAGE LOTS LOTS	
FRONT BUILDING SETBACK:	8' MINIMUM
SIDE BUILDING SETBACK:	5' MINIMUM
REAR BUILDING SETBACK:	10' MINIMUM
PROPOSED BUILDING SETBACKS - VILLA, TOWN HOME LOTS	
FRONT BUILDING SETBACK:	5' / 8' MINIMUM (SEE SHEET A1.00)
SIDE BUILDING SETBACK:	5' MINIMUM
REAR BUILDING SETBACK:	4' MINIMUM

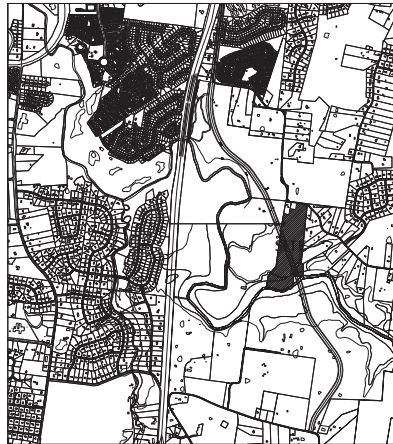
ENGINEERING PROVIDED BY:
MICHAEL RAY
FISHER & ARNOLD INC.
1420 DONELSON PIKE, SUITE A-12
NASHVILLE, TN. 37217
(615) 383-6300
mray@fisherarnold.com

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EDGE
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SUITE 202
NASHVILLE TN, 37203
(615) 250-8154
jhaas@edgelo.com

DEVELOPER:
T. KEITH GLENN
CRESCENT RESOURCES
227 W. TRADE STREET
SUITE 1000
CHARLOTTE, NC. 28202

DEVELOPER:
CHRIS PASCARELLA
PEARL STREET PARTNERS, LLC
205 POWELL PLACE
BRENTWOOD TN 37027
kpascarella@pearlstreetpartners.com

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Nashville, Tennessee 37203
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F 615-250-8155

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Echelon
PUD Development Plan
Franklin, TN
COF #2667

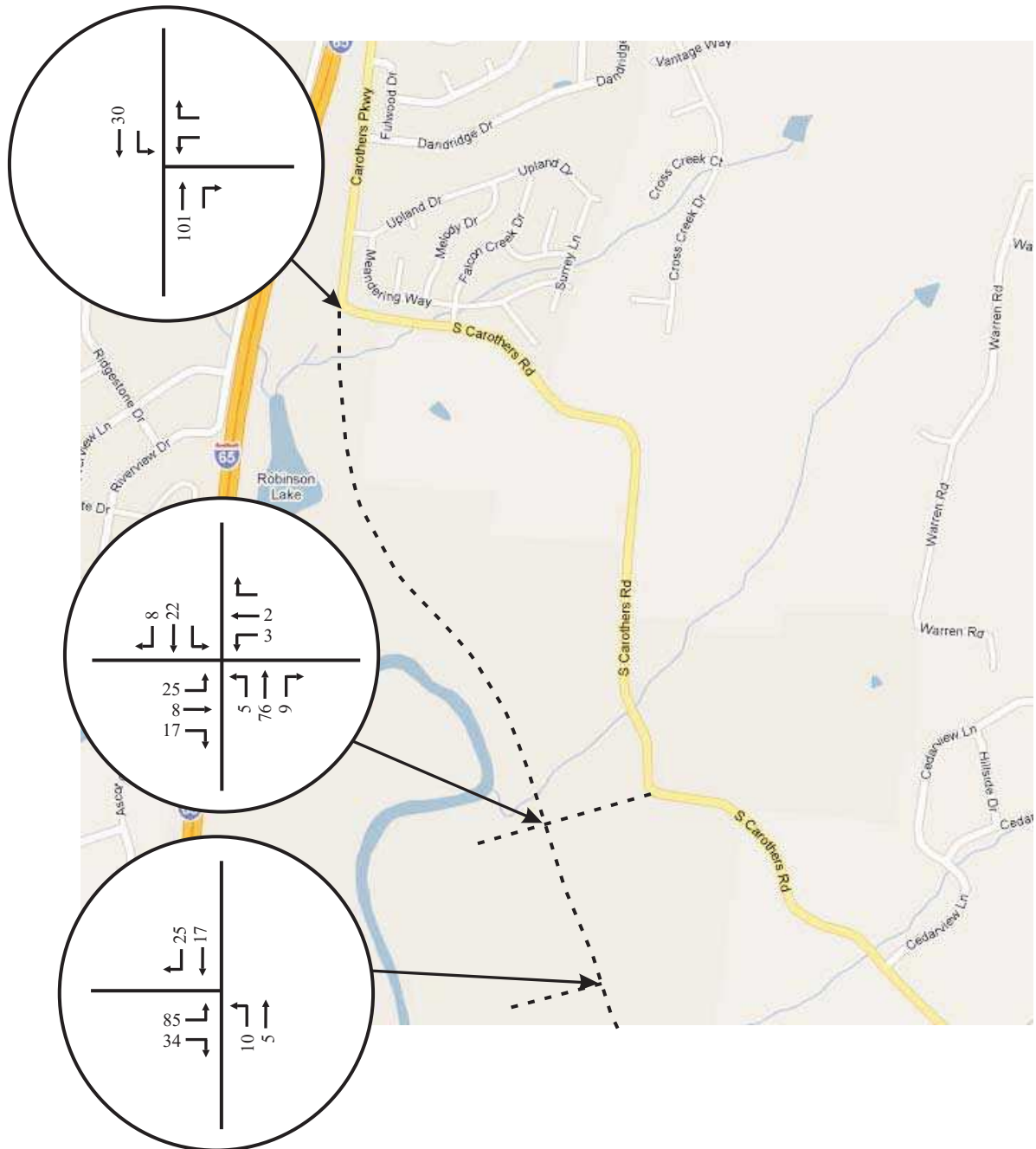
Crescent Resources
Charlotte, NC

PROJECT NO.	13007
Date	2/11/13
Revisions	
03/07/2013	
08/23/2013 POST PC	
10/10/2013 POST PC	

Sheet Title	
DEVELOPMENT PLAN	
Sheet Number	
L 1.00	



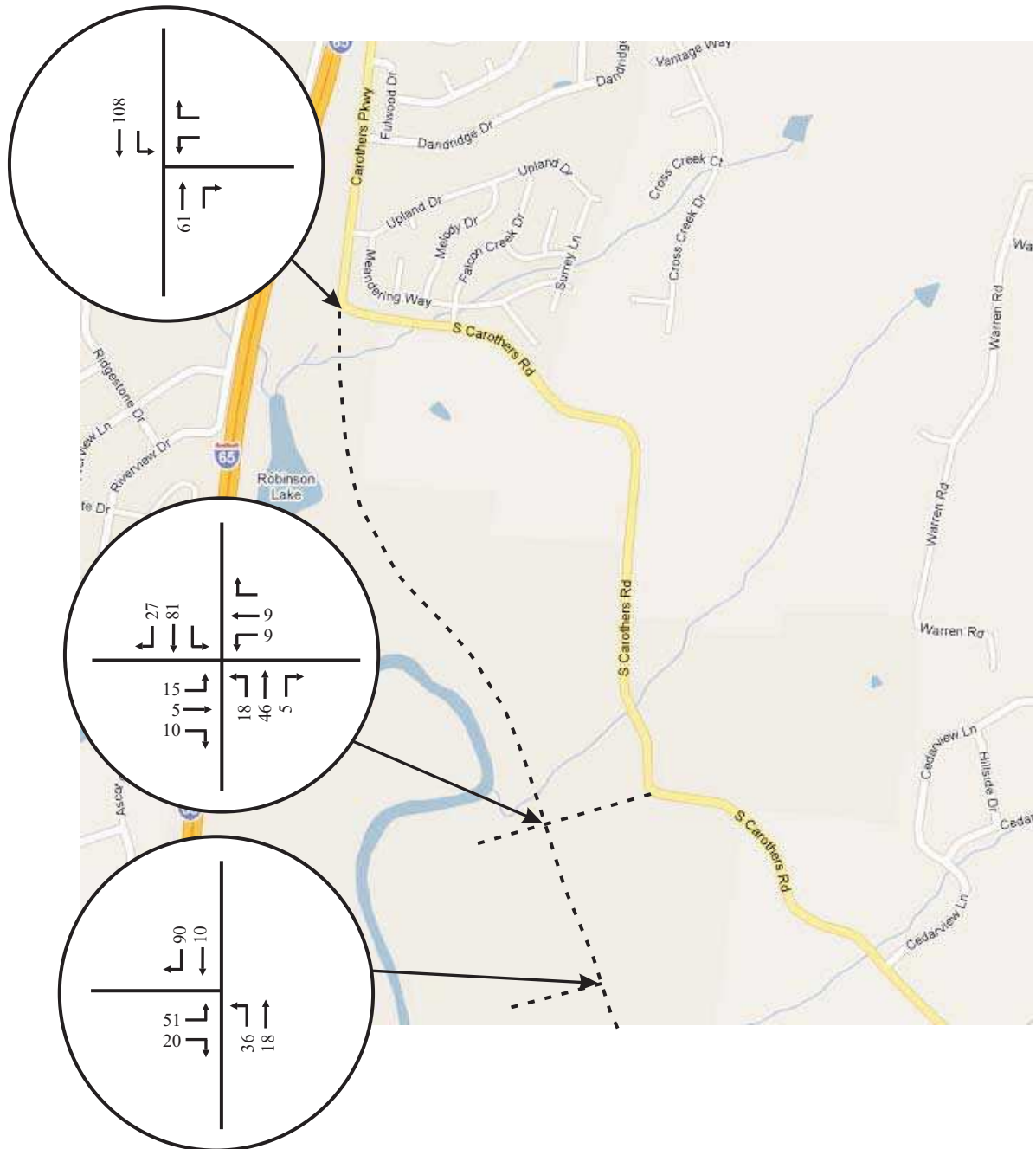
F i s c h b a c h
 Transportation Group, LLC
 Traffic Engineering and Planning



No Scale

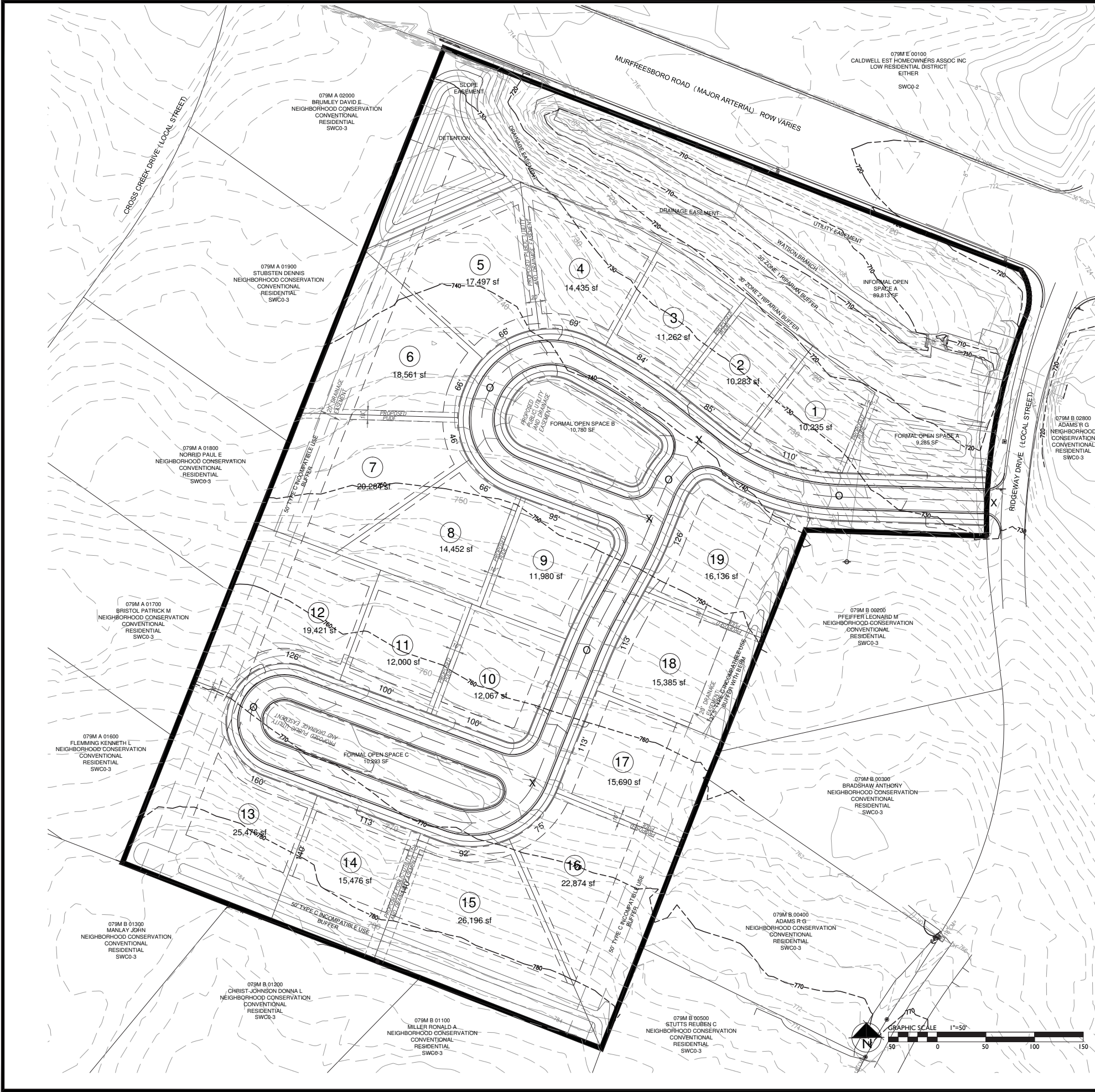
Figure 6A.
 AM Peak Hour Traffic Volumes
 Generated by the Water's Edge Project

F i s c h b a c h
 Transportation Group, LLC
 Traffic Engineering and Planning



No Scale

Figure 6C.
 PM Peak Hour Traffic Volumes
 Generated by the Water's Edge Project



LAND USE PLAN COMPLIANCE

- CHARACTER AREA OVERLAY: SWC0-3
APPLICABLE DEVELOPMENT STANDARD: CONVENTIONAL
1. THE EXISTING USES WITHIN SEWARD HALL CHARACTER AREA 3 ARE PREDOMINANTLY SINGLE FAMILY DETACHED HOMES. THE PROPOSED PLAN PROVIDES SINGLE FAMILY HOME LOTS.
 2. THE PROPOSED DEVELOPMENT PLAN PRESERVES THE FRONT PORTION OF THE PROPERTY ALONG MURFREESBORO ROAD AS OPEN SPACE. THIS OPEN SPACE "FRONT YARD" IS CONSISTENT WITH THE CHARACTER OF THE CORRIDOR.
 3. THE PROPOSED DEVELOPMENT WILL BE ACCESSED FROM RIDGEWAY DRIVE.

LOCAL COMPATIBILITY

THE PROPOSED SUBDIVISION IS PLANNED WITH TWO STORY SINGLE FAMILY HOMES RANGING IN SIZE BETWEEN 3500 SQUARE FEET AND 4600 SQUARE FEET. THESE HOMES ARE COMPATIBLE WITH THE HOMES WITHIN THE ADJACENT NEIGHBORHOODS, RIDGEWAY AND CROSS CREEK SUBDIVISIONS EVEN THOUGH THEY ARE PROPOSED ON LOTS LESS THAN ONE ACRE.

THE HOMES WITHIN THE RIDGEWAY AND CROSS CREEK SUBDIVISIONS ARE BETWEEN 1900 TO 5700 SQUARE FEET IN SIZE. THE AVERAGE HOME IS 3500 SQUARE FEET IN SIZE. THESE HOMES WERE BUILT ON ONE ACRE LOTS WITH SEPTIC TANKS ACCORDING TO WILLIAMSON COUNTY DEVELOPMENT REGULATIONS. SINCE THE DEVELOPMENT OF THESE HOMES, SEWER HAS BEEN MADE ACCESSIBLE BY THE CITY OF FRANKLIN WITH A SEWER MAIN ALONG MURFREESBORO ROAD.

THE PROPOSED PUD PLAN FOLLOWS THE ZONING ORDINANCE'S REQUIREMENTS FOR PROVIDING A TYPE 'C' INCOMPATIBLE USE BUFFERS WHERE ADJACENT LOTS ARE LESS THAN 75% OF THE ADJACENT LOTS. A TYPE 'C' BUFFER IS PLANNED ON 3 BOUNDARIES OF THE SITE ADJOINING ADJACENT LOTS ZONED NEIGHBORHOOD CONSERVATION (WILLIAMSON COUNTY). IN ADDITION TO SPACIAL REQUIREMENTS, THIS BUFFER WILL INCLUDE 16 TREES AND 40 SHRUBS EVERY ONE HUNDRED LINEAR FEET. THE NEIGHBORING HOMES AVERAGE A REAR SETBACK OF 88 FEET FROM OCTOBER PARK'S BOUNDARY. HOMES ARE AS CLOSE AS 25 FEET TO THE PROPERTY AND AS FAR AWAY AS 165 FEET. THE AVERAGE DISTANCE BETWEEN THE NEW HOMES AND THE EXISTING HOMES WILL BE 138 FEET.

COMPATIBILITY OF LOT SIZE SHOULD NOT BE THE ONLY FACTOR TO DETERMINE APPROPRIATENESS OF THE DEVELOPMENT PLAN. THE PROPOSED PLAN IS COMPATIBLE IN THE SIZE OF HOME AND COST OF HOME, AND ARE FULLY SCREENED FOR THE PRIVACY OF THE EXISTING NEIGHBORS AND THE NEW RESIDENTS.

THE DEVELOPMENT OF ONE ACRE LOTS WITHIN THE CITY OF FRANKLIN IS OFTEN BOTH COST PROHIBITIVE FOR DEVELOPMENT AND COST PROHIBITIVE FOR LONG TERM MAINTENANCE OF INFRASTRUCTURE. THE DENSITY AND LOT SIZES PROPOSED IN THE PUD ARE NECESSARY DUE TO THE COST OF INFRASTRUCTURE AND COST OF LAND. BOTH RIDGEWAY AND CROSS CREEK SUBDIVISIONS WERE DEVELOPED WITHOUT STORMWATER DETENTION BASINS, SEWER, CURB AND GUTTER, SIDEWALKS, FORMAL OPEN SPACE, NOR INFORMAL OPEN SPACE PRESERVATION AREAS. THE PER LOT COST OF DEVELOPMENT, INSTALLATION, AND MAINTENANCE IS DISPROPORTIONATELY HIGHER FOR NEW DEVELOPMENT THAN THE ADJACENT EXISTING SUBDIVISIONS DUE TO THE CITY'S DESIGN STANDARDS.

CONNECTIVITY INDEX

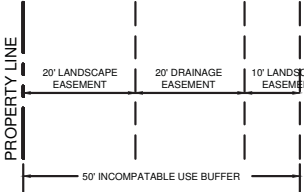
0 LINKS 1
X NODES 4

INDEX = 1.0

DUE TO EXISTING CONDITIONS OF THIS PROPERTY, AND ADJACENT EXISTING SUBDIVISION, OFF-SITE CONNECTIONS ARE NOT POSSIBLE AND ARE NOT PROVIDED WITH THIS PUD. A SPECIAL EXCEPTION IS REQUESTED FROM THE ENGINEERING DEPARTMENT FOR OFF-SITE CONNECTIONS.

INCOMPATIBLE USE BUFFER

THE SOUTHERN, EASTERN, AND WESTERN BOUNDARIES SHALL HAVE A TYPE 'C' INCOMPATIBLE USE BUFFER AS SHOWN ON THE SITE PLAN. INCOMPATIBLE USE BUFFERS ARE TO BE PLACED IN A LANDSCAPE EASEMENT. (SEE DIAGRAM BELOW)



PARKLAND DEDICATION

PARKLAND DEDICATION SHALL BE FEE IN LIEU OF FOR THIS DEVELOPMENT PLAN.

19 X 1200SF = 22,800 SF (0.52 ACRES)

HYDRANT FIRE FLOW (HYDRANT LOCATED 500' EAST OF THE INTERSECTION OF RIDGEWAY DR AND HWY 96)

WATER MAIN 16" DUCTILE IRON
FLOW: 1455 GPM
STATIC PRESSURE: 99 PSI
RESIDUAL PRESSURE: 75 PSI

STREAMSIDE BUFFER ENHANCEMENT

ENHANCEMENT SHALL INCLUDE REMOVAL OF INVASIVE SPECIES AND THE RE-ESTABLISHMENT OF NATIVE SPECIES WHICH PROVIDES A MIX OF CANOPY TREES, UNDERSTORY SHRUBS, AND A NATIVE SEED MIX OF FORBES/GRASSES/SEDGES/RUSHES SUITABLE FOR A MOIST SHADED UNDERSTORY.

THERE SHALL BE NO CLEARING, GRADING, CONSTRUCTION, STORAGE, OR DISTURBANCE OF VEGETATION ALLOWED IN THE STREAM BUFFER EXCEPT AS PERMITTED BY THE CITY ENGINEER.

PHASING

THE DEVELOPMENT WILL BE CONSTRUCTED AS A SINGLE PHASE.

CRITICAL TREE LOTS

LOTS 3, 4, 5, 6, 14, 16 & 20 ARE CRITICAL TREE LOTS.



SITE DATA:

PROJECT NAME: OCTOBER PARK
PROJECT NUMBER: 4686
SUBDIVISION: NA
LOT NUMBER: NA
ADDRESS: 1110 RIDGEWAY DRIVE
CITY: FRANKLIN, TN
COUNTY: WILLIAMSON
STATE: TENNESSEE
CIVIL DISTRICT: 14TH CIVIL DISTRICT
MAP, GROUP, PARCEL NUMBERS: MAP 79, PARCELS 60.07, 60.01, AND MAP 79M GROUP B PARCEL 1.00

EXISTING ZONING: WILLIAMSON COUNTY
NEIGHBORHOOD CONSERVATION
PROPOSED ZONING: SD-R 1.6 DUA
CHARACTER AREA OVERLAY: SWC0-3
APPLICABLE DEVELOPMENT STANDARD: CONVENTIONAL
TOTAL ACREAGE: 11.88 AC
TOTAL SQUARE FOOTAGE: 517,412 SF
MINIMUM REQUIRED SETBACKS:
FRONT YARD: 15'
REAR YARD: VARIES WITH BUFFER TREATMENT
SIDE YARD: 5'

OWNER: R. GLENN ADAMS
ADDRESS: 1100 RIDGEWAY DRIVE
CONTACT: FRANKLIN, TN 37067
GLENN ADAMS

APPLICANT: VERTEX DEVELOPMNTN, LLC
ADDRESS: 1212 HOSS ROAD
OFFICE PHONE: POWELL, TN 37849
EMAIL ADDRESS: 865-384-8124
CONTACT: sbethel.bethel@gmail.com
STEVE BETHEL

PLANNER/LANDSCAPE ARCHITECT: GAMBLE DESIGN COLLABORATIVE
ADDRESS: 144 SOUTHEAST PARKWAY
SUITE 200
FRANKLIN, TN 37064
OFFICE PHONE: 615.975.5765
EMAIL ADDRESS: greggambledesign@gmail.com
CONTACT: GREGG GAMBLED

PROJECT CHARACTERISTICS
BUILDING SQUARE FOOTAGE: N/A
BUILDING HEIGHT: 2 STORY
LANDSCAPE SURFACE RATIO: 0.84
MINIMUM LANDSCAPE RATIO: 0.40
INCOMPATIBLE USE BUFFER REQUIRED: YES
TYPE A BUFFER TO NORTH
TYPE C BUFFER, SOUTH, EAST, AND WEST

MINIMUM PARKING REQUIRED: N/A
MAXIMUM PARKING LIMIT: N/A
EXISTING PARKING: N/A
PARKING PROVIDED: SINGLE FAMILY DETACHED
2 PER UNIT

RESIDENTIAL DENSITY: 1.60 DUA (19 UNITS)
EXISTING TREE CANOPY: 1.66 AC
PRESERVED TREE CANOPY: 1.48 AC
PARKLAND FEE IN LIEU: 2.76 AC PROVIDED (23.22%)
OPEN SPACE: 2.76 AC PROVIDED (23.22%)

STATEMENT OF IMPACTS

WATER
WATER SERVICE WILL BE PROVIDED BY THE MILCROFTON UTILITY DISTRICT. THE WATER MAIN WILL BE SERVED FROM A MAIN IN RIDGEWAY DRIVE. 19 x 350 GDP = 6,650 GDP

SEWER
SEWER SERVICE WILL BE PROVIDED BY THE CITY OF FRANKLIN. SEWER MAIN CONNECTION AT MANHOLE LOCATED AT THE INTERSECTION OF RIDGEWAY DRIVE AND HIGHWAY 96.

DRAINAGE FACILITIES
THE PROPERTY WILL BE DRAINED TO THE NORTH TO DETENTION FACILITY. THE DETENTION POND WILL DRAIN TO WATSONS BRANCH BETWEEN THE SITE AND HWY 96.

POLICE AND FIRE
FRANKLIN FIRE DEPT STATION #2 - 2.2 MILES DRIVING DISTANCE
COLUMBIA AVE POLICE STATION - 3.8 MILES DRIVING DISTANCE

RECREATION FACILITIES
LIBERTY PARK - 3.0 MILES DRIVING DISTANCE

PROJECTED STUDENT POPULATION
THE STUDENT POPULATION IS PROJECTED AT A RATE OF .64 STUDENTS PER HOME: 19 x .64 = 12.2 STUDENTS
TRINITY ELEMENTARY SCHOOL 2.7 MILES
PAGE MIDDLE SCHOOL 6.0 MILES
PAGE HIGH SCHOOL 6.0 MILES

REFUSE COLLECTION
REFUSE COLLECTION SERVICE WILL BE PROVIDED BY THE CITY OF FRANKLIN SOLID WASTE.

RESTRICTIVE COVENANTS
A HOME OWNERS ASSOCIATION WILL BE ESTABLISHED PRIOR TO THE FIRST OCCUPANCY OF RESIDENTS. THE HOME OWNERS ASSOCIATION WILL REGULATE ARCHITECTURAL STANDARDS AND THE MAINTENANCE OF THE COMMUNITY. THE HOA WILL MAINTAIN ALL COMMON OPEN SPACE AND RECREATIONAL AREAS.

MINERAL RIGHTS
NO THIRD PARTY MINERAL RIGHTS ARE ASSOCIATED WITH THIS PROPERTY.

COF 4686

Revisions:
1. 11.10.2014
2. 12.03.2014

Drawing Notes:

GDC
GAMBLE
DESIGN COLLABORATIVE
DEVELOPMENT PLANNING AND
LANDSCAPE ARCHITECTURE

Date: OCT 13, 2014

**OCTOBER PARK PUD SUBDIVISION
DEVELOPMENT PLAN**
Parcels 60.07, 60.01 on Map 79 and 1.00 in Group B on Tax Map 79M
Franklin, Williamson County, Tennessee



GAMBLED DESIGN COLLABORATIVE
144 SOUTHEAST PARKWAY
SUITE 200
FRANKLIN, TENNESSEE 37064
GREG GAMBLED
ggambledesign@gmail.com
615.975.5765

**DEVELOPMENT
PLAN**

C 3.0

SITE DATA SHEET
PROJECT NAME: FOUNTAINS OF FRANKLIN, SITE PLAN, SECTION 2
PROJECT #: 4523
SUBDIVISION: SILVER GRACE
LOT NUMBER: 1 AND 2
ADDRESS: 4100 MURFREESBORO ROAD
CITY: FRANKLIN
COUNTY: WILLIAMSON
STATE: TENNESSEE
CIVIL DISTRICT: 14TH

DISTING. ZONING AND CHARACTER AREA OVERLAY:
BY RESIDENTIAL VARIETY DIST. / SCENARIO HALL SH2
OTHER APPLICABLE OVERLAYS:
APPLICABLE DEVELOPMENT STANDARD: CONVENTIONAL
ACREAGE OF SITE: 14.88
SQUARE FOOTAGE OF SITE: 648,134.2
MINIMUM REQUIRED SETBACK LINES:
STREET FRONTING: 30' LOCAL/50' ARTERIAL (VILLAS)
STREET FRONTING: 60' (SINGLE FAMILY LOTS)
SIDE YARD: 10'
REAR YARD: 30'

OWNER LOTS 1 & 2:
FOUNTAINS OF FRANKLIN, L.L.C.
2202 JEFFERSON COURT
FRANKLIN, TN 37064
(615)790-7041
MAP 79, PARCEL 58
MAP 80, PARCEL 39.04
BOOK 5006, PAGE 86
CONTAINING 13.51 ACRES (588,615.2 S.F.) &
CONTAINING 1.37 ACRES (59,519 S.F.)

APPLICANT/DEVELOPER:
GOODWORKS UNLIMITED, LLC
GARY KEOCKLEY
2202 JEFFERSON COURT
FRANKLIN, TN 37064
(615)790-7041
GKECKLEY@YAHOO.COM

BUILDING SQUARE FOOTAGE:
MEMORY CARE BUILDING: 49,548
PHASE 2 VILLAS: 23,213

BUILDING HEIGHT:
MEMORY CARE: ONE STORY-26'
VILLAS: ONE STORY-30'

LANDSCAPE SURFACE RATIO: 0.22
MIN. LANDSCAPE SURFACE RATIO: 0.10
INCOMPATIBLE-USE BUFFER REQUIRED: 37.5' CLASS C ALONG
EAST PROPERTY BOUNDARY (25% REDUCTION W/6' OPAQUE FENCE)

MINIMUM PARKING REQUIREMENT:
MAIN BUILDING: 0.25 PER PATIENT + 1 PER EMPLOYEE =
25 (59) + 15 = 30 SPACES (TEMPORARY CARE FACILITY)

TOTAL: 30 SPACES
MAXIMUM PARKING LIMIT: 120% OF 30 = 36 SPACES

PARKING PROVIDED:
MAIN BUILDING: 59 SPACES
TOTAL: 59 SPACES
ADDITIONAL SPACES FOR FUTURE SECTIONS

RESIDENTIAL DENSITY: 3.96 UNITS PER ACRE

PARKLAND DEDICATION: PAYMENT IN-LIEU BASED ON 30 UNITS
AT 1,200 S.F./UNIT = 36,000 S.F.

TREE CANOPY: 34,570 S.F. TO REMAIN; 58% OF LOT 2

OPEN SPACE:
REQUIRED:
FORMAL: 5% = 14,880 S.F. (0.5) = 32,409 S.F.
INFORMAL: 10% = 14,880 S.F. (1.0) = 64,817 S.F.
PROVIDED:
FORMAL: 45,807 S.F. = 7.08%
INFORMAL: 173,508 S.F. = 26.77%

WATER SUPPLY:
THE WATER UTILITY DISTRICT THAT SERVES THIS DEVELOPMENT IS THE MIDCROFTON UTILITY DISTRICT, 6333 ARNO RD FRANKLIN, TN 37064. THE CONTACT PERSON AT MIDCROFTON IS CARL SCOTT AT 615-794-5947. THE RECORDED DATA FOR THIS HYDRANT IS 105 PSI STATIC PRESSURE AND 96 PSI RESIDUAL PRESSURE WITH A FLOW RATE OF 1,300+ GPM.

ALL VILLAS AND ASSISTED SUITES TO HAVE AUTOMATIC FIRE SPRINKLERS.

SANITARY SEWER SERVICE:
THE UTILITY DISTRICT THAT SERVES THIS DEVELOPMENT IS THE CITY OF FRANKLIN. THE SEWER INFRASTRUCTURE FOR THIS DEVELOPMENT WAS INSTALLED IN PHASE 1. CLEAN-OUTS FOR THE VILLAS HAVE BEEN STUBBED OUT FOR CONNECTION DURING THIS PHASE. THE MEMORY CARE ADDITION WILL BE SERVED INTERNALLY BY THE EXISTING FACILITY. ALL SEWER CONNECTIONS MUST BE APPROVED BY THE CITY OF FRANKLIN (COF) AND CONSTRUCTION WILL ADHERE TO THE SPECIFICATIONS OF THE COF.

STORMWATER CONTROL:
ALL STORMWATER TREATMENT FOR QUALITY AND QUANTITY WERE INSTALLED DURING PHASE 1 FOR THE COMPLETE BUILD-OUT OF THIS DEVELOPMENT. NO NEW TREATMENT IS REQUIRED FOR THIS PHASE. ON SITE DETENTION WAS DESIGNED TO TREAT A MAXIMUM IMPERVIOUS AREA OF 266,588 S.F.

ELECTRIC SERVICE:
THE UTILITY DISTRICT THAT SERVES THIS DEVELOPMENT IS MIDDLE TENNESSEE ELECTRIC MEMBERSHIP CORP. (MTEC). MTEC HAS PROVIDED THE LAYOUT. ALL ELECTRIC SERVICE LINES TO BE UNDERGROUND. ALL CONSTRUCTION TO ADHERE TO THE SPECIFICATIONS OF MTEC.

TREE PROTECTION NOTE:
ALL TREE PROTECTION FENCING SHALL BE INSTALLED PRIOR TO ISSUANCE OF A GRADING PERMIT AND SHALL BE MAINTAINED IN GOOD WORKING ORDER UNTIL ALL CONSTRUCTION ACTIVITY IS COMPLETE. ANY REQUIRED EROSION CONTROL MEASURES SHALL BE PLACED OUTSIDE OF ANY TREE PROTECTION FENCING.

UTILITY NOTE:
WITHIN NEW DEVELOPMENTS AND FOR OFFSITE LINES CONSTRUCTED AS A RESULT OF, OR TO PROVIDE SERVICE TO THE NEW DEVELOPMENT, ALL UTILITIES SUCH AS CABLE TELEVISION, ELECTRICAL (EXCLUDING TRANSFORMERS), GAS, SEWER, TELEPHONE, AND WATER LINES SHALL BE PLACED UNDERGROUND.

SOLID WASTE SERVICE:
THE SITE IS CURRENTLY SERVICED BY A DUMPSITE LOCATED AT THE REAR OF THE EXISTING FACILITY. THIS WILL CONTINUE TO BE USED FOR THE PRESENT FACILITY AS WELL AS THE PHASE 2 ADDITIONS, MEMORY CARE UNIT AND VILLAS.

APPROVAL NOTE:
THIS SITE PLAN HAS BEEN DESIGNED TO MEET THE CITY OF FRANKLIN STANDARDS AND THE APPROVAL OF THE PLANNING COMMISSION. CHANGES SHALL NOT BE MADE TO THE APPROVED SITE PLAN UNLESS APPROVED BY EITHER THE RELEVANT DEPARTMENT SUPERINTENDENT OR THE PLANNING COMMISSION.

RETAINING WALL NOTE:
ALL RETAINING WALLS ON SITE SHALL MEET THE STANDARDS OF SECTION 6.6 OF THE FRANKLIN ZONING ORDINANCE. DETAILS OF RETAINING WALLS SHALL BE SUBMITTED TO THE DEPT. OF BUILDING AND NEIGHBORHOOD SERVICES FOR REVIEW. REFER TO LANDSCAPE PLANS IN THIS SUBMITAL FOR PLANTINGS AROUND WALLS.

CIVIL CONTRACTOR NOTES:

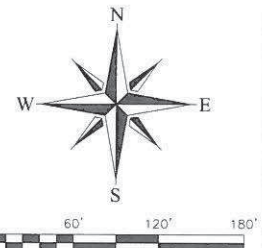
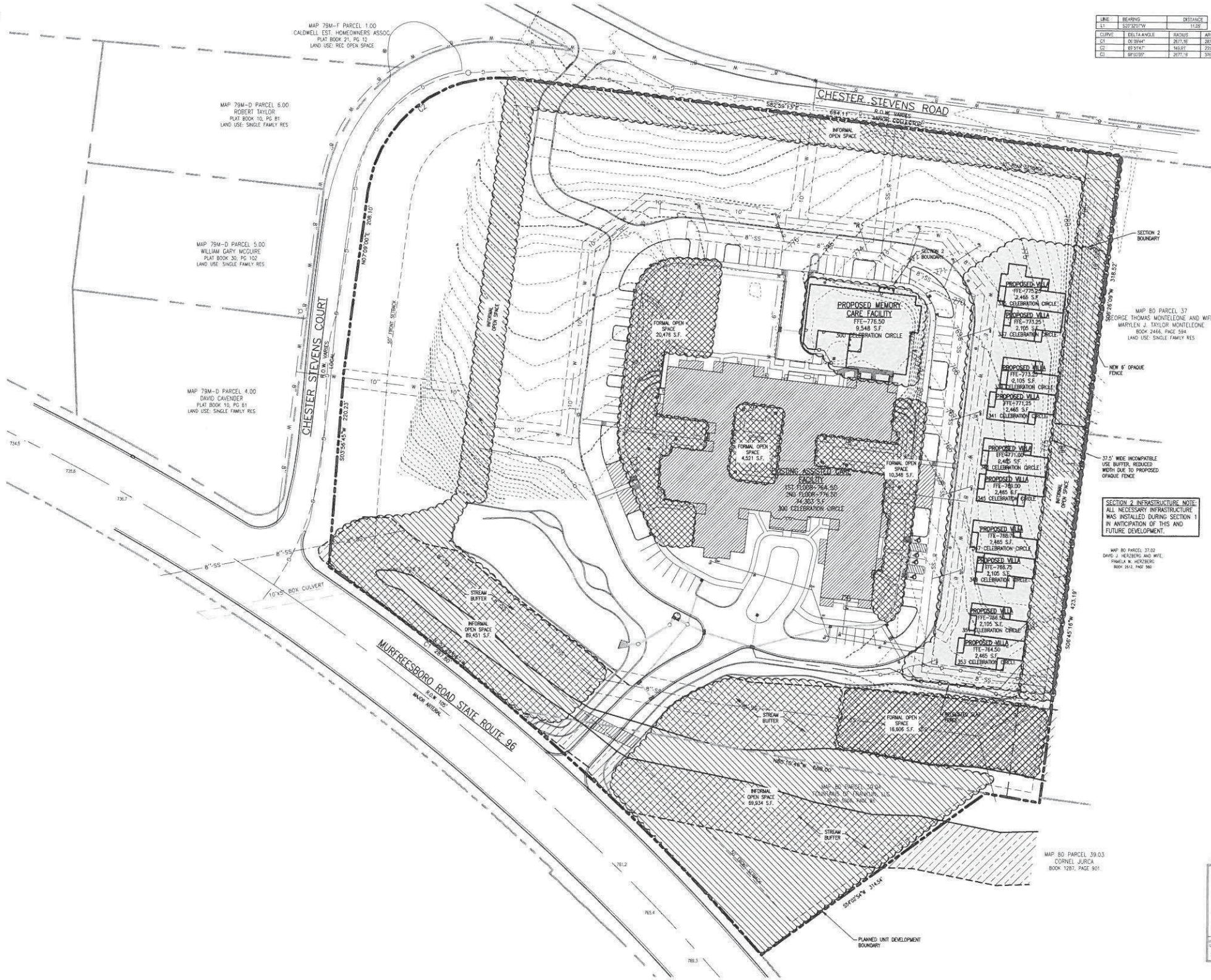
- THE SCOPE OF WORK IS THE TOTALITY OF THE CONTRACT DOCUMENTS INCLUDING PLANS, SPECIFICATIONS, FIELD ORDERS, SHOP DRAWING APPROVAL CONDITIONS AND PERFORMANCE REQUIREMENTS OF THE SCOPE OF WORK. THE SCOPE OF WORK IS IDENTIFIED WITH SPECIFICATION SECTIONS AND SHEET ALPHA NUMERIC CONVENTION, BUT SUCH IDENTIFICATION DOES NOT DEFINE, RESTRICT OR ASSIGN THE SCOPE OF WORK OR ORGANIZE THE CONTRACT.
- THE SCOPE OF WORK IS SUBJECT TO AND SHALL INCLUDE THE REQUIREMENTS OF THE APPLICABLE CODES, STANDARDS AND ORDINANCES FOR THE LOCATION OF THIS PROJECT AND THE INTERPRETATIONS OF THE CODES, STANDARDS AND ORDINANCES BY THE AUTHORITIES HAVING JURISDICTION OF THIS PROJECT. SUCH INTERPRETATION SHALL BE VERIFIED BY THE CONTRACTOR PRIOR TO BIDDING. ANY VARIANCE FROM THE CONTRACT DOCUMENTS SHALL BE INCLUDED IN THE BIDDING AS A QUALIFICATION OF ANY BID AND SHALL BE INCLUDED IN THE SCOPE OF WORK BY THE CONTRACTOR. FAILURE TO IDENTIFY ANY SUCH VARIANCE AS A QUALIFICATION IN A BID SHALL NOT BE A BASIS FOR A CHANGE ORDER. DO NOT SCALE DRAWINGS. IF DIMENSIONS OR ELEVATIONS ARE IN QUESTION, THE CONTRACTOR SHALL BE RESPONSIBLE FOR CLARIFICATION FROM THE ARCHITECT BEFORE IMPLEMENTATION OF CONSTRUCTION.
- CONTRACTOR SHALL VERIFY ALL CONDITIONS AND SHALL REPORT ANY CONDITION THAT VARIES FROM THE CONSTRUCTION AS SHOWN.
- CONTRACTOR SHALL VERIFY ALL EQUIPMENT REQUIREMENTS, FIXTURE REQUIREMENTS, SYSTEM REQUIREMENTS WHETHER OWNER FURNISHED OR CONTRACTOR FURNISHED, PRIOR TO IMPLEMENTATION OF ANY WORK ASSOCIATED WITH THE EQUIPMENT.
- CONTRACTOR SHALL PROVIDE WORK AS NEEDED FOR ALL SITE UTILITIES WHERE UTILITIES ARE INSTALLED BY OTHERS INCLUDING, BUT NOT LIMITED TO TRENCHING, CONDUIT, JUNCTION BOXES.
- CONTRACTOR SHALL PROVIDE FOR FIRE LINES AND DOMESTIC WATER LINES IN ACCORDANCE WITH THE REQUIREMENTS OF THE AUTHORITIES HAVING JURISDICTION INCLUDING BUT NOT LIMITED TO LICENSED INSTALLERS, TESTING, MATERIALS.
- NO IMPROVEMENT MAY BE ENCASED, CLOSED OR COVERED PRIOR TO INSPECTION AND ACCEPTANCE BY THE ARCHITECT. PROVIDE ARCHITECT WITH ADEQUATE NOTICE TO INSPECT ANY IMPROVEMENT READY FOR ENCLOSURE.
- CONTRACTOR SHALL LAYOUT BUILDING PAD, PARKING, SIDEWALKS AND ESTABLISH FINISH FLOOR ELEVATION FOR REVIEW AND APPROVAL OF ARCHITECT PRIOR TO IMPLEMENTATION.

GENERAL CONTRACTOR NOTES:

- THE SCOPE OF WORK IS THE TOTALITY OF THE CONTRACT DOCUMENTS INCLUDING PLANS, SPECIFICATIONS, FIELD ORDERS, SHOP DRAWING APPROVAL CONDITIONS AND PERFORMANCE REQUIREMENTS OF THE SCOPE OF WORK. THE SCOPE OF WORK IS IDENTIFIED WITH SPECIFICATION SECTIONS AND SHEET ALPHA NUMERIC CONVENTION, BUT SUCH IDENTIFICATION DOES NOT DEFINE, RESTRICT OR ASSIGN THE SCOPE OF WORK OR ORGANIZE THE CONTRACT.
- THE SCOPE OF WORK IS SUBJECT TO AND SHALL INCLUDE THE REQUIREMENTS OF THE APPLICABLE CODES, STANDARDS AND ORDINANCES FOR THE LOCATION OF THIS PROJECT AND THE INTERPRETATIONS OF THE CODES, STANDARDS AND ORDINANCES BY THE AUTHORITIES HAVING JURISDICTION OF THIS PROJECT. SUCH INTERPRETATION SHALL BE VERIFIED BY THE CONTRACTOR PRIOR TO BIDDING. ANY VARIANCE FROM THE CONTRACT DOCUMENTS SHALL BE INCLUDED IN THE BIDDING AS A QUALIFICATION OF ANY BID AND SHALL BE INCLUDED IN THE SCOPE OF WORK BY THE CONTRACTOR. FAILURE TO IDENTIFY ANY SUCH VARIANCE AS A QUALIFICATION IN A BID SHALL NOT BE A BASIS FOR A CHANGE ORDER.
- DO NOT SCALE DRAWINGS. IF DIMENSIONS ARE IN QUESTION, THE CONTRACTOR SHALL BE RESPONSIBLE FOR CLARIFICATION FROM THE ARCHITECT BEFORE IMPLEMENTATION OF CONSTRUCTION.
- CONTRACTOR SHALL VERIFY ALL CONDITIONS AND SHALL REPORT ANY CONDITION THAT VARIES FROM THE CONSTRUCTION AS SHOWN.
- CONTRACTOR SHALL VERIFY ALL EQUIPMENT REQUIREMENTS, FIXTURE REQUIREMENTS, SYSTEM REQUIREMENTS WHETHER OWNER FURNISHED OR CONTRACTOR FURNISHED, PRIOR TO IMPLEMENTATION OF ANY WORK ASSOCIATED WITH THE EQUIPMENT. PROVIDE PLUMBING SUPPLY AND DRAINS FOR ALL FIXTURES AND EQUIPMENT AS SHOWN ON ARCHITECTURAL, MECHANICAL, FIRE PROTECTION AND PLUMBING PLANS. LOCATE ALL ELECTRICAL SWITCHES AND PLUGS AS SHOWN ON ELECTRICAL OR ARCHITECTURAL PLANS AND INTERIOR ELEVATIONS.
- DIMENSIONS ARE NOMINAL TO THE FACE OF THE WALL OR CENTERLINE OF COLUMNS.
- ALL RATED WALLS EXTEND ONLY TO CEILING; RATED WALLS IN ATTICS ARE SHOWN ON ROOF PLAN.
- PROVIDED RATED WALLS AS NOTED BEHIND ALL FIRE EXTINGUISHER CABINETS AND OTHER PENETRATIONS.
- CONCEAL ALL PIPING IN WALLS OR FUR OUT WALL TO ENCASE PIPING. REVIEW ANY CONDITION REQUIRING FURRING WITH ARCHITECT PRIOR TO IMPLEMENTATION.
- PROVIDE APPROPRIATE STRUCTURAL SUPPORT FOR EQUIPMENT, LAVATORIES OR OTHER IMPROVEMENTS AS REQUIRED TO SUPPORT A MINIMUM LOAD OF 250 LBS.
- NO IMPROVEMENT MAY BE ENCASED, CLOSED OR COVERED PRIOR TO INSPECTION AND ACCEPTANCE BY THE ARCHITECT. PROVIDE ARCHITECT WITH ADEQUATE NOTICE TO INSPECT ANY IMPROVEMENT READY FOR ENCLOSURE.
- TO COORDINATE ALL WORK, MARK THE FLOORS AND WALLS FOR LOCATION OF WALLS, CABINETS, EQUIPMENT, TOILETS, SHOWERS, AIR HANDLING EQUIPMENT, DIFFUSERS, EXHAUSTS, SPRINKLER HEADS, DRAINS AND TEST VALVES, ELECTRICAL, SYSTEMS AND JUNCTION BOXES FOR REVIEW AND APPROVAL OF ARCHITECT PRIOR TO IMPLEMENTATION.

LINE	BEARING	DISTANCE
L1	S20°32'01"W	11.05'

CURVE	DELTA ANGLE	RADIUS	ARC LENGTH	CHORD BEARING	CHORD LENGTH
C1	00°59'44"	2677.16'	267.94'	N62°26'06"W	267.80'
C2	89°51'47"	149.51'	255.15'	N62°04'33"E	211.75'
C3	00°03'05"	2677.16'	376.20'	N45°22'41"W	375.80'



FRANKLIN PROJECT #:

- THE CITY OF FRANKLIN PROJECT NUMBER IS COF #4523

		RY ZONED ACRES	SINGLE FAMILY DWELLING UNITS	MAIN BUILDING VILLAS	TOTAL DWELLING UNITS	LOT NUMBERS OF BUILDABLE UNITS	LOT DENSITY (UNITS/AC)	REMAINING ACREAGE	REMAINING DWELLINGS
DEVELOPMENT	APPROVAL DATE	14.88	3	94	27	124	1	8.33	0
CONCEPT PLAN	9/8/09	14.88	3	94	27	124	1	8.33	0
REGULATING PLAN	3/25/10	14.88	3	94	27	124	1	8.33	0
SECTION 1	11/18/10	14.88	--	59	--	59	1	3.97	65
SECTION 2	TBD	14.88	--	18	10	87	1	5.84	37

DEVELOPMENT	APPROVAL DATE	RY ZONED ACRES	USE	PHASE TOTAL FLOOR AREA	ASSISTED LIVING FLOOR AREA	MEMORY CARE FLOOR AREA	VILLA FLOOR AREA	SINGLE FAMILY FLOOR AREA	PUD PROJECT TOTAL FLOOR AREA	PUD REMAINING FLOOR AREA	IMPERVIOUS SURFACE	TOTAL IMPERVIOUS SURFACE	TOTAL I.S.R.
CONCEPT PLAN	9/8/09	14.88	ASSISTED LIVING FACILITY, VILLAS, SINGLE FAMILY	153,658	--	--	--	--	153,658	--	238,806	238,806	0.37
REGULATING PLAN	3/25/10	14.88	ASSISTED LIVING FACILITY, VILLAS, SINGLE FAMILY	153,658	--	--	--	--	153,658	--	238,806	238,806	0.37
SECTION 1	11/18/10	14.88	ASSISTED LIVING FACILITY, VILLAS, MEMORY CARE	74,303	74,303	--	--	--	74,303	79,355	140,059	140,059	0.22
SECTION 2	TBD	14.88	VILLAS, MEMORY CARE	32,761	--	9,548	23,213	--	107,064	46,594	46,764	186,823	0.29
SECTION 3	TBD	14.88	ASSISTED LIVING FACILITY, VILLAS	30,942	5,157	--	24,785	--	138,006	15,652	0	--	--
SECTION 4	TBD	14.88	VILLAS, SINGLE FAMILY	15,652	--	--	11,660	3,992	153,658	0	0	--	--



DATE	DESCRIPTION
3/19/14	PRICING AND PERMITS

VILLA AND MEMORY CARE ADDITION FOR
Silver Grace
PUD SUBDIVISION, SITE PLAN, SECTION 2
300 CELEBRATION CIRCLE, FRANKLIN TN, 37067

DRAWING TITLE:
OVERALL PLAN

SCALE: 1"=60'

C1.2

**APPENDIX E
TRIP GENERATION**

TRIP GENERATION CALCULATIONS - Single-family Homes (NORTHERN PORTION)

The following calculations are based on the data compiled for ITE Land Use Code 210.

Average Daily Traffic

$$\ln(T) = 0.92 \ln(X) + 2.72$$

$$\ln(T) = 0.92 \ln(70) + 2.72$$

$$T = 756 \text{ vehicles}$$

$$\text{Enter} = 0.50 (756) = 378 \text{ vehicles}$$

$$\text{Exit} = 0.50 (756) = 378 \text{ vehicles}$$

AM traffic during peak hour of adjacent street

$$T = 0.70 (X) + 9.74$$

$$T = 0.70 (70) + 9.74$$

$$T = 59 \text{ vehicles}$$

$$\text{Enter} = 0.25 (59) = 15 \text{ vehicles}$$

$$\text{Exit} = 0.75 (59) = 44 \text{ vehicles}$$

PM traffic during peak hour of adjacent street

$$\ln(T) = 0.90 \ln(X) + 0.51$$

$$\ln(T) = 0.90 \ln(70) + 0.51$$

$$T = 76 \text{ vehicles}$$

$$\text{Enter} = 0.63 (76) = 48 \text{ vehicles}$$

$$\text{Exit} = 0.37 (76) = 28 \text{ vehicles}$$

TRIP GENERATION CALCULATIONS - Single-family Homes (NORTHERN PORTION)

The following calculations are based on the data compiled for ITE Land Use Code 210.

Average Daily Traffic

$$\ln(T) = 0.92 \ln(X) + 2.72$$

$$\ln(T) = 0.92 \ln(306) + 2.72$$

$$T = 2,938 \text{ vehicles}$$

$$\text{Enter} = 0.50 (2,938) = 1,469 \text{ vehicles}$$

$$\text{Exit} = 0.50 (2,938) = 1,469 \text{ vehicles}$$

AM traffic during peak hour of adjacent street

$$T = 0.70 (X) + 9.74$$

$$T = 0.70 (306) + 9.74$$

$$T = 224 \text{ vehicles}$$

$$\text{Enter} = 0.25 (224) = 56 \text{ vehicles}$$

$$\text{Exit} = 0.75 (224) = 168 \text{ vehicles}$$

PM traffic during peak hour of adjacent street

$$\ln(T) = 0.90 \ln(X) + 0.51$$

$$\ln(T) = 0.90 \ln(306) + 0.51$$

$$T = 287 \text{ vehicles}$$

$$\text{Enter} = 0.63 (287) = 181 \text{ vehicles}$$

$$\text{Exit} = 0.37 (287) = 106 \text{ vehicles}$$

APPENDIX F

RELEVANT PAGES FROM NCHRP REPORT 457:
ENGINEERING STUDY GUIDE FOR EVALUATING INTERSECTION IMPROVEMENTS

NCHRP

REPORT 457

**NATIONAL
COOPERATIVE
HIGHWAY
RESEARCH
PROGRAM**

Evaluating Intersection Improvements: An Engineering Study Guide

TRANSPORTATION RESEARCH BOARD

NATIONAL RESEARCH COUNCIL

can also indirectly reduce the delay to the left-turn or through movements by lessening their need to compete for service with the right-turn movement.

One disadvantage of adding a lane to the minor-road approach is that it may require reallocating the existing pavement or widening of the approach cross section. Sometimes the pavement width needed for the additional lane is available within the existing roadway cross section. In this instance, the only impact is a reallocation of the paved surface through modification of the pavement markings. However, in downtown settings this reallocation may require the removal of some curb parking stalls and can affect adjacent business significantly. Occasionally, the cross section must be widened to provide for the additional lane. If the needed lane width can be provided within the available right-of-way, the cost may be limited to that of construction. However, if additional right-of-way is needed, the costs of acquiring this property in urban settings can be high.

Guidance. The literature does not offer guidance regarding conditions where a second approach lane would benefit from the operation of a minor-road approach. However, the procedures in Chapter 17 of the *Highway Capacity Manual 2000* (15) can be used to identify major- and minor- road volume combinations that would benefit operationally from the provision of a second approach lane or bay. Bonneson and Fontaine (20) developed Figure 2-4 using these procedures and an assumed upper limit of 0.7 for the shared-lane, minor-road volume-to-capacity ratio.

Application. Figure 2-4 indicates the conditions that may justify the use of two approach lanes. Use of the information in this figure requires two types of data:

1. Major-road approach volume for the peak hour of the average day and
2. Minor-road turn movement volume for the peak hour of the average day (used to compute right-turn percentage).

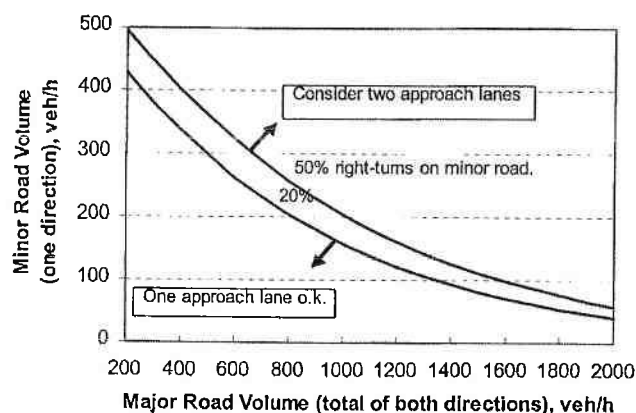


Figure 2-4. Guideline for determining minor-road approach geometry at two-way stop-controlled intersections.

Figure 2-4 would be used once for each minor-road approach to the intersection. The appropriate trend line would be identified on the basis of the percentage of right-turns on the subject minor-road approach. If the volume combination for the major and minor roads intersects above or to the right of this trend line, a second traffic lane should be considered for the subject minor-road approach. If a bay is selected for addition to the intersection, it should be long enough to store vehicles 95 percent of the time (i.e., the bay should not overflow more than 5 percent of the time). Techniques for estimating the 95th percentile storage length are provided in the section, [Increase the Length of the Turn Bay](#).

Add a Left-Turn Bay on the Major Road

Introduction. Provision of a left-turn bay on the major road to a two-way stop-controlled intersection can significantly improve operations and safety at the intersection. A left-turn bay effectively separates those vehicles that are slowing or stopped to turn from those vehicles in through traffic lanes. This separation minimizes turn-related crashes and eliminates unnecessary delay to through vehicles. Data reported by Neuman (21) indicate that the crash rate for unsignalized intersections can be reduced by 35 to 75 percent through the provision of a left-turn bay.

One disadvantage of adding a bay to the major-road approach is that it may require reallocating the existing pavement or widening of the approach cross section. Sometimes the pavement width needed for the additional lane is available within the existing roadway cross section. However, in downtown settings this reallocation may require the removal of some curb parking stalls and can affect adjacent business significantly. Occasionally, the cross section must be widened to provide for the turn bay. If the needed width can be provided within the available right-of-way, the cost may be limited to that of construction. However, if additional right-of-way is needed, the costs of acquiring this property in urban settings can be high.

Guidance. Neuman (21) suggests that the following guidelines should be used to determine when to provide a left-turn bay on the major road of a two-way stop-controlled intersection:

1. A left-turn lane should be considered at any median crossover on a divided, high-speed road.
2. A left-turn lane should be provided on the unstopped approach of a high-speed rural highway when it intersects with other arterials or collectors.
3. A left-turn lane is recommended on the unstopped approach of any intersection when the combination of intersection volumes intersect above or to the right of the appropriate trend line shown in Figure 2-5.

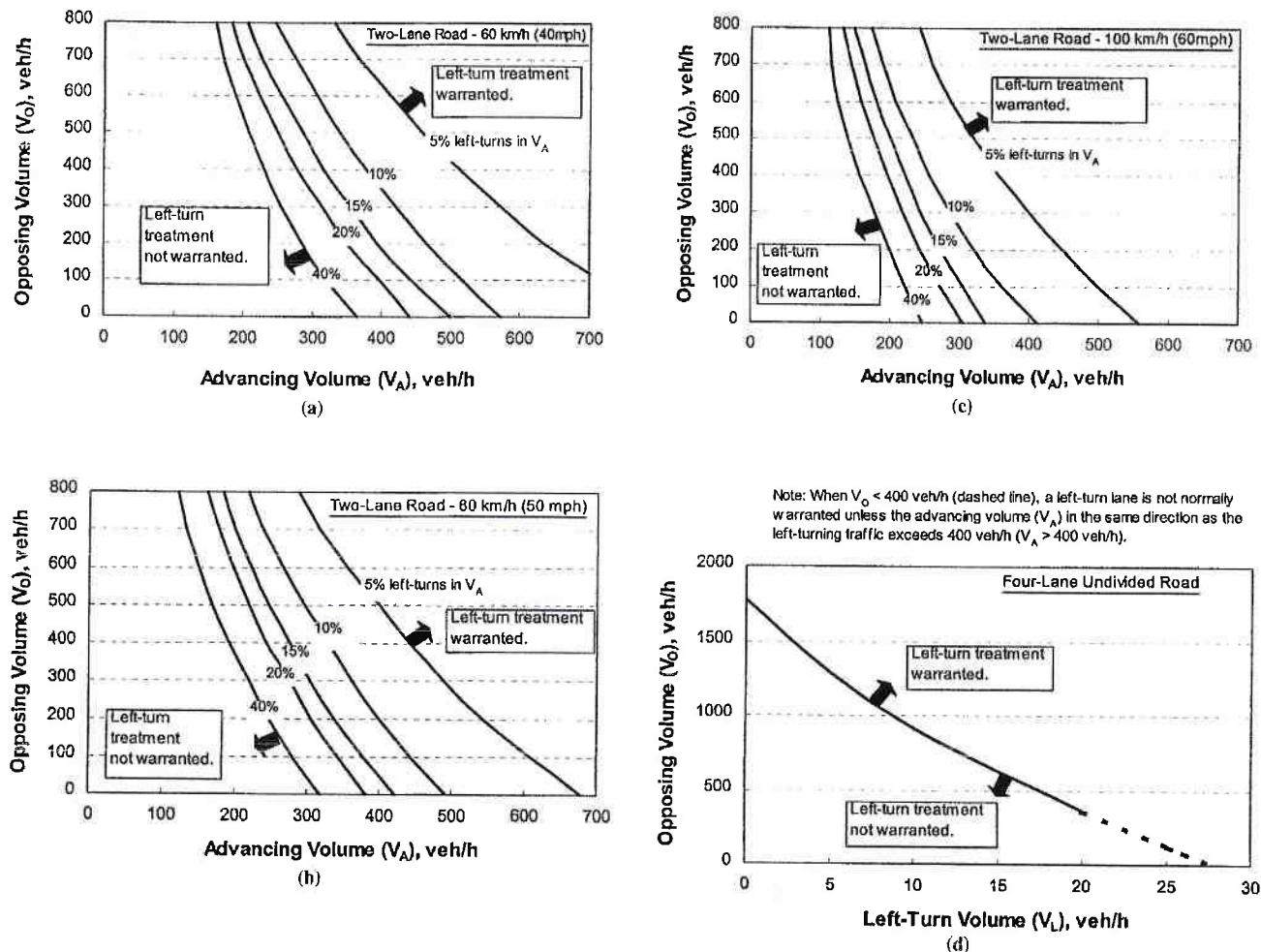


Figure 2-5. Guideline for determining the need for a major-road left-turn bay at a two-way stop-controlled intersection.

Application. The guidance stated in the preceding section defines the conditions that may justify the provision of a left-turn bay. Application of this guidance requires two types of data:

1. Major-road turn movement volume for the peak hour of the average day and
2. Major-road 85th percentile speed (posted speed can be substituted if data are unavailable).

Use of Figure 2-5 requires determination of the opposing volume, the advancing volume, and the operating speed. The opposing volume should include only the right-turn and through movements on the approach across from (and heading in the opposite direction of) the subject major-road approach. The advancing volume should include the left-turn, right-turn, and through movements on the subject approach. The operating speed can be estimated as the 85th percentile speed. If the operating speed does not coincide with 60, 80, or 100 km/h (i.e., 40, 50, or 60 mph), then interpolation can

be used or, as a more conservative approach, the operating speed can be rounded up to the nearest speed for which a figure is provided.

In application, Figure 2-5 is used once for each major-road approach to the intersection. The appropriate trend line is identified on the basis of the percentage of left-turns on the subject major-road approach. If the advancing and opposing volume combination intersects above or to the right of this trend line, a left-turn bay should be considered for the subject approach. If a bay is included at the intersection, it should be long enough to store left-turn vehicles 99.5 percent of the time (i.e., the bay should not overflow more than 0.5 percent of the time). Techniques for estimating this storage length are provided in the section, [Increase the Length of the Turn Bay](#).

Add a Right-Turn Bay on the Major Road

Introduction. Provision of a right-turn bay on the major road to a two-way stop-controlled intersection can signifi-

cantly improve operations and safety at the intersection. A right-turn bay effectively separates those vehicles that are slowing or stopped to turn from those vehicles in the through traffic lanes. This separation minimizes turn-related collisions (e.g., angle, rear-end, and same-direction-sideswipe) and eliminates unnecessary delay to through vehicles.

One disadvantage of adding a bay to the major-road approach is that it may require reallocating the existing pavement or widening of the approach cross section. Sometimes the pavement width needed for the additional lane is available within the existing roadway cross section. However, in downtown settings this reallocation may require the removal of some curb parking stalls and can affect adjacent business significantly. Occasionally, the cross section must be widened to provide for the turn bay. If the needed width can be provided within the available right-of-way, the cost may be limited to that of construction. However, if additional right-of-way is needed, the costs of acquiring this property in urban settings can be high.

Guidance. Hasan and Stokes (22) developed guidelines for determining when to provide a right-turn bay on the major road of a two-way stop-controlled intersection. These guidelines were based on an evaluation of the operating and collision costs associated with the right-turn maneuver relative to the cost of constructing a right-turn bay. The operating costs included those of road-user fuel and delay. Separate guidelines were developed for two-lane and four-lane roadways. These guidelines are shown in Figure 2-6.

Application. The guidance described in the preceding section defines conditions that may justify the provision of a right-turn bay. Application of this guidance requires two types of data:

1. Major-road turn movement volume for the peak hour of the average day and
2. Major-road 85th percentile speed (posted speed can be substituted if data are unavailable).

Figure 2-6 should be consulted once for each major-road approach. If the combination of major-road approach volume and right-turn volume intersects above or to the right of the trend line corresponding to the major-road operating speed, then a right-turn bay is a viable alternative.

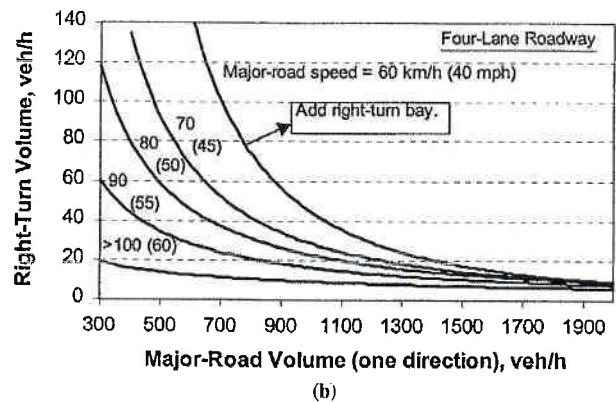
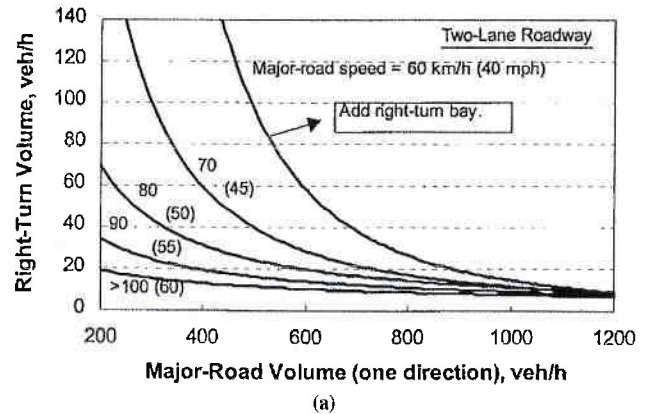


Figure 2-6. Guideline for determining the need for a major-road right-turn bay at a two-way stop-controlled intersection.

Increase Length of Turn Bay

Introduction. Turn bay length can affect the safety and operation of the intersection approach significantly. This effect becomes more negative as the frequency with which vehicles exceed the available storage increases. Also, for unstopped approaches, this effect becomes more negative as more of the turning vehicle's deceleration occurs in the through lane, prior to the bay. The need to provide adequate storage length, deceleration length, or both is dependent on the type of approach control used and whether the vehicle is turning left or right. Table 2-13 identifies the appropriate bay

TABLE 2-13 Turn-bay length components at unsignalized intersections

Approach Control	Length Components	
	Left-Turn Bay	Right-Turn Bay
Unstopped	Storage Length + Deceleration Length	Deceleration Length
Stopped	Storage Length	Storage Length