



8-SA-21-C
8-C-21-UR
Revised: 7/26/2021

July 26, 2021

Mr. Mike Conger
Knoxville-Knox County Planning
400 Main Street, Suite 403
Knoxville, TN 37902

Re: Traffic Letter for Dorchester Subdivision

Dear Mr. Conger:

Dorchester Subdivision is located north of the intersection of W Emory Road at Carpenter Road in Knox County, Tennessee. The development will include approximately 79 single family lots and a single driveway connection to Carpenter Road. Construction is proposed to take place this year and this analysis assumes full build out for the development will occur in 2024.

As a part of the construction of the Dorchester Subdivision Carpenter Road will be widened to 18 feet between the intersection of Carpenter Road at Ridgewalk Lane and Carpenter Road the proposed driveway connection (Road "A").

The purpose of this traffic analysis is to evaluate the driveway access to Carpenter Road focusing on operations and safety at the main subdivision access.

Existing Site Conditions

Carpenter Road along the property line is a two-lane Road. The Knoxville-Knox County Planning Commission classifies Carpenter Road as a Minor Collector with a 60 feet right-of-way per the Major Road Plan. Carpenter Road has no existing sidewalks or designated bike lanes in the vicinity of the proposed development. An aerial photo of the proposed driveway location is included in the attachments.

Carpenter Road between W Emory Road and Yount Road has an approximate length of 6,300 LF. Carpenter Road has a posted speed limit of 30 mph and an existing roadway width that varies between 15.5 and 18 feet. Per AASHTO "Guidelines for Geometric Design of Low-Volume Roads" Carpenter Road is classified as a Rural Major Access Road with a dual function of providing access to abutting properties as well as providing through or connecting service between other local roads or higher type facilities. All low-volume roads have a maximum average daily traffic volume of 2,000 vehicles per day or less.

Traffic Volumes

The Knoxville Regional TPO maintains a 24-hour count station in the vicinity of the proposed development. TPO count station ID: 093M287 is located on Carpenter Road north of W Emory Road and north of Carpenter Ridge Subdivision and Ridgewalk Lane. The Knoxville Regional TPO conducted a 24-hour count on Tuesday April 11, 2017 from

12:00 a.m. to 12:00 p.m. The AM peak hour at this count station occurred between 7:00 a.m. and 8:00 a.m. and the PM peak hour occurred between 5:15 p.m. and 6:15 p.m. The 2017 ADT was 834 vehicles per day, 432 vehicles per day northbound and 402 vehicles per day southbound. The count data collected is included in the attachments.

The annual growth rate for TPO station ID: 093M287 between 2007 and 2017 is approximately 1.20%. In order to calculate thru traffic at the proposed intersection of Carpenter Road at the driveway connection (Road "A") for the existing year 2021 and background year 2024 FMA assumed an annual growth rate of 1.5%. The existing 2021 ADT for Carpenter Road was projected at 885 vehicles per day and the projected 2024 ADT for Carpenter Road was 926 vehicles per day. Figure 1: 2021 Existing Peak Hour Traffic, Figure 2: 2024 Background Peak Hour Traffic and the ADT trend line growth charts are included in the attachments.

Trip Generation

The trip generation was calculated using the fitted curve equations where provided from *Trip Generation, 10th Edition*, published by the Institute of Transportation Engineers. Single-Family Detached Housing or Land Use 210 was used to calculate the daily trips, AM and PM peak hour trips. The land use worksheets are included in the attachments. A trip generation summary is shown in Table 1 – Trip Generation Summary.

**Table 1 - Trip Generation Summary
Dorchester Subdivision**

Land Use	Density	Daily Trips	AM Peak Hour		PM Peak Hour	
			Enter	Exit	Enter	Exit
Single-Family Detached Housing (LUC 210)	79 Lots	837	15	46	51	30

The total number of new trips generated by the Dorchester Subdivision will be 837 new daily trips, 61 trips during the AM peak hour and 81 trips during the PM peak hour.

Trip Distribution

Carpenter Road has an existing trip distribution of 20% northbound and 80% southbound during the AM peak hour and 65% northbound and 35% southbound during the PM peak hour. FMA assumed that 90% of the subdivision traffic would enter/exit from W Emory Road during both the AM and PM peak hours. Figure 3: Peak Hour Site Traffic is included in the attachments.

For the purpose of this study the thru traffic at the TPO count station ID: 093M287 was also used at the thru traffic at the proposed intersection of Carpenter Road at the driveway connection (Road "A"). Patriot Way at Carpenter Road is between the count station and the proposed driveway connection (Road "A") but the addition or subtraction of residential trips

between the two points was considered negligible for the purpose of this traffic study. Figure 4: Full Buildout Peak Hour Traffic is included in the attachments.

Turn Lane Warrants

The Knox County Department of Engineering and Public Works handbook, "Access Control and Driveway Design Policy," was used to determine if a northbound left turn lane or a southbound right turn is warranted at the intersection of Carpenter Road at the proposed driveway connection (Road "A"). After review there are no warranted turn lanes at the proposed intersection of Carpenter Road at the driveway connection (Road "A") during either the AM or PM peak hour conditions due to the existing low volume of traffic on Carpenter Road. The turn lane worksheets and analysis are included in the attachments.

Carpenter Road

Carpenter Road is classified as a Minor Collector per the Major Road Plan. The minimum intersection spacing required on a collector is 300 feet per the "Knoxville-Knox County Subdivision Regulations" as amended through February 13, 2020. The proposed driveway connection (Road "A") is located approximately 765 feet north of the intersection of Carpenter Road at Patriot Way. This driveway connection exceeds the typical minimum separation on a Minor Collector; therefore, no change is necessary.

The minimum required horizontal curve radius for a road with a 30 mph design speed is 250 feet. Per AASHTO "the existing horizontal curve geometry should generally be considered acceptable unless there is evidence of a site-specific crash pattern related to horizontal curvature."

Emory Road (SR 131) at Carpenter Road/Harrell Road

TDOT has prepared plans to improve and signalize the intersection of Emory Road (SR 131) at Carpenter Road/Harrell Road. The intersection improvements include signalization, realigning Carpenter Road to Harrell Road and widening all four directions to allow for separate left turn lanes and right/thru lanes at each approach. The TDOT "Road Safety Audit Report - SR 131 and Harrell Road/Carpenter Road" is included in the attachments.

Sight Distance

The minimum required intersection sight distance for a road with a posted speed limit of 30 mph is 300 feet in each direction in accordance with the "Knoxville-Knox County Subdivision Regulations" amended through February 13, 2020. The minimum required stopping sight distance per AASHTO "Geometric Design of Highways and Streets" is 200 feet for a road with a 30 mph design speed. Sight triangles and a sight distance profile were evaluated at the proposed intersection of Carpenter Road at the driveway connection (Road "A") and are included in the attachments. According to the sight distance profile the sight distance looking south is greater than 300 feet and the sight distance looking north is approximately 54 feet. The inadequate sight distance and stopping sight distance looking north is caused by a combination of trees and vegetation in the right-of-way and the slope of the ditch along Carpenter Road. FMA recommends that the contractor remove any necessary vegetation and grade cut slopes to achieve the minimum required stopping and intersection sight distance. The sight distance should be certified by a surveyor prior to the

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completion of construction activities.

I hope that this is helpful. Please contact me if you have any questions.

Thank you,



Addie Kirkham, P.E.

Enclosure: Attachments

Attachments



Subdivision Main Access

Knoxville - Knox County - KUB Geographic Information System



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Greater Traffic Company

	11-Apr-17	NB	Hour Totals		SB		Hour Totals			
	Tue	AM	PM	AM	PM	AM	PM	AM	PM	
12:00			1	3			0	4		
12:15			0	5			0	5		
12:30			1	3			0	5		
12:45			0	6	2	17	0	4	0	18
01:00			1	8			0	1		
01:15			0	1			0	6		
01:30			0	3			0	1		
01:45			0	7	1	19	0	7	0	15
02:00			0	9			0	11		
02:15			0	2			1	3		
02:30			0	13			0	5		
02:45			0	9	0	33	0	9	1	28
03:00			0	6			0	6		
03:15			0	14			0	6		
03:30			0	11			0	7		
03:45			0	13	0	44	0	7	0	26
04:00			0	12			0	6		
04:15			1	10			0	4		
04:30			0	12			2	7		
04:45			1	13	2	47	5	6	7	23
05:00			0	10			2	8		
05:15			0	9			0	7		
05:30			1	15			2	4		
05:45			0	17	1	51	6	7	10	26
06:00			0	12			2	12		
06:15			2	7			7	7		
06:30			5	13			12	5		
06:45			3	9	10	41	7	7	28	31
07:00			2	7			20	6		
07:15			4	9			13	6		
07:30			3	11			15	4		
07:45			8	11	17	38	14	8	62	24
08:00			2	6			5	3		
08:15			7	5			8	3		
08:30			3	9			7	5		
08:45			2	5	14	25	7	1	27	12
09:00			5	3			7	2		
09:15			3	2			7	1		
09:30			0	3			4	1		
09:45			6	2	14	10	4	1	22	5
10:00			4	2			6	0		
10:15			2	2			3	0		
10:30			4	2			4	1		
10:45			5	4	15	10	5	1	18	2
11:00			6	0			3	1		
11:15			4	1			4	0		
11:30			5	0			6	1		
11:45			4	1	19	2	2	0	15	2
		95	337	95	337	190	212	190	212	
Lane Total			432			402				

Project: Dorchester Subdivision

Intersection: Carpenter Road N of W Emory Road

Date Conducted: 4/11/2017

AM Peak Hour	7:00 AM - 8:00 AM	79
PM Peak Hour	5:15 PM - 6:15 PM	83

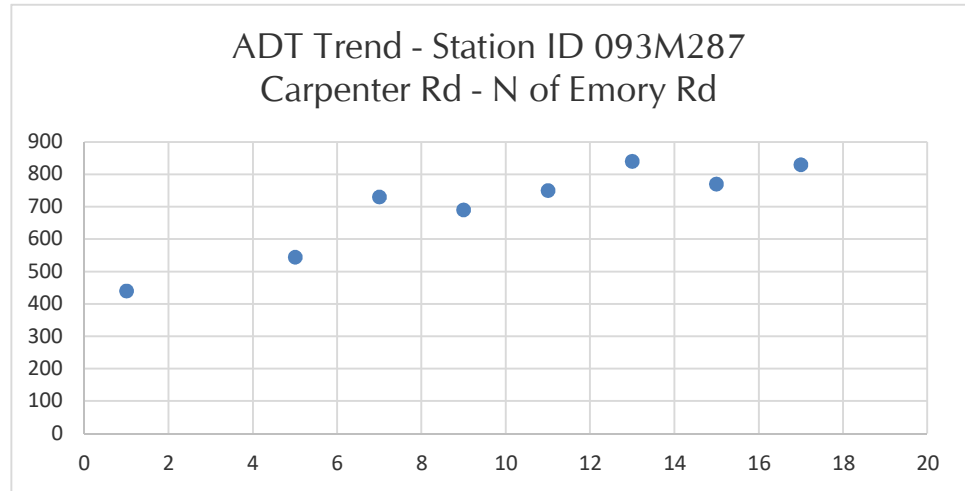
	Carpenter Road Northbound			Carpenter Road Southbound			
Start	-	Thru	Total	-	Thru	Total	Int. Total
Peak Hour Analysis from 7:00 AM to 9:00 AM							
AM Peak Hour begins at 7:00 AM							
7:00 AM	-	2	2	-	20	20	22
7:15 AM	-	4	4	-	13	13	17
7:30 AM	-	3	3	-	15	15	18
7:45 AM	-	8	8	-	14	14	22
Total Volume	-	17	17	-	62	62	79
Existing (1.5% over 4 yrs)		18			66		84
Future (1.5% over 7 yrs)		19			69		88
PHF	-	0.53		-	0.78		0.90

Peak Hour Analysis from 4:00 PM to 6:00 PM

PM Peak Hour begins at 5:15 PM

5:15 PM	-	9	9	-	7	7	16
5:30 PM	-	15	15	-	4	4	19
5:45 PM	-	17	17	-	7	7	24
6:00 PM	-	12	12	-	12	12	24
Total Volume	-	53	53	-	30	30	83
Existing (1.5% over 4 yrs)		56			32		88
Future (1.5% over 7 yrs)		59			33		92
PHF	-	0.78		-	0.63		0.86

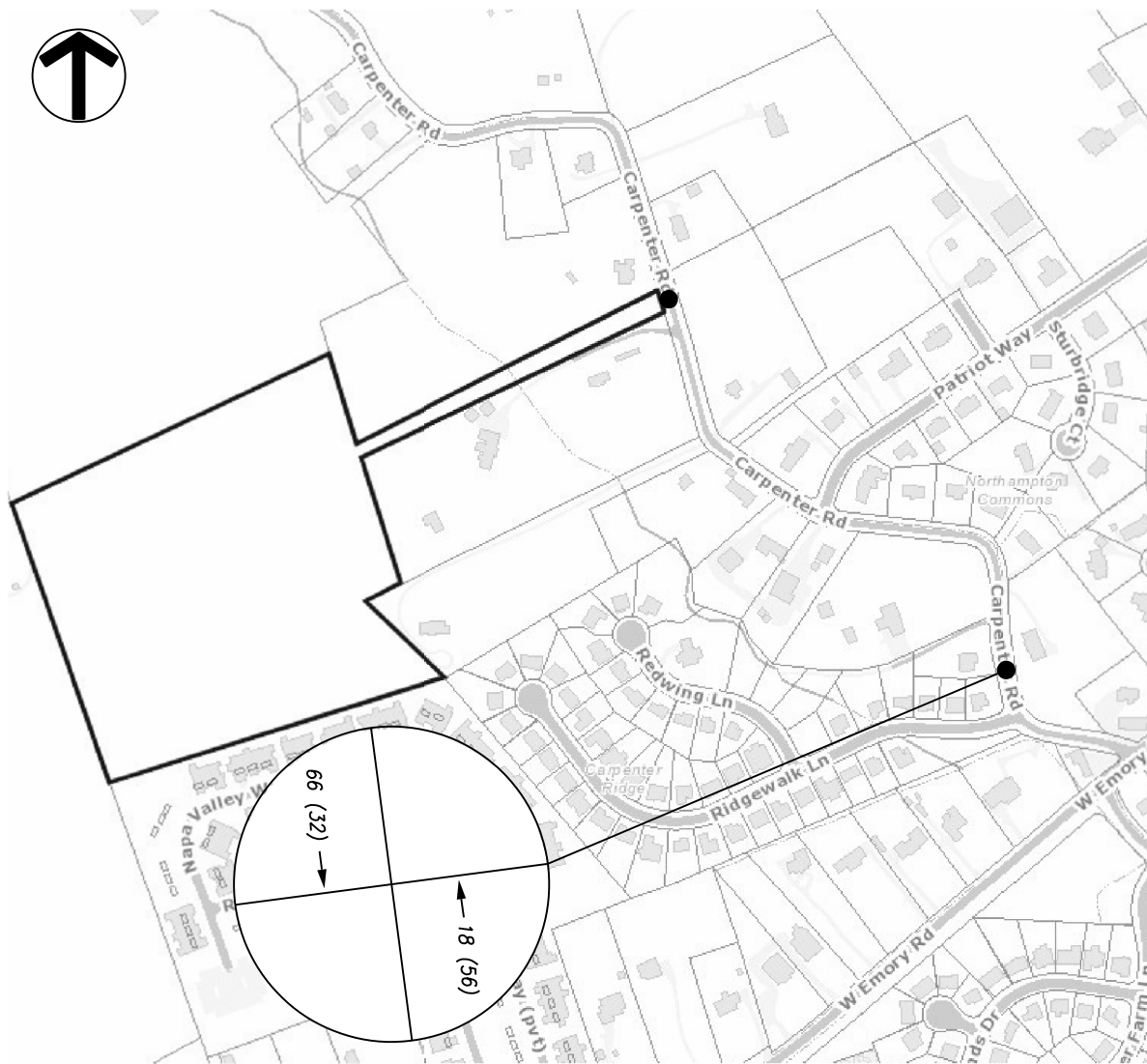
Year	Adjusted Average Daily Traffic
2001	440
2002	
2003	
2004	
2005	544
2006	
2007	730
2008	
2009	690
2010	
2011	750
2012	
2013	840
2014	
2015	770
2016	
2017	830



Most Recent Trend Line Growth

Year	ADT
2007	730
2017	830

Annual Percent Growth	1.20%
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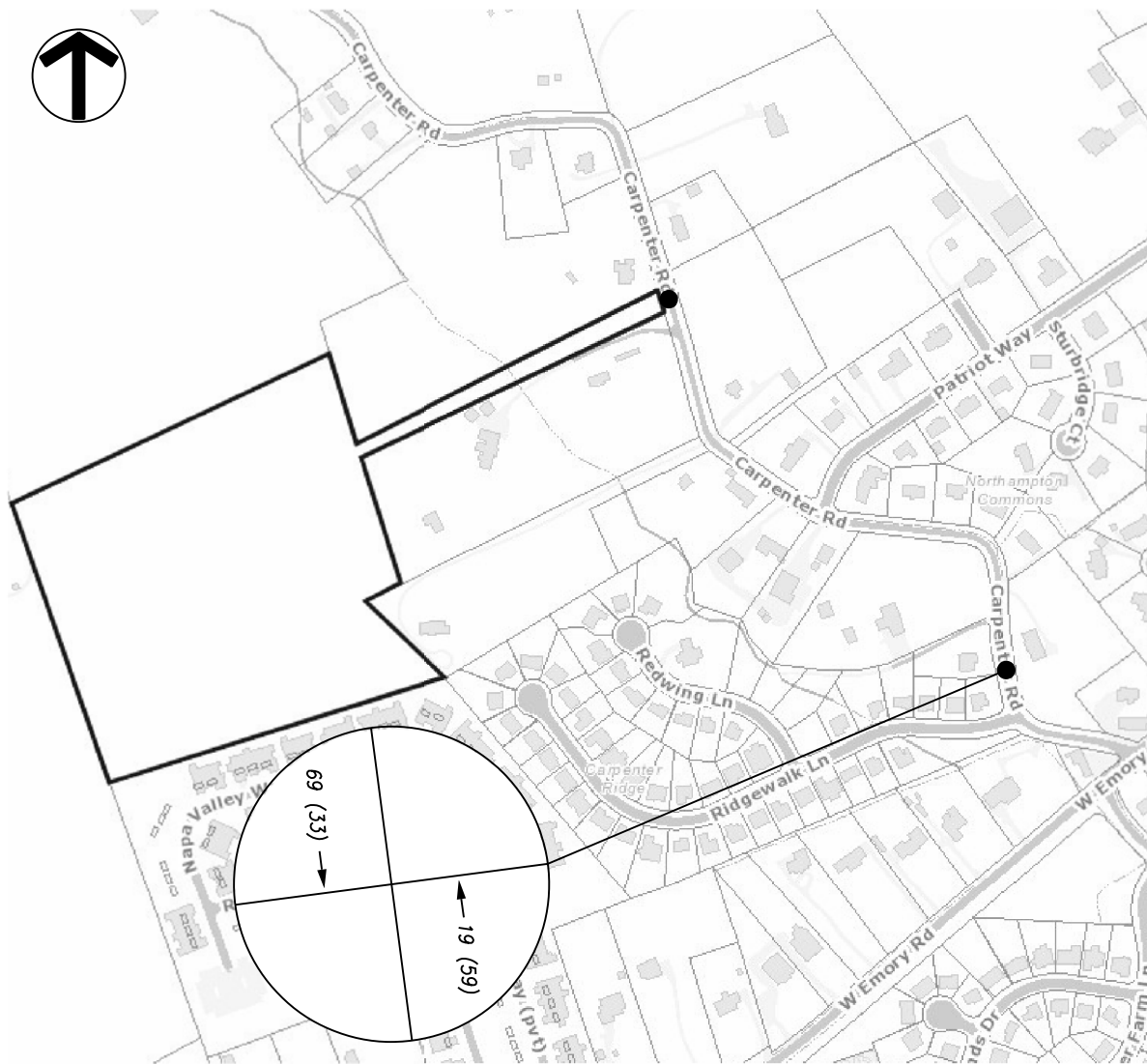


LEGEND:

← X (23)

TURNING MOVEMENT VOLUME AM (PM)

Figure 1: 2021 Existing Peak Hour Traffic



LEGEND:

← X (23)

TURNING MOVEMENT VOLUME AM (PM)

Figure 2: 2024 Background Peak Hour Traffic

Trip Generation

Project: Dorchester Subdivision

Date Conducted: 6/28/2021

Single-Family Detached Housing (LUC 210)

79 Single Family Lots

Average Daily Traffic

$$\ln(T) = 0.92\ln(X) + 2.71$$

$$\ln(T) = 0.92\ln(79) + 2.71$$

$$T = 837$$

Peak Hour of Adjacent Street Traffic

One Hour Between 7 and 9 a.m.

$$T = 0.71(X) + 4.80$$

$$T = 0.71(79) + 4.80$$

$$T = 61$$

Peak Hour of Adjacent Street Traffic

One Hour Between 4 and 6 p.m.

$$\ln(T) = 0.96\ln(X) + 0.20$$

$$\ln(T) = 0.96\ln(79) + 0.20$$

$$T = 81$$

Time Period	Total Trips	Percent		Number	
		Enter	Exit	Enter	Exit
Weekday (24 hours)	837	50%	50%	419	419
AM Peak Hour	61	25%	75%	15	46
PM Peak Hour	81	63%	37%	51	30

Single-Family Detached Housing (210)

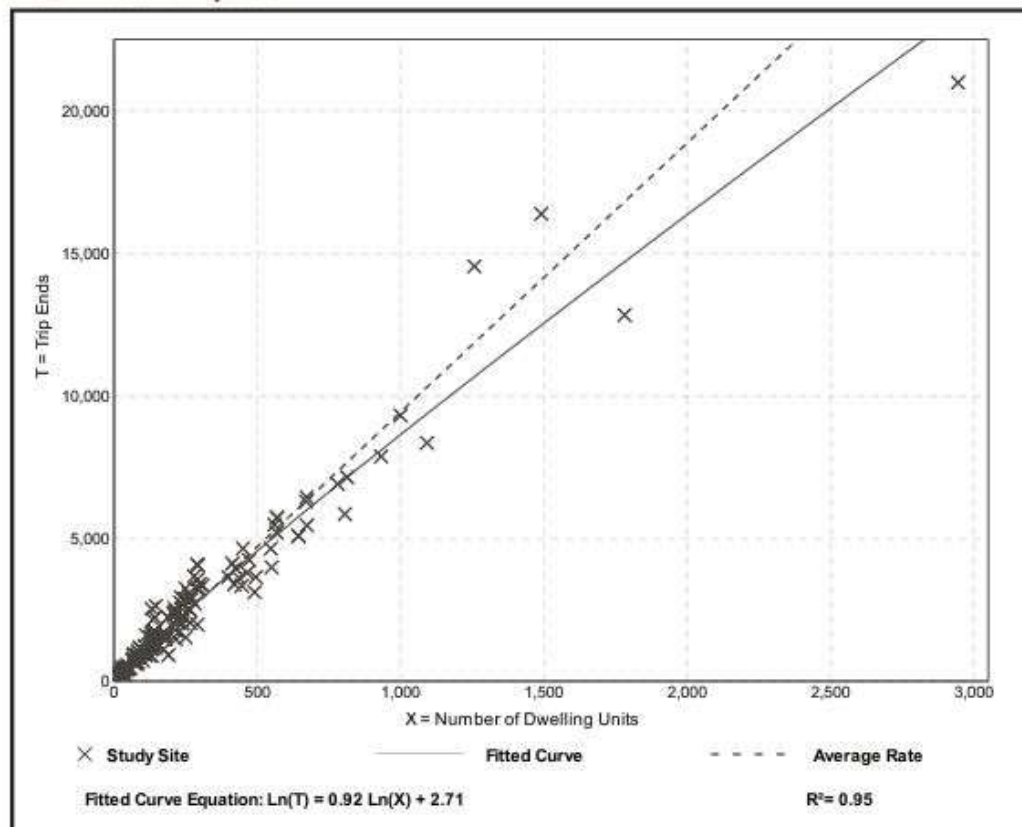
Vehicle Trip Ends vs: Dwelling Units
On a: Weekday

Setting/Location: General Urban/Suburban
Number of Studies: 159
Avg. Num. of Dwelling Units: 264
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per Dwelling Unit

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

Data Plot and Equation



Single-Family Detached Housing (210)

Vehicle Trip Ends vs: Dwelling Units

On a: Weekday,

Peak Hour of Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.

Setting/Location: General Urban/Suburban

Number of Studies: 173

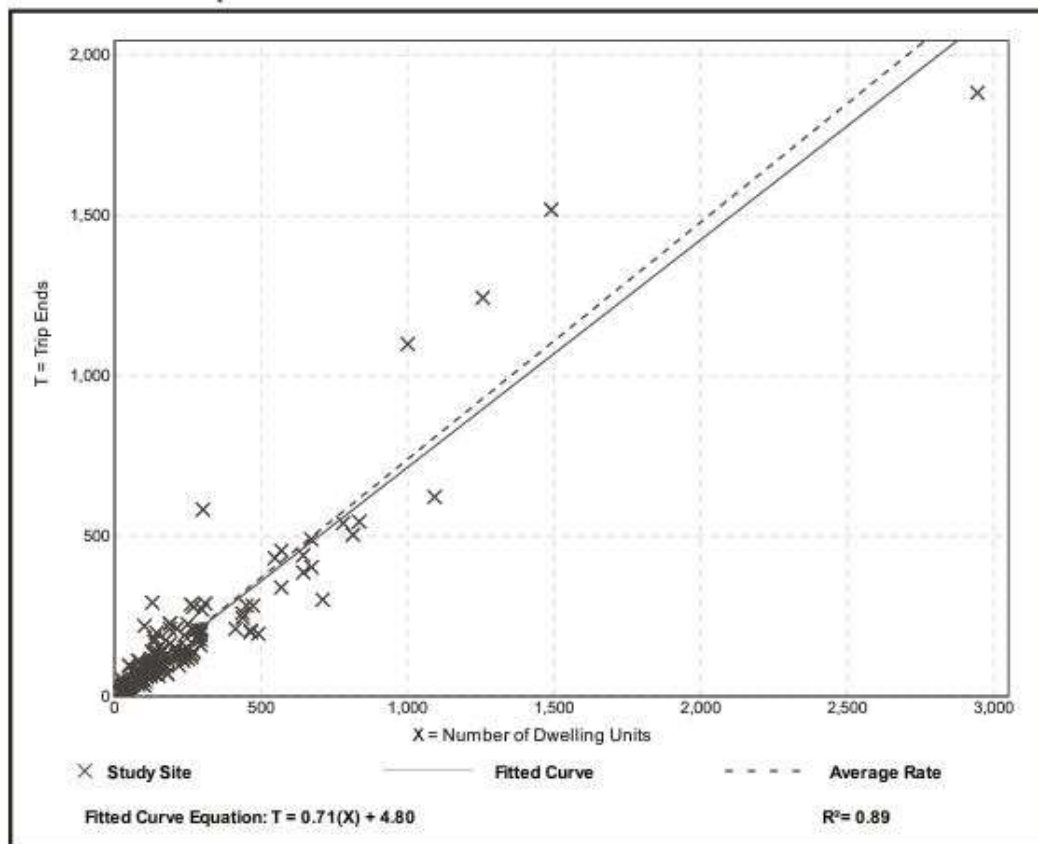
Avg. Num. of Dwelling Units: 219

Directional Distribution: 25% entering, 75% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.74	0.33 - 2.27	0.27

Data Plot and Equation



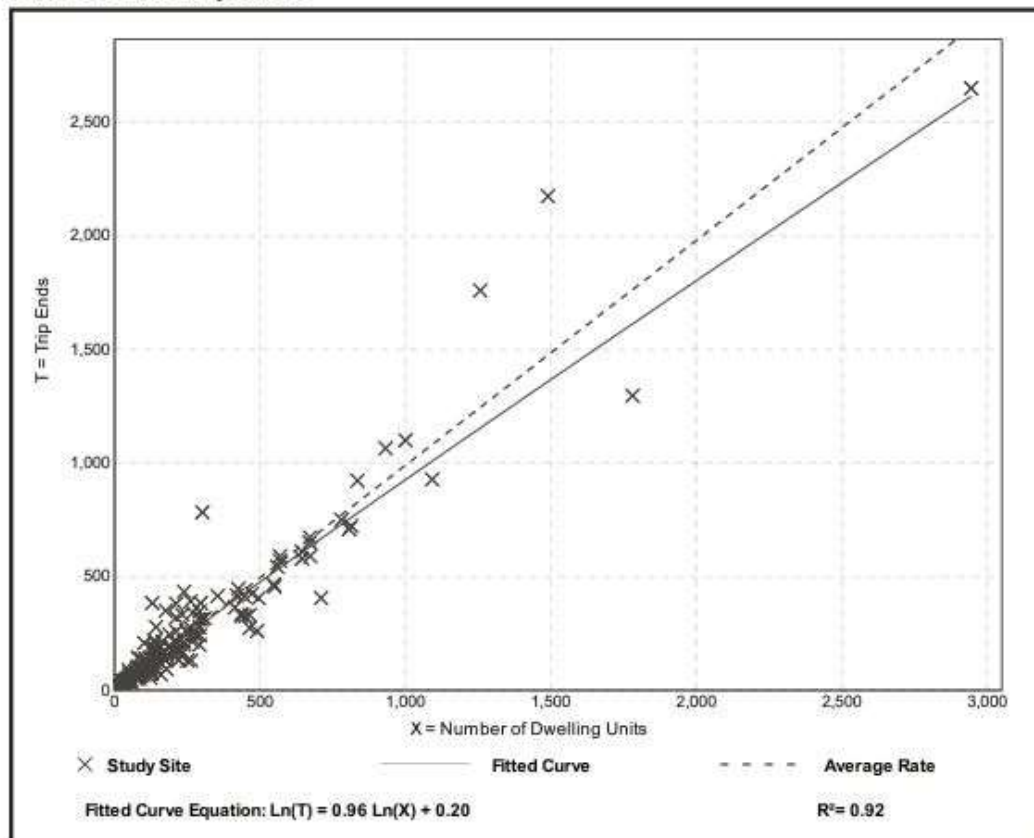
Single-Family Detached Housing (210)

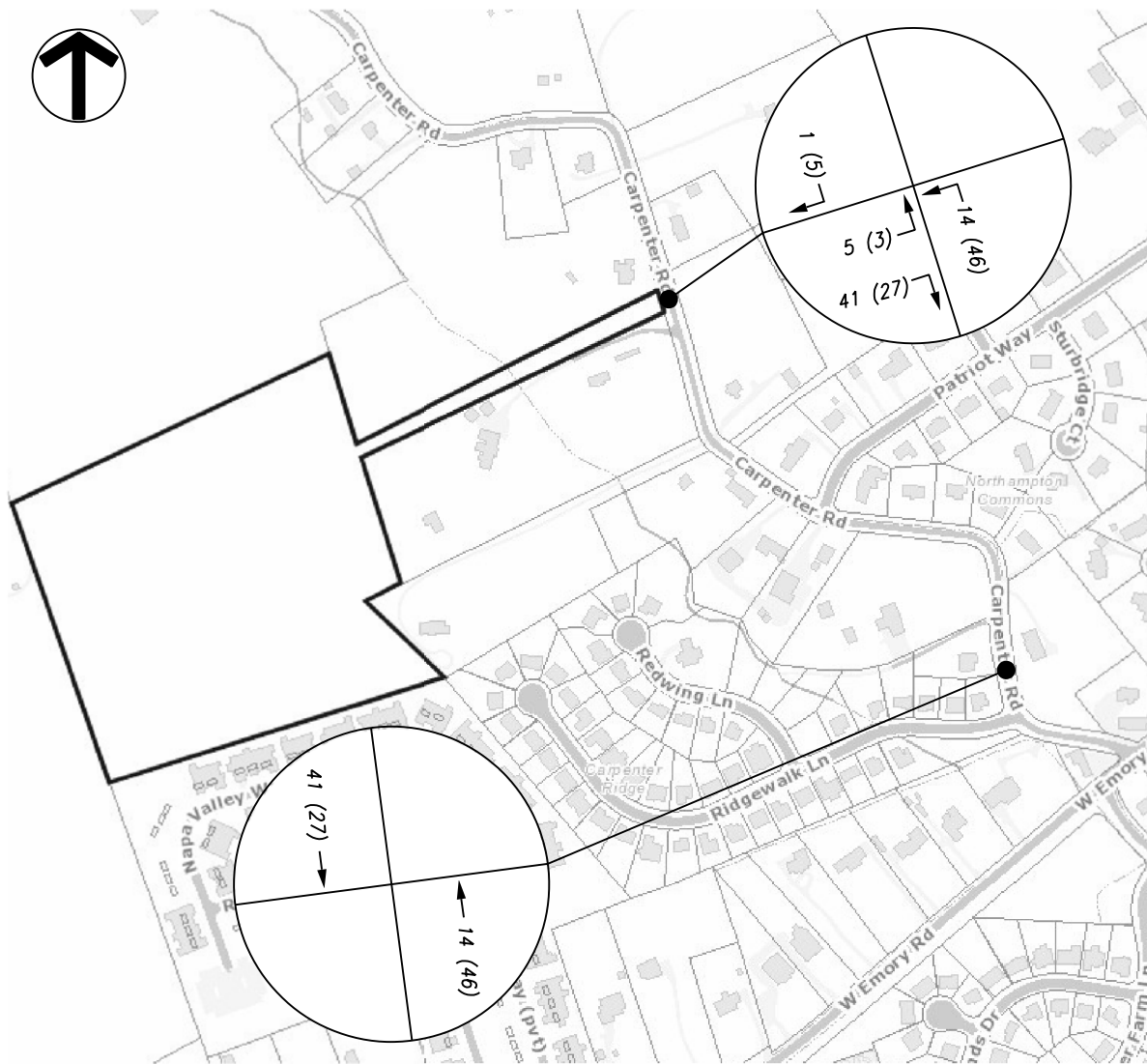
Vehicle Trip Ends vs: Dwelling Units
 On a: Weekday,
 Peak Hour of Adjacent Street Traffic,
 One Hour Between 4 and 6 p.m.
 Setting/Location: General Urban/Suburban
 Number of Studies: 190
 Avg. Num. of Dwelling Units: 242
 Directional Distribution: 63% entering, 37% exiting

Vehicle Trip Generation per Dwelling Unit

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

Data Plot and Equation



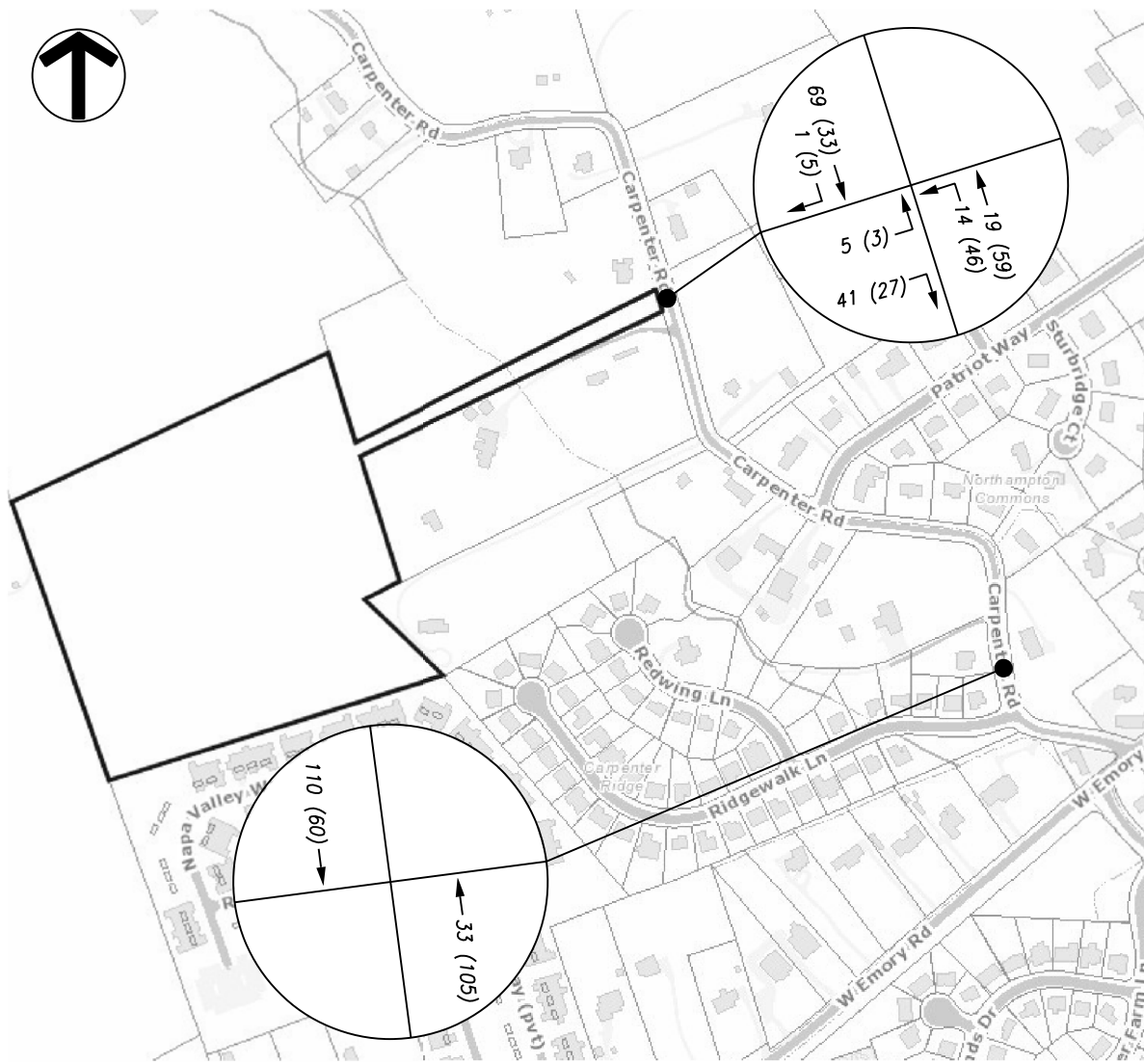


LEGEND:

← X (23)

TURNING MOVEMENT VOLUME AM (PM)

Figure 3: Peak Hour Site Traffic



LEGEND:

← X (23)

TURNING MOVEMENT VOLUME AM (PM)

Figure 4: Full Buildout Peak Hour Traffic

TABLE 4A

LEFT-TURN LANE VOLUME THRESHOLDS FOR TWO-LANE ROADWAYS WITH A PREVAILING SPEED OF 35 MPH OR LESS

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

OPPOSING VOLUME	THROUGH VOLUME PLUS RIGHT-TURN VOLUME *					
	100 - 149	150 - 199	200 - 249	250 - 299	300 - 349	350 - 399
100 - 149 150 - 199	300 245	AM Peak - 14 LT PM Peak - 46 LT	185 160	145 130	120 110	100 90
200 - 249 250 - 299	205 175		140 125	115 105	100 90	80 70
300 - 349 350 - 399	155 135	135 120	110 100	95 85	80 70	65 60
400 - 449 450 - 499	120 105	105 90	90 80	75 70	65 60	55 50
500 - 549 550 - 599	95 85	80 70	70 65	65 60	55 50	50 45
600 - 649 650 - 699	75 70	65 60	60 55	55 50	45 40	40 35
700 - 749 750 or More	65 60	55 50	50 45	45 40	35 35	30 30

OPPOSING VOLUME	THROUGH VOLUME PLUS RIGHT-TURN VOLUME *					
	350 - 399	400 - 449	450 - 499	500 - 549	550 - 599	= / > 600
100 - 149 150 - 199	100 90	80 75	70 65	60 55	55 50	50 45
200 - 249 250 - 299	80 70	72 65	460 55	55 50	50 45	45 40
300 - 349 350 - 399	65 60	60 55	50 50	50 45	45 40	40 40
400 - 449 450 - 499	55 50	50 45	45 45	45 40	40 35	35 35
500 - 549 550 - 599	50 45	45 40	40 40	40 35	35 35	35 35
600 - 649 650 - 699	40 35	35 35	35 35	35 30	35 30	30 30
700 - 749 750 or More	30 30	30 30	30 30	30 30	30 30	30 30

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

TABLE 4B
RIGHT-TURN LANE VOLUME THRESHOLDS
FOR TWO-LANE ROADWAYS WITH A PREVAILING SPEED OF 35 MPH OR LESS

RIGHT-TURN VOLUME	THROUGH VOLUME PLUS LEFT-TURN VOLUME *					
	<100	100 - 199	200 - 249	250 - 299	300 - 349	350 - 399
Fewer Than 25 25 - 49 50 - 99	<100	AM Peak - 1 RT PM Peak - 5 RT				
100 - 149 150 - 199						
200 - 249 250 - 299						Yes
300 - 349 350 - 399				Yes	Yes Yes	Yes Yes
400 - 449 450 - 499			Yes Yes	Yes Yes	Yes Yes	Yes Yes
500 - 549 550 - 599		Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
600 or More	Yes	Yes	Yes	Yes	Yes	Yes

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

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

Project: Dorchester Subdivision

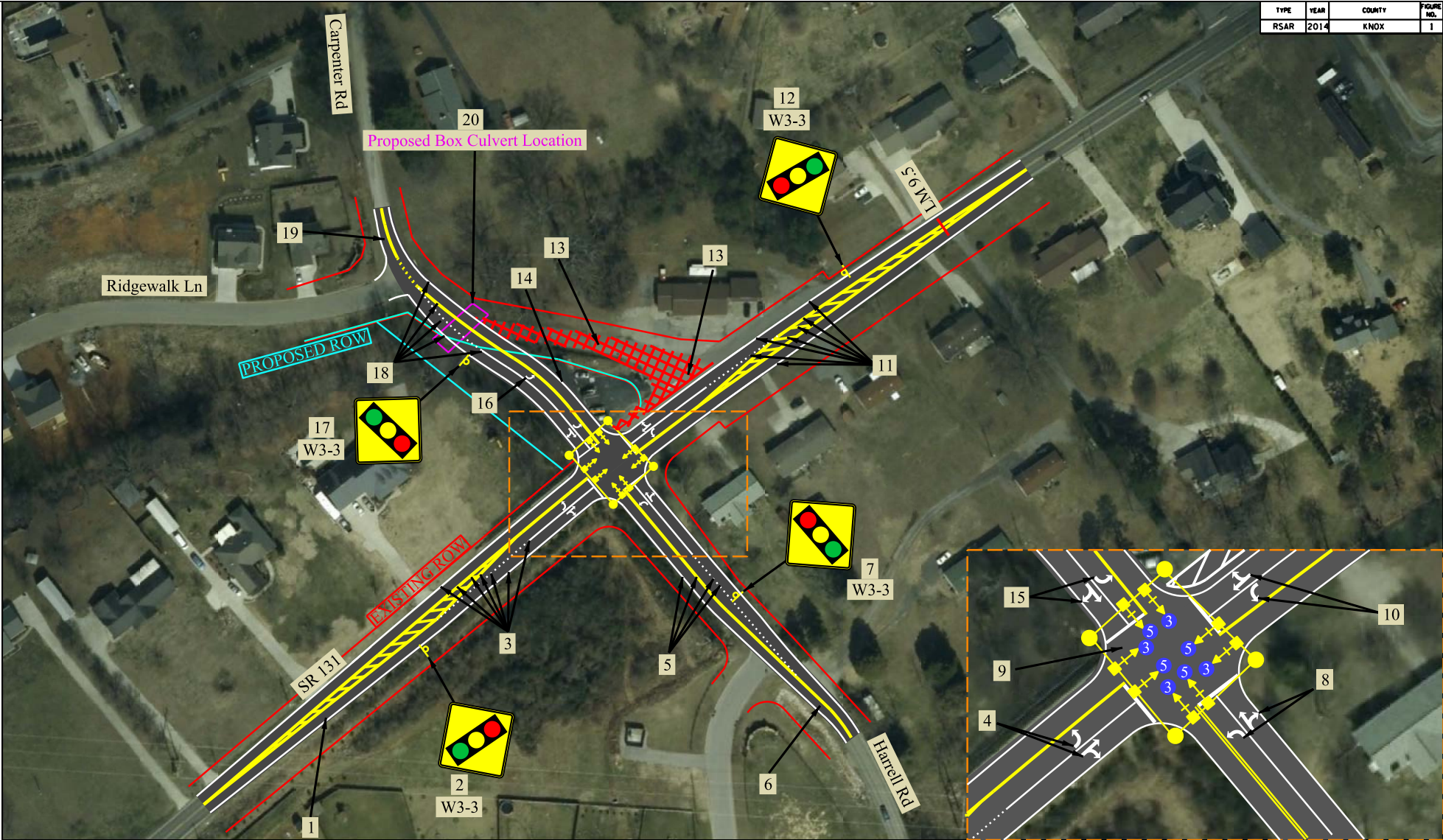
Carpenter Road at Driveway Connection

Carpenter Road
at Driveway Connection VOLUMES

LEFT TURN	Opposing	Thru	LT	LT MAX	Warrant Met
AM	70	19	14	300	NO
PM	38	59	46	300	NO

Carpenter Road
at Driveway Connection VOLUMES

RIGHT TURN	Thru	RT	RT MAX	Warrant Met
AM	69	1	599	NO
PM	33	5	599	NO

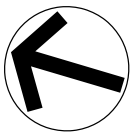


ROAD SAFETY AUDIT REPORT

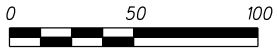
SR 131 AND HARRELL ROAD/CARPENTER ROAD
L.M. 9.51 - L.M. 9.54
KNOX COUNTY



STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION
STRATEGIC TRANSPORTATION
INVESTMENTS DIVISION
SR 131 &
HARRELL RD/
CARPENTER RD
L.M. 9.51-
L.M. 9.54
(FIGURE NO. 1)



INSTRUMENT NORTH



SCALE: 1" = 50'

