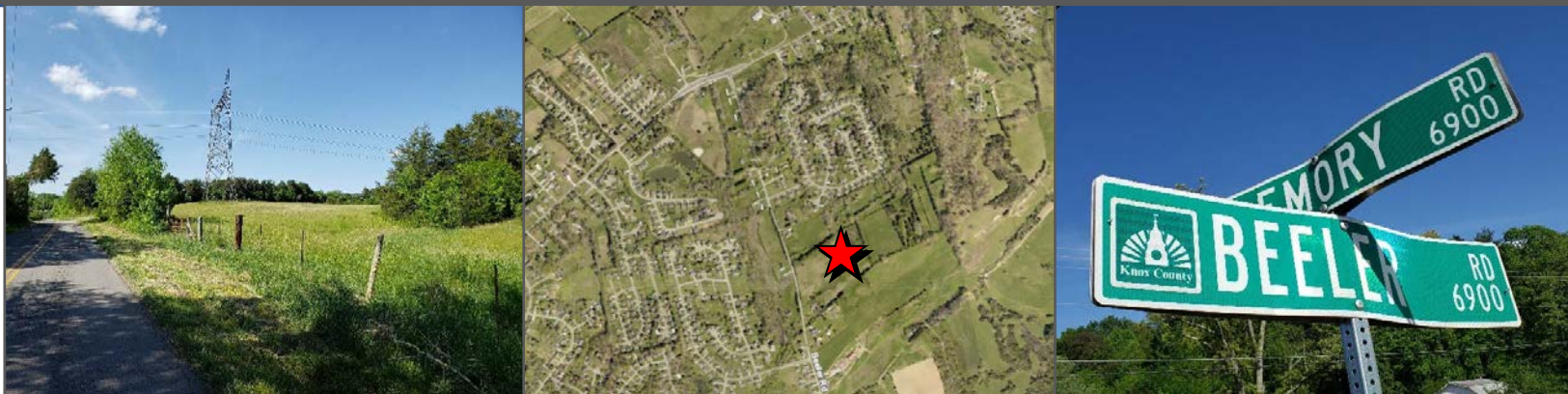


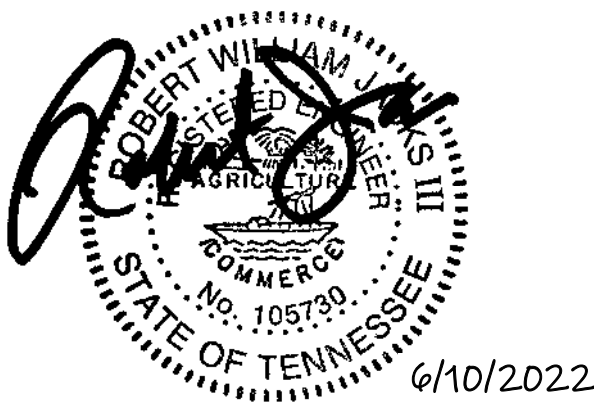


# Transportation Impact Study Beeler Road Subdivision Knox County, Tennessee



Revised June 2022

Prepared for:  
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7-SA-22-C / 7-A-22-UR  
TIS Version 2  
6/10/2022

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## EXECUTIVE SUMMARY

### **Preface:**

B&B Builders is proposing a residential development off Beeler Road in Northeast Knox County, TN. This report references the proposed development as “Beeler Road Subdivision” since a formal name has not been chosen. The development will include 84 attached townhouses and three detached houses on 27.54 +/- acres. It is anticipated to be fully built and occupied by 2027 and proposes a single main entrance on Beeler Road for the 84 attached townhouses. The three detached houses will have individual separate driveways on Beeler Road. This study’s primary purpose is to determine and evaluate the potential impacts of the development on the adjacent transportation system. The study includes a review of the primary access roads and intersections and is a Level 1 study established by Knoxville/Knox County Planning. Recommendations and mitigation measures are offered if transportation operations are projected to be below recognized engineering standards.

### **Study Results:**

The findings of this study include the following:

- The Beeler Road Subdivision with 84 attached townhouses and three detached houses is estimated to generate 857 trips at full build-out and occupancy on an average weekday. Of these daily trips, 49 are estimated to occur during the AM peak hour and 71 in the PM peak hour in 2027.
- The Proposed Main Entrance at Beeler Road for the 84 townhouses is expected in the projected 2027 conditions to operate with low vehicle delays in the AM and PM peak hours. Due to the expected low conflicting volumes, the construction of separate entering left and right-turn lanes are not recommended on Beeler Road at the Proposed Main Entrance. A single exiting lane for the development’s main entrance at Beeler Road will be sufficient.
- The intersection of East Emory Road at Beeler Road has been calculated to operate with high vehicle delays for motorists on the northbound approach of Beeler Road at East Emory Road in the existing and projected 2027 conditions. However, a TDOT project provided through the IMPROVE Act will widen East Emory Road from 2 lanes to 5 lanes. This road widening will provide additional roadway capacity and reduce the overall projected vehicle delays at the intersection of East Emory Road at Beeler Road.

### **Recommendations:**

The following recommendations are offered based on the study analyses. The recommendations are to minimize the impacts of the proposed development on the adjacent transportation system while attempting to achieve an acceptable traffic flow and improved safety.

- It is recommended that a Stop Sign (R1-1) be installed, and a 24" white stop bar be applied to the Proposed Main Entrance approach at Beeler Road. The stop bar should be applied a minimum of 4 feet away from the edge of the intersecting roadway and placed at the desired stopping point that maximizes the sight distance.
- Sight distances at the Proposed Main Entrance approach must not be impacted by future landscaping, signage, or vegetation. Based on a posted speed limit of 25-mph on Beeler Road, the desirable intersection sight distance is 250 feet looking in each direction at the Proposed Main Entrance. The required stopping sight distance is 155 feet looking to the north and the south at the Proposed Main Entrance. A visual inspection determined that the intersection and stopping sight distances are available. The site designer must ensure that these sight distances are accounted for and provided in the design plans.
- Sight distances at the individual separate driveways for the three detached houses on Beeler Road must also be accounted for and provided in the design plans.
- The TDOT project provided through the IMPROVE Act will widen East Emory Road from 2 to 5 lanes and provide the projected necessary roadway capacity for the turning movements at the intersection of East Emory Road at Beeler Road.
- Before the TDOT widening project is completed, in the interim, a traffic sign is recommended to be posted directly across from Beeler Road outside the paved shoulder of East Emory Road. It is recommended that a "No Passing on Shoulder" (R4-18) sign be installed to address the existing illegal movements committed by some motorists occasionally using the shoulder to pass stopped westbound left-turning vehicles on East Emory Road at Beeler Road. This sign should, at a minimum, be 24" x 30" in size, and it is recommended that it be posted outside the paved shoulder, facing westbound traffic, and at least 12 feet from the white edge line.
- The results determined that a storage length of 50 feet is recommended to be designated for westbound left-turns at the intersection of East Emory Road at Beeler Road. This length should include the appropriate white left-turn arrow and

delineation from the center turn lane that will be constructed by TDOT on East Emory Road.

- It is recommended that new traffic counts be conducted to examine whether the intersection of East Emory Road at Beeler Road could meet traffic signal warrants once the subdivisions on Beeler Road are constructed and fully occupied, and the East Emory Road widening project is completed.
- A 25-mph Speed Limit Sign (R2-1) is recommended to be posted near the beginning of the development's main entrance off Beeler Road. It is recommended that a "No Outlet" Sign (W14-2a) be installed at the front of the subdivision at Beeler Road. This sign can be installed above or below the street name sign.
- Stop Signs (R1-1) and 24" white stop bars are recommended on the new internal roadways.
- Sight distance at the new internal road intersections must not be impacted by signage, parked cars, or future landscaping. With a proposed speed limit of 25-mph in the development, the internal intersection sight distance is 250 feet. The required stopping sight distance is 155 feet for a level road grade. The site designer should ensure that internal sight distance lengths are met and account for different proposed road grades.
- Traffic calming measures may be needed to decrease internal vehicle speeds. Road "A" within the development has several vertical grades with a long, straight horizontal alignment. Straight road segments with steeper grades encourage higher vehicle speeds. It is recommended that the site designer consider installing speed humps or speed tables within the development to reduce internal speeds. Specifics of the traffic calming strategies should be discussed with Knox County Engineering in the detail design phase.
- All drainage grates and covers for the residential development must be pedestrian and bicycle safe.
- If directed by the local post office, the site designer should include a parking area within the development for a centralized mail delivery center. The site plan does not show a general location, and a specific plan with a parking area should be designed and provided.
- All road grade and intersection elements should be designed to AASHTO, TDOT, and Knox County specifications and guidelines to ensure proper operation.

## DESCRIPTION OF EXISTING CONDITIONS

### ▪ STUDY AREA:

The proposed location of this new residential development is shown on a map in Figure 1. This proposed development will be located off Beeler Road, 2,450 feet south of East Emory Road in Northeast Knox County, TN, and will have a single main entrance on Beeler Road. This development will be located south and adjacent to a new residential subdivision, Beeler Farms, currently under construction. As Knoxville/Knox County Planning requested, transportation impacts associated with the proposed development were analyzed at the intersection of East Emory Road at Beeler Road.

The proposed development property is in a more rural area that is gradually being transformed into an area more suburbanized and residential in character. The growing number of residential units in the surrounding area include stand-alone single-family residences and subdivisions of Beeler Farms, Opportunity Ridge, Twin Brooks, Victoria's Landing, and Huntington Place.

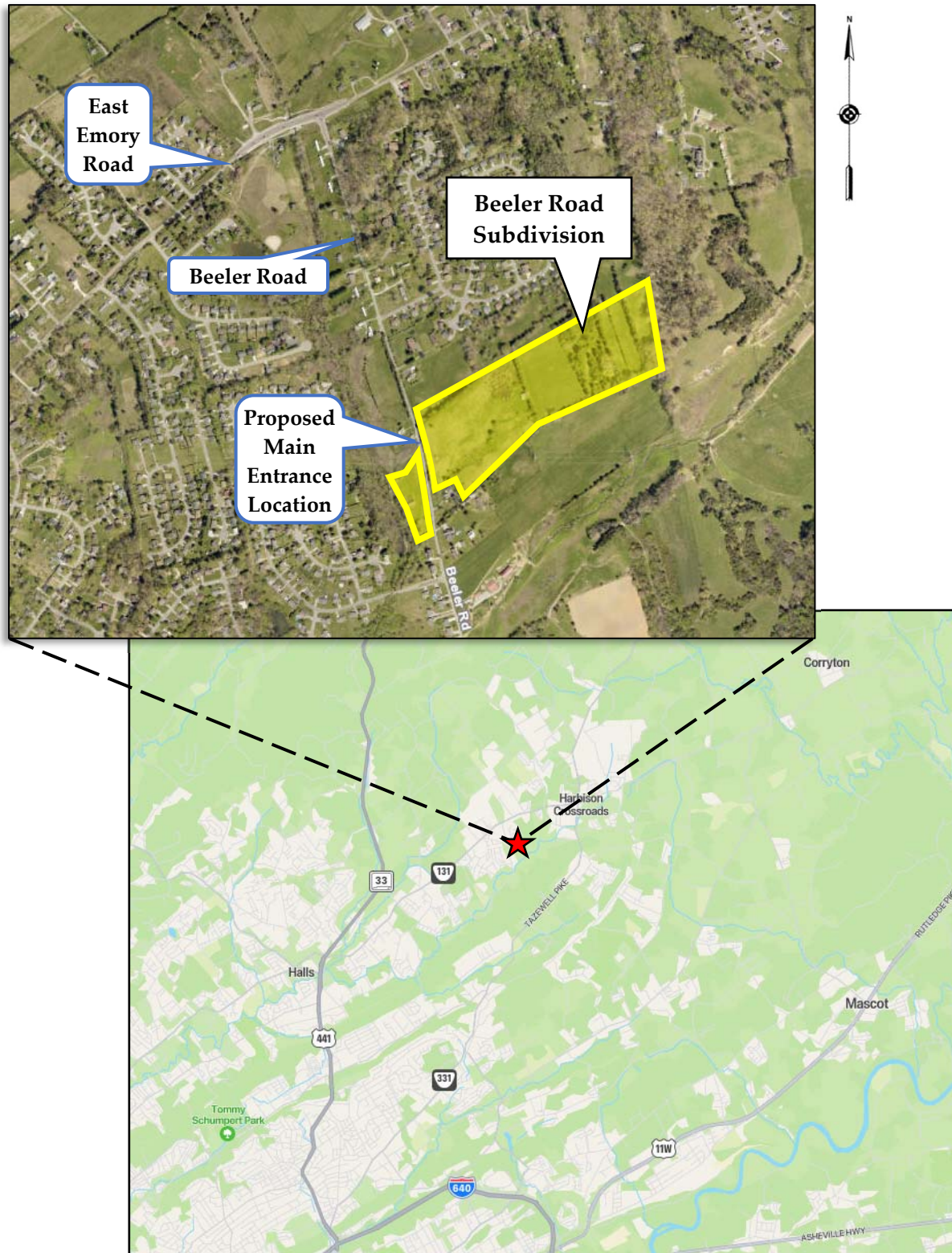
The development property exists on both sides of Beeler Road. The more significant portion of the development will be on the east side of Beeler Road and will contain 84 attached townhouses. The smaller portion of the proposed development (just over 2 acres) will be on the east side of Beeler Road, where three detached houses will be constructed.



**View of Proposed Development Site on  
South Side  
(Looking Northeast from Beeler Road)**

The proposed development site is currently undeveloped, with most of it used for farm activities. Both portions of the development property on each side of Beeler Road have old barns that will be removed for construction. The larger property on the east side of Beeler Road has some forested areas on the eastern end. A 200-foot-wide Tennessee Valley Authority electric transmission line and easement bisect the property to the southwest. Unnamed branches of Beaver Creek have been identified and run along the property lines on the far western and eastern edges of the development property.





**Figure 1**  
**Location Map**

▪ **EXISTING ROADWAYS:**

Table 1 lists the characteristics of the existing primary access roadways adjacent to the development property and included in the study:

**TABLE 1**  
**STUDY CORRIDOR CHARACTERISTICS**

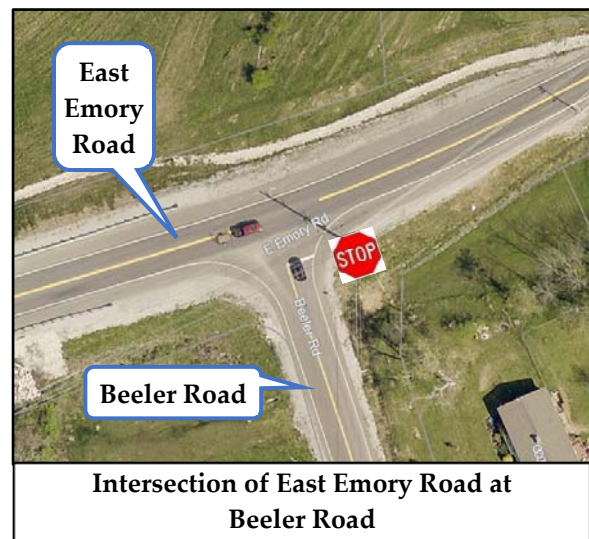
NAME	CLASSIFICATION <sup>1</sup>	SPEED LIMIT	LANES	ROAD WIDTH <sup>2</sup>	TRANSIT <sup>3</sup>	PEDESTRIAN FACILITIES	BICYCLE FACILITIES
East Emory Road (SR 131)	Major Arterial	45 mph	2 undivided	42 feet	None	None	None
Beeler Road	Major Collector	25 mph	2 undivided	18 feet	None	None	None

<sup>1</sup> 2018 Major Road Plan by Knoxville/Knox County Planning

<sup>2</sup> From edges of pavement

<sup>3</sup> According to Knoxville Area Transit System Map

**East Emory Road (SR 131)** is classified as a Major Arterial and generally traverses in a general southwest-northeast direction in the study area. East Emory Road is a state route and is a relatively straight road with minor horizontal and vertical curvature. The section of East Emory Road near the project site currently consists of a 2-lane pavement section approximately 42 feet wide with approximately 11.5-foot travel lanes with 8'-10' paved shoulders outside the travel lanes. The roadway pavement is marked with a double yellow centerline and white edge lines. Skip line rumble strips are provided outside the white edge lines on both sides. The posted speed limit on East Emory Road is 45-mph. A single utility light is provided at the intersection of East Emory Road at Beeler Road for road illumination.



The East Emory Road designation officially transitions from West Emory Road 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 in Knox County is approximately 18.5 miles.





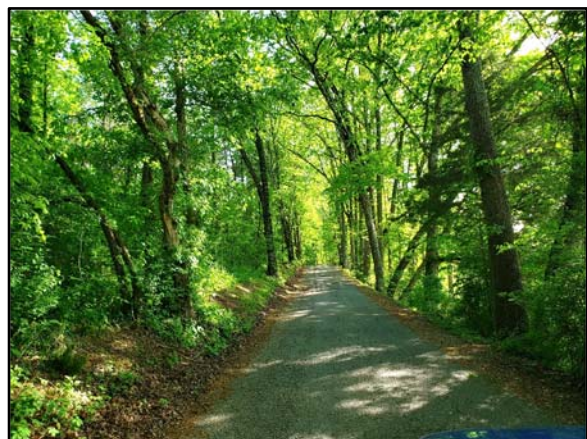
**Box Culvert for Kerns Branch on  
East Emory Road  
(Looking West)**

The area around the intersection of East Emory Road at Beeler Road has been modified within the last few years. From 2017 to 2018, the Tennessee Department of Transportation (TDOT) replaced a box culvert for Kerns Branch just west of the intersection. This replacement included shifting the alignment of East Emory Road further to the north and subsequently extended Beeler Road also slightly further to the north. This project also included installing new guardrails and providing widened and paved shoulders.

In 2017, the State of Tennessee passed the IMPROVE Act (Improving Manufacturing, Public Roads and Opportunities for a Vibrant Economy Act). This act provided cuts to the state sales tax on groceries and the Hall income tax, increases in fuel taxes, and included a list of 962 transportation projects to be paid with the new funding. One of these TDOT projects includes widening East Emory Road (SR 131). This project is currently in the design phase and proposes widening East Emory Road from 2 to 5 lanes.

For the proposed development, East Emory Road will provide access to the southwest towards north Knoxville and the northeast towards Harbison Crossroads and the Gibbs community. East Emory Road primarily provides access to residential subdivisions, stand-alone residences, and farm properties in the study area.

**Beeler Road** is classified as a Major Collector between Stormer Road and East Emory Road and has a posted speed limit of 25-mph. It intersects East Emory Road twice with a circuitous route with a total length of 2.2 miles. On its east end, closer to the development site, Beeler Road intersects East Emory Road at an unsignalized t-intersection and continues southward past the proposed development property and the existing Twin Brooks Subdivision entrance. The road pavement narrows significantly and is more isolatedly populated beyond the Twin Brooks Subdivision entrance. Beeler Road continues west



**Narrower Southern Side of Beeler Road**

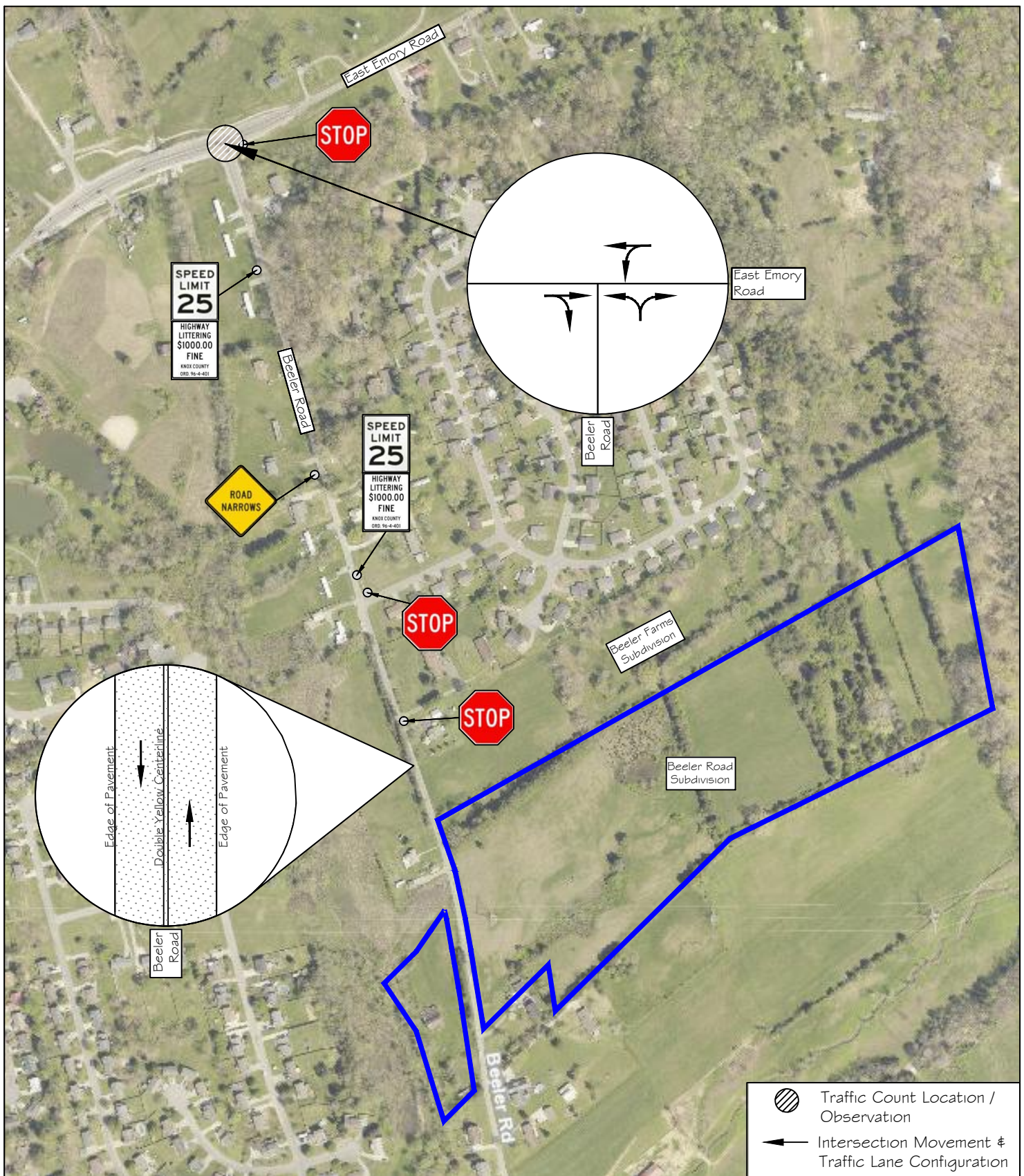
to Stormal Road and then northward back to East Emory Road at an unsignalized t-intersection. The two intersections of Beeler Road at East Emory Road are separated by approximately 1 mile. Both approaches of Beeler Road at East Emory Road are controlled by a Stop Sign (R1-1), with East Emory Road motorists operating freely.

At the intersection of Beeler Road at East Emory Road included in this study, Beeler Road has 12-foot lanes with a total pavement width of about 30 feet. Wider lanes were provided during the re-construction project on East Emory Road. About 250 feet south of this intersection, Beeler Road narrows down to 20 feet and continues to the south towards the development site averaging between 18 to 20 feet. Beeler Road is marked with a "Road Narrows" sign halfway between the development property and East Emory Road. A couple of spots on Beeler Road, closer to the Proposed Main Entrance for the proposed subdivision, were measured closer to 17.5 feet in width.

The pavement on Beeler Road is marked with a double yellow centerline and is characterized by mailboxes, private driveways, trees, drainage ditches, and utility poles outside the roadway pavement.

Figure 2 shows the existing lane configurations of the intersection examined in the study, the traffic count location for the study, and the current traffic road signage in the study area. The road signage shown in Figure 2 only includes warning and regulatory signage near the development site. The pages following Figure 2 give a further overview of the site study area with photographs.





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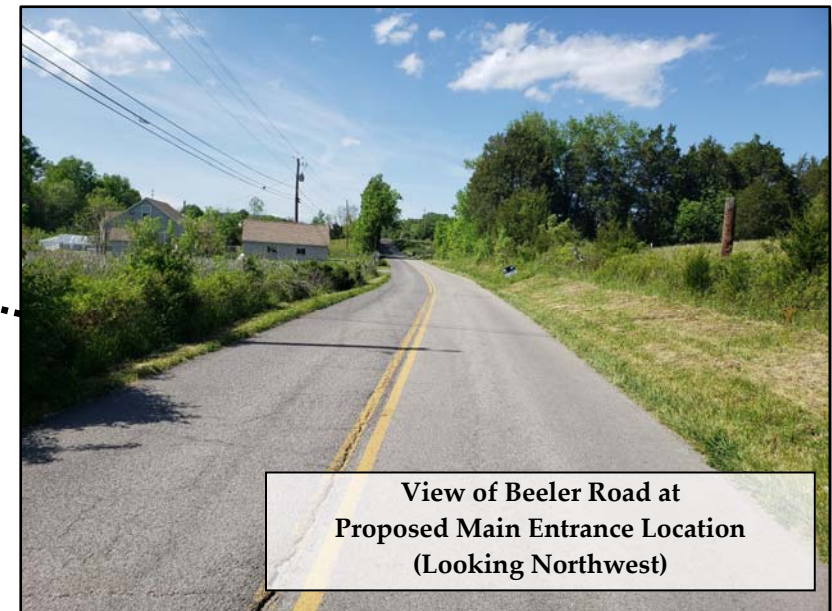
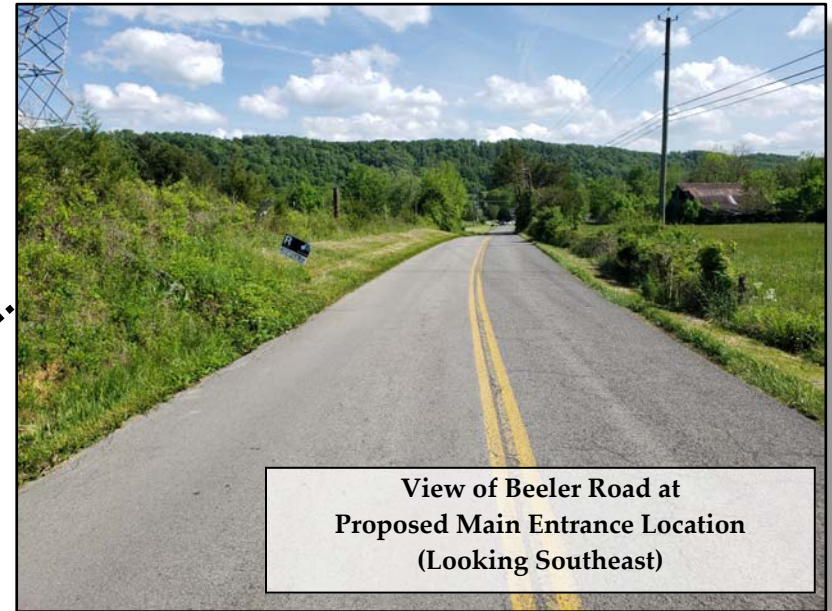
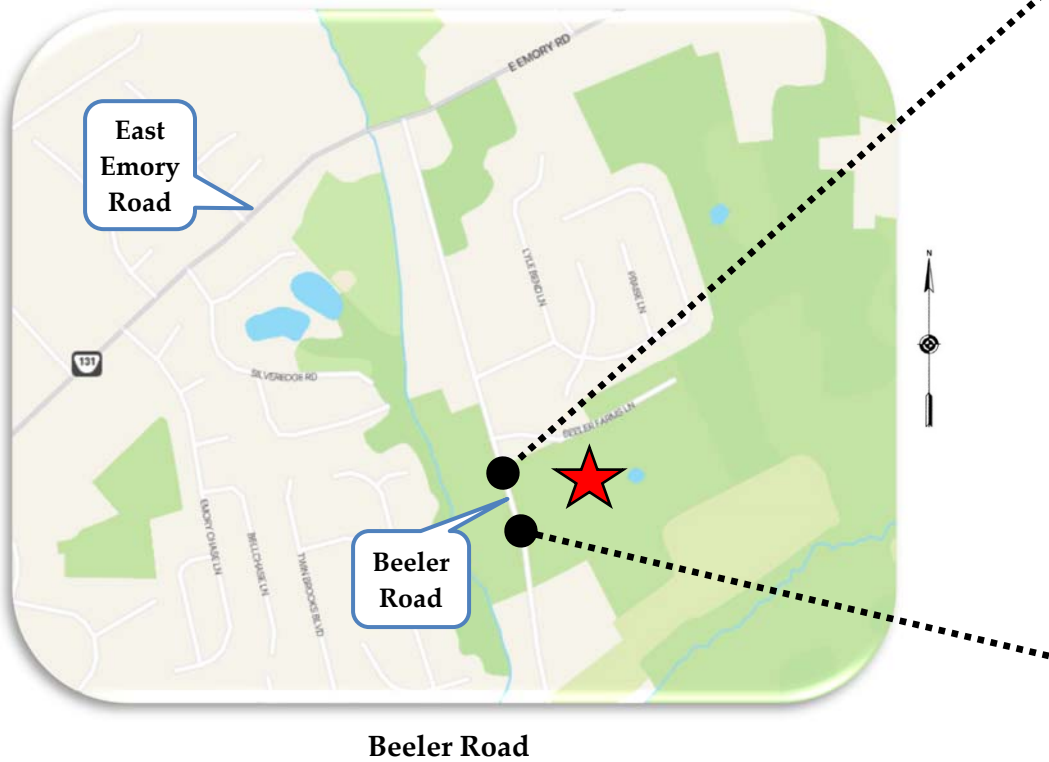
FIGURE 2

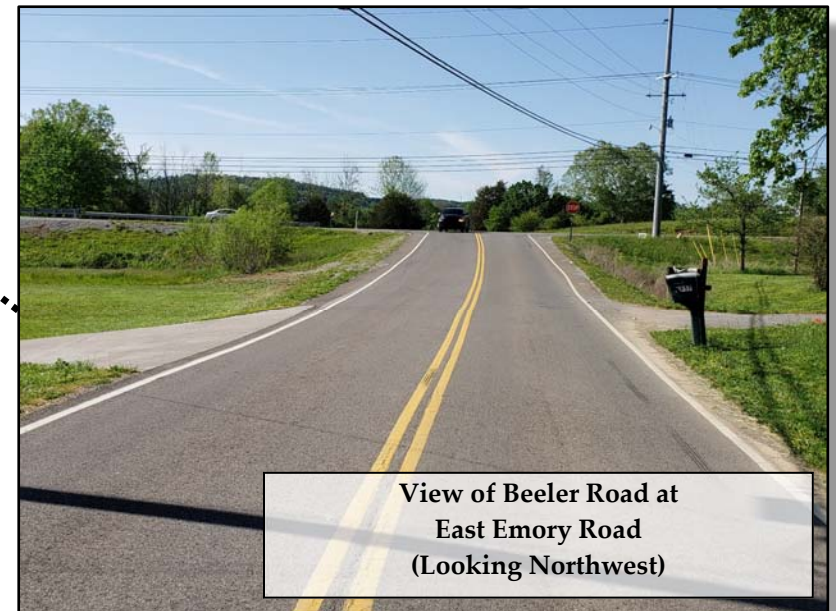
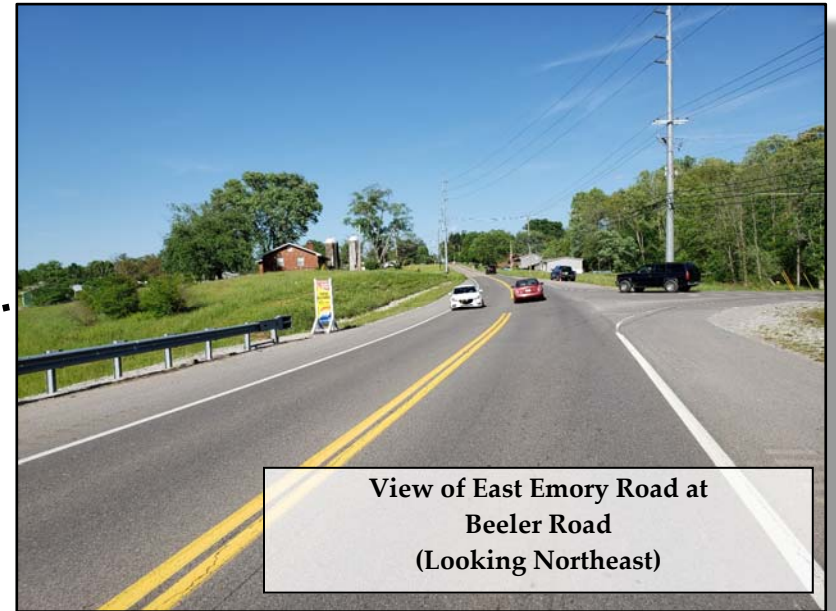
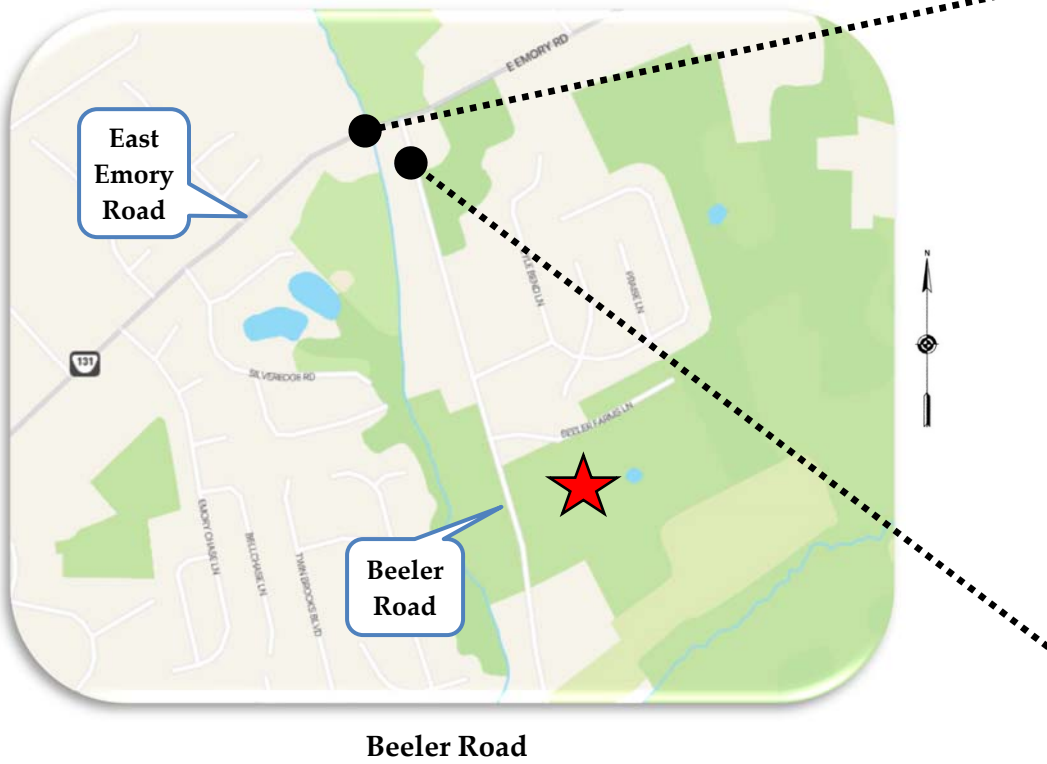
Beeler Road Subdivision

Traffic Count Location, Traffic Signage & Existing Lane Configurations

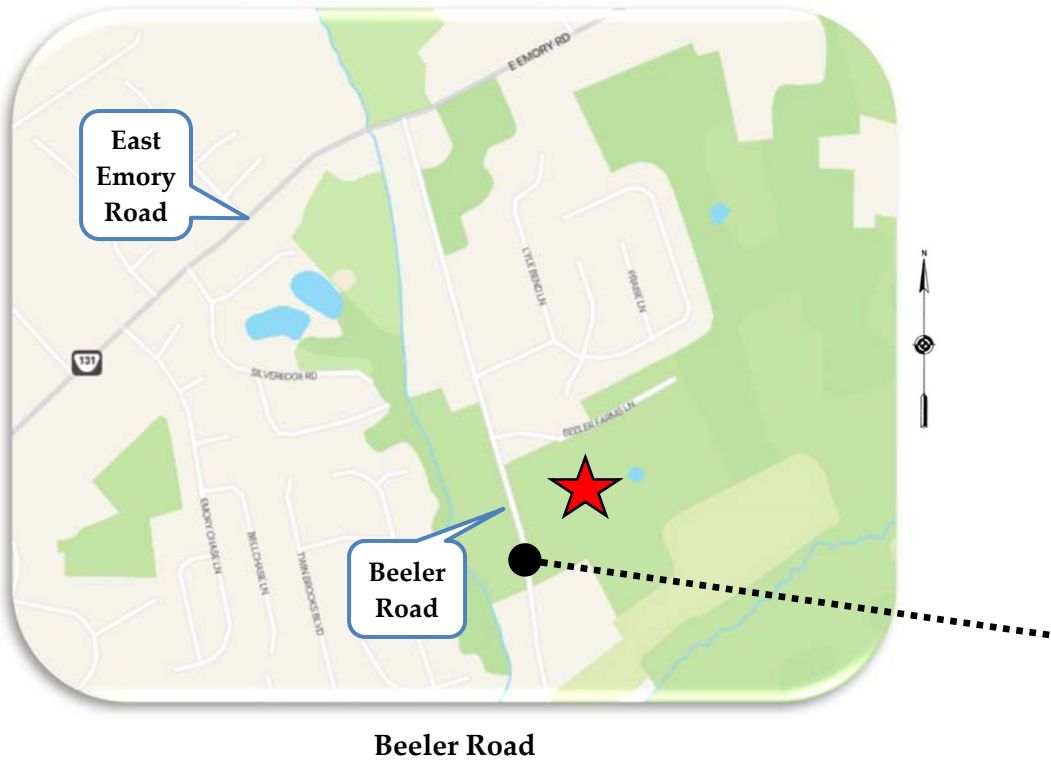


## PHOTO EXHIBITS









View of Project Site at  
Beeler Road  
(Looking Northeast)

▪ **EXISTING TRANSPORTATION VOLUMES PER MODE:**

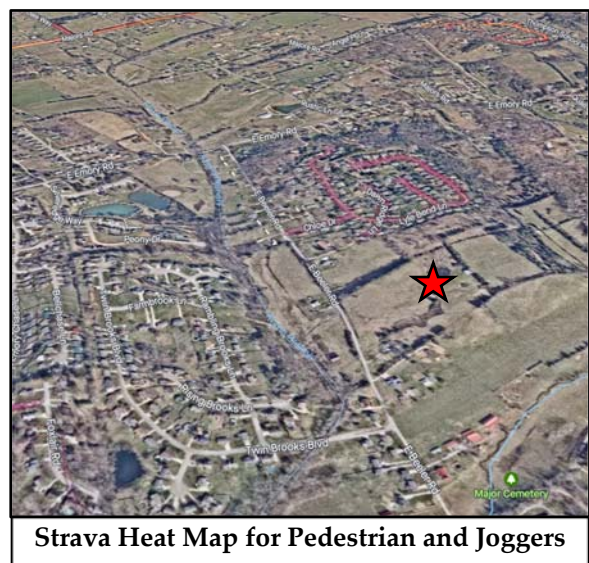
One annual vehicular traffic count location exists in the study area, and this count is conducted by the Tennessee Department of Transportation (TDOT). The count location data is the following and can be viewed with further details in Appendix A:

- Existing vehicular roadway traffic:  
The TDOT reported an Average Daily Traffic (ADT) on East Emory Road, east of Tazewell Pike, at 5,702 vehicles per day in 2021. From 2011 to 2021, this count station has indicated a 0.5% average annual traffic growth rate.

- Existing bicycle and pedestrian volumes:  
The average daily pedestrian and bicycle traffic is unknown along East Emory Road and Beeler Road. Due to the lack of facilities, it is assumed that there is a minimal number of pedestrians and bicyclists on these roads in the study area. During the traffic counts for this project at the intersection of East Emory Road at Beeler Road, no pedestrians or bicyclists were observed over 8 hours.



An online website, [strava.com](https://www.strava.com), provides “heat” maps detailing exercise routes taken by pedestrians, joggers, and bicyclists. The provided heat maps show the last two years of data, are updated monthly, and are gathered from individuals allowing their smart devices to track and compile their routes (millions of users). The activities in the maps are shown on the roads with color intensities with lighter colors signifying higher activity. The Strava heat map





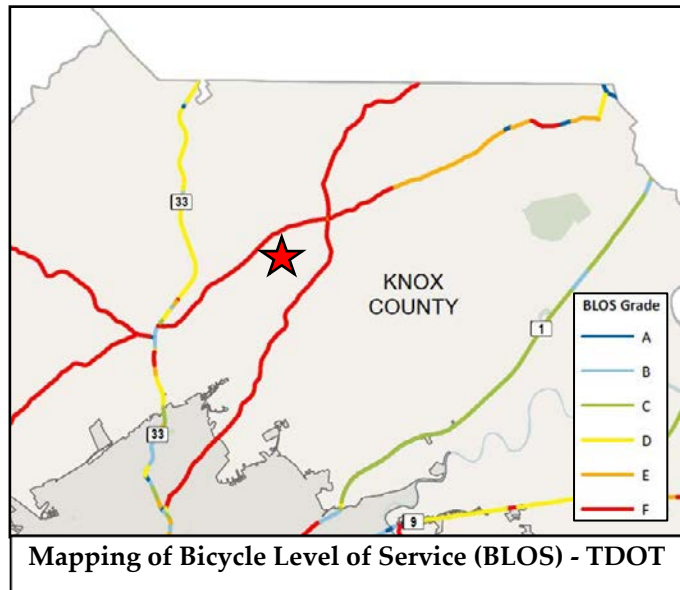
data shows that hardly any pedestrian or bicycle traffic occurs in the study area. Some pedestrian activity has been recorded in the existing Opportunity Ridge Subdivision north of the development site and on the east side of Beeler Road.

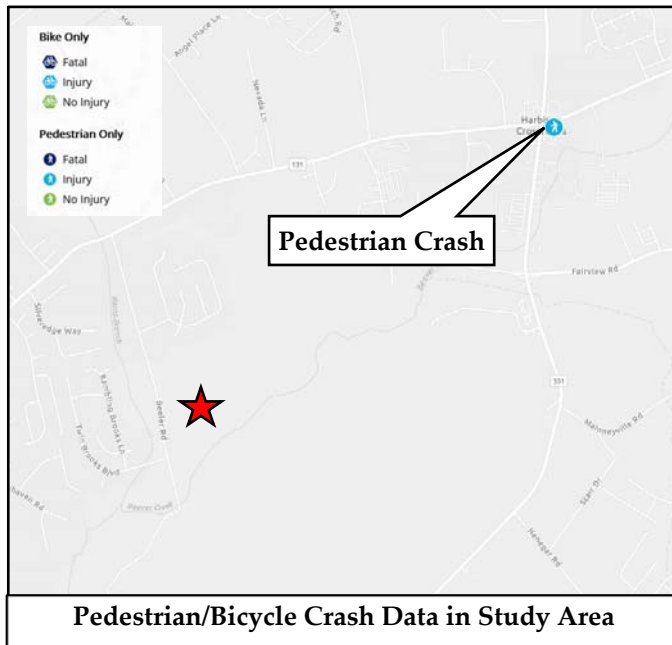
▪ **ON-STREET PARKING:**

On-street parking was not observed during the site review and is not allowed on East Emory Road or Beeler Road adjacent to the project site.

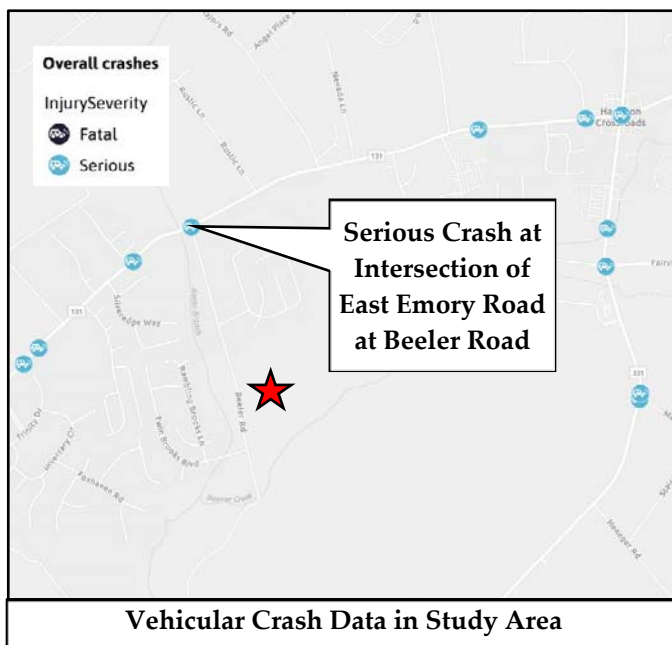
▪ **PEDESTRIAN AND BICYCLE FACILITIES:**

Bicycle facilities (lanes) are not available within the project site study area. Sidewalks are not provided either. Even though bicycle facilities are not provided on East Emory Road, TDOT has published mapping illustrating the Bicycle Level of Service (BLOS) for state routes in Knox County. BLOS is a nationally used measure of bicyclist comfort based on a roadway's geometry and traffic conditions. BLOS A designates the route as most suitable for bicyclists and BLOS F as the least suitable. The BLOS for East Emory Road (SR 11) in the study area at Beeler Road shows F grades.





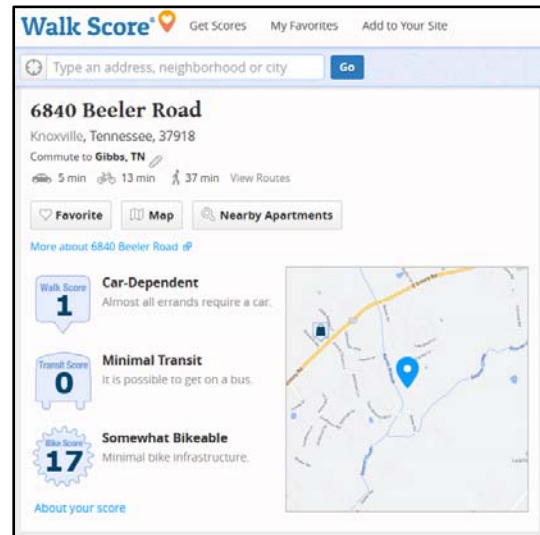
The Knoxville TPO provided a 2020 update to bicycle and pedestrian crash data for Knox County, Blount County, and other surrounding counties. According to the data, one of these incidents occurred near the study area in the past couple of years. This crash occurred on March 5<sup>th</sup>, 2019, near the intersection of East Emory Road at Tazewell Pike but did not list the cause of the crash. This incident was a pedestrian crash and resulted in an injury.



The Knoxville TPO also provides data related to “Life-Altering Traffic Crashes”. This data lists “the location of 2,326 traffic crashes in the Knoxville region that resulted in a fatality or serious injury between January 2016 and June 2019.” Several “Serious” crashes are shown on this TPO mapping on East Emory Road in the vicinity of the proposed development site. The closest crash to the development site occurred at the intersection of East Emory Road at Beeler Road, but details of the crash are not listed. The other “Serious” crashes on East Emory Road included one involving a DUI and one with a teen driver.

▪ **WALK SCORE:**

A private company offers an online website at [walkscore.com](http://walkscore.com) that grades and gives scores to locations within the United States based on “walkability”, “bikeability”, and transit availability based on a patented system. 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.



Appendix B shows maps and other information for the Walk Score, Bike Score, and Transit Score at the approximate development property address (6840 Beeler Road). The project site location is graded with a Walk Score of 1. This Walk Score indicates that all errands require a vehicle for travel at the property site due to the lack of sidewalks and the travel lengths required to amenity locations. The site is graded with a Bike Score of 17, which means there is minimal bike infrastructure, but it is somewhat bikeable. The site is given a Transit Score of zero.

▪ **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, and the overall KAT bus system map is in Appendix C. The closest public transit bus stop is 7.2 miles away by roadway off N Broadway Street on Garden Drive at Glenhaven Road and is on Route 22, “Broadway”. It operates on weekdays and weekends, and this route map is also included in Appendix C. Other transit services in the area include the East Tennessee Human Resource Agency (ETHRA) and the Community Action Committee (CAC), which provides transportation services when requested.



## PROJECT DESCRIPTION

### ▪ LOCATION AND SITE PLAN:

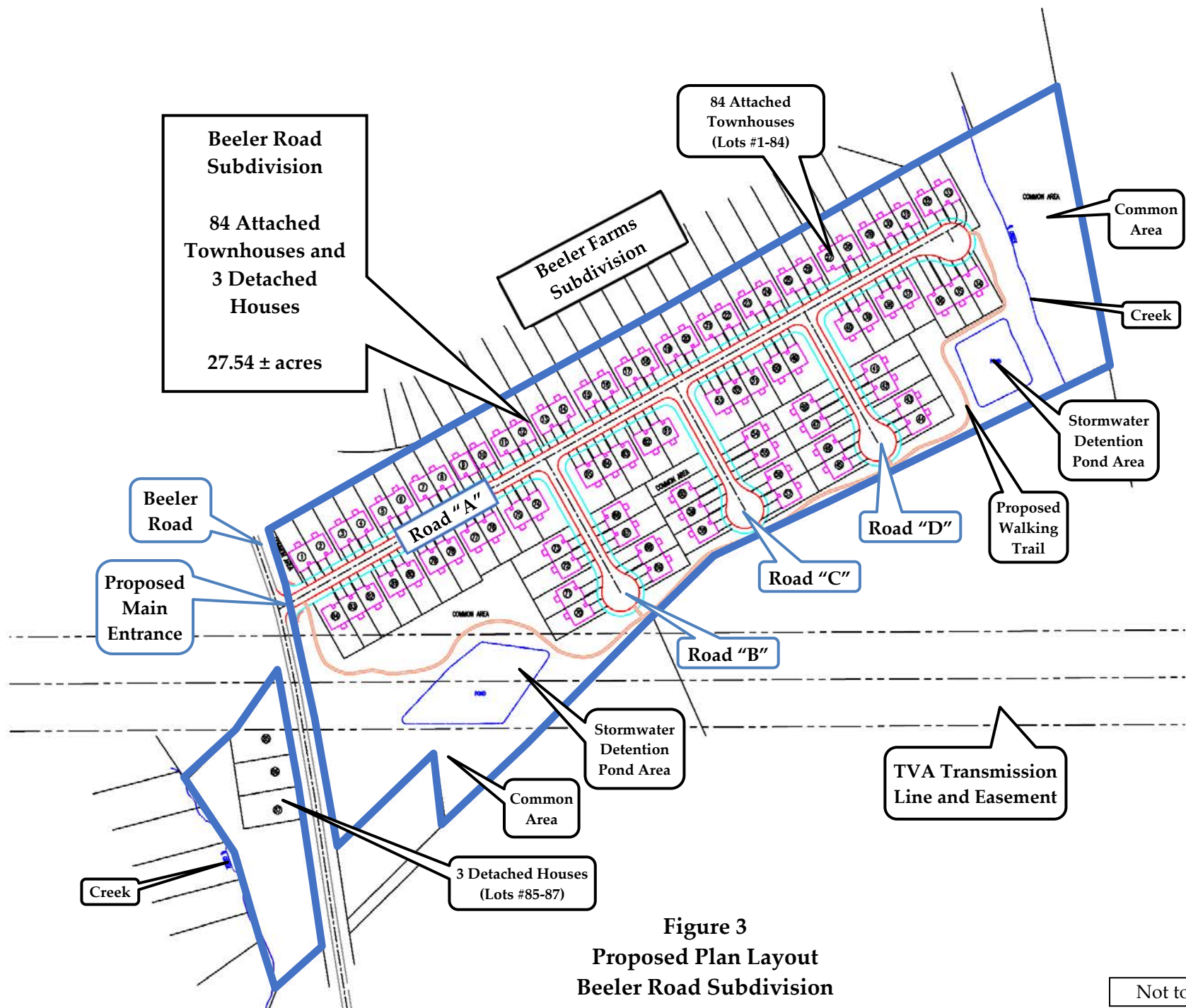
The proposed plan layout with 84 attached townhouses and three detached houses is designed by Batson, Himes, Norvell, and Poe and is shown in Figure 3. As shown in the figure, one new main entrance will be constructed for the townhouses (Lots #1 - 84) and will tie onto Beeler Road. Four new streets, labeled Road "A" thru Road "D", will be constructed internally with a total length of 2,586 feet (0.49 miles). All the internal roads will end at cul-de-sacs. The three detached houses on the west side of Beeler Road (Lots #85-87) will have individual separate driveways on Beeler Road a couple of hundred feet south of the proposed main entrance.

The main entrance at Beeler Road and the internal roadways will have a paved road width of 26 feet. The proposed main entrance on Beeler Road is approximately 510 feet to the southeast of the newly constructed Beeler Farms Subdivision entrance.

The residents in the subdivision will own the individual lots and units, and the minimum townhouse lot size will be 5,250 square feet, with a few lots closer to 8,000 square feet. The townhouse units will be around 1,900 ft<sup>2</sup> in size. Each townhouse will have an individual driveway with a garage. The three detached house lots on the west side of Beeler Road will be slightly larger than the townhouse lots.

Sidewalks are not proposed on the internal roads in the development. However, a walking trail is proposed along the entire length of the development on the southern side. The subdivision design shows four common areas in the development that will incorporate stormwater controls. To the southwest, the development will be bisected by a 200-foot-wide TVA electric transmission line and easement. The areas under the transmission line will be occupied by a common area and one of the stormwater detention ponds.

The schedule for completing the Beeler Road Subdivision depends on economic factors and construction timelines. This project is contingent on permitting, design, and other regulatory approvals. Currently, the area's real estate and housing market is experiencing tremendous activity and growth. This study assumed that the total construction build-out of the development and full occupancy would occur within the next five years (2027).



**Figure 3**  
**Proposed Plan Layout**  
**Beeler Road Subdivision**

Not to Scale



■ **PROPOSED USES AND ZONING REQUIREMENTS:**

The Beeler Road Subdivision development property was zoned as Agricultural (A) within Knox County, TN. The development property was recently requested to be rezoned to the Planned Residential (PR) zone with up to 4 units per acre. The Planned Residential (PR) zone allows for various land uses primarily within the residential realm. Uses permitted in this zone include single-family dwellings, duplexes, and multi-dwelling structures and developments. The most recent published online KGIS zoning map is provided in Appendix D. This requested rezoning included all the property on both sides of Beeler Road. The existing adjacent surrounding zoning and land uses are the following:

- Fifty-three single-family detached house lots exist north of the development property. Half of the houses have been constructed, and the remaining are under construction. These residences to the north are zoned in the Planned Residential (PR) zone and located in Beeler Farms Subdivision.
- To the east, two large parcels are zoned as Planned Residential (PR) with a density of less than two units per acre. These parcels are undeveloped and consist of areas for farm activities and forested areas.
- The properties to the south are zoned as Agricultural (A) and are occupied by farm fields and stand-alone single-family detached houses.
- Immediately to the west and across Beeler Road from the proposed main entrance and north of the proposed three detached houses, a single property is zoned Agricultural (A). It has a single-family detached house with a large field. The Twin Brooks Subdivision consists of single-family detached houses in the Planned Residential (PR) zone and is further to the west of the properties on Beeler Road.



▪ **DEVELOPMENT DENSITY:**

The Beeler Road Subdivision development's proposed density is based on a maximum of 84 townhouses and three detached houses on 27.54 acres. Eighty-seven housing units over 27.54 acres computes to 3.16 dwelling units per acre.

▪ **ON-SITE CIRCULATION:**

The entrance and internal roads will be designed and constructed to Knox County, TN specifications. The internal roads will be asphalt paved and include 6" concrete curbs. Concrete sidewalks are not being proposed for the internal road system. The lane widths will be 13 feet each, totaling a 26-foot pavement within a 50-foot right-of-way. The driveway entrance and internal roads will be public and will be maintained in the future by Knox County.

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

Besides residential passenger vehicles, the internal development roads will also provide access to service, delivery, maintenance, and fire protection/rescue vehicles. None of these other vehicle types should impact roadway operations other than when they occasionally enter and exit the development.

It is expected that the future residents in the development will be provided the opportunity for public school and private trash collection services if desired. The internal roadways will be designed and constructed to Knox County specifications and are expected to be adequate for fire protection and rescue vehicles, trash collection trucks, school buses, and single-unit delivery trucks. The development's internal road will accommodate the larger vehicle types and residents' standard passenger vehicles.



## ANALYSIS OF EXISTING AND PROJECTED CONDITIONS

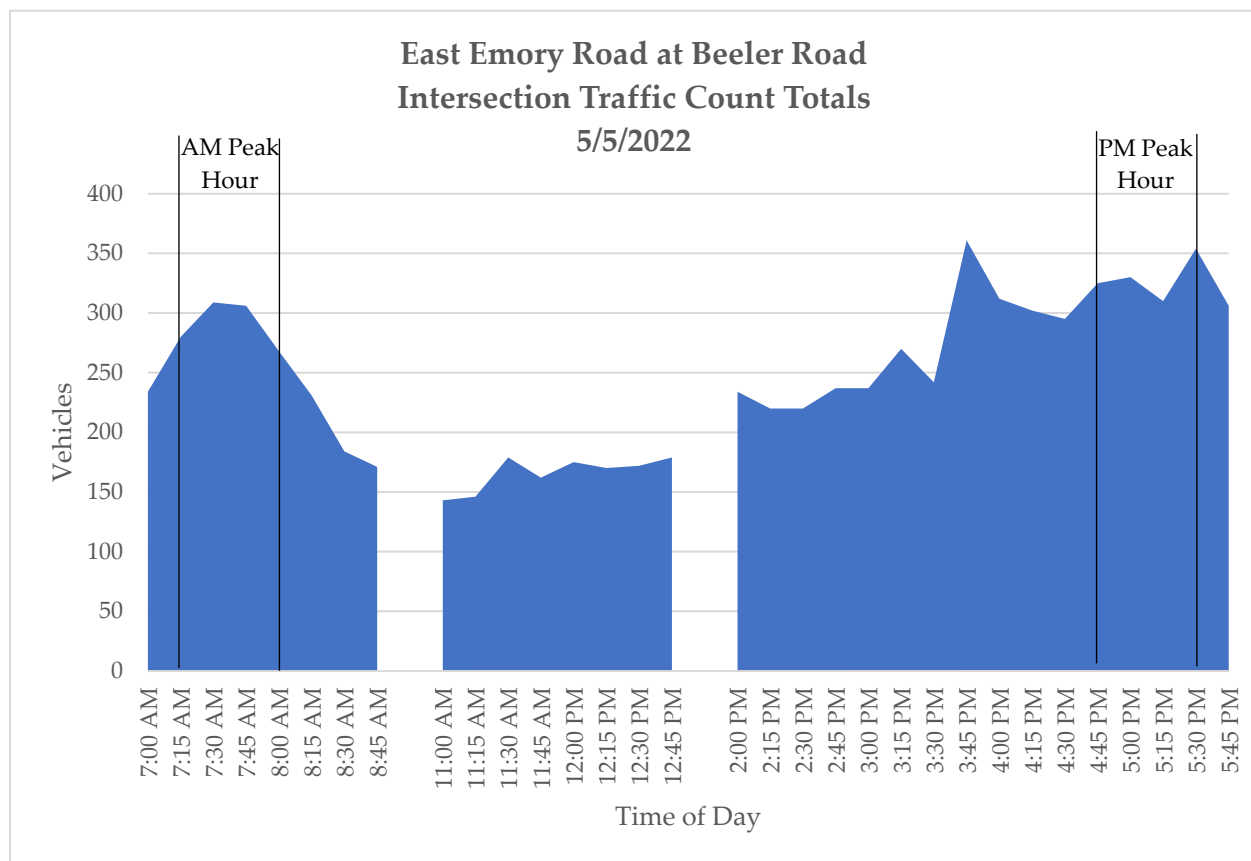
### ▪ EXISTING TRAFFIC CONDITIONS:

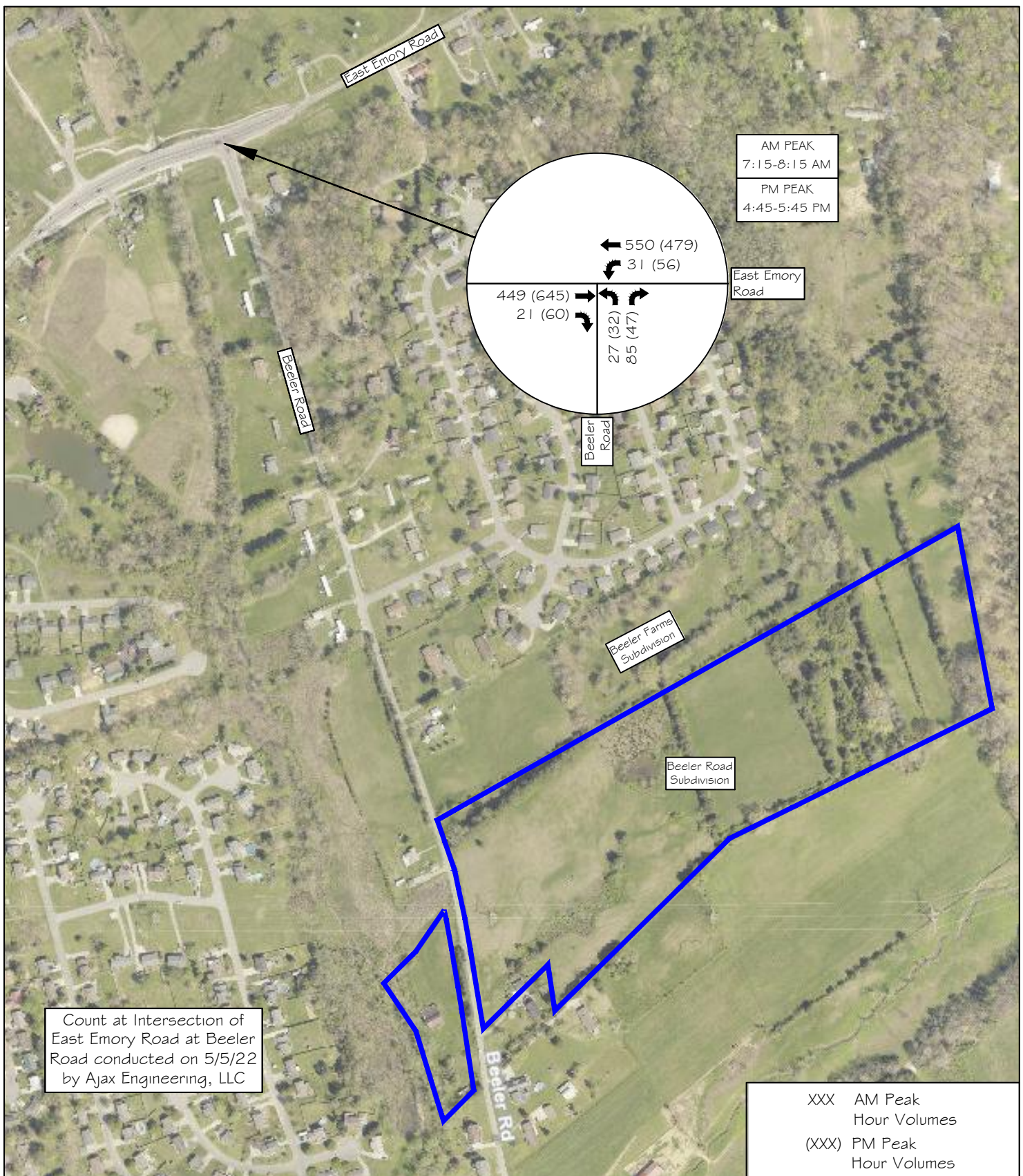
For this study, an 8-hour traffic count was conducted at the intersection of East Emory Road at Beeler Road on Thursday, May 5<sup>th</sup>, 2022. The manual traffic counts were conducted to tabulate the morning and afternoon peak period volumes and travel directions near the proposed development site. Based on the traffic volumes collected, the AM and PM peak hours were observed at 7:15 – 8:15 am and 4:45 – 5:45 pm at the intersection. Local county public schools were in session when the traffic counts were conducted.

The manual tabulated traffic counts can be reviewed in Figure 4 and Appendix E, and some observations are listed below.

- No bicyclists or pedestrians were observed during the traffic counts.
- Most of the observed traffic was passenger vehicles, but the traffic stream on East Emory Road and Beeler Road also included public school buses and dump trucks. Vehicles associated with the adjacent Beeler Farms Subdivision construction were observed on Beeler Road. These vehicles included concrete mixer trucks and large work trucks with trailers. A few semi-tractor-trailers were observed on East Emory Road.
- From 7-8 am, heavier traffic was observed turning right from Beeler Road towards the east onto East Emory Road than to the left. From 8-9 am, the number of right-turning and left-turning vehicles on Beeler Road averaged closer to each other. Since all the existing properties on Beeler Road are zoned for the Gibbs Schools located to the east, it is believed that this imbalance of right-turn motorists towards the east is partially contributable to parents taking their children to school. A brief spike in traffic was also observed around 3:30 pm at the intersection, coinciding with the middle and high school's dismissal.
- The northbound approach of Beeler Road is a single lane for left and right turns onto East Emory Road. However, the travel lane plus the shoulder pavement width on Beeler Road allow two vehicles to be side-by-side for both left and right-turns. During the traffic counts, occasionally, when a left-turning motorist on Beeler Road had significant delays due to heavy traffic on East Emory Road, a right-turning motorist would drive up on the shoulder alongside the waiting vehicle to avoid their turn in the queue.
- Likewise, similar shoulder activity was observed on East Emory Road. Some eastbound motorists on East Emory Road turning right onto Beeler Road used the paved shoulder to

remove themselves from the eastbound traffic stream. More dangerously, some impatient westbound motorists used the shoulder on East Emory Road to pass vehicles stopped on East Emory Road attempting to turn left onto Beeler Road. This maneuver was observed several times and included some impatient motorists passing more than one stopped vehicle. The most dangerous event was when a stopped westbound left-turn motorist on East Emory Road was courteous and allowed a left-turn motorist from Beeler Road to turn first. While this was occurring, another westbound thru motorist on East Emory Road passed the stopped vehicle on the shoulder and nearly caused a sideswipe collision with the left-turning motorist from Beeler Road.





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FIGURE 4

Beeler Road Subdivision

2022 Peak Hour Traffic Volumes -  
EXISTING CONDITIONS



Capacity analyses were undertaken to determine the Level of Service (LOS) for the existing 2022 traffic volumes shown in Figure 4 at the intersection of East Emory Road at Beeler Road. The capacity analyses were calculated following the Highway Capacity Manual (HCM) methods and utilizing Synchro Traffic Software (Version 11).

Methodology:

LOS is a qualitative measurement developed by the transportation profession to express 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 worst. This grading system provides a reliable, straightforward means to communicate road operations to the public. The HCM lists level of service criteria for unsignalized intersections and signalized intersections.



LOS is defined by delay per vehicle (seconds), and roadway facilities are also characterized by the volume-to-capacity ratio (v/c). LOS designations, which are based on delay, are reported differently for unsignalized and signalized intersections. For example, a delay of 20 seconds at an unsignalized intersection would indicate LOS C, and this delay would represent the additional delay a motorist would experience traveling through the intersection. Also, for example, a v/c ratio of 0.75 for an approach at an unsignalized intersection would indicate that it is operating at 75% of its available capacity. This difference is primarily due to motorists having different expectations between the two road facilities. Generally, for most instances, the LOS D / LOS E boundary is considered the upper limit of acceptable delay during peak periods in urban and suburban areas.

For unsignalized intersections, LOS 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. For unsignalized intersections, the analysis assumes that the mainline thru and right-turn traffic does not stop and is not affected by the traffic on the minor side streets. Thus, 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 movements. Table 2 lists the level of service criteria for unsignalized intersections. The analysis results of unsignalized intersections using the HCM methodologies are conservative due to the more significant vehicle gap parameters used in the method. More often, in normal road conditions, drivers are more willing to accept smaller gaps in traffic than what is modeled using the HCM methodology. The unsignalized intersection methodology also does not account for more significant gaps sometimes produced by nearby upstream and downstream signalized intersections. For unsignalized intersections, in most instances, the upper limit of acceptable delay during peak hours is the LOS D/E boundary at 35 seconds.

Intersection capacity results from the existing 2022 peak hour traffic are shown in Table 3. 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. Appendix F includes the worksheets for the existing 2022 peak hour capacity analyses.

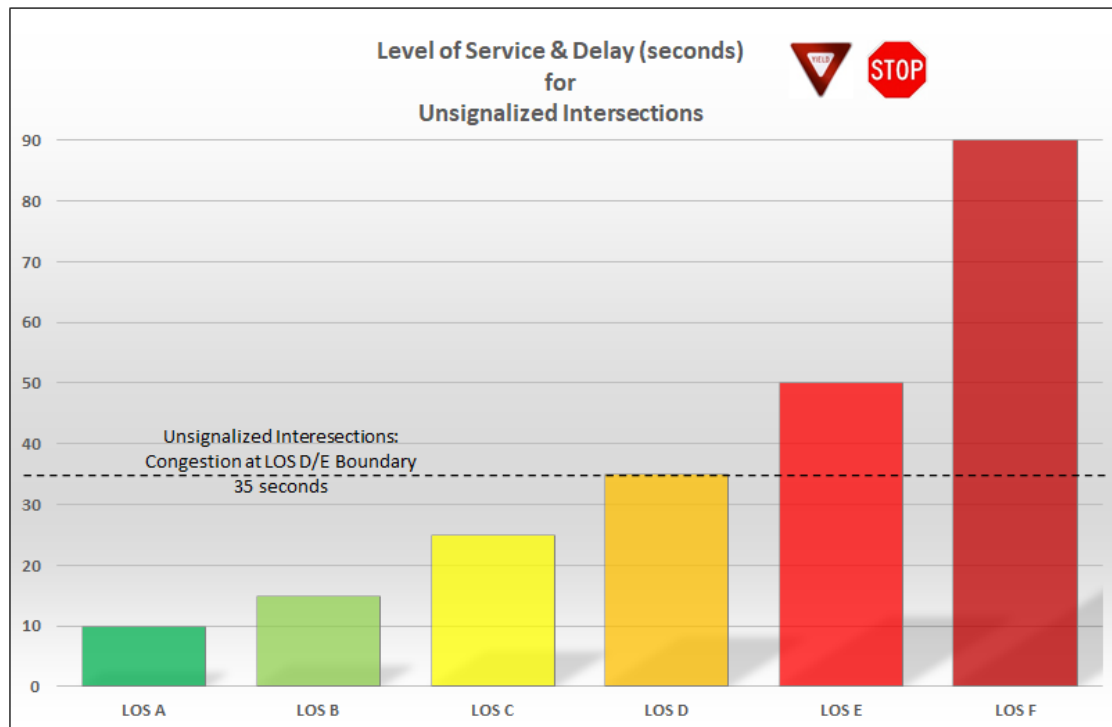
As shown in Table 3, the westbound left-turn movement on East Emory Road was calculated at LOS A in the AM and PM peak hours. However, the northbound approach of Beeler Road is calculated with poor LOS and high vehicle delays in the existing 2022 conditions, particularly in the PM peak hour.

**TABLE 2**  
**LEVEL OF SERVICE AND DELAY FOR UNSIGNALIZED INTERSECTIONS**




LEVEL OF SERVICE	DESCRIPTION	CONTROL DELAY (seconds/vehicle)
A	Little or no delay	0 - 10
B	Short Traffic Delays	>10 - 15
C	Average Traffic Delays	>15 - 25
D	Long Traffic Delays	>25 - 35
E	Very Long Traffic Delays	>35 - 50
F	Extreme Traffic Delays	>50

Source: Highway Capacity Manual, 6th Edition



**TABLE 3**  
**2022 INTERSECTION CAPACITY ANALYSIS RESULTS -**  
**EXISTING TRAFFIC CONDITIONS**

INTERSECTION	TRAFFIC CONTROL	APPROACH/ MOVEMENT	AM PEAK			PM PEAK		
			LOS	DELAY (seconds)	V/C	LOS	DELAY (seconds)	V/C
East Emory Road (EB & WB) at Beeler Road (NB)	 Unsignalized	Northbound Left/Right	D	26.9	0.449	F	62.4	0.664
		Westbound Left	A	8.5	0.038	A	9.7	0.081

Note: All analyses were calculated in Synchro 11 software and reported using HCM 2010 intersection methodology

<sup>a</sup> Level of Service

<sup>b</sup> Average Delay (sec/vehicle)

<sup>c</sup> Volume-to-Capacity Ratio

**LOS at Intersection of  
East Emory Road at  
Beeler Road in 2022  
AM Peak Hour  
without the Project**



**LOS at Intersection of  
East Emory Road at  
Beeler Road in 2022  
PM Peak Hour  
without the Project**

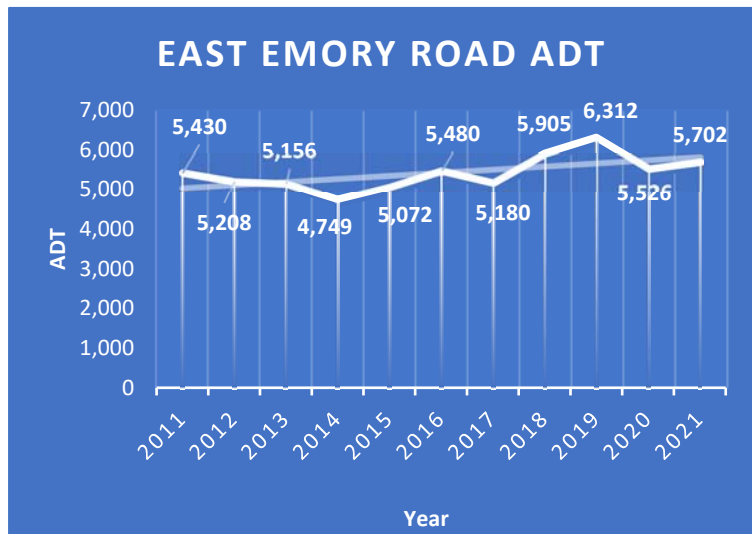




▪ **PROJECTED TRAFFIC CONDITIONS (WITHOUT THE PROJECT):**

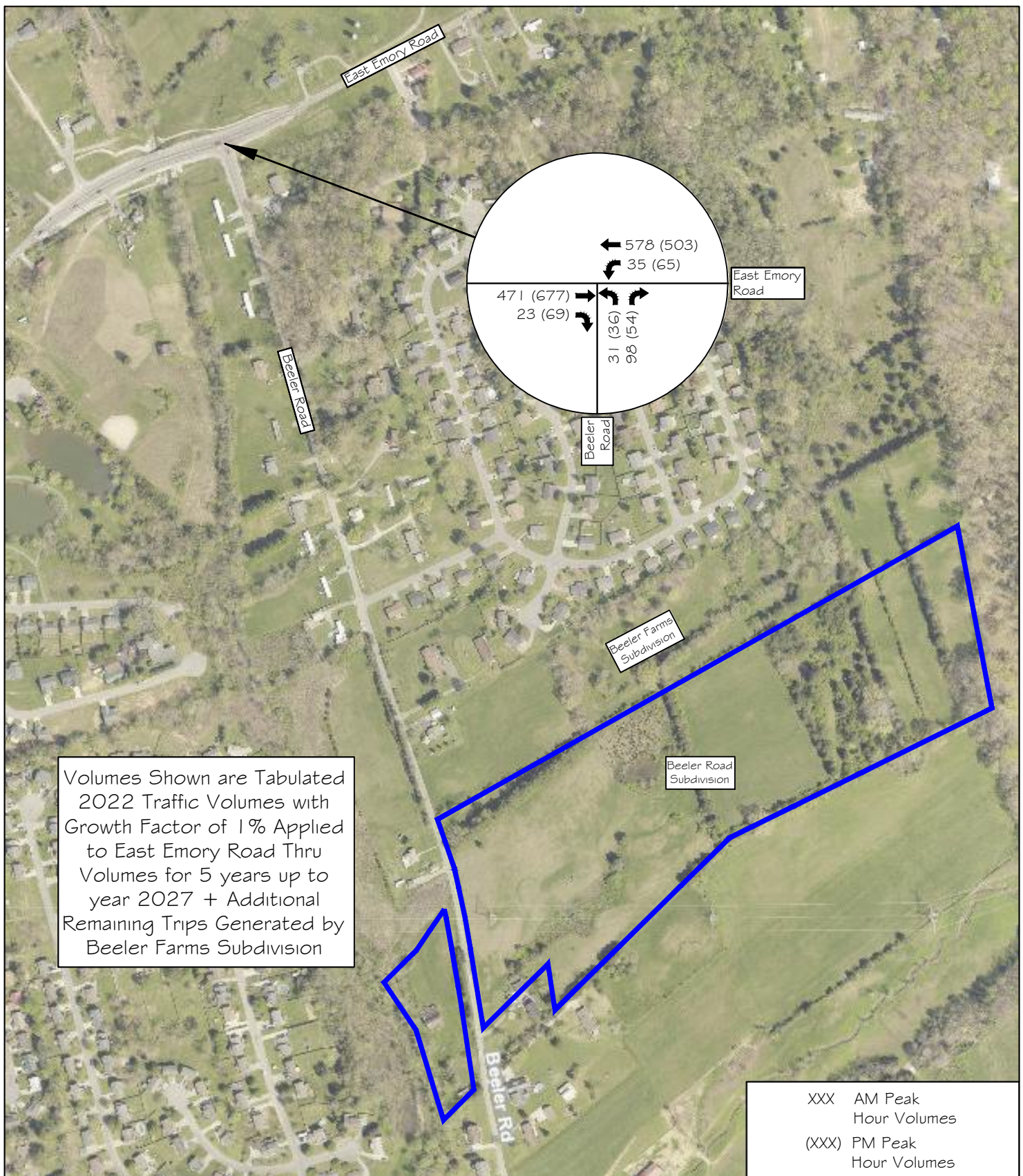
Horizon year traffic conditions represent the projected traffic volumes in the study area without the proposed project being developed (no-build option). The build-out and full occupancy for this proposed development is assumed to occur by 2027. This horizon year corresponds to five years for this development to reach full capacity and occupancy.

Vehicular traffic on East Emory Road in the study area has shown low annual growth over the past ten years (0.5%), according to the TDOT traffic count station and as shown in Appendix A. For this study, a higher annual growth rate of 1.0% was used to calculate future growth on East Emory Road up to 2027 to account for potential traffic growth in the study area and provide a conservative analysis.



In addition to the possibility of general growth in the area, the study also took into account the traffic growth due to the adjacent Beeler Farms Subdivision reaching completion. Currently, half of the houses in the adjacent subdivision are completed and occupied. The other half is under construction, with some currently for sale. This study calculated the trips generated when the remaining 27 Beeler Farms Subdivision detached houses are built and occupied in the near future. These trips were calculated, distributed, and added to the existing 2022 tabulated volumes at the intersection of East Emory Road and Beeler Road. These trips were accounted for based on the following methods presented in the following sections of the report. Figure 5 shows the projected 2027 traffic volumes at the intersection without the project during the AM and PM peak hours. These volumes include the assumed future growth of 1% for the eastbound and westbound thru volumes on East Emory Road, plus the additional traffic generated by the remaining 27 houses in the Beeler Farms Subdivision.

Capacity analyses were undertaken to determine the projected LOS in 2027 without the project at the intersection of East Emory Road at Beeler Road. The results are shown in Table 4. The results in Table 4 are similar to the existing 2022 results but resulted in higher vehicle delays.



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FIGURE 5

Beeler Road Subdivision

2027 Peak Hour Traffic Volumes -  
PROJECTED CONDITIONS  
(WITHOUT THE PROJECT)



**TABLE 4**  
**2027 INTERSECTION CAPACITY ANALYSIS RESULTS -**  
**PROJECTED TRAFFIC CONDITIONS (WITHOUT THE PROJECT)**

INTERSECTION	TRAFFIC CONTROL	APPROACH/ MOVEMENT	AM PEAK			PM PEAK		
			LOS	DELAY (seconds)	V/C	LOS	DELAY (seconds)	V/C
East Emory Road (EB & WB) at Beeler Road (NB)	 Unsignalized	Northbound Left/Right	D	34.6	0.565	F	106.4	0.874
		Westbound Left	A	8.6	0.043	A	10.0	0.098

Note: All analyses were calculated in Synchro 11 software and reported using HCM 2010 intersection methodology

<sup>a</sup> Level of Service

<sup>b</sup> Average Delay (sec/vehicle)

<sup>c</sup> Volume-to-Capacity Ratio

LOS at Intersection of  
East Emory Road at  
Beeler Road in 2027  
AM Peak Hour  
without the Project



LOS at Intersection of  
East Emory Road at  
Beeler Road in 2027  
PM Peak Hour  
without the Project



▪ **TRIP GENERATION:**

A generated trip is a single or one-direction vehicle movement entering or exiting the study site. The estimated amount of traffic that the three detached houses will generate was calculated based upon rates and equations for peak hour trips provided by Trip Generation Manual, 11th Edition, a publication of the Institute of Transportation Engineers (ITE). The Trip Generation Manual is the traditional and most popular resource for determining trip generation rates when traffic impact studies are produced. However, the trip rate for the 84 townhouses was based upon equations for peak hour trips provided by Knoxville-Knox County Planning. These equations were developed from local studies to estimate apartment (and townhouse) trip generation in the surrounding area and were published in December 1999. For Knox County, this is the preferred rate to use for apartments and townhouses. This local rate calculates higher trip rates than the similar ITE land use.

The data and calculations from ITE and the local study 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 BEELER ROAD SUBDIVISION**  
**84 Attached Townhouses and 3 Detached Houses**

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	Townhouses	84 Townhouses	816	22%	78%		55%	45%	
				10	36	46	37	30	67
#210	Single-Family Detached Housing	3 Houses	41	26%	74%		63%	37%	
				1	2	3	3	1	4
Total New Volume Site Trips			857	11	38	49	40	31	71

ITE Trip Generation Manual, 11th Edition and Local Trip Rates  
Trips calculated by using Fitted Curve Equation

For the proposed residential development, with 84 townhouses and three detached houses, it is estimated that 11 vehicles will enter and 38 will exit, for a total of 49 generated trips during the AM peak hour in the year 2027. Similarly, it is estimated that 40 vehicles will enter and 31 will exit, for a total of 71 generated trips during the PM peak hour in the year 2027. The calculated

trips generated for an average weekday are estimated to be 857 vehicles for the proposed development.

As discussed in the previous section, trip generation calculations were made for the remaining houses to be built and occupied in the adjacent subdivision, Beeler Farms Subdivision. These volumes were added to the intersection of East Emory Road at Beeler Road, as shown in Figure 5. Table 6 presents the trip generation results for the 27 houses remaining to be constructed and occupied in Beeler Farms Subdivision. A total of 53 houses are proposed for the adjacent subdivision, with half of them occupied and generating trips and tabulated in the existing traffic count. The calculations for this adjacent other subdivision are also shown in Appendix G.

**TABLE 6**  
**TRIP GENERATION FOR BEELER FARMS SUBDIVISION**  
**27 Detached Houses Remaining to be Constructed and Occupied**

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
#210	Single-Family Detached Housing	27 Remaining Houses	303	26%	74%		63%	37%	
				6	17	23	18	11	29
Total New Volume Site Trips			303	6	17	23	18	11	29

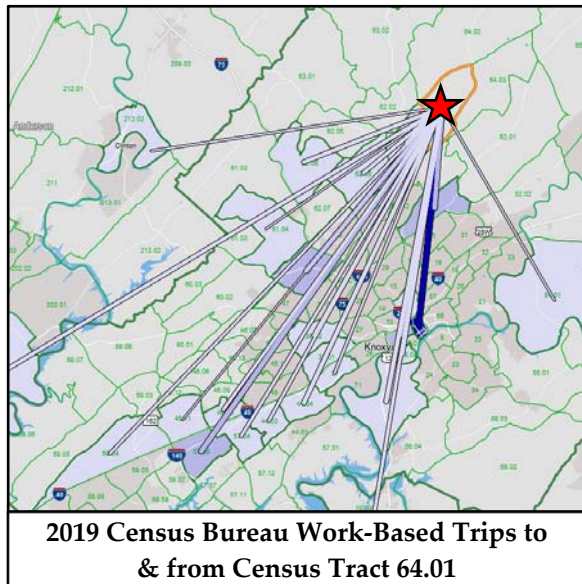
ITE Trip Generation Manual, 11th Edition

Trips calculated by using Fitted Curve Equation



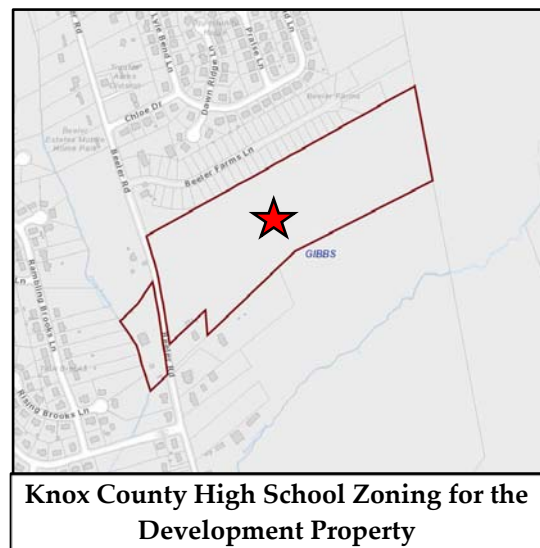
▪ **TRIP DISTRIBUTION AND ASSIGNMENT:**

Figure 6 shows the projected distribution of traffic entering and exiting the proposed development. The percentages assumed and shown in Figure 6 are based on several sources and engineering judgment. The first and primary source is based on the traffic count volumes and the observed directions of travel collected at the existing intersection.



The second source for projected trip distribution is based on work-related trips in the local area. Work-based trips will be a significant impetus for generated trips by the development, and these trips are more likely to travel to and from the south and southwest. This assertion is based on data from the United States Bureau website for Census Tract 64.01, where the development property is located. Based on 2019 (latest available) census data and as shown in Appendix H, most work-based trips in the surrounding area correspond to downtown Knoxville (including the University of Tennessee) and other areas of West Knoxville.

In addition to employment centers, some generated traffic will travel to and from public and private schools. Schools will be another impetus for external trip-making. The development property is currently zoned for Gibbs Elementary, Middle, and High School. All these schools are located 2.3 miles to the north and east of the development property off Tazewell Pike.



The Knox County Schools Transportation Department has developed Parental Responsibility Zones (PRZ) to determine whether students are offered transportation services to and from

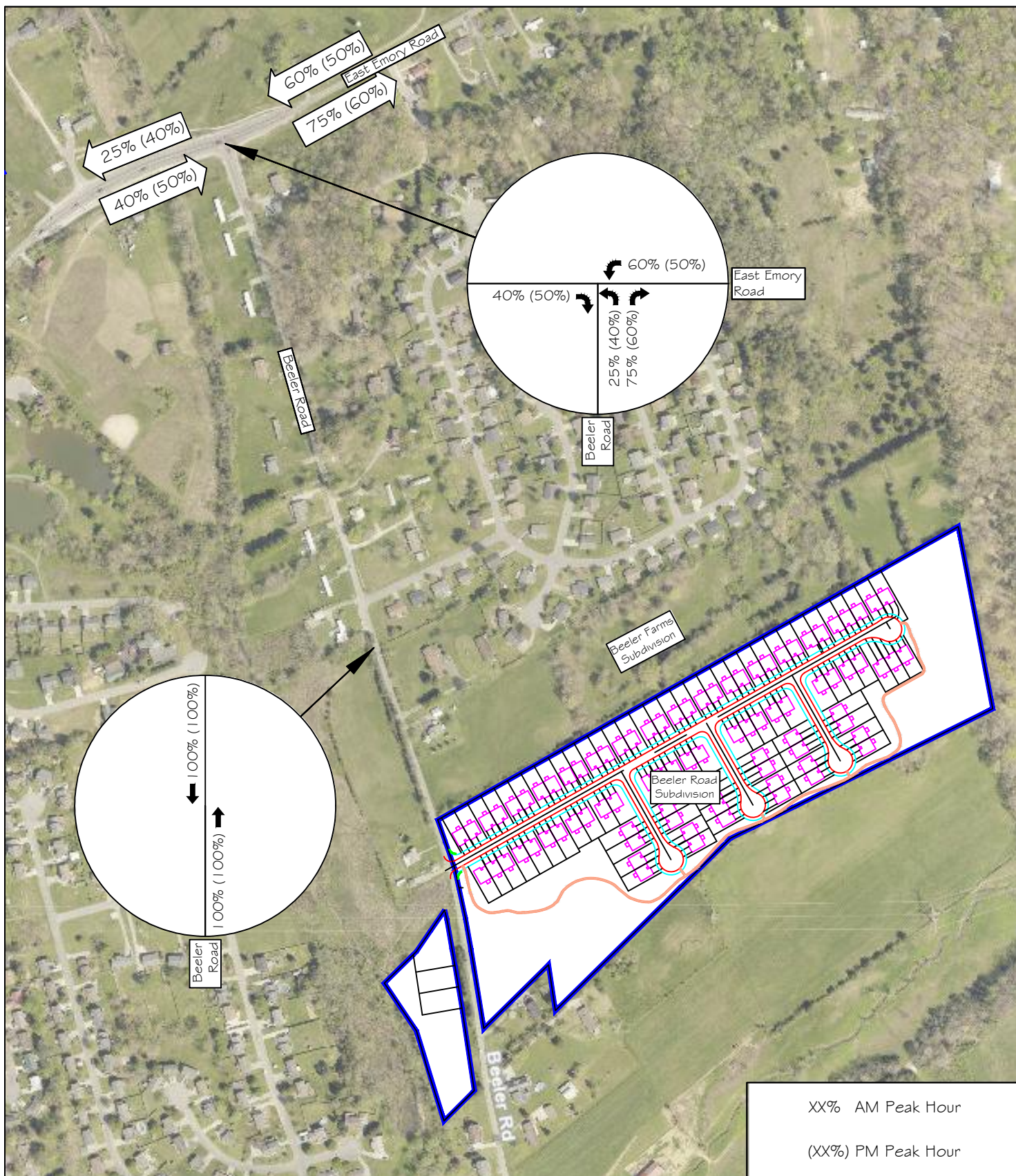
school. The PRZ is defined as being 1.5 miles for grades 6 – 12 and 1.0 miles for grades K – 5 from the point where the students' parcel is accessed to the point where the buses unload at the school. This development will be outside the PRZ for all the zoned schools, and all school-age children attending public schools in the development will be able to utilize this service if desired.

At first glance, a reasonable assumption would conclude that more traffic would be generated to and from the west and southwest via East Emory Road towards Knoxville. However, the existing traffic count showed that the existing residents along Beeler Road are heavily pulled towards the east and northeast towards Tazewell Pike. A lot of this is assumed to be associated with the Gibbs Schools. Some can also be attributed to the shopping centers and other commercial developments in and around the Gibbs community to the northeast around Tazewell Pike.

Ultimately, the distribution rate was assumed entirely on the observed traffic for entering and exiting trips at the studied intersection. All entering and exiting subdivision traffic was assumed will travel via Beeler Road to and from the north. None of the trips are assumed to use Beeler Road's narrower and longer southern and western sections to reach East Emory Road. Figure 7a shows the traffic assignment of the computed trips generated by the development (Table 5) based on the assumed distribution of trips shown in Figure 6.

Figure 7b shows the generated calculated trips assigned and distributed to the intersection of East Emory Road at Beeler Road for the 27 remaining houses to be built and occupied in the adjacent Beeler Farms Subdivision. These trips were distributed and assigned in Figure 5 at the same percentages assumed for the proposed Beeler Road Subdivision.





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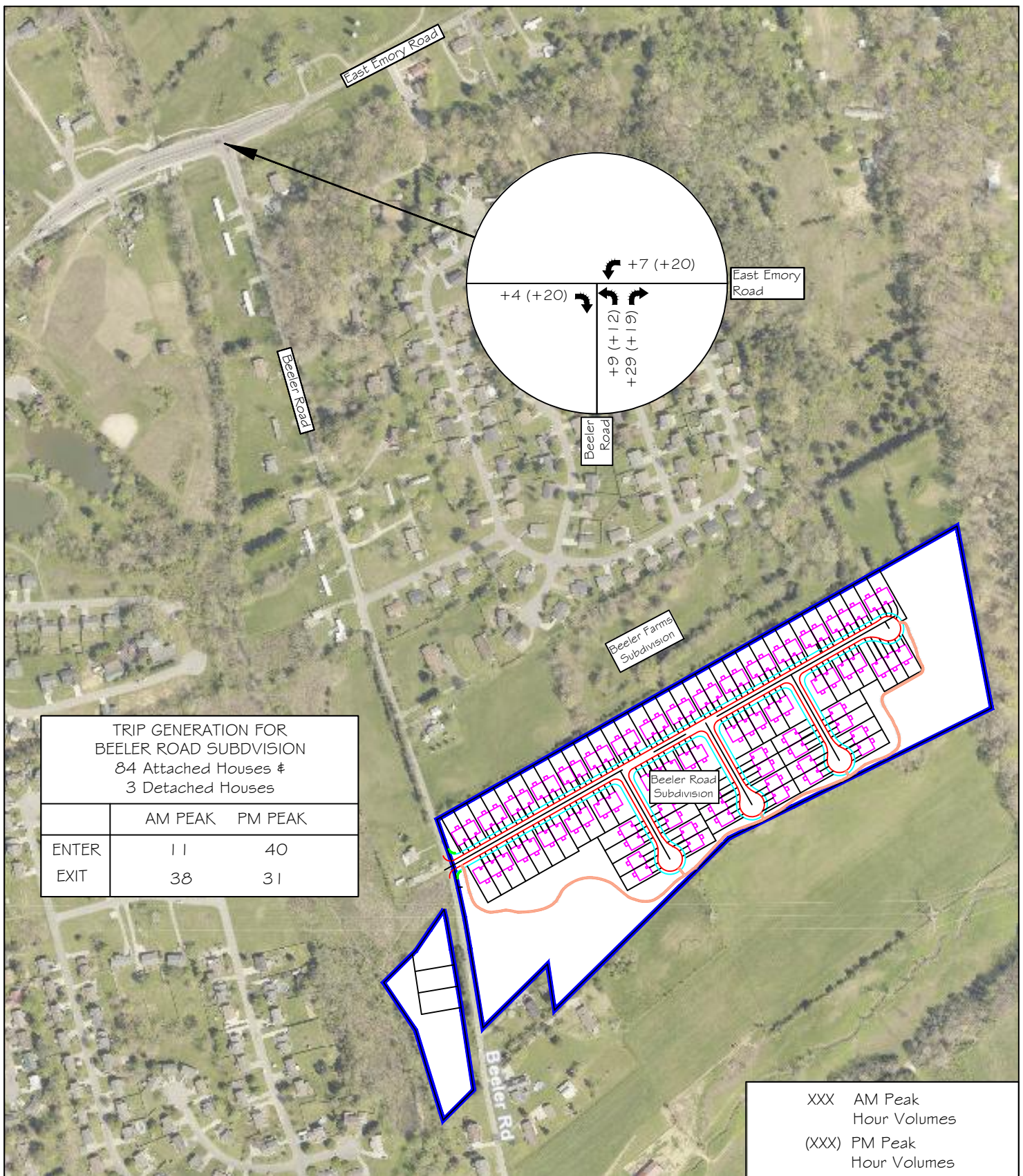


FIGURE 6

Beeler Road Subdivision

Directional Distribution of Generated Traffic during AM and PM Peak Hour





TRIP GENERATION FOR BEELER ROAD SUBDIVISION 84 Attached Houses & 3 Detached Houses		
	AM PEAK	PM PEAK
ENTER	11	40
EXIT	38	31



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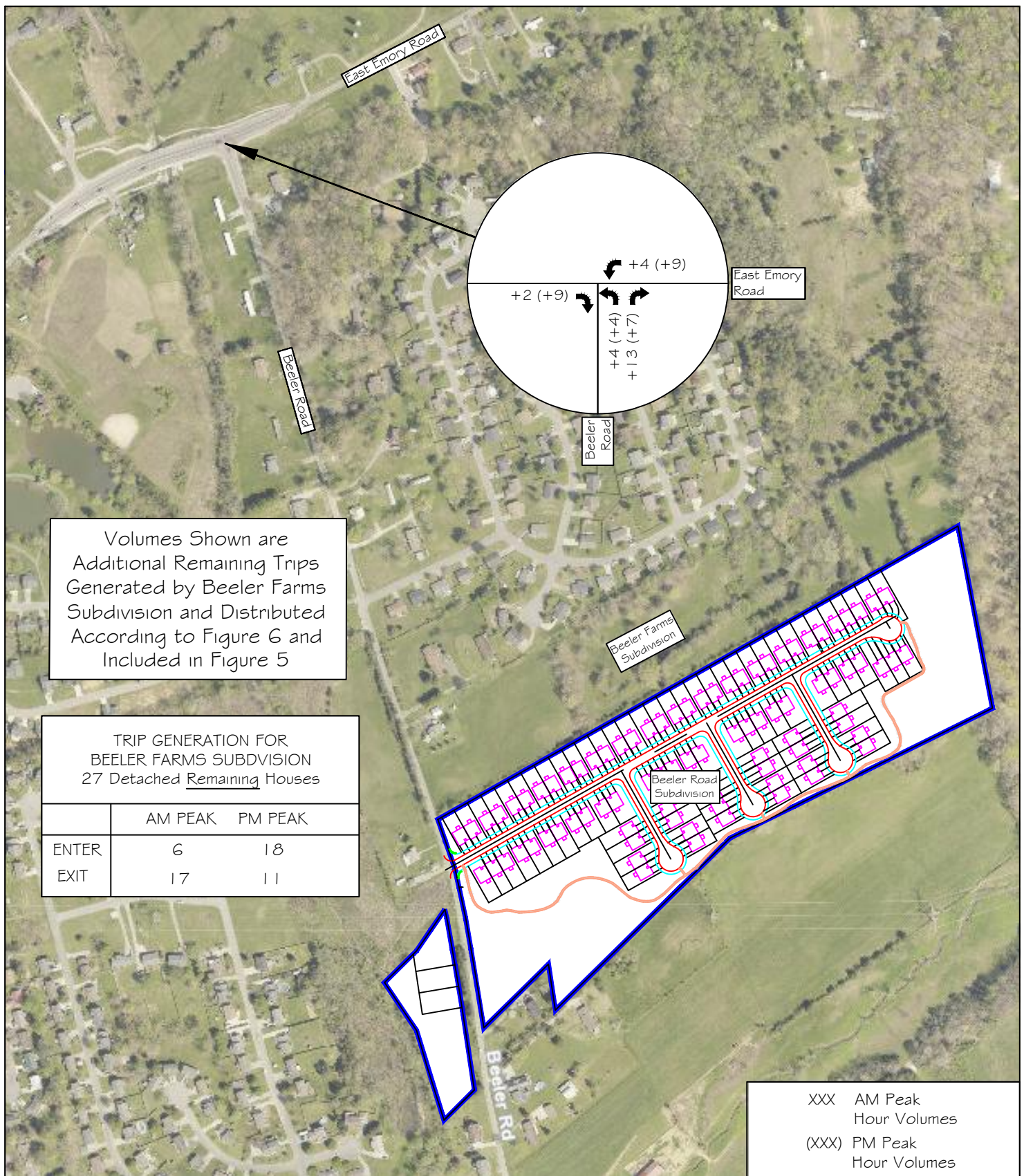


FIGURE 7a

Beeler Road Subdivision

Traffic Assignment of Generated Traffic  
during AM and PM Peak Hour





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FIGURE 7b

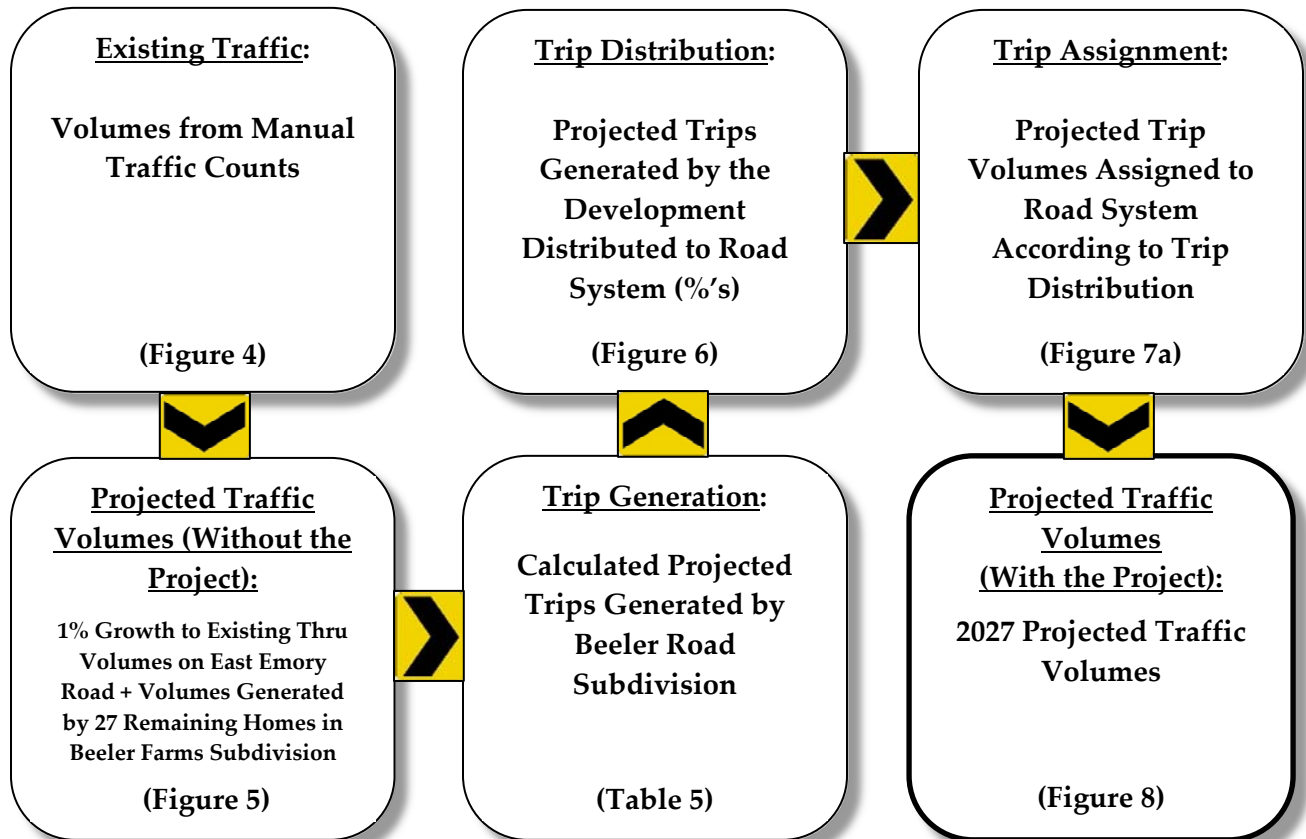
Beeler Road Subdivision

Traffic Assignment of Generated Traffic from Remaining Houses in Beeler Farms Subdivision during AM and PM Peak Hour

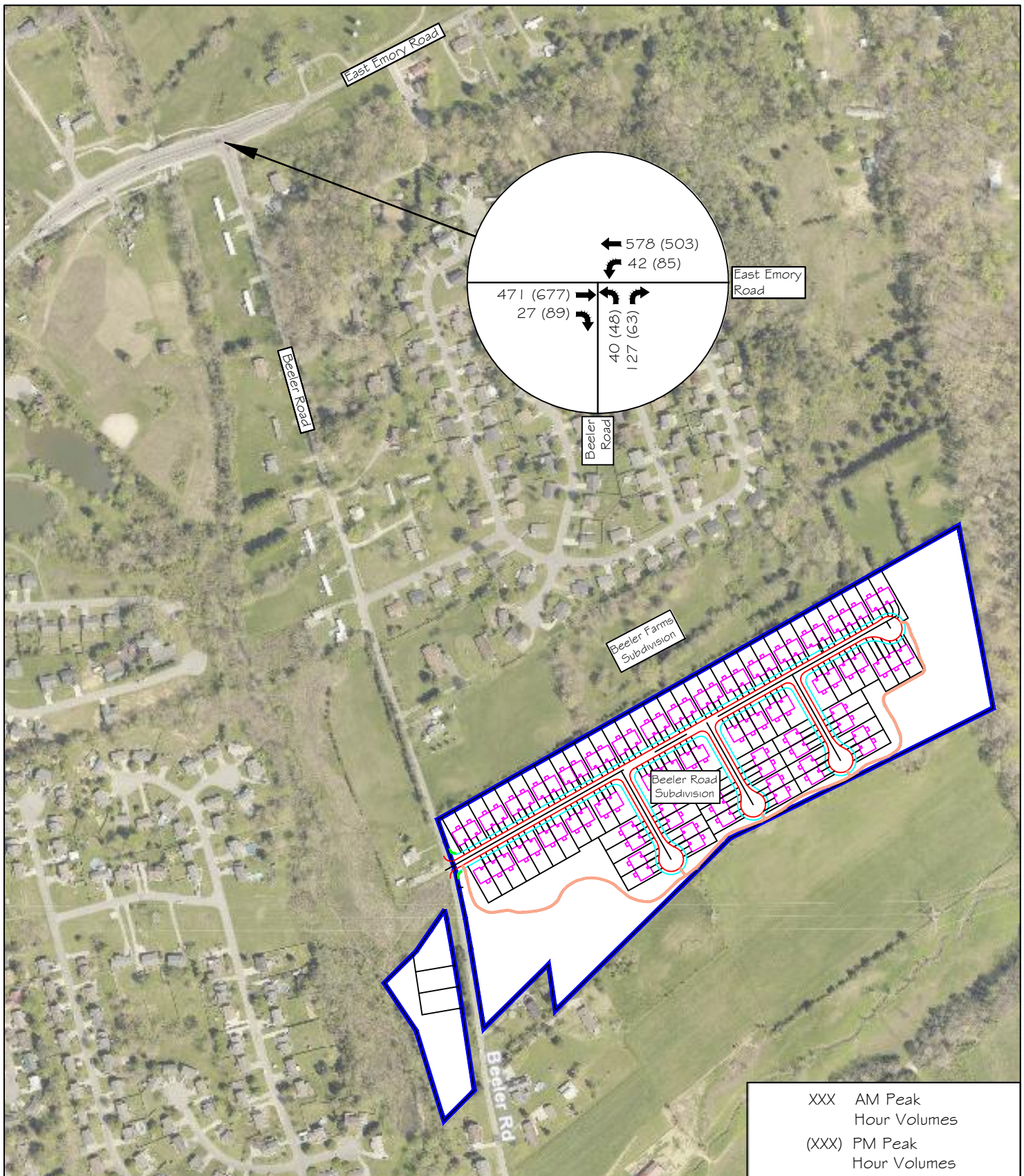


▪ **PROJECTED TRAFFIC CONDITIONS (WITH THE PROJECT):**

Overall, several additive steps were taken to estimate the total projected traffic volumes at the studied intersection when the Beeler Road Subdivision (and Beeler Farms Subdivision) is entirely constructed and occupied by 2027. The steps are illustrated below for clarity and review:



The calculated peak hour traffic (Table 5) generated by the Beeler Road Subdivision was added to the 2027 horizon year traffic (Figure 5) by following the predicted trip distributions and assignments (Figures 6 and 7a). This procedure was completed to obtain the total projected traffic volumes when the proposed development is fully built out and occupied in 2027. Figure 8 shows the projected 2027 AM and PM peak hour volumes with the generated development traffic at the studied intersection.



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FIGURE 8

Beeler Road Subdivision

2027 Peak Hour Traffic Volumes -  
 PROJECTED CONDITIONS  
 (WITH THE PROJECT)

Capacity analyses were conducted to determine the projected LOS at the studied intersection with the development traffic in 2027. The projected 2027 peak hour capacity results for the intersection with the project resulted in very poor LOS with high vehicle delays and can be seen in Table 7. The v/c ratio in the PM peak hour for northbound Beeler Road is 1.289, indicating that the approach will operate above capacity. Appendix F includes the worksheets for these capacity analyses.

**TABLE 7**  
**2027 INTERSECTION CAPACITY ANALYSIS RESULTS -**  
**PROJECTED TRAFFIC CONDITIONS (WITH THE PROJECT)**

INTERSECTION	TRAFFIC CONTROL	APPROACH/ MOVEMENT	AM PEAK			PM PEAK		
			LOS	DELAY (seconds)	V/C	LOS	DELAY (seconds)	V/C
East Emory Road (EB & WB) at Beeler Road (NB)	 Unsignalized	Northbound Left/Right	F	51.6	0.754	F	248.5	1.289
		Westbound Left	A	8.7	0.052	B	10.3	0.132

Note: All analyses were calculated in Synchro 11 software and reported using HCM 2010 intersection methodology

<sup>a</sup> Level of Service

<sup>b</sup> Average Delay (sec/vehicle)

<sup>c</sup> Volume-to-Capacity Ratio

A summary of the East Emory Road at Beeler Road intersection capacity analysis results is presented in Table 8. This table provides a side-by-side summary and comparison of the intersection for the following: 2022 existing conditions, projected conditions in the year 2027 without the project, and the projected conditions in the year 2027 with the project.



TABLE 8  
INTERSECTION CAPACITY ANALYSIS SUMMARY  
EAST EMORY ROAD AT BEELER ROAD



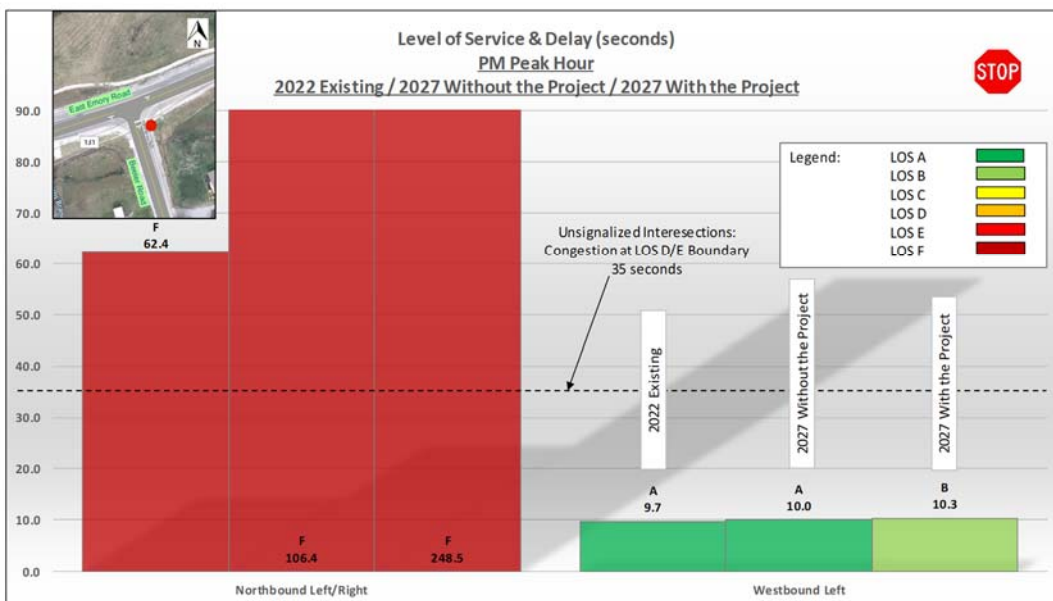
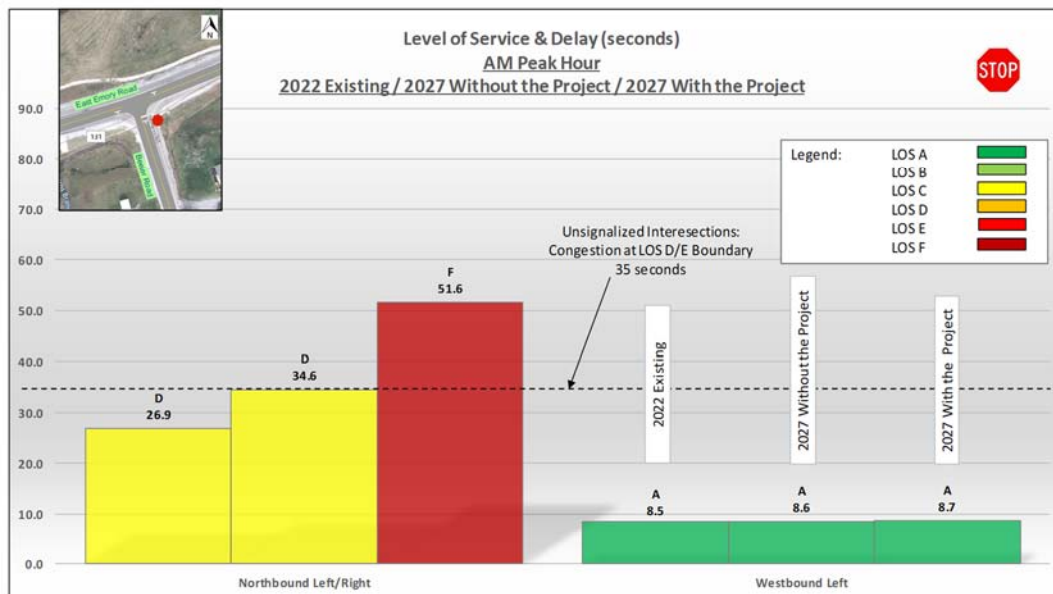
LOCATION / PEAK HOUR MOVEMENT	2022 EXISTING			2027 WITHOUT THE PROJECT			2027 WITH THE PROJECT		
	LOS <sup>a</sup>	Delay <sup>b</sup>	v/c <sup>c</sup>	LOS <sup>a</sup>	Delay <sup>b</sup>	v/c <sup>c</sup>	LOS <sup>a</sup>	Delay <sup>b</sup>	v/c <sup>c</sup>
<b>AM Peak</b>									
Northbound Left/Right	D	26.9	0.449	D	34.6	0.565	F	51.6	0.754
Westbound Left	A	8.5	0.038	A	8.6	0.043	A	8.7	0.052
<b>PM Peak</b>									
Northbound Left/Right	F	62.4	0.664	F	106.4	0.874	F	248.5	1.289
Westbound Left	A	9.7	0.081	A	10.0	0.098	B	10.3	0.132

Note: Analysis calculated in Synchro 11 software and reported with HCM 2010 methodology

<sup>a</sup> Level of Service

<sup>b</sup> Average Delay (sec/vehicle)

<sup>c</sup> Volume-to-Capacity Ratio





▪ **POTENTIAL TRANSPORTATION SAFETY ISSUES:**

The study area was investigated for potential existing and future safety issues when the development is completed. A couple of features of the adjacent transportation system are discussed in the following pages.

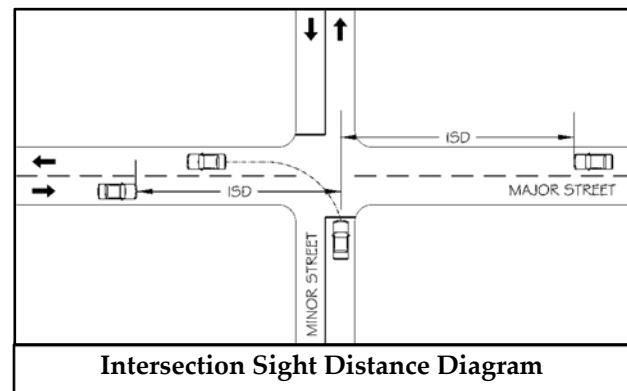
➤ **EVALUATION OF SIGHT DISTANCE**

For intersections, sight distance evaluations have two categories: Stopping Sight Distance (SSD) and Intersection Sight Distance (ISD).

Methodology:

SSD is the distance required for a motorist on a major street to perceive, react, and the vehicle to come to a complete stop before colliding with an object on the road. For evaluating intersections, this object would be another vehicle entering the intersection from a minor street. SSD can be considered the minimum visibility distance standard for evaluating the safety of an intersection.

ISD is considered the desirable visibility distance standard for evaluating the safety of an intersection. ISD is based on the time required to perceive, react, and complete the desired traffic maneuver once a motorist on a minor street decides to perform a traffic maneuver. Three traffic maneuvers are available for



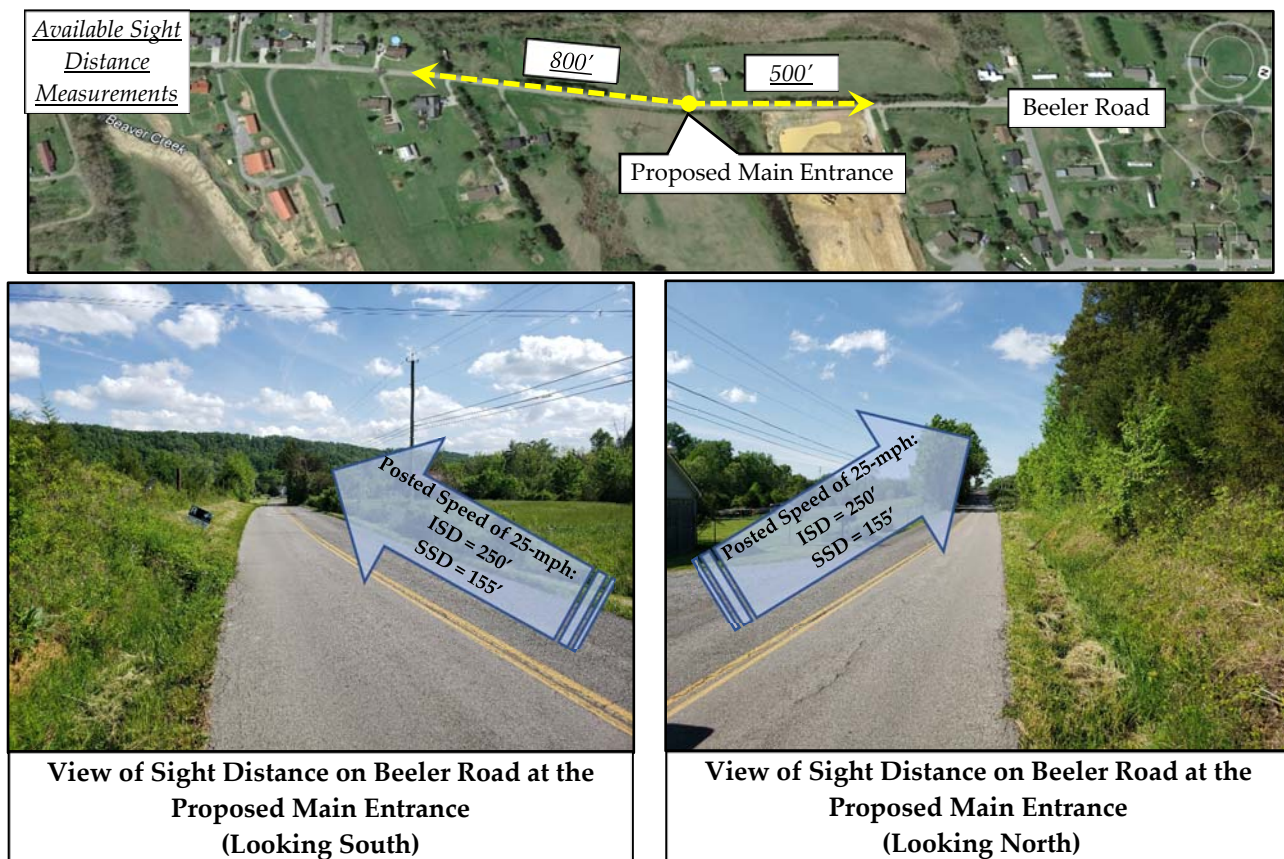
vehicles stopped on a minor street at a 4-way intersection: (1) left-turn, (2) right-turn, (3) or a crossing maneuver across the major street. For turns from the minor street, ISD is needed to allow a stopped motorist to turn onto a major street without being overtaken by an approaching vehicle. The most critical ISD is for left-turns from the minor street. The ISD for this maneuver includes the time to turn left and clear half of the intersection without conflicting with the oncoming traffic from the left and accelerating to the road's operating speed without causing the approaching vehicles from the right to reduce their speed substantially.

With a posted speed limit of 25-mph on Beeler Road, the ISD is 250 feet based on Knox County's requirement of 10 feet per 1-mph of the posted speed.

Beeler Road has a flat road grade at the Proposed Main Entrance location. Based on the posted speed limit of 25-mph on Beeler Road and the existing road grade, the SSD is calculated to be 155 feet looking to the north and 155 feet to the south.

Visual observations of the sight distances at the Proposed Main Entrance location on Beeler Road were undertaken. Using a Nikon Laser Rangefinder at the Proposed Main Entrance location, the ISD was visually estimated to be 500 feet to the north and 800 feet to the south. The intersection sight and stopping sight distances from the Proposed Main Entrance will be adequate based on visual observation. Visual observations were not made for the three detached house driveways on the western side of Beeler Road since their exact locations are unknown.

Images of the existing sight distances at the Proposed Main Entrance location are presented in the following, labeled with the ISD and SSD and the rangefinder measured sight distances.



➤ **EVALUATION OF TURN LANE THRESHOLDS**

An evaluation of the need for separate entering turn lanes into the development in the projected 2027 conditions was not conducted for the Proposed Main Entrance at Beeler Road due to the low expected conflicting volumes. However, an evaluation was conducted for the intersection of East Emory Road at Beeler Road.

The criteria used for this turn lane evaluation were based on Knox County's "Access Control and Driveway Design Policy" and TDOT's "Highway System Access Manual". These design policies relate vehicle volume thresholds based on prevailing speeds for two-lane and four-lane roadways.

According to Knox County's and TDOT's guidelines, with a posted speed limit of 45-mph, separate left and right-turn entering lanes on East Emory Road are warranted at Beeler Road based on the projected 2027 AM and PM peak hour traffic volumes. A subsequent evaluation determined that the existing 2022 volumes also warrant separate left and right-turn lanes on East Emory Road. The worksheets for these evaluations are provided in Appendix I.

## CONCLUSIONS & RECOMMENDATIONS

The following is an overview of recommendations to minimize the transportation impacts of the proposed Beeler Road Subdivision on the adjacent transportation system while attempting to achieve an acceptable traffic flow and safety level.



**Beeler Road at Proposed Main Entrance:** Projected level of service calculations were not completed for the Proposed Main Entrance intersection at Beeler Road due to the low expected conflicting volumes. The construction of left and right-turn lanes on Beeler Road for entering traffic is not recommended at the Proposed Main Entrance. A single exiting lane for the development's main entrance will be sufficient.

- 1a) It is recommended that a Stop Sign (R1-1) be installed, and a 24" white stop bar be applied to the Proposed Main Entrance approach at Beeler Road. The stop bar should be applied a minimum of 4 feet away from the edge of the intersecting roadway and placed at the desired stopping point that maximizes the sight distance.
- 1b) Sight distances at the Proposed Main Entrance approach must not be impacted by future landscaping, signage, or vegetation. A visual inspection determined that the intersection and stopping sight distances are available. Based on a posted speed limit of 25-mph on Beeler Road, the desirable intersection sight distance is 250 feet looking in each direction at each entrance. The required stopping sight distance is 155 feet looking to the north and the south at the Proposed Main Entrance. The site designer must ensure that these sight distances are accounted for and provided in the design plans.
- 1c) Sight distances at the individual separate driveways for the three detached houses on Beeler Road must also be accounted for and provided in the design plans.





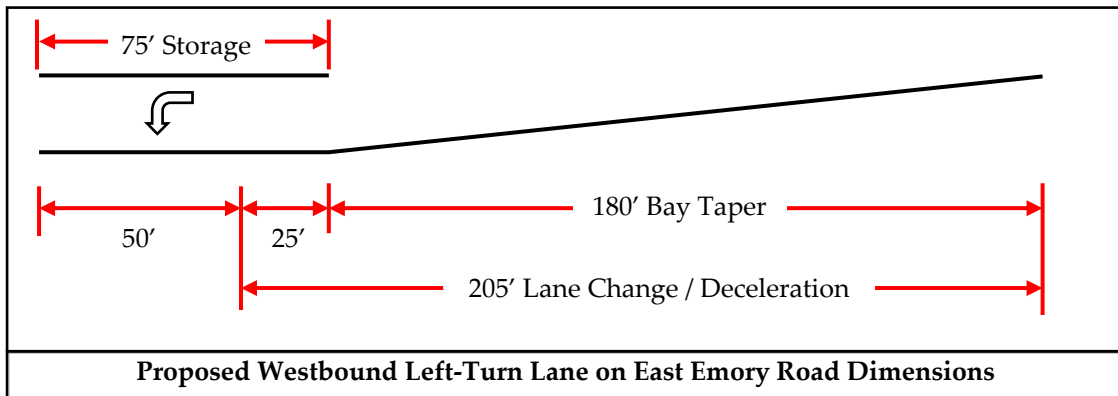
**East Emory Road at Beeler Road:** The existing 2022 and projected 2027 level of service calculations for the intersection of East Emory Road at Beeler Road resulted in high vehicle delays for the northbound approach in the AM and PM peak hours.

2a) With this intersection operating under unsignalized conditions, it was determined that the existing 2022 intersection traffic volumes currently warrant separate left and right-turn lanes on East Emory Road and would also be warranted in the projected 2027 conditions.

- i) Since East Emory Road is a state route, the proposed length of the warranted left-turn lane was calculated based on the guidance provided by TDOT. TDOT's Highway System Access Manual recommends that left-turn lane lengths at unsignalized intersections be designed based on the vehicle speed and traffic volumes. According to the Manual, "The total physical length of the exclusive turn lane should be the sum of the length for a lane change, deceleration, and storage distances." The lane change, deceleration, and storage distances can be determined in Table 3-11 and Table 3-12 in the Manual.

For a speed of 45-mph, the lane change/deceleration distance is 340 feet in Table 3-11. However, in constrained locations, a speed of 10-mph less than the design speed can be used. Thus, at a speed of 35-mph, the lane change/deceleration distance is 205 feet since this location on East Emory Road can be considered a constrained location. For the worst-case scenario in the projected 2027 PM peak hour, with a left-turn volume of 85 vehicles and an opposing volume of 766 vehicles (677 eastbound thru vehicles + 89 eastbound right-turn vehicles), the storage length required is between 50 and 75 feet as shown in Table 3-12.

The left-turn lane should include the appropriate approach taper in advance of the bay taper and storage length. The lane should include left-turn arrow pavement markings as shown in TDOT standard drawing T-M-4. For a left-turn lane width of 12 feet, the 205-foot lane change/deceleration distance should include a 180-foot bay taper length (15:1 taper) with the remaining 25 feet ( $205' - 180' = 25$  feet) added to the storage length. Thus, the proposed westbound left-turn lane on East Emory Road is recommended to have a storage length of 75 feet, as illustrated below:



- ii) Based on the projected volumes, a separate eastbound right-turn lane on East Emory Road is recommended for turning vehicles onto Beeler Road. The existing features will constrain the length of the eastbound right-turn lane on East Emory Road. The previously mentioned rebuilt box culvert on East Emory Road is located 205 feet (centerline to centerline) to the west of Beeler Road. The guardrail terminates 100 feet to the west of Beeler Road's western edge.

Due to the site constraints, it is recommended that the eastbound right-turn lane have a storage length of 25 feet and a taper length of 75 feet. This total 100-foot length is not ideal, but the possibility of constructing a longer right turn lane is hindered by the existing guardrail system, box culvert, and steep side slopes. This lane length will require that the side slope be modified, and the guardrail will need to be shortened and adjusted to accommodate the turn lane. The right-turn lane should include the appropriate right-turn arrow pavement markings as shown in TDOT standard drawing T-M-4. The designer must coordinate with TDOT on this modification.

An additional software program was used to calculate the 2027 projected left-turn vehicle queues at this intersection and determine if the recommended storage lengths would be adequate. The previously mentioned Synchro Traffic Software includes SimTraffic. The Synchro portion of the software performs the macroscopic calculations for intersections, and SimTraffic performs micro-simulation and animation of vehicular traffic. SimTraffic (Version 11) software was utilized to estimate the 2027 projected vehicle queues.

The 95th percentile vehicle queue is the recognized measurement in the traffic engineering profession as the design standard used when considering queue lengths. A 95th percentile vehicle queue length means 95% certainty that the vehicle queue will not extend beyond that point. The calculated vehicle queue results were based on averaging the outcome obtained during ten traffic simulations. The vehicle queue results from the SimTraffic software are in Appendix K. The 95th percentile vehicle queue lengths at the intersection for the 2027 projected conditions are shown in Table 9.

**TABLE 9**  
**TURN LANE STORAGE & VEHICLE QUEUE SUMMARY -**  
**2027 PROJECTED PEAK HOUR TRAFFIC VOLUMES (WITH THE PROJECT AND IMPROVEMENTS)**

INTERSECTION	APPROACH/ MOVEMENT	PROPOSED STORAGE (ft)	ADEQUATE LENGTH?	SIMTRAFFIC 95 <sup>th</sup> PERCENTILE QUEUE LENGTH (ft)	
				AM PEAK HOUR	PM PEAK HOUR
East Emory Road at Beeler Road	Eastbound Right	25	Yes	9	18
	Westbound Left	75	Yes	37	57
	Northbound Left/Right	N/A	N/A	95	91

Note: 95<sup>th</sup> percentile queues were calculated in SimTraffic 11 software

This updated and revised report has determined that the documented need for separate left and right-turn lanes on East Emory Road at Beeler Road will be satisfied by the capacity provided by the TDOT widening project. This project is currently in the design phase, and TDOT proposes widening East Emory Road from 2 to 5 lanes. This project will include 2 thru lanes in each direction and a center turn lane. Thus, East Emory Road will be widened to provide a center turn lane for westbound left-turns at Beeler Road, and the two thru lanes (in each direction) will eliminate the need for a separate eastbound right-turn lane at Beeler Road.

The right-turn volume thresholds were re-examined in the projected 2027 conditions to demonstrate that a separate eastbound right-turn lane will not be required in the future condition with a 5-lane roadway section. This re-examination included the AM and PM peak hour projected 2027 volumes on East Emory Road with five lanes. The worksheet from this re-examination is shown in Appendix I and shows that a separate eastbound right-turn lane would not be required with a 5-lane roadway section on East Emory Road.

Thus, the TDOT widening project will provide the necessary capacity for the turning movements on East Emory Road at Beeler Road. However, before the widening project

is completed, a traffic sign is recommended to be posted directly across from Beeler Road outside the paved shoulder of East Emory Road. It is recommended that a “No Passing on Shoulder” (R4-18) sign be installed to address the existing illegal movements committed by some motorists occasionally using the shoulder to pass stopped westbound left-turning vehicles on East Emory Road at Beeler Road. This sign should, at a minimum, be 24" x 30" in size, and it is recommended that it be posted outside the paved shoulder, facing westbound traffic, and at least 12 feet from the white edge line.

- 2b) The existing and projected right-turns at the northbound approach of Beeler Road at East Emory Road have higher amounts versus left-turns. Adding an exclusive right-turn lane on this approach would reduce delays for these motorists. Several right-turning motorists were observed using the shoulder to bypass stopped vehicles waiting to turn left onto East Emory Road. Dual lanes at unsignalized intersections operating under stop conditions can be an issue due to the potential for motorists having to compete for sight distance.




**View of Existing Sight Distance on East  
Emory Road at Beeler Road  
(Looking West)**

However, this approach in 2027 was projected to operate with a v/c ratio greater than 1. With the existing geometry on East Emory Road, it is anticipated that a northbound exclusive right-turn lane on Beeler Road could be constructed that would allow motorists to see in both directions freely without being obstructed by other vehicles. The sight distance concern would need to be worked on during the design of the other recommended turn lane additions at the intersection. If constructed, the overall intersection delay would be decreased, and the overall queue lengths on the northbound approach of Beeler Road would be decreased. If not constructed, it is anticipated that more right-turning motorists will become impatient due to excessive delays and queues and will utilize the shoulder more than currently occurring. Without a northbound right turn lane, the approach will operate over capacity. The results of adding a northbound right-turn lane on Beeler Road are shown in Tables 10 and 11. The LOS and vehicle queue results in these tables include the recommended eastbound left-turn lane, westbound right-turn lane, and a separate right-turn lane on Beeler Road. The worksheets for these results are provided in Appendix F and K.



**TABLE 10**  
**2027 INTERSECTION CAPACITY ANALYSIS RESULTS -**  
**PROJECTED TRAFFIC CONDITIONS (WITH THE PROJECT AND IMPROVEMENTS)**  
**INCLUDING A NORTHBOUND RIGHT-TURN LANE)**

INTERSECTION	TRAFFIC CONTROL	APPROACH/ MOVEMENT	AM PEAK			PM PEAK		
			LOS	DELAY (seconds)	V/C	LOS	DELAY (seconds)	V/C
East Emory Road (EB & WB) at Beeler Road (NB)	 Unsignalized	Northbound Left	F	57.8	0.448	F	161.2	0.865
		Northbound Right	B	14.2	0.268	C	17.1	0.225
		Westbound Left	A	8.7	0.052	B	10.3	0.132

Note: All analyses were calculated in Synchro 11 software and reported using HCM 2010 intersection methodology

<sup>a</sup> Level of Service

<sup>b</sup> Average Delay (sec/vehicle)

<sup>c</sup> Volume-to-Capacity Ratio

**TABLE 11**  
**TURN LANE STORAGE & VEHICLE QUEUE SUMMARY -**  
**2027 PROJECTED PEAK HOUR TRAFFIC VOLUMES (WITH THE PROJECT AND IMPROVEMENTS**  
**INCLUDING A NORTHBOUND RIGHT-TURN LANE)**


INTERSECTION	APPROACH/ MOVEMENT	PROPOSED STORAGE (ft)	ADEQUATE LENGTH?	SIMTRAFFIC 95 <sup>th</sup> PERCENTILE QUEUE LENGTH (ft)	
				AM PEAK HOUR	PM PEAK HOUR
East Emory Road at Beeler Road	Eastbound Right	25	Yes	9	18
	Westbound Left	75	Yes	39	57
	Northbound Left	N/A	N/A	49	59
	Northbound Right	75	Yes	56	52

Note: 95<sup>th</sup> percentile queues were calculated in SimTraffic 11 software

Based on these results, it could be recommended that a northbound right-turn lane with 75 feet of storage be constructed on Beeler Road. However, this updated and revised report has determined that the TDOT widening project will eliminate the need for a separate northbound right-turn lane on Beeler Road. The additional lanes that will be provided on East Emory Road will produce more gaps in the traffic flow to allow for northbound left and right-turning vehicles from Beeler Road to enter the traffic stream. The capacity calculations and vehicle queues were re-analyzed with the intersection operating with 5-lanes on East Emory Road and a single lane on Beeler Road with the projected 2027 traffic volumes. The results of these calculations are shown in Table 12 and Table 13. The worksheets for these results are provided in Appendix F and K. The results of this re-analysis determined that a storage length of 50 feet is recommended to be designated for left-turns on East Emory Road at the intersection with Beeler Road.

This length should include the appropriate white left-turn arrow and delineation from the center turn lane that TDOT will construct.

**TABLE 12**  
**2027 INTERSECTION CAPACITY ANALYSIS RESULTS -**  
**PROJECTED TRAFFIC CONDITIONS (WITH THE PROJECT AND TDOT WIDENING PROJECT)**  
**WITH A SINGLE NORTHBOUND LANE ON BEELER ROAD**

INTERSECTION	TRAFFIC CONTROL	APPROACH/ MOVEMENT	AM PEAK			PM PEAK		
			LOS	DELAY (seconds)	V/C	LOS	DELAY (seconds)	V/C
East Emory Road (EB & WB) at Beeler Road (NB)	 Unsignalized	Northbound Left/Right	D	25.4	0.468	C	16.0	0.376
		Westbound Left	B	10.3	0.133	A	8.7	0.053

Note: All analyses were calculated in Synchro 11 software and reported using HCM 2010 intersection methodology

<sup>a</sup> Level of Service

<sup>b</sup> Average Delay (sec/vehicle)

<sup>c</sup> Volume-to-Capacity Ratio

**TABLE 13**  
**TURN LANE STORAGE & VEHICLE QUEUE SUMMARY -**  
**PROJECTED TRAFFIC CONDITIONS (WITH THE PROJECT AND TDOT WIDENING PROJECT)**  
**WITH A SINGLE NORTHBOUND LANE ON BEELER ROAD**

INTERSECTION	APPROACH/ MOVEMENT	PROPOSED STORAGE (ft)	ADEQUATE LENGTH?	95 <sup>th</sup> PERCENTILE QUEUE LENGTH (ft)	
				AM PEAK HOUR	PM PEAK HOUR
East Emory Road at Beeler Road	Eastbound Right	N/A	N/A	-	-
	Westbound Left (TWLTL)	50	Yes	12.5	5
	Northbound Left/Right	N/A	N/A	60	42.5

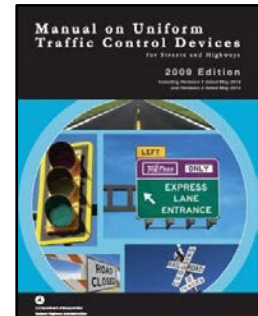
Note: 95<sup>th</sup> percentile queues were calculated in Synchro 11 software

- 2c) As a further investigation into potential remediation for this intersection, an evaluation was conducted with respect to traffic signal warrants.

Methodology:

The Manual on Uniform Traffic Control Devices – 2009 Edition

(MUTCD) presents nine different warrants that the traffic engineering profession has developed 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 Manual's signal warrants 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 must be applied before justifying the need for a traffic signal installation. These additional studies are significant in ensuring that a traffic signal's installation will not degrade safety and efficiencies.



The MUTCD defines nine different warrants, two of which are potentially applicable for 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 applications 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 use 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.

Even though nine warrants are offered to justify a traffic signal, according to the TDOT Traffic Signal Manual, the agency gives precedence to Warrant #1 (Eight Hour Vehicular Volume) and Warrant #7 (Crash Experience). Even though Warrant #2 is not a primary warrant used by TDOT, it is included in this study. Furthermore, TDOT does not allow installing a traffic signal on a state route based on speculative developments or unrealized traffic volumes.

The intersection of East Emory Road at Beeler Road was evaluated in the projected 2027 conditions to determine whether a traffic signal could be justified based on the MUTCD Warrants listed above. Beeler Road was used as the minor side street for the warrant analysis, and East Emory Road was the major street. Warrant #7 was not analyzed at this intersection for this study. Warrant #7 was not included because one of the primary criteria for an intersection to meet the warrant is that an “Adequate trial of alternatives with satisfactory observance and enforcement has failed to reduce the crash frequency...” It is not believed that any specific alternatives have been implemented and observed at this intersection; therefore, this warrant was not included in this study.

A spreadsheet was used to calculate the 2027 traffic volumes generated by the development being added to the intersection during the highest 8 hours of traffic based on the assumed trip distribution. This spreadsheet is shown in Appendix J. The MUTCD warrants are intentionally constructed to allow the analyst to use engineering judgment and be flexible on whether right-turn volumes are included in the analysis. When not including the northbound right-turns on Beeler Road in the analysis, it is calculated that this intersection will not meet Warrants #1 or #2 in the projected 2027 conditions. This assumption would be appropriate if an exclusive right-turn lane is constructed and provided on Beeler Road. However, if an exclusive right-turn lane is not provided and 25% of the right-turning vehicles on Beeler Road are included in the analysis, then the intersection would meet Warrant #2. If 50% is included, the intersection will meet Warrant #1, Condition B, and Warrant #2. Appendix J shows the traffic signal warrant spreadsheets for these intersection evaluations.

Once again, with this updated and revised report, the potential need for a traffic signal in the projected conditions will be impacted by the TDOT widening project on East Emory Road. Traffic signal warrants for this intersection were re-analyzed with the additional lanes that will be provided on East Emory Road by the TDOT widening project. The results were similar to the outcomes obtained when not including the



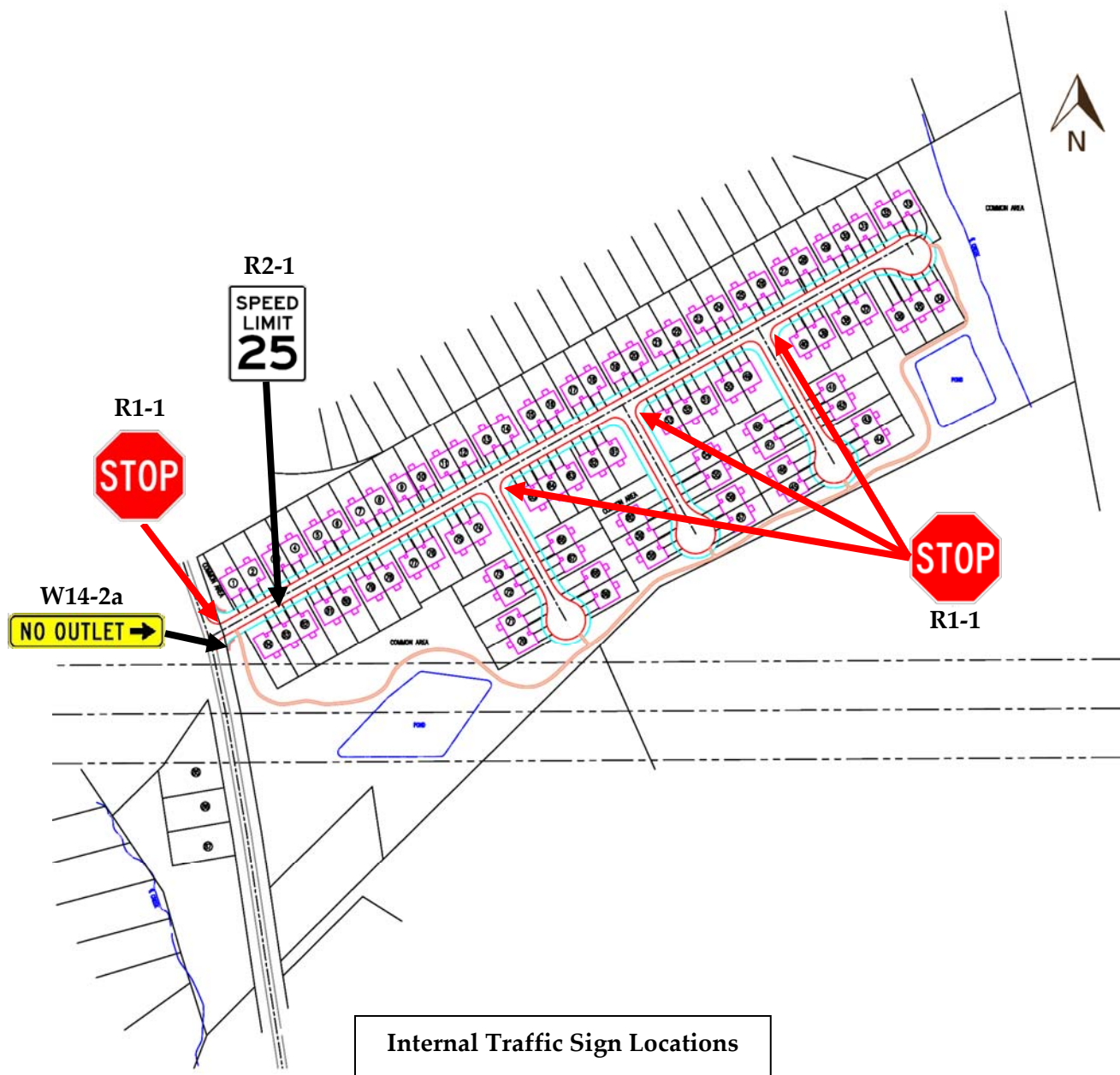
additional traffic lanes provided by the widening project. Whether or not right turn movements on Beeler Road were included in the analysis greatly influenced whether a traffic signal could be justified in the projected conditions. Appendix J includes the traffic signal warrant spreadsheet for an intersection evaluation with East Emory Road having 5-lanes and right turn volumes from Beeler Road not included.

In conclusion, since TDOT does not allow for a traffic signal to be constructed on speculative or projected volumes, it is recommended that traffic counts be re-conducted in the future once the subdivisions on Beeler Road are constructed and fully occupied, and the road widening of East Emory Road is completed. Updated traffic counts will allow a re-examination of the Traffic Signal Warrants and establish a timeframe if and when this intersection could or should be signalized with the widened section of East Emory Road. Traffic crash data should also be included in the examination.



**Beeler Road Subdivision Internal Roads:** The layout plan shows one main entrance at Beeler Road constructed for the development, as shown in Figure 3.

- 3a) A 25-mph Speed Limit Sign (R2-1) is recommended to be posted near the beginning of the development's main entrance off Beeler Road. It is recommended that a "No Outlet" Sign (W14-2a) be installed at the front of the subdivision at Beeler Road. This sign can be installed above or below the street name sign.
- 3b) Stop Signs (R1-1) with 24" white stop bars and other traffic signage are recommended to be installed at the internal locations, as shown below:



- 3c) Sight distance at the new internal road intersections must not be impacted by signage, parked cars, or future landscaping. With a proposed speed limit of 25-mph in the development, the internal intersection sight distance is 250 feet. The required stopping sight distance is 155 feet for a level road grade. The site designer should ensure that internal sight distance lengths are met and account for different proposed road grades.
- 3d) Traffic calming measures may be needed to decrease internal vehicle speeds. Road “A” within the development has several vertical grades with a long, straight horizontal alignment. Straight road segments with steeper grades encourage higher vehicle speeds. It is recommended that the site designer consider installing speed humps or speed tables within the development to reduce internal speeds. Specifics of the traffic calming strategies should be discussed with Knox County Engineering in the detail design phase.
- 3e) All drainage grates and covers for the residential development must be pedestrian and bicycle safe.
- 3f) If directed by the local post office, the site designer should include a parking area within the development for a centralized mail delivery center. The site plan does not show a general location, and a specific plan with a parking area should be designed and provided.
- 3g) All road grade and intersection elements should be designed to AASHTO, TDOT, and Knox County specifications and guidelines to ensure proper operation.

## **APPENDIX A**

### **HISTORICAL TRAFFIC COUNT DATA**



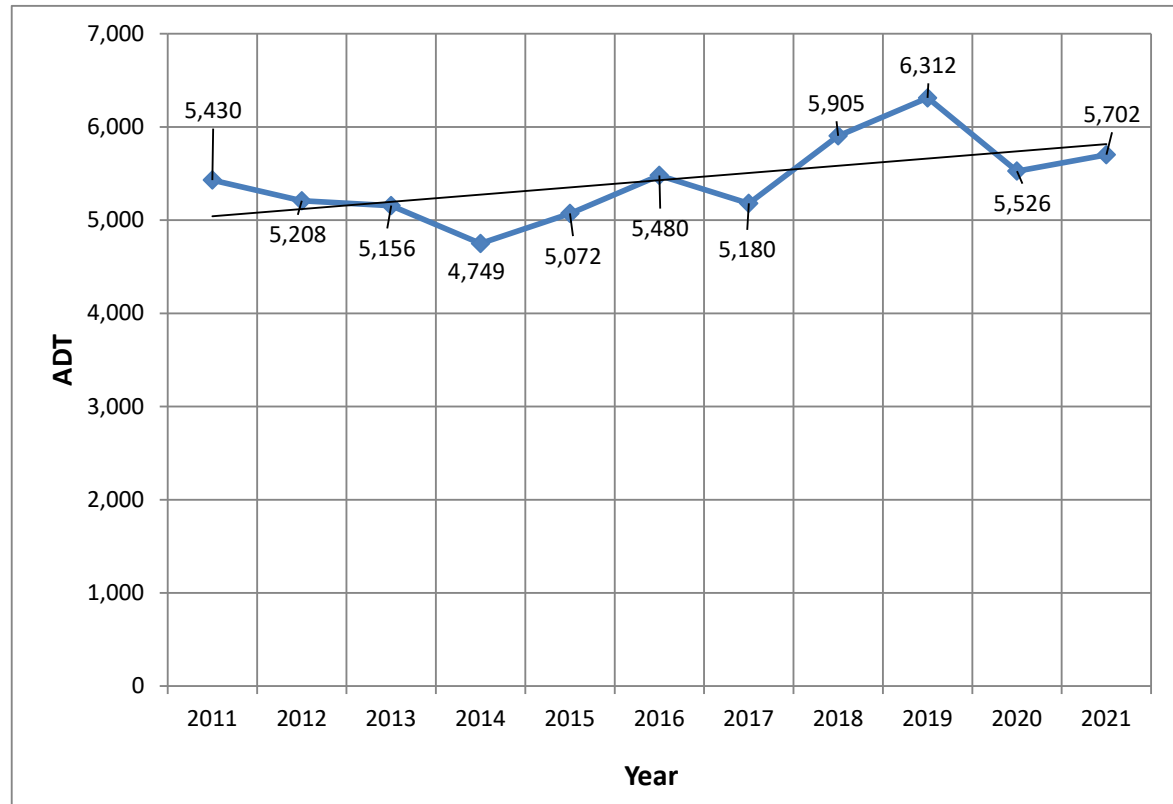
## Historical Traffic Counts

Organization: TDOT

Station ID #: 47000009

Location: East Emory Road, East of Tazewell Pike

YEAR	AADT	
2011	5,430	Trendline ↓
2012	5,208	
2013	5,156	
2014	4,749	
2015	5,072	
2016	5,480	
2017	5,180	
2018	5,905	
2019	6,312	
2020	5,526	
2021	5,702	



2011 - 2021 Growth Rate = 5.0%

Average Annual Growth Rate = 0.5%

TN

TDOT

Department of Transportation

MS2

Transportation Data Management System

[Home](#)
[TMC](#)
[TCL](#)
[TTDS](#)
[RSHS](#)
[NMDS](#)
[WOIS](#)
[RTTV](#)

[Login](#)
[+ Locate](#)
[+ Locate All](#)
[Email This](#)

Auto-Locate OFF

List View

All Data

Record

7066

of 15600

Goto Record

go

Location ID	47000009	MPU ID	
Type	SPOT	HPMS ID	
On NHS		On HPMS	
LRS ID	47SR331001	LRS Loc Pt.	8888
SF Group	Urban	Route Type	
AF Group	1A	Route	
CF Group	Knox	Active	Yes
Class Dist Grp	1A	Category	CC
Seas Class Grp			
WIM Group			
QC Group	Default		
Funct'l Class	Minor Arterial	Milepost	
Located On	E. EMORY RD.		
Loc On Alias	E. OF HARBISON CROSS RDS		

More Detail

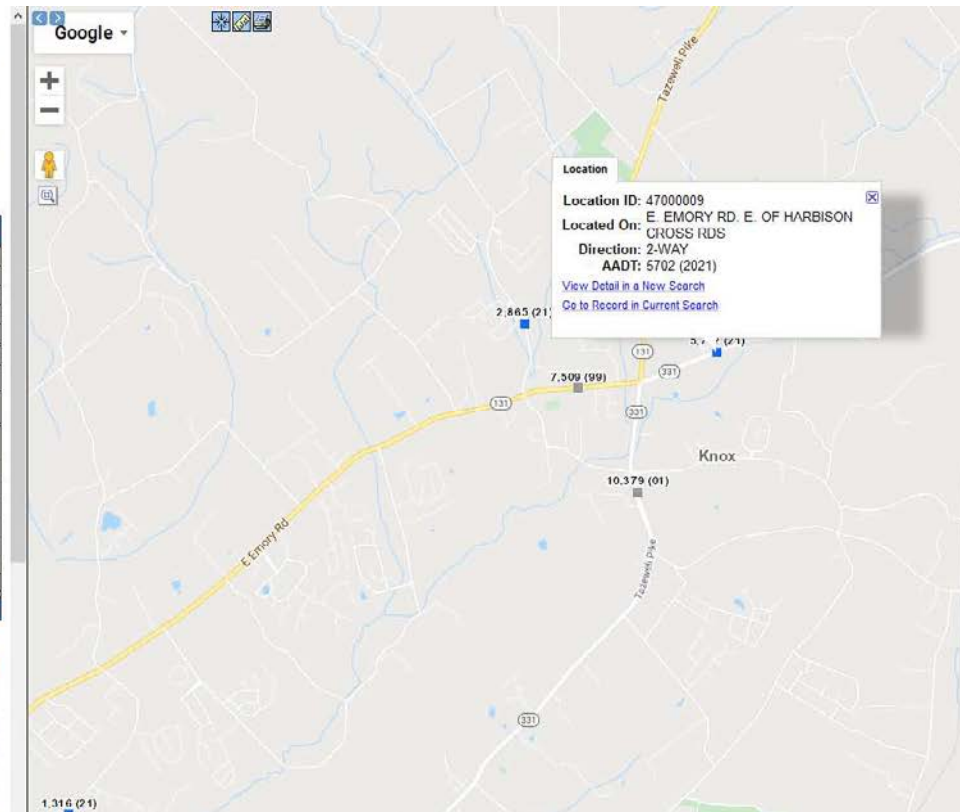
STATION DATA

Directions: 2-WAY

AADT

Year	AADT	DIY-30	K %	D %	PA	DC	Src
2021	5,702	521	0	65	5,515 (97%)	187 (3%)	
2020	5,526	539	10	65	5,315 (96%)	211 (4%)	
2019	6,312		12	65			
2018	5,905		10	65			
2017	5,180		9	65			

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## **APPENDIX B**

### **WALK SCORE**



# WALKSCORE


(from walkscore.com)




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

[Go](#)


## 6840 Beeler Road

Knoxville, Tennessee, 37918

Commute to **Gibbs, TN** 

 5 min  13 min  37 min [View Routes](#)

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

[More about 6840 Beeler Road](#) 

Walk Score

1

**Car-Dependent**  
Almost all errands require a car.

Transit Score

0

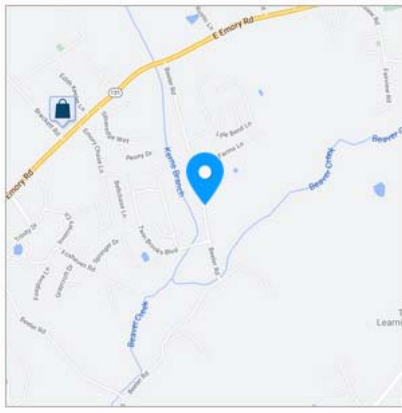
**Minimal Transit**  
It is possible to get on a bus.

Bike Score

17

**Somewhat Bikeable**  
Minimal bike infrastructure.

[About your score](#)

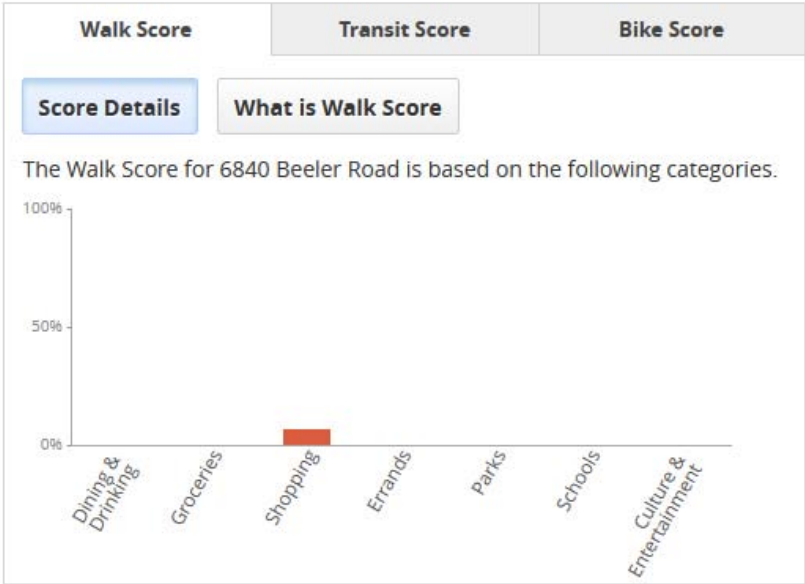


Scores for 6840 Beeler Road



Walk Score  
**1**

Bike Score  
**17**



Scores for 6840 Beeler Road



Walk Score  
**1**

Bike Score  
**17**

Walk Score	Transit Score	Bike Score
Transit Score measures how well a location is served by public transit based on the distance and type of nearby transit lines.		
90-100	<b>Rider's Paradise</b> World-class public transportation	
70-89	<b>Excellent Transit</b> Transit is convenient for most trips	
50-69	<b>Good Transit</b> Many nearby public transportation options	
25-49	<b>Some Transit</b> A few nearby public transportation options	
0-24	<b>Minimal Transit</b> It is possible to get on a bus	

# Scores for 6840 Beeler Road



Walk Score

1

Bike Score

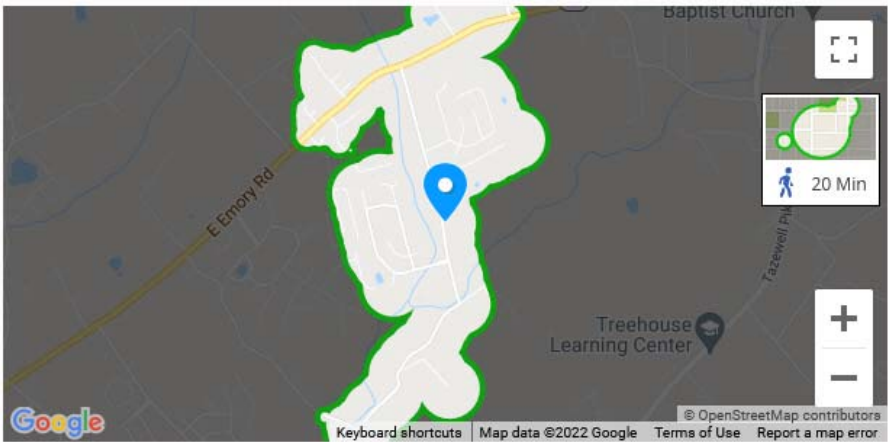
17

Walk Score	Transit Score	Bike Score
Bike Score measures whether an area is good for biking based on bike lanes and trails, hills, road connectivity, and destinations.		
90-100	<b>Biker's Paradise</b> Daily errands can be accomplished on a bike	
70-89	<b>Very Bikeable</b> Biking is convenient for most trips	
50-69	<b>Bikeable</b> Some bike infrastructure	
0-49	<b>Somewhat Bikeable</b> Minimal bike infrastructure	

## Travel Time Map

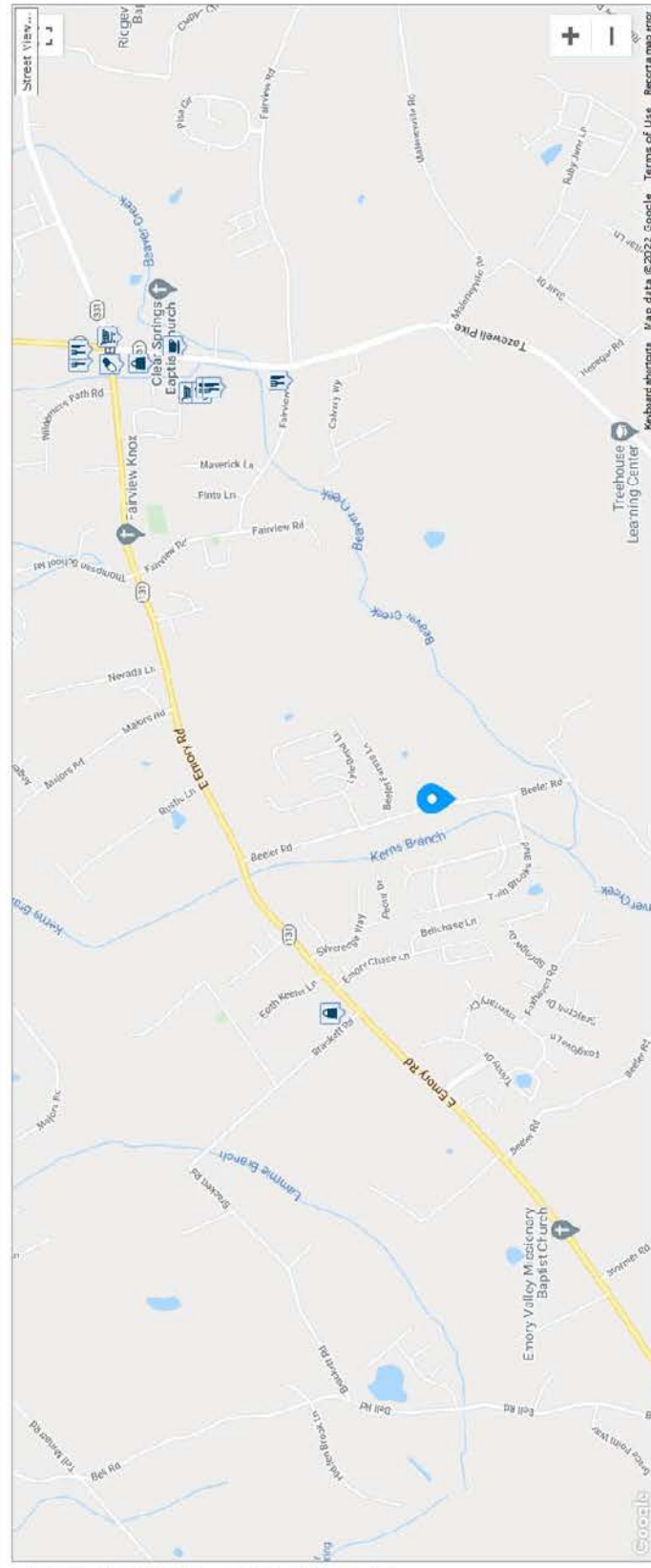
[Add to your site](#)

Explore how far you can travel by car, bus, bike and foot from 6840 Beeler Road.



## What's Nearby

<b>Restaurants:</b>		
Twister's Diner & Sundae		1mi
<b>Coffee:</b>		
Pike House Coffee		1.2mi
<b>Bars:</b>		
The Rock Tavern		3.9mi
<b>Groceries:</b>		
Isa,		1.1mi
<b>Parks:</b>		
Fountain City Park		6mi
<b>Schools:</b>		
Gibbs Middle School		1.5mi
<b>Shopping:</b>		
Flowers by Pella		6mi
<b>Entertainment:</b>		
Redbox		1.3mi
<b>Erands:</b>		
CVS Pharmacy		1.1mi
<b>Search Nearby:</b>		



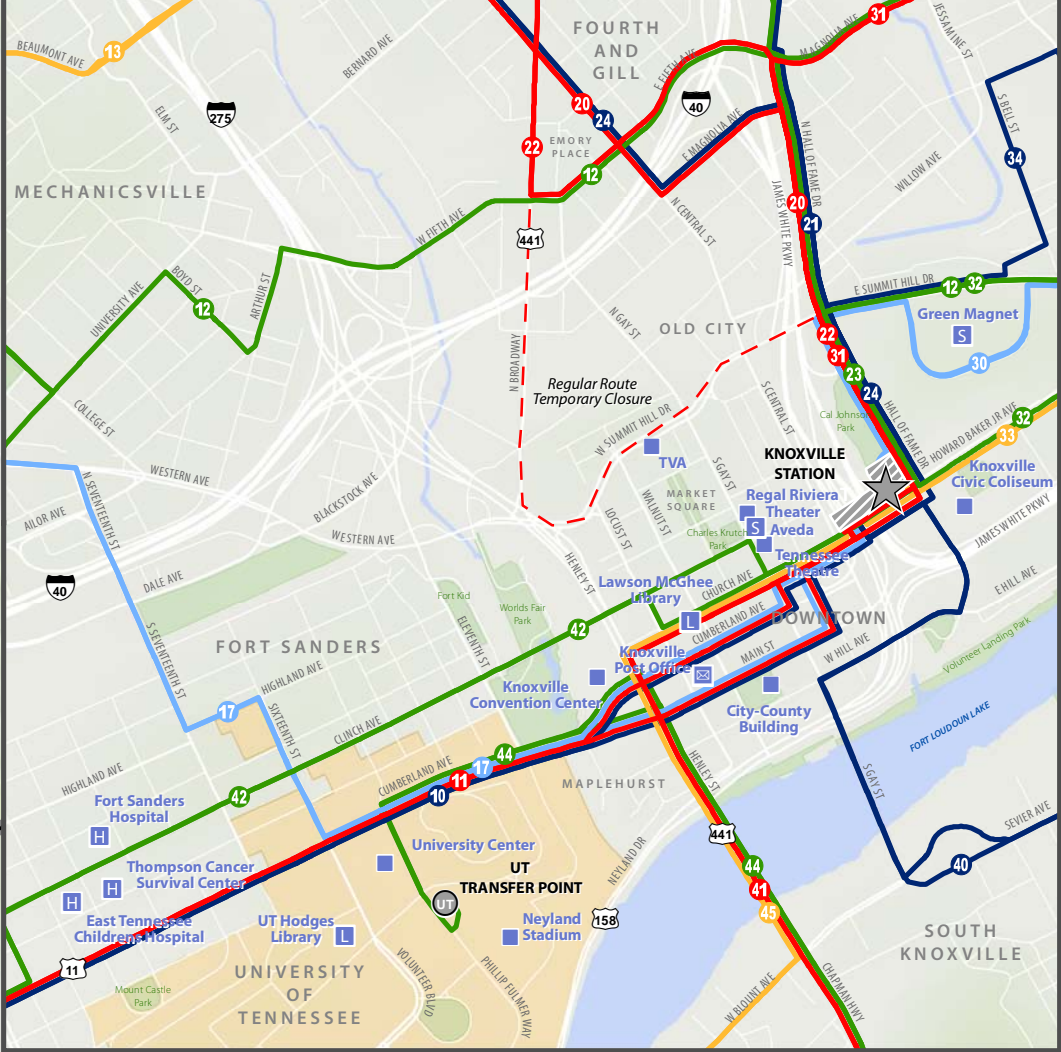


## **APPENDIX C**

### **KNOXVILLE AREA TRANSIT MAP AND INFORMATION**



Knoxville City Center



**Legend**

Transfer Point

Lift Service Area Boundary

**Points of Interest**

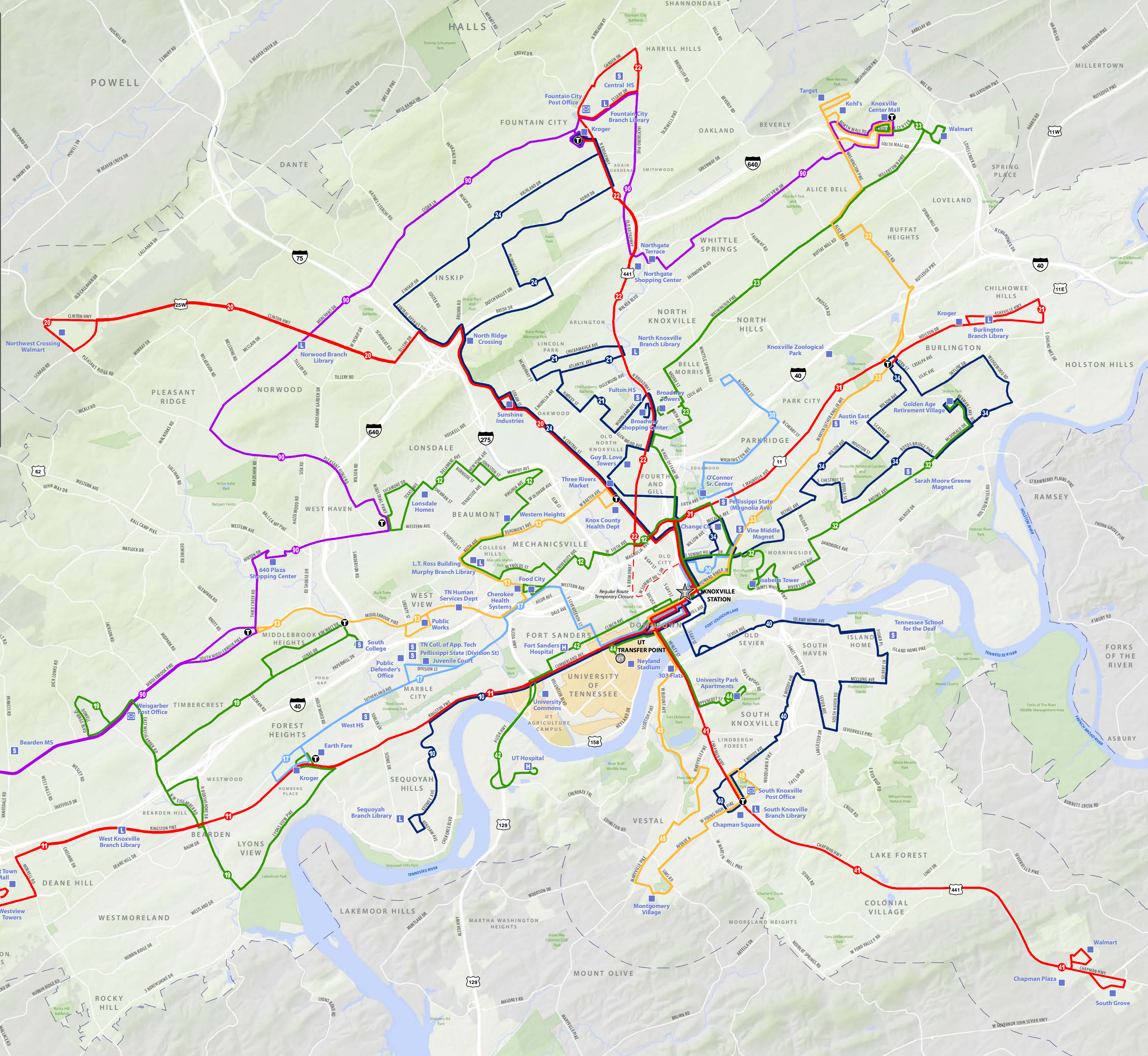
- Hospital
- School
- Library
- Point of Interest
- Post Office

**Distances**

0 5 10 Minutes Walking

0 5 10 Minutes Biking

0 0.5 1 Map Scale in Miles



FARE INFORMATION

With a base fare of **\$1.50**, KAT offers a variety of passes. Please note that only the fares marked with an asterisk can be purchased when boarding the bus. Others are available at KAT's Customer Service Counter at Knoxville Station (301 Church Ave.) or by mail via [katbus.com](http://katbus.com).

FARE TYPE	REGULAR FARE	REDUCED FARE
One-Ride Pass*	\$1.50	\$0.75
1 Day Pass*	\$4.00	\$2.00
7 Day Pass	\$15.00	\$7.50
30 Day Pass	\$50.00	\$25.00
20 Ride Pass	\$25.00	\$12.50
Transfer*	\$0.50	\$0.25

REDUCED FARE INFORMATION

A reduced fare is available to those who qualify. Qualifying individuals include seniors age 65 or over, Medicare card holders, students under the age of 18, and persons with disabilities. Proper identification (Medicare card or a valid KAT I.D. card) is required before boarding. For more information on how to obtain a discounted-fare I.D. visit [katbus.com/fares](http://katbus.com/fares) or call 637-3000.

BUS STOPS ONLY!

KAT buses stop **ONLY** at locations designated by bus stop signs. Generally, bus stops are located at least every ¼ mile along the route.

KAT HOLIDAYS

KAT buses do not run on the following holidays:

- New Year's Day
- Thanksgiving
- Independence Day
- Christmas

Please note that KAT's Knoxville Station Customer Service counter is also closed during those days.

KAT buses run on a Saturday schedule on the following holidays:

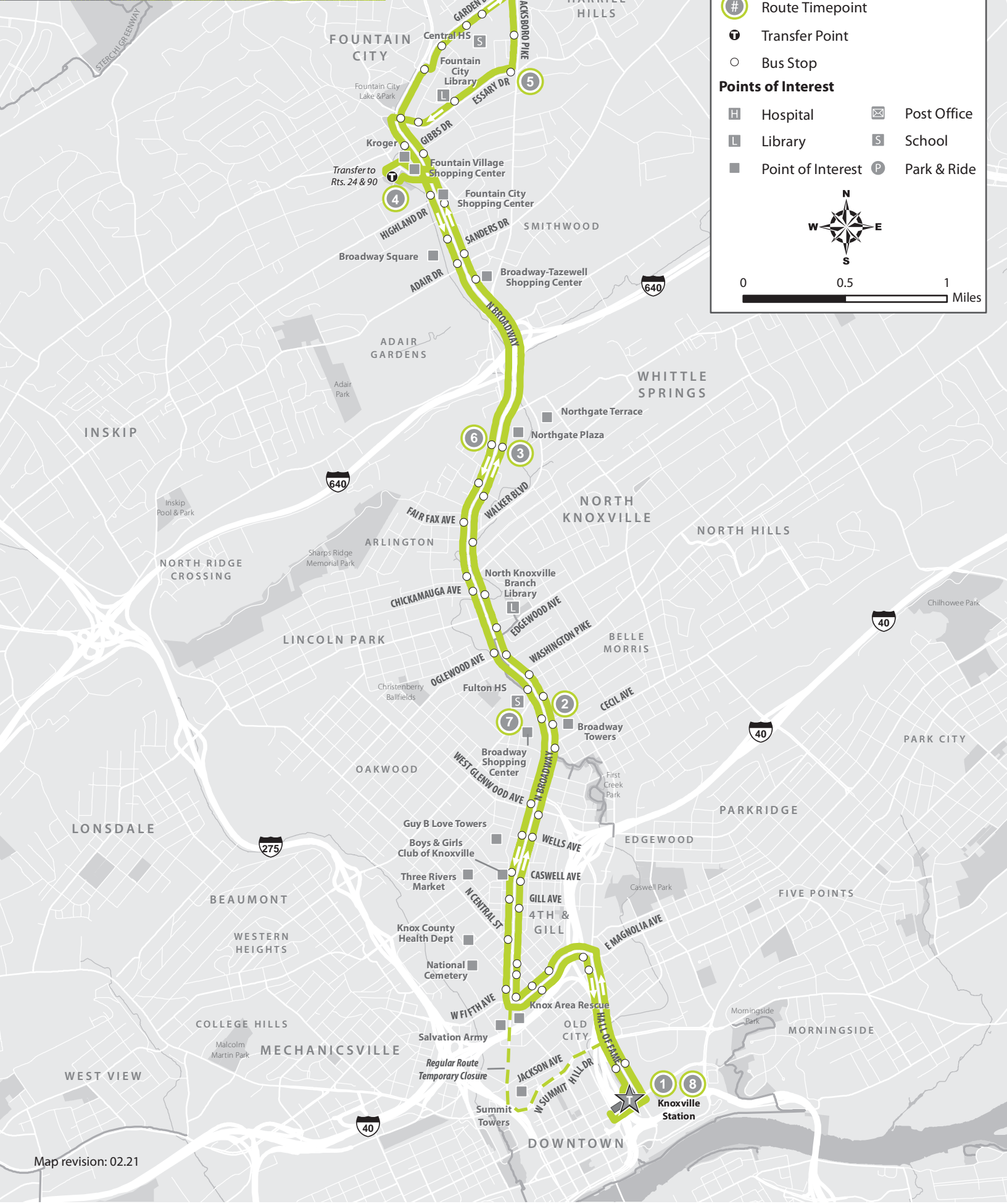
- Martin Luther King, Jr. Day
- Day after Thanksgiving
- Memorial Day
- Christmas Eve
- Labor Day

KAT's administrative offices are closed on all holidays listed above.



# 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

22

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

LONG TERM  
DETOUR

kat

KNOXVILLE  
AREA TRANSIT

Information Updated: February 1, 2021

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	8:50	8:55	9:06	9:11	9:25
	8:45	8:58	9:05	9:20	9:25	9:36	9:41	9:55
	9:15	9:28	9:35	9:50	9:55	10:06	10:11	10:25
	9:45	9:58	10:05	10:20	10:25	10:36	10:41	10:55
	10:15	10:28	10:35	10:50	10:55	11:06	11:11	
	11:15	11:28	11:35	11:40	To Garage			

Need help reading this schedule?  
Need other general information on how to ride?  
Visit [www.katbus.com](http://www.katbus.com) or call 865-637-3000



# 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

**LONG TERM DETOUR**

Information Updated: February 1, 2021

## Saturday-Sunday 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	
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	—	8:48	8:55	9:10
	9:15	9:28	9:35	9:44	—	9:48	9:55	10:10
	10:15	10:28	10:35	10:44	—	10:48	10:55	11:10
	11:15	11:28	11:35	11:44	—	11:48	11:55	12:10
P.M.	12:15	12:28	12:35	12:44	—	12:48	12:55	1:10
	1:15	1:28	1:35	1:44	—	1:48	1:55	2:10
	2:15	2:28	2:35	2:44	—	2:48	2:55	3:10
	3:15	3:28	3:35	3:44	—	3:48	3:55	4:10
	4:15	4:28	4:35	4:44	—	4:48	4:55	5:10
	5:15	5:28	5:35	5:44	—	5:48	5:55	6:10
	6:15	6:28	6:35	6:44	—	6:48	6:55	7:10
	7:15	7:28	7:35	7:44	—	7:48	7:55	8:10
	8:15	8:28	8:35	8:40	To Garage			

Need help reading this schedule?

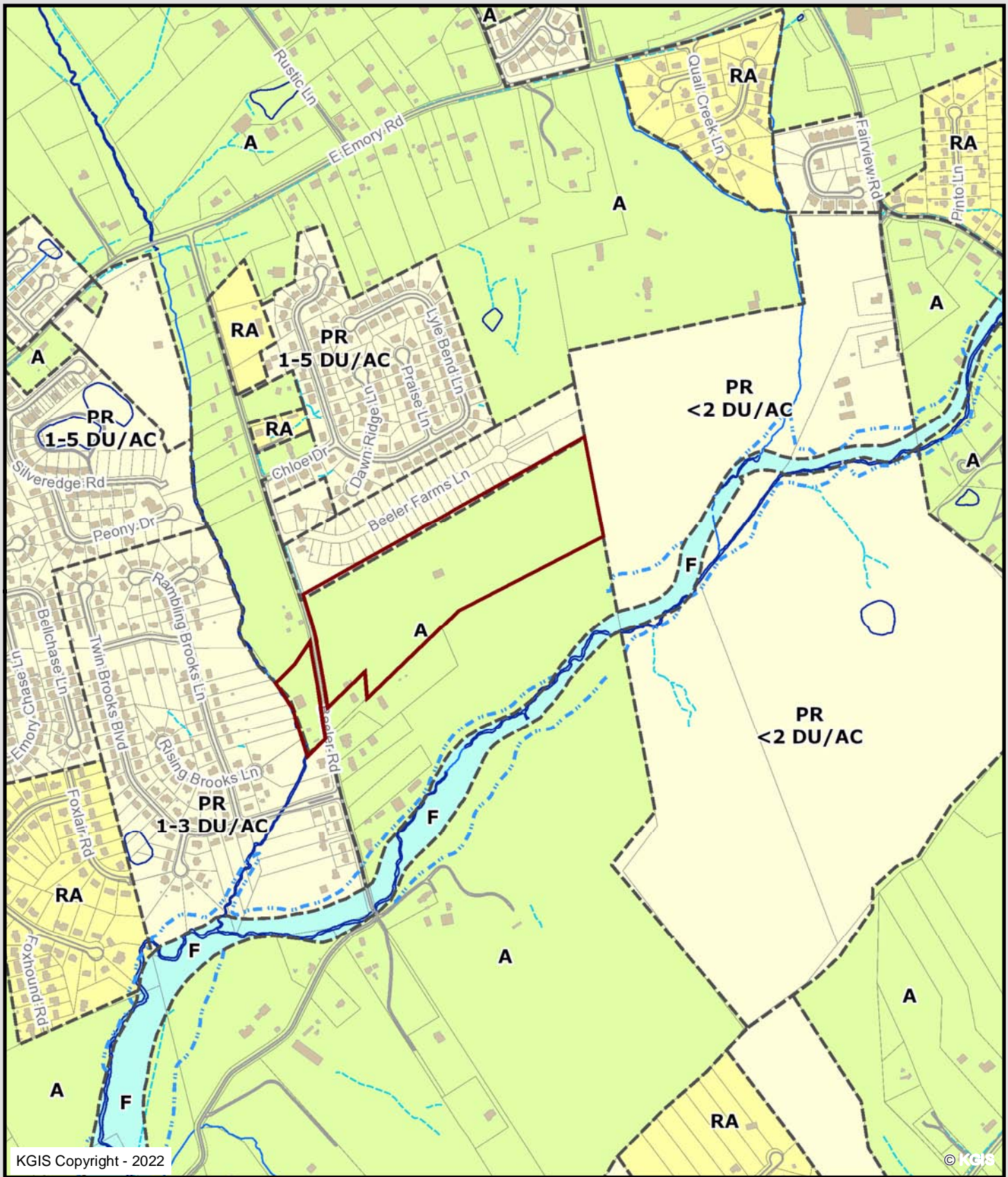
Need other general information on how to ride?

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## **APPENDIX D**

### **ZONING MAP**





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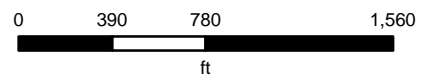
## Zoning Map

Beeler Road Subdivision

Knoxville - Knox County - KUB Geographic Information System



Printed: 5/11/2022 at 11:42:40 AM



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## **APPENDIX E**

### **MANUAL TRAFFIC COUNT DATA**

## TRAFFIC COUNT DATA

Major Street: East Emory Road (WB and EB)  
 Minor Street: Beeler Road (NB)  
 Traffic Control: Stop Sign on Beeler Road

5/5/2022 (Thursday)  
 Warm, Sunny  
 Conducted by: Ajax Engineering

	East Emory Road		Beeler Road		East Emory Road			
TIME BEGIN	WESTBOUND		NORTHBOUND		EASTBOUND		VEHICLE TOTAL	PEAK HOUR
	LT	THRU	LT	RT	THRU	RT		
7:00 AM	3	108	9	27	82	5	234	7:15 AM - 8:15 AM
7:15 AM	8	117	9	22	119	5	280	
7:30 AM	10	148	8	24	115	4	309	
7:45 AM	9	161	5	16	111	4	306	
8:00 AM	4	124	5	23	104	8	268	
8:15 AM	7	113	11	4	93	3	231	
8:30 AM	4	105	5	13	52	5	184	
8:45 AM	8	86	5	6	55	11	171	
TOTAL	53	962	57	135	731	45	1983	
11:00 AM	1	59	9	7	62	5	143	
11:15 AM	5	62	6	2	68	3	146	
11:30 AM	6	77	8	4	76	8	179	
11:45 AM	5	62	11	8	68	8	162	
12:00 PM	8	64	11	6	73	13	175	12:00 PM - 1:00 PM
12:15 PM	5	66	7	2	84	6	170	
12:30 PM	2	70	10	1	83	6	172	
12:45 PM	5	61	5	10	91	7	179	
TOTAL	37	521	67	40	605	56	1326	
2:00 PM	10	97	4	10	110	3	234	
2:15 PM	7	89	4	7	106	7	220	
2:30 PM	7	78	6	10	113	6	220	
2:45 PM	10	95	4	11	110	7	237	
3:00 PM	11	102	8	15	96	5	237	
3:15 PM	10	109	10	8	123	10	270	
3:30 PM	18	98	6	6	107	7	242	
3:45 PM	21	178	11	5	135	11	361	
4:00 PM	11	129	10	8	144	10	312	
4:15 PM	14	113	7	10	147	11	302	
4:30 PM	11	103	10	9	151	11	295	4:45 PM - 5:45 PM
4:45 PM	17	120	4	9	164	11	325	
5:00 PM	16	109	8	12	173	12	330	
5:15 PM	12	112	11	16	143	16	310	
5:30 PM	11	138	9	10	165	21	354	
5:45 PM	13	115	6	13	150	9	306	
TOTAL	199	1785	118	159	2137	157	4555	

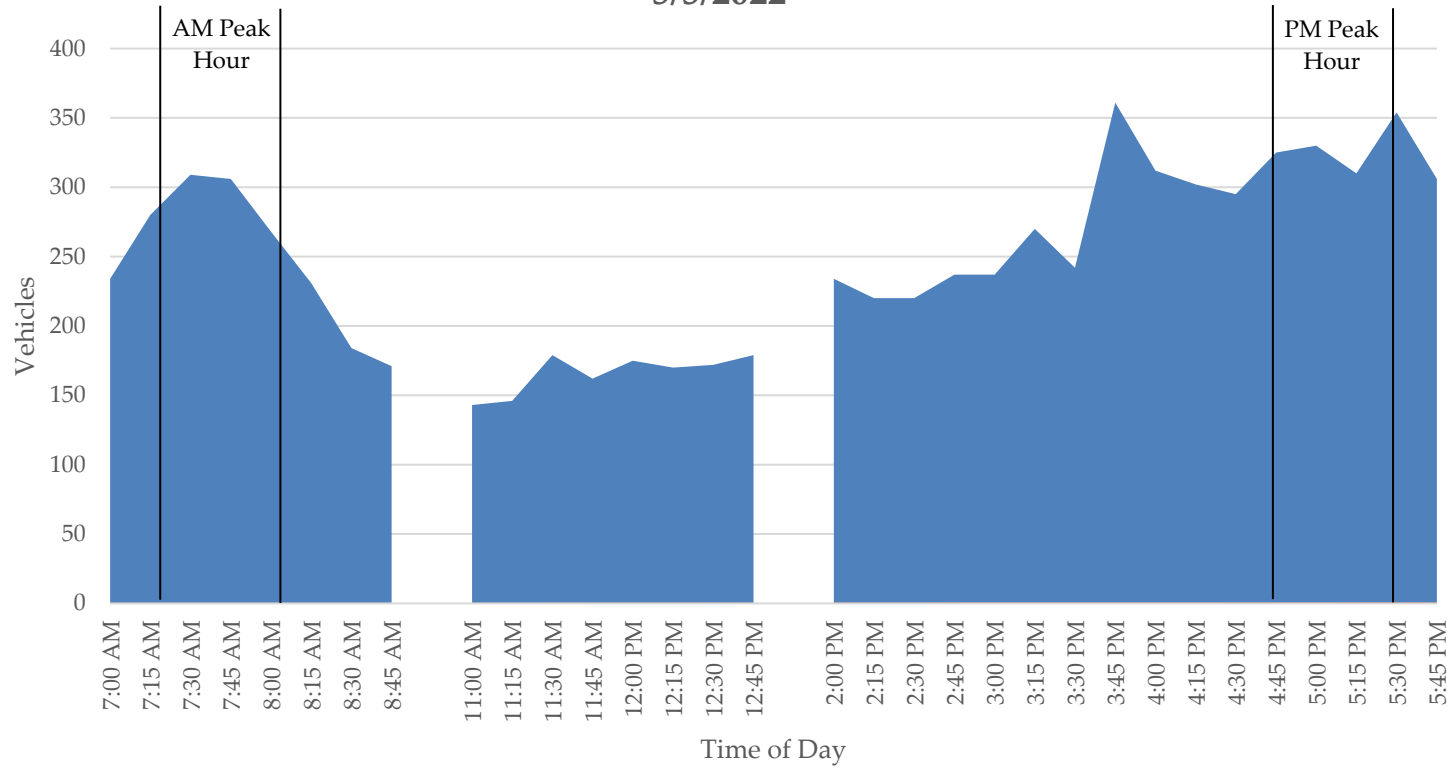
**2022 AM Peak Hour** 7:15 AM - 8:15 AM

TIME BEGIN	East Emory Road		Beeler Road		East Emory Road	
	WESTBOUND		NORTHBOUND		EASTBOUND	
	LT	THRU	LT	RT	THRU	RT
7:15 AM	8	117	9	22	119	5
7:30 AM	10	148	8	24	115	4
7:45 AM	9	161	5	16	111	4
8:00 AM	4	124	5	23	104	8
TOTAL	31	550	27	85	449	21
PHF	0.78	0.85	0.75	0.89	0.94	0.66

**2022 PM Peak Hour** 4:45 PM - 5:45 PM

TIME BEGIN	East Emory Road		Beeler Road		East Emory Road	
	WESTBOUND		NORTHBOUND		EASTBOUND	
	LT	THRU	LT	RT	THRU	RT
4:45 PM	17	120	4	9	164	11
5:00 PM	16	109	8	12	173	12
5:15 PM	12	112	11	16	143	16
5:30 PM	11	138	9	10	165	21
TOTAL	56	479	32	47	645	60
PHF	0.82	0.87	0.73	0.73	0.93	0.71

# East Emory Road at Beeler Road Intersection Traffic Count Totals 5/5/2022








## **APPENDIX F**

### **CAPACITY ANALYSES – HCM WORKSHEETS (SYNCHRO 11)**

## EXISTING CONDITIONS

Intersection

Int Delay, s/veh 2.9

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	449	21	31	550	27	85
Future Vol, veh/h	449	21	31	550	27	85
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, %	-5	-	-	-5	5	-
Peak Hour Factor	94	66	78	85	75	89
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	478	32	40	647	36	96

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	510
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.12
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.218
Pot Cap-1 Maneuver	-	-	1055
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	1055
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-




Approach	EB	WB	NB
HCM Control Delay, s	0	0.5	26.9
HCM LOS			D

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	293	-	-	1055	-
HCM Lane V/C Ratio	0.449	-	-	0.038	-
HCM Control Delay (s)	26.9	-	-	8.5	0
HCM Lane LOS	D	-	-	A	A
HCM 95th %tile Q(veh)	2.2	-	-	0.1	-



**Intersection**

Int Delay, s/veh 4.9

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	645	60	56	479	32	47
Future Vol, veh/h	645	60	56	479	32	47
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, %	-5	-	-	-5	5	-
Peak Hour Factor	93	71	82	87	73	73
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	694	85	68	551	44	64

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	779
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.12
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.218
Pot Cap-1 Maneuver	-	-	838
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	838
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-




Approach	EB	WB	NB
HCM Control Delay, s	0	1.1	62.4
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	163	-	-	838	-
HCM Lane V/C Ratio	0.664	-	-	0.081	-
HCM Control Delay (s)	62.4	-	-	9.7	0
HCM Lane LOS	F	-	-	A	A
HCM 95th %tile Q(veh)	3.8	-	-	0.3	-

## **PROJECTED CONDITIONS (WITHOUT THE PROJECT)**

Intersection

Int Delay, s/veh 4

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	471	23	35	578	31	98
Future Vol, veh/h	471	23	35	578	31	98
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, %	-5	-	-	-5	5	-
Peak Hour Factor	94	66	78	85	75	89
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	501	35	45	680	41	110




Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	536
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.12
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.218
Pot Cap-1 Maneuver	-	-	1032
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	1032
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.5	34.6
HCM LOS			D

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	268	-	-	1032	-
HCM Lane V/C Ratio	0.565	-	-	0.043	-
HCM Control Delay (s)	34.6	-	-	8.6	0
HCM Lane LOS	D	-	-	A	A
HCM 95th %tile Q(veh)	3.2	-	-	0.1	-

Intersection

Int Delay, s/veh 8.7

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	677	69	65	503	36	54
Future Vol, veh/h	677	69	65	503	36	54
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, %	-5	-	-	-5	5	-
Peak Hour Factor	93	71	82	87	73	73
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	728	97	79	578	49	74

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	825
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.12
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.218
Pot Cap-1 Maneuver	-	-	805
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	805
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.2	106.4
HCM LOS			F




Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	141	-	-	805	-
HCM Lane V/C Ratio	0.874	-	-	0.098	-
HCM Control Delay (s)	106.4	-	-	10	0
HCM Lane LOS	F	-	-	A	A
HCM 95th %tile Q(veh)	5.8	-	-	0.3	-



## **PROJECTED CONDITIONS (WITH THE PROJECT)**

Intersection

Int Delay, s/veh 7.2

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	471	27	42	578	40	127
Future Vol, veh/h	471	27	42	578	40	127
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, %	-5	-	-	-5	5	-
Peak Hour Factor	94	66	78	85	75	89
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	501	41	54	680	53	143




Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	542
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.12
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.218
Pot Cap-1 Maneuver	-	-	1027
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	1027
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.6	51.6
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	260	-	-	1027	-
HCM Lane V/C Ratio	0.754	-	-	0.052	-
HCM Control Delay (s)	51.6	-	-	8.7	0
HCM Lane LOS	F	-	-	A	A
HCM 95th %tile Q(veh)	5.5	-	-	0.2	-

**Intersection**

Int Delay, s/veh 23

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	677	89	85	503	48	63
Future Vol, veh/h	677	89	85	503	48	63
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, %	-5	-	-	-5	5	-
Peak Hour Factor	93	71	82	87	73	73
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	728	125	104	578	66	86

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	853
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.12
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.218
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	1.6	248.5
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	118	-	-	786	-
HCM Lane V/C Ratio	1.289	-	-	0.132	-
HCM Control Delay (s)	248.5	-	-	10.3	0
HCM Lane LOS	F	-	-	B	A
HCM 95th %tile Q(veh)	10	-	-	0.5	-

**Notes**

-: Volume exceeds capacity    \$: Delay exceeds 300s    +: Computation Not Defined    \*: All major volume in platoon

## **PROJECTED CONDITIONS (WITH THE PROJECT AND IMPROVEMENTS)**



Intersection

Int Delay, s/veh 3.8

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Traffic Vol, veh/h	471	27	42	578	40	127
Future Vol, veh/h	471	27	42	578	40	127
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	50	75	-	0	100
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	-5	-	-	-5	5	-
Peak Hour Factor	94	66	78	85	75	89
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	501	41	54	680	53	143

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	542
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.12
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.218
Pot Cap-1 Maneuver	-	-	1027
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	1027
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.6	26.1
HCM LOS			D

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	119	532	-	-	1027	-
HCM Lane V/C Ratio	0.448	0.268	-	-	0.052	-
HCM Control Delay (s)	57.8	14.2	-	-	8.7	-
HCM Lane LOS	F	B	-	-	A	-
HCM 95th %tile Q(veh)	2	1.1	-	-	0.2	-

Intersection

Int Delay, s/veh 7.8

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Traffic Vol, veh/h	677	89	85	503	48	63
Future Vol, veh/h	677	89	85	503	48	63
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	50	75	-	0	100
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	-5	-	-	-5	5	-
Peak Hour Factor	93	71	82	87	73	73
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	728	125	104	578	66	86

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	853
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.12
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.218
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	1.6	79.4
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	76	383	-	-	786	-
HCM Lane V/C Ratio	0.865	0.225	-	-	0.132	-
HCM Control Delay (s)	161.2	17.1	-	-	10.3	-
HCM Lane LOS	F	C	-	-	B	-
HCM 95th %tile Q(veh)	4.4	0.9	-	-	0.5	-

**PROJECTED CONDITIONS (WITH THE PROJECT & TDOT WIDENING PROJECT)  
WITH SINGLE NB LANE**

Intersection

Int Delay, s/veh 3.8

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Traffic Vol, veh/h	471	27	42	578	40	127
Future Vol, veh/h	471	27	42	578	40	127
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	50	75	-	0	100
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	-5	-	-	-5	5	-
Peak Hour Factor	94	66	78	85	75	89
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	501	41	54	680	53	143

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	542
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.12
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.218
Pot Cap-1 Maneuver	-	-	1027
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	1027
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.6	26.1
HCM LOS			D

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	119	532	-	-	1027	-
HCM Lane V/C Ratio	0.448	0.268	-	-	0.052	-
HCM Control Delay (s)	57.8	14.2	-	-	8.7	-
HCM Lane LOS	F	B	-	-	A	-
HCM 95th %tile Q(veh)	2	1.1	-	-	0.2	-



Intersection

Int Delay, s/veh 7.8

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Traffic Vol, veh/h	677	89	85	503	48	63
Future Vol, veh/h	677	89	85	503	48	63
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	50	75	-	0	100
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	-5	-	-	-5	5	-
Peak Hour Factor	93	71	82	87	73	73
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	728	125	104	578	66	86

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	853
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.12
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.218
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	1.6	79.4
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	76	383	-	-	786	-
HCM Lane V/C Ratio	0.865	0.225	-	-	0.132	-
HCM Control Delay (s)	161.2	17.1	-	-	10.3	-
HCM Lane LOS	F	C	-	-	B	-
HCM 95th %tile Q(veh)	4.4	0.9	-	-	0.5	-

## **APPENDIX G**

### **LOCAL AND ITE TRIP GENERATION RATES**

# Local Apartment Trip Generation Study

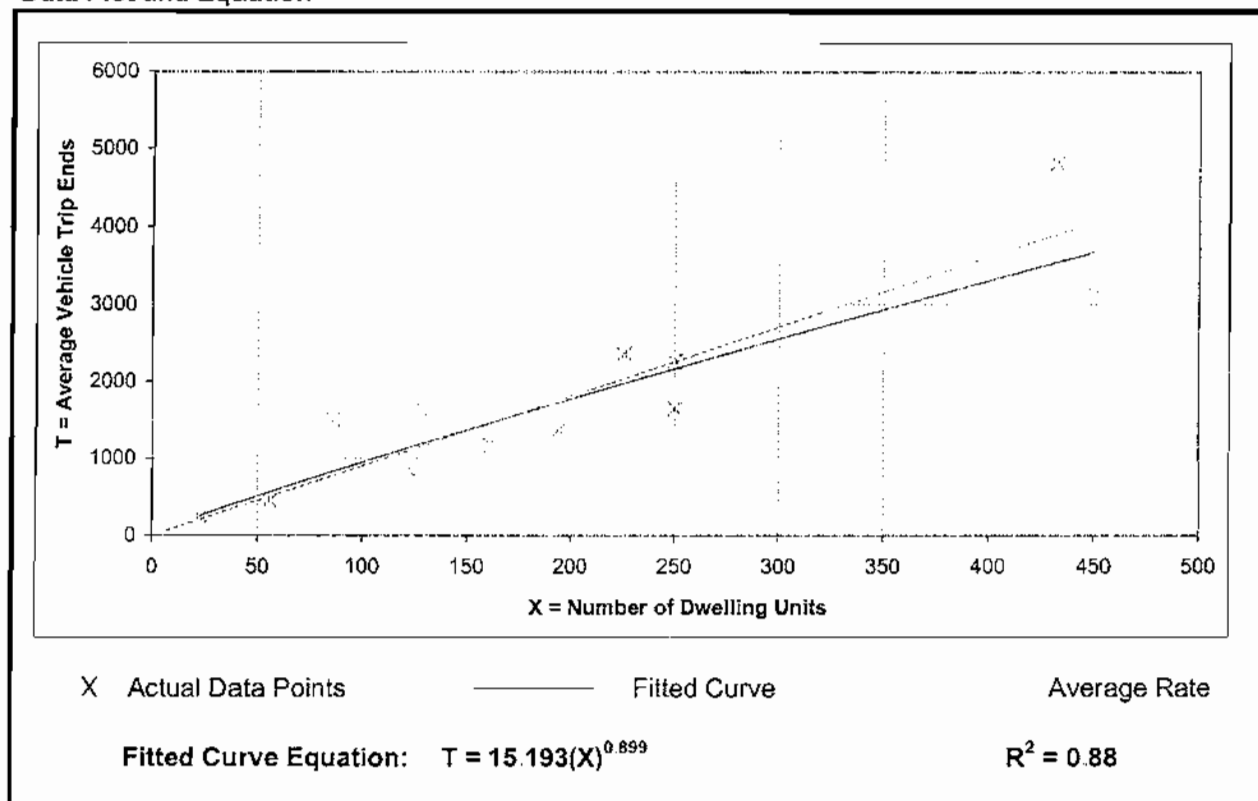
Average Vehicle Trip Ends vs: Dwelling Units  
On a: Weekday

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

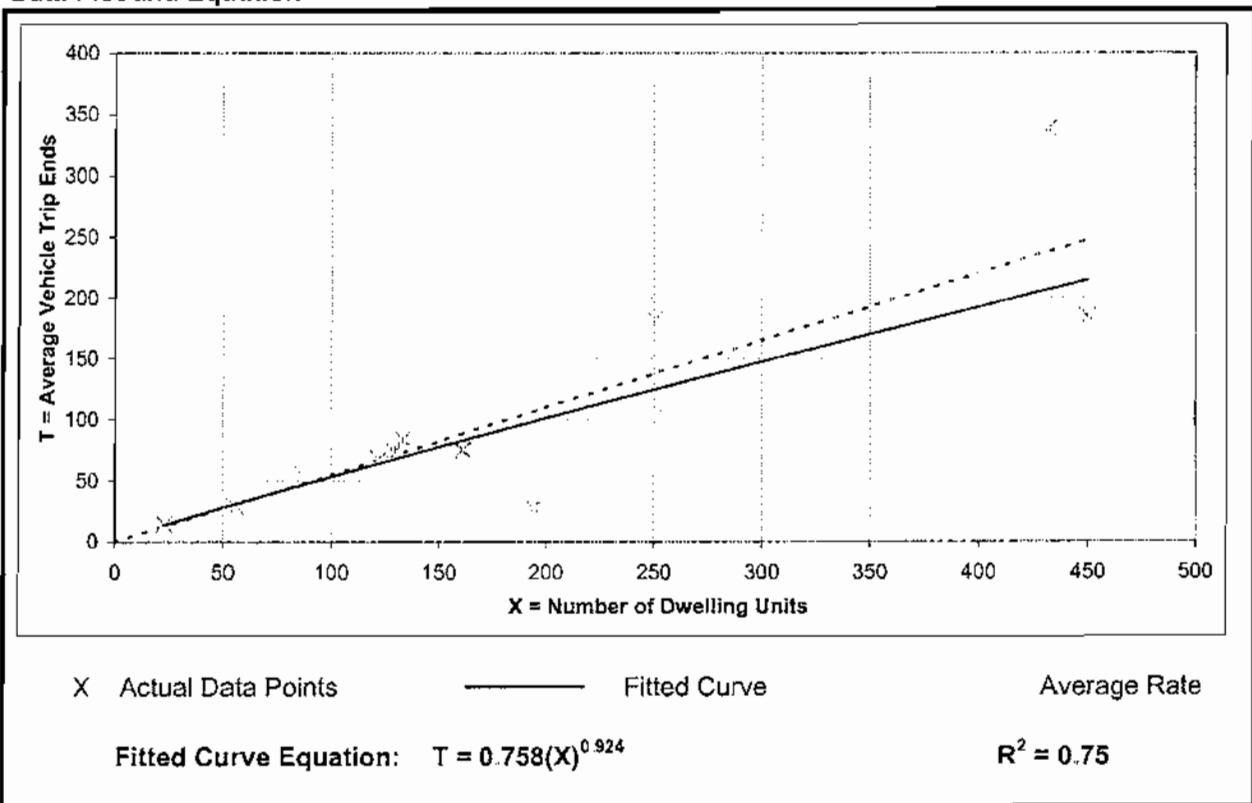
Average Vehicle Trip Ends vs: Dwelling Units  
On a: Weekday,  
Peak Hour of Adjacent Street Traffic,  
One Hour Between 7 and 9 a.m.

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

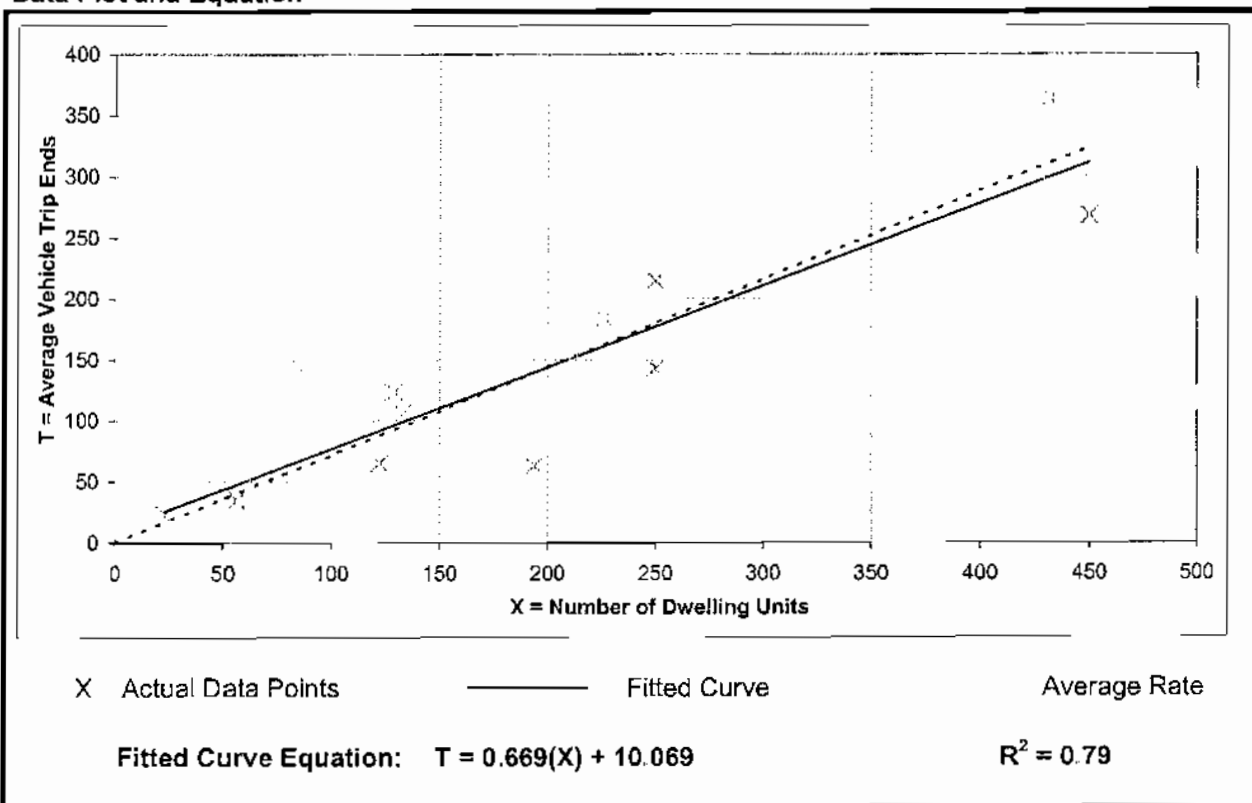
Average Vehicle Trip Ends vs: Dwelling Units  
On a: Weekday,  
Peak Hour of Adjacent Street Traffic,  
One Hour Between 4 and 6 p.m.

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

A single-family detached housing site includes any single-family detached home on an individual lot. A typical site surveyed is a suburban subdivision.

### Specialized Land Use

Data have been submitted for several single-family detached housing developments with homes that are commonly referred to as patio homes. A patio home is a detached housing unit that is located on a small lot with little (or no) front or back yard. In some subdivisions, communal maintenance of outside grounds is provided for the patio homes. The three patio home sites total 299 dwelling units with overall weighted average trip generation rates of 5.35 vehicle trips per dwelling unit for weekday, 0.26 for the AM adjacent street peak hour, and 0.47 for the PM adjacent street peak hour. These patio home rates based on a small sample of sites are lower than those for single-family detached housing (Land Use 210), lower than those for single-family attached housing (Land Use 251), and higher than those for senior adult housing -- single-family (Land Use 251). Further analysis of this housing type will be conducted in a future edition of *Trip Generation Manual*.

### Additional Data

The technical appendices provide supporting information on time-of-day distributions for this land use. The appendices can be accessed through either the ITETripGen web app or the trip generation resource page on the ITE website (<https://www.ite.org/technical-resources/topics/trip-and-parking-generation/>).

For 30 of the study sites, data on the number of residents and number of household vehicles are available. The overall averages for the 30 sites are 3.6 residents per dwelling unit and 1.5 vehicles per dwelling unit.

The sites were surveyed in the 1980s, the 1990s, the 2000s, and the 2010s in Arizona, California, Connecticut, Delaware, Illinois, Indiana, Kentucky, Maryland, Massachusetts, Minnesota, Montana, New Jersey, North Carolina, Ohio, Ontario (CAN), Oregon, Pennsylvania, South Carolina, South Dakota, Tennessee, Vermont, Virginia, and West 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, 869, 903, 925, 936, 1005, 1007, 1008, 1010, 1033, 1066, 1077, 1078, 1079

# Single-Family Detached Housing (210)

Vehicle Trip Ends vs: Dwelling Units  
On a: Weekday

Setting/Location: General Urban/Suburban

Number of Studies: 174

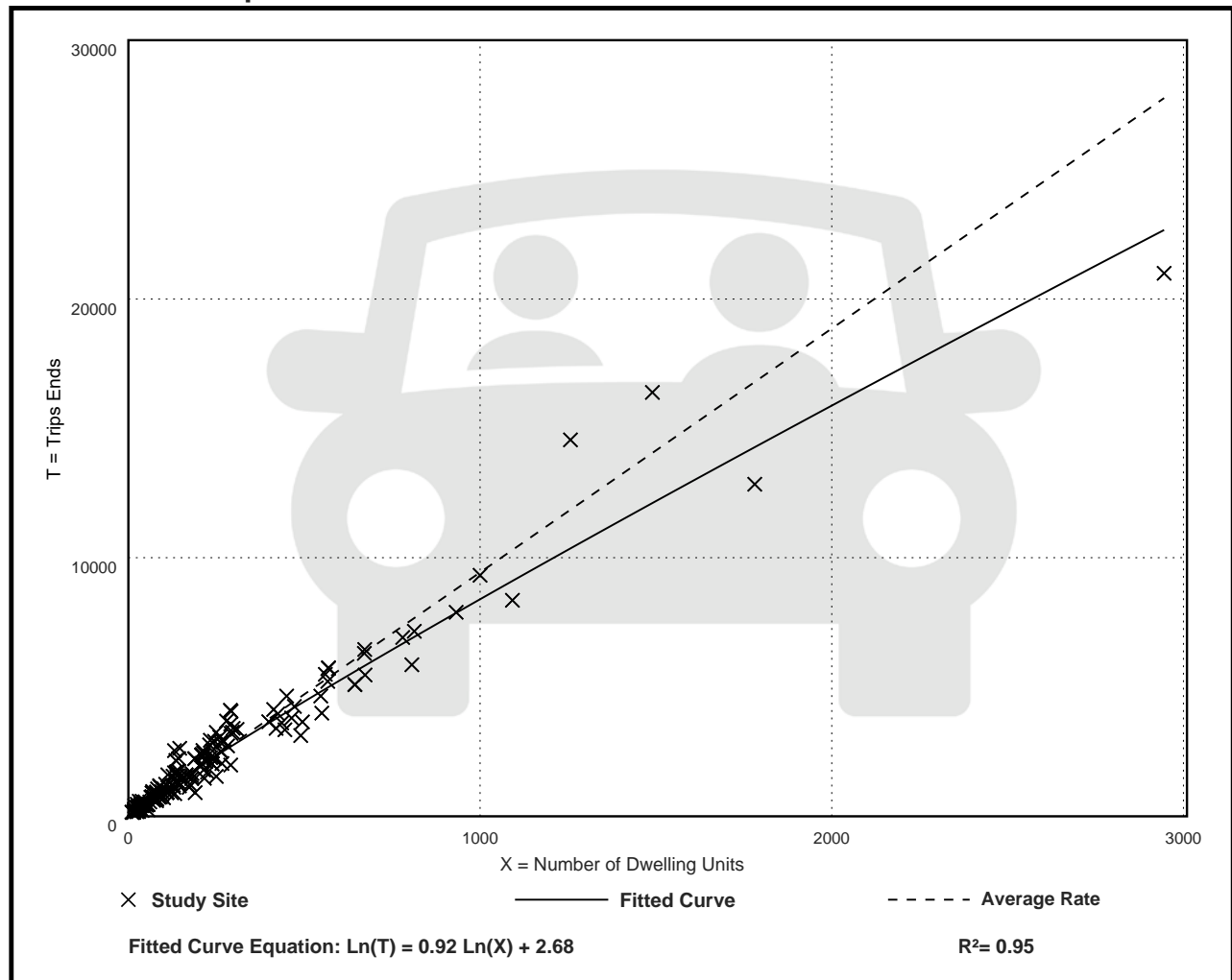
Avg. Num. of Dwelling Units: 246

Directional Distribution: 50% entering, 50% exiting

## Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
9.43	4.45 - 22.61	2.13

## 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: 192

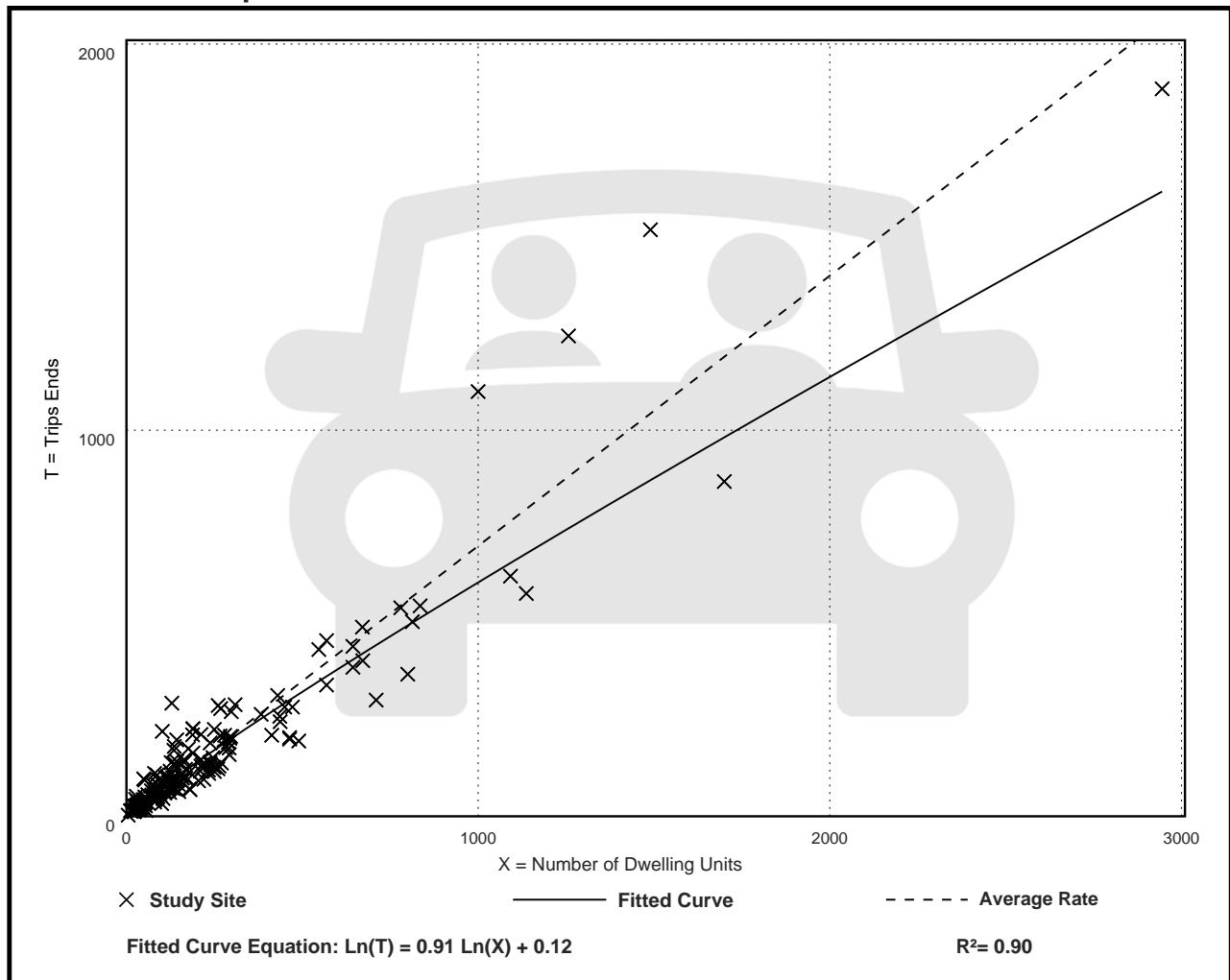
Avg. Num. of Dwelling Units: 226

Directional Distribution: 26% entering, 74% exiting

## Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.70	0.27 - 2.27	0.24

## 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: 208

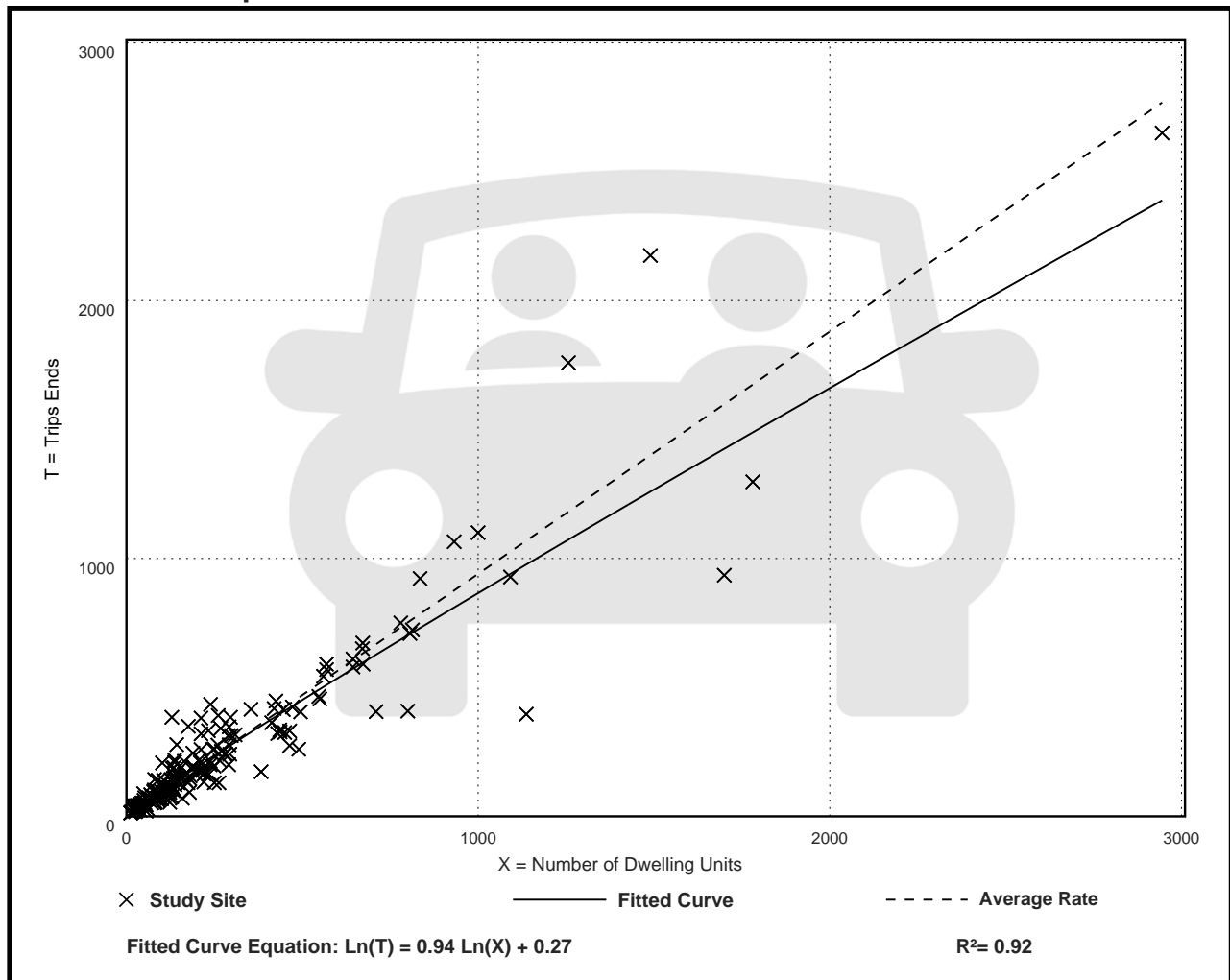
Avg. Num. of Dwelling Units: 248

Directional Distribution: 63% entering, 37% exiting

## Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.94	0.35 - 2.98	0.31

## Data Plot and Equation



# TRIP GENERATION FOR BEELER ROAD SUBDIVISION

84 Attached Townhouses and 3 Detached Houses

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	Townhouses	84 Townhouses	816	22%	78%		55%	45%	
				10	36	46	37	30	67
#210	Single-Family Detached Housing	3 Houses	41	26%	74%		63%	37%	
				1	2	3	3	1	4
Total New Volume Site Trips			857	11	38	49	40	31	71

ITE Trip Generation Manual, 11th Edition and Local Trip Rates

Trips calculated by using Fitted Curve Equation

## TRIP GENERATION FOR BEELER ROAD SUBDIVISION

### 84 Attached Townhouses

84 Residential Houses = X

---

#### Weekday:

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

$$T = 15 * 53.69$$

$$T = \underline{\underline{816 \text{ trips}}}$$

---

#### Peak Hour of Adjacent Traffic between 7 and 9 am:

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

$$T = 0.758 * 60$$

$$T = \underline{\underline{46 \text{ trips}}}$$

---

#### Peak Hour of Adjacent Traffic between 4 and 6 pm:

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

$$T = 0.669 * 84 + 10.07$$

$$T = \underline{\underline{67 \text{ trips}}}$$

## TRIP GENERATION FOR BEELER ROAD SUBDIVISION

### 3 Detached Houses

3 Residential Houses = X

---

#### Weekday:

Fitted Curve Equation:  $\ln(T) = 0.92 \ln(X) + 2.68$

$$\ln(T) = 0.92 * 1.10 + 2.68$$

$$\ln(T) = 3.69$$

$$T = \underline{\underline{41 \text{ trips}}}$$

---

#### Peak Hour of Adjacent Traffic between 7 and 9 am:

Fitted Curve Equation:  $\ln(T) = 0.91 \ln(X) + 0.12$

$$T = 0.91 * 1 + 0.12$$

$$\ln(T) = 1.12$$

$$T = \underline{\underline{3 \text{ trips}}}$$

---

#### Peak Hour of Adjacent Traffic between 4 and 6 pm:

Fitted Curve Equation:  $\ln(T) = 0.94 \ln(X) + 0.27$

$$\ln(T) = 0.94 * 1.10 + 0.27$$

$$\ln(T) = 1.30$$

$$T = \underline{\underline{4 \text{ trips}}}$$



**TRIP GENERATION FOR BEELER FARMS SUBDIVISION**  
**27 Detached Houses Remaining to be Constructed and Occupied**

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
#210	Single-Family Detached Housing	27 Remaining Houses	303	26%	74%		63%	37%	
				6	17	23	18	11	29
Total New Volume Site Trips			303	6	17	23	18	11	29

ITE Trip Generation Manual, 11th Edition  
 Trips calculated by using Fitted Curve Equation

## TRIP GENERATION FOR BEELER FARMS SUBDIVISION

### 27 Detached Houses Remaining to be Constructed and Occupied

27 Residential Houses = X

---

#### Weekday:

Fitted Curve Equation:  $\ln(T) = 0.92 \ln(X) + 2.68$

$$\ln(T) = 0.92 * 3.30 + 2.68$$

$$\ln(T) = 5.71$$

$$T = \underline{\underline{303 \text{ trips}}}$$

---

#### Peak Hour of Adjacent Traffic between 7 and 9 am:

Fitted Curve Equation:  $\ln(T) = 0.91 \ln(X) + 0.12$

$$T = 0.91 * 3 + 0.12$$

$$\ln(T) = 3.12$$

$$T = \underline{\underline{23 \text{ trips}}}$$

---

#### Peak Hour of Adjacent Traffic between 4 and 6 pm:

Fitted Curve Equation:  $\ln(T) = 0.94 \ln(X) + 0.27$

$$\ln(T) = 0.94 * 3.30 + 0.27$$

$$\ln(T) = 3.37$$

$$T = \underline{\underline{29 \text{ trips}}}$$

## **APPENDIX H**

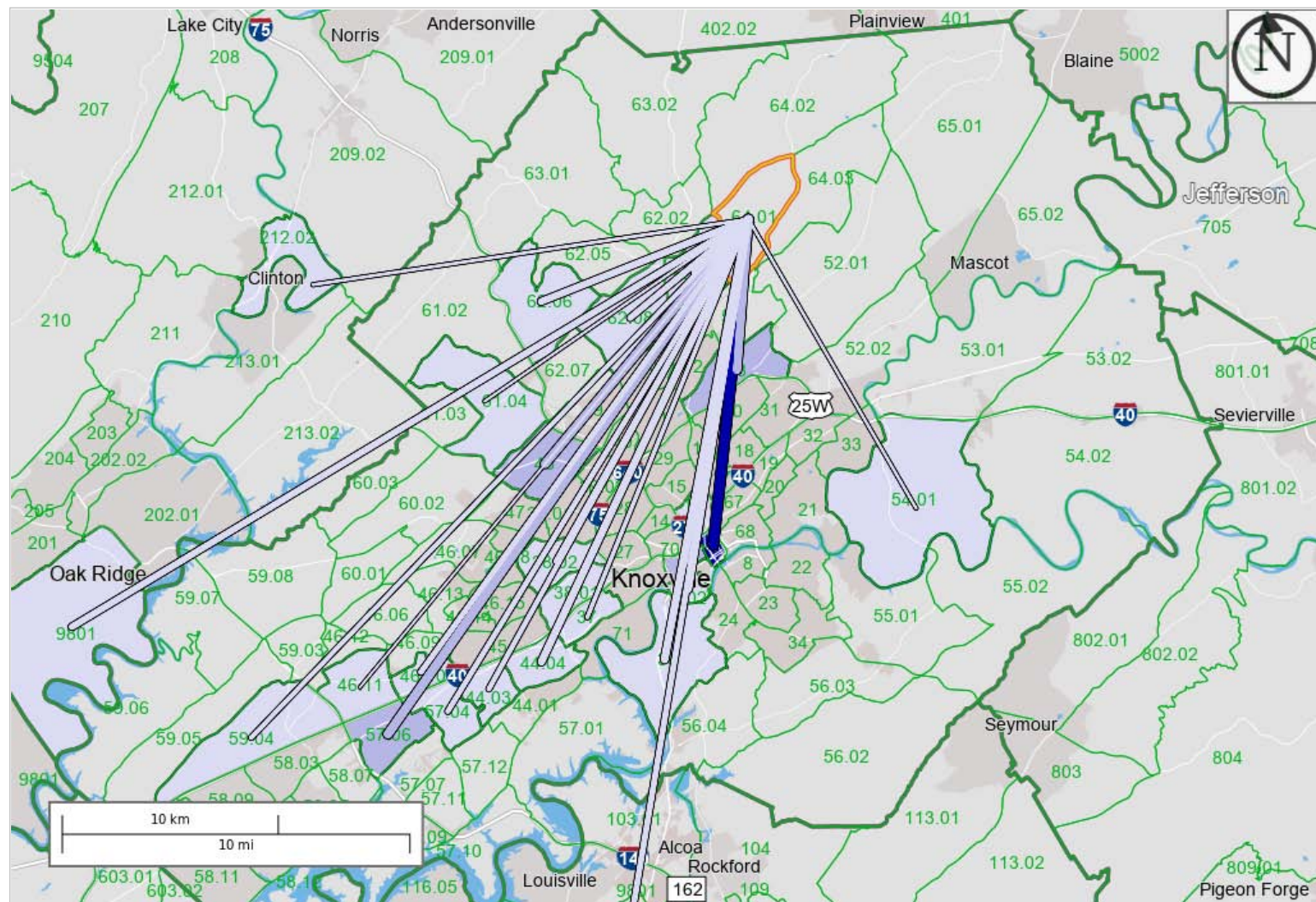
### **2019 CENSUS BUREAU DATA**

## Work Destination Report - Home Selection Area to Work Census Tracts All Jobs for All Workers in 2019

Created by the U.S. Census Bureau's OnTheMap <https://onthemap.ces.census.gov> on 05/11/2022

### Counts of All Jobs from Home Selection Area to Work Census Tracts in 2019

#### All Workers



#### Map Legend

##### Job Count

- 184 - 210
- 157 - 183
- 130 - 156
- 104 - 129
- 77 - 103
- 50 - 76
- 23 - 49

##### Selection Areas

- ✧ Analysis Selection

##### Job Count

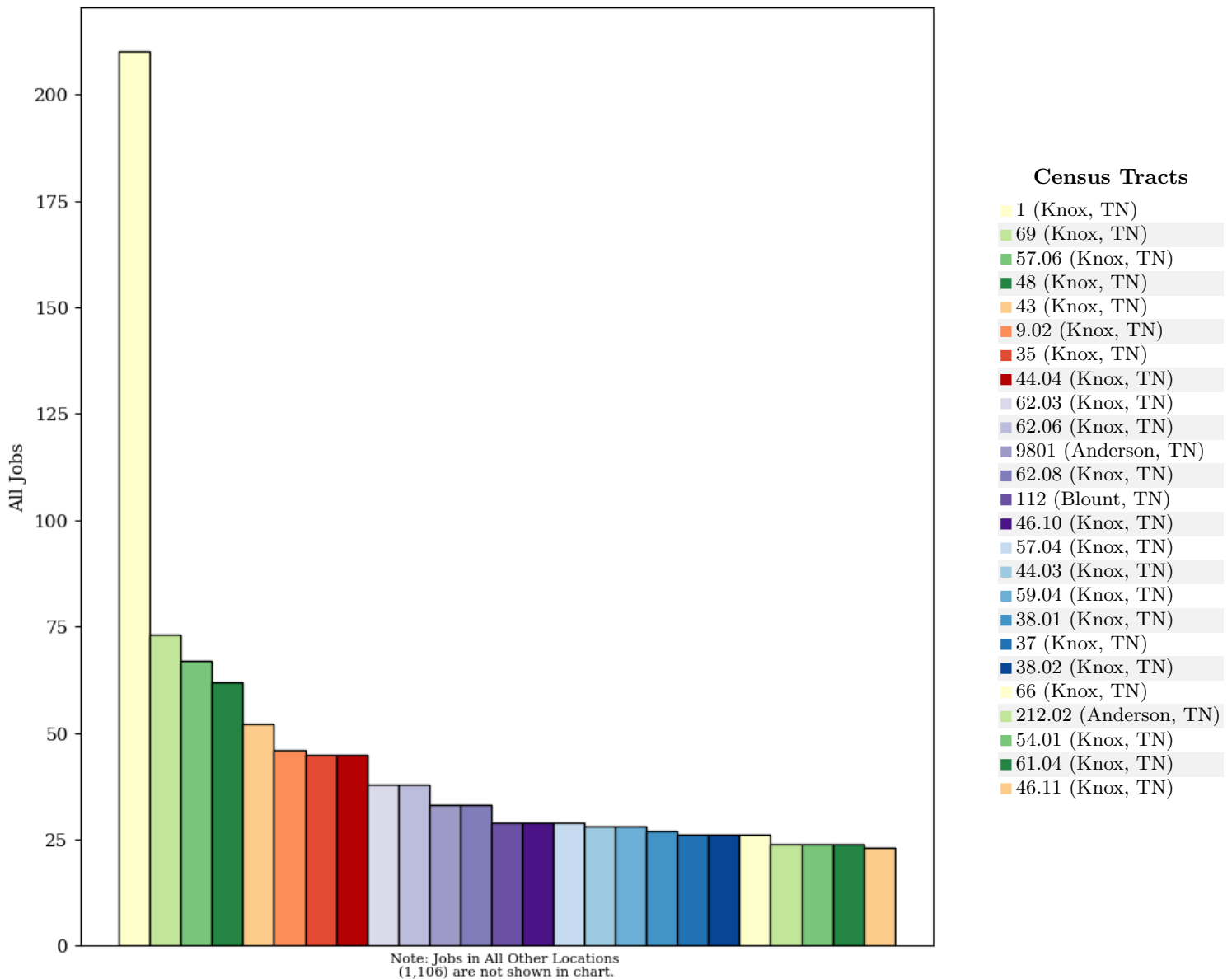
- ✧ 184 - 210
- ✧ 157 - 183
- ✧ 130 - 156
- ✧ 104 - 129
- ✧ 77 - 103
- ✧ 50 - 76
- ✧ 23 - 49





# All Jobs from Home Selection Area to Work Census Tracts in 2019

## All Workers



# All Jobs from Home Selection Area to Work Census Tracts in 2019

## All Workers

Census Tracts as Work Destination Area	2019	
	Count	Share
All Census Tracts	2,191	100.0
1 (Knox, TN)	210	9.6
69 (Knox, TN)	73	3.3
57.06 (Knox, TN)	67	3.1
48 (Knox, TN)	62	2.8
43 (Knox, TN)	52	2.4
9.02 (Knox, TN)	46	2.1
35 (Knox, TN)	45	2.1
44.04 (Knox, TN)	45	2.1
62.03 (Knox, TN)	38	1.7
62.06 (Knox, TN)	38	1.7

Census Tracts as Work Destination Area	2019	
	Count	Share
9801 (Anderson, TN)	33	1.5
62.08 (Knox, TN)	33	1.5
112 (Blount, TN)	29	1.3
46.10 (Knox, TN)	29	1.3
57.04 (Knox, TN)	29	1.3
44.03 (Knox, TN)	28	1.3
59.04 (Knox, TN)	28	1.3
38.01 (Knox, TN)	27	1.2
37 (Knox, TN)	26	1.2
38.02 (Knox, TN)	26	1.2
66 (Knox, TN)	26	1.2
212.02 (Anderson, TN)	24	1.1
54.01 (Knox, TN)	24	1.1
61.04 (Knox, TN)	24	1.1
46.11 (Knox, TN)	23	1.0
All Other Locations	1,106	50.5

## Additional Information

### Analysis Settings

Analysis Type	Destination
Destination Type	Census Tracts
Selection area as	Home
Year(s)	2019
Job Type	All Jobs
Selection Area	64.01 (Knox, TN) from Census Tracts
Selected Census Blocks	41
Analysis Generation Date	05/11/2022 11:37 - OnTheMap 6.8.1
Code Revision	f9358819d46a60bb89052036516a1c8fe8bbbbeac
LODES Data Version	20211018_1647

### Data Sources

Source: U.S. Census Bureau, OnTheMap Application and LEHD Origin-Destination Employment Statistics (Beginning of Quarter Employment, 2nd Quarter of 2002-2019).

### Notes

1. Race, Ethnicity, Educational Attainment, and Sex statistics are beta release results and are not available before 2009.
2. Educational Attainment is only produced for workers aged 30 and over.
3. Firm Age and Firm Size statistics are beta release results for All Private jobs and are not available before 2011.

**APPENDIX I**

**KNOX COUNTY TURN LANE VOLUME THRESHOLD WORKSHEETS**



TABLE 5A

**LEFT-TURN LANE VOLUME THRESHOLDS  
FOR TWO-LANE ROADWAYS WITH A PREVAILING SPEED OF 36 TO 45 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	250	180	140	110	80	70
150 - 199	200	140	105	90	70	60
200 - 249	160	115	85	75	65	55
250 - 299	130	100	75	65	60	50
300 - 349	110	90	70	60	55	45
350 - 399	100	80	65	55	50	40
400 - 449	90	70	60	50	45	35
450 - 499	80	65	55	45	40	30
500 - 549	70	60	45	35	35	25
550 - 599	65	55	40	35	30	25
600 - 649	60	45	35	30	25	25
650 - 699	55	35	35	30	25	20
700 - 749	50	35	30	25	20	20
750 or More	45	35	25	25	20	20

OPPOSING VOLUME	THROUGH VOLUME PLUS RIGHT-TURN VOLUME *					
	350 - 399	400 - 449	450 - 499	500 - 549	550 - 599	=/ > 600
100 - 149	70	<div style="border: 1px dashed green; padding: 5px; text-align: center;">                     East Emory Road at Beeler Road                       2022 Existing AM WB Left Turns = 31                       Left Turn Lane Warranted                 </div>	50	45	40	35
150 - 199	60		45	40	35	30
200 - 249	55		40	35	30	30
250 - 299	50		35	30	30	30
300 - 349	45		35	30	25	25
350 - 399	40		30	25	25	20
400 - 449	35		30	25	20	20
450 - 499	30		25	20	20	20
500 - 549	25		20	20	20	15
550 - 599	25		20	20	20	15
600 - 649	25	20	20	20	20	15
650 - 699	20	20	20	20	20	15
700 - 749	20	20	20	15	15	15
750 or More	20	20	20	15	15	15

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

$$449 + 21 = 470$$



TABLE 5B

**RIGHT-TURN LANE VOLUME THRESHOLDS  
FOR TWO-LANE ROADWAYS WITH A PREVAILING SPEED OF 36 TO 45 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						
200 - 249 250 - 299					Yes	Yes
300 - 349 350 - 399			Yes	Yes Yes	Yes Yes	Yes Yes
400 - 449 450 - 499		Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
500 - 549 550 - 599	Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
600 or More	Yes	Yes	Yes	Yes	Yes	Yes

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

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

TABLE 5A

**LEFT-TURN LANE VOLUME THRESHOLDS  
FOR TWO-LANE ROADWAYS WITH A PREVAILING SPEED OF 36 TO 45 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	250	180	140	110	80	70
150 - 199	200	140	105	90	70	60
200 - 249	160	115	85	75	65	55
250 - 299	130	100	75	65	60	50
300 - 349	110	90	70	60	55	45
350 - 399	100	80	65	55	50	40
400 - 449	90	70	60	50	45	35
450 - 499	80	65	55	45	40	30
500 - 549	70	60	45	35	35	25
550 - 599	65	55	40	35	30	25
600 - 649	60	45	35	30	25	25
650 - 699	55	35	35	30	25	20
700 - 749	50	35	30	25	20	20
750 or More	45	35	25	25	20	20

479

OPPOSING VOLUME	THROUGH VOLUME PLUS RIGHT-TURN VOLUME *					
	350 - 399	400 - 449	450 - 499	500 - 549	550 - 599	=/ > 600
100 - 149	70	60	50	45	40	35
150 - 199	60	55	45	40	35	30
200 - 249	<div> <p>East Emory Road at Beeler Road</p> <p>2022 Existing PM WB Left Turns = 56</p> <p>Left Turn Lane Warranted</p> </div>	50	40	35	30	30
250 - 299		45	35	30	30	30
300 - 349		40	35	30	25	25
350 - 399		35	30	25	25	20
400 - 449		30	30	25	20	20
450 - 499		25	25	20	20	20
500 - 549	25	25	20	20	20	15
550 - 599		20	20	20	20	15
600 - 649	25	20	20	20	20	15
650 - 699	20	20	20	20	20	15
700 - 749	20	20	20	15	15	15
750 or More	20	20	20	15	15	15

$$645 + 60 = 705$$

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

TABLE 5B

**RIGHT-TURN LANE VOLUME THRESHOLDS  
FOR TWO-LANE ROADWAYS WITH A PREVAILING SPEED OF 36 TO 45 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						
200 - 249 250 - 299					Yes	Yes Yes
300 - 349 350 - 399			Yes	Yes Yes	Yes Yes	Yes Yes
400 - 449 450 - 499		Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
500 - 549 550 - 599	Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
600 or More	Yes	Yes	Yes	Yes	Yes	Yes

RIGHT-TURN VOLUME	THROUGH VOLUME PLUS LEFT-TURN VOLUME *					
	350 - 399	400 - 449	450 - 499	500 - 549	550 - 600	645 + / > 600
Fewer Than 25 25 - 49 50 - 99					Yes Yes	Yes Yes
100 - 149 150 - 199		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
400 - 449 450 - 499	Yes Yes			Yes Yes	Yes Yes	Yes Yes
500 - 549 550 - 599	Yes Yes			Yes Yes	Yes Yes	Yes Yes
600 or More	Yes	Yes	Yes	Yes	Yes	Yes

East Emory Road at  
Beeler Road  
  
2022 Existing PM  
EB Right Turns = 60  
  
Right Turn Lane  
Warranted

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



TABLE 5A

**LEFT-TURN LANE VOLUME THRESHOLDS  
FOR TWO-LANE ROADWAYS WITH A PREVAILING SPEED OF 36 TO 45 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	250	180	140	110	80	70
150 - 199	200	140	105	90	70	60
200 - 249	160	115	85	75	65	55
250 - 299	130	100	75	65	60	50
300 - 349	110	90	70	60	55	45
350 - 399	100	80	65	55	50	40
400 - 449	90	70	60	50	45	35
450 - 499	80	65	55	45	40	30
500 - 549	70	60	45	35	35	25
550 - 599	65	55	40	35	30	25
600 - 649	60	45	35	30	25	25
650 - 699	55	35	35	30	25	20
700 - 749	50	35	30	25	20	20
750 or More	45	35	25	25	20	20

OPPOSING VOLUME	THROUGH VOLUME PLUS RIGHT-TURN VOLUME *					
	350 - 399	400 - 449	450 - 499	500 - 549	550 - 599	=/ > 600
100 - 149	70	<div>East Emory Road at Beeler Road</div> <div>2027 Projected AM WB Left Turns = 42</div> <div>Left Turn Lane Warranted</div>	50	45	40	35
150 - 199	60		45	40	35	30
200 - 249	55		40	35	30	30
250 - 299	50		35	30	30	30
300 - 349	45		35	30	25	25
350 - 399	40		30	25	25	20
400 - 449	35		30	25	20	20
450 - 499	30		25	20	20	20
500 - 549	25		20	20	20	15
550 - 599	25		20	20	20	15
600 - 649	25	20	20	20	20	15
650 - 699	20	20	20	20	20	15
700 - 749	20	20	20	15	15	15
750 or More	20	20	20	15	15	15

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

TABLE 5B

**RIGHT-TURN LANE VOLUME THRESHOLDS  
FOR TWO-LANE ROADWAYS WITH A PREVAILING SPEED OF 36 TO 45 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						
200 - 249 250 - 299					Yes	Yes
300 - 349 350 - 399			Yes	Yes Yes	Yes Yes	Yes Yes
400 - 449 450 - 499		Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
500 - 549 550 - 599	Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
600 or More	Yes	Yes	Yes	Yes	Yes	Yes

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

East Emory Road at  
Beeler Road

2027 Projected AM  
EB Right Turns = 27

Right Turn Lane NOT  
Warranted

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



TABLE 5A

**LEFT-TURN LANE VOLUME THRESHOLDS  
FOR TWO-LANE ROADWAYS WITH A PREVAILING SPEED OF 36 TO 45 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	250	180	140	110	80	70
150 - 199	200	140	105	90	70	60
200 - 249	160	115	85	75	65	55
250 - 299	130	100	75	65	60	50
300 - 349	110	90	70	60	55	45
350 - 399	100	80	65	55	50	40
400 - 449	90	70	60	50	45	35
450 - 499	80	65	55	45	40	30
500 - 549	70	60	45	35	35	25
550 - 599	65	55	40	35	30	25
600 - 649	60	45	35	30	25	25
650 - 699	55	35	35	30	25	20
700 - 749	50	35	30	25	20	20
750 or More	45	35	25	25	20	20

OPPOSING VOLUME	THROUGH VOLUME PLUS RIGHT-TURN VOLUME *					
	350 - 399	400 - 449	450 - 499	500 - 549	550 - 599	=/ > 600
100 - 149	70	<div style="border: 1px dashed green; padding: 5px; text-align: center;">                     East Emory Road at Beeler Road                       2027 Projected PM WB Left Turns = 85                       Left Turn Lane Warranted                 </div>	50	45	40	35
150 - 199	60		45	40	35	30
200 - 249	55		40	35	30	30
250 - 299	50		35	30	30	30
300 - 349	45		35	30	25	25
350 - 399	40		30	25	25	20
400 - 449	35		30	25	20	20
450 - 499	30		25	20	20	20
500 - 549	25		20	20	20	15
550 - 599	25		20	20	20	15
600 - 649	25	20	20	20	20	15
650 - 699	20	20	20	20	20	15
700 - 749	20	20	20	15	15	15
750 or More	20	20	20	15	15	15

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

TABLE 5B

**RIGHT-TURN LANE VOLUME THRESHOLDS  
FOR TWO-LANE ROADWAYS WITH A PREVAILING SPEED OF 36 TO 45 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						
200 - 249 250 - 299					Yes	Yes Yes
300 - 349 350 - 399			Yes	Yes Yes	Yes Yes	Yes Yes
400 - 449 450 - 499		Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
500 - 549 550 - 599	Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
600 or More	Yes	Yes	Yes	Yes	Yes	Yes

RIGHT-TURN VOLUME	THROUGH VOLUME PLUS LEFT-TURN VOLUME *					
	350 - 399	400 - 449	450 - 499	500 - 549	550 - 600	677 + / > 600
Fewer Than 25 25 - 49 50 - 99					Yes Yes	Yes Yes
100 - 149 150 - 199		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
400 - 449 450 - 499	Yes Yes			Yes Yes	Yes Yes	Yes Yes
500 - 549 550 - 599	Yes Yes			Yes Yes	Yes Yes	Yes Yes
600 or More	Yes	Yes	Yes	Yes	Yes	Yes

East Emory Road at  
Beeler Road

2027 Projected PM  
EB Right Turns = 89

Right Turn Lane  
Warranted

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

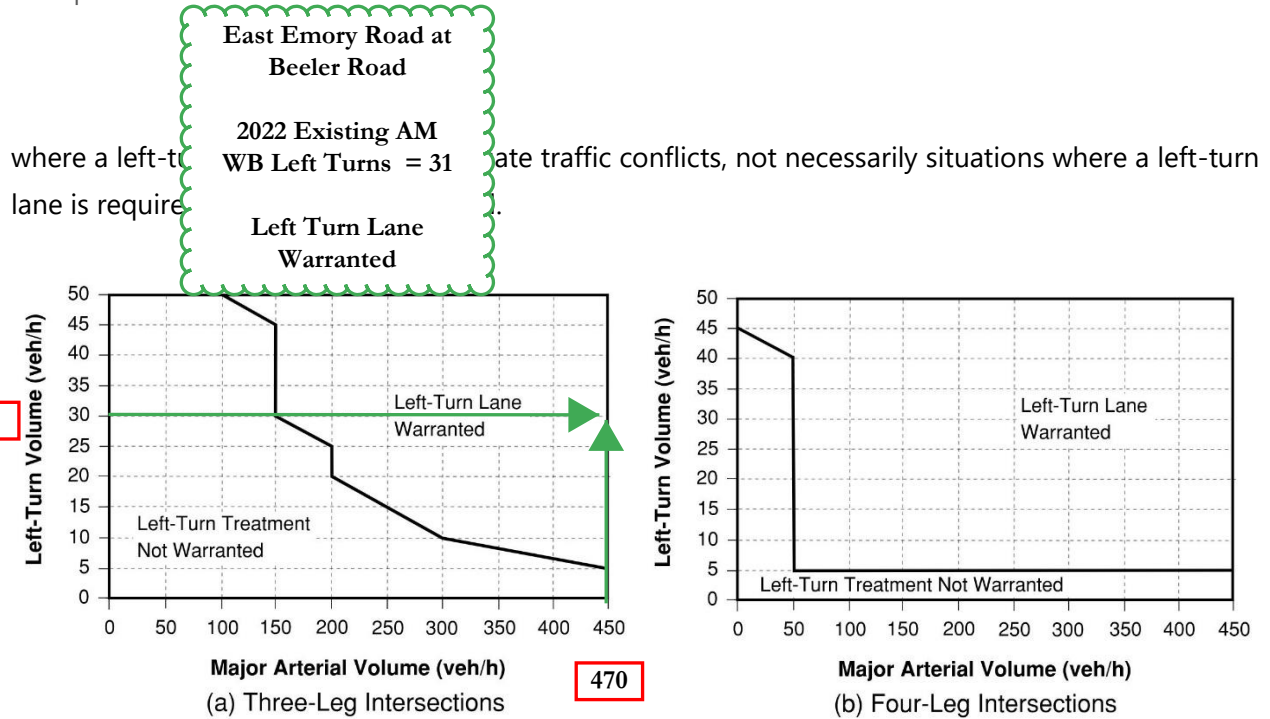


Figure 3-15: Left-Turn Lane Warrant for Urban and Suburban Arterials (Unsignalized)<sup>20, 21</sup>

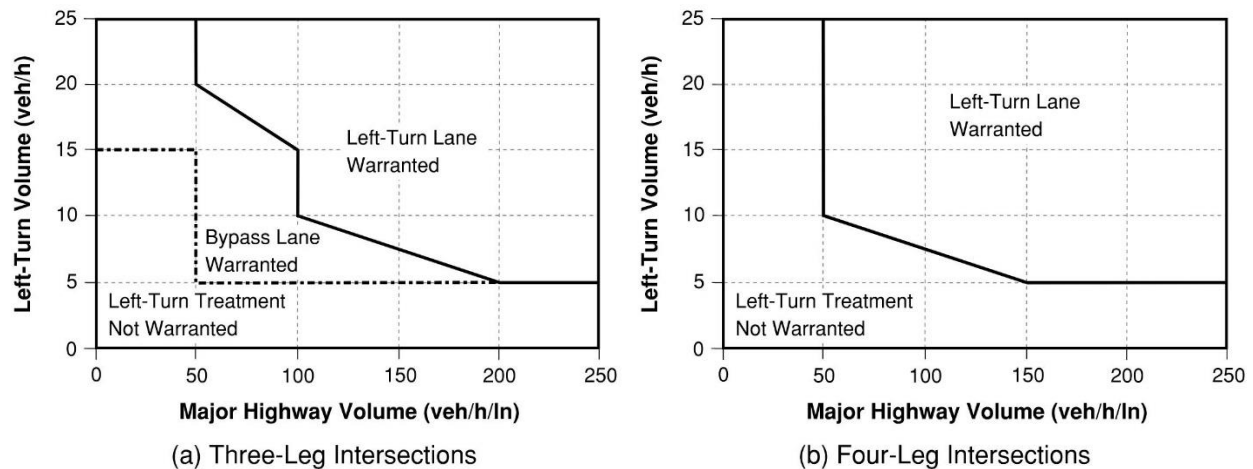


Figure 3-16: Left-Turn Lane Warrant for Two-Lane Rural Roadways (Unsignalized)<sup>20, 21</sup>

<sup>20</sup> TRB, NCHRP Report 745, Left-Turn Accommodations at Unsignalized Intersections (2013)

<sup>21</sup> AASHTO, A Policy on Geometric Design of Highways and Streets 7<sup>th</sup> Edition (2018)

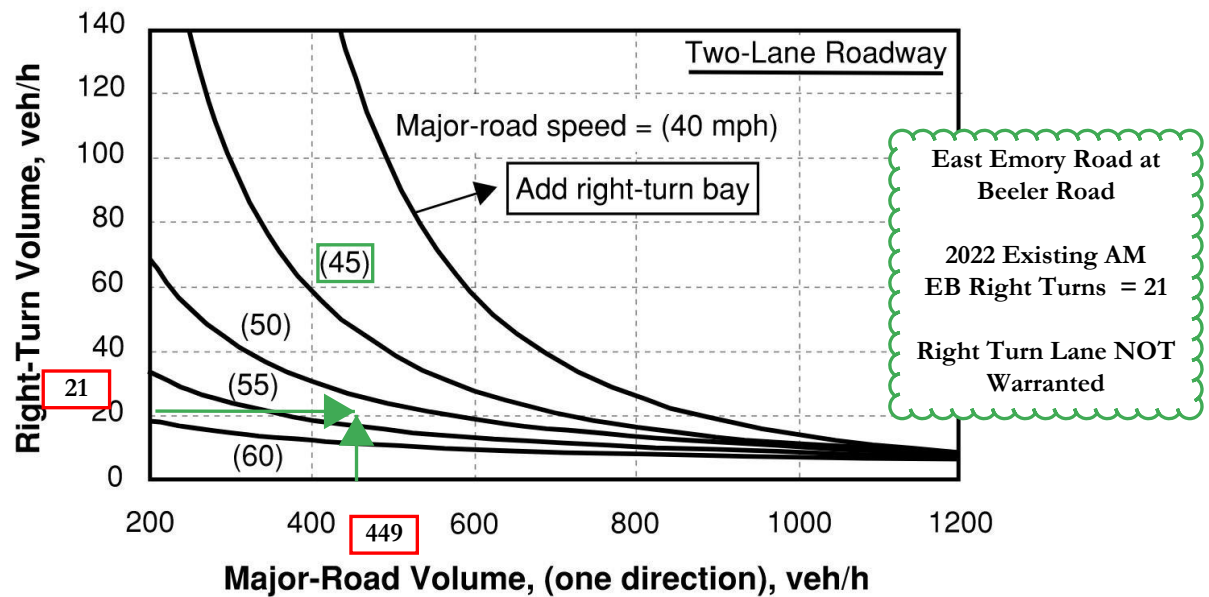


Figure 3-18: Right-Turn Lane Warrant along Two-Lane Roadway (Unsignalized Intersection with Two-Way Stop-Control)<sup>24</sup>

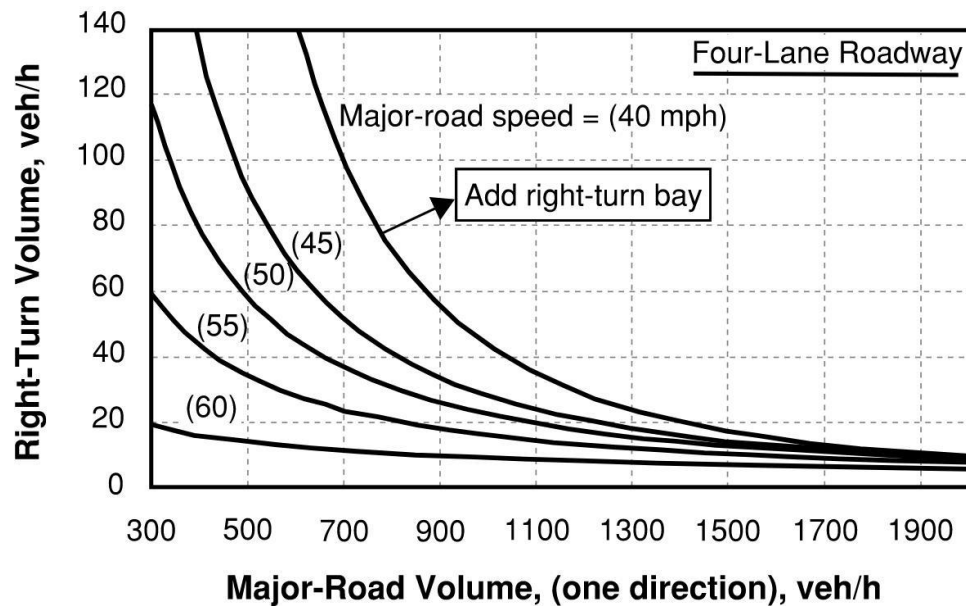


Figure 3-19: Right-Turn Lane Warrant along Four-Lane Roadway (Unsignalized Intersection with Two-Way Stop-Control)<sup>25</sup>

<sup>24</sup> TRB, NCHRP 457, Evaluating Intersection Improvements (2001)

<sup>25</sup> TRB, NCHRP 457, Evaluating Intersection Improvements (2001)



where a left-turn lane is required to address traffic conflicts, not necessarily situations where a left-turn lane is required.

**East Emory Road at Beeler Road**  
**2022 Existing PM WB Left Turns = 56**  
**Left Turn Lane Warranted**

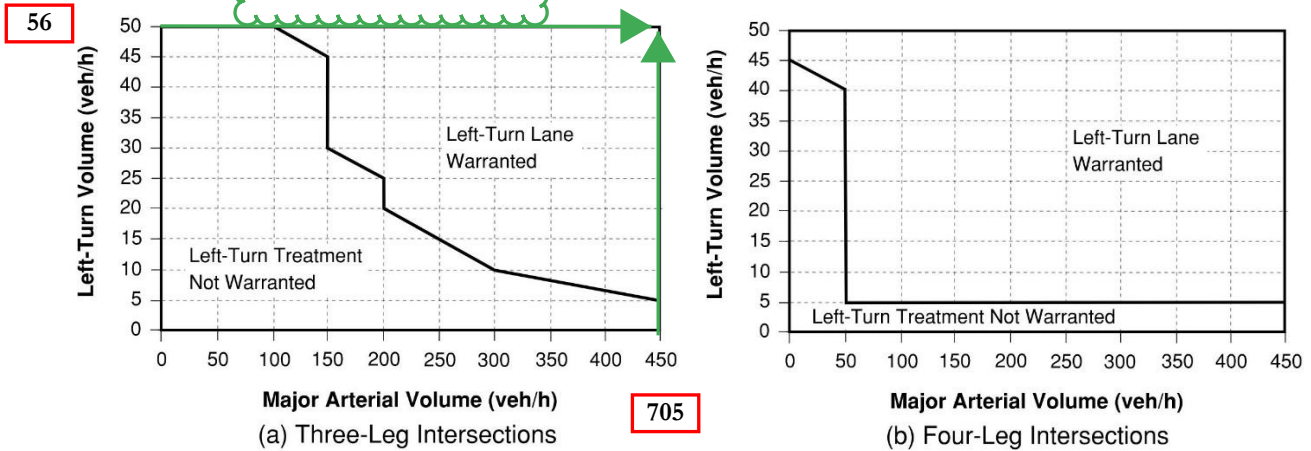


Figure 3-15: Left-Turn Lane Warrant for Urban and Suburban Arterials (Unsignalized)<sup>20, 21</sup>

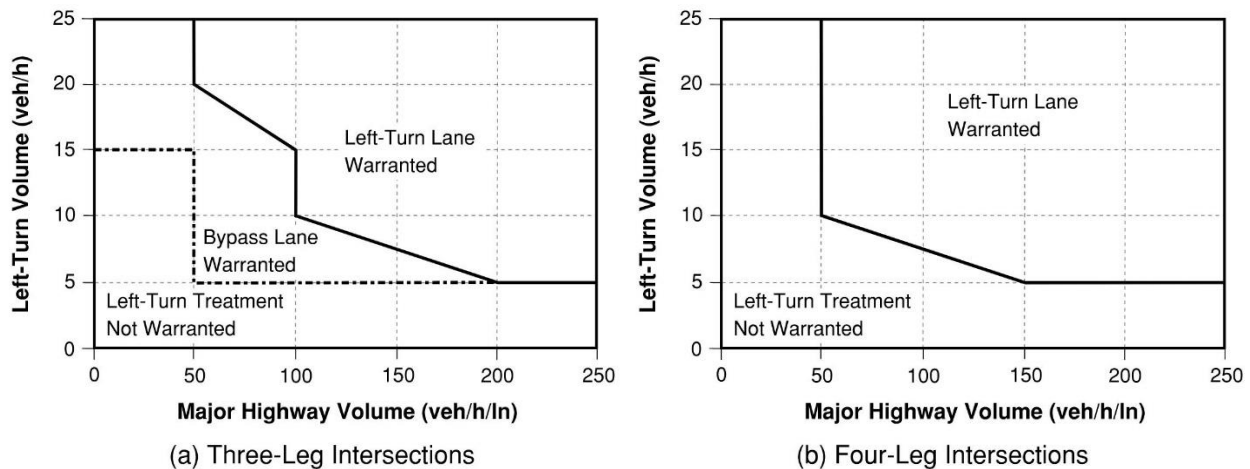


Figure 3-16: Left-Turn Lane Warrant for Two-Lane Rural Roadways (Unsignalized)<sup>20, 21</sup>

<sup>20</sup> TRB, NCHRP Report 745, Left-Turn Accommodations at Unsignalized Intersections (2013)

<sup>21</sup> AASHTO, A Policy on Geometric Design of Highways and Streets 7<sup>th</sup> Edition (2018)



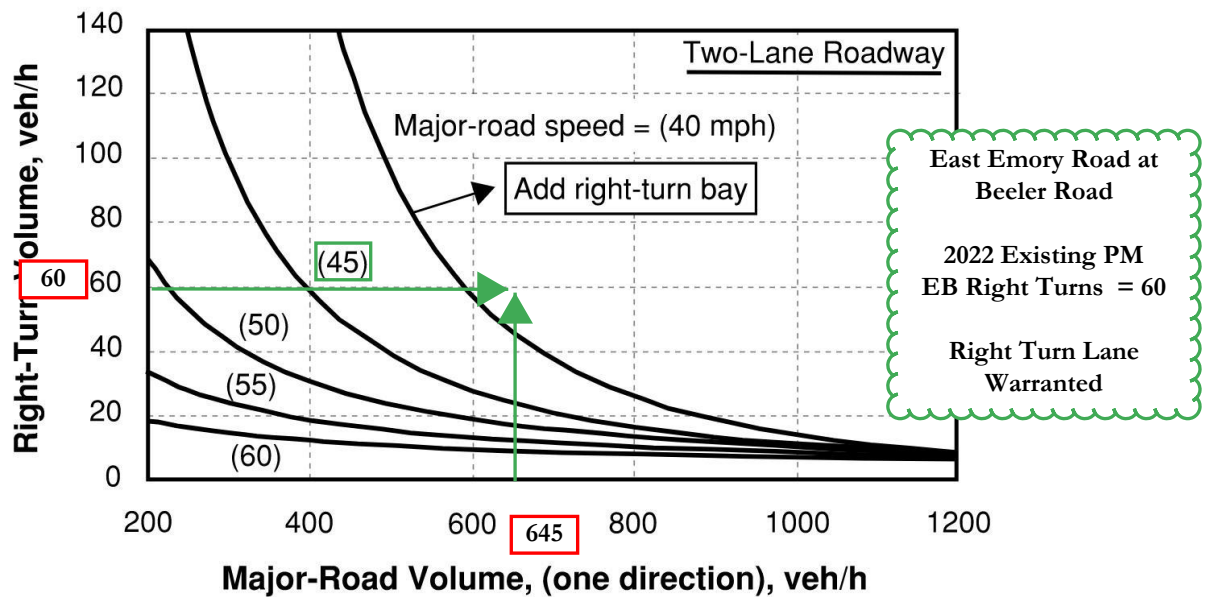


Figure 3-18: Right-Turn Lane Warrant along Two-Lane Roadway (Unsignalized Intersection with Two-Way Stop-Control)<sup>24</sup>

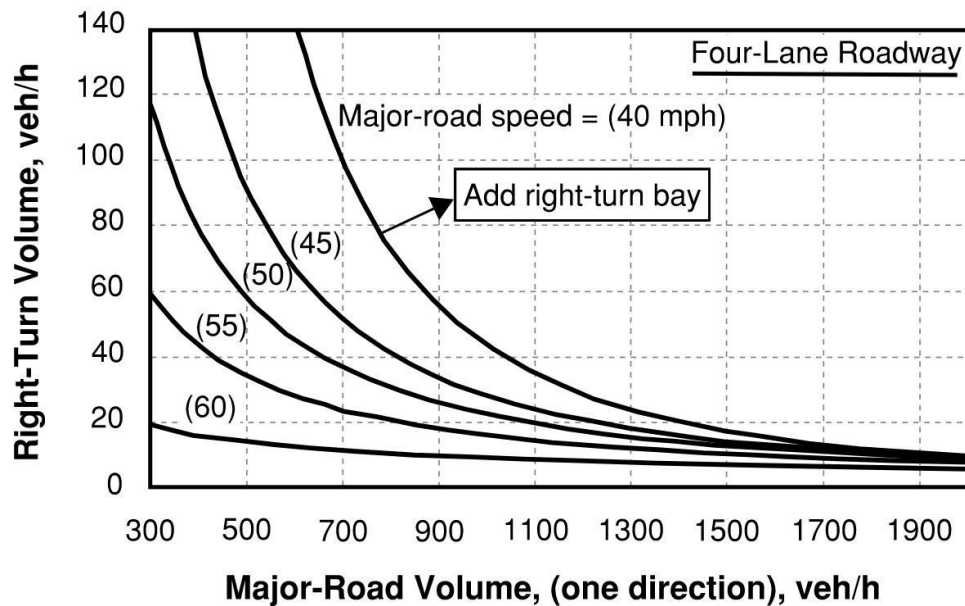


Figure 3-19: Right-Turn Lane Warrant along Four-Lane Roadway (Unsignalized Intersection with Two-Way Stop-Control)<sup>25</sup>

<sup>24</sup> TRB, NCHRP 457, Evaluating Intersection Improvements (2001)

<sup>25</sup> TRB, NCHRP 457, Evaluating Intersection Improvements (2001)

East Emory Road at Beeler Road

2027 Existing AM  
WB Left Turns = 42

where a left-turn lane is required to address traffic conflicts, not necessarily situations where a left-turn lane is required.

Left Turn Lane Warranted

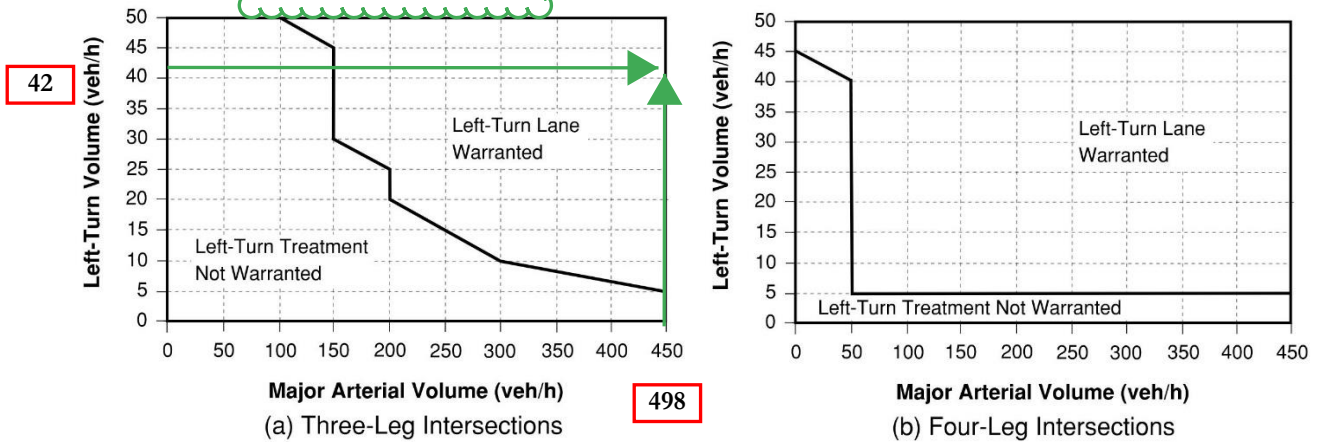


Figure 3-15: Left-Turn Lane Warrant for Urban and Suburban Arterials (Unsignalized)<sup>20, 21</sup>

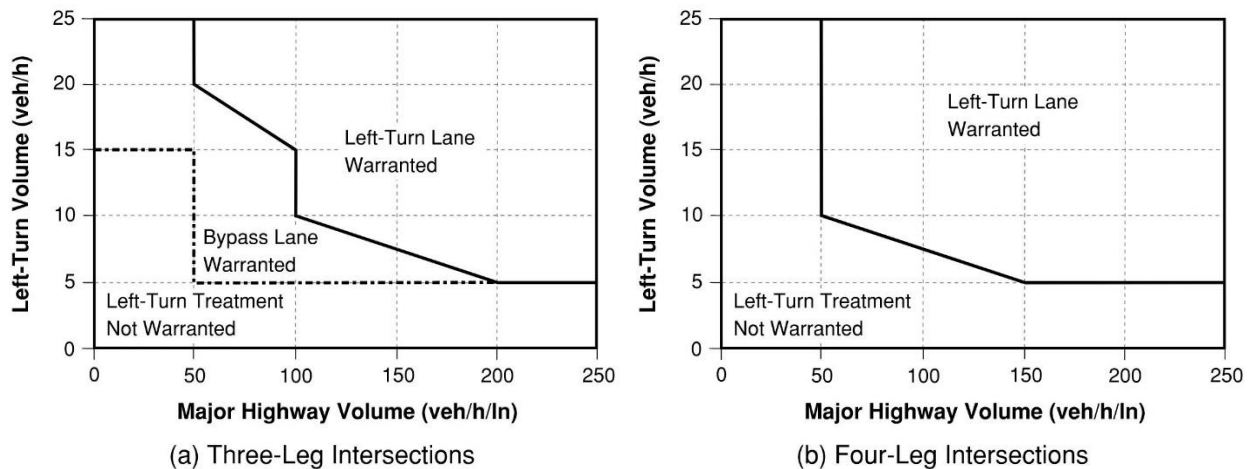


Figure 3-16: Left-Turn Lane Warrant for Two-Lane Rural Roadways (Unsignalized)<sup>20, 21</sup>

<sup>20</sup> TRB, NCHRP Report 745, Left-Turn Accommodations at Unsignalized Intersections (2013)

<sup>21</sup> AASHTO, A Policy on Geometric Design of Highways and Streets 7<sup>th</sup> Edition (2018)

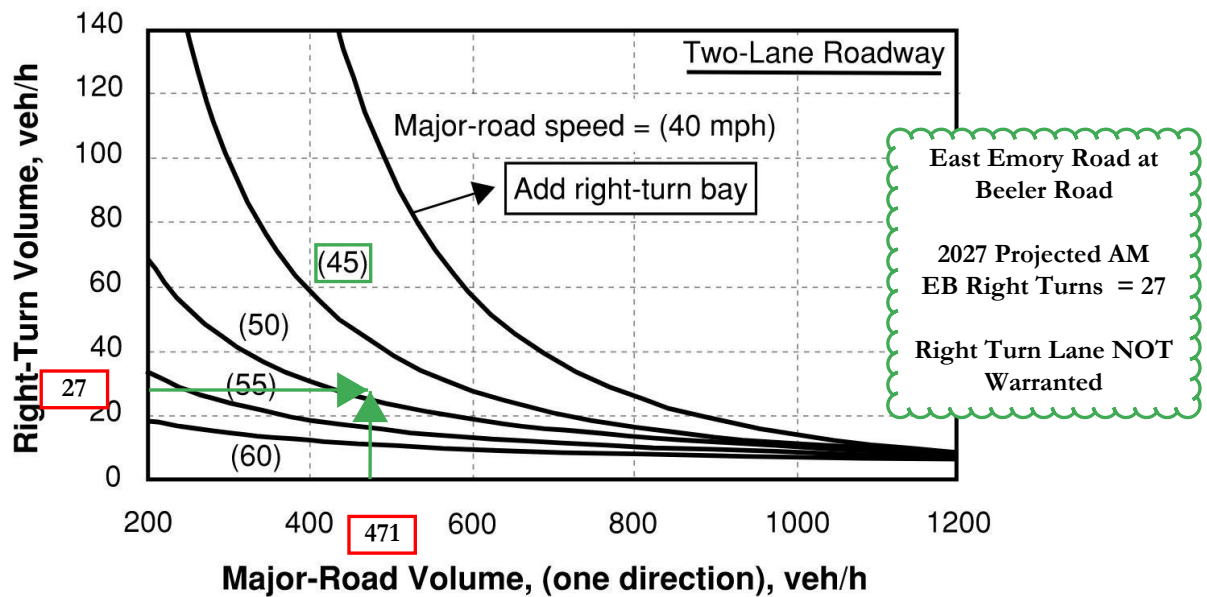


Figure 3-18: Right-Turn Lane Warrant along Two-Lane Roadway (Unsignalized Intersection with Two-Way Stop-Control)<sup>24</sup>

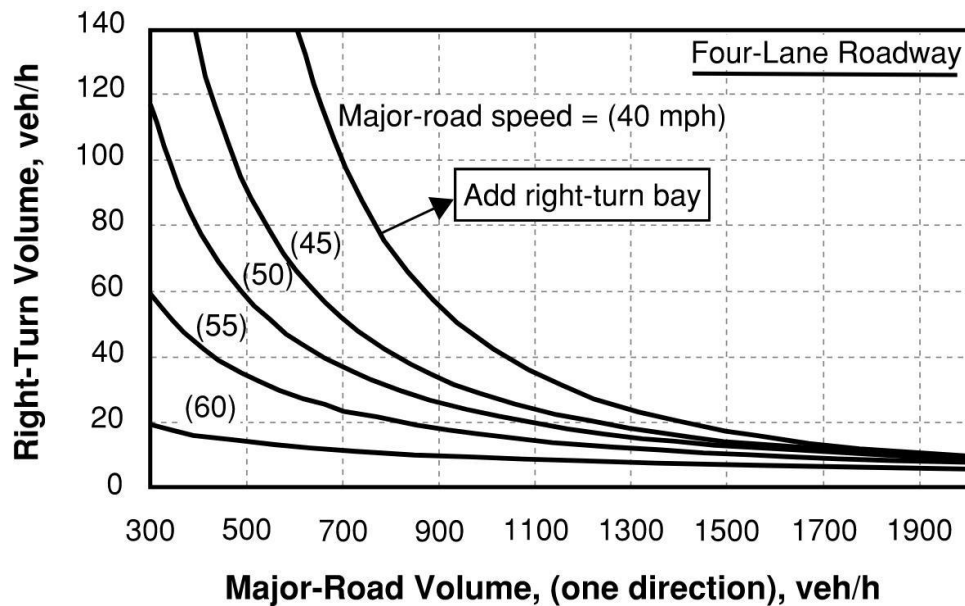


Figure 3-19: Right-Turn Lane Warrant along Four-Lane Roadway (Unsignalized Intersection with Two-Way Stop-Control)<sup>25</sup>

<sup>24</sup> TRB, NCHRP 457, Evaluating Intersection Improvements (2001)

<sup>25</sup> TRB, NCHRP 457, Evaluating Intersection Improvements (2001)

where a left-turn lane is required

East Emory Road at  
Beeler Road

2027 Existing PM  
WB Left Turns = 85

Left Turn Lane  
Warranted

ate traffic conflicts, not necessarily situations where a left-turn

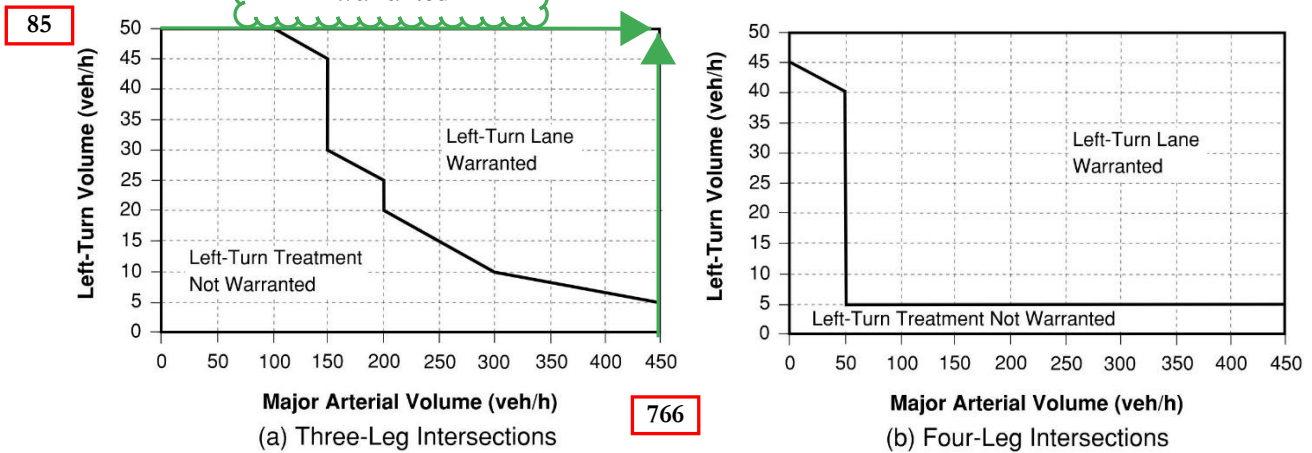


Figure 3-15: Left-Turn Lane Warrant for Urban and Suburban Arterials (Unsignalized)<sup>20, 21</sup>

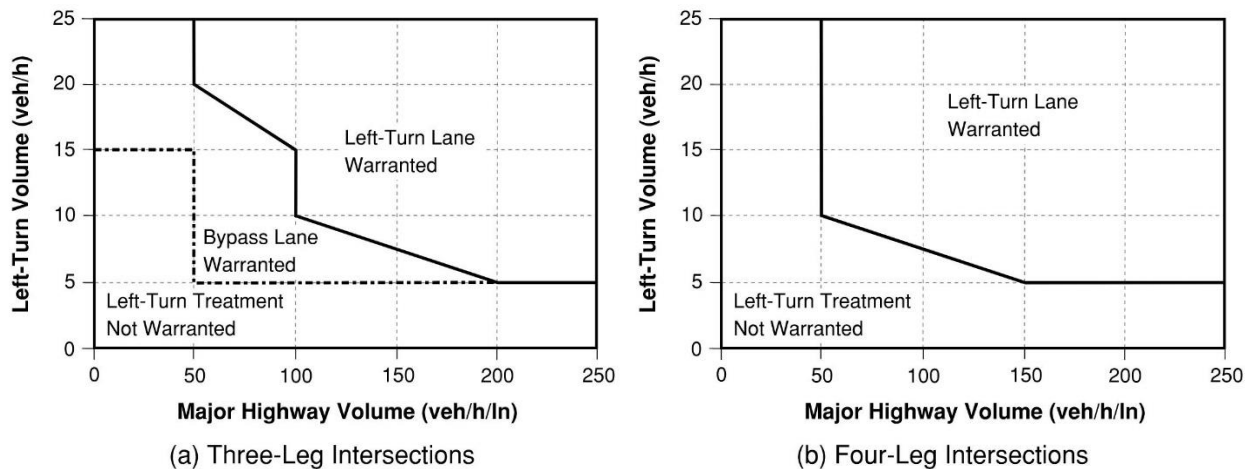


Figure 3-16: Left-Turn Lane Warrant for Two-Lane Rural Roadways (Unsignalized)<sup>20, 21</sup>

<sup>20</sup> TRB, NCHRP Report 745, Left-Turn Accommodations at Unsignalized Intersections (2013)

<sup>21</sup> AASHTO, A Policy on Geometric Design of Highways and Streets 7<sup>th</sup> Edition (2018)

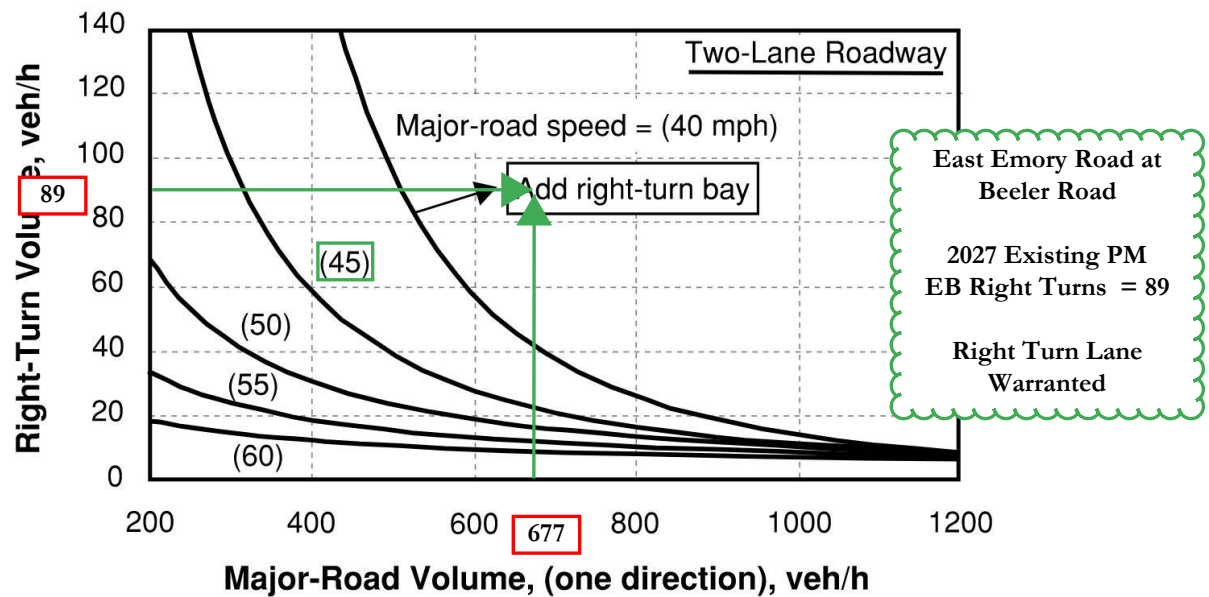


Figure 3-18: Right-Turn Lane Warrant along Two-Lane Roadway (Unsignalized Intersection with Two-Way Stop-Control)<sup>24</sup>

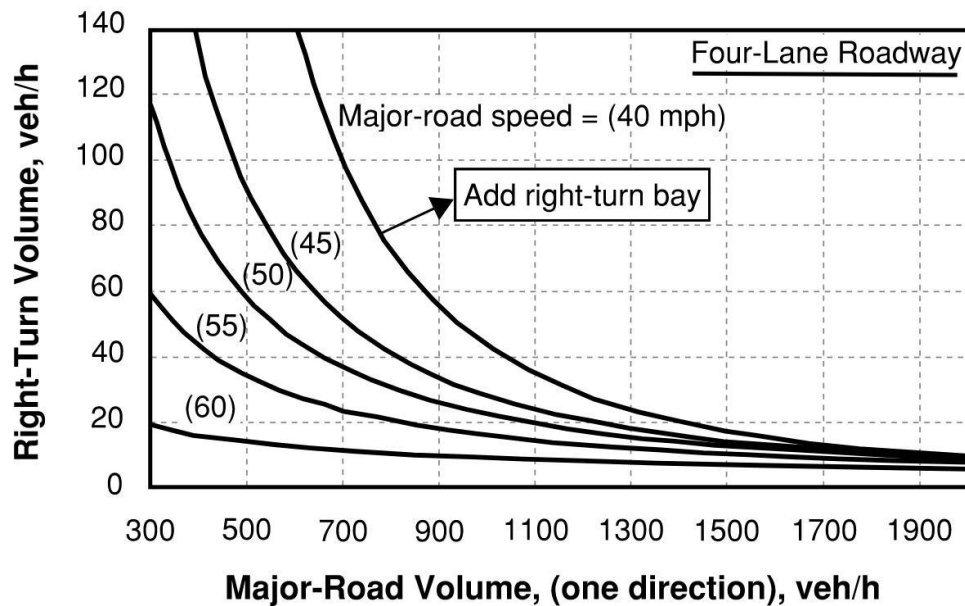


Figure 3-19: Right-Turn Lane Warrant along Four-Lane Roadway (Unsignalized Intersection with Two-Way Stop-Control)<sup>25</sup>

<sup>24</sup> TRB, NCHRP 457, Evaluating Intersection Improvements (2001)

<sup>25</sup> TRB, NCHRP 457, Evaluating Intersection Improvements (2001)



TABLE 5B

**RIGHT-TURN LANE VOLUME THRESHOLDS  
FOR TWO-LANE ROADWAYS WITH A PREVAILING SPEED OF 36 TO 45 MPH**

$$471/2 = 235.5 * 1.05 = 248$$

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

East Emory Road at  
Beeler Road  
(Widened to 5-Lanes)

2027 Projected AM  
EB Right Turns = 27

Right 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
100 - 149 150 - 199		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 5B

**RIGHT-TURN LANE VOLUME THRESHOLDS  
FOR TWO-LANE ROADWAYS WITH A PREVAILING SPEED OF 36 TO 45 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						
200 - 249 250 - 299					Yes	Yes
300 - 349 350 - 399			Yes	Yes Yes	Yes Yes	Yes Yes
400 - 449 450 - 499		Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
500 - 549 550 - 599	Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
600 or More	Yes	Yes	Yes	Yes	Yes	Yes

$$677/2 = 338.5 * 1.05 = 356$$

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
100 - 149 150 - 199		Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
200 - 249 250 - 299	Yes Yes		Yes Yes	Yes Yes	Yes Yes	Yes Yes
300 - 349 350 - 399	Yes Yes		Yes Yes	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
600 or More	Yes	Yes	Yes	Yes	Yes	Yes

East Emory Road at  
Beeler Road  
(Widened to 5-Lanes)

2027 Projected PM  
EB Right Turns = 89

Right Turn Lane NOT  
Warranted

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

## **APPENDIX J**

### **TRAFFIC SIGNAL WARRANT WORKSHEETS**

**PROJECTED FUTURE VOLUMES IN YEAR 2027 WITH TRAFFIC GROWTH AND GENERATED TRAFFIC**  
**East Emory Road at Beeler Road**

TIME BEGIN	East Emory Road		Beeler Road		East Emory Road	
	WESTBOUND		NORTHBOUND		EASTBOUND	
	LT	THRU	LT	RT	THRU	RT
7:00 AM	3	108	9	27	82	5
7:15 AM	8	117	9	22	119	5
7:30 AM	10	148	8	24	115	4
7:45 AM	9	161	5	16	111	4
Sum	30	534	31	89	427	18
Growth from Beeler Farms	4	0	5	16	0	2
General Growth	0	26.7	0	0	21.35	0
Trips Generated 7-8 am	10	0	15	45	0	7
2027	44	561	51	150	448	27
8:00 AM	4	124	5	23	104	8
8:15 AM	7	113	11	4	93	3
8:30 AM	4	105	5	13	52	5
8:45 AM	8	86	5	6	55	11
Sum	23	428	26	46	304	27
Growth from Beeler Farms	3	0	4	12	0	2
General Growth	0	21.4	0	0	15.2	0
Trips Generated 8-9 am	8	0	11	34	0	5
2027	33	449	41	92	319	34
11:00 AM	1	59	9	7	62	5
11:15 AM	5	62	6	2	68	3
11:30 AM	6	77	8	4	76	8
11:45 AM	5	62	11	8	68	8
Sum	17	260	34	21	274	24
Growth from Beeler Farms	2	0	3	8	0	1
General Growth	0	13	0	0	13.7	0
Trips Generated 11am-12 pm	5	0	8	23	0	4
2027	24	273	45	53	288	29
12:00 PM	8	64	11	6	73	13
12:15 PM	5	66	7	2	84	6
12:30 PM	2	70	10	1	83	6
12:45 PM	5	61	5	10	91	7
Sum	20	261	33	19	331	32
Growth from Beeler Farms	2	0	3	9	0	1
General Growth	0	13.05	0	0	16.55	0
Trips Generated 12-1 pm	6	0	9	26	0	4
2027	28	274	45	54	348	37
2:00 PM	10	97	4	10	110	3
2:15 PM	7	89	4	7	106	7
2:30 PM	7	78	6	10	113	6
2:45 PM	10	95	4	11	110	7
Sum	34	359	18	38	439	23
Growth from Beeler Farms	3	0	4	11	0	2
General Growth	0	17.95	0	0	21.95	0
Trips Generated 2-3 pm	7	0	11	32	0	5
2027	44	377	32	81	461	29
3:00 PM	11	102	8	15	96	5
3:15 PM	10	109	10	8	123	10
3:30 PM	18	98	6	6	107	7
3:45 PM	21	178	11	5	135	11
Sum	60	487	35	34	461	33
Growth from Beeler Farms	3	0	5	14	0	2
General Growth	0	24.35	0	0	23.05	0
Trips Generated 3-4 pm	9	0	13	39	0	6
2027	72	511	53	87	484	41
4:00 PM	11	129	10	8	144	10
4:15 PM	14	113	7	10	147	11
4:30 PM	11	103	10	9	151	11
4:45 PM	17	120	4	9	164	11
Sum	53	465	31	36	606	43
Growth from Beeler Farms	4	0	5	16	0	2
General Growth	0	23.25	0	0	30.3	0
Trips Generated 4-5 pm	10	0	15	44	0	7
2027	66	488	51	96	636	52
5:00 PM	16	109	8	12	173	12
5:15 PM	12	112	11	16	143	16
5:30 PM	11	138	9	10	165	21
5:45 PM	13	115	6	13	150	9
Sum	52	474	34	51	631	58
Growth from Beeler Farms	4	0	6	17	0	3
General Growth	0	23.7	0	0	31.55	0
Trips Generated 5-6 pm	11	0	16	48	0	7
2027	67	498	56	116	663	68

Existing Volumes

Existing Volumes

Existing Volumes

Existing Volumes

Sum

Growth from Beeler Farms

Growth Rate of 1.0% for 5 years

Trips Generated by Beeler Road Subdivision

Total Sum

Assumed Average Growth Rate (%)=	1.0%	0% Increase due to Covid
Number of years =	5	
Horizon Year =	2027	# of Horizon Years = 5

Note 1: 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 TDOT Table 4.2 in Traffic Design Manual)

Note 2: It is assumed that the construction of homes is linear growth

Daily Trips Generated by Entire Development:	857	Daily Trips Generated from Subdivision/Year	171	=	857 / 5
100% of trips		trips by	857		2027

	AM	PM
Traffic Movement Assumed Distribution:	25% to west East Emory, 75% to east East Emory 40% from west East Emory, 60% from east East Emory	40% to west East Emory, 60% to east East Emory 50% from west East Emory, 50% from east East Emory

Assume all rownhouses

Entering and Exiting %'s (from local trip rate):

22% Enter	AM Hours
78% Exit	

Directional Distribution Assumptions:

50% Enter	Mid-Day Hours	25% to west East Emory Road 75% to east East Emory Road 40% from west East Emory Road 60% from east East Emory Road
50% Exit		25% to west East Emory Road 75% to east East Emory Road 40% from west East Emory Road 60% from east East Emory Road
55% Enter	PM Hours	40% to west East Emory Road 60% to east East Emory Road 50% from west East Emory Road 50% from east East Emory Road
45% Exit		

Assume same DD for AM Peak Hour

TDOT Traffic Engineering Office - Table 4.2 - TDOT Traffic Design Manual

Population Tier = A (Knoxville)

TDOT Region 1 Average for Arterial Facilities (Two-Lane)

Time of Day	Percentage of Trips
7-8 am	9.03%
8-9 am	6.78%
11 am-Noon	4.68%
Noon-1 pm	5.17%
2-3 pm	6.34%
3-4 pm	7.83%
4-5 pm	8.79%
5-6 pm	9.64%
	58.26%

**PROJECTED FUTURE VOLUMES FROM GENERATED TRAFFIC FROM REMAINING HOMES IN BEELER FARMS SUBDIVISION**  
**East Emory Road at Beeler Road**

TIME BEGIN	East Emory Road		Beeler Road		East Emory Road	
	WESTBOUND		NORTHBOUND		EASTBOUND	
	LT	THRU	LT	RT	THRU	RT
7:00 AM						
7:15 AM						
7:30 AM						
7:45 AM						
Trips Generated 7-8 am	4	0	5	16	0	2
8:00 AM						
8:15 AM						
8:30 AM						
8:45 AM						
Trips Generated 8-9 am	3	0	4	12	0	2
11:00 AM						
11:15 AM						
11:30 AM						
11:45 AM						
Trips Generated 11am-12 pm	2	0	3	8	0	1
12:00 PM						
12:15 PM						
12:30 PM						
12:45 PM						
Trips Generated 12-1 pm	2	0	3	9	0	1
2:00 PM						
2:15 PM						
2:30 PM						
2:45 PM						
Trips Generated 2-3 pm	3	0	4	11	0	2
3:00 PM						
3:15 PM						
3:30 PM						
3:45 PM						
Trips Generated 3-4 pm	3	0	5	14	0	2
4:00 PM						
4:15 PM						
4:30 PM						
4:45 PM						
Trips Generated 4-5 pm	4	0	5	16	0	2
5:00 PM						
5:15 PM						
5:30 PM						
5:45 PM						
Trips Generated 5-6 pm	4	0	6	17	0	3

Growth from Beeler Farms

Remaining Daily  
Trips Generated by  
Beeler Farms Subdivision: 303

	AM	PM
Traffic Movement Assumed Distribution:	25% to west East Emory, 75% to east East Emory 40% from west East Emory, 60% from east East Emory	40% to west East Emory, 60% to east East Emory 50% from west East Emory, 50% from east East Emory

Assume all townhouses

Entering and Exiting %'s (from local trip rate):

22% Enter AM Hours  
78% Exit

Directional Distribution Assumptions:

25% to west East Emory Road  
75% to east East Emory Road  
40% from west East Emory Road  
60% from east East Emory Road

50% Enter Mid-Day Hours  
50% Exit

25% to west East Emory Road  
75% to east East Emory Road  
40% from west East Emory Road  
60% from east East Emory Road

Assume same DD for AM Peak Hour

55% Enter PM Hours  
45% Exit

40% to west East Emory Road  
60% to east East Emory Road  
50% from west East Emory Road  
50% from east East Emory Road

TDOT Traffic Engineering Office - Table 4.2 - TDOT Traffic Design Manual

Population Tier = A (Knoxville)

TDOT Region 1 Average for Arterial Facilities (Two-Lane)

Time of Day	Percentage of Trips
7-8 am	9.03%
8-9 am	6.78%
11 am-Noon	4.68%
Noon-1 pm	5.17%
2-3 pm	6.34%
3-4 pm	7.83%
4-5 pm	8.79%
5-6 pm	9.64%
	58.26%



# Traffic Signal Warrant Analysis

Project Name	Beeler Road Subdivision
Project/File #	#2207
Scenario	2027 - Projected Traffic Volumes

Intersection Information	
Major Street Name	East Emory Road
North/South or East/West	E/W
Speed Limit > 40 mph	Yes
# of Approach Lanes	1
% of Right Turn Traffic to Include	0%
Minor Street Name	Beeler Road
# of Approach Lanes	1
% of Right Turn Traffic to Include	0%
Isolated Community < 10,000 pop	No

0% of Right Turns  
from Beeler Road  
Included in Traffic  
Signal Warrant  
Thresholds

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

# Traffic Signal Warrant Analysis

## East Emory Road (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		448	27	
8 - 9 AM		319	34	
9 - 10 AM				
10 - 11 AM				
11 - 12 PM		288	29	
12 - 1 PM		348	37	
1 - 2 PM				
2 - 3 PM		461	29	
3 - 4 PM		484	41	
4 - 5 PM		636	52	
5 - 6 PM		663	68	
6 - 7 PM				
7 - 8 PM				
8 - 9 PM				
9 - 10 PM				
10 - 11 PM				
11 - 12 AM				
Total Vehicles (unadjusted)			3,964	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	44	561		
8 - 9 AM	33	449		
9 - 10 AM				
10 - 11 AM				
11 - 12 PM	24	273		
12 - 1 PM	28	274		
1 - 2 PM				
2 - 3 PM	44	377		
3 - 4 PM	72	511		
4 - 5 PM	66	488		
5 - 6 PM	67	498		
6 - 7 PM				
7 - 8 PM				
8 - 9 PM				
9 - 10 PM				
10 - 11 PM				
11 - 12 AM				
Total Vehicles (unadjusted)			3,809	0

## Beeler Road (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	51		150	
8 - 9 AM	41		92	
9 - 10 AM				
10 - 11 AM				
11 - 12 PM	45		53	
12 - 1 PM	45		54	
1 - 2 PM				
2 - 3 PM	32		81	
3 - 4 PM	53		87	
4 - 5 PM	51		96	
5 - 6 PM	56		116	
6 - 7 PM				
7 - 8 PM				
8 - 9 PM				
9 - 10 PM				
10 - 11 PM				
11 - 12 AM				
Total Vehicles (unadjusted)			1,103	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	Beeler Road Subdivision
Project/File #	#2207
Scenario	2027 - Projected Traffic Volumes

Intersection Information			
Major Street (E/W Road)	East Emory Road	Minor Street (N/S Road)	Beeler Road
Analyzed with	1 approach lane	Analyzed with	1 Approach Lane
Total Approach Volume	7773 vehicles	Total Approach Volume	1103 vehicles
Total Ped/Bike Volume	0 crossings	Total Ped/Bike Volume	0 crossings
Right turn reduction of	1 percent applied	Right turn reduction of	1 percent applied

Reduction applied to warrant thresholds due to high speed on East Emory Road

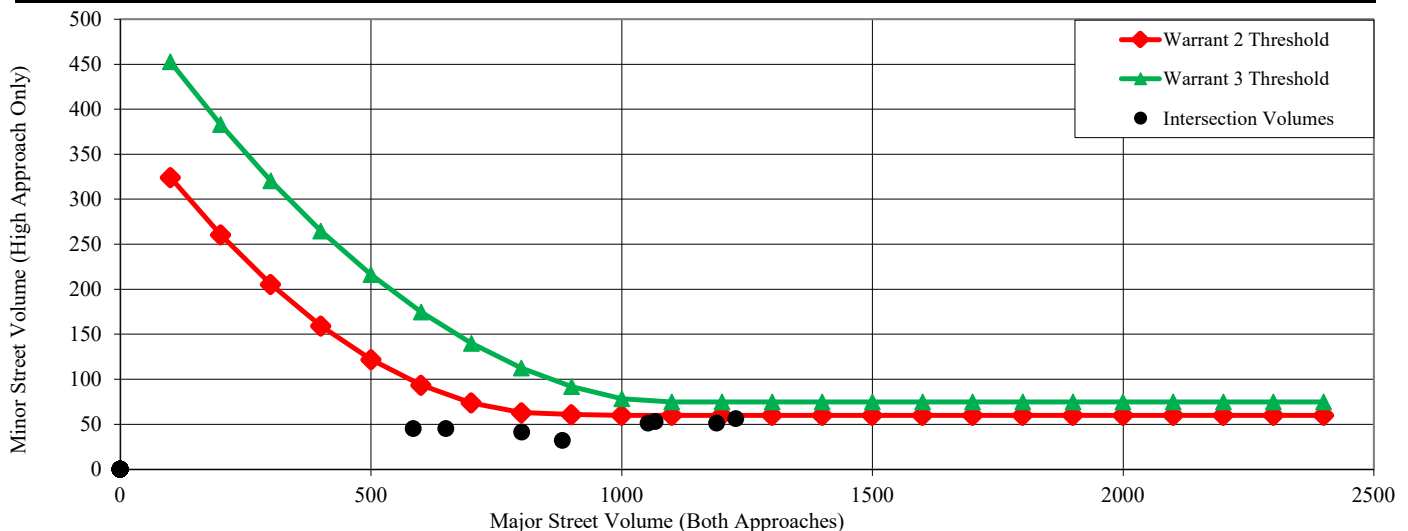
Warrant 1, Eight Hour Vehicular Volume			
	Condition A	Condition B	Condition A+B*
Condition Satisfied?	Not satisfied	Not satisfied	Not satisfied
Required values reached for	0 hours	2 hours	0 (Cond. A) & 6 (Cond. B)
Criteria - Major Street (veh/hr)	350	525	280 (Cond. A) & 420 (Cond. B)
Criteria - Minor 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 A	Condition B
Condition Satisfied?	Satisfied	Not Satisfied
Required values reached for	799 total, 150 minor, 6.3 delay	0 hours
Criteria - Total Approach Volume (veh in one hour)	650	See Figure Below
Criteria - Minor Street High Side Volume (veh in one hour)	150	
Criteria - Minor Street High Side Delay (veh-hrs)	5	

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





CIVIL ENGINEERING / TRAFFIC ENGINEERING

# Traffic Signal Warrant Analysis

Project Name	Beeler Road Subdivision
Project/File #	#2207
Scenario	2027 - Projected Traffic Volumes

Intersection Information	
Major Street Name	East Emory Road
North/South or East/West	E/W
Speed Limit > 40 mph	Yes
# of Approach Lanes	1
% of Right Turn Traffic to Include	0%
Minor Street Name	Beeler Road
# of Approach Lanes	1
% of Right Turn Traffic to Include	25%
Isolated Community < 10,000 pop	No

25% of Right Turns  
from Beeler Road  
Included in Traffic  
Signal Warrant  
Thresholds

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

# Traffic Signal Warrant Analysis

## East Emory Road (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		448	27	
8 - 9 AM		319	34	
9 - 10 AM				
10 - 11 AM				
11 - 12 PM		288	29	
12 - 1 PM		348	37	
1 - 2 PM				
2 - 3 PM		461	29	
3 - 4 PM		484	41	
4 - 5 PM		636	52	
5 - 6 PM		663	68	
6 - 7 PM				
7 - 8 PM				
8 - 9 PM				
9 - 10 PM				
10 - 11 PM				
11 - 12 AM				
Total Vehicles (unadjusted)			3,964	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	44	561		
8 - 9 AM	33	449		
9 - 10 AM				
10 - 11 AM				
11 - 12 PM	24	273		
12 - 1 PM	28	274		
1 - 2 PM				
2 - 3 PM	44	377		
3 - 4 PM	72	511		
4 - 5 PM	66	488		
5 - 6 PM	67	498		
6 - 7 PM				
7 - 8 PM				
8 - 9 PM				
9 - 10 PM				
10 - 11 PM				
11 - 12 AM				
Total Vehicles (unadjusted)			3,809	0

## Beeler Road (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	51		150	
8 - 9 AM	41		92	
9 - 10 AM				
10 - 11 AM				
11 - 12 PM	45		53	
12 - 1 PM	45		54	
1 - 2 PM				
2 - 3 PM	32		81	
3 - 4 PM	53		87	
4 - 5 PM	51		96	
5 - 6 PM	56		116	
6 - 7 PM				
7 - 8 PM				
8 - 9 PM				
9 - 10 PM				
10 - 11 PM				
11 - 12 AM				
Total Vehicles (unadjusted)			1,103	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	Beeler Road Subdivision
Project/File #	#2207
Scenario	2027 - Projected Traffic Volumes

Intersection Information			
Major Street (E/W Road)	East Emory Road	Minor Street (N/S Road)	Beeler Road
Analyzed with	1 approach lane	Analyzed with	1 Approach Lane
Total Approach Volume	7773 vehicles	Total Approach Volume	1103 vehicles
Total Ped/Bike Volume	0 crossings	Total Ped/Bike Volume	0 crossings
Right turn reduction of	1 percent applied	Right turn reduction of	0.75 percent applied

Reduction applied to warrant thresholds due to high speed on East Emory Road

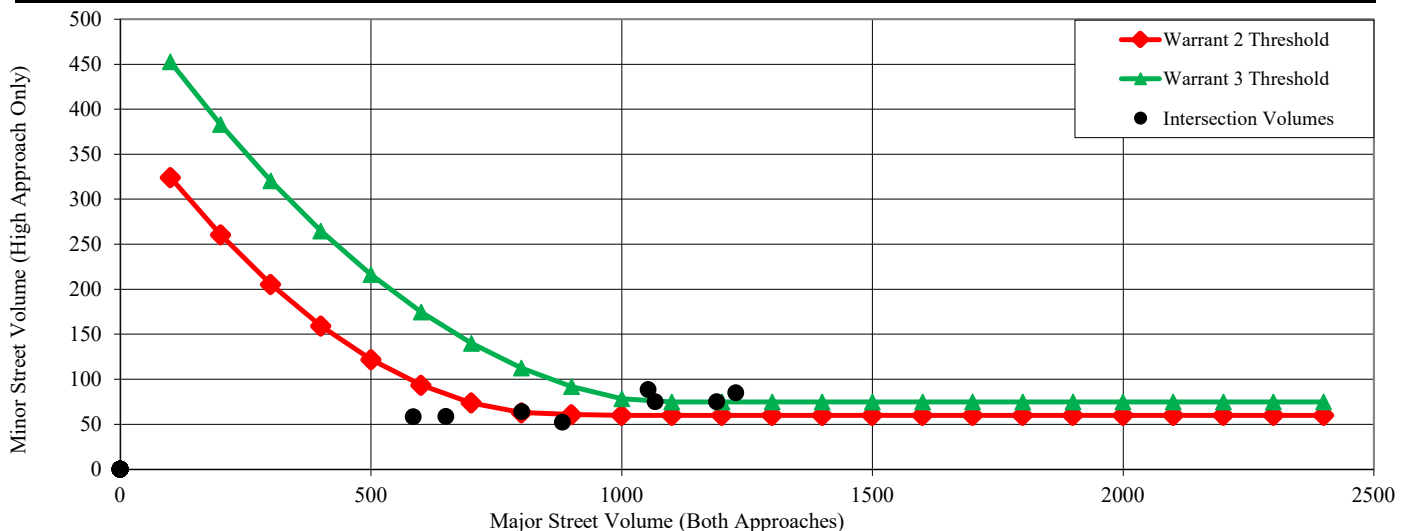
Warrant 1, Eight Hour Vehicular Volume			
	Condition A	Condition B	Condition A+B*
Condition Satisfied?	Not satisfied	Not satisfied	Not satisfied
Required values reached for	0 hours	7 hours	2 (Cond. A) & 8 (Cond. B)
Criteria - Major Street (veh/hr)	350	525	280 (Cond. A) & 420 (Cond. B)
Criteria - Minor 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?	Satisfied
Required values reached for	5 hours
Criteria	See Figure Below

Warrant 3, Peak Hour Vehicular Volume		
	Condition A	Condition B
Condition Satisfied?	Satisfied	Satisfied
Required values reached for	799 total, 150 minor, 6.3 delay	3 hours
Criteria - Total Approach Volume (veh in one hour)	650	See Figure Below
Criteria - Minor Street High Side Volume (veh in one hour)	150	
Criteria - Minor Street High Side Delay (veh-hrs)	5	

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





# Traffic Signal Warrant Analysis

CIVIL ENGINEERING / TRAFFIC ENGINEERING

Project Name	Beeler Road Subdivision
Project/File #	#2207
Scenario	2027 - Projected Traffic Volumes

Intersection Information	
Major Street Name	East Emory Road
North/South or East/West	E/W
Speed Limit > 40 mph	Yes
# of Approach Lanes	1
% of Right Turn Traffic to Include	0%
Minor Street Name	Beeler Road
# of Approach Lanes	1
% of Right Turn Traffic to Include	50%
Isolated Community < 10,000 pop	No

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

50% of Right Turns  
from Beeler Road  
Included in Traffic  
Signal Warrant  
Thresholds

# Traffic Signal Warrant Analysis

## East Emory Road (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		448	27	
8 - 9 AM		319	34	
9 - 10 AM				
10 - 11 AM				
11 - 12 PM		288	29	
12 - 1 PM		348	37	
1 - 2 PM				
2 - 3 PM		461	29	
3 - 4 PM		484	41	
4 - 5 PM		636	52	
5 - 6 PM		663	68	
6 - 7 PM				
7 - 8 PM				
8 - 9 PM				
9 - 10 PM				
10 - 11 PM				
11 - 12 AM				
Total Vehicles (unadjusted)			3,964	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	44	561		
8 - 9 AM	33	449		
9 - 10 AM				
10 - 11 AM				
11 - 12 PM	24	273		
12 - 1 PM	28	274		
1 - 2 PM				
2 - 3 PM	44	377		
3 - 4 PM	72	511		
4 - 5 PM	66	488		
5 - 6 PM	67	498		
6 - 7 PM				
7 - 8 PM				
8 - 9 PM				
9 - 10 PM				
10 - 11 PM				
11 - 12 AM				
Total Vehicles (unadjusted)			3,809	0

## Beeler Road (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	51		150	
8 - 9 AM	41		92	
9 - 10 AM				
10 - 11 AM				
11 - 12 PM	45		53	
12 - 1 PM	45		54	
1 - 2 PM				
2 - 3 PM	32		81	
3 - 4 PM	53		87	
4 - 5 PM	51		96	
5 - 6 PM	56		116	
6 - 7 PM				
7 - 8 PM				
8 - 9 PM				
9 - 10 PM				
10 - 11 PM				
11 - 12 AM				
Total Vehicles (unadjusted)			1,103	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	Beeler Road Subdivision
Project/File #	#2207
Scenario	2027 - Projected Traffic Volumes

Intersection Information			
Major Street (E/W Road)	East Emory Road	Minor Street (N/S Road)	Beeler Road
Analyzed with	1 approach lane	Analyzed with	1 Approach Lane
Total Approach Volume	7773 vehicles	Total Approach Volume	1103 vehicles
Total Ped/Bike Volume	0 crossings	Total Ped/Bike Volume	0 crossings
Right turn reduction of	1 percent applied	Right turn reduction of	0.5 percent applied

Reduction applied to warrant thresholds due to high speed on East Emory Road

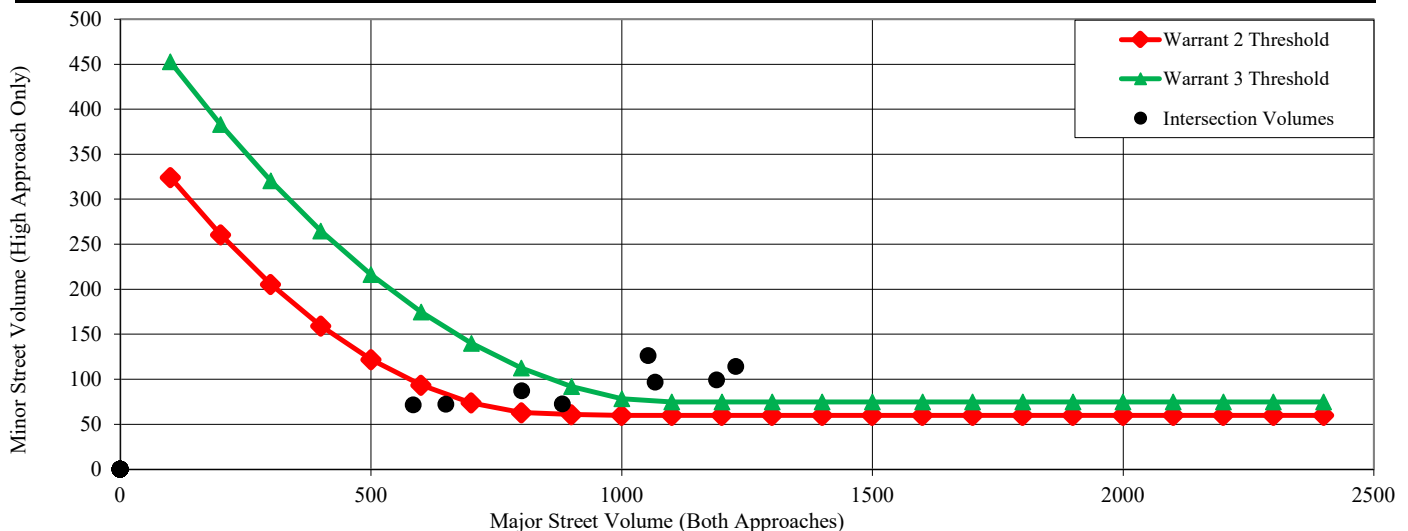
Warrant 1, Eight Hour Vehicular Volume			
	Condition A	Condition B	Condition A+B*
Condition Satisfied?	Not satisfied	Satisfied	Not satisfied
Required values reached for	2 hours	8 hours	5 (Cond. A) & 8 (Cond. B)
Criteria - Major Street (veh/hr)	350	525	280 (Cond. A) & 420 (Cond. B)
Criteria - Minor Street (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?	Satisfied
Required values reached for	6 hours
Criteria	See Figure Below

Warrant 3, Peak Hour Vehicular Volume		
	Condition A	Condition B
Condition Satisfied?	Satisfied	Satisfied
Required values reached for	799 total, 150 minor, 6.3 delay	4 hours
Criteria - Total Approach Volume (veh in one hour)	650	See Figure Below
Criteria - Minor Street High Side Volume (veh in one hour)	150	
Criteria - Minor Street High Side Delay (veh-hrs)	5	

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





# Traffic Signal Warrant Analysis

CIVIL ENGINEERING / TRAFFIC ENGINEERING

Project Name	Beeler Road Subdivision
Project/File #	#2207
Scenario	2027 - Projected Traffic Volumes (With TDOT Widening)

Intersection Information	
Major Street Name	East Emory Road
North/South or East/West	E/W
Speed Limit > 40 mph	Yes
# of Approach Lanes	2 or more
% of Right Turn Traffic to Include	0%
Minor Street Name	Beeler Road
# of Approach Lanes	1
% of Right Turn Traffic to Include	0%
Isolated Community < 10,000 pop	No

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



# Traffic Signal Warrant Analysis

## East Emory Road (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		448	27	
8 - 9 AM		319	34	
9 - 10 AM				
10 - 11 AM				
11 - 12 PM		288	29	
12 - 1 PM		348	37	
1 - 2 PM				
2 - 3 PM		461	29	
3 - 4 PM		484	41	
4 - 5 PM		636	52	
5 - 6 PM		663	68	
6 - 7 PM				
7 - 8 PM				
8 - 9 PM				
9 - 10 PM				
10 - 11 PM				
11 - 12 AM				
Total Vehicles (unadjusted)			3,964	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	44	561		
8 - 9 AM	33	449		
9 - 10 AM				
10 - 11 AM				
11 - 12 PM	24	273		
12 - 1 PM	28	274		
1 - 2 PM				
2 - 3 PM	44	377		
3 - 4 PM	72	511		
4 - 5 PM	66	488		
5 - 6 PM	67	498		
6 - 7 PM				
7 - 8 PM				
8 - 9 PM				
9 - 10 PM				
10 - 11 PM				
11 - 12 AM				
Total Vehicles (unadjusted)			3,809	0

## Beeler Road (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	51		150	
8 - 9 AM	41		92	
9 - 10 AM				
10 - 11 AM				
11 - 12 PM	45		53	
12 - 1 PM	45		54	
1 - 2 PM				
2 - 3 PM	32		81	
3 - 4 PM	53		87	
4 - 5 PM	51		96	
5 - 6 PM	56		116	
6 - 7 PM				
7 - 8 PM				
8 - 9 PM				
9 - 10 PM				
10 - 11 PM				
11 - 12 AM				
Total Vehicles (unadjusted)			1,103	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	Beeler Road Subdivision
Project/File #	#2207
Scenario	2027 - Projected Traffic Volumes (With TDOT Widening)

Intersection Information			
Major Street (E/W Road)	East Emory Road	Minor Street (N/S Road)	Beeler Road
Analyzed with	2 or more approach lanes	Analyzed with	1 Approach Lane
Total Approach Volume	7773 vehicles	Total Approach Volume	1103 vehicles
Total Ped/Bike Volume	0 crossings	Total Ped/Bike Volume	0 crossings
Right turn reduction of	1 percent applied	Right turn reduction of	1 percent applied

Reduction applied to warrant thresholds due to high speed on East Emory Road

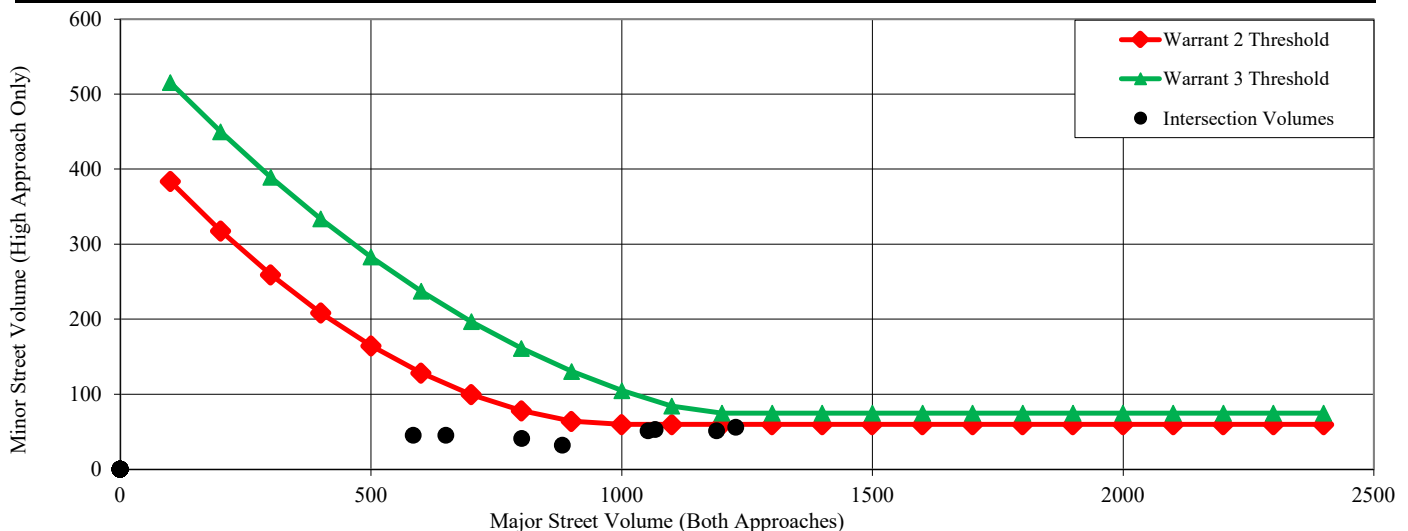
Warrant 1, Eight Hour Vehicular Volume			
	Condition A	Condition B	Condition A+B*
Condition Satisfied?	Not satisfied	Not satisfied	Not satisfied
Required values reached for	0 hours	2 hours	0 (Cond. A) & 6 (Cond. B)
Criteria - Major Street (veh/hr)	420	630	336 (Cond. A) & 504 (Cond. B)
Criteria - Minor 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 A	Condition B
Condition Satisfied?	Satisfied	Not Satisfied
Required values reached for	799 total, 150 minor, 6.3 delay	0 hours
Criteria - Total Approach Volume (veh in one hour)	650	See Figure Below
Criteria - Minor Street High Side Volume (veh in one hour)	150	
Criteria - Minor Street High Side Delay (veh-hrs)	5	

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



## **APPENDIX K**

### **SIMTRAFFIC VEHICLE QUEUE WORKSHEETS**

## Intersection: 4: Beeler Road & East Emory Road

Movement	EB	WB	NB
Directions Served	R	L	LR
Maximum Queue (ft)	12	44	120
Average Queue (ft)	1	12	51
95th Queue (ft)	9	37	95
Link Distance (ft)			196
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)	25	75	
Storage Blk Time (%)	0	0	
Queuing Penalty (veh)	0	0	

Vehicle Queues with  
Exclusive Left-Turn  
and Right-Turn Lanes  
on East Emory Road

## Network Summary

Network wide Queuing Penalty: 0

## Intersection: 4: Beeler Road & East Emory Road

Movement	EB	EB	WB	NB	
Directions Served	T	R	L	LR	
Maximum Queue (ft)	2	36	66	119	
Average Queue (ft)	0	2	28	47	Vehicle Queues with Exclusive Left-Turn and Right-Turn Lanes on East Emory Road
95th Queue (ft)	2	18	57	91	
Link Distance (ft)	222			196	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)		25	75		
Storage Blk Time (%)		0	0		
Queuing Penalty (veh)		0	1		

## Network Summary

Network wide Queuing Penalty: 1
---------------------------------



## Intersection: 4: Beeler Road & East Emory Road

Movement	EB	WB	NB	NB
Directions Served	R	L	L	R
Maximum Queue (ft)	12	46	58	73
Average Queue (ft)	1	13	22	31
95th Queue (ft)	9	39	49	56
Link Distance (ft)			196	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	25	75		75
Storage Blk Time (%)	0	0	0	0
Queuing Penalty (veh)	0	0	0	0

Vehicle Queues with  
Exclusive Left-Turn  
and Right-Turn Lanes  
on East Emory Road  
& Right-Turn Lane  
on Beeler Road

## Network Summary

Network wide Queuing Penalty: 1

## Intersection: 4: Beeler Road & East Emory Road

Movement	EB	EB	WB	NB	NB
Directions Served	T	R	L	L	R
Maximum Queue (ft)	2	38	68	74	68
Average Queue (ft)	0	3	28	27	24
95th Queue (ft)	2	18	57	59	52
Link Distance (ft)	222			196	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)		25	75		75
Storage Blk Time (%)	0	0	0	1	0
Queuing Penalty (veh)	0	0	1	0	0

Vehicle Queues with  
Exclusive Left-Turn  
and Right-Turn Lanes  
on East Emory Road  
& Right-Turn Lane  
on Beeler Road

## Network Summary

Network wide Queuing Penalty: 2

## **APPENDIX L**

### **RESPONSE LETTER TO ADDRESS KNOXVILLE/KNOX COUNTY PLANNING REVIEW COMMENTS**



11812 Black Road  
Knoxville, Tennessee 37932  
Phone (865) 556-0042  
[ajaxengineering@gmail.com](mailto:ajaxengineering@gmail.com)

June 10, 2022

**PROJECT NAME:** Beeler Road Subdivision

**TO:** Knoxville-Knox County Planning

**SUBJECT:** Comment Response Document for Beeler Road Subdivision TIS -  
From Email Comments dated June 9, 2022

Knoxville-Knox County Planning, Knox County Engineering, and TDOT Staff:

The following response document addresses comments from an email from Mike Conger, PE, dated June 9, 2022. This letter is added to the end of the revised report in Appendix L.

- 1. Please include reference to the future TDOT widening project in this section of E. Emory Rd that is included in the TDOT IMPROVE Act and is currently in the Design phase and proposing to widen the road from 2 to 5-lanes.**

Response: The referenced TDOT project has been added to the report and has significantly changed the recommendations presented in the report. The initial references to the IMPROVE Act have been added to the report in the Study Results on Page 1, the Recommendations on Page 2, and on Page 7 in the Description of Existing Conditions. This TDOT project is further discussed in the Conclusions & Recommendation portion of the report and includes its effect on the recommendations for the project. Overall, the proposed TDOT widening project has greatly impacted the recommendations provided for the project since widening East Emory Road will provide the necessary roadway capacity for the turning movements at Beeler Road.

This updated and revised report includes the original recommendations regarding the need for separate turn lanes at the intersection of East Emory Road at Beeler Road. The original recommendations are followed in this revised report with subsequent discussions regarding the impact

of the proposed TDOT road widening project on East Emory Road and its impact on the original recommendations.

2. Regarding the existing safety concerns noted in the TIS due to eastbound traffic occasionally passing vehicles stopped to make a left turn onto Beeler Road - please provide interim recommendations to mitigate this issue prior to either a potential left turn lane being constructed or the upcoming major widening project such as signing/stripping measures that may be applicable like "Do Not Pass on Shoulder" signage.

Response: This comment has been addressed on Page 2 in the Recommendations and on Page 49. A "Do Not Pass on Shoulder" (R4-18) traffic sign has been recommended to be installed on East Emory Road facing westbound traffic directly across Beeler Road outside the paved shoulder.

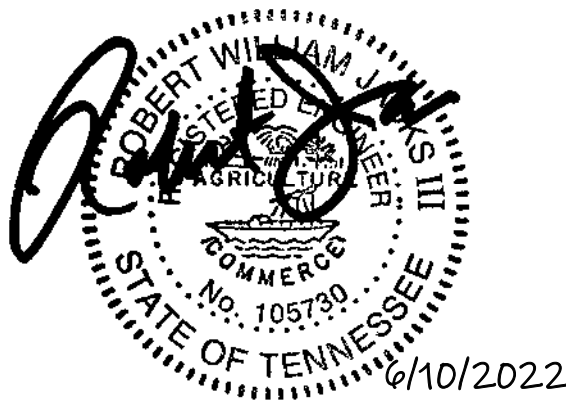
In addition to the revisions listed above, other changes in the report include the following:

- Updated Title Page
- Updated Table of Contents
- Updated Page Footers
- Updated Study Results on Page 1
- Updated Recommendations on Page 2-3
- Added Table 12 and Table 13
- Added additional right-turn lane worksheets in Appendix I
- Added additional traffic signal warrant worksheet in Appendix J
- Added Appendix L to include this response letter

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

Sincerely,

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





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