

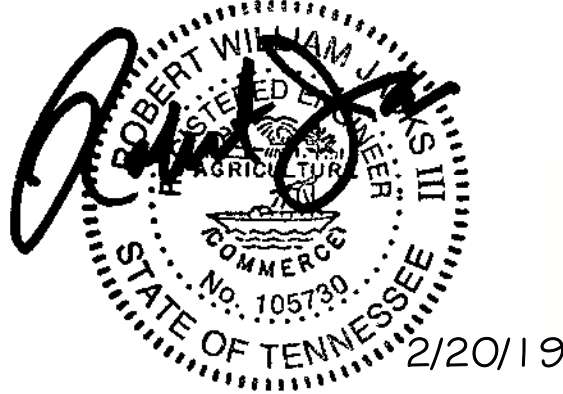
TRANSPORTATION IMPACT STUDY

THOMAS LANE SUBDIVISION

KNOX COUNTY, TENNESSEE

-Prepared For-

Turner Homes, LLC
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Revised February 2019

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EXECUTIVE SUMMARY

Preface:

Turner Homes, LLC is proposing to construct a residential development that is adjacent to East Emory Road (SR 131) in north Knox County, TN. This proposed residential development is currently listed as “Turner Homes, LLC on Thomas Lane” but will be referred to as “Thomas Lane Subdivision” for this report. The Thomas Lane Subdivision will consist of 91 single-family attached homes. Two of four existing single-family detached homes located on the southwest side at the end of Thomas Lane will be razed and the other two will be incorporated into the development. There are also four other existing homes on the northeast side of Thomas Lane that will remain. These four homes will not be incorporated into the Thomas Lane Subdivision, but the traffic generated by these homes will mix with the new residential development traffic on Thomas Lane. The purpose of this study is to determine and evaluate the potential impacts of the proposed development on the adjacent transportation system. The study includes a review of the operating characteristics of the existing transportation system that will provide access to the proposed development site. Recommendations and mitigation measures will be analyzed and offered where traffic operations have been projected to be below traffic engineering standards.

Study Results:

The findings of this study include the following:

- At full build-out, the proposed 91-lot single-family attached lot residential development with six existing single-family detached homes along Thomas Lane is expected to generate approximately 956 trips on an average weekday. 59 of these trips are estimated to occur during the AM peak hour and 78 trips in the PM peak hour at full build-out.
- The addition of the proposed residential development trips at the intersection of Thomas Lane at East Emory Road (SR 131) is anticipated to operate very well in the projected conditions for vehicular traffic on East Emory Road (SR 131) in the year 2024 with respect to road capacity. However, the northbound approach movements at this intersection were calculated to operate at Level of Service (LOS) F during the PM peak hour in the projected conditions in the year 2024. The intersection was analyzed to determine if traffic signal warrants

were met for potential traffic signalization. It was determined that based on the projected volumes in the year 2024, the intersection will not meet warrants for signalization. However, as explained in the report, even though northbound motorists will experience large delays, the maximum queue length for this approach is calculated to be only 2 vehicles.

Recommendations:

The following recommendations are offered based on the study analyses:

- An exclusive eastbound right turn lane should be constructed at the intersection of East Emory Road (SR 131) at Thomas Lane. The right turn lane should be no less than 50 feet in length with a 50-foot taper as shown on the concept plan. These lengths are not ideal, but the possibility of constructing a longer right turn lane is hindered by an existing driveway located at 4830 East Emory Road (SR 131). If this property could be purchased by the developer, a more ideal storage length of 75 feet with a 150-foot taper could be provided.
- The sight distance available looking east and to the west from Thomas Lane at East Emory Road (SR 131) has not been measured by a licensed land surveyor. The required sight distance is 480 feet based on a spot speed study on East Emory Road (SR 131). Measurements made by a rolling measuring wheel indicated that this distance is potentially available but may currently be reduced by existing features such as utility poles and vegetation. These existing features may need to be removed and vegetation will need to be maintained in the future. The actual sight distance will need to be measured by a licensed land surveyor.
- As part of the proposed widening of Thomas Lane by the developer, it is recommended in the southeast corner of the intersection that the existing utility pole be relocated, and the cedar tree be removed. Relocating and removing these existing features will reduce interference with sight distance, allow the Stop Sign (R1-1) to be moved closer to the white stop bar, and allow for the construction of a larger turn radius for northbound right turns towards the east.
- The internal roadways and intersections within the Thomas Lane Subdivision should include design elements with the appropriate sight distance requirements, road signage, pavement markings, and the construction of internal sidewalks.

DESCRIPTION OF EXISTING CONDITIONS

■ STUDY AREA:

The proposed location of this new residential subdivision is shown on a map in Figure 1. This proposed development is located adjacent to East Emory Road (SR 131) in north Knox County. The proposed development is to be comprised of several new internal paved roadways and will contain a maximum of 91 single-family attached residential lots with two existing single-family detached residential lots on approximately 18.83 acres. To analyze the transportation impacts associated with the proposed development, the following roadways and intersection were reviewed in this report where the greatest impact is expected:

- East Emory Road (SR 131)
- Thomas Lane
- Intersection of East Emory Road (SR 131) at Thomas Lane

In the adjacent vicinity of this study area, there are several other residential subdivisions, individual residences, and undeveloped properties. The development property for the 91 single-family attached residential lots currently is unoccupied and a large majority of it is recently used for hay production. The construction of the development will involve removing 2 existing single-family detached homes and retaining 2 existing single-family homes on the west side of Thomas Lane.

The proposed site for the Thomas Lane Subdivision is bounded by residential subdivisions to the south, west, and east; single-family homes and East Emory Road (SR 131) to the north, and undeveloped property to the southeast. A Knoxville Utilities Board electrical substation is located to the extreme southeast corner of the development. The site is also crossed by a stream and an overhead TVA electrical transmission line.

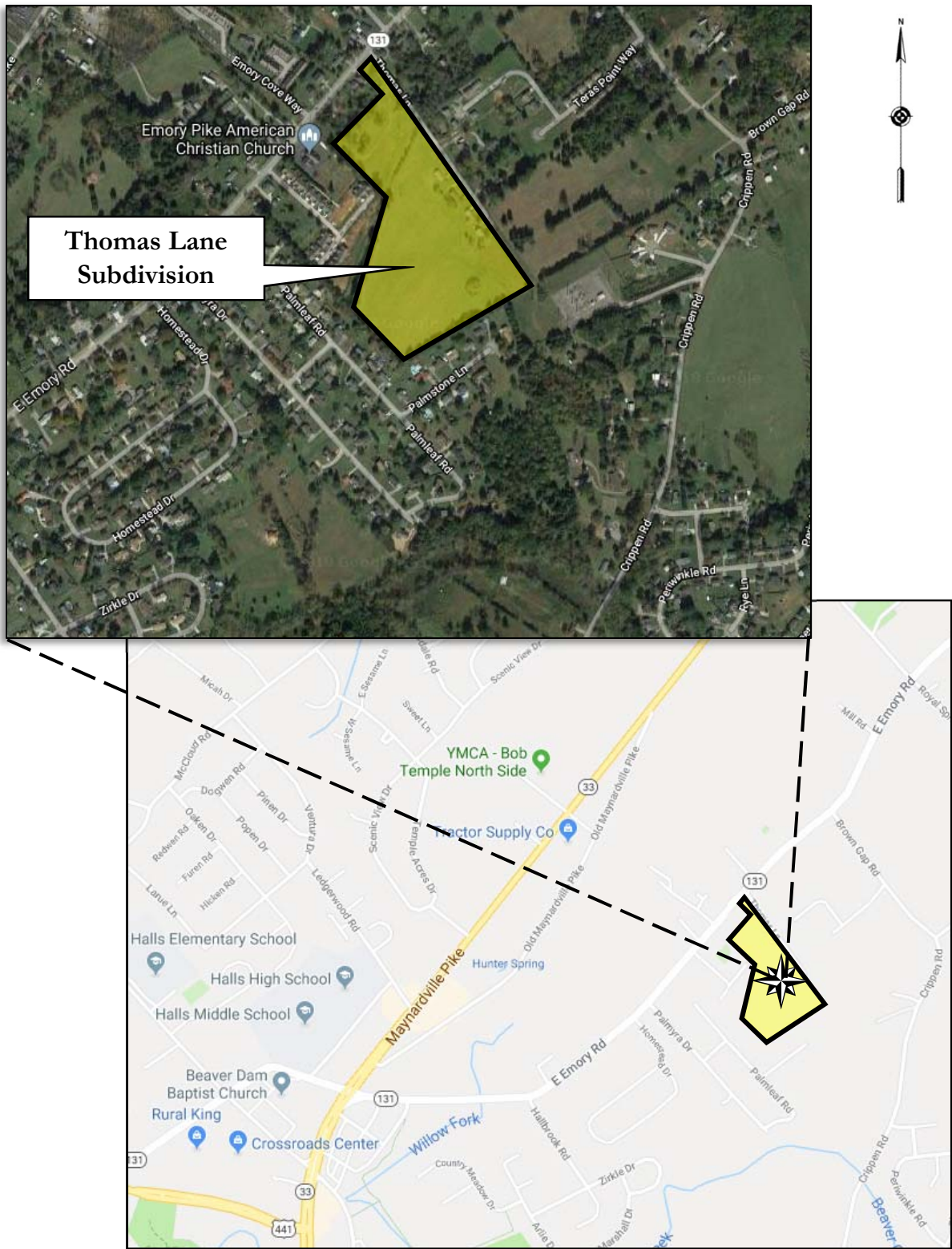


Figure 1
Location Map

■ **EXISTING ROADWAYS:**

Table 1 shows the characteristics of the key existing roadways included in the study:

**TABLE 1
STUDY CORRIDOR CHARACTERISTICS**

NAME	CLASSIFICATION ¹	SPEED LIMIT	LANES	ROAD WIDTH ²	TRANSIT ³	PEDESTRIAN FACILITIES	BICYCLE FACILITIES
East Emory Road (SR 131)	Major Arterial	45 mph	2 undivided	22 feet	None	No sidewalks	No bike lanes
Thomas Lane	Local Street	Not posted	2 undivided	14 - 16 feet	None	No sidewalks	No bike lanes

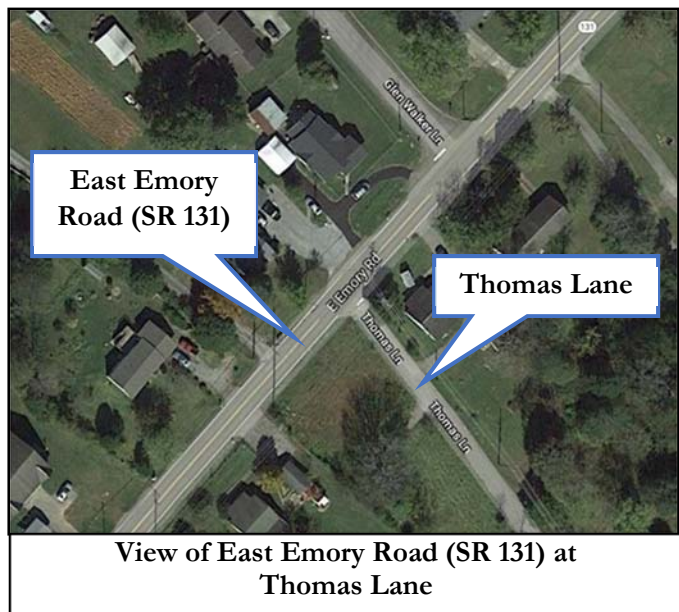
¹ 2018 Major Road Plan by Knoxville/Knox County Metropolitan Planning Commission

² Edge of curb to edge of curb or edge of pavements near project site

³ According to Knoxville Area Transit System Map

East Emory Road (SR 131) traverses in a general southwest-northeast direction adjacent to the development property. East Emory Road (SR 131) is a fairly straight road with some minor horizontal and vertical curvature. The section of East Emory Road (SR 131) adjacent to the project site currently consists of a 2-lane pavement section approximately 22 feet wide with approximately 9.5-foot lanes with minimal clearance outside the pavement surface.



The East Emory Road (SR 131) designation officially transitions from West Emory Road (SR 131) to the southwest at the intersection with Heiskell Road /Central Avenue Pike to the west of Interstate 75. On the northeast end, the road continues into Grainger County. The total length of East Emory Road (SR 131) in Knox County is approximately 18.5 miles. East Emory Road (SR 131) currently provides access to many residential subdivisions and individual residences within the study area. Roadway lighting is not provided at the intersection of East Emory Road (SR 131) at Thomas Lane.



Thomas Lane traverses in a northwest-southeast direction and is approximately 1,130 feet in length. Thomas Lane is a very narrow road that currently provides access to 8 single-family detached homes. Thomas Lane does not have a posted speed limit and has a very rough road surface.

Figure 2 shows the lane configurations of the study intersection and the location where the traffic count was conducted. It also shows the posted speed limit in the area along with distances between East Emory Road (SR 131) at Thomas Lane and other major upstream/downstream existing intersections. The pages following Figure 2 give an overview of the site study area with photographs.



 Traffic Count Location / Observation
 Intersection Movement & Traffic Lane Configuration



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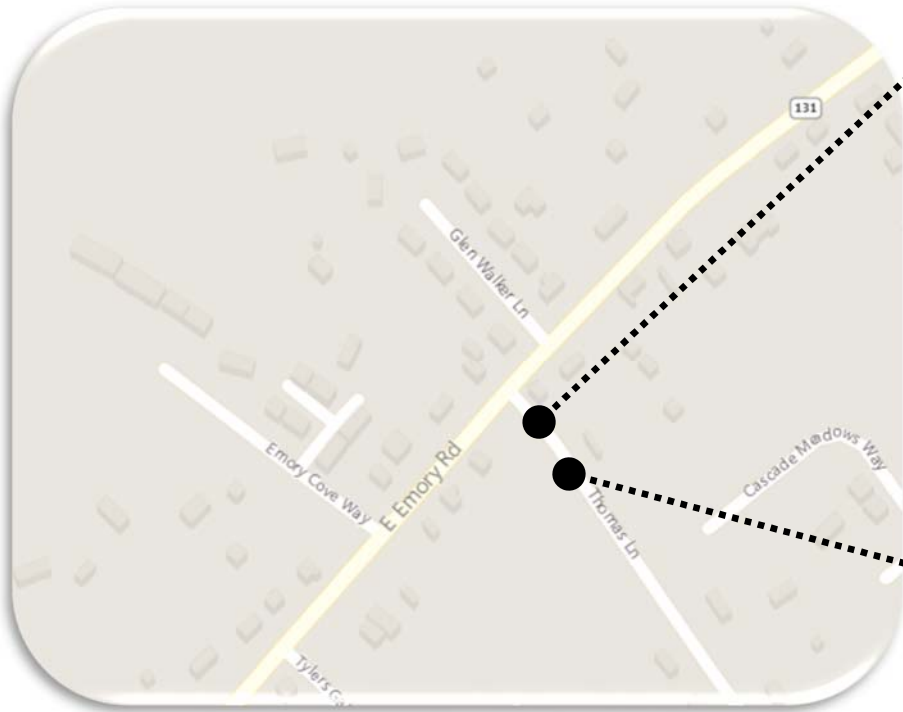
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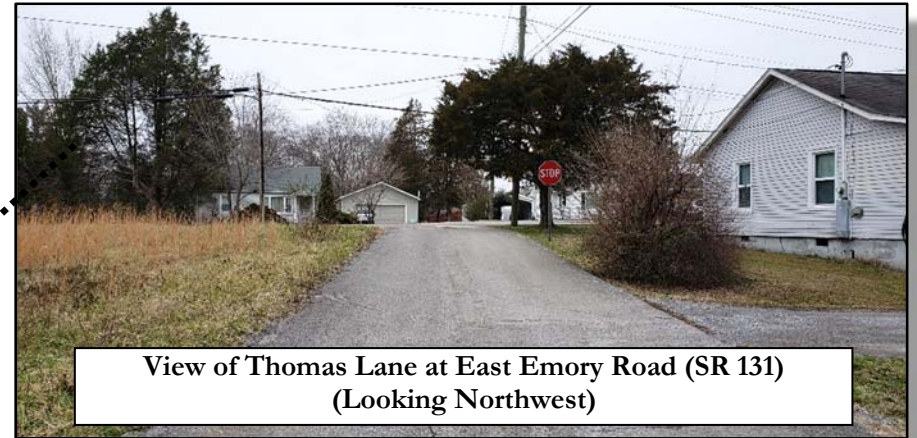
FIGURE 2
 Thomas Lane Subdivision
 Traffic Count Location & Existing Lane Configurations

PHOTO EXHIBITS

8



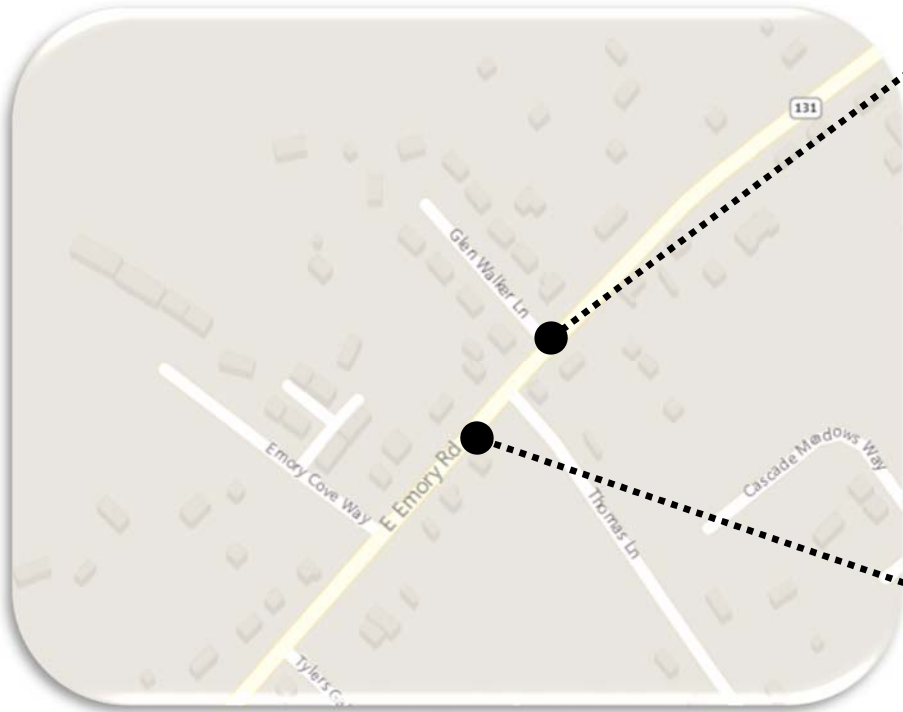
East Emory Road (SR 131) at Thomas Lane



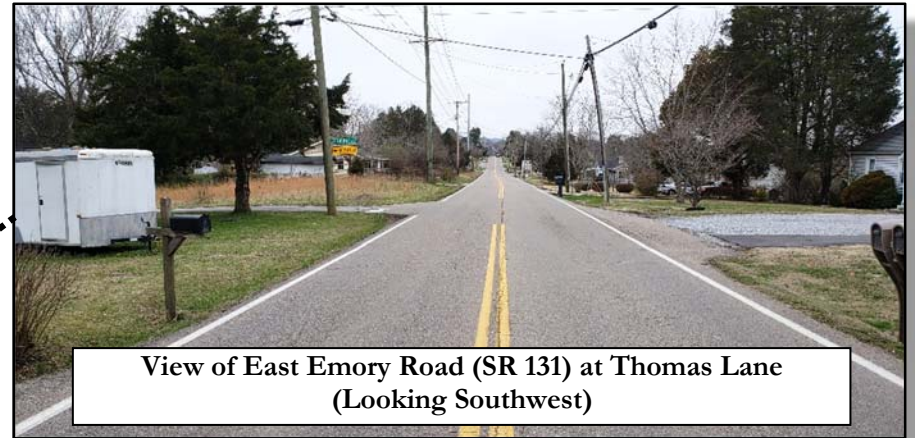
**View of Thomas Lane at East Emory Road (SR 131)
(Looking Northwest)**



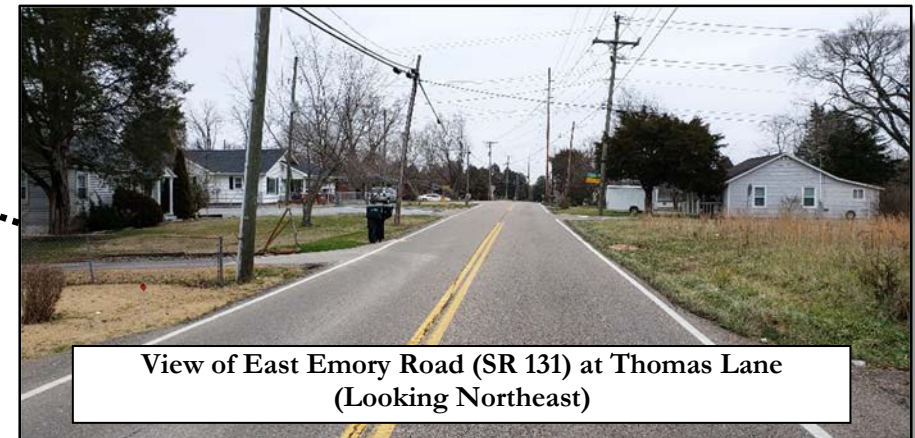
**View of Thomas Lane
(Looking Southeast)**



East Emory Road (SR 131) at Thomas Lane



View of East Emory Road (SR 131) at Thomas Lane (Looking Southwest)



View of East Emory Road (SR 131) at Thomas Lane (Looking Northeast)

■ **EXISTING TRANSPORTATION VOLUMES PER MODE:**

There are two permanent vehicular traffic count locations adjacent to this project site. One count location is conducted by the Tennessee Department of Transportation (TDOT) on a yearly basis and one count location is conducted by the Knoxville Regional Transportation Planning Organization (TPO) on a biennial basis. The count location data is the following:

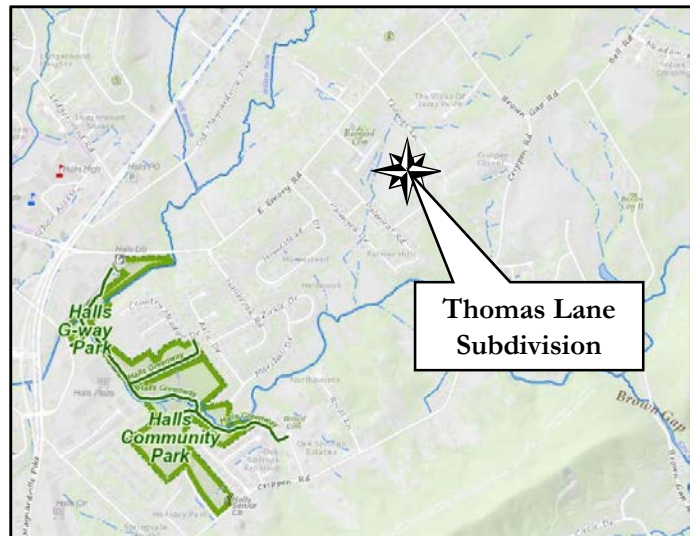
- Existing vehicular roadway traffic:
 - Average Daily Traffic (ADT) on East Emory Road (SR 131) approximately 3,000 feet to the west of the project site was reported by the TDOT at 12,222 vehicles per day in 2017. From 2007 – 2017, this count station has indicated a +1.1% average annual growth rate.
 - ADT on Brown Gap Road to the northeast of the project site was reported by the TPO at 2,150 vehicles per day in 2016. Traffic data at this location on Brown Gap Road has been collected biennially over the past 10 years. Based on data only from 2006, 2008, 2010, 2012, 2014, and 2016; the average annual growth rate was calculated to be +0.1%. All the researched historical traffic count data for this report can be viewed in Appendix A.

■ **ON-STREET PARKING:**

Currently, on-street parking is not allowed on East Emory Road (SR 131) or on Thomas Lane adjacent to the project site.

■ **PEDESTRIAN AND BICYCLE FACILITIES:**

Bicycle facilities (lanes) and pedestrian sidewalks are not currently available within the project site study area on East Emory Road (SR 131) or Thomas Lane. There are also not any greenways adjacent to the proposed site. The nearest greenway and park facilities to the proposed residential subdivision are located nearly 1 mile to the southwest of the project site near the intersection of East Emory Road (SR 131), Maynardville Pike (SR 33), and Norris Freeway (US 441). This recreation facility includes Halls Community Park and Halls Greenway Park and consists of paved trails, ball fields, and a playground.



■ **WALK SCORE:**

A private company offers an online website at walkscore.com that grades and gives scores to locations within the United States based on “walkability”, “bikeability”, and transit availability. According to the website, the numerical values assigned for the Walk Score and the Bike Score are based on the distance to the closest amenity in various relevant categories (businesses, schools, parks, etc.) and are graded from 0 to 100. The Transit Score measures how well a location is served by public transit based on distance and type of nearby transit. The Transit Score is also graded from 0 to 100.

Appendix B shows a map and other information for the Thomas Lane Subdivision residential development Walk Score, Bike Score, and Transit Score at the intersection of East Emory Road (SR 131) at Thomas Lane. Based on the project location, the site is given a Walk Score of 12. This Walk Score indicates that the site is almost completely dependent on vehicles for errands and travel. This low walkability score is due to the complete absence of sidewalks on East Emory Road (SR 131) to outside destinations/amenities even though there are several

potential destinations/amenities just to the south and west of the site along Maynardville Pike (SR 33). The site is given a Bike Score of 32, which means that there is minimal bike infrastructure. Also, based on the project location, the site is given a Transit Score of 0 due to the lack of public transit at this location.

■ **TRANSIT SERVICES:**

The City of Knoxville has a network of public transit opportunities offered by Knoxville Area Transit (KAT). Bus service is not available in this area of Knox County. The overall KAT bus system map is in Appendix C. The closest public transit KAT bus service stop location is located to the south 4.4 miles away (by roadway) on North Broadway. This KAT service is Route 22 “Broadway”. It operates on weekdays and weekends and this route map is also included in Appendix C. Other transit services include the East Tennessee Human Resource Agency (ETHRA) and the Community Action Committee (CAC) which provides transportation services when requested along with private taxis, and ride-sharing opportunities (Uber, etc.).

PROJECT DESCRIPTION

■ LOCATION AND SITE PLAN:

The proposed plan layout given by Batson, Himes, Norvell & Poe is shown in Figure 3. As can be seen in the figure, two entrance roadways will tie onto Thomas Lane. This residential development is expected to be comprised of a maximum of 91 single-family attached residential lots on approximately 18.83 acres. The residential lots in the development will average approximately 2,000 square feet in size. The proposed home sites and roadways are designed to maximize the lots on the property while providing large amounts of open space. Each attached residential home in the Thomas Lane Subdivision will include a one-car garage and there will be several smaller parking lots to provide for overflow and visitor parking. The parking lots will provide approximately 91 automobile parking spaces.

The existing site is currently unoccupied, and a large amount of the area is recently used for hay production. There are 4 existing single-family properties and lots on the west side of Thomas Lane that will be incorporated into the development. Two of these existing homes will be razed during construction for the Thomas Lane Subdivision and two will remain.

The proposed subdivision is expected to be constructed with three new internal paved roadways within the development. The total length of the 2-lane roadways within the development will be just at 1,625 feet and will include 11-foot lanes. Several areas within the property will be dedicated as common areas which will also include stormwater detention facilities. Due to the existing narrowness of Thomas Lane, the developer is proposing to widen Thomas Lane to 20 feet. This widening will occur from the intersection at East Emory Road (SR 131) for approximately 1,000 feet to the current end of Thomas Lane.

The actual schedule for completion of this new residential development is dependent on economic factors and construction timelines. 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 of the development and full occupancy will occur within the next 5 years (2024).

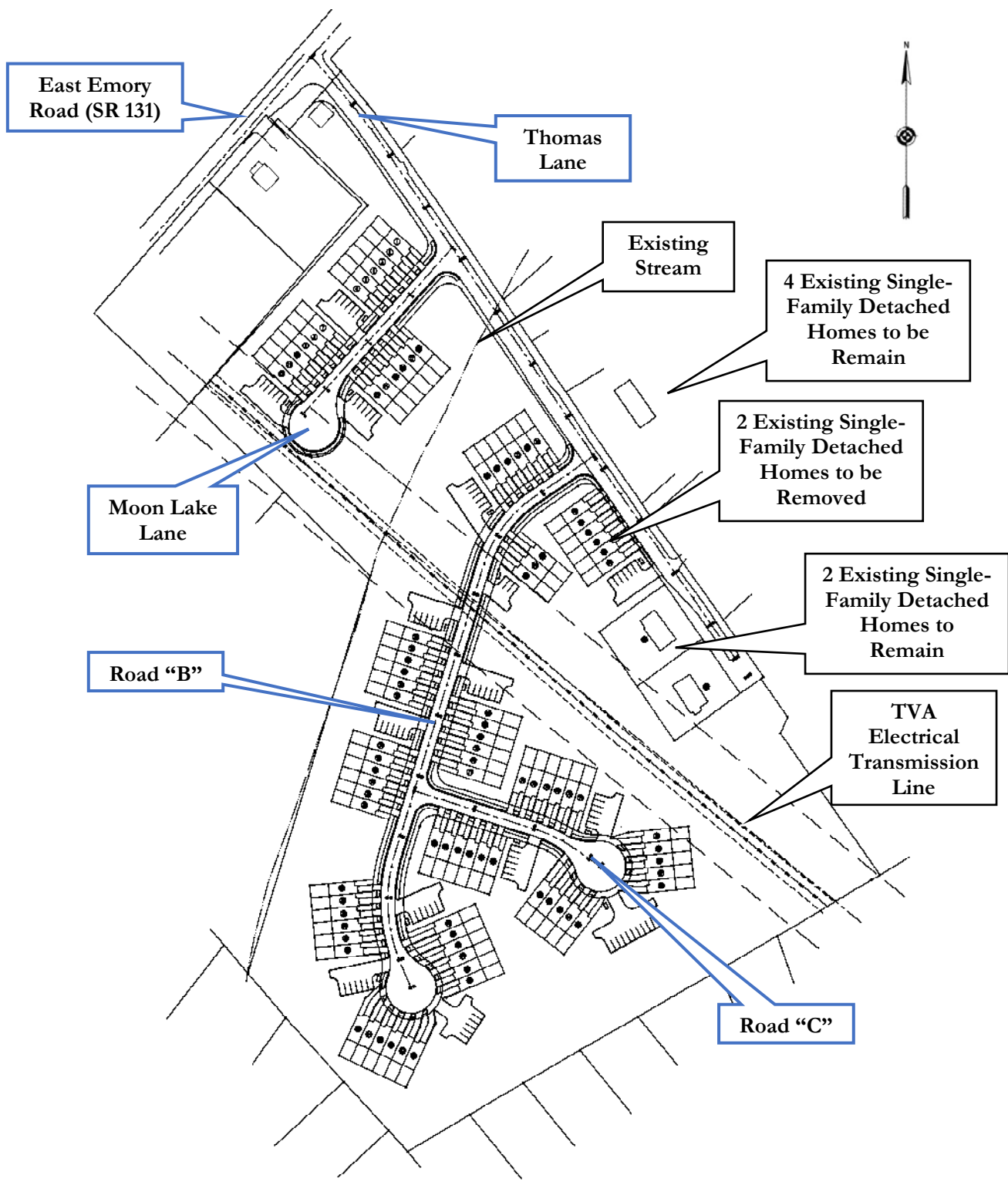


Figure 3
Plan Layout
Thomas Lane Subdivision

■ **PROPOSED USES AND ZONING REQUIREMENTS:**

The proposed single-family attached residential development is expected to be comprised of three new internal roadways with 91 lots on approximately 18.83 acres. The development will incorporate lots dedicated to common/green space in which some will incorporate the storm water controls for the development.

The property for the development is in Knox County and was rezoned in 2006 from Agricultural (A) to Planned Residential (PR) with an allowable density of 5 units per acre. The existing adjacent surrounding land uses are the following:

- The properties to the southwest of the proposed development are zoned General Residential (RB) and consist of Palmer Hills Subdivision. The properties in Palmer Hills consist of single-family detached homes.
- The property to the west of the proposed development is zoned Planned Residential (PR) and consists of Tyler Garden Condominiums.
- The properties to the northwest and northeast of the proposed development consist of a strip of single-family detached homes that are zoned as Agricultural (A) and front East Emory Road (SR 131).
- The properties to the northeast and east of the proposed development are zoned as Planned Residential (PR) and Low Density Residential (RA). These properties consist of single-family residential detached homes and The Villas of Teras Point development.
- The properties to the east and southeast of the proposed development are zoned as Agricultural (A) and consists of large single-family residential properties.

The Planned Residential (PR) zone allows for a variety of land uses primarily within the residential realm. Uses permitted in this zone include single family dwellings, duplexes, and multi-dwelling structures and developments. The current zoning map is provided in Appendix D.

- **DEVELOPMENT DENSITY:**

The proposed density for the residential development is based on a maximum of 93 lots (91 new single-family attached homes and 2 existing single-family detached homes) on 18.83 acres. This computes to 4.94 dwelling units per acre which is less than the allowable density of the property at 5 dwelling units per acre.

- **ON-SITE CIRCULATION:**

The total length of the new internal roadways within the development will be just over 1,625 feet. The internal 2-lane roadways for the development will be paved, include 6” extruded concrete curbing and the lane widths will be 13 feet for a total of 26-foot pavement width. A five-foot sidewalk with a 2-foot grass strip will be provided on both sides of the internal roadways.

The developer is proposing to widen Thomas Lane. One thousand feet of Thomas Lane will be widened to 20 feet beginning at the intersection with East Emory Road (SR 131) for approximately 1,000 feet to the current end of Thomas Lane. This road widening will include lane widths of 10 feet for both directions and an 8” extruded curb only on the west side of Thomas Lane. At the request of Knox County, the end of Thomas Lane will also be re-constructed to include a cul-de-sac.

- **SERVICE AND DELIVERY VEHICLE ACCESS AND CIRCULATION:**

In addition to passenger vehicles, the proposed internal roadways will also provide access to service, delivery, maintenance, and fire protection vehicles. It is not expected that any of these vehicles will interfere with off-site adjacent roadway operations other than when they occasionally enter and exit the development. The internal roadways in the subdivision are expected to be able to accommodate these types of vehicles along with passenger vehicles.

TRAFFIC ANALYSIS OF EXISTING AND PROPOSED CONDITIONS

■ EXISTING TRAFFIC CONDITIONS

Traffic counts were conducted at the intersection of East Emory Road (SR 131) at Thomas Lane as directed by the MPC.

Traffic counts at the intersection of East Emory Road (SR 131) at Thomas Lane were obtained on Wednesday, January 16, 2019, for a total of 8 hours. The counts were conducted during the morning, mid-day, and afternoon peak periods. Local schools were in session when the traffic counts were conducted. Based on the traffic volumes counted, the AM peak hour was observed from 7:00 – 8:00 AM. The PM peak hour of traffic was observed from 5:00 – 6:00 PM.

The manual tabulated traffic counts can be reviewed in Appendix E. In Figure 4, the volumes shown are from the existing traffic counts during the AM and PM peak hours observed at the intersection of East Emory Road (SR 131) at Thomas Lane. Overall, the vehicular traffic on Thomas Lane was non-existent during the peak hours but very heavy along East Emory Road (SR 131). Several school buses were observed during the traffic counts. Most of the traffic observed during the study traffic count was typical passenger vehicles.



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FIGURE 4

Thomas Lane Subdivision

2019 Peak Hour Traffic Volumes -
EXISTING TRAFFIC CONDITIONS

Capacity analyses were undertaken to determine the existing Level of Service (LOS) for the studied intersection with respect to vehicular traffic. The capacity analyses were calculated by following the methods outlined in the Highway Capacity Manual and using Synchro Traffic Software (Version 8). LOS is a qualitative measurement developed by the transportation profession of how well an intersection or roadway performs based on a driver's perception. 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. This grading system provides a reliable straightforward means to communicate road operations to the public. The Highway Capacity Manual (HCM) lists level of service criteria for unsignalized intersections and signalized intersections.

For unsignalized intersections, Level of Service is measured in terms of delay (in seconds). This measure is an attempt to quantify delay that includes travel time, driver discomfort, and fuel consumption. The LOS for a two-way stop (or yield) controlled intersection is defined by the delay for each minor approach and major street left-turn movement. Table 2 lists the level of service criteria for unsignalized intersections.

From the capacity calculations, the results from the existing peak hour vehicular traffic can be seen in Table 3 for the intersection. The intersection in the table is shown with a LOS designation, delay (in seconds), and v/c ratio (volume/capacity) for the AM and PM peak hours. A v/c ratio of 1 would indicate that the traffic volumes are at the roadway capacity. Appendix F includes the worksheets from the capacity analyses for the existing peak hour vehicular traffic. As can be seen in Table 3, the studied intersection is shown to operate at good levels during the existing AM and PM peak hours for westbound left turns but was calculated to operate at LOS C and LOS D for northbound left/right turning movements from Thomas Lane in the AM and PM peak hours respectively.

A/B



C/D



E/F



(Source: FDOT)

TABLE 2



LEVEL OF SERVICE AND DELAY FOR UNSIGNALIZED INTERSECTIONS



LEVEL OF SERVICE	DESCRIPTION	DELAY RANGE (seconds/vehicle)
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

TABLE 3
2019 PEAK HOUR LEVEL OF SERVICE & DELAY - EXISTING TRAFFIC CONDITIONS

INTERSECTION	TRAFFIC CONTROL	APPROACH	AM PEAK			PM PEAK		
			LOS	DELAY (seconds)	V/C	LOS	DELAY (seconds)	V/C
East Emory Road (SR 131) at Thomas Lane	Unsignalized	Northbound Left/Right	C	15.2	0.022	D	27.5	0.024
		Westbound Left	A	7.9	0.003	A	0.0	-

Note: All analyses were calculated in Synchro 8 software and reported with HCM 2010 methodology for intersections

■ **OPENING YEAR TRAFFIC CONDITIONS (WITHOUT PROJECT):**

Opening year traffic volume estimates represent the future condition the proposed study area is potentially subject to without the proposed project being developed (no-build option). As previously stated, the build-out and full occupancy for this proposed new residential development was assumed to occur in the year 2024. This corresponds to five years for the development to reach full capacity and occupancy.


Traffic growth on East Emory Road (SR 131) has shown overall positive growth over the past 10 years according to the TDOT count station (historical traffic data is shown in Appendix A). From 2007 thru 2017, the average annual growth rate was calculated to be +1.1%. Currently, there are no known other relevant significant upcoming developments adjacent to the proposed site on East Emory Road (SR 131) that would indicate large future increased traffic volumes in the study area in the short term. To ensure a reasonable estimate for this study, a 1.5% annual growth rate was used to consider any future development in the area and potential rising travel volumes. The results of this growth rate applied to the existing traffic volumes can be seen in Figure 5 for the year 2024. Figure 5 shows the projected opening year traffic volumes during the AM and PM peak hours at the intersection of East Emory Road (SR 131) at Thomas Lane based on an assumed annual growth rate of 1.5%. The volumes shown in Figure 5 could potentially exist in the future even without the proposed residential project being constructed and developed.

TDOT is planning to widen and improve 4.94 miles of East Emory Road (SR 131) from Maynardville Pike (SR 33) to Tazewell Pike (SR 331) at some point in the future. According to the TDOT website, the project status is currently in preliminary engineering. It is not known at this point the number of lanes that East Emory Road (SR 131) will be widened to and when this will occur. It is assumed for this study that this road widening and improvement will occur after 2024 when this development is assumed to have reached full build-out and occupancy.

The capacity analysis for the intersection of East Emory Road (SR 131) at Thomas Lane was calculated with these additional growth volumes for the year 2024. For vehicular traffic in the year 2024, the intersection was calculated to operate similarly to the existing conditions during the AM and PM peak hours. It is important to point out that these projected

calculated LOS designations for the intersection could potentially exist in the future even without the proposed Thomas Lane Subdivision being constructed and developed.

**TABLE 4
2024 PEAK HOUR LEVEL OF SERVICE & DELAY - OPENING YEAR (WITHOUT PROJECT)**

INTERSECTION	TRAFFIC CONTROL	APPROACH	AM PEAK			PM PEAK		
			LOS	DELAY (seconds)	V/C	LOS	DELAY (seconds)	V/C
East Emory Road (SR 131) at Thomas Lane	 Unsignalized	Northbound Left/Right	C	23.4	0.362	D	31.1	0.028
		Westbound Left	A	8.0	0.013	A	0.0	-

Note: All analyses were calculated in Synchro 8 software and reported with HCM 2010 methodology for intersections




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



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NORTH

FIGURE 5
Thomas Lane Subdivision
2024 Peak Hour Traffic Volumes -
OPENING YEAR TRAFFIC (WITHOUT
PROJECT)

■ TRIP GENERATION

A generated trip is a single or one-direction vehicle movement that is either entering or exiting the study site. The estimated amount of traffic that will be generated by the proposed 91 single-family attached homes was calculated based upon equations for peak hour trips provided by the Knoxville-Knox County Metropolitan Planning Commission (MPC). These equations were developed by the MPC from local studies to estimate apartment trip generation in the surrounding area and were published in December 1999. The 91 single-family attached homes are estimated to operate like an apartment complex since the units are attached, grouped together, and provide parking similar to an apartment complex.

The trip generation for the existing single-family detached residential homes on Thomas Lane was calculated based upon rates and equations for peak hour trips provided by Trip Generation Manual, 10th Edition, a publication of the Institute of Transportation Engineers (ITE).

The estimated number of generated trips for Thomas Lane includes the 91 single-family attached homes, the 2 existing single-family detached homes on the southwest side of Thomas Lane that will be incorporated in the Thomas Lane Subdivision, and an additional 4 existing single-family detached homes that access Thomas Lane from the northeast side. Including all these existing and proposed homes will provide traffic volume estimates in the future conditions on Thomas Lane. The trip rate data from the MPC and ITE for the proposed land uses are shown in Appendix G. A summary of this information is presented in the following table.

TABLE 5
TRIP GENERATION FOR THOMAS LANE SUBDIVISION
91 Single-Family Attached Homes (Apartments)
& 6 Existing Homes to Remain

ITE LAND USE CODE	LAND USE DESCRIPTION	UNITS	GENERATED DAILY TRAFFIC	GENERATED TRAFFIC AM PEAK HOUR			GENERATED TRAFFIC PM PEAK HOUR		
				ENTER	EXIT	TOTAL	ENTER	EXIT	TOTAL
Local Trip Rate	Apartments	91 homes	877	22%	78%		55%	45%	
				11	38	49	39	32	71
#210	Single-Family Detached Housing	6 Existing Homes to Remain	79	25%	75%		63%	37%	
				2	8	10	4	3	7
Total New Volume Site Trips			956	13	46	59	43	35	78

MPC Local Trip Rate and ITE Trip Generation Manual, 10th Edition

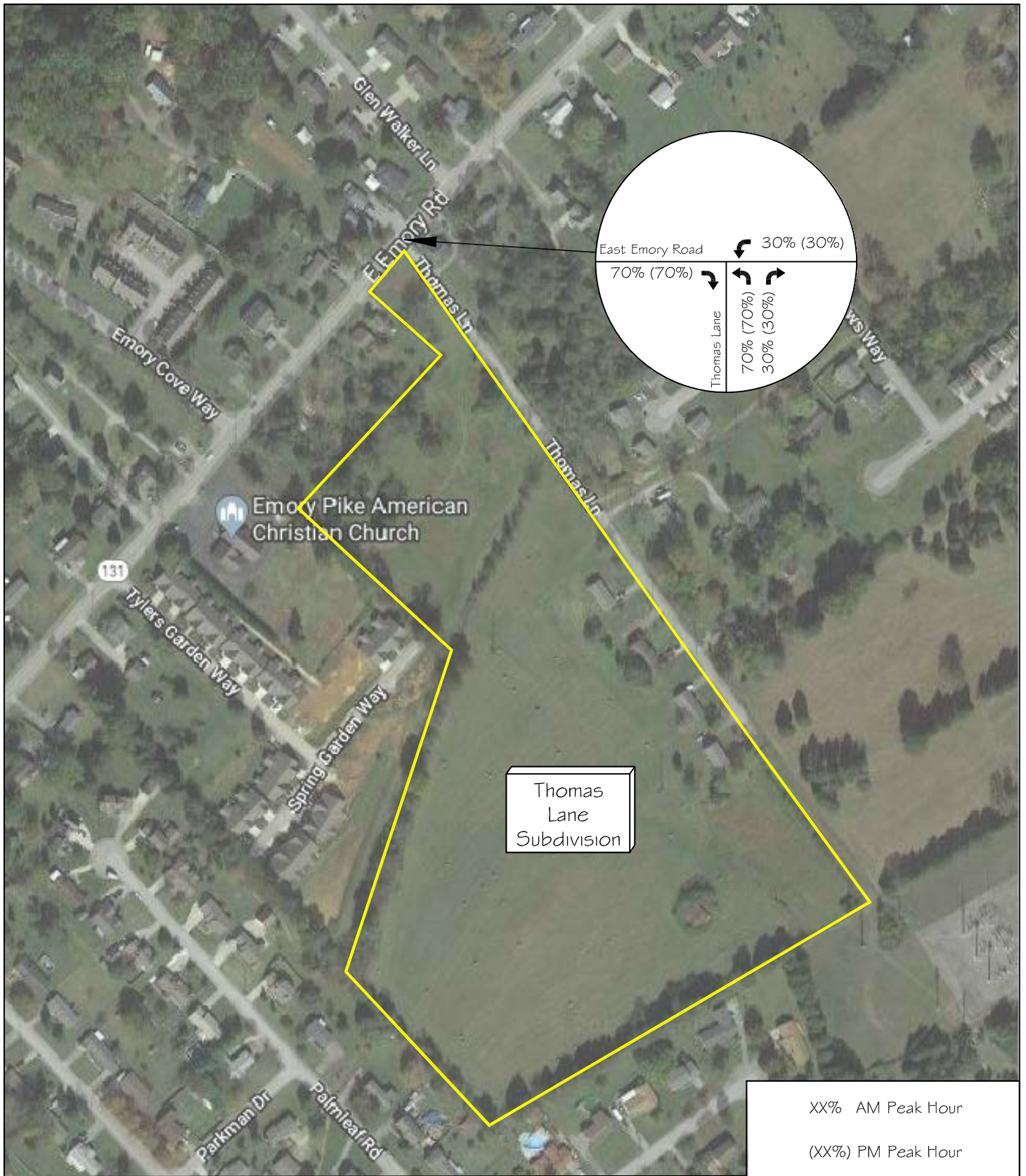
With a maximum of 91 single-family attached residences (apartments) and 6 existing single-family detached residences that will remain, it is estimated that 13 vehicles will enter Thomas Lane and 46 will exit, for a total of 59 generated trips during the AM Peak Hour in the year 2024. Similarly, it is estimated that 43 vehicles will enter Thomas Lane and 35 will exit, for a total of 78 generated trips during the PM Peak Hour in the year 2024. The calculated trips generated for an average weekday could be expected to be approximately 956 vehicles for the entire proposed development and the remaining existing homes in the year 2024. No trip reductions were included either for pass-by or internal trips.

■ TRIP DISTRIBUTION AND ASSIGNMENT

Figure 6 shows the projected distribution for traffic entering/exiting Thomas Lane during the future AM and PM peak hour at the intersection of East Emory Road (SR 131) at Thomas Lane. The percentages that are shown pertain to the trips generated by the new proposed residential dwellings in the subdivision and the existing remaining homes on Thomas Lane that were calculated from the ITE Trip Generation Manual. These percentages were determined based on the existing traffic volume movements collected during the traffic count.

There are a variety of destinations that will potentially “attract” the projected traffic to and from the new development and the existing homes on Thomas Lane. Most of these destinations will be accessed by using Maynardville Pike (SR 33) to the north and west via East Emory Road (SR 131). In addition to employment centers and commercial development, traffic will travel to and from a variety of public and private elementary, middle, and high schools. This proposed residential development is currently zoned for Adrian Burnett Elementary School, Halls Middle School, and Halls High School.

Figure 7 shows the Traffic Assignment of the computed trips that will be generated by the new development and the existing homes on Thomas Lane (from Table 5) and applied to the various intersection movements based on the assumed distribution of trips shown in Figure 6.



11812 Black Road
Knoxville, TN 37932
Phone: (865) 556-0042
Email: ajaxengineering@gmail.com

NOT TO SCALE

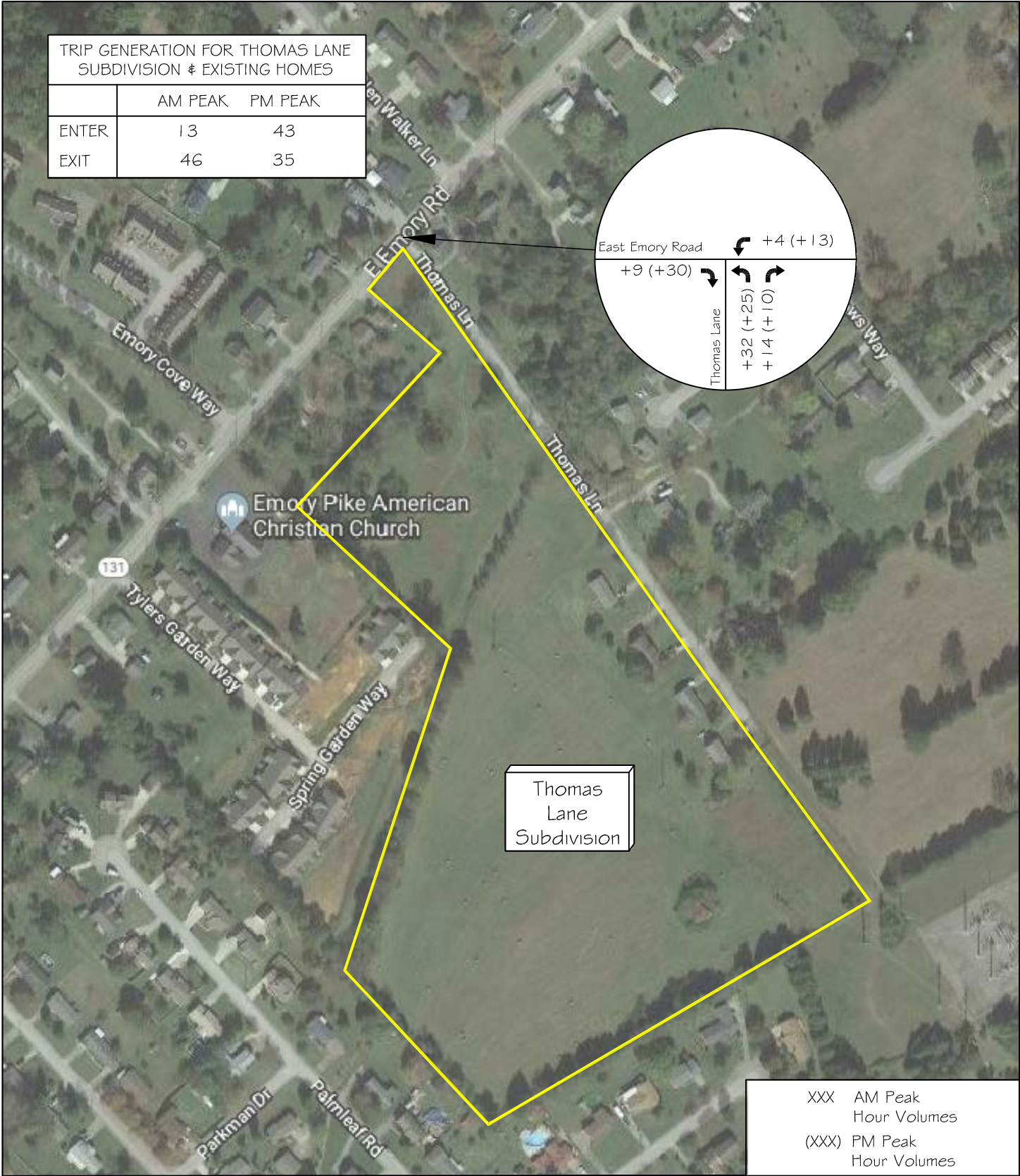


FIGURE 6

Thomas Lane Subdivision

Directional Distribution of Generated Traffic during AM and PM Peak Hour

TRIP GENERATION FOR THOMAS LANE SUBDIVISION & EXISTING HOMES		
	AM PEAK	PM PEAK
ENTER	13	43
EXIT	46	35



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 Email: ajaxengineering@gmail.com

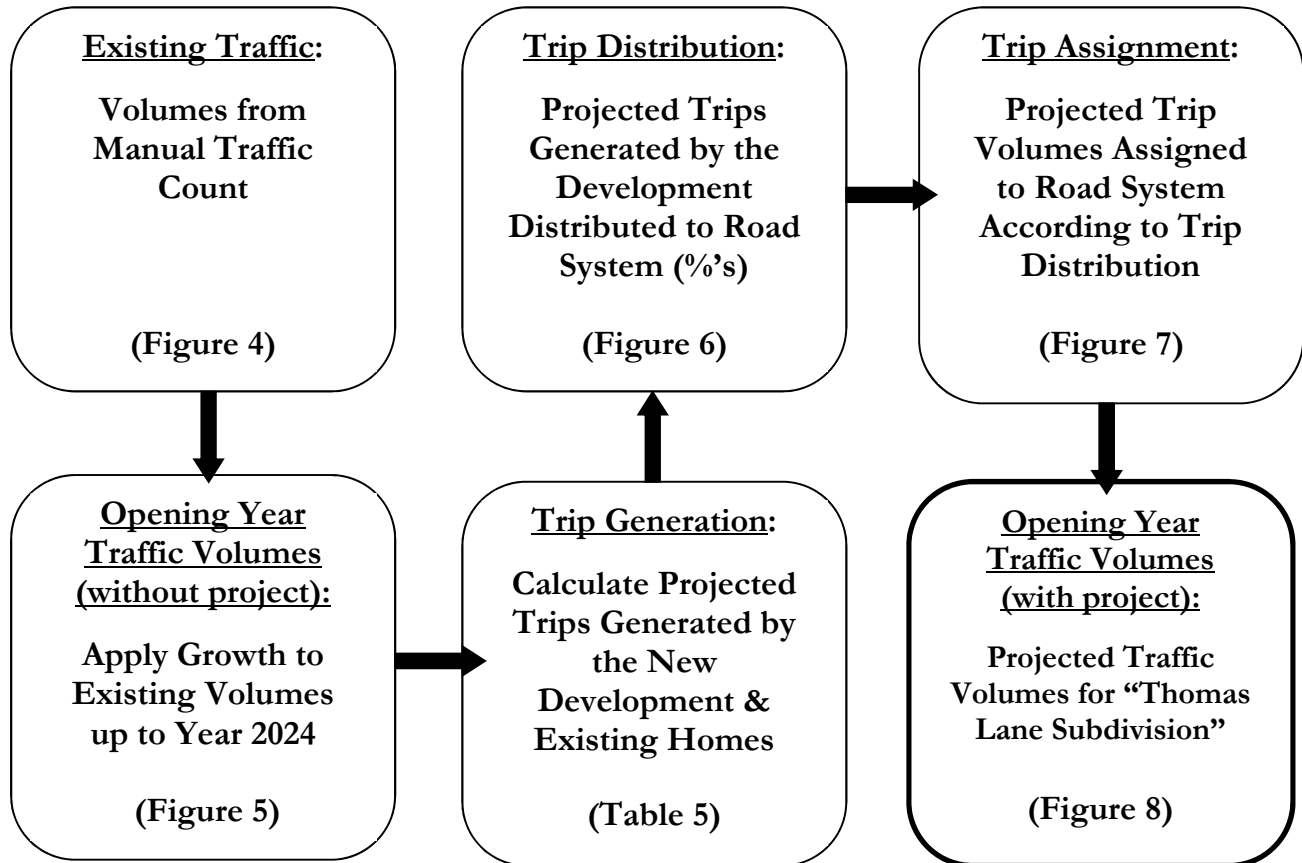
NOT TO SCALE



FIGURE 7
 Thomas Lane Subdivision
 Traffic Assignment of Generated
 Traffic during AM and PM Peak Hour

■ **OPENING YEAR TRAFFIC CONDITIONS (WITH PROJECT)**

Overall, several additive steps were taken to estimate the total opening year projected traffic volumes at the intersection of East Emory Road (SR 131) at Thomas Lane when the residential development is fully constructed and occupied in the year 2024. The steps are illustrated below for clarity:



To calculate the total future projected traffic volumes at the studied intersection, the calculated peak hour traffic (from ITE Trip Generation) generated by the new proposed residential development and existing homes was added to the 2024 opening year traffic eastbound and westbound volumes at the intersection of East Emory Road (SR 131) at Thomas Lane (shown in Figure 5) in accordance with the predicted directional distributions and assignments (shown in Figures 6 and 7). This procedure was necessary to obtain the total projected traffic volumes at the time the development is fully built-out. Figure 8 shows the projected AM and PM peak hour volumes at the studied intersection for the year 2024.



11812 Black Road
 Knoxville, TN 37932
 Phone: (865) 556-0042
 Email: ajaxengineering@gmail.com

NOT TO SCALE



FIGURE 8


Thomas Lane Subdivision

2024 Peak Hour Traffic Volumes -
 OPENING YEAR TRAFFIC (WITH
 PROJECT)

Capacity analyses were conducted to determine the projected Level of Service for vehicles at the studied intersection for the year 2024 with the development traffic. Appendix F includes the worksheets for these capacity analyses.

The results of the capacity calculations of the projected 2024 peak hour vehicular traffic volumes at the intersection of East Emory Road (SR 131) at Thomas Lane can be seen in Table 6 for the AM and PM peak hour. As compared to Table 4, the overall delays are increased as expected with the addition of the traffic volumes generated by the residential development. As can be seen in the table, the northbound approach is calculated to operate at LOS F with respect to capacity in the PM peak hour. This large calculated delay is due to the increase in northbound generated volumes combined with the large traffic volumes on East Emory Road (SR 131).

TABLE 6
2024 PEAK HOUR LEVEL OF SERVICE & DELAY - OPENING YEAR (WITH PROJECT)

INTERSECTION	TRAFFIC CONTROL	APPROACH	AM PEAK			PM PEAK		
			LOS	DELAY (seconds)	V/C	LOS	DELAY (seconds)	V/C
East Emory Road (SR 131) at Thomas Lane	 Unsignalized	Northbound Left/Right	D	25.1	0.404	F	97.2	0.817
		Westbound Left	A	8.0	0.017	B	10.1	0.020

Note: All analyses were calculated in Synchro 8 software and reported with HCM 2010 methodology for intersections

▪ **POTENTIAL SAFETY ISSUES**

The study area was investigated for potential existing and future safety issues. Several features of the adjacent transportation system were identified and are discussed in the following pages.

▀ **SPOT SPEED STUDY**

A spot speed study was conducted on East Emory Road to sample and tabulate the existing vehicle speeds along the road in the vicinity of the proposed development. The equipment used for the speed study was a Bushnell Speedster III Radar Speed Gun. The vehicles that were tabulated for the spot speed study were the eastbound and westbound motorists along East Emory Road near the intersection with Thomas Lane.

As expected, the results of the study indicate that most of the traffic along East Emory Road travels at a higher speed than the posted speed limit. The posted speed limit on East Emory Road is 45 mph. The results of the spot speed study indicate that the observed 85th percentile speed was 48 mph. The spot speed field observations are provided in Appendix H.

▀ **EVALUATION OF TURN LANE THRESHOLDS**

The intersection of East Emory Road (SR 131) at Thomas Lane was evaluated for the need for separate turn lanes for entering vehicles into the development in the year 2024. The standard design policy that was used for these turn lane evaluations is based on “Knox County’s Access Control and Driveway Design Policy”. This design policy by Knox County relates vehicle volume thresholds based on prevailing speeds for two-lane roadways. Using these criteria, a determination was made whether turn lanes are warranted.

Based on the projected traffic volumes at the intersection of East Emory Road (SR 131) at Thomas Lane and according to “Knox County’s Access Control and Driveway Design Policy”, a separate left (westbound) turn lane is not warranted on East Emory Road (SR 131) for entering vehicles. However, a separate right (eastbound) turn lane is warranted on East Emory Road (SR 131). The Knox County turn lane policy worksheets are in Appendix I and the results given in the Appendix are based on the projected volumes during the AM and PM

peak hour volumes at the intersection in the year 2024. The speed classification that was chosen for this evaluation was based on the spot speed study on East Emory Road that showed the 85th percentile speed was 48 mph. Therefore, this study evaluation used the Knox County classification for speeds of 46 to 55 mph and the calculated projected volumes.

➤ **EVALUATION OF SIGHT DISTANCE**

Based on the spot speed study on East Emory Road (SR 131) and Knox County policy of requiring 10 feet of sight distance per 1 mph of speed, the required intersection sight distance would be 480 feet looking each direction on East Emory Road (SR 131) at the intersection with Thomas Lane.

Using a rolling measuring wheel and looking northeast at the intersection of East Emory Road (SR 131) and Thomas Lane, the sight distance was measured to be approximately 450 feet at the roadway edge. Sight distance looking to the southwest at the intersection of East Emory Road (SR 131) and Thomas Lane was measured to be approximately 1,200 feet at the roadway edge. Some existing features and obstacles may reduce these estimated sight distances. Vegetation, mailboxes, fences, and utility poles are present within the sight distance zones and could severely limit the required sight distance. The site designer should ensure that these sight distance lengths are met, and they should be labeled on the plans. Measuring more accurate sight distances on East Emory Road (SR 131) will need to be performed by a licensed surveyor.



**View of Sight Distance on East Emory Road (SR 131)
Looking Northeast from Thomas Lane**



**View of Sight Distance on East Emory Road (SR 131)
Looking Southwest from Thomas Lane**

CONCLUSIONS AND RECOMMENDATIONS

The following is an overview of recommendations to minimize the traffic impacts of the proposed development on the surrounding road system while attempting to achieve an acceptable level of traffic flow and safety.

1) **East Emory Road (SR 131) at Thomas Lane:**

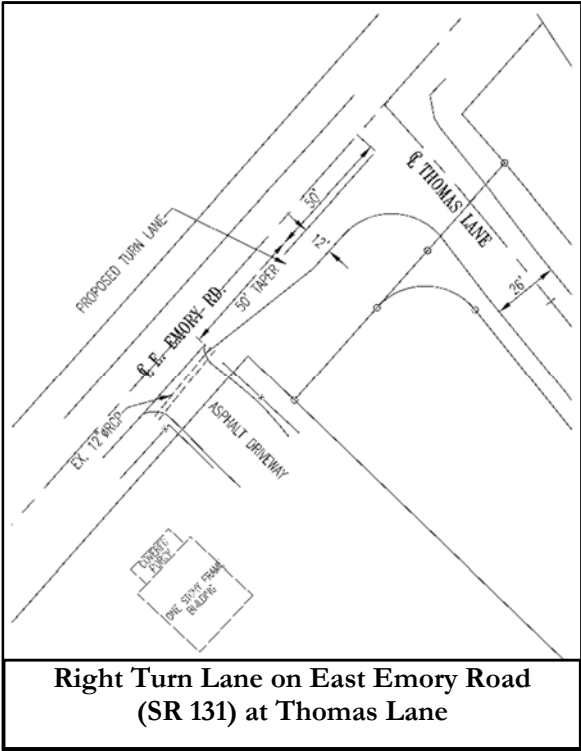
From the capacity calculations, it has been shown (Table 6) that the level of service for vehicles exiting out of the development will operate at a reduced level in the projected conditions in the year 2024, especially in the PM peak hour. For the projected PM peak period in the year 2024, northbound left and right turning exiting vehicles are calculated to operate at LOS F. This lower level of service is directly related to the large amount of eastbound and westbound thru movements on East Emory Road (SR 131) in the peak periods that will conflict with northbound exiting vehicles. During peak periods, queues are expected to form at the northbound approach on Thomas Lane and drivers will experience large delays.

- 1a) A separate right (eastbound) turn lane on East Emory Road (SR 131) for turning vehicles onto Thomas Lane is recommended based on the projected volumes. The East Emory Road (SR 131) at Thomas Lane intersection turn lane need was evaluated based on the projected 2024 traffic volumes at the intersection and according to “Knox County’s Access Control and Driveway Design Policy”.

As part of the construction of the Thomas Lane Subdivision, the developer is planning on widening Thomas Lane to 20 feet. As part, and in addition to this road widening, the design by Batson, Himes, Norvell & Poe also shows plans for constructing a right turn lane that has a storage length of 50 feet with a taper length of 50 feet for a total length of 100 feet. The stopping sight distance recommended by A Policy on Geometric Design of Highway and Streets by AASHTO (American Association of State Highway and Transportation Officials) is 360 feet to decelerate from 45 mph. However, this recommended length is based on vehicles coming to a complete stop and the right turning

vehicles coming off East Emory Road (SR 131) at Thomas Lane will not completely stop.

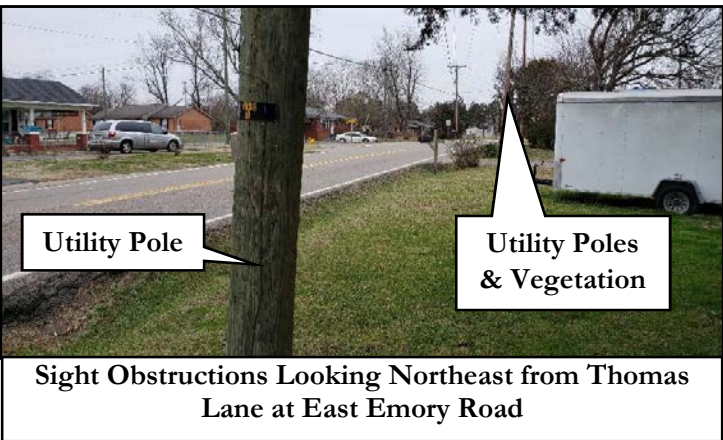
There is an existing residential driveway located 100 feet to the west of this intersection at 4830 East Emory Road (SR 131). This existing residential driveway reduces the amount of distance available to construct a right turn lane. Once an accurate survey and design are completed, the available right turn lane length will be more defined. However, it is recommended that the storage length and taper length not be reduced any further than the total of 100 feet.



Right Turn Lane on East Emory Road (SR 131) at Thomas Lane

This 100-foot length is not ideal, but the possibility of constructing a longer right turn lane is hindered by an existing driveway located at 4830 East Emory Road (SR 131). If this property could be purchased by the developer, a more ideal storage length of 75 feet with a 150-foot taper could be provided.

1b) The recommended intersection sight distance requirement is 480 feet at the intersection of East Emory Road (SR 131) at Thomas Lane based on the spot speed study. The sight distance in both




directions at this intersection on East Emory Road (SR 131) will need to be maintained in the future and must not be impacted by future landscaping or by existing vegetation. The designer should ensure that this intersection is given the maximum amount of sight distance to provide clear unobstructed views. There are some existing features along East Emory Road (SR 131) that may impact the available sight distance that may need to be removed or relocated based on an official measurement by a licensed surveyor. The existing features that may impact sight distance include utility poles and vegetation.

The required sight distance should be measured at the intersection at a minimum of 15 feet from the edge of the roadway per Knox County Subdivision Regulations (Section 3.04.J.5). The sight distance should be measured from a driver eye height of three and one-half (3.50) feet on the minor road to a height of object at three and one-half (3.50) feet above the pavement surface on the major road. The sight distance must be measured and verified by a licensed land surveyor. With large delays potentially experience by northbound movements from Thomas Lane onto East Emory Road (SR 131), it is imperative that the required sight distance be available and maintained.

- 1c) This intersection was calculated to operate adequately in 2019 but projected to operate poorly with respect to the level of service for northbound turns during the year 2024 when the development is expected to be fully constructed and occupied.

Capacity analyses were re-calculated for the intersection of East Emory Road (SR 131) at Thomas Lane with an eastbound right turn lane added to the intersection as shown in the concept plan and as recommended based on the Knox County volume thresholds. Appendix F includes the worksheets for these capacity analyses. The results of the capacity calculations with the projected 2024 peak hour vehicular traffic volumes at this intersection with an eastbound right turn lane reduced the delay for the northbound approach by over 13 seconds in the PM peak hour. This is due to the right turns being removed from the eastbound thru lane movement. The results are shown in Table 7.

TABLE 7
2024 PEAK HOUR LEVEL OF SERVICE & DELAY - OPENING YEAR (WITH PROJECT)
WITH ADDED EASTBOUND RIGHT TURN LANE

INTERSECTION	TRAFFIC CONTROL	APPROACH	AM PEAK			PM PEAK		
			LOS	DELAY (seconds)	V/C	LOS	DELAY (seconds)	V/C
East Emory Road (SR 131) at Thomas Lane		Northbound Left/Right	C	24.8	0.400	F	89.3	0.788
		Westbound Left	A	8.0	0.016	A	9.9	0.019

Note: All analyses were calculated in Synchro 8 software and reported with HCM 2010 methodology for intersections

- 1d) As an investigation into potential remediation for the projected high northbound vehicle delays, this intersection was examined with the projected 2024 traffic volumes with respect to traffic signal warrants. The traffic counts at this intersection were conducted from 7-9 am, 11 am–1 pm and 2-6 pm for a total of 8 hours.

The Manual on Uniform Traffic Control Devices – 2009 Edition (MUTCD) presents 9 different warrants that have been developed by the traffic engineering profession to determine whether a traffic signal is warranted. These warrants cover a broad range of minimum elements required to indicate whether a traffic signal is justified for any particular location. These elements consist of traffic volumes, pedestrian volumes, crash history, and other factors. The MUTCD explicitly states that a traffic control signal should not be installed unless one or more of the signal warrants in the manual are met. However, the satisfaction of a warrant does not entirely in itself justify the need for a traffic signal. Sometimes further engineering studies and judgments also need to be applied before justifying the need for the installation of a traffic signal. These further studies are a very important step in ensuring that installation of a traffic signal will not actually bring about degradations in safety and efficiencies.

The MUTCD defines 9 different warrants, two of which are potentially applicable to this intersection at this time and are explained below:

■ Warrant 1, Eight-Hour Vehicular Volume:
Warrant 1 is comprised of 2 conditions – A and B. The Minimum Vehicular Volume, Condition A, is intended for application where the volume of intersecting traffic is the principal reason for consideration of signal installation. The Interruption of Continuous Traffic, Condition B, is intended for application at locations where Condition A is not satisfied and 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.

■ 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 control signal.

The intersection of East Emory Road (SR 131) and Thomas Lane was evaluated for possible justification for a traffic signal based on the MUTCD Warrants listed above and the projected 2024 traffic count volumes. Thomas Lane was used as the minor side street for the warrant analysis and East Emory Road (SR 131) was the major street. The analysis shows that this intersection does not meet Warrant 1 or 2 in the projected 2024 conditions. The results of the traffic signal warrant assessment at this intersection for the projected volumes of 2024 are in Appendix J.

1e) As part of the analysis of the intersection, the projected queue length of the northbound lane on Thomas Lane in the year 2024 was calculated.

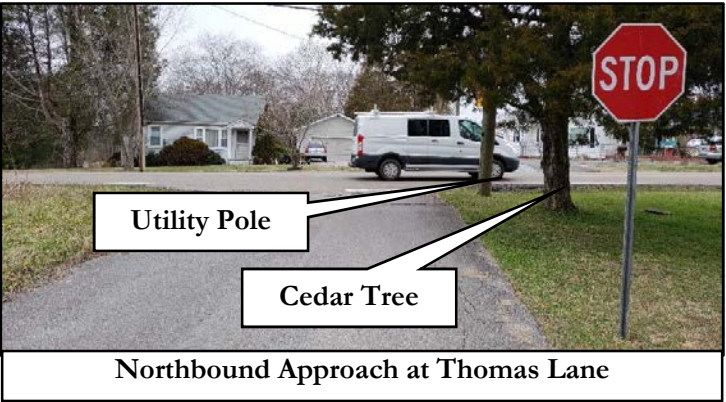
To estimate the projected queue length, SimTraffic (Version 8) software was employed. SimTraffic performs micro-simulation and animation of vehicular traffic and calculates various vehicle parameters such as intersection vehicle queue lengths. Based on the projected volumes during the AM and PM peak hours, the 95th percentile queue lengths were calculated. The 95th percentile queue is the recognized measurement in the traffic engineering profession as the design standard used when considering vehicle queue lengths. A 95th percentile queue means that there is a 95% certainty the queue will not extend

beyond that point. The calculated queue results were based on averaging the outcome obtained during 10 traffic simulations. The queue results from the SimTraffic software are in Appendix K.

The results shown in the Appendix indicate that the 95th percentile queue length for the northbound approach of Thomas Lane at East Emory Road (SR 131) was calculated to be 44 feet during the projected AM peak hour and 42 feet during the projected PM peak hour in the year 2024. This would indicate that even though the level of service will be quite poor during these peak hours, the estimated queue lengths are reasonable. A queue length of 44 feet would be just over two car lengths.

If the projected turns at the northbound approach at the intersection of East Emory Road (SR 131) at Thomas Lane was more balanced between left and right turns, an argument could be made to recommend separate left and right turn lanes. Since most northbound traffic will turn left to head west, coupled with the minimal queue lengths; it is believed that constructing another lane would not be justified despite the poor level of service during the peak periods.

- 1f) Currently, there is a Stop Sign (R1-1) and a white stop bar applied at the Thomas Lane approach at East Emory Road (SR 131). However, due to an existing cedar tree, the Stop Sign (R1-1) is



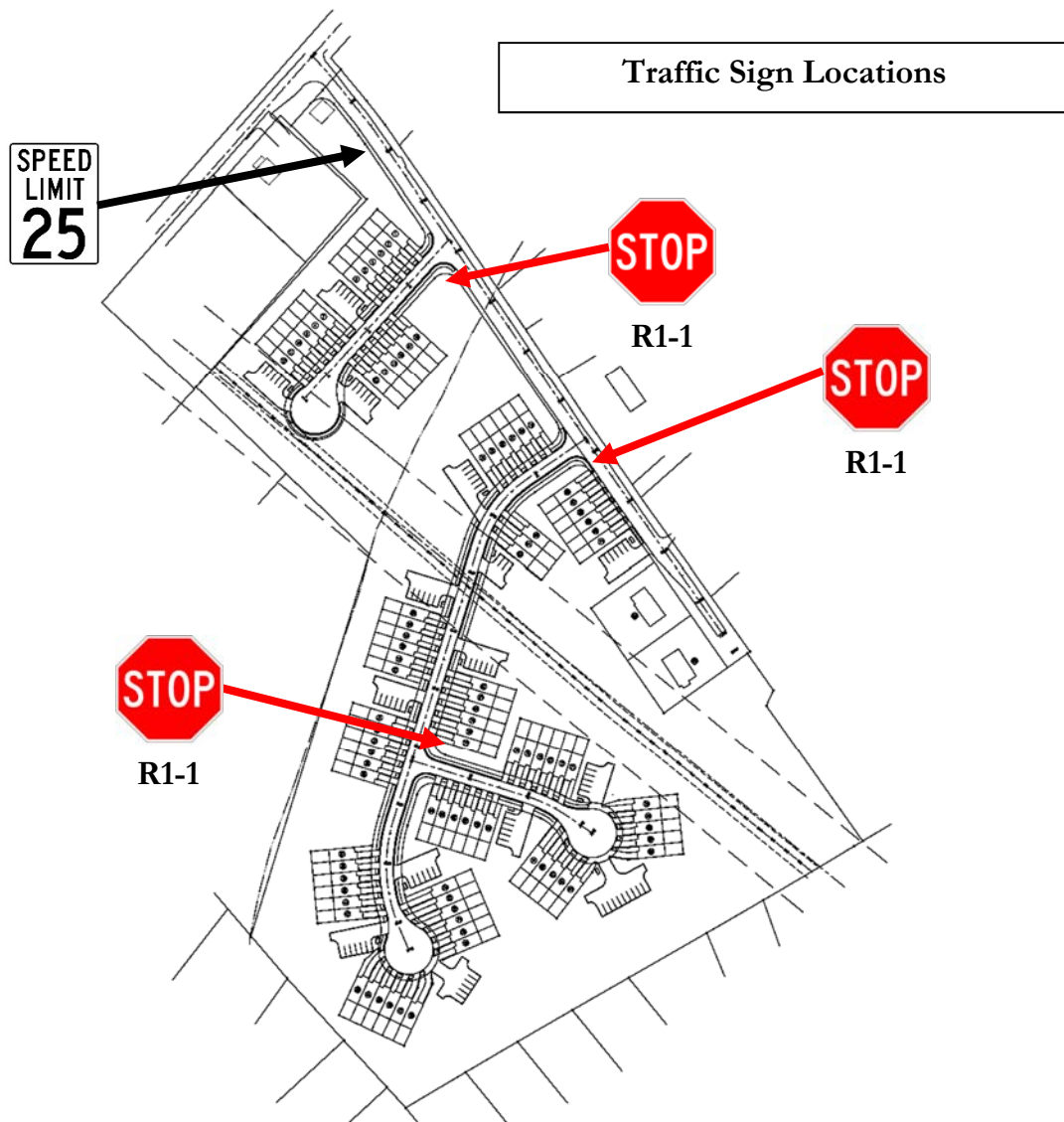
posted approximately 30 feet away from the white stop bar. As part of the widening of Thomas Lane by the developer, it is recommended that the cedar tree and utility pole in the southeast corner of the intersection be removed and relocated respectively. Eliminating these existing features will reduce interference with sight distance, allow the Stop Sign (R1-1) to be moved closer to the white stop bar, and allow for a larger turn radius be constructed for

northbound right turns heading east. During the widening of Thomas Lane, the stop bar should be reapplied at a minimum of 4 feet away from the edge of East Emory Road (SR 131) and should be placed at the desired stopping point that provides the maximum sight distance.

2) **Thomas Lane Subdivision Internal Roads:** The layout plan shows several new roadways being constructed within the development as shown in Figure 3.

2a) It is recommended that a 25-mph speed limit sign be posted on Thomas Lane just to the south of East Emory Road (SR 131) for vehicles traveling towards the new proposed subdivision.

2b) Stop Signs (R1-1) should be installed at the internal intersections as shown below:



- 2c) Sight distance at the new internal intersections must not be impacted by new signage, future landscaping, or parked vehicles. For a posted 25 mph speed limit for the internal residential development streets, the internal intersection sight distance requirement is 250 feet. The required intersection sight distance at Thomas Lane at Road “B” and Moon Lake Lane is also 250 feet. The road layout designer should ensure that these sight distance lengths are met, maximized, and they should be labeled on the plans.
- 2d) All road grade and intersection elements internally and externally should be designed to AASHTO, TDOT, and Knox County Engineering specifications and guidelines to ensure proper operation.

3) **Pedestrian and Bicycle Considerations:**

- 3a) A 5-foot concrete sidewalk with a minimum 2-foot planting strip along all the internal roadways should be constructed at a minimum of one side of each road as shown in the layout plan.
- 3b) The sidewalks that are proposed for the development should have appropriate ADA compliant curbed ramps at the intersection corners.
- 3c) All drainage grates and covers for the residential development need to be pedestrian and bicycle friendly.

APPENDIX A

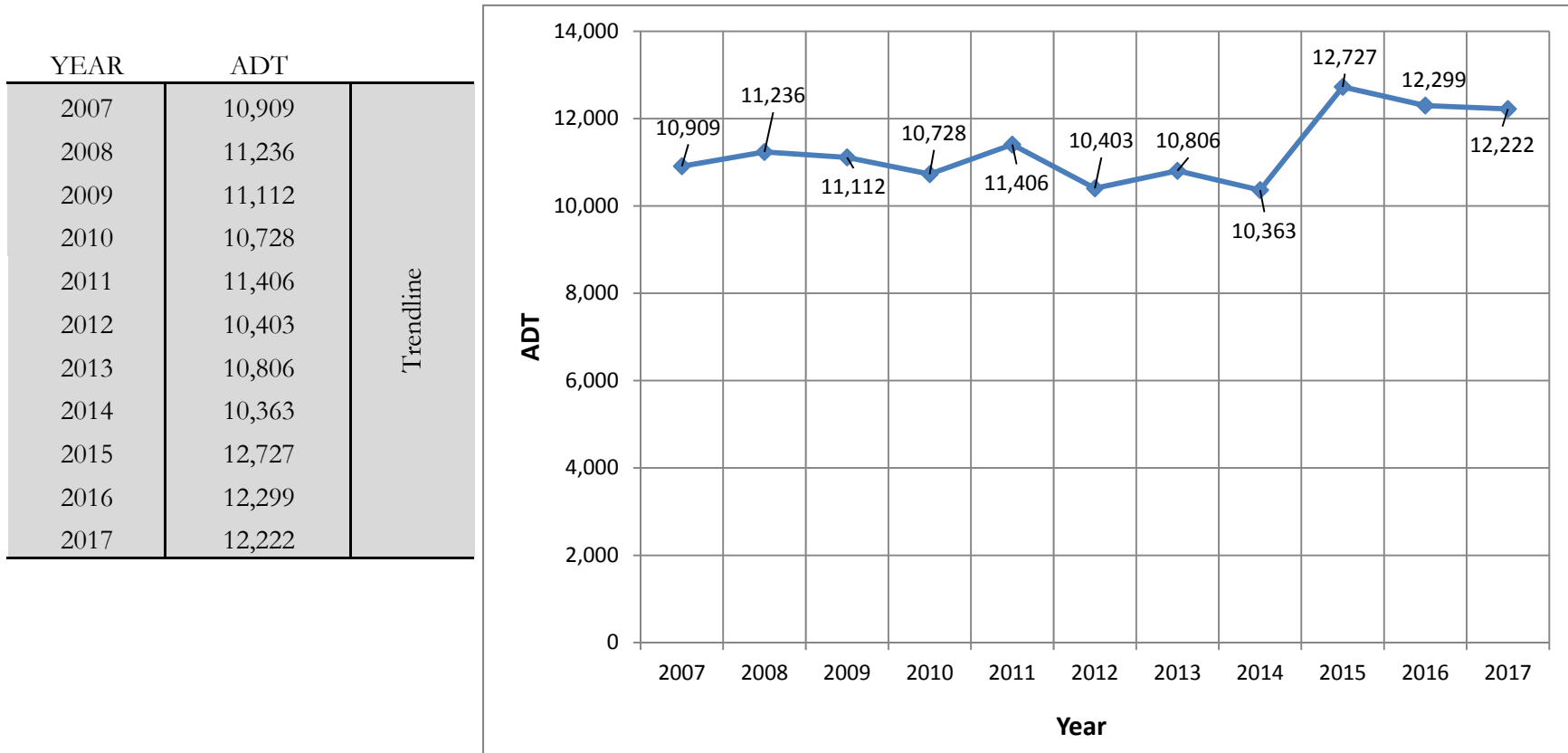
HISTORICAL TRAFFIC COUNT DATA

Historical Traffic Counts

Organization: TDOT

Station ID #: 000019

Location: SR 131 (East Emory Road), NE of Halls Cross Roads

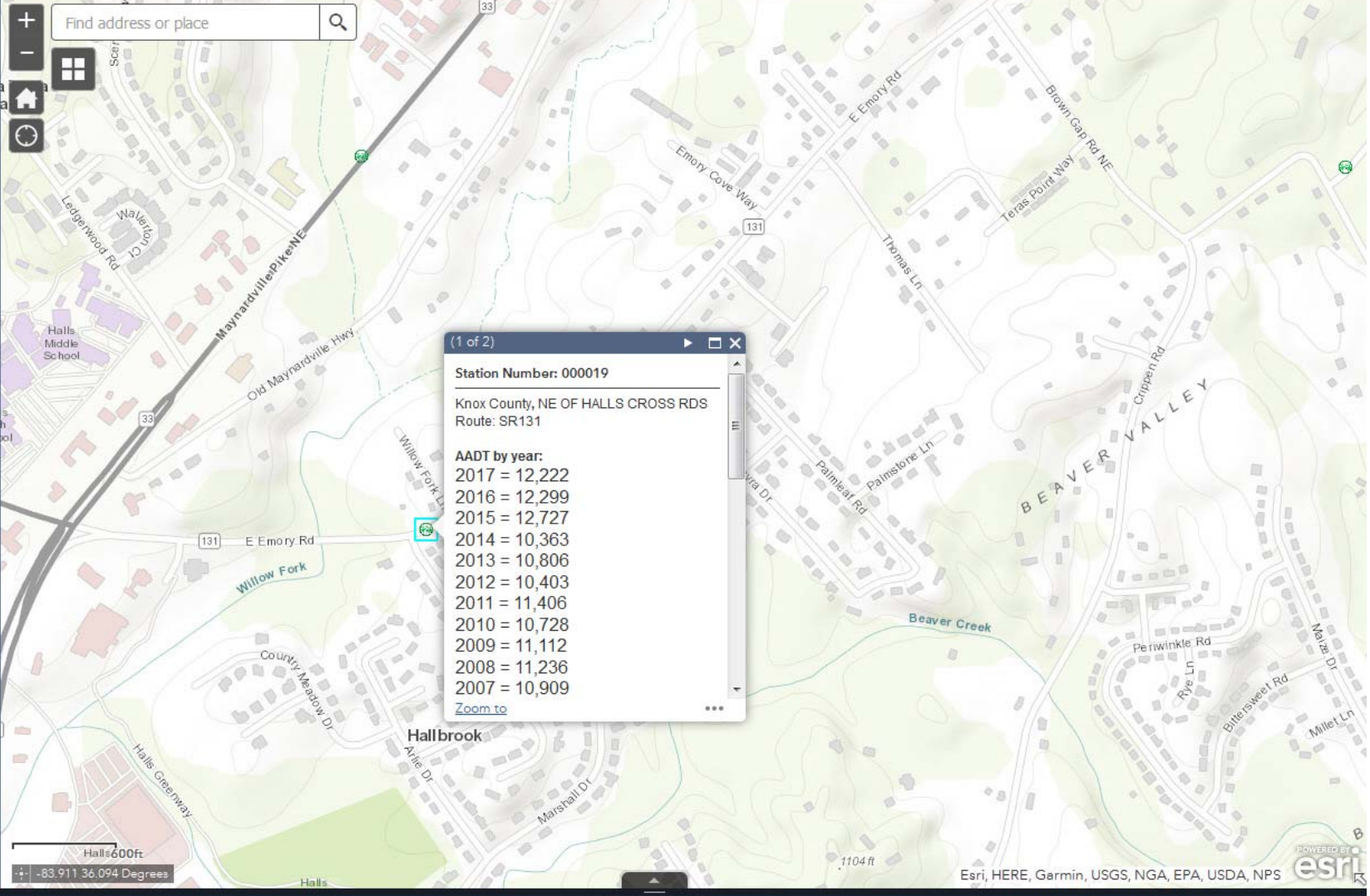


2007 - 2017 Growth Rate = 12.0%

Average Annual Growth Rate = 1.1%



Find address or place



(1 of 2)

Station Number: 000019

Knox County, NE OF HALLS CROSS RDS

Route: SR131

AADT by year:

2017	=	12,222
2016	=	12,299
2015	=	12,727
2014	=	10,363
2013	=	10,806
2012	=	10,403
2011	=	11,406
2010	=	10,728
2009	=	11,112
2008	=	11,236
2007	=	10,909

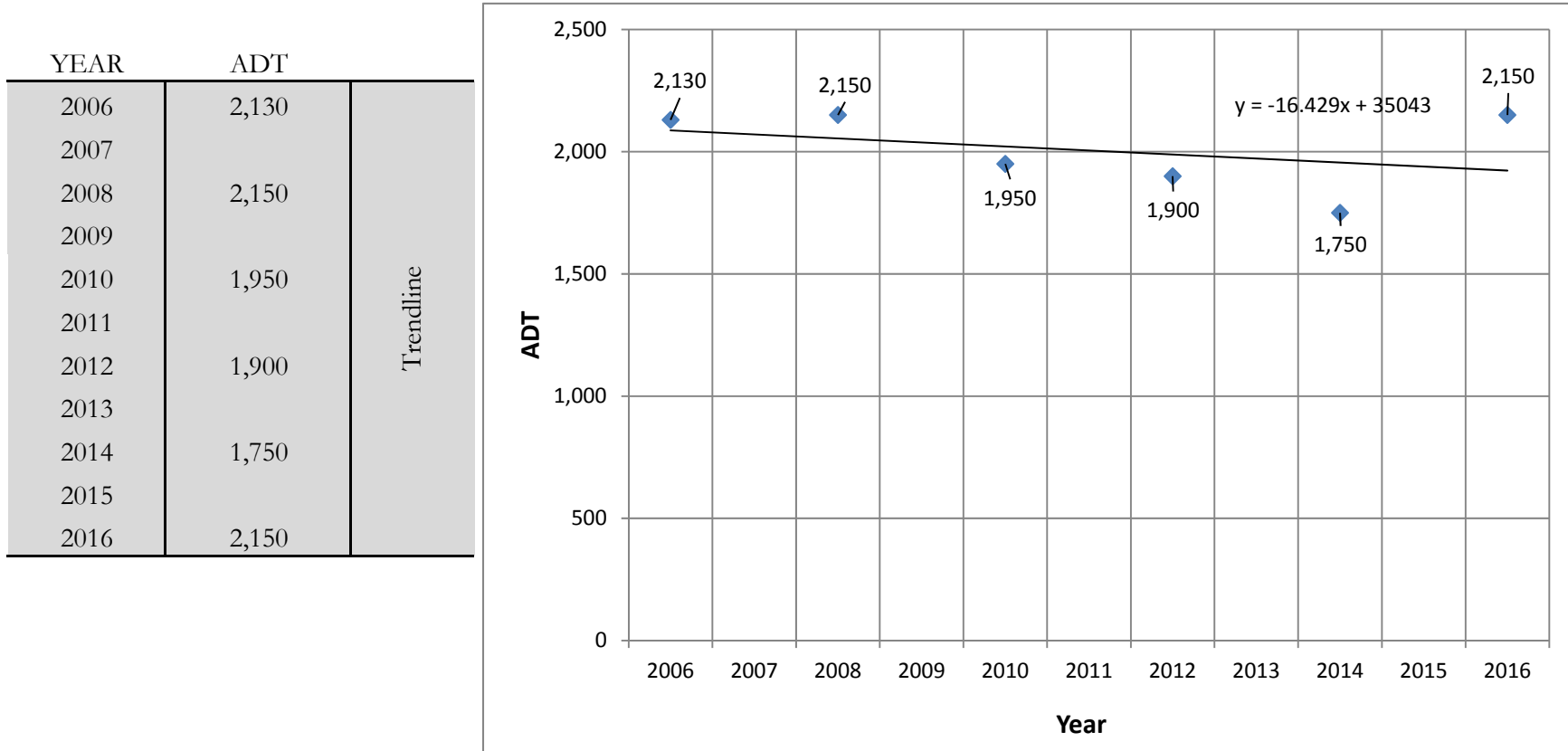
Zoom to

Historical Traffic Counts

Organization: TPO

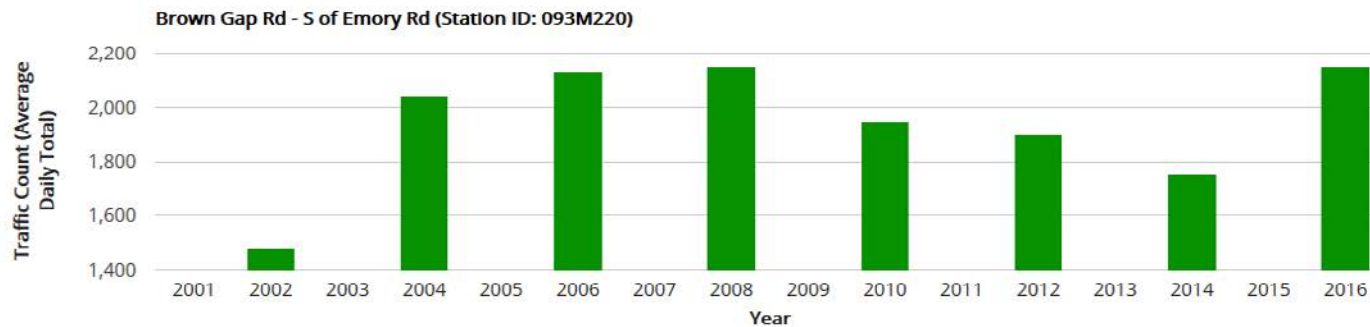
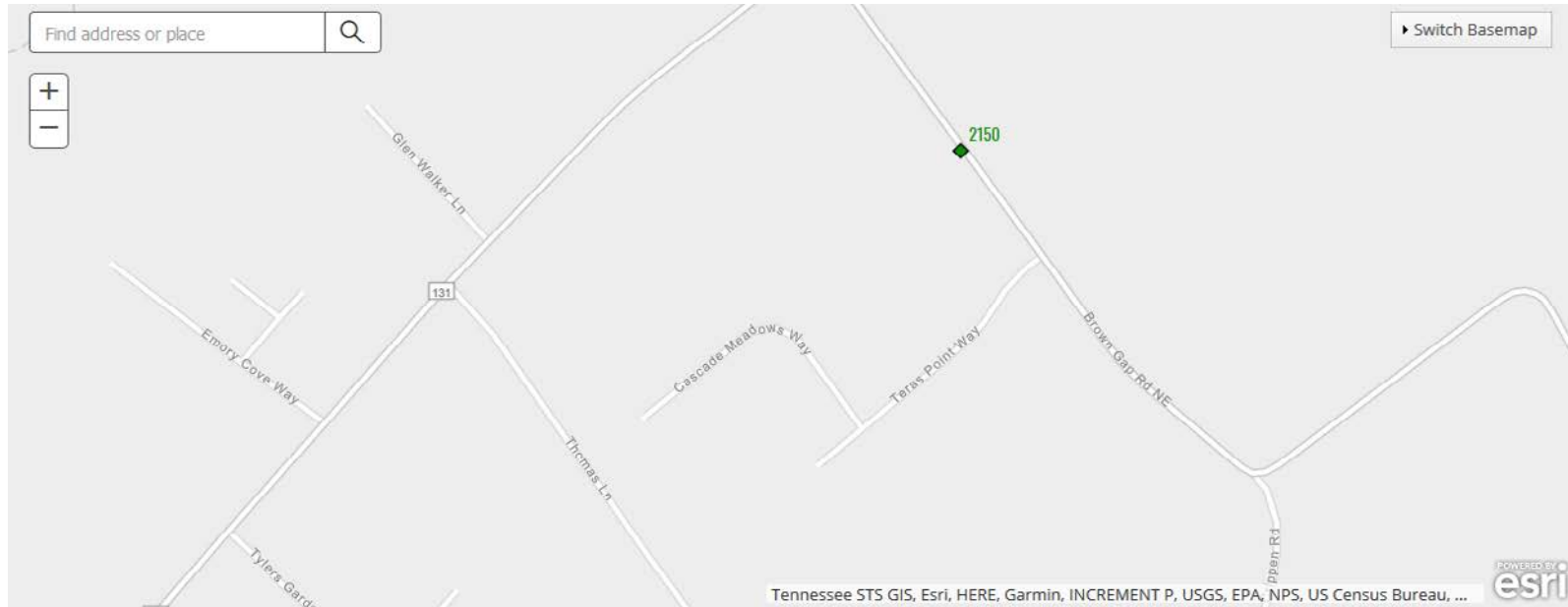
Station ID #: 093M220

Location: Brown Gap Road - S of Emory Road



2006 - 2016 Growth Rate = 0.9%

Average Annual Growth Rate = 0.1%




[Download CSV](#)

Click on a traffic count station above - ◆ (TDOT) or ◆ (TPO) or ✕ (Discontinued)- to view a chart with the historic traffic counts

APPENDIX B

WALK SCORE


WALK SCORE
(from walkscore.com)



Walk Score  [Get Scores](#) [Find Apartments](#) [My Favorites](#) [Add to Your Site](#)

Type an address, neighborhood or city


4830 Tennessee 131

Knoxville, Tennessee, 37938

Commute to **Downtown Knoxville** 

 30 min  60+ min  60+ min [View Routes](#)

[Favorite](#) [Map](#) [Nearby Apartments](#)

[Looking for a home for sale in Knoxville?](#) 

Walk Score
12

Car-Dependent
Almost all errands require a car.

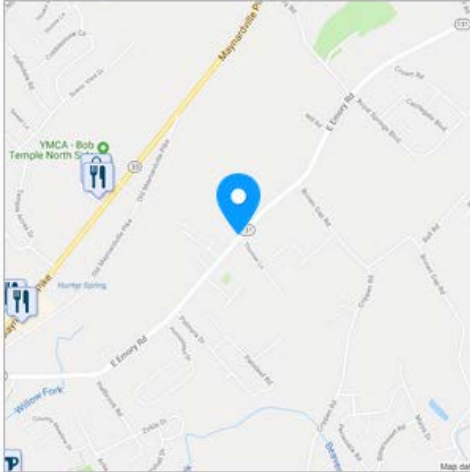
Transit Score
0

Minimal Transit
It is possible to get on a bus.

Bike Score
32

Somewhat Bikeable

[About your score](#)
[Add scores to your site](#)



Scores for 4830 Tennessee 131



Walk Score **12**

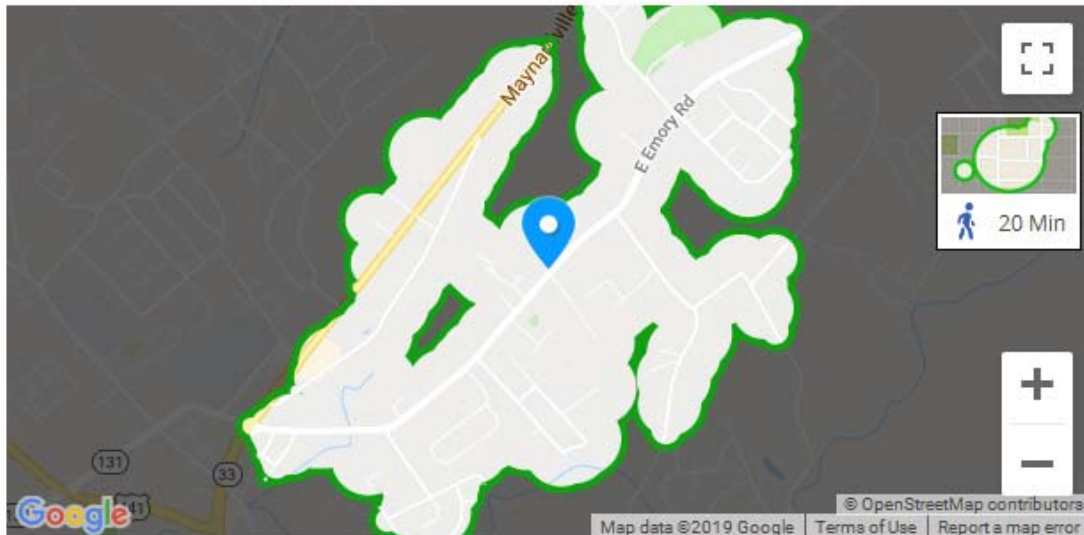
Bike Score **32**



Travel Time Map

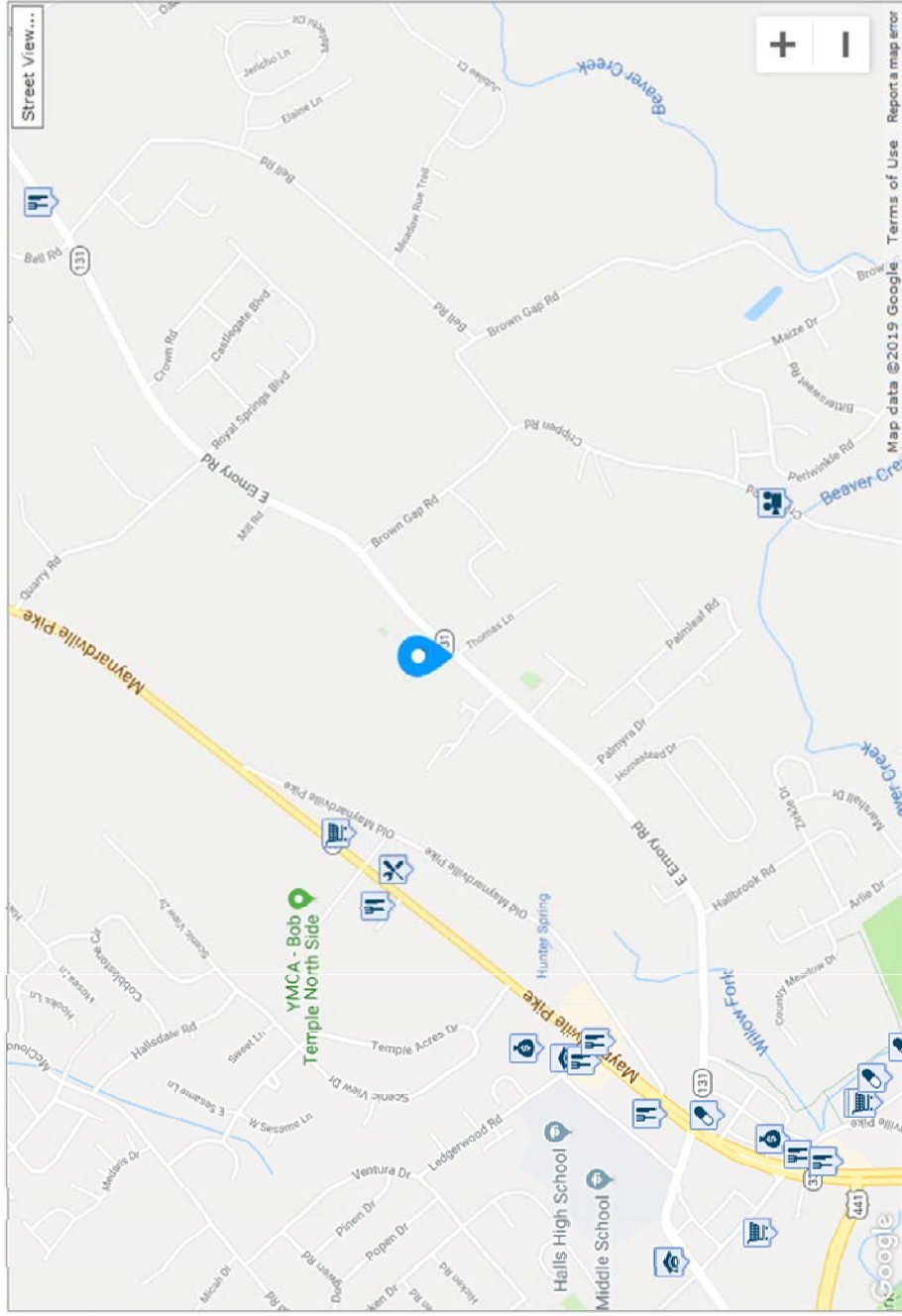
[Add to your site](#)

Explore how far you can travel by car, bus, bike and foot from 4830 Tennessee 131.



What's Nearby

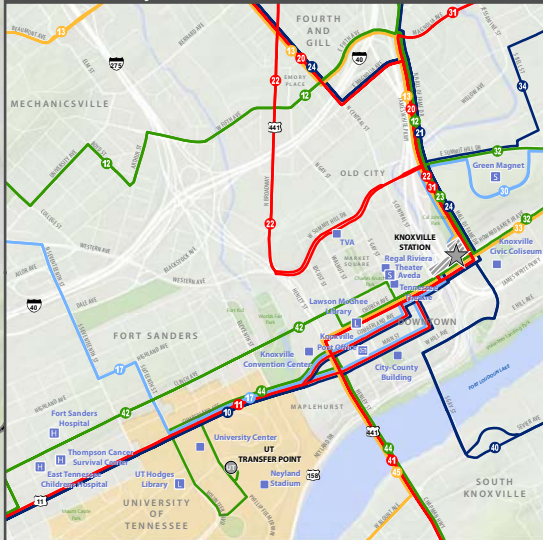
- Restaurants:**
 - Eb's Eats & Treats .4mi
- Coffee:**
 - McDonald's 1.6mi
- Bars:**
 - The Rocks Tavern 1.4mi
- Groceries:**
 - Avanti Savoia Imports, LLC .3mi
- Parks:**
 - Fountain City Park 3.9mi
- Schools:**
 - North Knox Career Technical7mi
- Shopping:**
 - Hammers 1.4mi
- Entertainment:**
 - Tennessee Theatre .6mi
- Errands:**
 - Tractor Supply Co. .4mi
- Search Nearby:**



APPENDIX C

KNOXVILLE AREA TRANSIT MAP AND INFORMATION

Knoxville City Center



Legend

- Transfer Point
- Lift Service Area Boundary

Points of Interest

- Hospital
- School
- Library
- Point of Interest
- Post Office

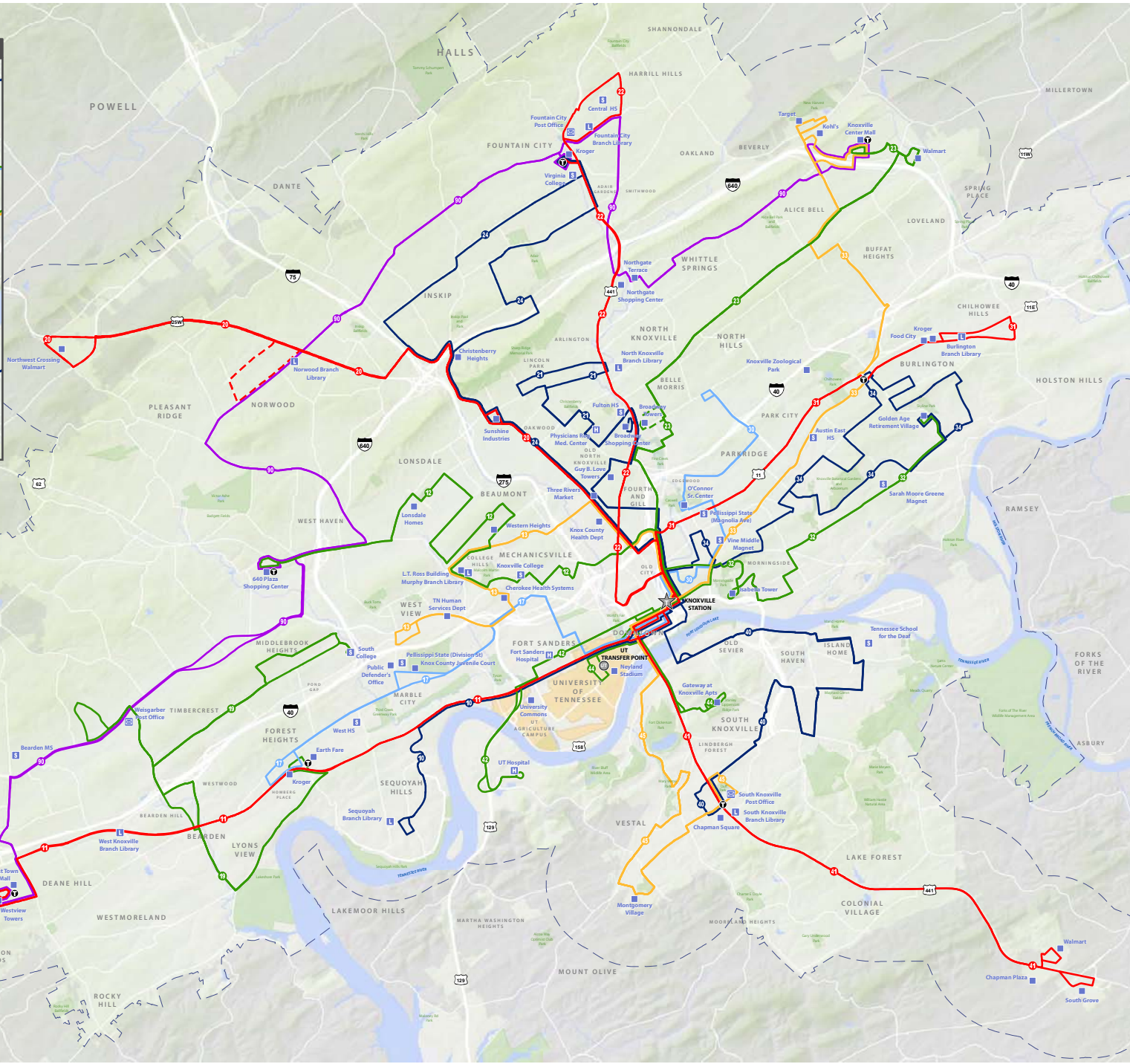
Distances

0 5 10 Minutes Walking

0 5 10 Minutes Biking

0 0.5 1 Map Scale in Miles

NORTH



22 BROADWAY

(Weekdays and Weekends)

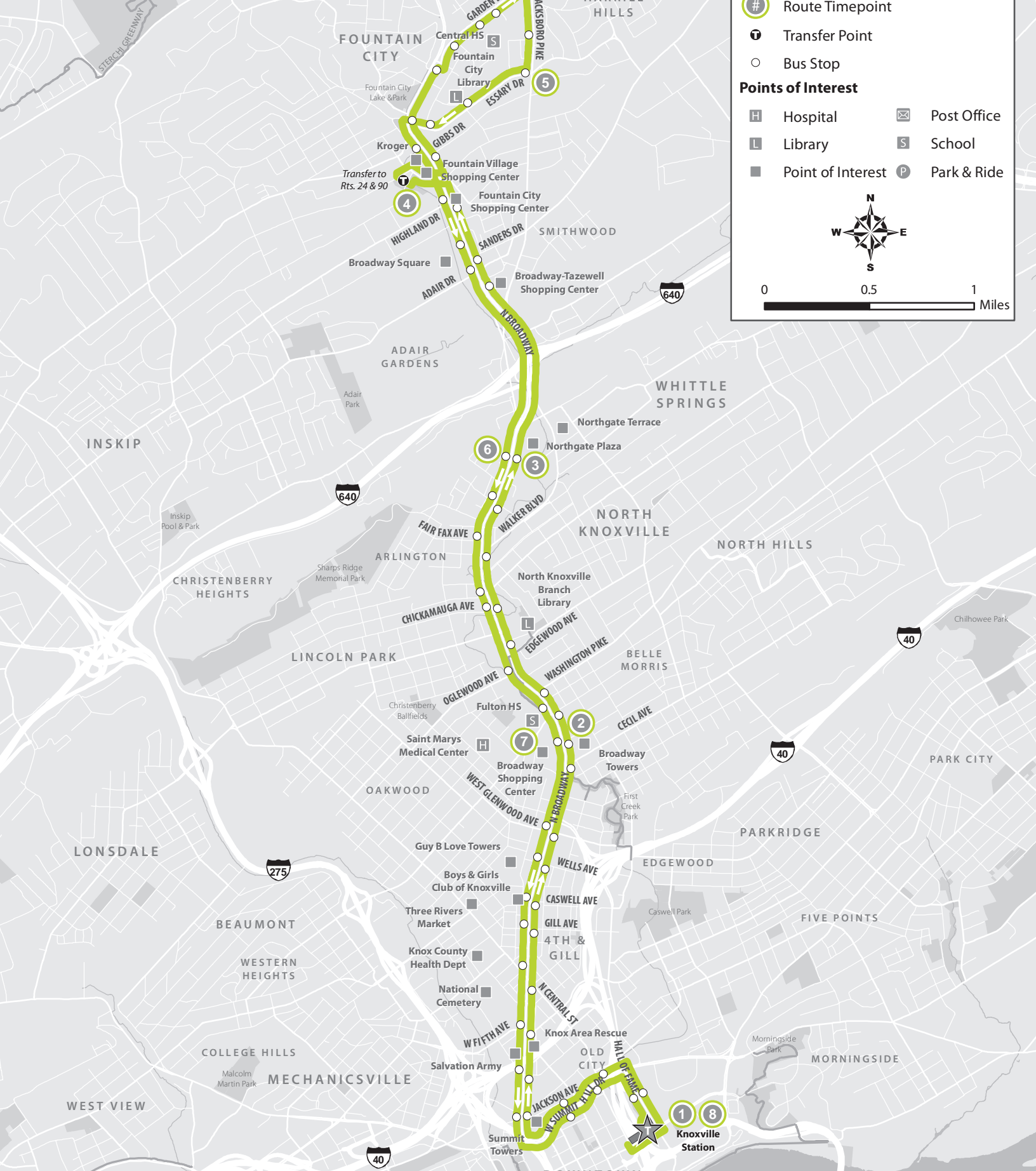
Legend

- Route Timepoint
- Transfer Point
- Bus Stop

Points of Interest

Hospital	Post Office
Library	School
Point of Interest	Park & Ride

0 0.5 1 Miles





BROADWAY

(Weekdays and Weekends)

SERVES:

- ★ Broadway Shopping Center
- ★ Central High School
- ★ Fountain City
- ★ Fountain City Library
- ★ Fulton High School
- ★ Knox Road/Kroger
- ★ Knoxville Station/Downtown
- ★ Northgate Shopping Center
- ★ North Knoxville Branch Library



Information Updated: May 14, 2018

Weekday Schedule Route 22: Broadway

Going away from Downtown				Going toward Downtown			
T Transfer to:				Rts. 24 & 90			
Knoxville Station—Platform H	Broadway Shopping Center	Northgate Shopping Center	Fountain City Superstop	Jacksboro at Essary	Northgate Shopping Center	Broadway Shopping Center	Knoxville Station
1	2	3	4	5	6	7	8

WEEKDAY SCHEDULE								
A.M.	—	—	—	—	5:40	5:51	5:56	6:10
	—	—	—	—	5:55	6:06	6:11	6:25
	—	—	—	—	6:10	6:21	6:26	6:40
	—	—	—	—	6:25	6:36	6:41	6:55
	6:00	6:13	6:20	6:35	6:40	6:51	6:56	7:10
	6:15	6:28	6:35	6:50	6:55	7:06	7:11	7:25
	6:30	6:43	6:50	7:05	7:10	7:21	7:26	7:40
	6:45	6:58	7:05	7:20	7:25	7:36	7:41	7:55
	7:00	7:13	7:20	7:35	7:40	7:51	7:56	8:10
	7:15	7:28	7:35	7:50	7:55	8:06	8:11	8:25
	7:30	7:43	7:50	8:05	8:10	8:21	8:26	8:40
	7:45	7:58	8:05	8:20	8:25	8:36	8:41	8:55
	8:00	8:13	8:20	8:35	8:40	8:51	8:56	9:10
	8:15	8:28	8:35	8:50	8:55	9:06	9:11	9:25
	8:30	8:43	8:50	9:05	9:10	9:21	9:26	9:40
	8:45	8:58	9:05	9:20	9:25	9:36	9:41	9:55
	9:00	9:13	9:20	9:35	9:40	9:51	9:56	10:10
	9:30	9:43	9:50	10:05	10:10	10:21	10:26	10:40
	10:00	10:13	10:20	10:35	10:40	10:51	10:56	11:10
	10:30	10:43	10:50	11:05	11:10	11:21	11:26	11:40
	11:00	11:13	11:20	11:35	11:40	11:51	11:56	12:10
	11:30	11:43	11:50	12:05	12:10	12:21	12:26	12:40
P.M.	12:00	12:13	12:20	12:35	12:40	12:51	12:56	1:10
	12:30	12:43	12:50	1:05	1:10	1:21	1:26	1:40
	1:00	1:13	1:20	1:35	1:40	1:51	1:56	2:10
	1:30	1:43	1:50	2:05	2:10	2:21	2:26	2:40
	2:00	2:13	2:20	2:35	2:40	2:51	2:56	3:10
	2:30	2:43	2:50	3:05	3:10	3:21	3:26	3:40
	3:00	3:13	3:20	3:35	3:40	3:51	3:56	4:10
	—	—	—	—	3:55	4:06	4:11	4:25
	3:30	3:43	3:50	4:05	4:10	4:21	4:26	4:40
	3:45	3:58	4:05	4:20	4:25	4:36	4:41	4:55
	4:00	4:13	4:20	4:35	4:40	4:51	4:56	5:10
	4:15	4:28	4:35	4:50	4:55	5:06	5:11	5:25
	4:30	4:43	4:50	5:05	5:10	5:21	5:26	5:40
	4:45	4:58	5:05	5:20	5:25	5:36	5:41	5:55
	5:00	5:13	5:20	5:35	5:40	5:51	5:56	6:10
	5:15	5:28	5:35	5:50	5:55	6:06	6:11	6:25
	5:30	5:43	5:50	6:05	6:10	6:21	6:26	6:40
	5:45	5:58	6:05	6:20	6:25	6:36	6:41	6:55
	6:00	6:13	6:20	6:35	6:40	6:51	6:56	7:10
	6:15	6:28	6:35	6:50	6:55	7:06	7:11	7:25
	6:30	6:43	6:50	7:05	7:10	7:21	7:26	7:40
	6:45	6:58	7:05	7:20	7:25	7:36	7:41	7:55
	7:15	7:28	7:35	7:50	7:55	8:06	8:11	8:25
	7:45	7:58	8:05	8:15	8:25	8:36	8:41	8:55
	8:15	8:28	8:35	8:45	8:55	9:06	9:11	9:25
	8:45	8:58	9:05	9:15	9:25	9:36	9:41	9:55
	9:15	9:28	9:35	9:45	9:55	10:06	10:11	10:25
	9:45	9:58	10:05	10:15	10:25	10:36	10:41	10:55
	10:15	10:28	10:35	10:45	10:55	11:06	11:11	11:25
	11:15	11:28	11:35	11:40	To Garage			



BROADWAY

(Weekdays and Weekends)

SERVES:

- ★ Broadway Shopping Center
- ★ Central High School
- ★ Fountain City
- ★ Fountain City Library
- ★ Fulton High School
- ★ Knox Road/Kroger
- ★ Knoxville Station/Downtown
- ★ Northgate Shopping Center
- ★ North Knoxville Branch Library



Information Updated: May 14, 2018

Saturday-Sunday Schedule Route 22: Broadway

Going away from Downtown				Going toward Downtown				
Transfer to:			Rts. 24 & 90					
Knoxville Station—Platform H 1	Broadway Shopping Center 2	Northgate Shopping Center 3	Fountain City Superstop 4	Jacksboro at Essary 5	Northgate Shopping Center 6	Broadway Shopping Center 7	Knoxville Station 8	
SATURDAY SCHEDULE								
A.M.	7:00	7:13	7:20	7:35	7:40	7:51	7:56	8:10
	7:30	7:43	7:50	8:05	8:10	8:21	8:26	8:40
	8:00	8:13	8:20	8:35	8:40	8:51	8:56	9:10
	8:30	8:43	8:50	9:05	9:10	9:21	9:26	9:40
	9:00	9:13	9:20	9:35	9:40	9:51	9:56	10:10
	9:30	9:43	9:50	10:05	10:10	10:21	10:26	10:40
	10:00	10:13	10:20	10:35	10:40	10:51	10:56	11:10
	10:30	10:43	10:50	11:05	11:10	11:21	11:26	11:40
	11:00	11:13	11:20	11:35	11:40	11:51	11:56	12:10
	11:30	11:43	11:50	12:05	12:10	12:21	12:26	12:40
P.M.	12:00	12:13	12:20	12:35	12:40	12:51	12:56	1:10
	12:30	12:43	12:50	1:05	1:10	1:21	1:26	1:40
	1:00	1:13	1:20	1:35	1:40	1:51	1:56	2:10
	1:30	1:43	1:50	2:05	2:10	2:21	2:26	2:40
	2:00	2:13	2:20	2:35	2:40	2:51	2:56	3:10
	2:30	2:43	2:50	3:05	3:10	3:21	3:26	3:40
	3:00	3:13	3:20	3:35	3:40	3:51	3:56	4:10
	3:30	3:43	3:50	4:05	4:10	4:21	4:26	4:40
	4:00	4:13	4:20	4:35	4:40	4:51	4:56	5:10
	4:30	4:43	4:50	5:05	5:10	5:21	5:26	5:40
	5:00	5:13	5:20	5:35	5:40	5:51	5:56	6:10
	5:30	5:43	5:50	6:05	6:10	6:21	6:26	6:40
	6:00	6:13	6:20	6:35	6:40	6:51	6:56	7:10
	6:30	6:43	6:50	7:05	7:10	7:21	7:26	7:40
	7:00	7:13	7:20	7:35	7:40	7:51	7:56	8:10
	7:30	7:43	7:50	8:05	8:10	8:21	8:26	8:40
	8:00	8:13	8:20	8:35	8:40	8:51	8:56	9:10
	8:30	8:43	8:50	9:05	9:10	9:21	9:26	9:40
	9:00	9:13	9:20	9:35	9:40	9:51	9:56	10:10
	9:30	9:43	9:50	10:05	10:10	10:21	10:26	10:40
	10:00	10:13	10:20	10:35	10:40	10:51	10:56	11:10
	10:30	10:43	10:50	11:05	11:10	11:21	11:26	
	11:15	11:28	11:35	11:50	11:55	12:06	12:11	To Garage
SUNDAY SCHEDULE								
A.M.	8:15	8:28	8:35	8:44	—	8:47	8:55	9:10
	9:15	9:28	9:35	9:44	—	9:47	9:55	10:10
	10:15	10:28	10:35	10:44	—	10:47	10:55	11:10
	11:15	11:28	11:35	11:44	—	11:47	11:55	12:10
P.M.	12:15	12:28	12:35	12:44	—	12:47	12:55	1:10
	1:15	1:28	1:35	1:44	—	1:47	1:55	2:10
	2:15	2:28	2:35	2:44	—	2:47	2:55	3:10
	3:15	3:28	3:35	3:44	—	3:47	3:55	4:10
	4:15	4:28	4:35	4:44	—	4:47	4:55	5:10
	5:15	5:28	5:35	5:44	—	5:47	5:55	6:10
	6:15	6:28	6:35	6:44	—	6:47	6:55	7:10
	7:15	7:28	7:35	7:44	—	7:47	7:55	8:10
	8:15	8:28	8:35	8:40	To Garage			

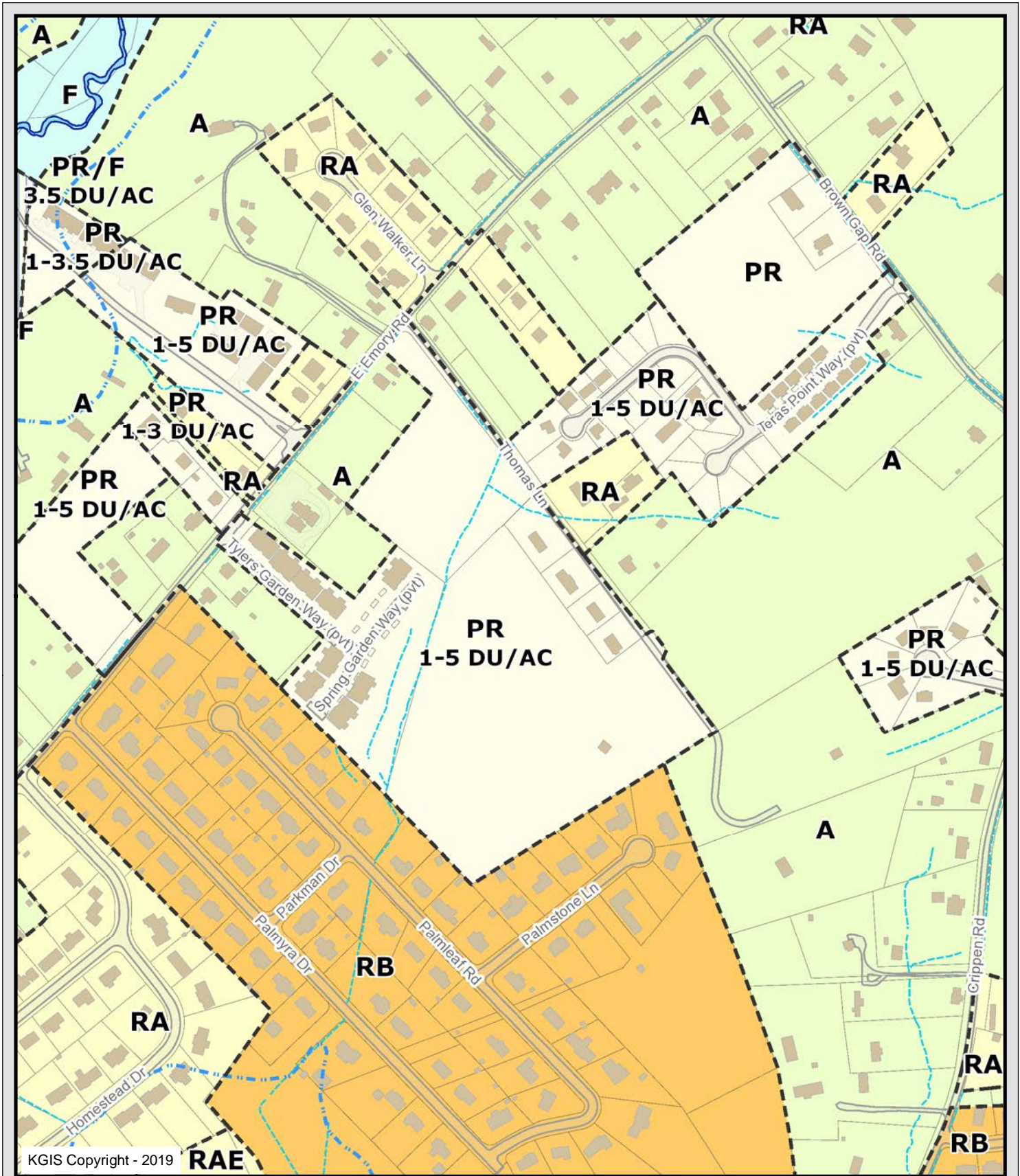
Need help reading this schedule?

Need other general information on how to ride?

[Click here to Download the General Schedule Information pdf](#) available from katbus.com

APPENDIX D

ZONING MAP



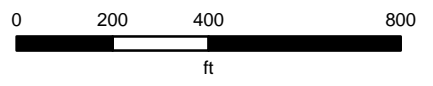
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Thomas Lane Subdivision Zoning Map

Knoxville - Knox County - KUB Geographic Information System



Printed: 1/26/2019 at 1:42:57 PM



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APPENDIX E

MANUAL TRAFFIC COUNT DATA

TRAFFIC COUNT DATA

Major Street: East Emory Road (WB - EB)
 Minor Street: Thomas Lane (NB)
 Traffic Control: Stop Control on Thomas Lane

1/16/2019 (Wednesday)
 Overcast/Cold
 Conducted by: Ajax Engineering

TIME	East Emory Road		Thomas Lane		East Emory Road		VEHICLE TOTAL	PEAK HOUR
	WESTBOUND	THRU	NORTHBOUND	EASTBOUND	THRU	RT		
BEGIN	LT	THRU	LT	RT	THRU	RT		
7:00 AM	0	158	0	0	41	0	199	7:00 AM - 8:00 AM
7:15 AM	0	143	1	1	70	0	215	
7:30 AM	1	175	1	0	83	0	260	
7:45 AM	0	150	0	0	67	0	217	
8:00 AM	0	124	0	0	62	0	186	
8:15 AM	0	144	0	0	52	0	196	
8:30 AM	0	110	0	0	38	0	148	
8:45 AM	0	80	0	0	41	0	121	
TOTAL	1	1084	2	1	454	0	1542	
11:00 AM	0	75	1	1	49	0	126	
11:15 AM	1	80	0	0	61	0	142	
11:30 AM	0	72	0	0	59	1	132	
11:45 AM	0	64	2	0	83	0	149	
12:00 PM	0	62	0	0	91	0	153	
12:15 PM	0	91	0	0	86	0	177	
12:30 PM	0	79	0	0	89	1	169	
12:45 PM	0	80	0	0	88	0	168	
TOTAL	1	603	3	1	606	2	1216	
2:00 PM	0	63	0	0	99	0	162	
2:15 PM	0	81	0	0	101	0	182	
2:30 PM	0	90	0	1	99	0	190	
2:45 PM	0	69	0	0	114	1	184	
3:00 PM	0	89	0	0	122	0	211	
3:15 PM	0	85	0	0	120	1	206	
3:30 PM	0	75	0	0	136	0	211	
3:45 PM	0	87	0	0	172	0	259	
4:00 PM	0	95	0	0	138	1	234	
4:15 PM	0	96	0	0	163	0	259	
4:30 PM	0	92	1	0	202	1	296	
4:45 PM	0	97	1	0	182	1	281	
5:00 PM	0	98	1	0	190	1	290	5:00 PM - 6:00 PM
5:15 PM	0	91	0	0	193	1	285	
5:30 PM	0	95	0	0	194	0	289	
5:45 PM	0	112	0	0	216	1	329	
TOTAL	0	1112	3	0	2028	7	3150	

2019 AM Peak Hour 7:00 AM - 8:00 AM

TIME	East Emory Road		Thomas Lane		East Emory Road	
	WESTBOUND	THRU	NORTHBOUND	EASTBOUND	THRU	RT
BEGIN	LT	THRU	LT	RT	THRU	RT
7:00 AM	0	158	0	0	41	0
7:15 AM	0	143	1	1	70	0
7:30 AM	1	175	1	0	83	0
7:45 AM	0	150	0	0	67	0
TOTAL	1	626	2	1	261	0
PHF	0.25	0.89	0.50	0.25	0.79	-

2019 PM Peak Hour 5:00 PM - 6:00 PM

TIME	East Emory Road		Thomas Lane		East Emory Road	
	WESTBOUND	THRU	NORTHBOUND	EASTBOUND	THRU	RT
BEGIN	LT	THRU	LT	RT	THRU	RT
5:00 PM	0	98	1	0	190	1
5:15 PM	0	91	0	0	193	1
5:30 PM	0	95	0	0	194	0
5:45 PM	0	112	0	0	216	1
TOTAL	0	396	1	0	793	3
PHF	-	0.88	0.25	-	0.92	0.75

APPENDIX F

CAPACITY ANALYSES – HCM WORKSHEETS (SYNCHRO 8)

EXISTING TRAFFIC CONDITIONS

HCM 2010 TWSC
 3: Thomas Lane & East Emory Road (SR 131)

1/24/2019

Intersection

Int Delay, s/veh 0.1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	261	0	1	626	2	1
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	1	-
Peak Hour Factor	79	90	25	89	50	25
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	330	0	4	703	4	4

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	330
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.1
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.2
Pot Cap-1 Maneuver	-	-	1241
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	1241
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0	15.2
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	361	-	-	1241	-
HCM Lane V/C Ratio	0.022	-	-	0.003	-
HCM Control Delay (s)	15.2	-	-	7.9	0
HCM Lane LOS	C	-	-	A	A
HCM 95th %tile Q(veh)	0.1	-	-	0	-

HCM 2010 TWSC
 3: Thomas Lane & East Emory Road (SR 131)

1/24/2019

Intersection

Int Delay, s/veh 0.1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	793	3	0	396	1	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	1	-
Peak Hour Factor	92	75	90	88	25	90
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	862	4	0	450	4	0

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	866
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.1
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.2
Pot Cap-1 Maneuver	-	-	786
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	786
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0	27.5
HCM LOS			D

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	164	-	-	786	-
HCM Lane V/C Ratio	0.024	-	-	-	-
HCM Control Delay (s)	27.5	-	-	0	-
HCM Lane LOS	D	-	-	A	-
HCM 95th %tile Q(veh)	0.1	-	-	0	-

OPENING YEAR TRAFFIC CONDITIONS (WITHOUT PROJECT)

HCM 2010 TWSC
 3: Thomas Lane & East Emory Road (SR 131)

1/24/2019

Intersection

Int Delay, s/veh 0.1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	281	0	1	673	2	1
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	1	-
Peak Hour Factor	79	90	25	89	50	25
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	356	0	4	756	4	4

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	356
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.1
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.2
Pot Cap-1 Maneuver	-	-	1214
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	1214
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0	16.2
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	329	-	-	1214	-
HCM Lane V/C Ratio	0.024	-	-	0.003	-
HCM Control Delay (s)	16.2	-	-	8	0
HCM Lane LOS	C	-	-	A	A
HCM 95th %tile Q(veh)	0.1	-	-	0	-

HCM 2010 TWSC
 3: Thomas Lane & East Emory Road (SR 131)

1/24/2019

Intersection

Int Delay, s/veh 0.1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	852	3	0	426	1	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	1	-
Peak Hour Factor	92	75	90	88	25	90
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	926	4	0	484	4	0

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	930
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.1
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.2
Pot Cap-1 Maneuver	-	-	744
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	744
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0	31.1
HCM LOS			D

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	142	-	-	744	-
HCM Lane V/C Ratio	0.028	-	-	-	-
HCM Control Delay (s)	31.1	-	-	0	-
HCM Lane LOS	D	-	-	A	-
HCM 95th %tile Q(veh)	0.1	-	-	0	-

OPENING YEAR TRAFFIC CONDITIONS (WITH PROJECT)

HCM 2010 TWSC
 3: Thomas Lane & East Emory Road (SR 131)

2/17/2019

Intersection

Int Delay, s/veh 2.5

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	281	9	5	673	32	14
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	1	-
Peak Hour Factor	79	90	25	89	50	25
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	356	10	20	756	64	56

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	366
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.1
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.2
Pot Cap-1 Maneuver	-	-	1204
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	1204
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.2	25.1
HCM LOS			D

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	297	-	-	1204	-
HCM Lane V/C Ratio	0.404	-	-	0.017	-
HCM Control Delay (s)	25.1	-	-	8	0
HCM Lane LOS	D	-	-	A	A
HCM 95th %tile Q(veh)	1.9	-	-	0.1	-

HCM 2010 TWSC
 3: Thomas Lane & East Emory Road (SR 131)

2/17/2019

Intersection

Int Delay, s/veh 6.9

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	852	33	13	426	25	10
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	1	-
Peak Hour Factor	92	75	90	88	25	90
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	926	44	14	484	100	11

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	970
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.1
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.2
Pot Cap-1 Maneuver	-	-	719
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	719
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.3	97.2
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	136	-	-	719	-
HCM Lane V/C Ratio	0.817	-	-	0.02	-
HCM Control Delay (s)	97.2	-	-	10.1	0
HCM Lane LOS	F	-	-	B	A
HCM 95th %tile Q(veh)	5.1	-	-	0.1	-

**OPENING YEAR TRAFFIC CONDITIONS (WITH PROJECT)
WITH ADDED EASTBOUND RIGHT TURN LANE**

HCM 2010 TWSC
 3: Thomas Lane & East Emory Road (SR 131)

2/17/2019

Intersection

Int Delay, s/veh 2.5

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	281	9	5	673	32	14
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	1	-
Peak Hour Factor	79	90	25	89	50	25
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	356	10	20	756	64	56

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	356
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.1
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.2
Pot Cap-1 Maneuver	-	-	1214
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	1214
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.2	24.8
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	300	-	-	1214	-
HCM Lane V/C Ratio	0.4	-	-	0.016	-
HCM Control Delay (s)	24.8	-	-	8	0
HCM Lane LOS	C	-	-	A	A
HCM 95th %tile Q(veh)	1.8	-	-	0.1	-

HCM 2010 TWSC
 3: Thomas Lane & East Emory Road (SR 131)

2/17/2019

Intersection

Int Delay, s/veh 6.4

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	852	33	13	426	25	10
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	1	-
Peak Hour Factor	92	75	90	88	25	90
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	926	44	14	484	100	11

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	926
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.1
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.2
Pot Cap-1 Maneuver	-	-	746
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	746
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.3	89.3
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	141	-	-	746	-
HCM Lane V/C Ratio	0.788	-	-	0.019	-
HCM Control Delay (s)	89.3	-	-	9.9	0
HCM Lane LOS	F	-	-	A	A
HCM 95th %tile Q(veh)	4.9	-	-	0.1	-

APPENDIX G

ITE TRIP GENERATION RATES

Local Apartment Trip Generation Study

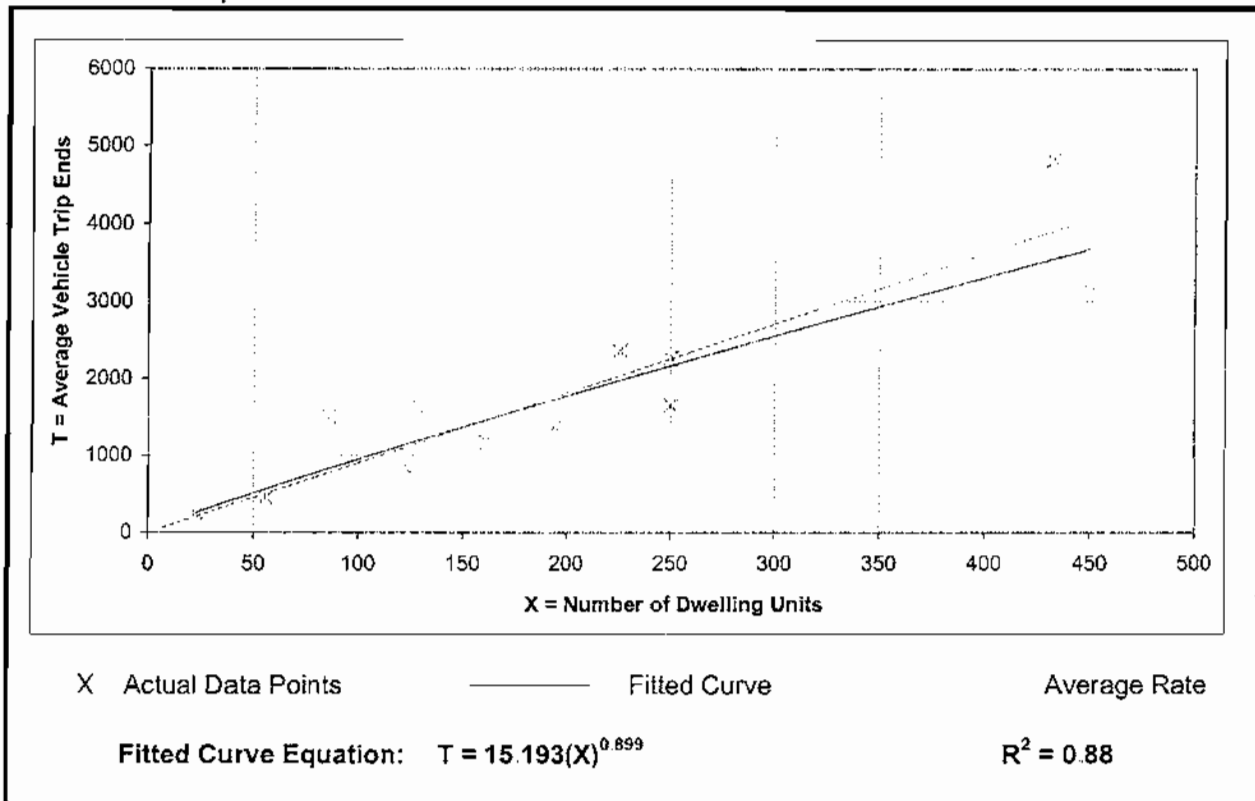
Average Vehicle Trip Ends vs: Dwelling Units
On a: Weekday

Number of Studies: 13
Average Number of Dwelling Units: 193
Directional Distribution: 50% entering, 50% exiting

Trip Generation Per Dwelling Unit

Average Rate	Ranges of Rates	Standard Deviation
9.03	6.59 - 17.41	2.47

Data Plot and Equation



Local Apartment Trip Generation Study

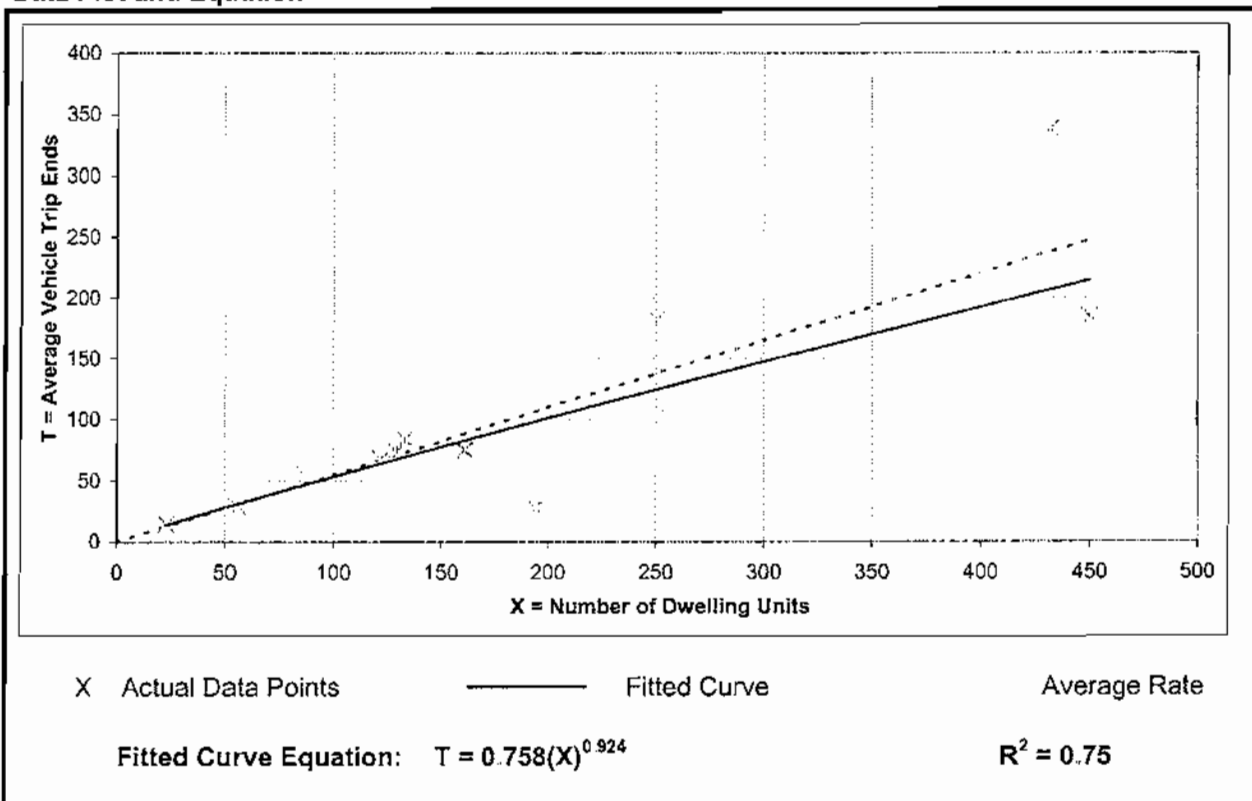
Average Vehicle Trip Ends vs: Dwelling Units
 On a: Weekday,
 Peak Hour of Adjacent Street Traffic,
 One Hour Between 7 and 9 a.m.

Number of Studies: 13
 Average Number of Dwelling Units: 193
 Directional Distribution: 22% entering, 78% exiting

Trip Generation Per Dwelling Unit

Average Rate	Ranges of Rates	Standard Deviation
0.55	0.14 - 0.78	0.18

Data Plot and Equation



Local Apartment Trip Generation Study

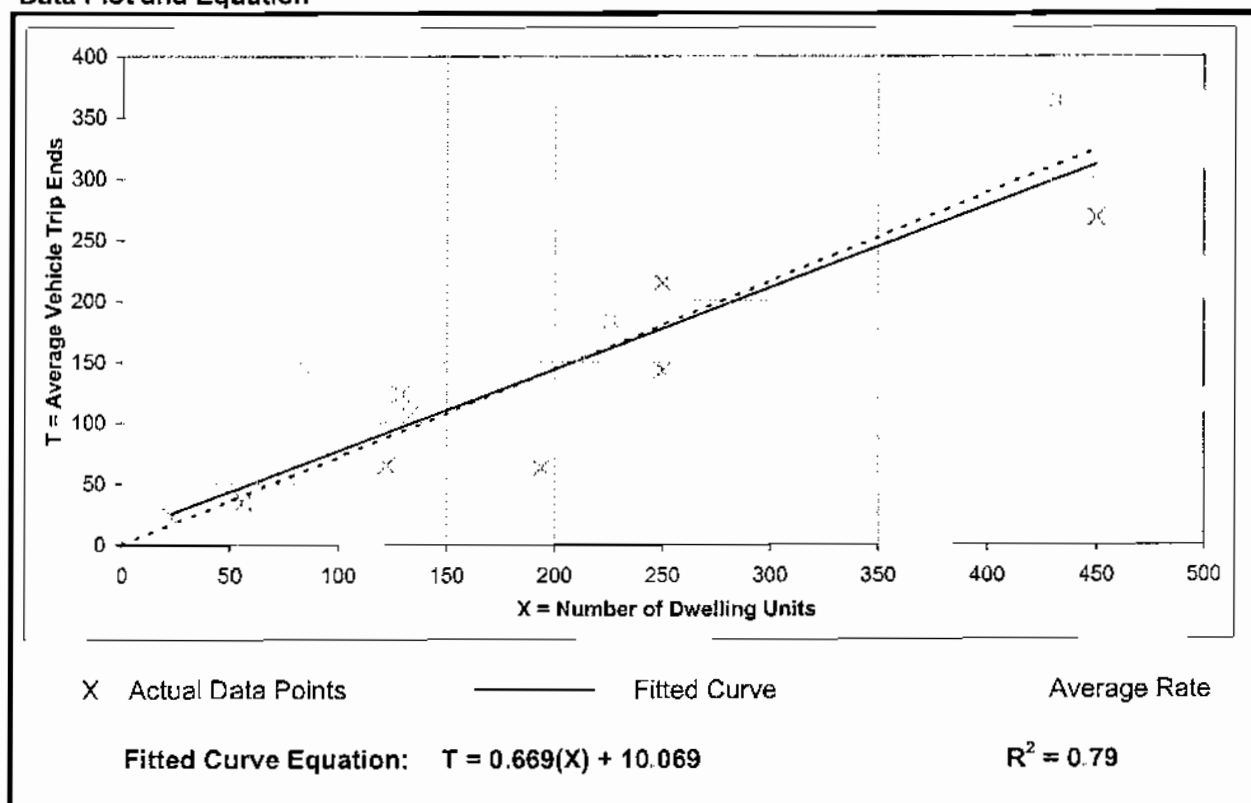
Average Vehicle Trip Ends vs: Dwelling Units
 On a: Weekday,
 Peak Hour of Adjacent Street Traffic,
 One Hour Between 4 and 6 p.m.

Number of Studies: 13
 Average Number of Dwelling Units: 193
 Directional Distribution: 55% entering, 45% exiting

Trip Generation Per Dwelling Unit

Average Rate	Ranges of Rates	Standard Deviation
0.72	0.32 - 1.66	0.25

Data Plot and Equation



Land Use: 210

Single-Family Detached Housing

Description

Single-family detached housing includes all single-family detached homes on individual lots. A typical site surveyed is a suburban subdivision.

Additional Data

The number of vehicles and residents had a high correlation with average weekday vehicle trip ends. The use of these variables was limited, however, because the number of vehicles and residents was often difficult to obtain or predict. The number of dwelling units was generally used as the independent variable of choice because it was usually readily available, easy to project, and had a high correlation with average weekday vehicle trip ends.

This land use included data from a wide variety of units with different sizes, price ranges, locations, and ages. Consequently, there was a wide variation in trips generated within this category. Other factors, such as geographic location and type of adjacent and nearby development, may also have had an effect on the site trip generation.

Single-family detached units had the highest trip generation rate per dwelling unit of all residential uses because they were the largest units in size and had more residents and more vehicles per unit than other residential land uses; they were generally located farther away from shopping centers, employment areas, and other trip attractors than other residential land uses; and they generally had fewer alternative modes of transportation available because they were typically not as concentrated as other residential land uses.

Time-of-day distribution data for this land use are presented in Appendix A. For the six general urban/suburban sites with data, the overall highest vehicle volumes during the AM and PM on a weekday were counted between 7:15 and 8:15 a.m. and 4:00 and 5:00 p.m., respectively. For the two sites with Saturday data, the overall highest vehicle volume was counted between 3:00 and 4:00 p.m. For the one site with Sunday data, the overall highest vehicle volume was counted between 10:15 and 11:15 a.m.

The sites were surveyed in the 1980s, the 1990s, the 2000s, and the 2010s in California, Connecticut, Delaware, Illinois, Indiana, Maryland, Minnesota, Montana, New Jersey, North Carolina, Ohio, Oregon, Pennsylvania, South Carolina, South Dakota, Tennessee, Vermont, and Virginia.

Source Numbers

100, 105, 114, 126, 157, 167, 177, 197, 207, 211, 217, 267, 275, 293, 300, 319, 320, 356, 357, 367, 384, 387, 407, 435, 522, 550, 552, 579, 598, 601, 603, 614, 637, 711, 716, 720, 728, 735, 868, 903, 925, 936

Single-Family Detached Housing (210)

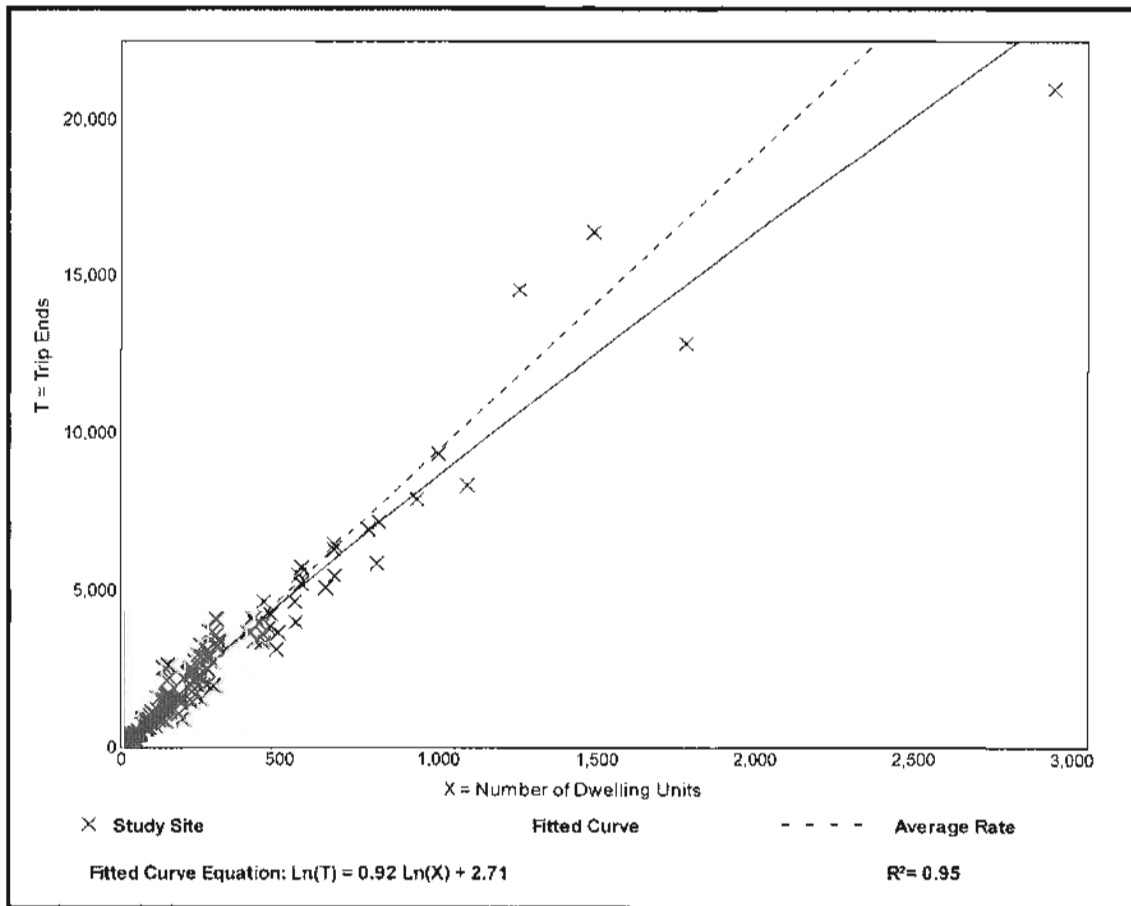
Vehicle Trip Ends vs: Dwelling Units
On a: Weekday

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)

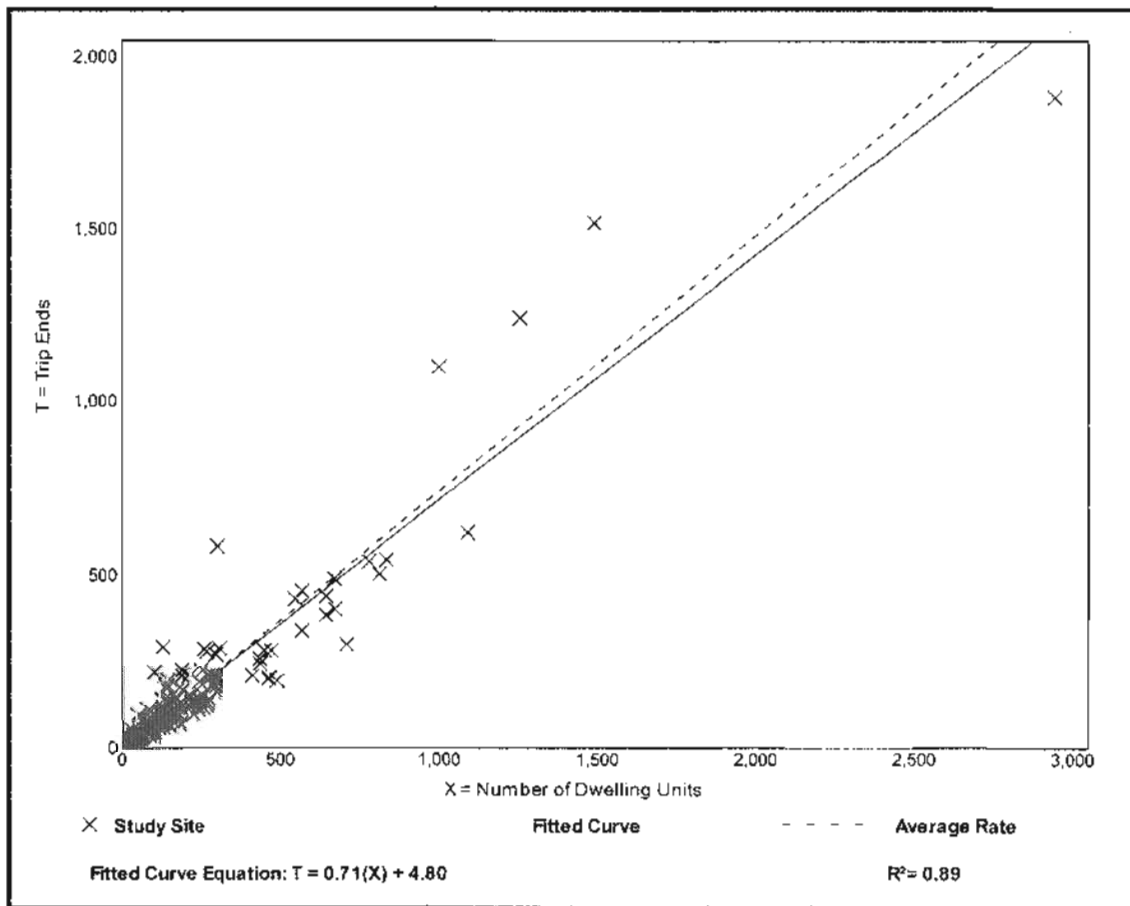
Vehicle Trip Ends vs: Dwelling Units
On a: Weekday,
Peak Hour of Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.

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)

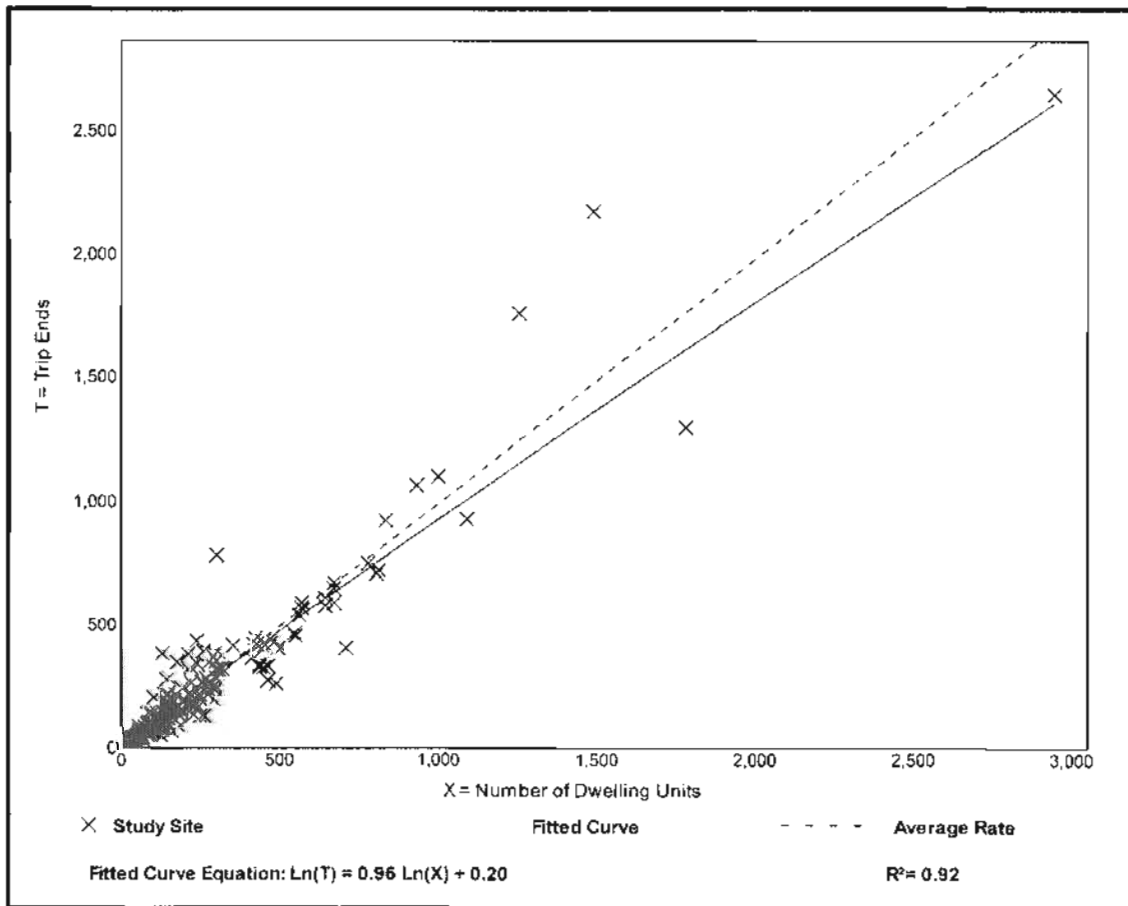
Vehicle Trip Ends vs: Dwelling Units
 On a: Weekday,
 Peak Hour of Adjacent Street Traffic,
 One Hour Between 4 and 6 p.m.

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



TRIP GENERATION FOR THOMAS LANE SUBDIVISION
91 Single-Family Attached Homes (Apartments)
& 6 Existing Homes to Remain

ITE LAND USE CODE	LAND USE DESCRIPTION	UNITS	GENERATED DAILY TRAFFIC	GENERATED TRAFFIC AM PEAK HOUR			GENERATED TRAFFIC PM PEAK HOUR		
				ENTER	EXIT	TOTAL	ENTER	EXIT	TOTAL
Local Trip Rate	Apartments	91 homes	877	22%	78%		55%	45%	
				11	38	49	39	32	71
#210	Single-Family Detached Housing	6 Existing Homes to Remain	79	25%	75%		63%	37%	
				2	8	10	4	3	7
Total New Volume Site Trips			956	13	46	59	43	35	78

MPC Local Trip Rate and ITE Trip Generation Manual, 10th Edition

TRIP GENERATION FOR THOMAS LANE SUBDIVISION
91 single-family attached homes (apartments)

91 Residential Units = X

Weekday:

Fitted Curve Equation: $T = 15.193(X)^{0.899}$

$$T = 15.193 * 57.700$$
$$\underline{\underline{T = 877 \text{ trips}}}$$

Peak Hour of Adjacent Traffic between 7 and 9 am:

Fitted Curve Equation: $T = 0.758(X)^{0.924}$

$$T = 0.758 * 64.588$$
$$\underline{\underline{T = 49 \text{ trips}}}$$

Peak Hour of Adjacent Traffic between 4 and 6 pm:

Fitted Curve Equation: $T = 0.669(X)+10.069$

$$T = 0.669 * 91 + 10.069$$
$$\underline{\underline{T = 71 \text{ trips}}}$$

TRIP GENERATION FOR EXISTING HOMES TO REMAIN
6 single-family detached homes

6 Residential Units = X

Weekday:

Fitted Curve Equation: $\ln(T) = 0.92 \ln(X) + 2.71$

$$\ln(T) = 0.92 * 1.79 + 2.71$$

$$\ln(T) = 4.36$$

$$\underline{\underline{T = 79 \text{ trips}}}$$

Peak Hour of Adjacent Traffic between 7 and 9 am:

Fitted Curve Equation: $T = 0.71(X) + 4.80$

$$T = 0.71 * 6 + 4.80$$

$$\underline{\underline{T = 10 \text{ trips}}}$$

Peak Hour of Adjacent Traffic between 4 and 6 pm:

Fitted Curve Equation: $\ln(T) = 0.96 \ln(X) + 0.2$

$$\ln(T) = 0.96 * 1.79 + 0.20$$

$$\ln(T) = 1.92$$

$$\underline{\underline{T = 7 \text{ trips}}}$$

APPENDIX H
SPOT SPEED STUDY

SPOT SPEED STUDY

Location: East Emory Road at Thomas Lane
 Posted Speed Limit: 45 mph
 Equipment: Bushnell Speedster III Radar Speed Gun
 Direction: Westbound and Eastbound

Date: 2/18/19
 Weather: Partly Cloudy
 Time: 1:30 PM
 Pavement Conditions: Dry

Vehicle #	Speed (mph)
1	42
2	45
3	45
4	46
5	48
6	48
7	46
8	51
9	46
10	48
11	55
12	46
13	46
14	45
15	44
16	44
17	51
18	43
19	42
20	47
21	42
22	43
23	46
24	50
25	43

Vehicle #	Speed (mph)
26	42
27	43
28	43
29	42
30	40
31	40
32	48
33	47
34	46
35	43
36	47
37	43
38	47
39	42
40	47
41	50
42	45
43	40
44	49
45	47
46	46
47	44
48	45
49	41
50	46

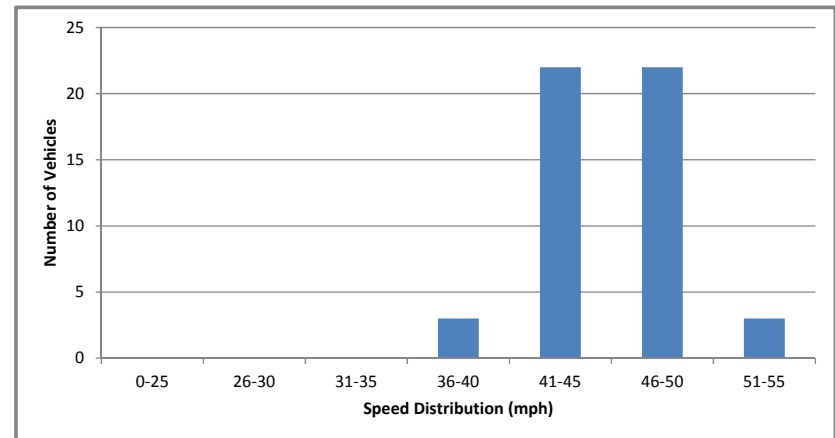
Sample Size Requirements (*ITE Manual of Transportation Engineering Studies*)

$$N = (S * K/E)^2$$

where: N = minimum number of measured speeds
 S = estimated sample standard deviation (mph)
 K = constant corresponding to desired confidence level
 E = permitted error in the average speed estimate (mph)

S = 5 mph (Table 3-2, page 38)
 K = 2.58 (Confidence level of 99% - Table 3-3, page 38)
 E = 2 mph assumed error range

Therefore, N = 42 observations needed



Average speed = 45.3 mph
 50th percentile speed = 45.5 mph
 85th percentile speed = 48.0 mph

APPENDIX I

KNOX COUNTY TURN LANE VOLUME THRESHOLD WORKSHEETS

TABLE 6A

LEFT-TURN LANE VOLUME THRESHOLDS
FOR TWO-LANE ROADWAYS WITH A PREVAILING SPEED OF 46 TO 55 MPH

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

OPPOSING VOLUME	THROUGH VOLUME PLUS RIGHT-TURN VOLUME *					
	100 - 149	150 - 199	200 - 249	250 - 299	300 - 349	350 - 399
100 - 149	200	140	100	75	60	50
150 - 199	175	120	85	65	55	45
200 - 249	150	100	75	60	50	40
250 - 299	130	85	65	55	45	35
300 - 349	110	75	60	50	40	30
350 - 399	95	65	55	45	35	25
400 - 449	80	60	50	40	30	25
450 - 499	70	55	45	35	25	20
500 - 549	60	50	40	30	25	20
550 - 599	50	45	35	25	20	20
600 - 649	45	40	30	25	20	20
650 - 699	40	35	30	20	20	20
700 - 749	35	35	25	20	20	15
750 or More	35	35	25	20	15	15

OPPOSING VOLUME	THROUGH VOLUME PLUS RIGHT-TURN VOLUME *					
	350 - 399	400 - 449	450 - 499	500 - 549	550 - 599	=/ > 600
100 - 149	50	45	40	35	30	25
150 - 199	45	40	35	30	30	25
200 - 249	40	35	30	25	25	20
250 - 299	35	35	30	25	25	20
300 - 349	30	30	25	25	20	20
350 - 399	25	25	25	20	20	20
400 - 449	25	25	20	20	20	15
450 - 499	20	20	20	20	20	15
500 - 549	20	20	20	20	15	15
550 - 599	20	20	20	15	15	15
600 - 649	20	20	20	15	15	15
650 - 699	20	15	15	15	15	15
700 - 749	15	15	15	15	15	15
750 or More	15	15	15	15	15	15

East Emory Road
(SR 131) at Thomas Lane
2024 Projected AM
Left Turns = 5
Turn Lane NOT Warranted

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

TABLE 6B

RIGHT-TURN LANE VOLUME THRESHOLDS
FOR TWO-LANE ROADWAYS WITH A PREVAILING SPEED OF 46 TO 55 MPH

RIGHT-TURN VOLUME	THROUGH VOLUME PLUS LEFT-TURN VOLUME *					
	<100	100 - 199	200 - 249	250 - 299	300 - 349	350 - 399
Fewer Than 25 25 - 49 50 - 99						
100 - 149 150 - 199						Yes
200 - 249 250 - 299				Yes	Yes Yes	Yes Yes
300 - 349 350 - 399				Yes Yes	Yes Yes	Yes Yes
400 - 449 450 - 499		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

East Emory Road
(SR 131) at Thomas Lane
2024 Projected AM
Right Turns = 9

Turn Lane NOT
Warranted

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	Yes Yes	Yes Yes
100 - 149 150 - 199	Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
200 - 249 250 - 299	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
300 - 349 350 - 399	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
400 - 449 450 - 499	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
500 - 549 550 - 599	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
600 or More	Yes	Yes	Yes	Yes	Yes	Yes

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

TABLE 6A

LEFT-TURN LANE VOLUME THRESHOLDS
FOR TWO-LANE ROADWAYS WITH A PREVAILING SPEED OF 46 TO 55 MPH

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

OPPOSING VOLUME	THROUGH VOLUME PLUS RIGHT-TURN VOLUME *					
	100 - 149	150 - 199	200 - 249	250 - 299	300 - 349	350 - 399
100 - 149	200	140	100	75	60	50
150 - 199	175	120	85	65	55	45
200 - 249	150	100	75	60	50	40
250 - 299	130	85	65	55	45	35
300 - 349	110	75	60	50	40	30
350 - 399	95	65	55	45	35	25
400 - 449	80	60	50	40	30	25
450 - 499	70	55	45	35	25	20
500 - 549	60	50	40	30	25	20
550 - 599	50	45	35	25	20	20
600 - 649	45	40	30	25	20	20
650 - 699	40	35	30	20	20	20
700 - 749	35	35	25	20	20	15
750 or More	35	35	25	20	15	15

OPPOSING VOLUME	THROUGH VOLUME PLUS RIGHT-TURN VOLUME *					
	350 - 399	400 - 449	450 - 499	500 - 549	550 - 599	=/ > 600
100 - 149	50	45	40	35	30	25
150 - 199	45	40	35	30	30	25
200 - 249	40	35	30	25	25	20
250 - 299	35	35	30	25	25	20
300 - 349	30	30	<div style="border: 2px dashed green; border-radius: 15px; padding: 5px;"> East Emory Road (SR 131) at Thomas Lane 2024 Projected PM Left Turns = 13 Turn Lane NOT Warranted </div>		20	20
350 - 399	25	25			20	20
400 - 449	25	25			20	15
450 - 499	20	20			20	15
500 - 549	20	20			15	15
550 - 599	20	20			15	15
600 - 649	20	20			15	15
650 - 699	20	15			15	15
700 - 749	15	15			15	15
750 or More	15	15			15	15

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

TABLE 6B

RIGHT-TURN LANE VOLUME THRESHOLDS
FOR TWO-LANE ROADWAYS WITH A PREVAILING SPEED OF 46 TO 55 MPH

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

East Emory Road
(SR 131) at Thomas Lane
2024 Projected PM
Right Turns = 33

Turn Lane
Warranted

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

APPENDIX J

TRAFFIC SIGNALIZATION WARRANTS

TRAFFIC SIGNAL WARRANTS

PROJECTED FUTURE VOLUMES

TIME BEGIN	East Emory Road		Thomas Lane		East Emory Road	
	WESTBOUND		NORTHBOUND		EASTBOUND	
	LT	THRU	LT	RT	THRU	RT
7:00 AM		158			41	
7:15 AM		143			70	
7:30 AM		175			83	
7:45 AM		150			67	
SUM		626			261	
		46.95			19.575	
7-8 am		673			281	
Year 2022	4	673	28	12	281	9
8:00 AM		124			62	
8:15 AM		144			52	
8:30 AM		110			38	
8:45 AM		80			41	
SUM		458			193	
		34.35			14.475	
8-9 am		492			207	
Year 2022	3	492	21	9	207	7
11:00 AM		75			49	
11:15 AM		80			61	
11:30 AM		72			59	
11:45 AM		64			83	
SUM		291			252	
		21.825			18.9	
11am-12 pm		313			271	
Year 2022	5	313	13	5	271	13
12:00 PM		62			91	
12:15 PM		91			86	
12:30 PM		79			89	
12:45 PM		80			88	
SUM		312			354	
		23.4			26.55	
12-1 pm		335			381	
Year 2022	7	335	17	7	381	17
2:00 PM		63			99	
2:15 PM		81			101	
2:30 PM		90			99	
2:45 PM		69			114	
SUM		303			413	
		22.725			30.975	
2-3 pm		326			444	
Year 2022	9	326	12	5	444	22
3:00 PM		89			122	
3:15 PM		85			120	
3:30 PM		75			136	
3:45 PM		87			172	
SUM		336			550	
		25.2			41.25	
3-4 pm		361			591	
Year 2022	12	361	15	6	591	27
4:00 PM		95			138	
4:15 PM		96			163	
4:30 PM		92			202	
4:45 PM		97			182	
SUM		380			685	
		28.5			51.375	
4-5 pm		409			736	
Year 2022	13	409	17	7	736	31
5:00 PM		98			190	
5:15 PM		91			193	
5:30 PM		95			194	
5:45 PM		112			216	
SUM		396			793	
		29.7			59.475	
5-6 pm		426			852	
Year 2022	19	426	24	10	852	45

Existing Volumes
Existing Volumes
Existing Volumes
Existing Volumes
Sum
Growth Rate of 1% for 3.5 Years
Existing Volumes in Future
Volumes in Future

Assumed Growth Rate (%)= 1.5
Number of years = 5 (2024)

Note:
The entering and exiting traffic volumes are estimated based on trip generation of the entire development, based on assumed amounts of entering and exiting traffic, assumed percentages of directional traffic, and the assumed percentage of trips based on time of day (from NCHRP Report 365)

Entire Development: 727 Daily Trips Generated

Entering and Exiting %:		Directional Distribution Assumptions:	
25% Entering	AM Hours	30% from East	70% from West
75% Exiting		70% to East	30% to West
50% Entering	Mid-Day Hours	30% from East	70% from West
50% Exiting		70% to East	30% to West
65% Entering	PM Hours	30% from East	70% from West
35% Exiting		70% to East	30% to West

NCHRP Report 365 - Table 41
Urban Size = 500,000 - 999,999
Knoxville Urban Size (2014) = 857,585

Time of Day	Percentage of Trips
7-8 am	7.42%
8-9 am	5.42%
11 am-Noon	4.95%
Noon-1 pm	6.64%
2-3 pm	6.56%
3-4 pm	8.28%
4-5 pm	9.31%
5-6 pm	13.50%
	62.08%

Note: The original value shown in the NCHRP Report gives a value of 9.52% for the 5-6 pm period. However, to match the projected generated traffic volumes, this percentage was increased to 13.5%

For example, 7-8 AM for WB Left Turns:
Volume = 737 Daily Trips * 25% Exiting * 30% Trips from East * 7.42% Trips (at 7-8 AM)
Volume = 737 x .25 x .3 x .0742
Volume = 4 Trips

This spreadsheet is used to estimate the future project hourly volumes to determine if an intersection will meet traffic signal warrants.



Traffic Signal Warrant Analysis

CIVIL ENGINEERING / TRAFFIC ENGINEERING

Project Name	Thomas Lane Subdivision
Project/File #	1901
Scenario	2024 - Projected Traffic Volumes

Intersection Information	
Major Street Name	East Emory Road (SR 131)
North/South or East/West	E/W
Speed Limit > 40 mph	Yes
# of Approach Lanes	1
% of Right Turn Traffic to Include	100%
Minor Street Name	Thomas Lane
# of Approach Lanes	1
% of Right Turn Traffic to Include	100%
Isolated Community < 10,000 pop	No

Additional Warrants to Consider	
Warrant 3, Peak Hour (A - Volume and Delay)	No
All-Way Stop Warrant	No



Traffic Signal Warrant Analysis

East Emory Road (SR 131) (Major Street) Volume

Eastbound Volume by Hour				
Time	Left Turns	Through	Right Turns	Peds/Bikes
12 - 1 AM				
1 - 2 AM				
2 - 3 AM				
3 - 4 AM				
4 - 5 AM				
5 - 6 AM				
6 - 7 AM				
7 - 8 AM		281	9	
8 - 9 AM		207	7	
9 - 10 AM				
10 - 11 AM				
11 - 12 PM		271	13	
12 - 1 PM		381	17	
1 - 2 PM				
2 - 3 PM		444	22	
3 - 4 PM		591	27	
4 - 5 PM		736	31	
5 - 6 PM		852	45	
6 - 7 PM				
7 - 8 PM				
8 - 9 PM				
9 - 10 PM				
10 - 11 PM				
11 - 12 AM				
Total Vehicles (unadjusted)			3,934	0

Westbound Volume by Hour				
Time	Left Turns	Through	Right Turns	Peds/Bikes
12 - 1 AM				
1 - 2 AM				
2 - 3 AM				
3 - 4 AM				
4 - 5 AM				
5 - 6 AM				
6 - 7 AM				
7 - 8 AM	4	673		
8 - 9 AM	3	492		
9 - 10 AM				
10 - 11 AM				
11 - 12 PM	5	313		
12 - 1 PM	7	335		
1 - 2 PM				
2 - 3 PM	9	326		
3 - 4 PM	12	361		
4 - 5 PM	13	409		
5 - 6 PM	19	426		
6 - 7 PM				
7 - 8 PM				
8 - 9 PM				
9 - 10 PM				
10 - 11 PM				
11 - 12 AM				
Total Vehicles (unadjusted)			3,407	0

Thomas Lane (Minor Street) Volume

Northbound Volume by Hour				
Time	Left Turns	Through	Right Turns	Peds/Bikes
12 - 1 AM				
1 - 2 AM				
2 - 3 AM				
3 - 4 AM				
4 - 5 AM				
5 - 6 AM				
6 - 7 AM				
7 - 8 AM	28		12	
8 - 9 AM	21		9	
9 - 10 AM				
10 - 11 AM				
11 - 12 PM	13		5	
12 - 1 PM	17		7	
1 - 2 PM				
2 - 3 PM	12		5	
3 - 4 PM	15		6	
4 - 5 PM	17		7	
5 - 6 PM	24		10	
6 - 7 PM				
7 - 8 PM				
8 - 9 PM				
9 - 10 PM				
10 - 11 PM				
11 - 12 AM				
Total Vehicles (unadjusted)			208	0

Southbound Volume by Hour				
Time	Left Turns	Through	Right Turns	Peds/Bikes
12 - 1 AM				
1 - 2 AM				
2 - 3 AM				
3 - 4 AM				
4 - 5 AM				
5 - 6 AM				
6 - 7 AM				
7 - 8 AM				
8 - 9 AM				
9 - 10 AM				
10 - 11 AM				
11 - 12 PM				
12 - 1 PM				
1 - 2 PM				
2 - 3 PM				
3 - 4 PM				
4 - 5 PM				
5 - 6 PM				
6 - 7 PM				
7 - 8 PM				
8 - 9 PM				
9 - 10 PM				
10 - 11 PM				
11 - 12 AM				
Total Vehicles (unadjusted)			0	0



Traffic Signal Warrant Analysis

Warrants 1 - 3 (Volume Warrants)

Project Name	Thomas Lane Subdivision
Project/File #	1901
Scenario	2024 - Projected Traffic Volumes

Intersection Information			
Major Street (E/W Road)	East Emory Road (SR 131)	Minor Street (N/S Road)	Thomas Lane
Analyzed with	1 approach lane	Analyzed with	1 Approach Lane
Total Approach Volume	7341.05 vehicles	Total Approach Volume	208 vehicles
Total Ped/Bike Volume	0 crossings	Total Ped/Bike Volume	0 crossings
Right turn reduction of	0 percent applied	Right turn reduction of	0 percent applied

Reduction applied to warrant thresholds due to high speed on East Emory Road (SR 131)

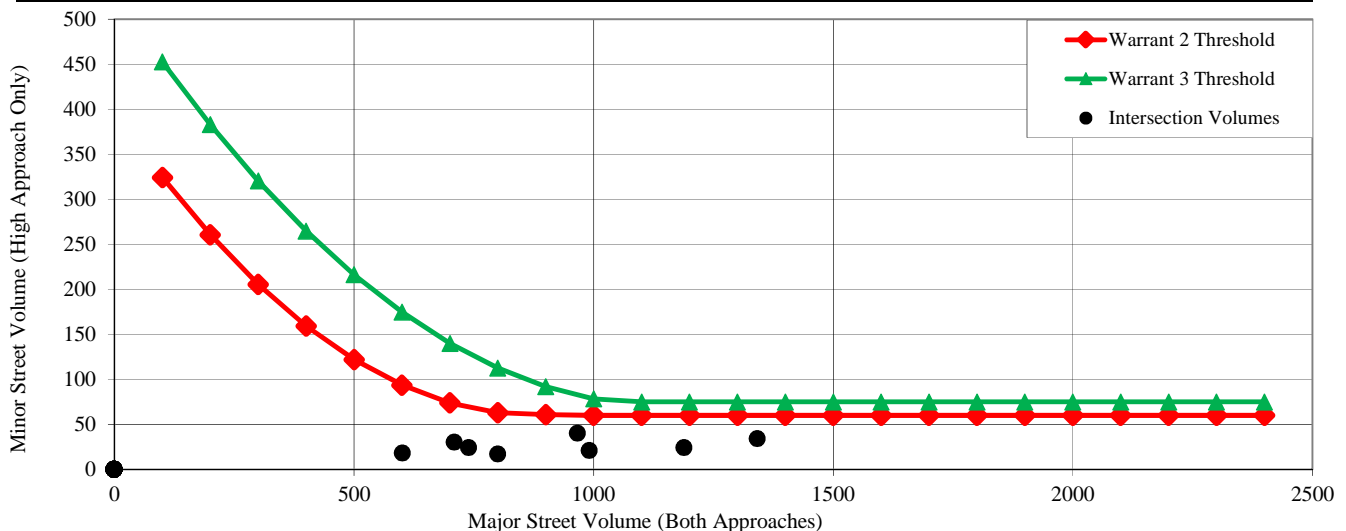
Warrant 1, Eight Hour Vehicular Volume			
Condition Satisfied?	Not satisfied	Not satisfied	Not satisfied
Required values reached for	0 hours	0 hours	0 (Cond. A) & 0 (Cond. B)
Criteria - Major Street (veh/hr)	350	525	280 (Cond. A) & 420 (Cond. B)
Criteria - Minor Street (veh/hr)	105	53	84 (Cond. A) & 42 (Cond. B)

* Should be applied only after an adequate trail of other alternatives that could cause less delay and inconvenience to traffic has failed to solve the traffic problems.

Warrant 2, Four Hour Vehicular Volume	
Condition Satisfied?	Not satisfied
Required values reached for	0 hours
Criteria	See Figure Below

Warrant 3, Peak Hour Vehicular Volume		
Condition Satisfied?	Not Examined	Not Satisfied
Required values reached for		0 hours
Criteria - Total Approach Volume (veh in one hour)		See Figure Below
Criteria - Minor Street High Side Volume (veh in one hour)		
Criteria - Minor Street High Side Delay (veh-hrs)		

Figure 4C-2 (Warrant 2 - 70% Factor) & Figure 4C-4 (Warrant 3 - 70% Factor)



APPENDIX K

SIMTRAFFIC QUEUE LENGTH CALCULATIONS

Intersection: 3: Thomas Lane & East Emory Road (SR 131)

Movement	WB	NB
Directions Served	LT	LR
Maximum Queue (ft)	5	35
Average Queue (ft)	1	22
95th Queue (ft)	9	44
Link Distance (ft)	837	598
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 0

Intersection: 3: Thomas Lane & East Emory Road (SR 131)

Movement	WB	NB
Directions Served	LT	LR
Maximum Queue (ft)	100	49
Average Queue (ft)	11	19
95th Queue (ft)	53	42
Link Distance (ft)	837	598
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 0



11812 Black Road
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Phone (865) 556-0042
ajaxengineering@gmail.com

February 25, 2019

PROJECT NAME: Thomas Lane Subdivision

TO: Knoxville-Knox County Planning
Knox County Engineering Department
Tennessee Department of Transportation (TDOT)

SUBJECT: TIS Comment Response Document for Thomas Lane Subdivision
Review Comments dated December 11, 2018

Dear Knoxville-Knox County Planning, Knox County Engineering, and TDOT staff:

The following comment response document is submitted to address comments dated December 11, 2018.

1. **Reviewer Comment:** On page iv, please re-number Table 6 & 7 with the appropriate pages.

Response: The Table of Contents pages have been updated with the appropriate page numbers.

2. **Reviewer Comment:** To estimate the number of trips for this development, please use the Knoxville-Knox County Planning (previously MPC) Local Apartment LUC worksheet for the Trip Generation of the 91-lot single-family attached lot residential development. The reason for this is because the units are attached, grouped together, and provide parking for guests like an apartment complex. The Knoxville-Knox County Planning Staff has decided to use the Local Apartment worksheet for apartments, condos and townhomes.

Response: Revisions have been made to Table 5, the discussion under Trip Generation, and Appendix A to reflect the requested trip rate changes. The changes in the trip generation numbers have been carried forward in the subsequent portions of the report.

3. **Reviewer Comment:** Please complete a speed study along E Emory Road at Thomas Lane during the off-peak hours since the number of vehicles turning left onto Thomas Lane is really close to warrant a left-turn lane given the 36 to 45 mph speed table used. The review team wants to know if the marked speed limit of 45 mph is really close to what vehicles are traveling or if the table needs to be updated to the 46 to 55 mph speed table. This needs to be evaluated with TDOT and Knox County Engineering.

Response: A spot speed study was conducted on East Emory Road adjacent to Thomas Lane on 2/18/19 at 1:30 pm. The results of the spot speed study are in Appendix H in the revised report. The results of the spot speed study indicated an 85th percentile speed of 48.0 mph on East Emory Road. Using the Knox County worksheets for speeds of 46 to 55 mph did not change the original recommendations with respect to turn lanes. Even though the speed classification changed, the amount of projected entering and exiting traffic was reduced in the PM peak hour due to using the recommended Local Apartment Trip Generation Rates instead of ITE's trip generation rates for Multifamily Housing (Low Rise) (Land Use #220).

4. **Reviewer Comment:** On page 1, please clarify the existing single-family housing currently existing, how many houses are to stay, and how many houses are to be torn down. The first paragraph and first bullet point are somewhat contradictory and unclear.

Response: On page 1 first paragraph, the discussion regarding the existing single-family housing that is existing, to remain, or torn down is clarified. Further updated clarification is made in Figure 3.

5. **Reviewer Comment:** Please make the bubbles in Figures 2, 4, 5, 6, 7, & 8 have white background, not the hatched. It makes it hard to tell what some of the numbers are.

Response: The original drawing and pdf file did not have any hatch within the bubbles and did have a white background. It is not known why this happened except perhaps due to printing issue. It is hoped that they subsequent revised printed report does not have any of these "artifacts" and the numbers in the bubbles are legible.

6. **Reviewer Comment:** On page 13 third paragraph, please correct the widening of Thomas Lane to 20 feet. Knox County Engineering will require 20 feet for the widening.

Response: On page 13 third paragraph, the widening of Thomas Lane has been changed to 20 feet. This was also changed on page 35.

7. **Reviewer Comment:** On page 16 third paragraph, correct the widening to 20 feet and add that Knox County is requiring a cul-de-sac be installed to terminate Thomas Lane.

Response: On page 16 third paragraph, the widening of Thomas Lane was corrected to 20 feet and a sentence was added that Knox County is requiring that the end of Thomas Lane be re-constructed with a cul-de-sac.

8. **Reviewer Comment:** Please update Table 5 as previously discussed in point #2 above. Also, the PM Peak Hour trips generated totals were incorrect, but that will be changed when the other land use is used.

Response: Table 5 was updated with the new trip rates and this information was carried forward in the report.

9. **Reviewer Comment:** Carry edits from Table 5 of Trip Generation to the appropriate figures.

Response: Table 5 was updated with the new trip rates and this information was carried forward in the report and in the appropriate figures – Figures 7 and 8.

10. **Reviewer Comment:** The cedar tree looking to the east from Thomas Lane will need to be removed, not relocated as said in the Conclusions and Recommendations.

Response: At the end of the original report, the cedar tree and utility pole were discussed to be removed and relocated respectively - “As part of the widening of Thomas Lane by the developer, it is recommended that the cedar tree and utility pole in the southeast corner of the intersection be removed and relocated respectively.” However, in the Recommendations on page 2, the wording has been changed to remove any confusions about what should be removed and what should be relocated.

11. **Reviewer Comment:** On page 35 section 1a), please give a clearer picture of the right-turn lane improvements on E Emory Road.

Response: On page 36 (previously page 35) section 1a), a clearer picture was updated in the report.

12. Reviewer Comment: On page 41, the Traffic Sign Location picture needs to remove OM4-1 since Thomas Lane will end as a cul-de-sac, not a dead end.

Response: On page 42 (previously page 41), the End of Roadway Signs (OM4-1) were removed from the picture and discussion.

In addition to the requested revisions, other changes in the report include the following:

- Updated Title Page
- Updated Table of Contents and page numbers
- Updated Page Footers
- Updated Figures 3, 7, and 8
- Updated Tables 5, 6, and 7
- Updated Appendix A, F, G, Added Appendix H (Spot Speed Study), I (previously H), and K (previously J)
- Updated discussion for projected queue lengths on Thomas Lane on page 40
- Updated discussion on sight distance based on results from the spot speed study on page 2, 33, and 36

If you have any questions or further comments, please feel free to contact me at any time. I look forward to your review and approval.

Sincerely,

Ajax Engineering, LLC
Robert W. Jacks, P.E.

