

**TRAFFIC IMPACT STUDY
FOR
HICKORY CREEK ROAD SUBDIVISION**

KNOX COUNTY, TENNESSEE

-Prepared For-

Ideal Engineering Solutions, Inc.
325 Wooded Lane
Knoxville, TN 37922

-Prepared By-



ENGINEERING, LLC

Ajax Engineering, LLC
514 Mutton Hollow Road
New Market, TN 37820



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INTRODUCTION

The purpose of this traffic study is to analyze the traffic impacts of a new proposed residential subdivision in Knox County, Tennessee. This development is being proposed on the south side of Hickory Creek Road in northwest Knox County. This traffic impact study for the new residential subdivision follows the procedures and standards as outlined for a Level One (I) study developed by the Knoxville/Knox County Metropolitan Planning Commission.

Included in this traffic impact study is a review of the operating characteristics of the existing roadway system that will provide access to the proposed site. In addition, the trips that are expected to be generated by the proposed development were determined and applied to the existing road system. The impacted road locations were then re-evaluated to determine the potential traffic impacts of the proposed development. These projected traffic volumes are also coupled with identifiable recommendations of road or intersection improvements that would mitigate the expected increase in traffic volume.

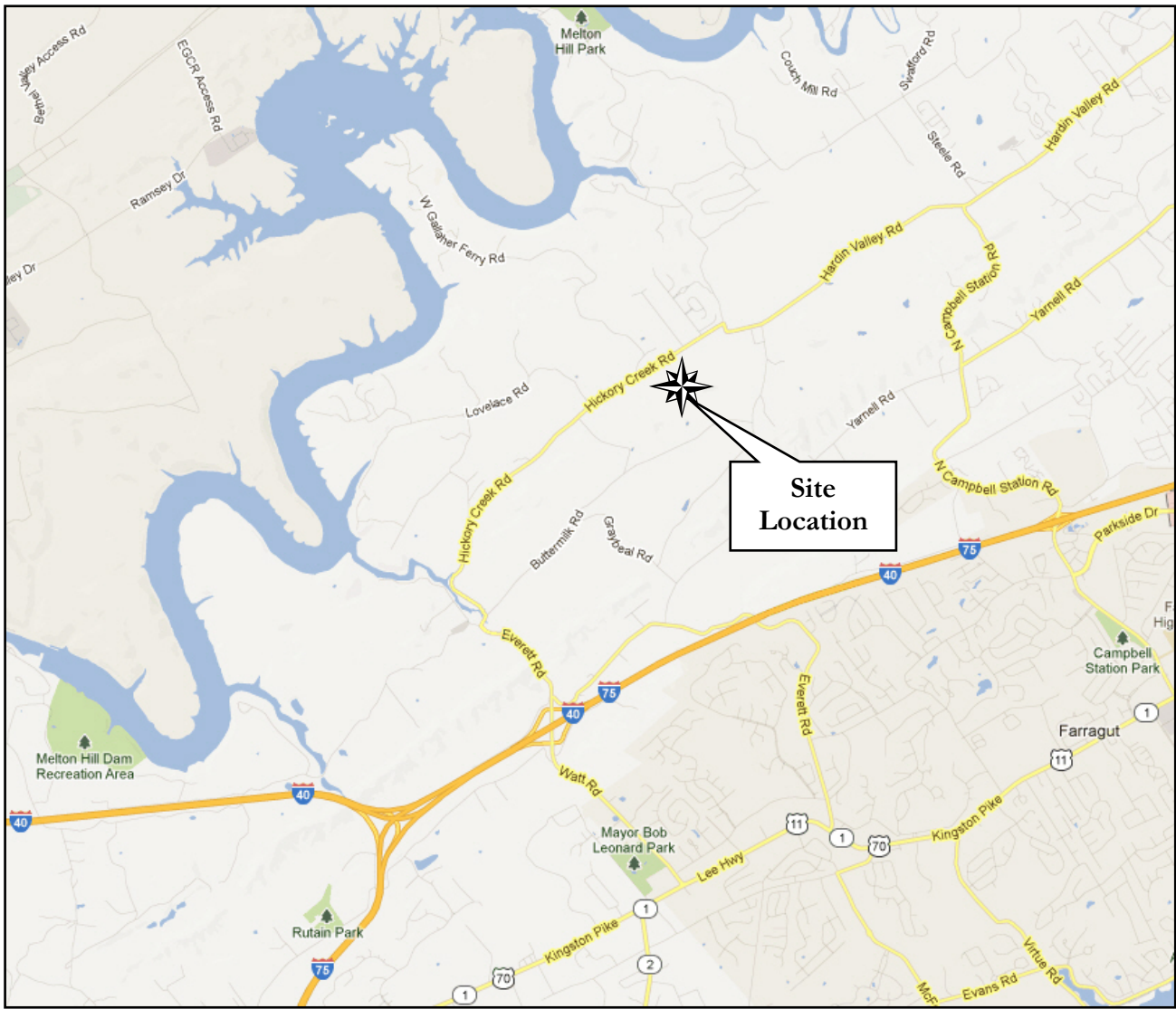
PROJECT DESCRIPTION

The proposed location of this new residential subdivision is shown on a map in Figure 1. Figure 1 includes a map that shows an area-wide view. The development is to be located on the south side of Hickory Creek Road just to the east of the intersection at W. Gallaher Ferry Road. Major adjacent access will be provided by Hickory Creek Road, which travels in a northeast-southwest direction in the project area. In the vicinity of this study area, there are a couple of other residential subdivisions, individual residences, and farm land. The existing site primarily consists of woods and farm land that appears to have been maintained for hay production.

This residential development is expected to be comprised of several new internal streets and residential lots on approximately 50 acres. The development will ultimately include 150 lots ranging in size from a quarter of an acre up to an acre in size. The proposed concept plan layout given and designed by David Campbell, PE with Ideal Engineering Solutions, Inc. is shown in Figure 2.

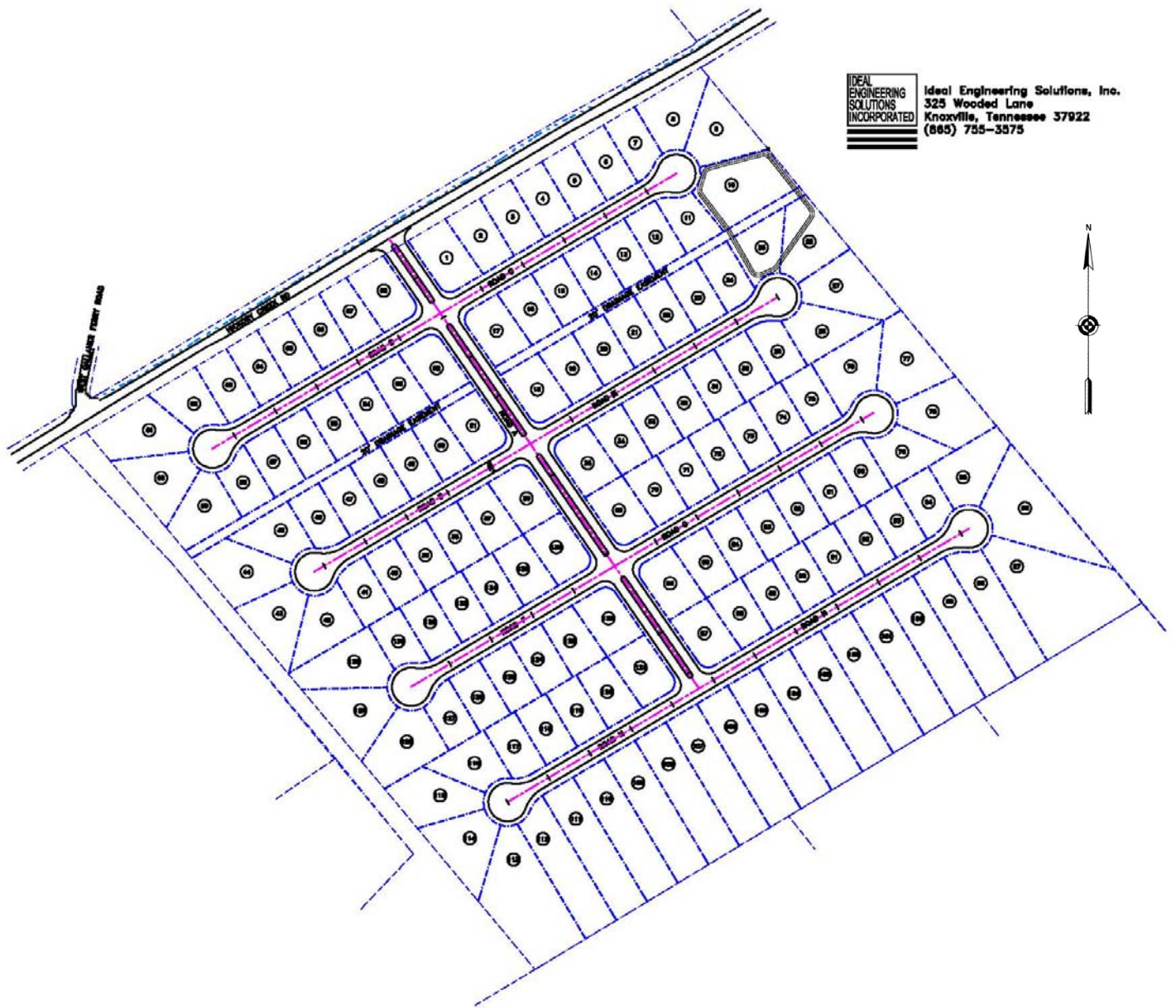
Actual completion of this new residential development is projected to be completed within a schedule depending on economic factors and this project is also contingent on

permitting, design, and other issues. However, for the purposes of this study, it was assumed that the total construction build-out and actual livability of the lots will occur by the year 2016.



(google.com)

Figure 1
Location Map



IDEAL
ENGINEERING
SOLUTIONS
INCORPORATED

Ideal Engineering Solutions, Inc.
325 Wooded Lane
Knoxville, Tennessee 37922
(865) 755-3575



Figure 2
Proposed Concept Plan Layout

EXISTING CONDITIONS

The road to be reviewed for the development was examined to determine the traffic impacts of the proposed new development. The road examined for this study includes Hickory Creek Road since this road will supply all of the access to the new development. Hickory Creek Road will provide access to the proposed new residential subdivision and is described below:

Hickory Creek Road is a two-lane arterial road and traverses in a northeast-southwest direction in the study area. Hickory Creek Road consists of a 2-lane section near the project area with approximately 9 foot lanes. The speed limit on Hickory Creek Road has been posted at 40 mph in the immediate area. Average Daily Traffic (ADT) on Hickory Creek Road in the vicinity of this development (approximately 1 mile to the southwest towards the Loudon County line) was reported by the Tennessee Department of Transportation (TDOT) at 1,564 vehicles per day in 2011 (Station #000135). Historical TDOT data for this traffic count station can be viewed in the Appendix.

PHOTO REFERENCES



**View of Hickory Creek Road
from Proposed Roadway Tie-In
*(Looking Southwest)***



**View of Hickory Creek Road
from Proposed Roadway Tie-In
*(Looking Northeast)***



**View of Hickory Creek Road Looking North
Towards Proposed Roadway Tie-In**



Southeast View of Proposed Site

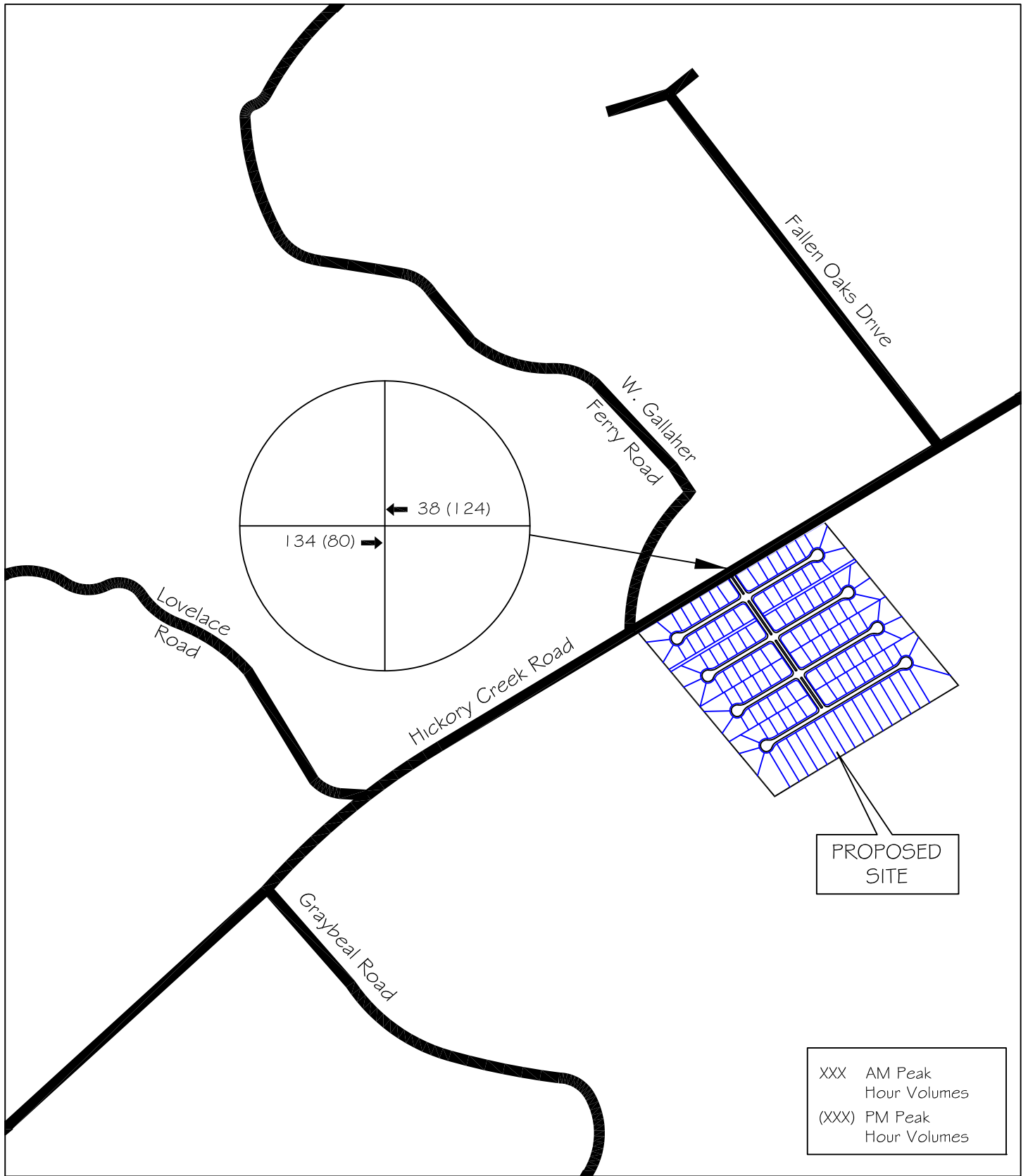
EXISTING TRAFFIC VOLUMES

In order to analyze the traffic impacts associated with the proposed future development, collection of traffic counts were necessary in order to conduct an analysis of the proposed intersection of Hickory Creek Road with the new road tie-in to the residential subdivision. The traffic counts were obtained on Thursday, December 20th, 2012 from the hours of 7:00 AM to 9:00 AM and from 4:00 PM to 6:00 PM. These counts were tabulated for Hickory Creek Road adjacent to the proposed road connection and were obtained when the local schools were in session prior to the Christmas break. Based on these traffic counts, the AM peak hour of traffic was determined to have occurred between the hour of 7:15 AM and 8:15 AM. The PM peak hour of traffic occurred between the hour of 4:30 PM and 5:30 PM. The manual traffic count results can be reviewed in Appendix A and the existing peak hour volumes at the road location are shown in Figure 3.

Capacity analyses were not conducted for this roadway segment but were observed to operate at a more than adequate manner.

BACKGROUND TRAFFIC VOLUMES

Background traffic volumes are estimates of non-related site generated traffic for a particular horizon or design year. These background traffic volume estimates represent the future base condition for which the proposed study area is subject to even without the project being developed. As previously stated, the build-out year for the proposed new Hickory Creek Road residential subdivision was assumed to occur in 2016. Background traffic volumes for this project were obtained by applying a 3% annual growth rate to the existing traffic volumes counted at the roadway. A 3% growth was used to take into account any future development in the area and rising travel patterns. The results of this growth rate application to the existing traffic volume at the roadway can be seen in Figure 4 for the year 2016.



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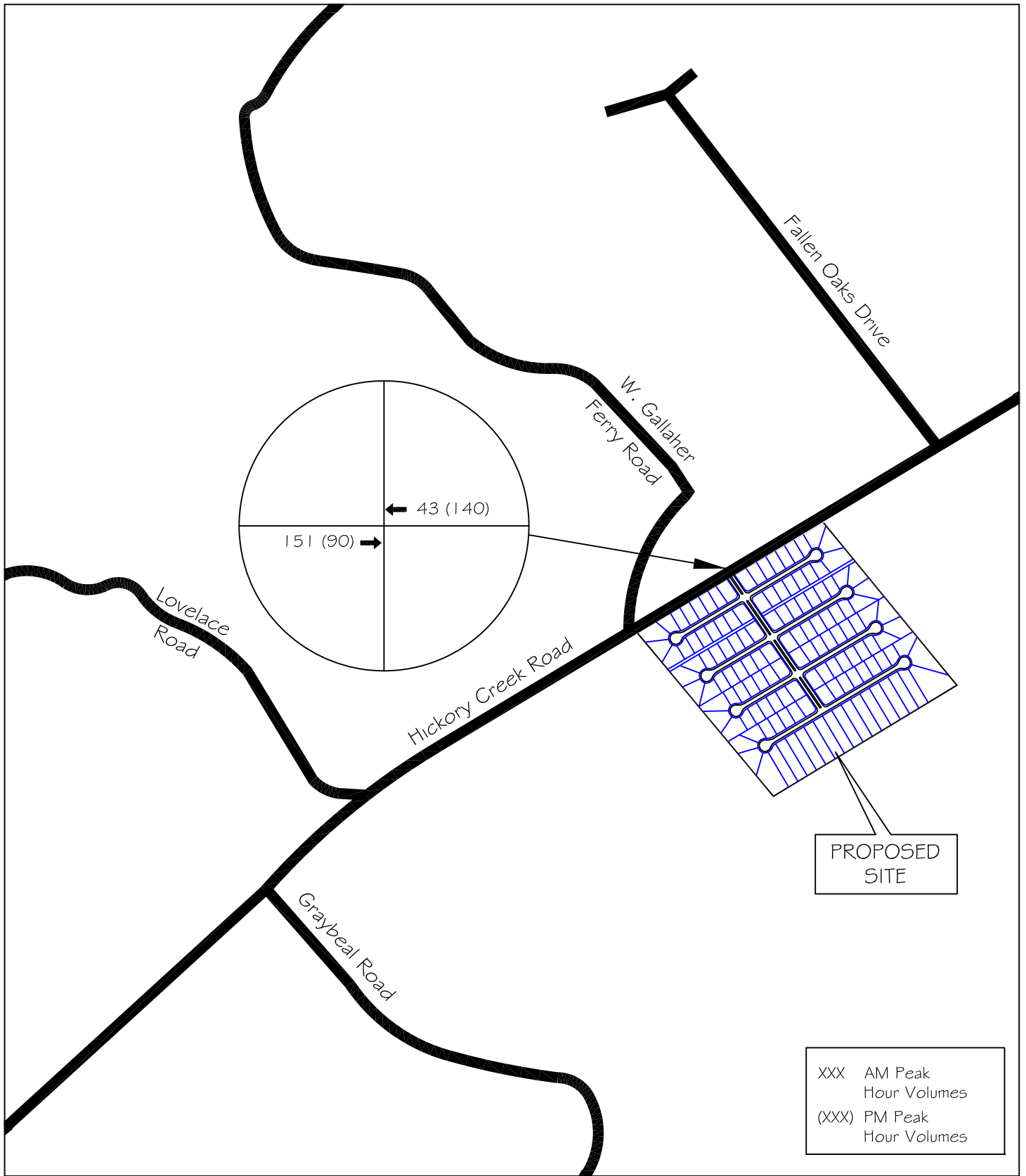
514 Mutton Hollow Road
 New Market, TN 37820
 Phone (865) 556-0042
 Email ajaxengineering@gmail.com

NOT TO SCALE



FIGURE 3

2012 Peak Hour Traffic Volumes
 (Existing)



PROPOSED SITE

XXX AM Peak Hour Volumes
 (XXX) PM Peak Hour Volumes



ENGINEERING, LLC
 514 Mutton Hollow Road
 New Market, TN 37820
 Phone (865) 556-0042
 Email ajaxengineering@gmail.com

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FIGURE 4

2016 Peak Hour Traffic Volumes (Background)

TRIP GENERATION

The estimated amount of traffic that will be generated by the proposed development was calculated based upon equations for peak hour trips provided by Trip Generation, 7th Edition, a publication of the Institute of Transportation Engineers (ITE). A summary of this information is presented in the following:

- ITE Trip Generation Land Use Code #210 (Single-Family Detached Housing)
- Average Vehicle Trip Ends vs. Dwelling Units

**TABLE 1
TRIP GENERATION FOR HICKORY CREEK SUBDIVISION**

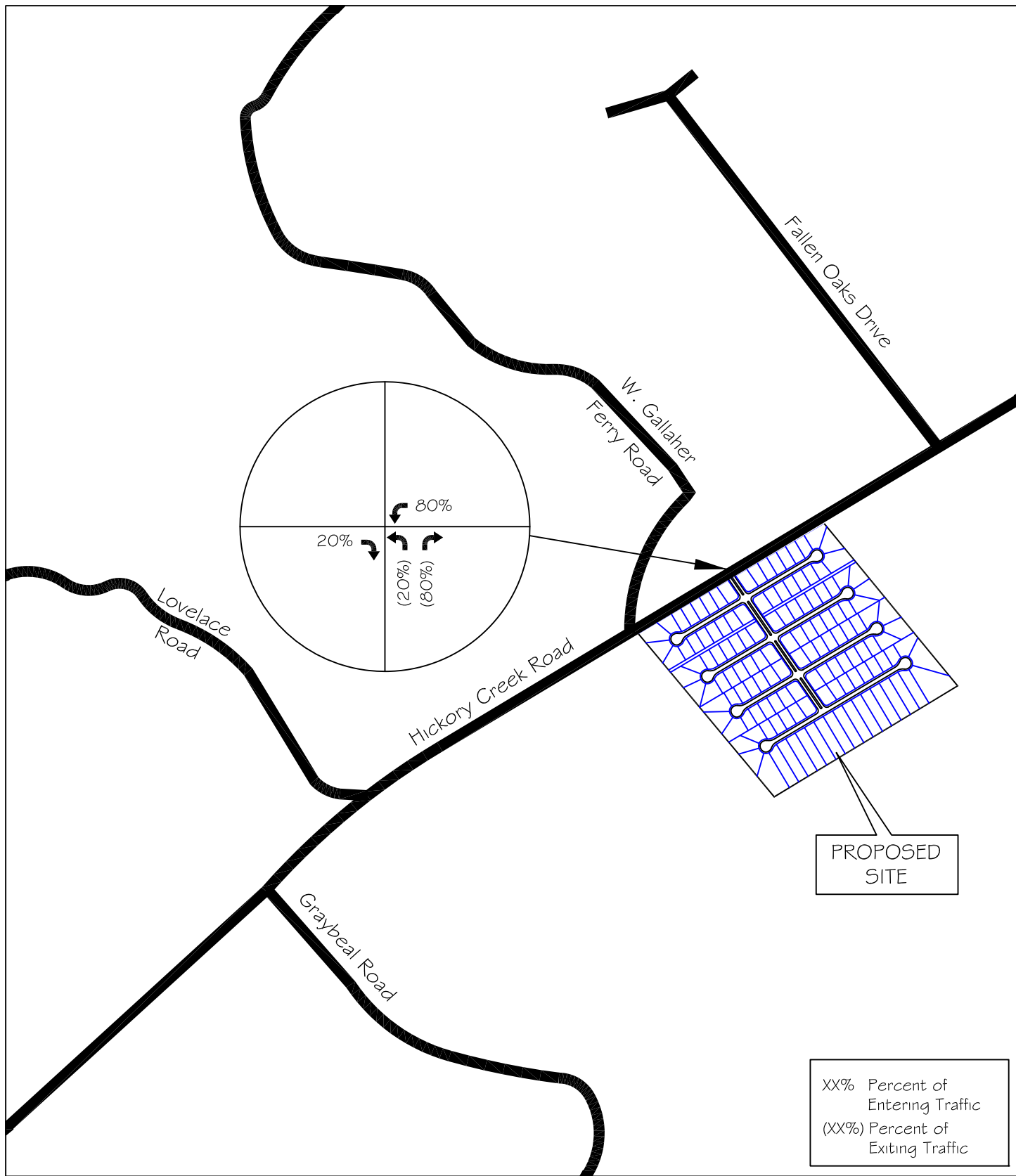
LAND USE	SIZE	AVERAGE DAILY TRAFFIC	GENERATED TRAFFIC AM PEAK HOUR			GENERATED TRAFFIC PM PEAK HOUR		
			ENTER	EXIT	TOTAL	ENTER	EXIT	TOTAL
			26%	74%		64%	36%	
Dwelling Units	150 units	1,510	30	85	115	99	56	155
TOTALS			30	85	115	99	56	155

Therefore, based on these calculations, it can be expected that 30 vehicles will enter the development during the AM Peak Hour, 85 will exit, for a total of 115 new generated trips during the AM Peak Hour (7:15 AM – 8:15 AM). Similarly, it can be expected that 99 vehicles will enter the development during the PM Peak Hour, 56 will exit, for a total of 155 new generated trips during the PM Peak Hour (4:30 PM – 5:30 PM). Additionally, the calculated trips generated for an average day can be expected to be 1,510 vehicles.

TRIP DISTRIBUTION/ASSIGNMENT

The directional distribution of trips that will be generated by the proposed development were surmised and applied to the new proposed intersection as shown in Figure 5 and Figure 6. Figure 5 shows the projected distribution for traffic entering/exiting the new residential subdivision during the AM peak hour. Figure 6 shows the projected distribution for traffic entering/exiting the new residential subdivision during the PM peak hour. The percentages shown only pertain to the new trips generated by the new residential dwellings.

These projected trip distributions were based from the existing traffic movements at the examined roadway, reasonable assumptions of popular directions by future motorists' travel patterns, and surrounding concentrations of development and population.



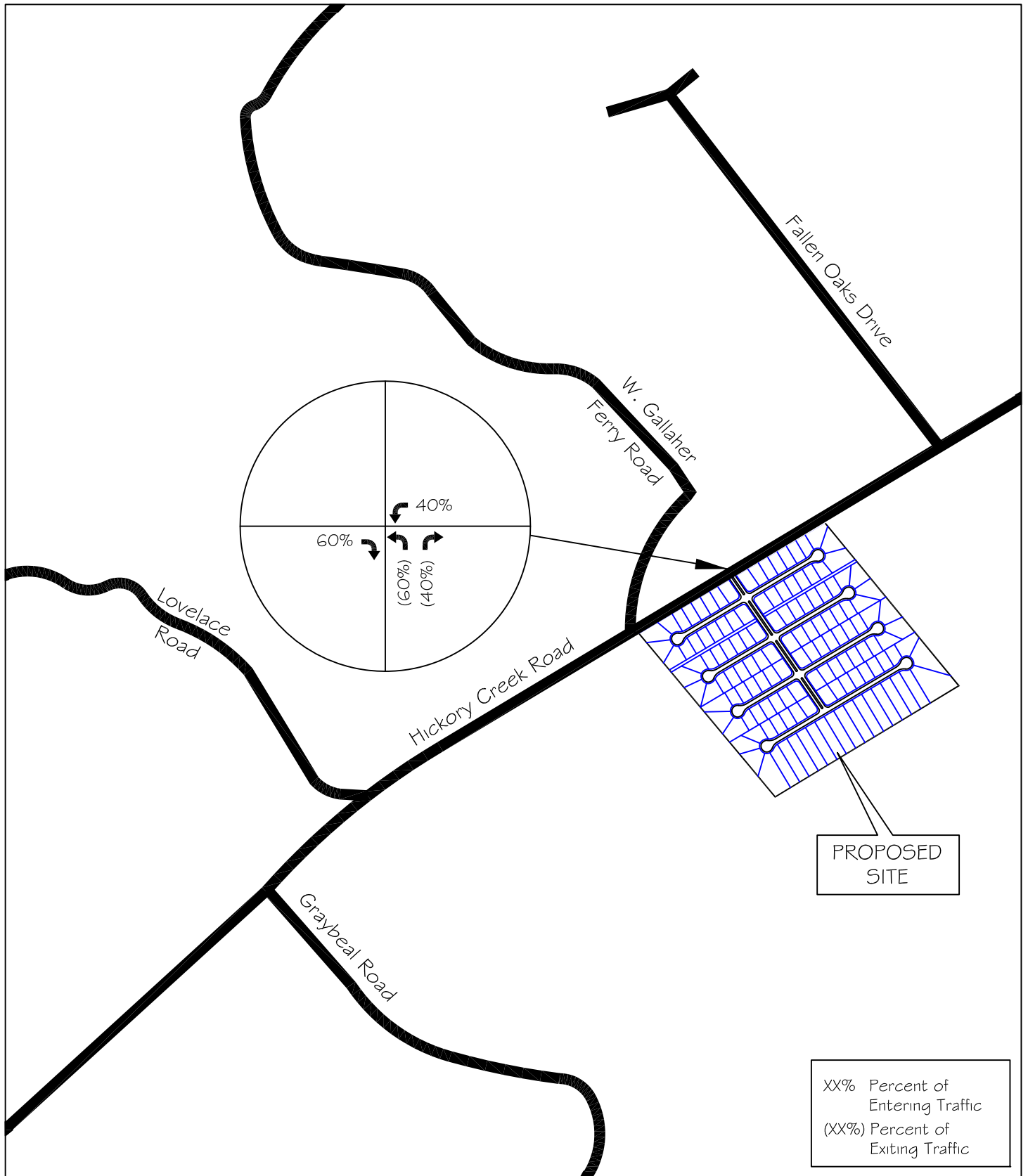
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 Email ajaxengineering@gmail.com

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FIGURE 5

Directional Distribution
 (AM Peak)



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FIGURE 6

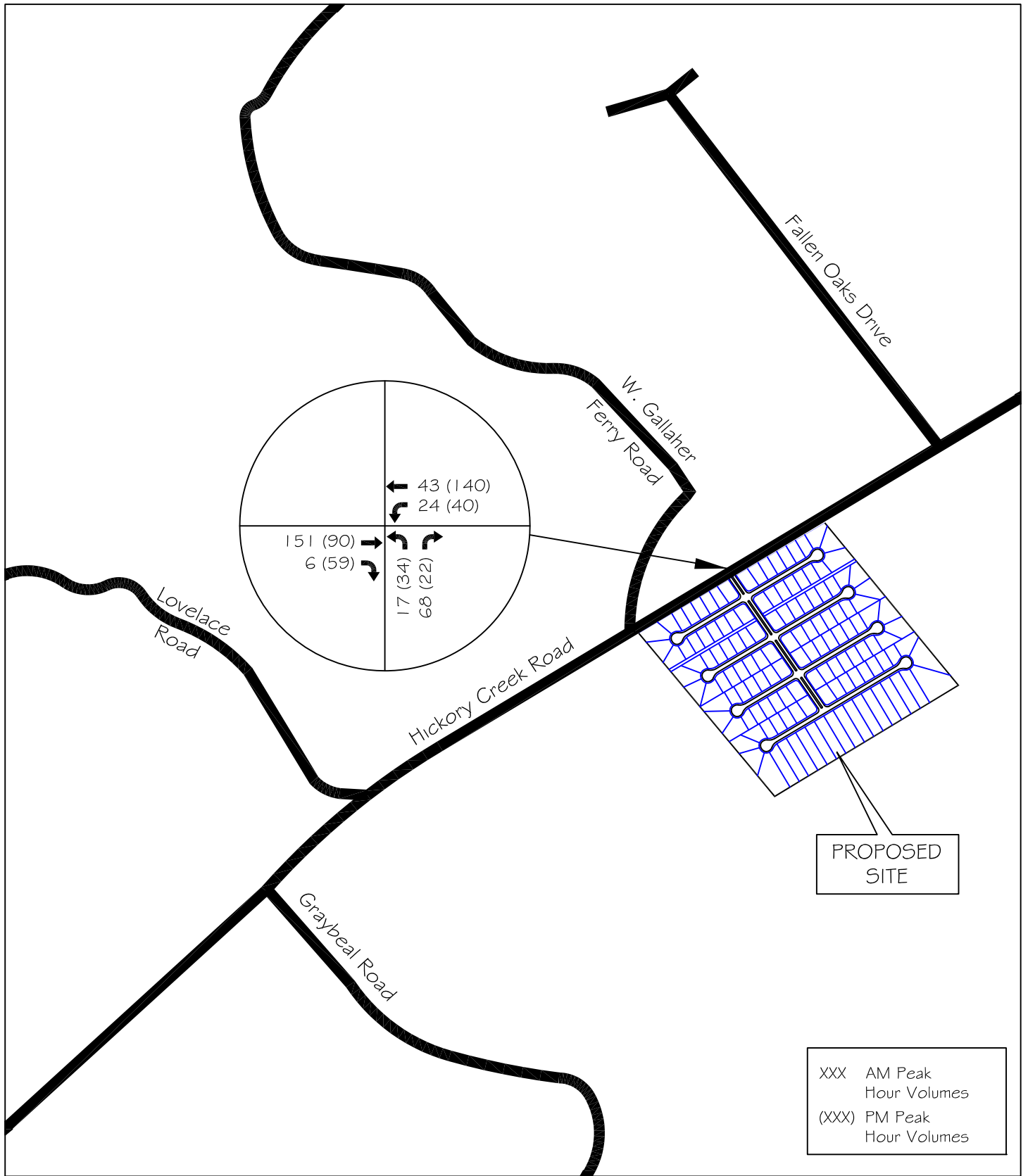
Directional Distribution
 (PM Peak)

PROJECTED TRAFFIC VOLUMES

As a final step, application of the calculated peak hour trips generated by the new proposed Hickory Creek Road residential subdivision were added to the background traffic volumes according to the predicted directional distributions. This procedure was necessary to obtain the total projected traffic volumes at the time the development is fully occupied by the year 2016. AM and PM peak hour capacity analyses were conducted to determine the traffic impact of the projected development at the new unsignalized intersection of Hickory Creek Road and the proposed new roadway connection. Figure 7 shows the projected AM and PM peak hour volumes at the studied intersection for the year 2016. The Appendix includes the worksheets for these capacity analyses.

Capacity analyses are undertaken to determine the existing Level of Service (LOS) for the proposed intersection. The capacity analysis was calculated by following the methods outlined in the Highway Capacity Manual, TRB Special Report 209. As an aid in calculating the capacity of the intersection, Synchro Traffic Software (Version 5) was utilized.

LOS is an indication of how well an intersection or roadway performs. LOS designations include LOS A through LOS F. The designation of LOS A signifies a roadway or intersection operating at best, while LOS F signifies road operations at the worst. The Highway Capacity Manual lists Level of Service criteria for unsignalized intersections and is presented in this report as Table 2. For unsignalized intersections, Level of Service is measured in terms of delay. This measure is an attempt to quantify delay that includes lost travel time, driver discomfort, and fuel consumption. Level of Service for unsignalized intersections are calculated for turning movements associated with stop or yield control (new subdivision road) and also for left turns on “un-controlled” major streets (Hickory Creek Road).



ENGINEERING, LLC

514 Mutton Hollow Road
 New Market, TN 37820
 Phone (865) 556-0042
 Email ajaxengineering@gmail.com

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FIGURE 7

2016 Peak Hour Traffic Volumes
 (Projected)

TABLE 2


**LEVEL OF SERVICE FOR
UNSIGNALIZED INTERSECTIONS**

LEVEL OF SERVICE	DESCRIPTION	DELAY RANGE (sec/veh)
A	Little or no delay	<= 10
B	Short Traffic Delays	>10 and <=15
C	Average Traffic Delays	>15 and <=25
D	Long Traffic Delays	>25 and <=35
E	Very Long Traffic Delays	>35 and <=50
F	Extreme Traffic Delays	>50

Source: Highway Capacity Manual, TRB Special Report 209

From the capacity calculations, the results from the projected peak hour traffic can be seen in Table 3 for the intersection. The intersection is shown with a LOS designation for the AM and PM peak hours in the table. For the proposed new unsignalized intersection, the peak hour levels of service are shown to operate at a very good level during both the AM and PM peak hours. Generally, for most instances, LOS D or E is considered the upper limit of acceptable delay.

**TABLE 3
2016 PEAK HOUR LEVEL OF SERVICE - PROJECTED**

INTERSECTION	TRAFFIC CONTROL	TURNING MOVEMENT	LEVEL OF SERVICE	
			AM PEAK	PM PEAK
Hickory Creek Road and New Subdivision Roadway	Unsignalized 	Westbound Left	A	A
		Northbound Left/Right	B	B
		Northbound Approach	B	B

RECOMMENDATIONS

The analyses presented in this study of the proposed new residential subdivision indicate that the traffic generated by this proposed development will not create an unacceptable impact on the traffic capacity of Hickory Creek Road. After all the analyses have been conducted and reviewed, the following recommendations are provided for the proposed new residential development on Hickory Creek Road:

- Eastbound and Westbound Approaches (Hickory Creek Road): From the capacity calculations, it has been shown that westbound left turns into the development should operate at LOS A during the AM and PM peak hours. It does not appear that new separate eastbound right turns or westbound left turns into the development are warranted or needed to be constructed due to the low predicted volumes.

- Northbound Approach (New Subdivision Road): From the capacity calculations, it has been shown that northbound left/right turns from a single exiting lane should operate at LOS B during the AM peak hour and PM peak hour.
 - The new roadway connection with Hickory Creek Road should be constructed with a Stop Sign (R1-1).
 - Sight distance at the new intersection must not be impacted by new signage or landscaping. Currently, based at the proposed location of the tie-in road, the existing sight distance at this approach has been examined and determined to be adequate for left and right turning exiting vehicles out of the development. The existing row of cedar trees that line Hickory Creek Road on the south side should be removed to insure proper sight distance and the proposed roadway should tie-in at an appropriate grade.
 - The grade and the intersection elements should be designed to AASHTO and Knox County Engineering specifications and guidelines to insure proper operation.

CONCLUSIONS

The analyses presented in this study of the proposed new Hickory Creek Road residential subdivision indicate that the traffic generated by this proposed development will not create an unacceptable impact at the new unsignalized intersection of Hickory Creek Road and the proposed roadway during the AM and PM peak hours at the time of projected full build-out (2016).

In review, this traffic study used existing traffic counts that were obtained on December 20, 2012. The estimated number of trips generated by this new residential development was calculated using the Institute of Transportation Engineers, Trip Generation Manual. At the time of full build-out in 2016, a growth factor of 3% was assumed and used to determine the future traffic of the surrounding roadway. The trips generated by the development were added to these projected future volumes with a trip distribution assignment according to the surrounding area and based on existing traffic movements. Ultimately, acceptable levels of service were calculated and determined for the studied intersection.

Overall, even with this proposed development being added to the existing traffic landscape in Knox County, Tennessee, efficient and safe traffic conditions should be maintainable and achievable when coupled with the recommendations of this report.

APPENDIX A
MANUAL TRAFFIC COUNT DATA

TRAFFIC COUNT DATA

Major Street: Hickory Creek Road
 Minor Street: N/A

12/20/2012
 Overcast/Rain/Cold

Primary Movement: Vehicles

TIME BEGIN	WESTBOUND		EASTBOUND		VEHICLE TOTAL	PEAK HOUR
	THRU	THRU	THRU	THRU		
7:00 AM	6		19		25	
7:15 AM	9		40		49	7:15 AM - 8:15 AM
7:30 AM	10		34		44	
7:45 AM	14		29		43	
8:00 AM	5		31		36	
8:15 AM	7		18		25	
8:30 AM	8		14		22	
8:45 AM	8		20		28	
TOTAL	67		205		272	
4:00 PM	28		23		51	
4:15 PM	27		21		48	
4:30 PM	29		21		50	4:30 PM - 5:30 PM
4:45 PM	24		18		42	
5:00 PM	35		16		51	
5:15 PM	36		25		61	
5:30 PM	30		14		44	
5:45 PM	26		18		44	
TOTAL	235		156		391	










**APPENDIX B
CAPACITY ANALYSES**

**HCM WORKSHEETS
(SYNCHRO 5)**

HCM Unsignalized Intersection Capacity Analysis











3: Hickory Creek Road & New Subdivision Road

Projected AM
1/2/2013

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	-3%	
Volume (veh/h)	151	6	24	43	17	68
Peak Hour Factor	0.70	0.70	0.75	0.75	0.90	0.90
Hourly flow rate (veh/h)	216	9	32	57	19	76
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage (veh)						
vC, conflicting volume			224		341	220
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			98		97	91
cM capacity (veh/h)			1344		644	825
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	224	89	94			
Volume Left	0	32	19			
Volume Right	9	0	76			
cSH	1700	1344	781			
Volume to Capacity	0.13	0.02	0.12			
Queue Length (ft)	0	2	10			
Control Delay (s)	0.0	2.9	10.2			
Lane LOS		A	B			
Approach Delay (s)	0.0	2.9	10.2			
Approach LOS			B			
Intersection Summary						
Average Delay			3.0			
Intersection Capacity Utilization			24.2%		ICU Level of Service	A

HCM Unsignalized Intersection Capacity Analysis
 3: Hickory Creek Road & New Subdivision Road

Projected PM
 1/2/2013

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	-3%	
Volume (veh/h)	90	59	40	140	34	22
Peak Hour Factor	0.70	0.70	0.75	0.75	0.90	0.90
Hourly flow rate (veh/h)	129	84	53	187	38	24
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage (veh)						
vC, conflicting volume			213		464	171
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			96		93	97
cM capacity (veh/h)			1357		538	878
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	213	240	62			
Volume Left	0	53	38			
Volume Right	84	0	24			
cSH	1700	1357	635			
Volume to Capacity	0.13	0.04	0.10			
Queue Length (ft)	0	3	8			
Control Delay (s)	0.0	2.0	11.3			
Lane LOS		A	B			
Approach Delay (s)	0.0	2.0	11.3			
Approach LOS			B			
Intersection Summary						
Average Delay			2.3			
Intersection Capacity Utilization			38.3%		ICU Level of Service	A

APPENDIX C
TDOT TRAFFIC COUNTS



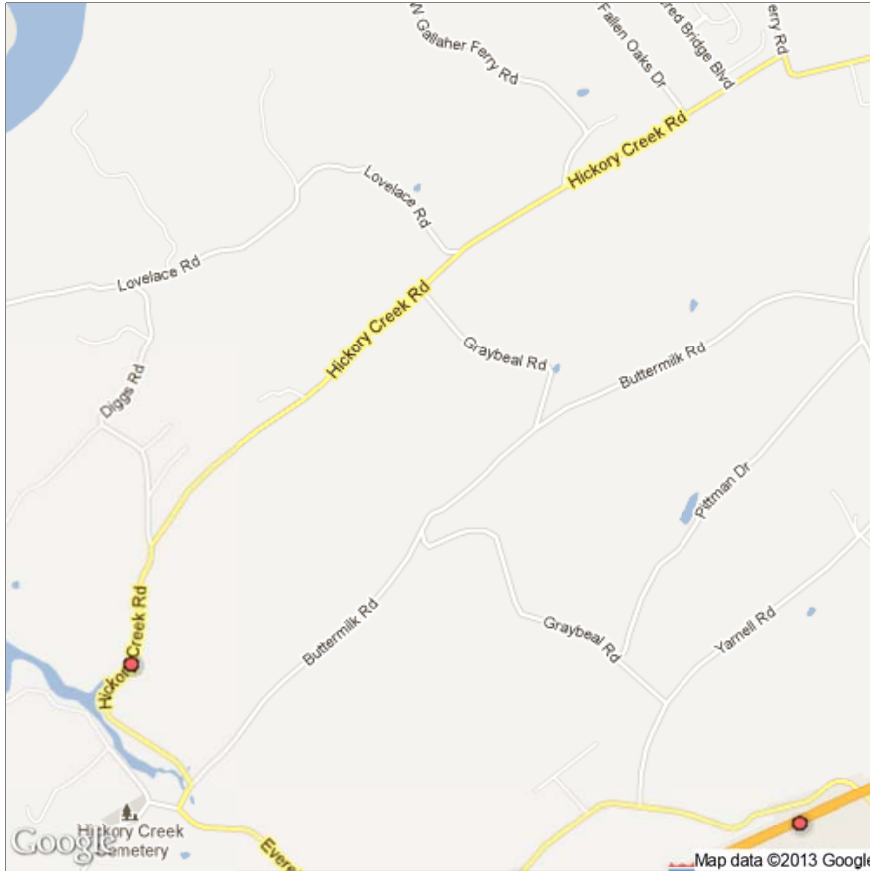
Tennessee Department of Transportation
John Schroer, Commissioner

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Traffic History reflects the Annual Average Daily Traffic (AADT) count along specific locations on Tennessee's road network

View stations on map: **Select a county...**

Non-Map Record Search: **Anderson** Station Number: **Search**



Station Information	
Station	000135
Route	02422
Location	HICKORY CR DR-NEAR LOUDON CO LINE
County	Knox
2011	1564
2010	1403
2009	1387
2008	1669
2007	1742
2006	1632
2005	1521
2004	1477
2003	1024
2002	1461
2001	1515
2000	1826
1999	1223
1998	1555
1997	1400
1996	1381
1995	1379
1994	1024
1993	1377

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Department of Transportation
James K. Polk Building, Suite 700
Nashville, TN 37243-0349
615.741.2848