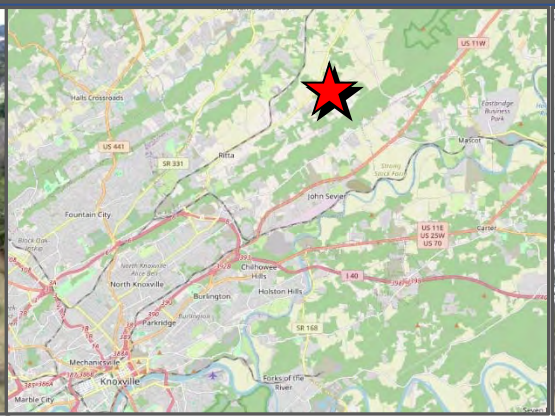
AJAX ENGINEERING

CIVIL ENGINEERING / TRAFFIC ENGINEERING

Transportation Impact Study

4923 Shipe Road Subdivision

Knox County, Tennessee



Revised April 15, 2025

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EXECUTIVE SUMMARY

Preface:

Brightside Development, LLC proposes a residential development adjacent to Shipe Road in Northeast Knox County, TN. The proposed development will include constructing 86 single-family detached houses on 34.5 +/- acres. The development is named and referenced in this study as "4923 Shipe Road Subdivision" since a formal name has not yet been chosen. The development proposes one entrance to Shipe Road to the east. However, a second road entrance is expected to be provided to Ellistown Road to the west via an internal road connection to another proposed residential development named the "KV Construction Subdivision". The proposed 4923 Shipe Road Subdivision and this adjacent subdivision are both anticipated to be fully built and occupied by 2028.

The primary purpose of this study is to determine and evaluate the potential impacts of the 4923 Shipe Road Subdivision on the adjacent transportation system, and it includes the impacts from the KV Construction Subdivision since the two are expected to be internally connected, which will allow travel to and from each other's proposed entrances. The study also considers the impact if the adjacent KV Construction Subdivision is not built. This report 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 significant findings of this study include the following:

- The 4923 Shipe Road Subdivision, with 86 single-family detached houses, is estimated to generate 878 vehicle trips at full build-out and occupancy on an average weekday. Of these daily trips, 65 are estimated to occur during the AM peak hour and 86 in the PM peak hour in 2028.
- If built, the proposed residential subdivision adjacent to the west, the KV Construction Subdivision, will provide access to Ellistown Road for the 4923 Shipe Road Subdivision residents. The KV Construction Subdivision proposes 47 single-family detached houses. With an internal road connection between the two subdivisions, the proposed Shipe Road and Ellistown Road entrances are calculated to operate with minimal vehicle delays and queues.

- With both subdivisions constructed, the calculated entering volumes from Shipe Road and Ellistown Road into the new residential subdivisions are not projected to meet warrants for separate turn lanes on Shipe Road or Ellistown Road.
- If the KV Construction Subdivision is not built, resulting in a single entrance to Shipe Road, the trips generated by the 4923 Shipe Road Subdivision are calculated to operate with minimal vehicle delays and queues. With a single entrance at Shipe Road, the entering trips for the 4923 Shipe Road Subdivision will not meet warrants for separate entering turn lanes on Shipe Road.
- The existing pavement section width of Shipe Road between Bud Hawkins Road and the proposed entrance for the 4923 Shipe Road Subdivision is relatively narrow, with a few spots just below 18 feet in width.

Recommendations:

The following summary recommendations are offered based on the study analyses to minimize the impacts of the proposed developments on the adjacent transportation system while attempting to achieve an acceptable traffic flow and improved safety. While not explicitly requested to be included in this study, the recommendations provided for the Proposed Shipe Road Entrance and internal subdivision roads should apply to the adjacent proposed KV Construction Subdivision. More details regarding all the recommendations are discussed at the end of the report.

Shipe Road at Proposed Shipe Road Entrance:

- Future landscaping, existing vegetation, or signage must not impact the intersection sight distances from the Proposed Shipe Road Entrance at Shipe Road.
- It is recommended that a Stop Sign (R1-1) be installed and a 24" white stop bar be applied to the Proposed Entrance approach at Shipe Road. The stop bar should be applied a minimum of 4 feet away from the edge of Shipe Road and placed at the desired stopping point that maximizes the sight distance.

4923 Shipe Road Subdivision Internal Roads:

- A 25-mph Speed Limit Sign (R2-1) with additional plaque signage, as shown in the report, is recommended to be posted near the beginning of the Proposed Entrance road off Shipe Road.
- Stop Signs (R1-1) with 24" white stop bars are recommended to be installed at the internal road intersections, as shown in the report.
- Dual end-of-roadway object markers (OM4-1) should be installed at the end of the internal road terminating at the KV Construction Subdivision property to the west.

This sign can be removed once an internal road connection is entirely constructed and open for vehicular traffic between the two subdivisions.

- The proposed lots in the 4923 Shipe Road Subdivision adjacent to Shipe Road should not be allowed direct vehicular access.
- Sight distance at the new internal intersections must not be impacted by new signage, parked cars, or future landscaping. With a proposed speed limit of 25-mph in the development, the required internal intersection sight distance is 250 feet. The civil site designer should ensure this internal sight distance length is met.
- The civil site designer has identified and labeled a centralized mail delivery center location within the development for the subdivision residents. It is recommended that a parking area or paved area outside the internal road accompany this center to dissuade on-street parking that could block traffic flow.
- All drainage grates and covers for the residential development must be pedestrian and bicycle-safe.
- A couple of the internal roads in the proposed subdivision are shown with long, straight road segments. Straight road segments encourage higher vehicle speeds. It is recommended that the civil site designer consider including traffic calming measures on these internal roads, such as speed humps or tables. Specifics regarding this recommendation should be discussed in the design phase with Knox County Engineering. However, speed humps should be limited to no more than two strategically placed on each of the two proposed east-west internal roads.
- All road and intersection elements should be designed to AASHTO and Knox County specifications and guidelines to ensure proper operation.

Shipe Road:

- Shipe Road between Bud Hawkins Road and the proposed entrance location for the 4923 Shipe Road Subdivision was measured to have a few spots less than 18 feet in width. If both subdivisions are constructed with additional road access provided to Ellistown Road for the 4923 Shipe Road Subdivision residents, it is estimated that Shipe Road will experience much less generated traffic than Ellistown Road. Nonetheless, to provide a factor of safety, it is recommended that Shipe Road between the Proposed Shipe Road Entrance and Bud Hawkins Road to the north be provided with a road width greater than or equal to 18 feet the entire distance, approximately 850 feet. However, it is expected that this widening will only need to occur for a few hundred at most, where the pavement is currently less than 18 feet.

DESCRIPTION OF EXISTING CONDITIONS

- **STUDY AREA:**

The location of this proposed 4923 Shipe Road Subdivision is shown on a map in Figure 1. This development will be located on the western side of Shipe Road, with a proposed entrance approximately 850 feet southeast of the t-intersection of Bud Hawkins Road in Northeast Knox County, TN. The entrance for the subdivision will be located 170 feet north of the existing residential driveway at 4923 Shipe Road. Figure 1 also shows the location of a separate adjacent proposed subdivision by KV Construction.

The 4923 Shipe Road Subdivision will be constructed from one existing parcel that currently contains a single-family detached residence and other structures. As requested, transportation impacts associated with the development were analyzed at the intersection of Shipe Road at the Proposed Shipe Road Entrance, where the development will have road access to and from external destinations. Due to the potential access point to Ellistown Road provided by an internal road connection to the proposed KV Construction Subdivision, the entrance intersection for this other proposed subdivision on Ellistown Road was also included in the study.

The proposed development property is in a fairly rural area, slowly transitioning to a more developed area. A few other residential subdivisions and many standalone houses are in the surrounding area. In addition to residential areas, large pockets of forest, undeveloped properties, farms, and a church and cemetery are nearby.

The 4923 Shipe Road Subdivision property is partially cleared. The southern portions of the property are forested, with the open areas mowed and maintained. A single-family detached house with several outbuildings, including sheds, barns, and a swimming pool, is located on the property. These structures will be removed during the construction of the subdivision. The residence currently has roadway access via a gravel driveway from the west to Shipe Road. The topography for the proposed subdivision property is mainly defined by rolling terrain with an unnamed tributary cutting through the middle of the property, flowing from west to east. The southern portion of the property begins a considerable climb to a large hill with a peak a bit further to the south of the development property.

Washington Pike provides the major road access in this area of Knox County, traversing between N Broadway (US 441) in Knoxville to the southwest and SR 61 near Blaine, TN, to the northeast.

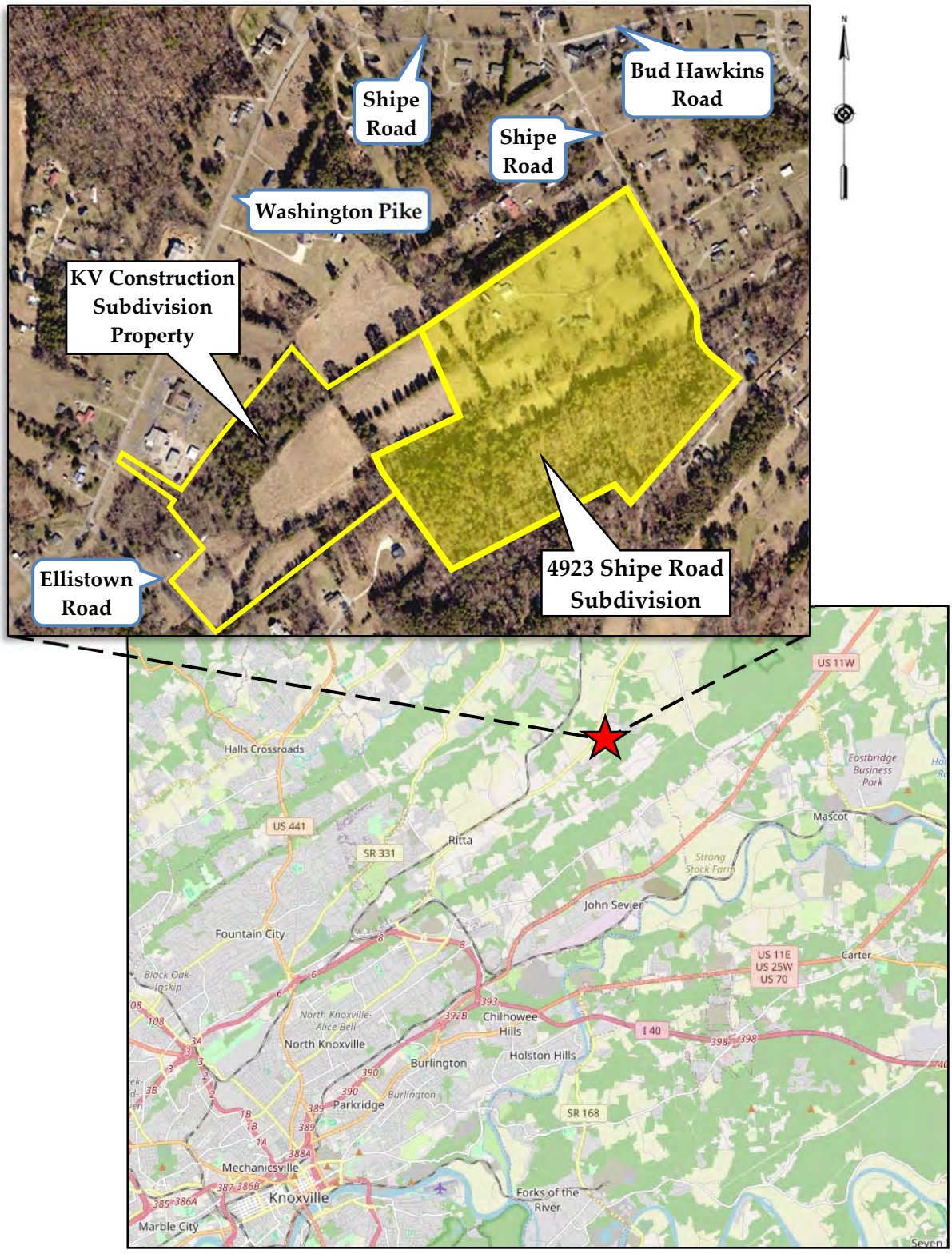


Figure 1
Location Map

- **EXISTING ROADWAYS:**

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

TABLE 1
STUDY CORRIDOR CHARACTERISTICS

NAME	CLASSIFICATION [1]	SPEED LIMIT	LANES	ROAD WIDTH [2]	TRANSIT [3]	PEDESTRIAN FACILITIES	BICYCLE FACILITIES
Shipe Road	Major Collector	30 mph	2 lanes undivided	17.75 - 20.5 feet	None	None	No bike lanes
Ellistown Road	Minor Collector	30 mph	2 lanes undivided	20 feet	None	None	No bike lanes

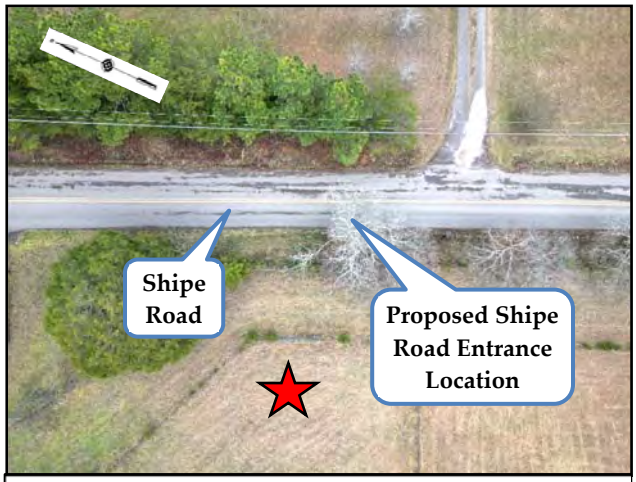
[1] 2018 Major Road Plan by Knoxville/Knox County Planning
[2] Edge of curb to edge of curb or edge of pavements near project site
[3] According to Knoxville Area Transit System Map

Shipe Road is a 2-lane undivided roadway classified as a major collector between Washington Pike and Rutledge Pike (US 11W/SR 1). Shipe Road begins at an unsignalized t-intersection with Washington Pike on its northwestern end, and it ends at an unsignalized t-intersection with Rutledge Pike (US 11W/SR 1) on its southeastern end. It traverses in a generally northwest-southeast direction with a total length of 3.0 miles. Shipe Road has a few sharp horizontal turns along its length and crosses Millertown Pike south of the development site. The posted speed limit on Shipe Road is 30 mph at the proposed development site. To the north of the development site, Shipe Road makes a sharp turn at Bud Hawkins Road. Near this intersection, a church and a private school are in the southeast corner. Flashing beacons are located on Shipe Road and Bud Hawkins Road in advance of this school, with a posted speed limit of 15 mph when flashing.

Shipe Road was measured every 100 feet with asphalt pavement widths between 17.7' and 20.5' between the proposed entrance location for the development and Bud Hawkins Road to the north. A double yellow centerline separates the two lanes on the roadway, but it does not have outside white edge lines. Unlined grass ditches and vegetation are on the side slopes immediately outside the pavement. Utility streetlights for roadway illumination are not provided on Shipe Road. Bike lanes and sidewalks are also not provided on the roadway.

Shipe Road along the development property has a straight horizontal road alignment. Shipe Road has relatively good pavement conditions and is very lightly traveled. Future residents of

the 4923 Shipe Road Subdivision will be provided access to Shipe Road via the new entrance intersection for travel to and from external destinations. However, if the proposed adjacent KV Construction Subdivision is constructed with an internal road connection between the two subdivisions, Ellistown Road is expected to be the primary roadway for travel to and from external destinations with less vehicular activity on Shipe Road.



Shipe Road at Proposed Shipe Road Entrance Location

Ellistown Road is a 2-lane minor collector street that traverses similarly to Shipe Road between Washington Pike and Rutledge Pike. However, Ellistown Road, unlike Shipe Road, continues past Rutledge Pike (US 11W/SR1). Past Rutledge Pike to the southeast, it ends abruptly at the Northeast Knox Utility District Water Treatment Plant entrance. Further south of the study area, Ellistown Road is classified as a major collector between Bud McMillan Road and Rutledge Pike.

Ellistown Road – South of Washington Pike (Looking North)

Ellistown Road has a posted speed limit of 30 mph. Ellistown Road has a measured asphalt width of 20 feet at the location of the proposed entrance for the KV Construction Subdivision. A double yellow centerline separates the two lanes with a few inches of additional pavement outside white edge lines. Unlined grass ditches and vegetation are on the side slopes immediately outside the pavement. Utility streetlights for roadway illumination are not provided on Ellistown Road. Bike lanes and sidewalks are also not provided on the roadway.

Figure 2 shows the traffic count locations for the study and the current traffic signage along Shipe Road, Ellistown Road, and Washington Pike in the study area. The traffic 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.

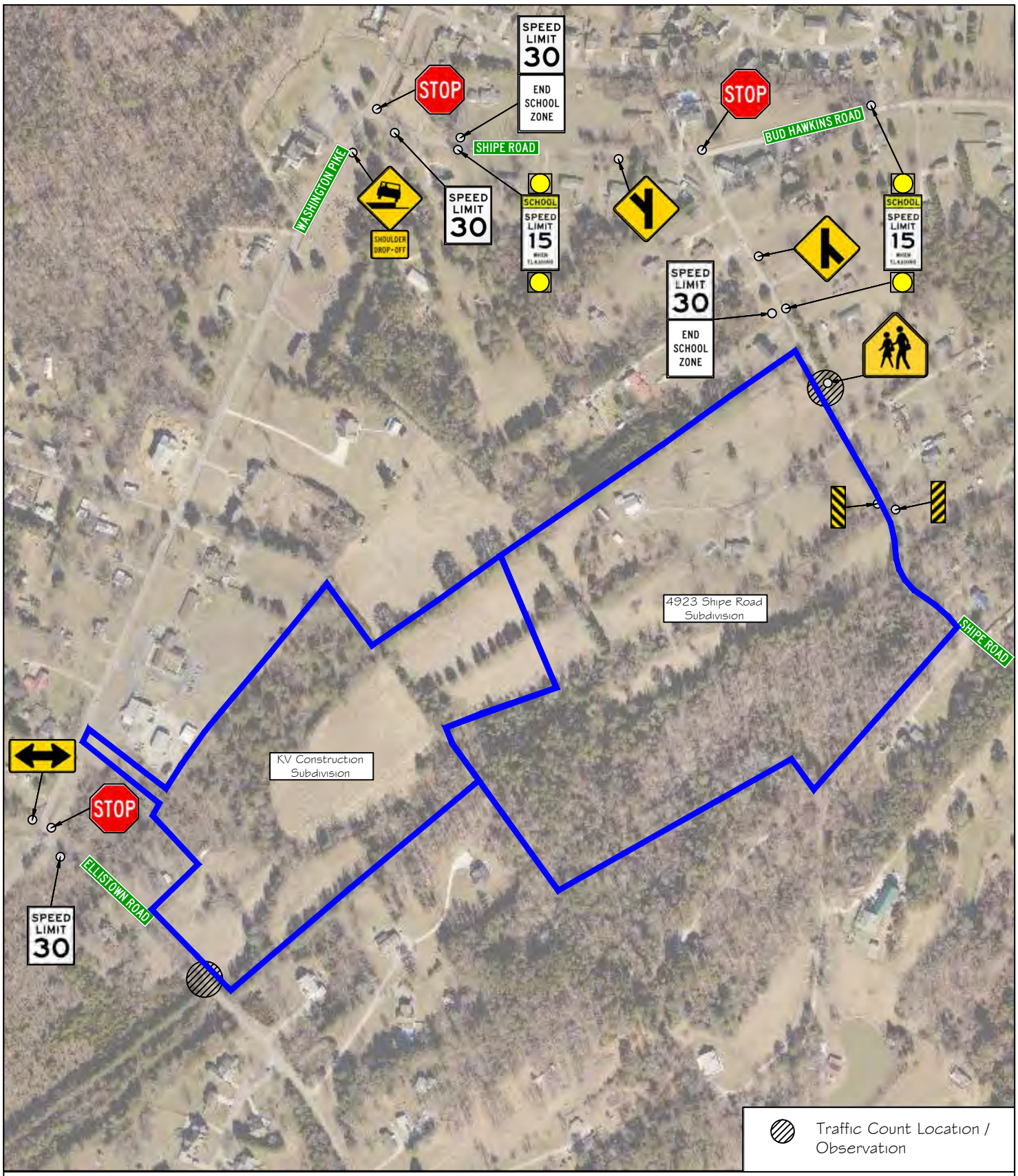


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FIGURE 2

4923 Shipe Road Subdivision

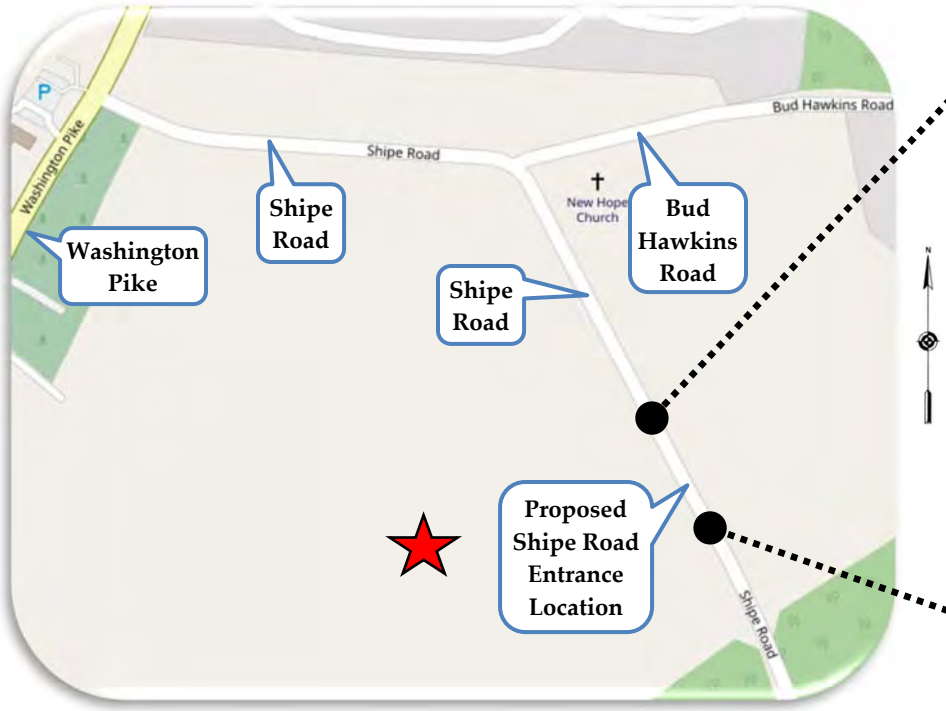
Traffic Count Locations & Traffic Signage

PHOTO EXHIBITS

Proposed Development Site

Aerial View of Proposed Development Site (Looking Southwest)

Aerial View of Proposed Development Site (Looking North)



Shipe Road

View of Shipe Road at Proposed Shipe Road Entrance Location (Looking Southeast)

View of Shipe Road at Proposed Shipe Road Entrance Location (Looking Northwest)

- **EXISTING TRANSPORTATION VOLUMES PER MODE**:

A few annual vehicular traffic count locations are located near the study area, and the Tennessee Department of Transportation (TDOT) and the Knoxville Transportation Planning Organization (TPO) conduct these counts. The TPO count has been conducted sporadically over the past 10 years. The count location data is the following and can be viewed with further details in Appendix A:

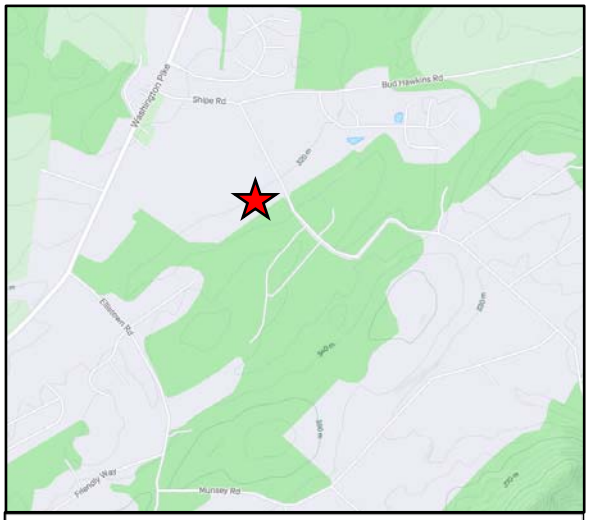
- Existing vehicular roadway traffic:
  The Tennessee Department of Transportation reported an Average Daily Traffic (ADT) for the following locations:
  - Washington Pike, north of the project site, at 3,697 vehicles per day in 2023. From 2013 – 2023, this count station has indicated a +0.7% average annual growth rate.
  - Ellistown Road, south of the development site and north of Millertown Pike, at 1,838 vehicles per day in 2023. From 2013 – 2023, this count station has indicated a +1.6% average annual growth rate.

  The Knoxville TPO reported an Average Daily Traffic (ADT) for the following location:
  - Shipe Road, south of the development and north of Millertown Pike, at 440 vehicles per day in 2023. From 2017 – 2023, this count station has indicated a -2.4% average annual growth rate.

- Existing bicycle and pedestrian volumes:
  The average daily pedestrian and bicycle traffic along Shipe Road and Ellistown Road is unknown. However, without sidewalks, these roadways are assumed to have minimal pedestrian and bicyclist activity. During the traffic counts for this project, no bicyclists or pedestrians were observed.

  An online website, strava.com, provides "heat" maps detailing 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 darker colors signifying higher activity. The Strava heat maps show no pedestrian activity near the development site. Surprisingly, however, a fair amount of bicycle activity is shown on Bud Hawkins Road

to the north, Shipe Road, and Munsey Road to the south. A minor amount of bicycle traffic is shown on Washington Pike.

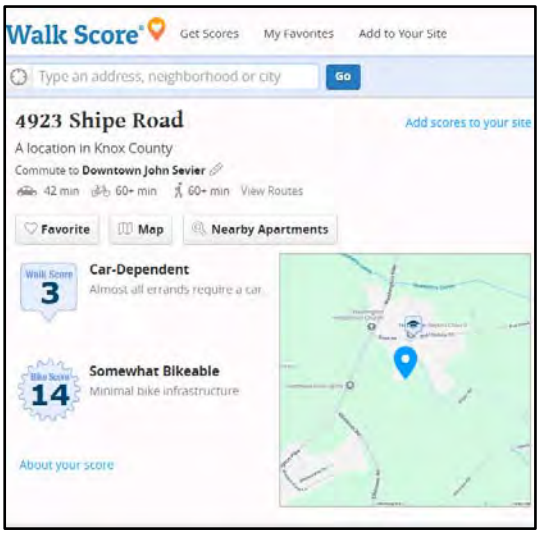


Strava Heat Map for Pedestrian and Joggers

Strava Heat Map for Bicyclists

- **WALK SCORE**:

A private company offers a website at 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.

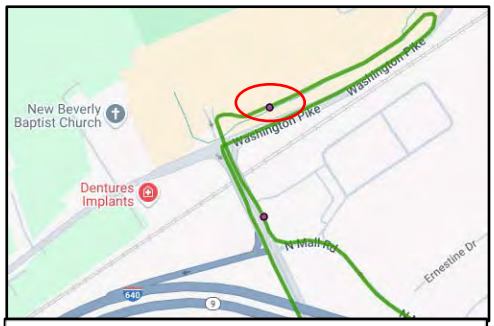


The project site location is graded with a Walk Score of 3 at the development property address. This Walk Score indicates that almost all errands currently require a vehicle for travel at the development property. The Walk Score is graded very low due to the lack of sidewalks and nearby amenities. The site is given a Bike Score of 14, which means there is minimal infrastructure. A Transit Score is not given since no public transportation opportunities are near the development site. Overall, this study assumed no vehicle trip reductions due to pedestrian or bicyclist activity by the future 4923 Shipe Road Subdivision residents (or KV Construction Subdivision residents).

- **TRANSIT SERVICES:**

The City of Knoxville has a network of public transit opportunities offered by Knoxville Area Transit (KAT). However, bus service is not available near the development site.

The closest public transit bus stop to the development site is 6.1 miles to the east on Route 23, "Millertown Pike". It is located on Washington Pike in front of the Target shopping center near Interstate 640. This route has established bus service every 30 minutes at this bus stop. It operates on weekdays and weekends. 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.



KAT Route 23, "Millertown Pike"

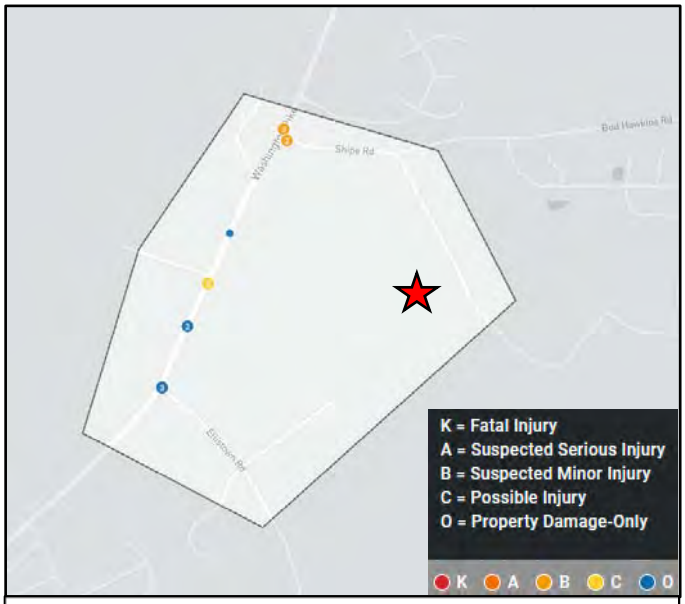
Since the distance to the nearest public bus service is several miles away, with no sidewalks or bike lanes available to access the bus stop without using a private vehicle, the proposed subdivisions are not expected to have any reduced vehicle trips due to public transit usage.

- **CRASH DATA**:

For this project, access to the AASHTOWare Safety online platform was provided. This AASHTO (American Association of State Highway and Transportation Officials) platform is a component of several offerings that include the compilation of crash data for local state DOTs to use in safety analyses. TDOT provides vehicle crash data to this system and is an extension of its existing E-TRIMS (Enhanced Tennessee Roadway Information Management System) database. The crash data in the E-TRIMS system is from the statewide TITAN (Tennessee Integrated Traffic Analysis Network) database. The TITAN database includes all reportable vehicle crash data from Tennessee law enforcement agencies.

In the vicinity of the proposed residential subdivisions, fourteen crashes occurred during the past 3 years between March 6th, 2022, and March 6th, 2025. All these crashes were collisions along Washington Pike, and 50% were with objects outside the roadway. The collisions outside of the roadway were with ditches (4), utility poles (2), and a culvert (1). Ten of the 14 crashes were property damage only, two had suspected minor injuries, and two involved possible injuries.

The other seven crashes that did not involve objects outside the roadway included six angle collisions and one side-swipe, opposite direction.



Screenshot of Crashes in Study Area from AASHTOWare Safety Platform

At the Washington Pike at Ellistown Road intersection, three of the 14 crashes occurred, and all were property damage only (PDO). One was a side-swipe, opposite direction crash, one was an angle crash, and the other was a collision with a ditch. At the Washington Pike at Shipe Road intersection, three of the 14 crashes occurred, with two suspected minor injuries and one possible injury. The crashes at this intersection included two angle crashes and a collision with a ditch.

The crash data along Washington Pike do not readily indicate potential issues with additional vehicles generated to and from the proposed residential subdivisions. However, the minor increase in vehicular trips at the intersections due to the proposed subdivisions would potentially increase the exposure of conflicting vehicles, but only slightly compared to the existing volumes. The information in the system was insufficient to determine the potential crash causes, but further research provided by the individual crash reports may provide better insight. With seven crashes occurring outside the roadway, the data indicates that vehicles on Washington Pike in the study area occasionally have issues maintaining control and staying on the roadway.

PROJECT DESCRIPTION

- **LOCATION AND SITE PLAN:**

The proposed plan layout with 86 single-family detached houses on 34.5 +/- acres is designed by LJA Engineering, Inc. and is shown in Figure 3. The design shows four new internal streets, with one on the western end of the property potentially having a future road connection to the proposed KV Construction Subdivision. As shown in the figure, the proposed entrance for the 4923 Shipe Road Subdivision will be constructed on the west side of Shipe Road.

View of Development Site at Shipe Road (Looking Southeast)

The 4923 Shipe Road Subdivision will have a large amount of open space and common areas for the residents. The common area will be nearly 14 acres of the 34.5 acre total. The developer is not proposing on-site amenities for the future subdivision residents other than providing open common areas. This subdivision does not propose internal sidewalks, but walking trails may be provided.

The houses in the subdivision will be on both sides of the unnamed tributary that splits the development site's property. The typical lot dimensions for the single-family detached houses in the subdivision will be 110 feet deep and 55 feet wide, providing an average single-family house lot area of 6,050 square feet. Each single-family house will have a garage and driveway.

The schedule for the completion of this new residential development depends on economic factors and construction timelines. This project is also contingent on permitting, design, and other regulatory approvals. Overall, the local real estate market for new housing remains quite competitive due to population growth and other factors. This study assumed that the total construction build-out of the 4923 Shipe Road Subdivision and full occupancy would occur by 2028. The proposed KV Construction Subdivision adjacent to the west was also assumed to occur by 2028.

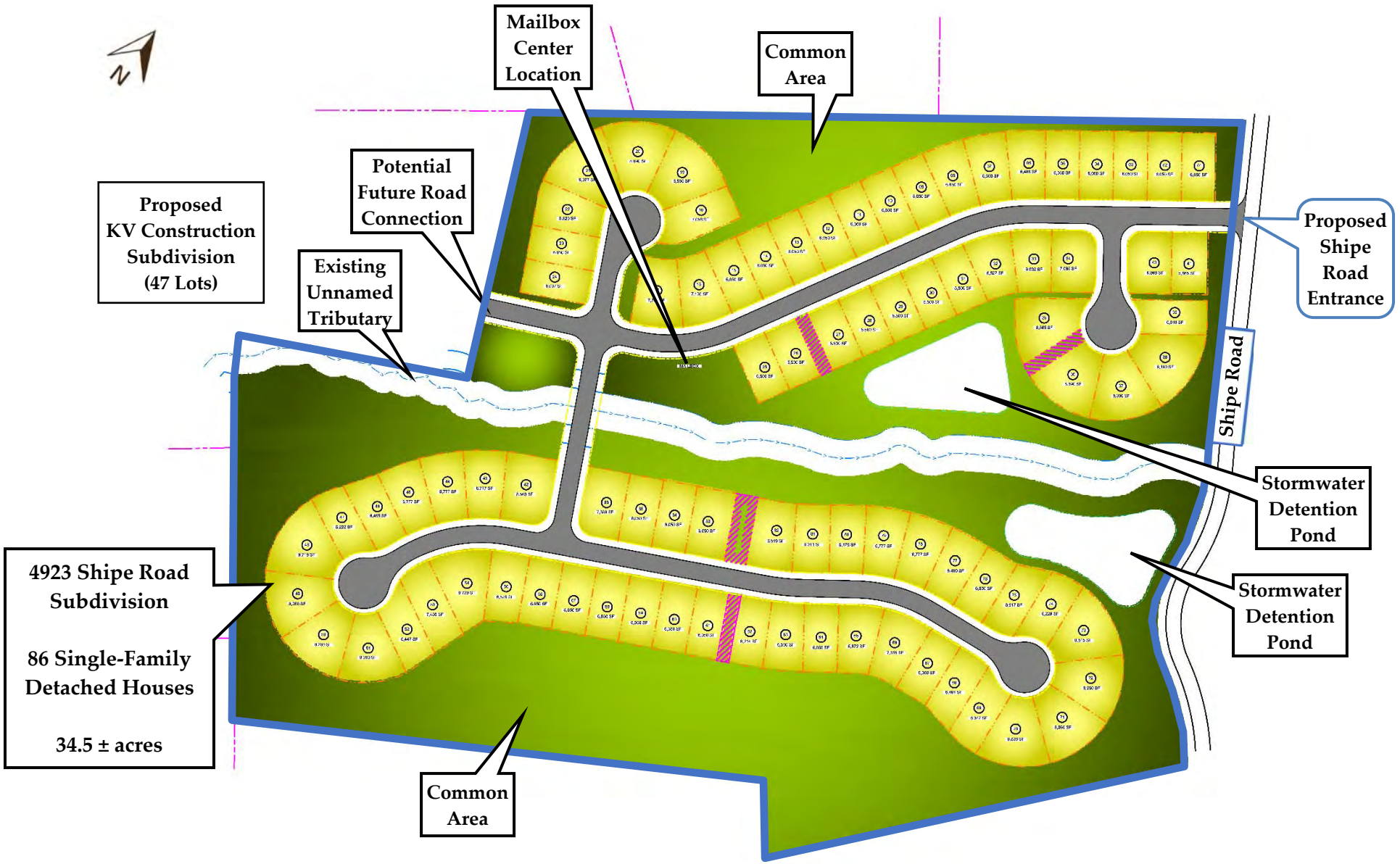


Figure 3
Proposed Plan Layout
4923 Shipe Road Subdivision

Not to Scale – Edited by Ajax Engineering for Display Purposes

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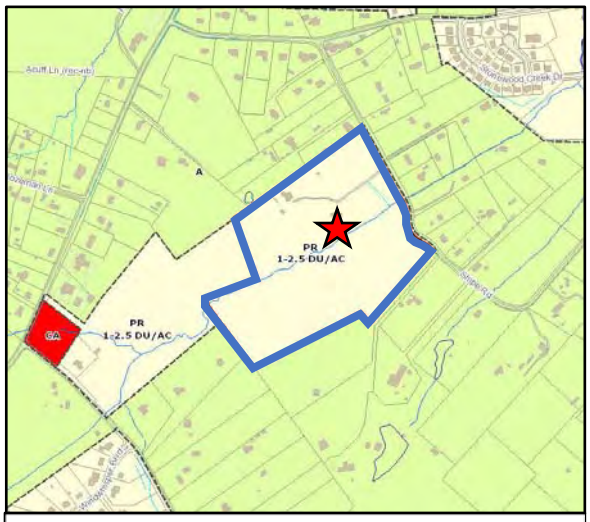
- **PROPOSED USES AND ZONING REQUIREMENTS:**

The 4923 Shipe Road Subdivision development parcel is in Knox County, TN. In 2005, this property was rezoned to Planned Residential (PR) with an allowable density of up to 2.5 units per acre. Uses permitted in the Planned Residential zone include single-family dwellings, duplexes, and multi-dwelling structures and developments. The most recently published online KGIS zoning map is provided in Appendix B and shown here. The existing adjacent surrounding zoning and land uses are the following:



KGIS Existing Zoning Map

- All the surrounding properties, except the one to the southwest, are zoned as Agricultural (A) and consist of single-family detached houses on large lots or undeveloped properties. All of these properties have external access via Shipe Road, Ellistown Road, or Washington Pike.
- The property to the southwest is zoned as Planned Residential (PR), with an allowable density of up to 2.5 units per acre. This property is currently undeveloped and has road access to Washington Pike to the north via a narrow strip of land and Ellistown Road to the west. This property has been proposed to be developed by KV Construction with 47 single-family detached lots on a parcel of 20.3 acres. A single entrance to Ellistown Road is proposed that will provide road access for this development and potentially a secondary entrance to Shipe Road if and when an internal road connector is constructed with the 4923 Shipe Road Subdivision.

- **ON-SITE CIRCULATION:**

The total length of the four internal roads in the 4923 Shipe Road Subdivision will be 3,119 feet (0.59 miles), designed and constructed to Knox County specifications. The development will have asphalt-paved internal roadways with extruded concrete curbs. The lane widths internally will be 13 feet each for a total 26-foot pavement width. No sidewalks are proposed on the internal roads in this development. The public right-of-way width within the development will be 50 feet, and the internal streets will be dedicated public roads. Knox County will maintain these streets in the development after construction.

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

Besides residential passenger vehicles, the internal roadways will provide service, delivery, maintenance, and fire protection/rescue vehicle access. These vehicle types will not impact roadway operations except when they occasionally enter and exit the development. Curbside private garbage collection services are expected to be available for this residential subdivision if desired. The new public streets will be designed and constructed to Knox County specifications and are expected to be adequate for fire protection and rescue vehicles, trash collection trucks, and single-unit delivery trucks. The development's internal drives will accommodate the larger vehicle types and residents' standard passenger vehicles and be sufficiently sized to allow vehicles to turn around within the proposed cul-de-sacs.

ANALYSIS OF EXISTING AND PROJECTED CONDITIONS

- **EXISTING TRAFFIC CONDITIONS:**

This study conducted 6-hour traffic counts for Shipe Road and Ellistown Road on Tuesday, December 17th, 2024. Local schools were in session. Manual traffic counts were conducted to identify and tabulate the morning and afternoon peak period volumes and the travel directions near the proposed development site. Shipe Road had an observed AM peak hour of 7:00 – 8:00 AM, and Ellistown Road had an observed AM peak hour of 7:15 – 8:15 AM. Both roadways had a PM peak hour from 3:45 – 4:45 PM. The manual tabulated traffic counts can be reviewed in Figure 4 and Appendix C. Some observations of the roadway travel include the following:

- No bicyclists or pedestrians were observed during either road's morning or afternoon traffic counts.
- Most vehicles were passenger cars during the traffic count. However, school buses were observed on both Shipe Road and Ellistown Road.
- Fairly even northbound and southbound thru traffic on Shipe Road was observed during the AM and PM peak hours. This section of Shipe Road is lightly traveled.
- On Ellistown Road, a 60/40 split was observed in the AM peak hour, with 60% heading south and 40% heading north. The pattern was reversed in the PM peak hour, with 55% heading northbound and 45% southbound. Overall, a fair amount of vehicular traffic on Ellistown Road is suspected to be "cut-thru" traffic between Washington Pike on the north and Millertown Pike and Rutledge Pike to the south.

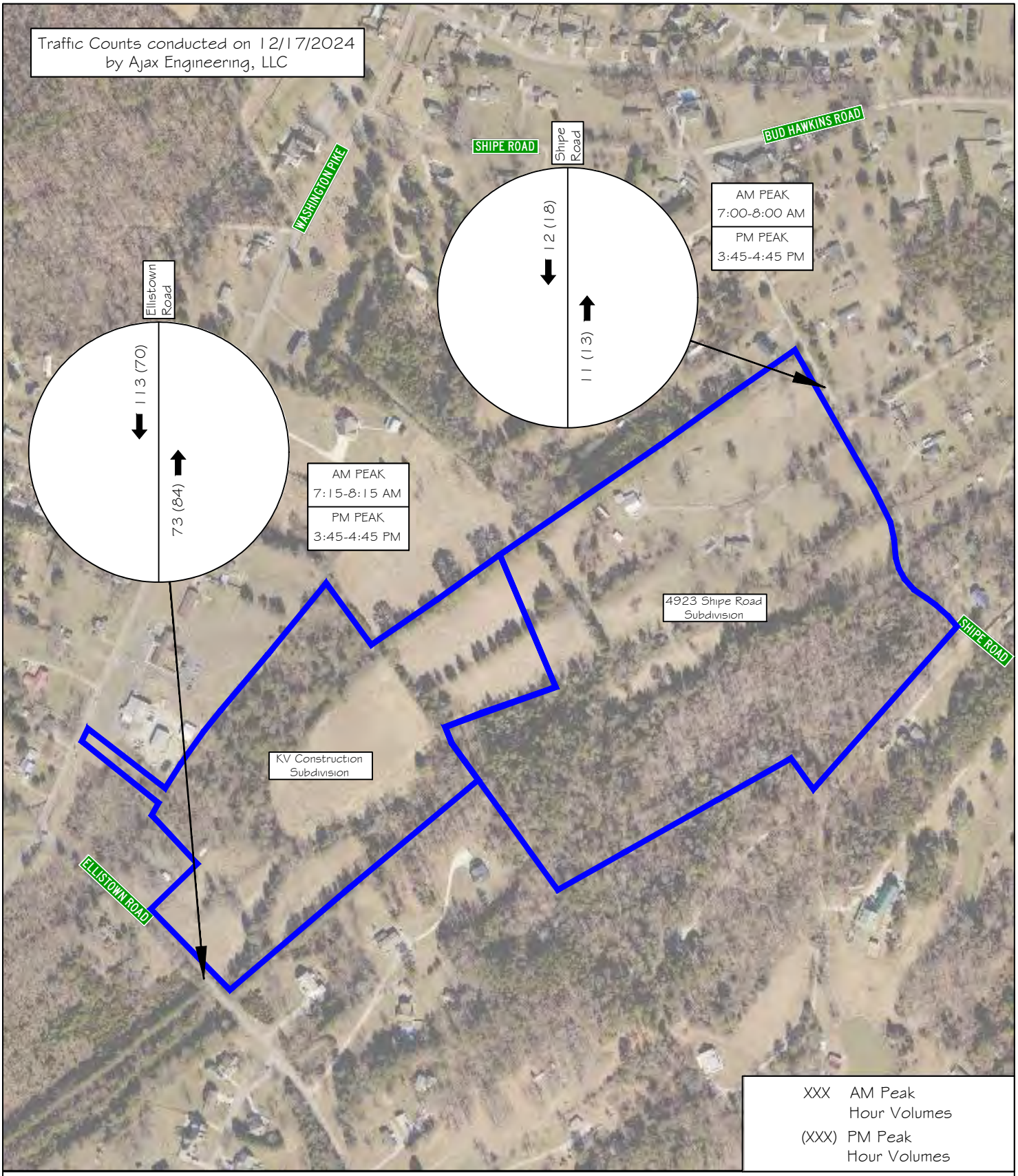


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FIGURE 4

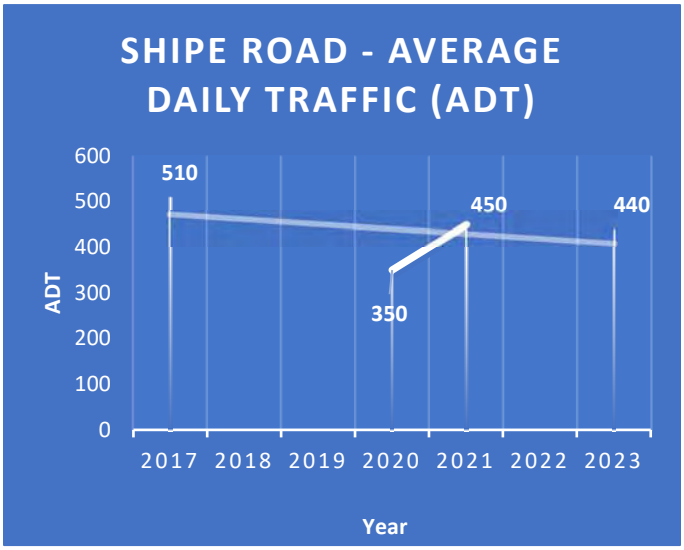
4923 Shipe Road Subdivision

2024 Peak Hour Traffic Volumes - EXISTING TRAFFIC CONDITIONS

- **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). This proposed development's build-out and full occupancy are assumed to occur by 2028. For this study, the same year was assumed for the proposed adjacent KV Construction Subdivision.

According to the nearby count stations, vehicular traffic has been relatively flat to negative over the past few years. Specifically, while sporadically collected, the TPO data shown in Appendix A indicates that Shipe Road has experienced a negative annual growth of -2.4% over the past six years, from 2017 to 2023. The TDOT traffic count data has shown +0.7% growth over 10 years on Washington Pike and +1.6% on Ellistown Road.



Nonetheless, this study used an annual growth rate of +2% to calculate future growth on Shipe Road and Ellistown Road up to 2028 to provide a conservative result. The annual growth rate of 2% was applied to the existing 2024 thru volumes tabulated on the roadways to estimate the future volumes in the horizon year of 2028 without the proposed development traffic.

Figure 5 shows the projected horizon year traffic volumes without either proposed residential subdivision development between Shipe Road or Ellistown Road during the 2028 AM and PM peak hours.

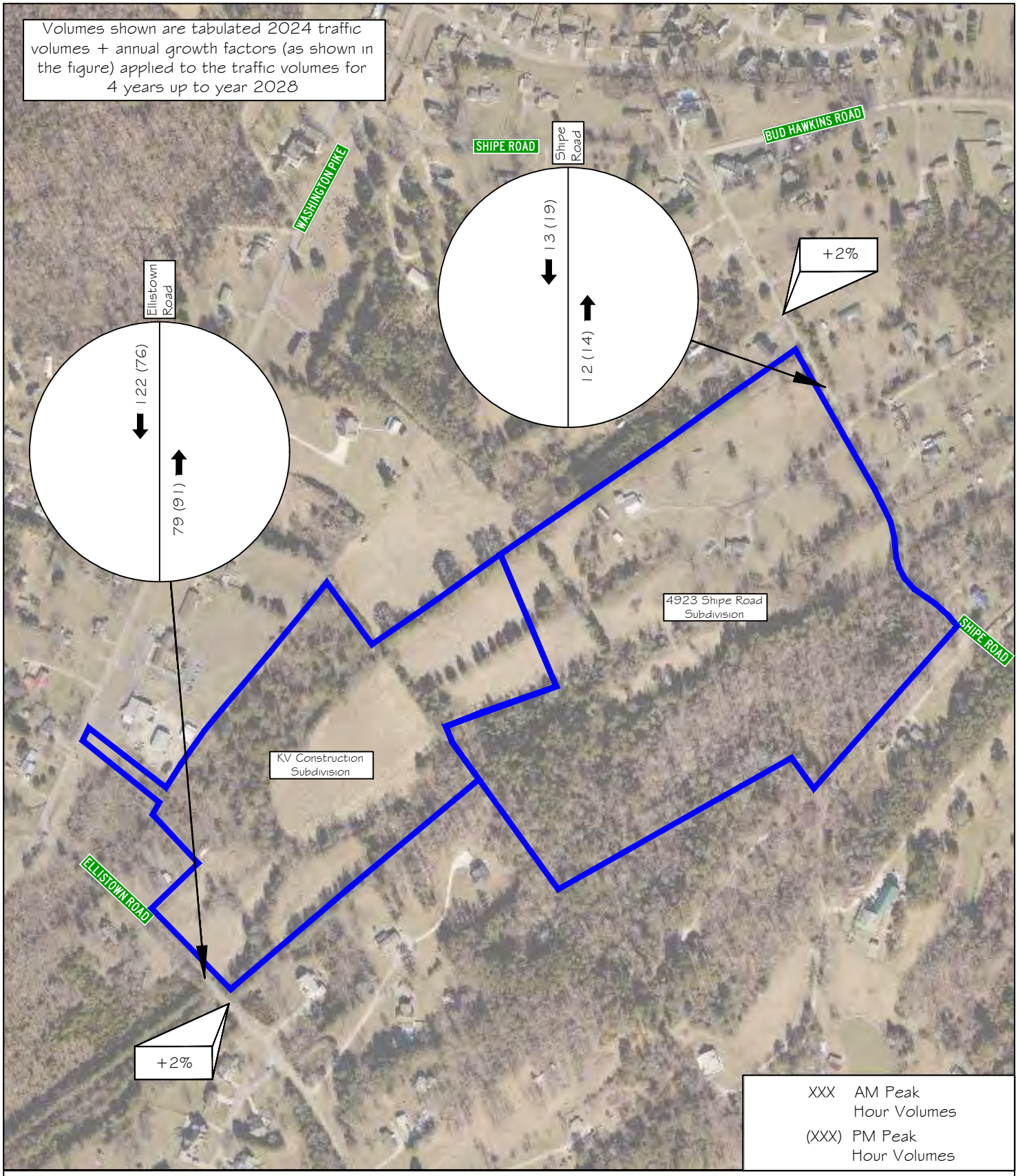


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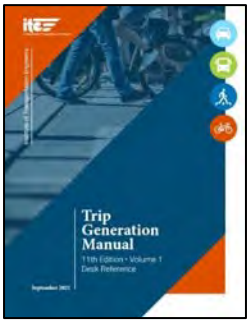
FIGURE 5

4923 Shipe Road Subdivision

2028 Peak Hour Traffic Volumes - PROJECTED TRAFFIC CONDITIONS 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 the proposed 86 single-family detached houses in the 4923 Shipe Road subdivision will generate was calculated based on rates and equations provided by the Trip Generation Manual, 11th Edition, an Institute of Transportation Engineers (ITE) publication. The Trip Generation Manual is the traditional and most popular resource for determining trip generation rates when transportation impact studies are produced. The data and calculations from ITE for the proposed land use are shown in Appendix D. A summary of this information is presented in the following table:

TABLE 2a
TRIP GENERATION FOR 4923 SHIPE ROAD SUBDIVISION
86 Single-Family Detached Houses

ITE LAND USE CODE	LAND USE DESCRIPTION	# OF 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	86	878	26%	74%		63%	37%	
				17	48	65	54	32	86
Total New Volume Site Trips			**878**	**17**	**48**	**65**	**54**	**32**	**86**

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

For the proposed 4923 Shipe Road Subdivision, it is estimated that 17 vehicles will enter and 48 will exit, for a total of 65 generated trips during the AM peak hour in the year 2028. Similarly, it is estimated that 54 vehicles will enter and 32 will exit, for a total of 86 generated trips during the PM peak hour in the year 2028. The calculated trips generated for an average weekday are estimated to be 878 vehicles for the proposed development. No vehicle trip reductions were included in the calculations or analysis.

Furthermore, the proposed adjacent KV Construction Subdivision was included in the analysis due to the potential internal road connection between the two subdivisions providing entrances on Shipe Road and Ellistown Road.

The KV Construction Subdivision will include 46 single-family detached houses and is also assumed to be constructed and fully occupied by 2028. Trips generated by this adjacent development were calculated and are shown in Table 2b with calculations provided in Appendix D.

TABLE 2b
TRIP GENERATION FOR KV CONSTRUCTION SUBDIVISION
47 Single-Family Detached Houses

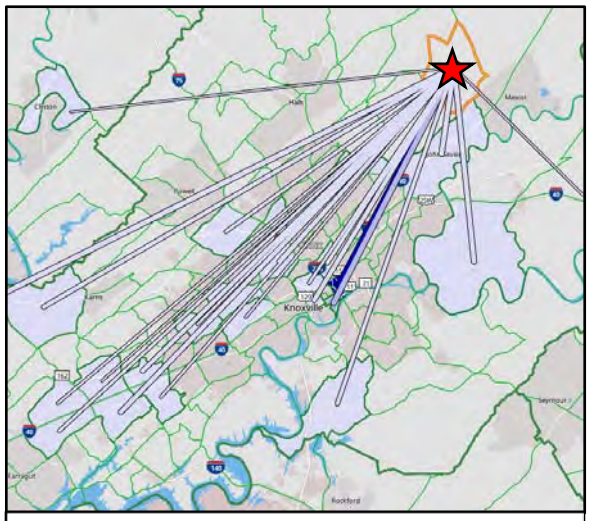
ITE LAND USE CODE	LAND USE DESCRIPTION	# OF UNITS	GENERATED DAILY TRAFFIC	GENERATED TRAFFIC AM PEAK HOUR			GENERATED TRAFFIC PM PEAK HOUR		
				ENTER	EXIT	TOTAL	ENTER	EXIT	TOTAL
#210	Single-Family Detached Housing	47	504	26%	74%		63%	37%	
				10	27	37	31	18	49
Total New Volume Site Trips			**504**	**10**	**27**	**37**	**31**	**18**	**49**

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

Thus, the total new generated trips by both subdivisions are calculated to be 27 entering and 75 exiting vehicles in the 2028 AM peak hour and 85 entering and 50 exiting vehicles in the 2028 PM peak hour.

- **TRIP DISTRIBUTION AND ASSIGNMENT:**

The projected trip distribution and assignment for the 4923 Shipe Road Subdivision (and the KV Construction Subdivision) are based on several sources and engineering judgment. The first source is based on the existing traffic count volumes and the observed travel directions collected on Shipe Road and Ellistown Road.



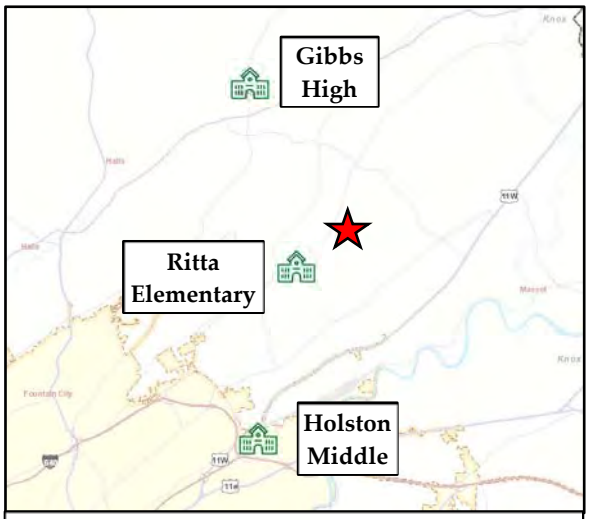
Top 25 Locations of 2022 Census Bureau Work-Based Trips to & from Census Tract 52.04

The second source for determining the projected trip distribution is based on work-related trips in the local area. Work-based trips will be a significant impetus for trips generated by the development, and these trips are more likely to travel to and from the southwest. This assertion is based on data from the United States Bureau website for Census Tract 52.04, where the proposed subdivision properties are located. Based on 2022 (latest available) census data and as presented in Appendix E, most work-based trips in the surrounding area correspond to downtown Knoxville, the University of Tennessee, areas of West Knoxville, and Oak Ridge, TN. Some of the work-based trips also correspond to the Forks of the River Industrial Park, Alcoa, and Maryville, TN areas. With a provided internal road connection between the two proposed subdivisions, most of these work-based locations are expected to generate more traffic via the Proposed Ellistown Road Entrance to and from the southwest via Washington Pike, Millertown Pike, and Rutledge Pike, much more so than the Proposed Shipe Road Entrance.

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. Both proposed subdivision properties are currently zoned for Ritta Elementary, Holston Middle, and Gibbs High School. The zoned public schools for these development properties are located north, south, and southwest of the development site. The zoned schools are between 3.5 and 8.4 miles from the proposed subdivisions by roadway. Using online route mapping software, the shortest and quickest routes from the proposed subdivisions to and from these schools will be made by mainly utilizing Washington Pike and Ellistown Road. The furthest school, Holston Middle School, is located 8.4 miles to the south, and the closest school, Ritta Elementary, is 3.5 miles directly to the

southwest on Washington Pike. Gibbs High School is 6.3 miles to the north.

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 where the students' parcel is accessed to the point where the buses unload at the school. These developments will be outside the PRZ for all the zoned schools, and all school-age children attending public schools in the proposed residential subdivisions will be able to utilize this service if desired.



Zoned Public School Locations

Based on all these factors, Figure 6a shows the projected distribution of traffic entering and exiting the proposed residential subdivisions at the Proposed Shipe Road Entrance and the Proposed Ellistown Road Entrance. Figure 6b shows the projected distribution if the adjacent KV Construction Subdivision does not come to fruition and all generated trips to and from the 4923 Shipe Road Subdivision have singular access to Shipe Road.

With both entrances provided, Shipe Road is expected to experience much less generated traffic than the Ellistown Road access point. However, if the KV Construction Subdivision is not built, it is expected that the generated traffic on Shipe Road will travel more frequently to and from Washington Pike versus towards the south on Shipe Road due to quicker travel provided by Washington Pike.

Figure 7a shows the traffic assignment of the computed trips generated by the 4923 Shipe Road Subdivision and KV Construction Subdivision based on the assumed distribution of trips shown in Figure 6a. Figure 7b shows the projected assignment if the adjacent KV Construction Subdivision does not come to fruition and all generated trips to and from the 4923 Shipe Road Subdivision have singular access to Shipe Road with the assumed distribution of trips shown in Figure 6b.

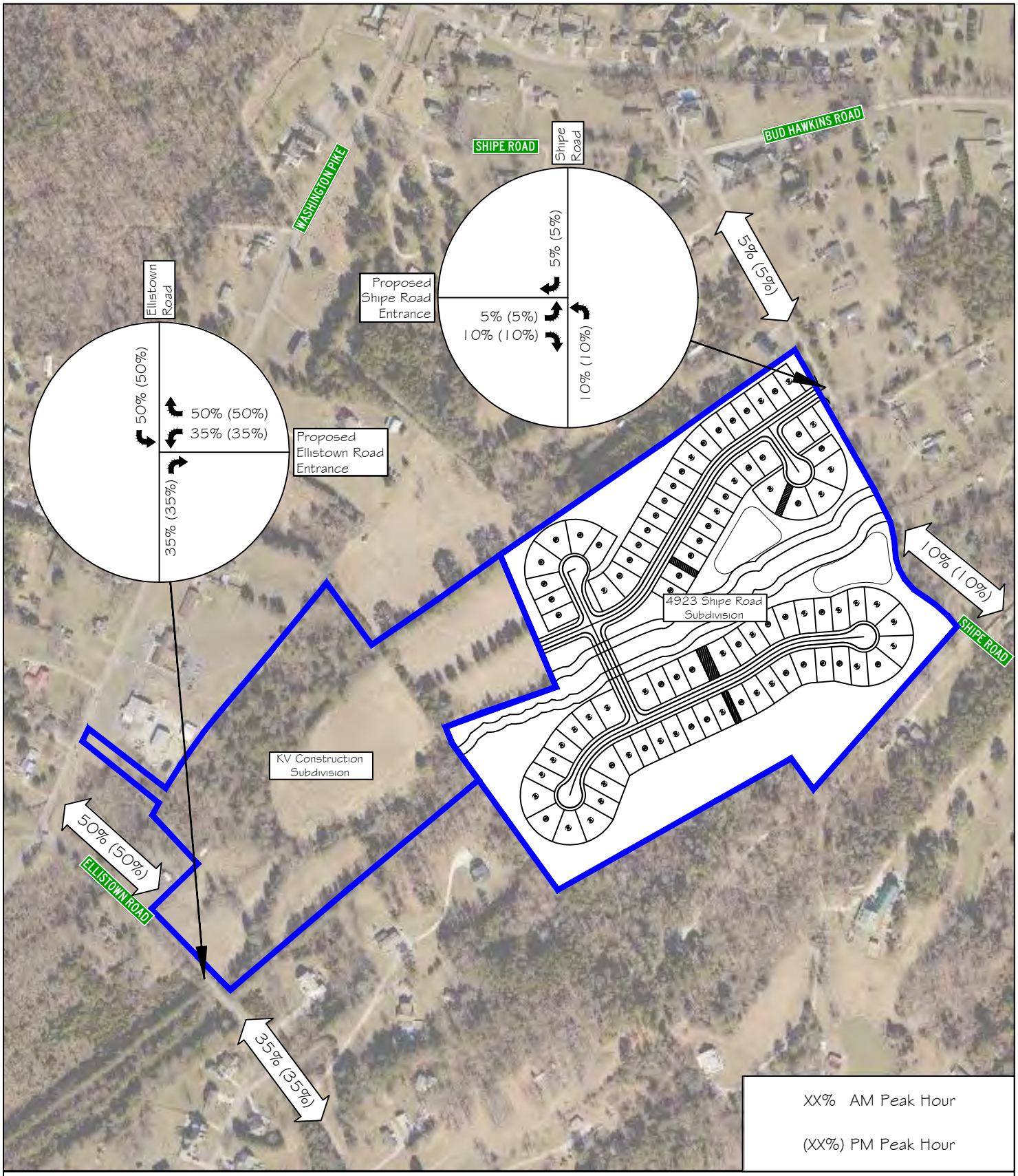


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FIGURE 6a

4923 Shipe Road Subdivision

Directional Distribution of Generated Traffic during AM and PM Peak Hour

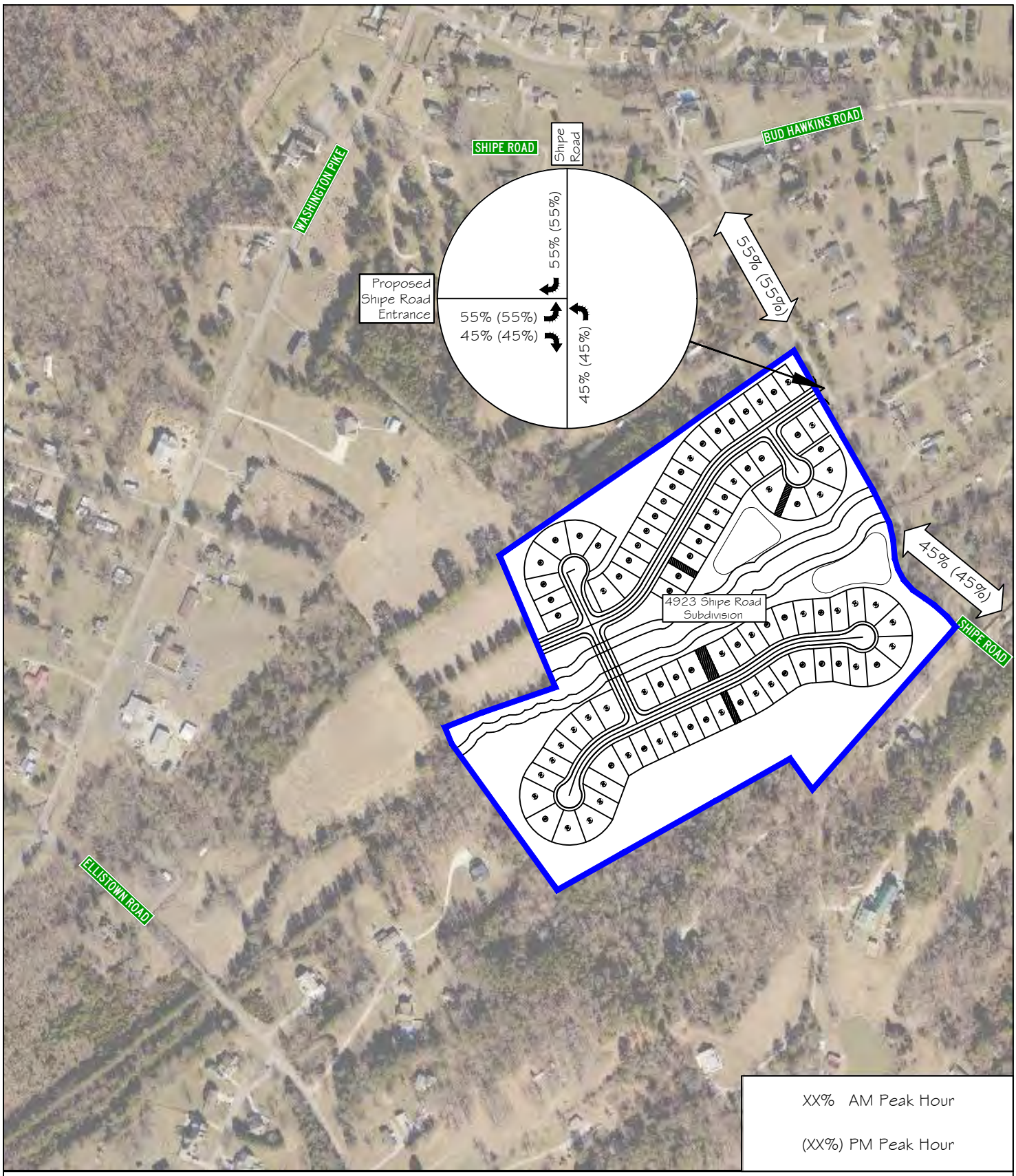

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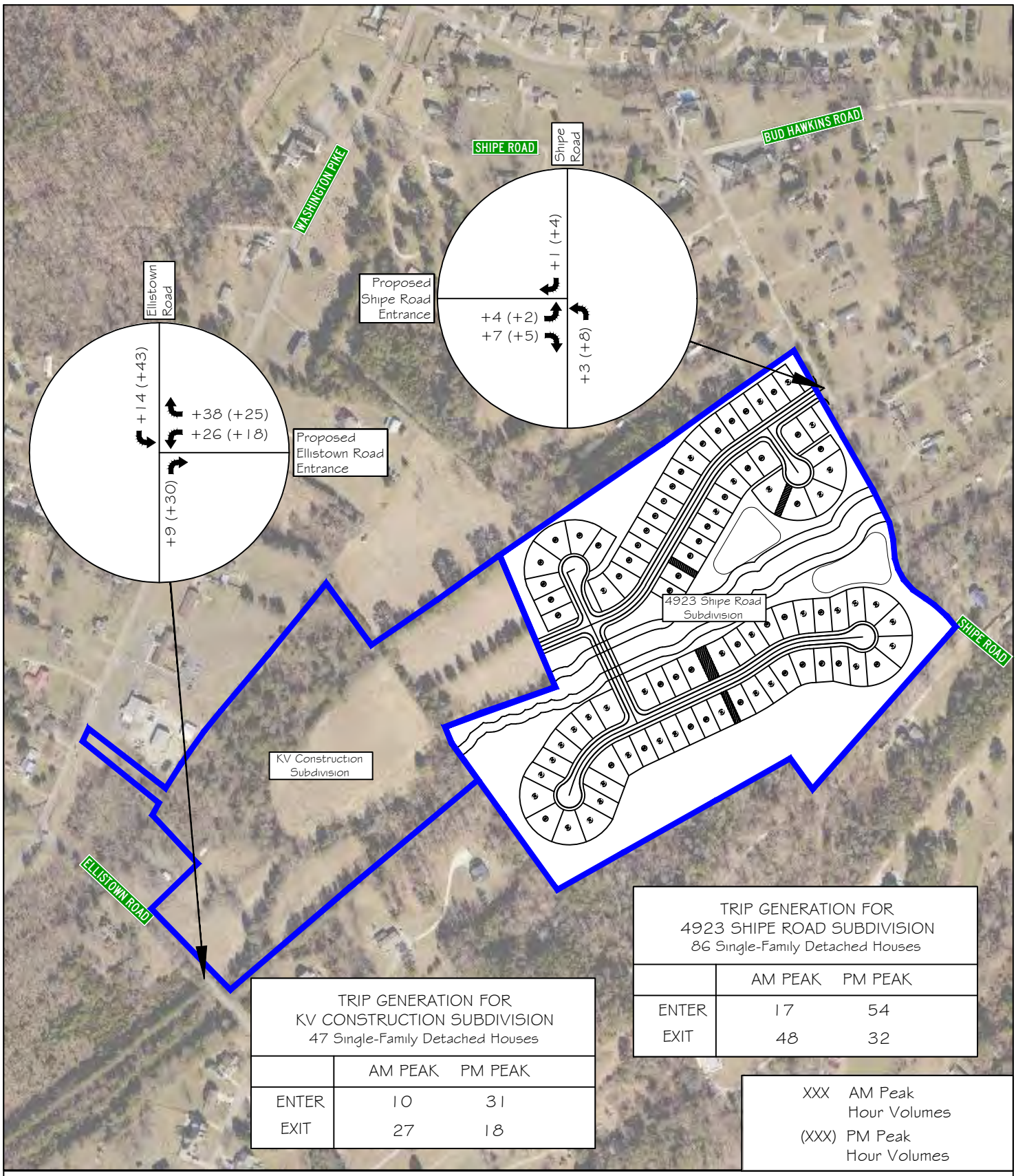
FIGURE 6b

4923 Shipe Road Subdivision

Directional Distribution of Generated Traffic during AM and PM Peak Hour (Without KV Construction Subdivision)



TRIP GENERATION FOR
KV CONSTRUCTION SUBDIVISION
47 Single-Family Detached Houses

	AM PEAK	PM PEAK
ENTER	10	31
EXIT	27	18

TRIP GENERATION FOR
4923 SHIPE ROAD SUBDIVISION
86 Single-Family Detached Houses

	AM PEAK	PM PEAK
ENTER	17	54
EXIT	48	32

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

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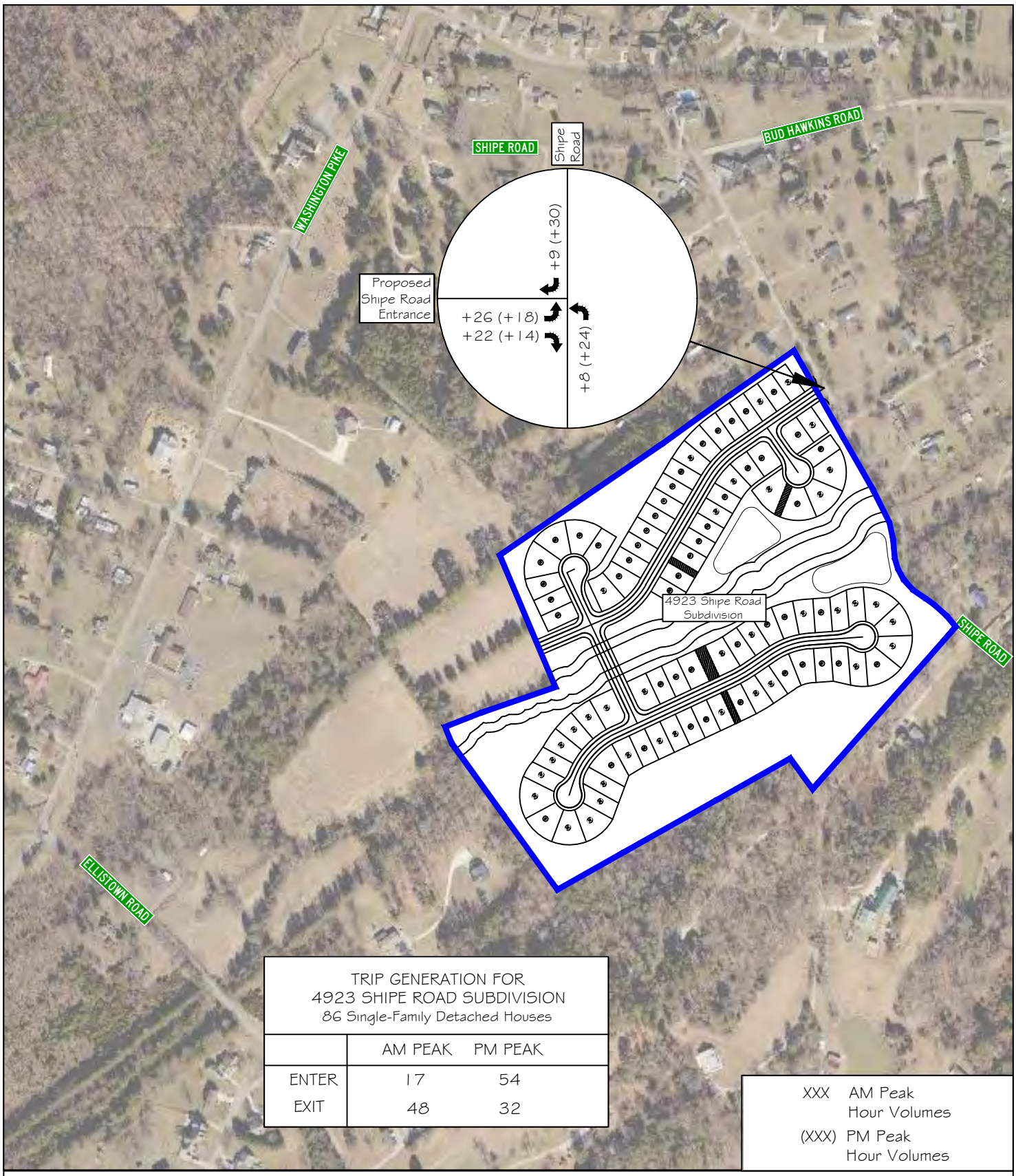
FIGURE 7a

4923 Shipe Road Subdivision

Traffic Assignment of Generated Trips during AM and PM Peak Hour



TRIP GENERATION FOR 4923 SHIPE ROAD SUBDIVISION 86 Single-Family Detached Houses		
	AM PEAK	PM PEAK
ENTER	17	54
EXIT	48	32

XXX AM Peak Hour Volumes

(XXX) PM Peak Hour Volumes

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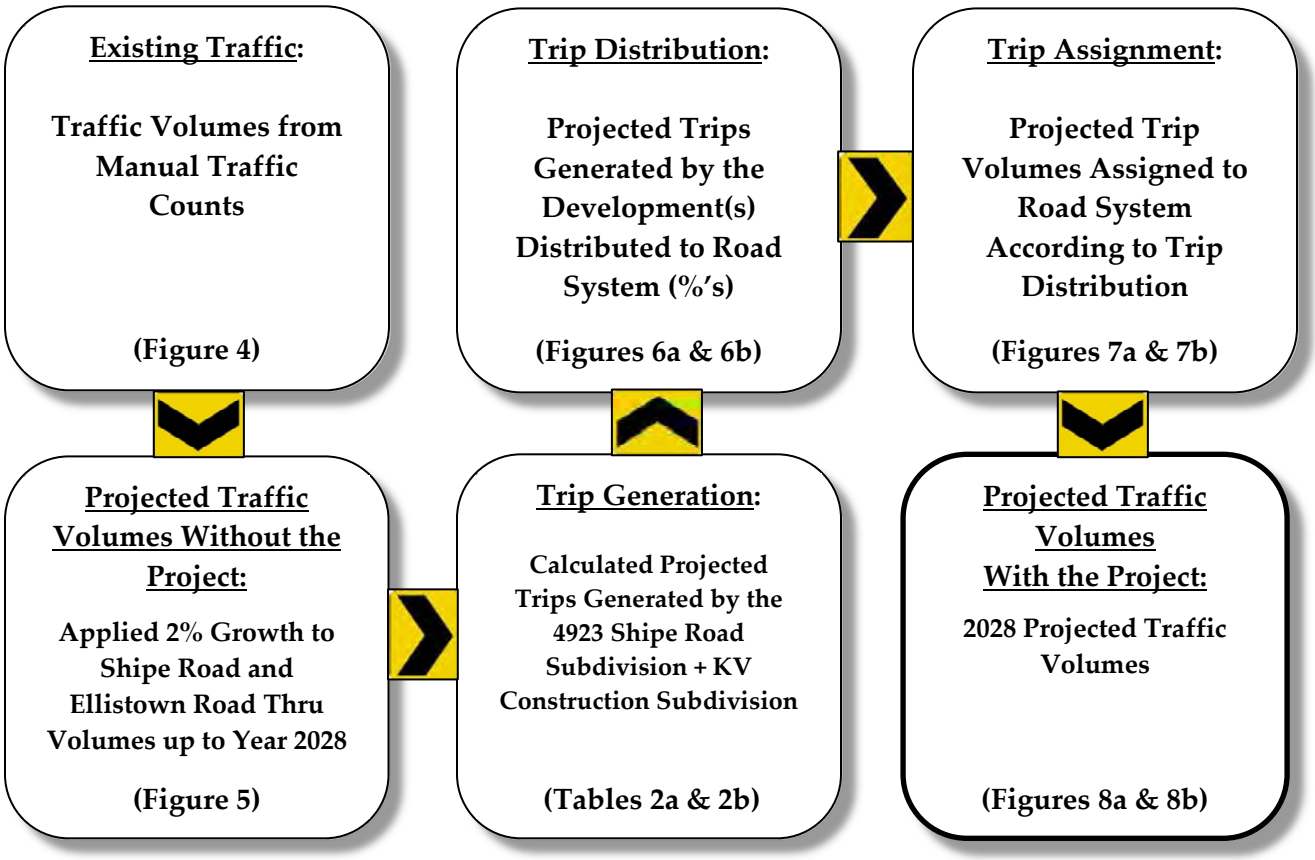
FIGURE 7b

4923 Shipe Road Subdivision

Traffic Assignment of Generated Trips during AM and PM Peak Hour (Without KV Construction Subdivision)

- **PROJECTED TRAFFIC CONDITIONS WITH THE PROJECT:**

Several additive steps were taken to estimate the total projected traffic volumes at the proposed entrance intersections on Shipe Road and Ellistown Road when the 4923 Shipe Road Subdivision and the KV Construction Subdivision are both constructed and fully occupied in 2028. The study also included the scenario with the KV Construction Subdivision not being built and all the trips for the 4923 Shipe Road Subdivision using Shipe Road exclusively. The steps are illustrated below for clarity and review:



The calculated peak hour traffic generated by the 4923 Shipe Road Subdivision and KV Construction Subdivision was added to the 2028 horizon year traffic by following the predicted trip distributions and assignments. This procedure was completed to obtain the total projected traffic volumes at the entrance intersections. Figures 8a and 8b show the projected volumes at the studied intersections in 2028. Figure 8a is for the scenario if both subdivisions are constructed and connected. Figure 8b shows the result if the KV Construction Subdivision is not built and all 4923 Shipe Road Subdivision trips use the Proposed Shipe Road Entrance exclusively.

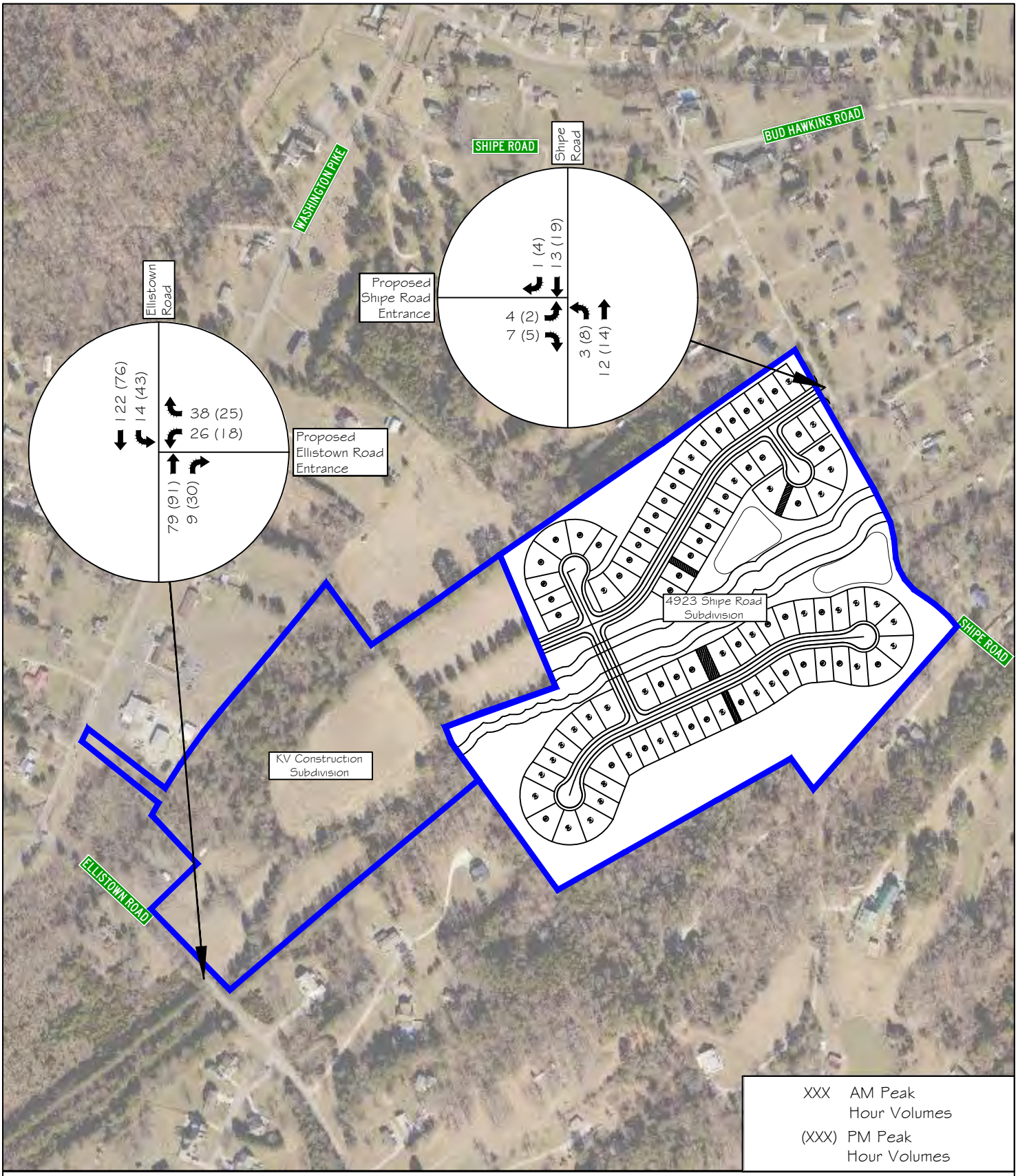


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FIGURE 8a

4923 Shipe Road Subdivision

2028 Peak Hour Traffic Volumes - PROJECTED TRAFFIC CONDITIONS WITH THE PROJECT

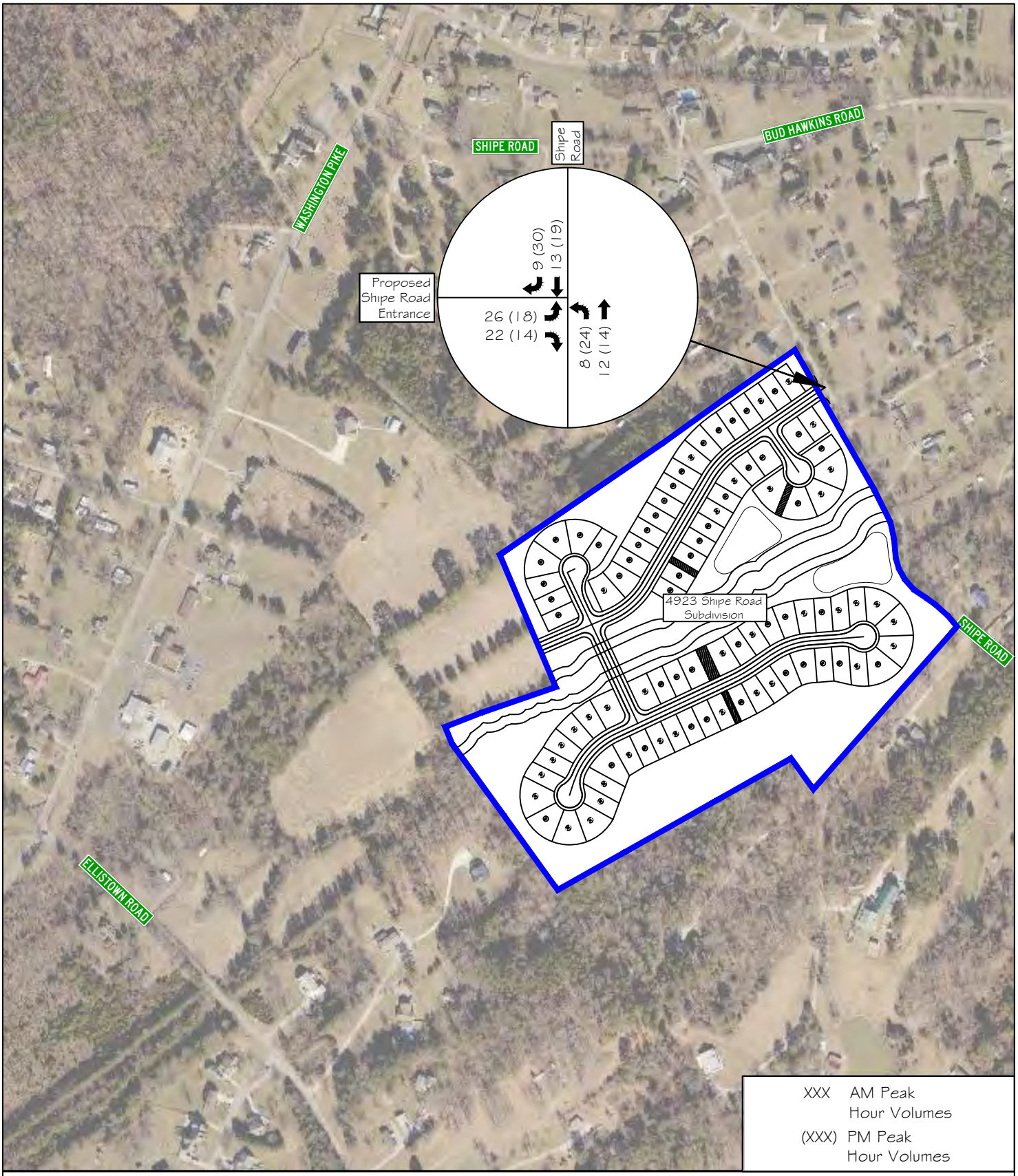

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FIGURE 8b

4923 Shipe Road Subdivision

2028 Peak Hour Traffic Volumes - PROJECTED TRAFFIC CONDITIONS WITH THE PROJECT (Without KV Construction Subdivision)

Capacity analyses were undertaken to determine the Level of Service (LOS) for the projected 2028 entrance intersection traffic volumes shown in Figures 8a and 8b. The capacity analyses were calculated following the Highway Capacity Manual (HCM) methods and utilizing Synchro Traffic Software (Version 12).

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 the 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, representing 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' 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.

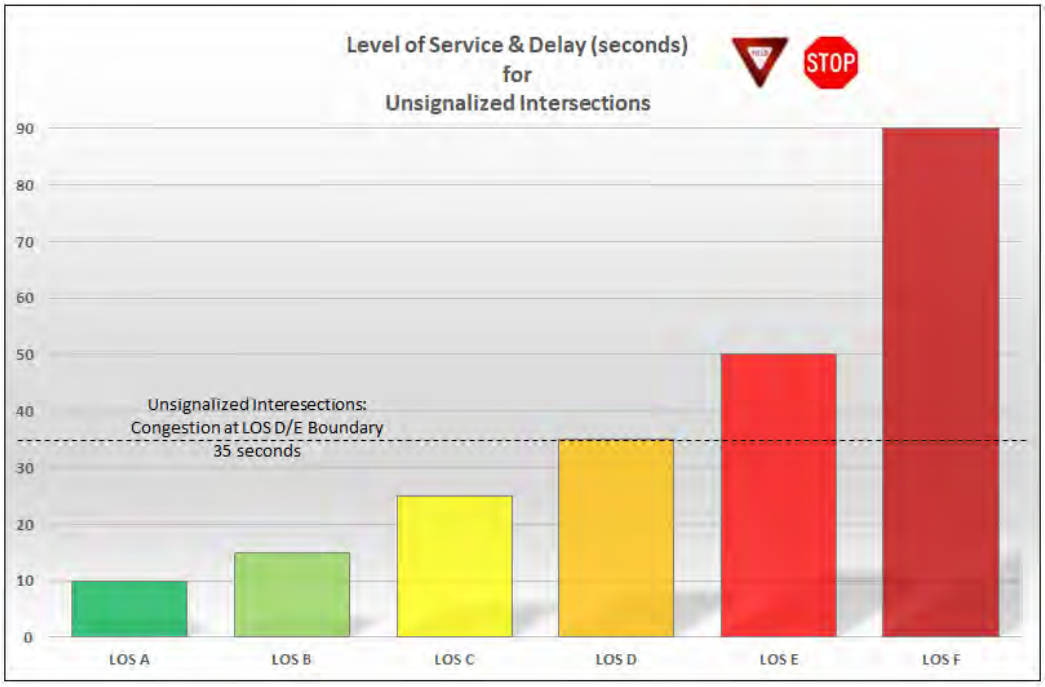
For unsignalized intersections, LOS is measured in terms of delay (in seconds). This measure attempts to quantify delay, including travel time, driver discomfort, and fuel consumption. For unsignalized intersections, the analysis assumes that the mainline thru and right-turn traffic does not stop and 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 3 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. 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.

TABLE 3
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, 7th Edition



Intersection capacity results from the projected 2028 peak hour traffic are shown in Tables 4a and 4b. Table 4a shows the results with both entrances constructed with an internal road connection between the 4923 Shipe Road Subdivision and the KV Construction Subdivision. Table 4b shows the result if the KV Construction Subdivision is not built. The intersections in the table are 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 projected 2028 peak hour capacity analyses.

As shown in the tables, the entrance intersections are projected to operate with excellent LOS and very low vehicle delays in the AM and PM peak hours in either scenario.

TABLE 4a
2028 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
Ellistown Road (SB & NB) at Proposed Ellistown Road Entrance (WB)	STOP Unsignalized	Westbound Left/Right	A	9.6	0.082	A	9.7	0.058
		Southbound Left	A	7.4	0.010	A	7.5	0.032
Shipe Road (SB & NB) at Proposed Shipe Road Entrance (EB)	STOP Unsignalized	Northbound Left	A	7.2	0.002	A	7.3	0.005
		Eastbound Left/Right	A	8.6	0.012	A	8.6	0.008

Note: All analyses were calculated in Synchro 12 software and reported using 7th Edition intersection methodology
[a] Level of Service , [b] Average Delay (sec/vehicle) , [c] Volume-to-Capacity Ratio

TABLE 4b
2028 INTERSECTION CAPACITY ANALYSIS RESULTS -
PROJECTED TRAFFIC CONDITIONS WITH THE PROJECT (WITHOUT KV CONSTRUCTION SUBDIVISION)

INTERSECTION	TRAFFIC CONTROL	APPROACH/ MOVEMENT	AM PEAK			PM PEAK		
			LOS	DELAY (seconds)	V/C	LOS	DELAY (seconds)	V/C
Shipe Road (SB & NB) at Proposed Shipe Road Entrance (EB)	STOP Unsignalized	Northbound Left	A	7.3	0.005	A	7.4	0.017
		Eastbound Left/Right	A	8.8	0.053	A	9.0	0.037

Note: All analyses were calculated in Synchro 12 software and reported using 7th Edition intersection methodology
[a] Level of Service , [b] Average Delay (sec/vehicle) , [c] Volume-to-Capacity Ratio

- **POTENTIAL TRANSPORTATION SAFETY ISSUES:**

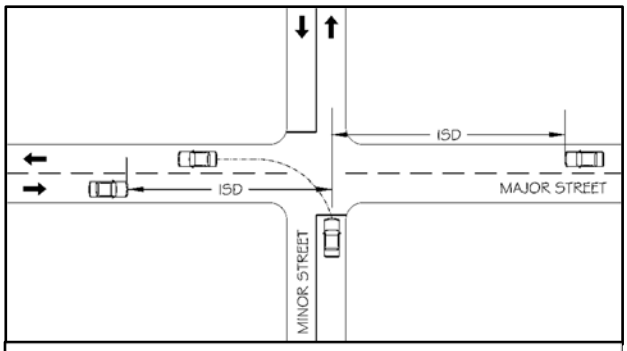
The study area was investigated for potential existing and future safety issues when the development is constructed. These transportation features are discussed in the following pages.

- **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 the required visibility distance standard for evaluating the safety of an intersection per section 3.04.J.5 in the Knoxville-Knox County Subdivision Regulations. 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.



Intersection Sight Distance Diagram

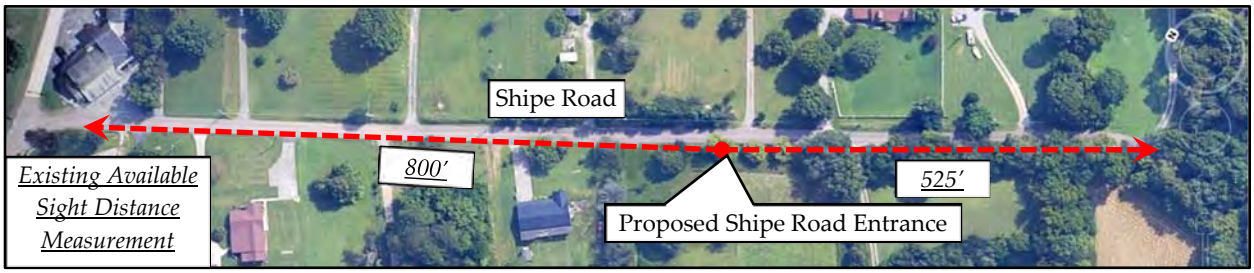
Three traffic maneuvers are available for vehicles stopped on a minor street at a 4-way intersection: (1) left-turn, (2) right-turn, (3) or a crossing maneuver across the major street. For turns from the minor street, ISD is needed to allow a stopped motorist to turn onto a major street without being 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.

Shipe Road and Ellistown Road have posted speed limits of 30 mph. Based on Knox County's policy of requiring 10 feet of sight distance per 1 mph of speed, the required intersection sight distance is 300 feet. This distance is required for a motorist to exit safely to the left or right from the proposed entrances onto Shipe Road or Ellistown Road.

Visual observations of the sight distances on Shipe Road and Ellistown Road at the proposed entrance locations were undertaken. Using a Nikon Laser Rangefinder from the Proposed Shipe Road Entrance location at Shipe Road, the available sight distance was visually estimated to be 525 feet to the south and 800 feet to the north. Horizontal curves to the north and south on Shipe Road hinder further distance viewing.

Visual observations of the sight distances from the Proposed Ellistown Road Entrance at Ellistown Road for the proposed KV Construction Subdivision were also undertaken. The available sight distance was visually estimated to be 600 feet to the south and 375 feet to the north at the Proposed Ellistown Road Entrance location. The vertical curve on Ellistown Road between Washington Pike and the Proposed Ellistown Road Entrance location currently hinders further distance viewing to the north.

Images of the existing sight distances at the proposed entrance locations on Shipe Road and Ellistown Road are labeled in the following images with the required ISD and rangefinder-measured sight distances.



View of Sight Distance on Shipe Road at Proposed Shipe Road Entrance (Looking North)

View of Sight Distance on Shipe Road at Proposed Shipe Road Entrance (Looking South)

View of Sight Distance on Ellistown Road at Proposed Ellistown Road Entrance (Looking South)

View of Sight Distance on Ellistown Road at Proposed Ellistown Road Entrance (Looking North)

- **EVALUATION OF TURN LANE THRESHOLDS**

The need for separate entering turn lanes was evaluated in the projected 2028 conditions for the proposed entrances on Shipe Road and Ellistown Road.

The criteria used for these turn lane evaluations were based on Knox County's "Access Control and Driveway Design Policy". This design policy relates vehicle volume thresholds based on prevailing speeds for two-lane and four-lane roadways. The locations of these proposed entrance intersections are within a 30 mph speed zone; thus, the intersections were evaluated based on these posted speeds. The worksheets for these evaluations are provided in Appendix G.

Based on the projected 2028 traffic volumes at the proposed entrance intersections, separate left or right-turn entering lanes on Shipe Road and Ellistown Road will not be warranted. This result remains valid for either scenario, whether both subdivisions are constructed with an internal road connection or if the KV Construction Subdivision is not built with only a single entrance for the 4923 Shipe Road Subdivision at Shipe Road.

- **PROJECTED VEHICLE QUEUES**

An additional software program calculated the 2028 AM and PM peak hour projected vehicle queues at the proposed entrance intersections. 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 software was utilized to estimate the projected vehicle queues at the intersections.

The 95th percentile vehicle queue is the recognized measurement in the transportation engineering profession as the design standard used when considering vehicle 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 in the software.

The 95th percentile vehicle queue lengths at the entrance intersections are shown in Tables 5a and 5b for the projected 2028 conditions. Table 5a shows the results with both entrances constructed for the 4923 Shipe Road Subdivision and the KV Construction Subdivision. Table 5b shows the result if the KV Construction Subdivision is not built with all entering and exiting trips for the

4923 Shipe Road Subdivision occurring at the Proposed Shipe Road Entrance. The vehicle queue worksheet results from the SimTraffic software are in Appendix H.

TABLE 5a
VEHICLE QUEUE SUMMARY -
2028 PROJECTED PEAK HOUR TRAFFIC WITH THE PROJECT

INTERSECTION	APPROACH/ MOVEMENT	SIMTRAFFIC 95th PERCENTILE QUEUE LENGTH (ft)	
		AM PEAK HOUR	PM PEAK HOUR
Ellistown Road (SB & NB) at	Westbound Left/Right	48	47
Proposed Ellistown Road Entrance (WB)	Southbound Left	9	28
Shipe Road (SB & NB) at	Westbound Left/Right	31	25
Proposed Shipe Road Entrance (EB)	Southbound Left	0	0

Note: 95th percentile queues were calculated in SimTraffic 12 software

TABLE 5b
VEHICLE QUEUE SUMMARY -
2028 PROJECTED PEAK HOUR TRAFFIC WITH THE PROJECT
(WITHOUT KV CONSTRUCTION SUBDIVISION)

INTERSECTION	APPROACH/ MOVEMENT	SIMTRAFFIC 95th PERCENTILE QUEUE LENGTH (ft)	
		AM PEAK HOUR	PM PEAK HOUR
Shipe Road (SB & NB) at	Westbound Left/Right	47	46
Proposed Shipe Road Entrance (EB)	Southbound Left	0	9

Note: 95th percentile queues were calculated in SimTraffic 12 software

Tables 5a and 5b show minimal vehicle queue lengths on the entrance intersection approaches in the 2028 AM and PM peak hours. The longest vehicle queues are calculated for the exiting approaches at both entrances, with queues just under 50 feet. Based on these results, the longest vehicle queues will be just under two passenger vehicles, assuming a length of 25 feet per vehicle.

CONCLUSIONS & RECOMMENDATIONS

The following is an overview of recommendations to minimize the transportation impacts of the 4923 Shipe Road Subdivision (and KV Construction Subdivision) on the adjacent transportation system while attempting to achieve an acceptable traffic flow and safety level.

Shipe Road at Proposed Shipe Road Entrance: This intersection is projected to operate with very short vehicle delays and minimal vehicle queues for all movements.

1a) Separate left and right-turn lanes on Shipe Road are not warranted at this proposed entrance. This result is valid for either scenario if both subdivisions, 4923 Shipe Road Subdivision and the KV Construction Subdivision, are built and provided with an internal road connection or if only the 4923 Shipe Road Subdivision is constructed with a single entrance on Shipe Road.

1b) Future landscaping, existing vegetation, or signage must not impact the intersection sight distances from the Proposed Shipe Road Entrance at Shipe Road.

1c) Based on a posted speed limit of 30 mph on Shipe Road, the required intersection sight distance is 300 feet for exiting left and right-turning vehicles. The existing sight distances from the Proposed Shipe Road Entrance at Shipe Road were estimated visually to be adequate in both directions.

1d) It is recommended that a Stop Sign (R1-1) be installed and a 24" white stop bar be applied to the Proposed Entrance approach at Shipe Road. The stop bar should be applied a minimum of 4 feet away from the edge of Shipe Road and placed at the desired stopping point that maximizes the sight distance.

2 **4923 Shipe Road Subdivision Internal Roads:** The layout plan shows four new streets, as shown in Figure 3.

2a) A 25-mph Speed Limit Sign (R2-1) with additional plaque signage, as shown in the image below, is recommended to be posted near the beginning of the Proposed Entrance road off Shipe Road.

2b) A Stop Sign (R1-1) with a 24" white stop bar is recommended to be installed at the internal road intersections, as shown in the image below. Dual end-of-roadway object markers (OM4-1) should be installed at the end of the internal road terminating at the KV Construction Subdivision property to the west. This sign can be removed once an internal road connection is entirely constructed and open for vehicular traffic between the two subdivisions.

Internal Traffic Sign Locations

2c) The proposed lots in the 4923 Shipe Road Subdivision adjacent to Shipe Road should not be allowed direct vehicular access.

2d) Sight distance at the new internal intersections must not be impacted by new signage, parked cars, or future landscaping. With a proposed speed limit of 25-mph in the development, the required internal intersection sight distance is 250 feet. The civil site designer should ensure this internal sight distance length is met.

2e) The civil site designer has identified and labeled a centralized mail delivery center location within the development for the subdivision residents. It is recommended that a parking area or paved area outside the internal road accompany this center to dissuade on-street parking that could block traffic flow.

2f) All drainage grates and covers for the residential development must be pedestrian and bicycle-safe.

2g) A couple of the internal roads in the proposed subdivision are shown with long, straight road segments. Straight road segments encourage higher vehicle speeds. It is recommended that the civil site designer consider including traffic calming measures on these internal roads, such as speed humps or tables. Specifics regarding this recommendation should be discussed in the design phase with Knox County Engineering. However, speed humps should be limited to no more than two strategically placed on each of the two proposed east-west internal roads.

2h) All road and intersection elements should be designed to AASHTO and Knox County specifications and guidelines to ensure proper operation.

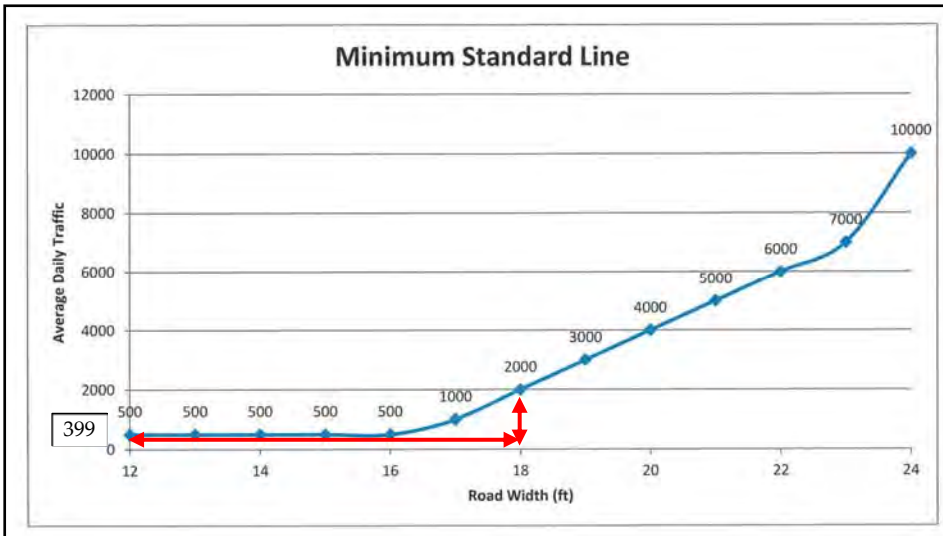
Shipe Road: Shipe Road between Bud Hawkins Road and the Proposed Shipe Road Entrance location was measured to have a few spots less than 18 feet in width. If both subdivisions are constructed with road access provided to Ellistown Road for the 4923 Shipe Road Subdivision residents, it is estimated that Shipe Road will experience much less generated traffic than Ellistown Road.

Knox County Engineering has published an informal minimum standard relating Average Daily Traffic (ADT) versus road widths. A graph of this minimum standard is shown in the image below.

The pavement road measurements conducted for this study between the Proposed Shipe Road Entrance location and Bud Hawkins Road to the north showed existing road widths of 17.7' and 20.5'. These road measurements were made every 100 feet.

The 2028 ADT on Shipe Road between the Proposed Shipe Road Entrance and Bud Hawkins Road can be approximated by assuming that the peak hour (PM) thru volumes shown in Figure 5 are approximately 10% of the daily traffic. With this assumption, the 2028 ADT on Shipe Road between the Proposed Shipe Road Entrance and Bud Hawkins Road can be calculated to be 330 vehicles (19+14/10%). Adding the daily trips from the proposed subdivisions (assuming 5% to and from the north on Shipe Road, as shown in Figure 6a) would result in a 2028 ADT of 399 vehicles on Shipe Road (daily trips = 878 + 504 * 5% = 399). According to the Knox County chart, a road width of 16 feet could support an ADT of 399 vehicles. A road width of 18 feet would be appropriate for up to 2,000 vehicles per day based on Knox County's ADT/road width minimum standard.

Nonetheless, to provide a level of safety, Shipe Road is recommended to be widened to a minimum width of 18 feet between the Proposed Shipe Road Entrance and the intersection with Bud Hawkins Road, a distance of approximately 850 feet. However, it is expected that this widening will only need to occur for a few hundred at most, where the pavement is currently less than 18 feet.



Knox County Engineering and Public Works Minimum Standard Line – ADT vs. Road Width

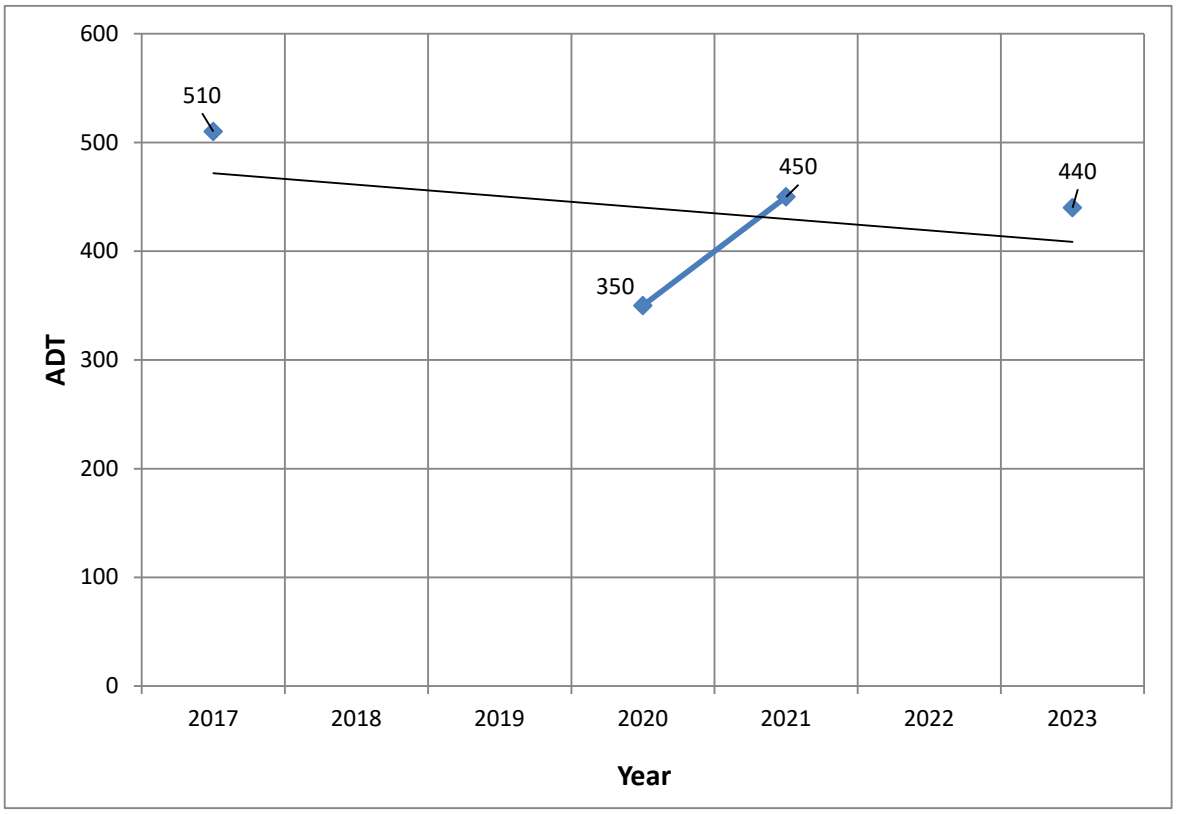
APPENDIX A

HISTORICAL TRAFFIC COUNT DATA

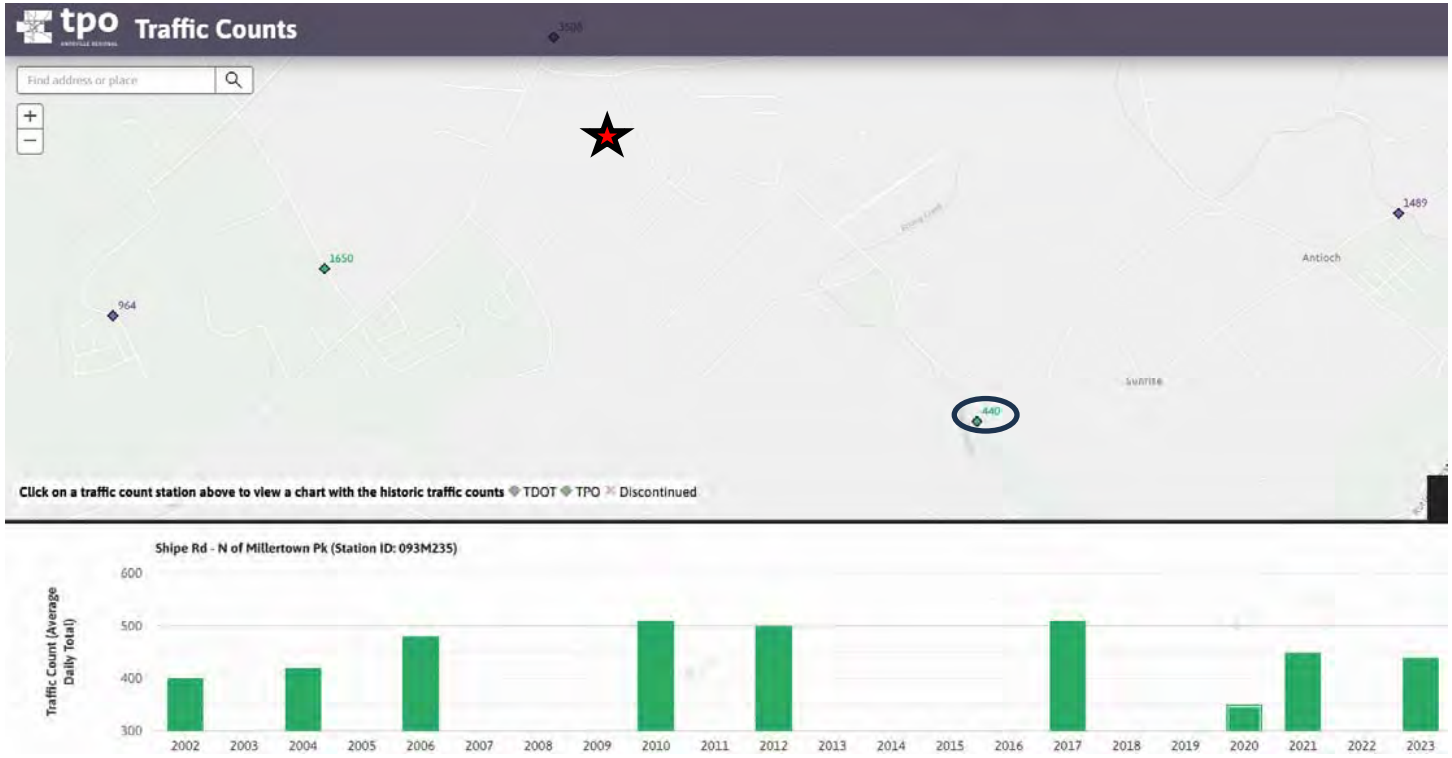
Historical Traffic Counts

Organization: Knoxville Regional TPO
Station ID #: 093M235
Location: Shipe Road, north of Millertown Pike

YEAR	AADT	
2013		
2014		
2015		
2016		
2017	510	Trendline
2018		
2019		
2020	350	
2021	450	
2022		
2023	440	



2017 - 2023 Growth Rate = -13.7%
Average Annual Growth Rate = -2.4%

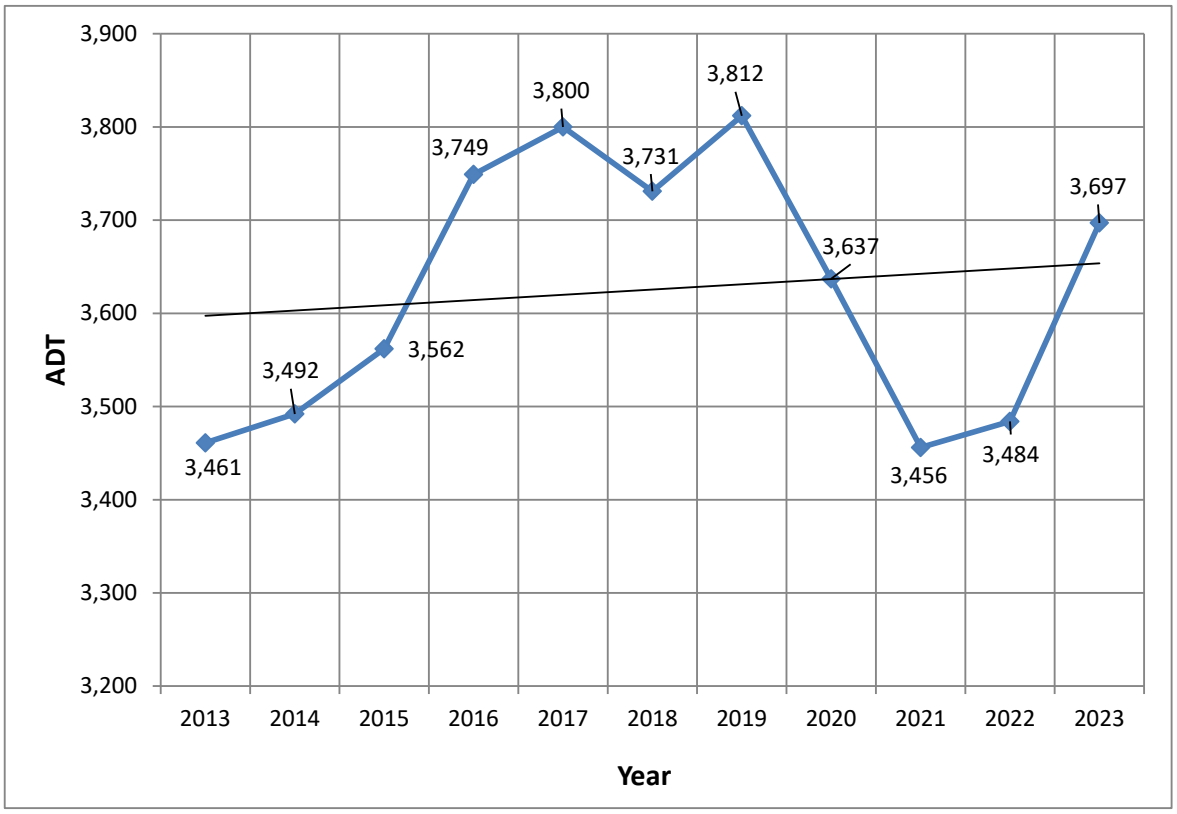

tpo Traffic Counts
Find address or place
1650
964
1489
Antioch
440
Click on a traffic count station above to view a chart with the historic traffic counts TDOT TPO Discontinued
Shipe Rd - N of Millertown Pk (Station ID: 093M235)
Traffic Count (Average Daily Total)
600
500
400
300
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023

Historical Traffic Counts

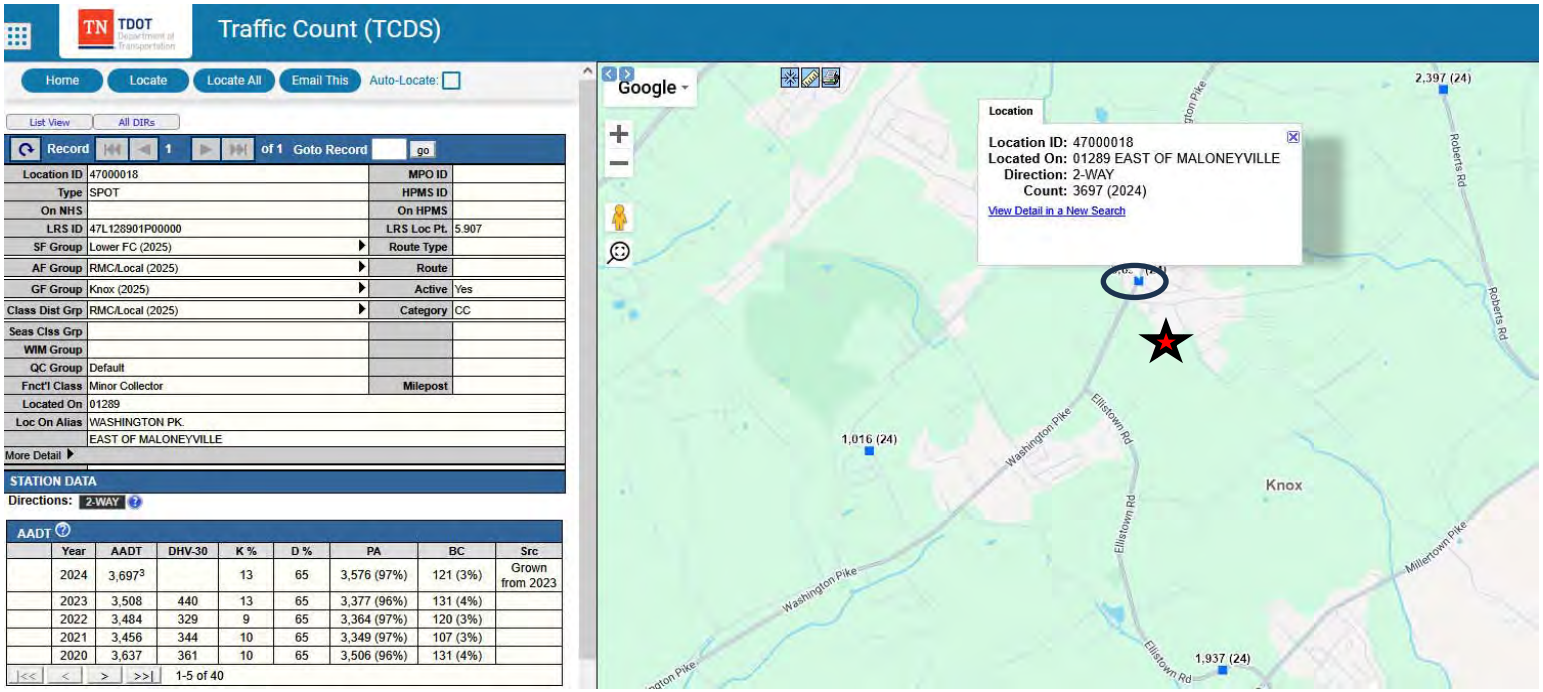
Organization: TDOT
Station ID #: 47000018
Location: Washington Pike, north of Shipe Road

YEAR	AADT
2013	3,461
2014	3,492
2015	3,562
2016	3,749
2017	3,800
2018	3,731
2019	3,812
2020	3,637
2021	3,456
2022	3,484
2023	3,697

Trendline



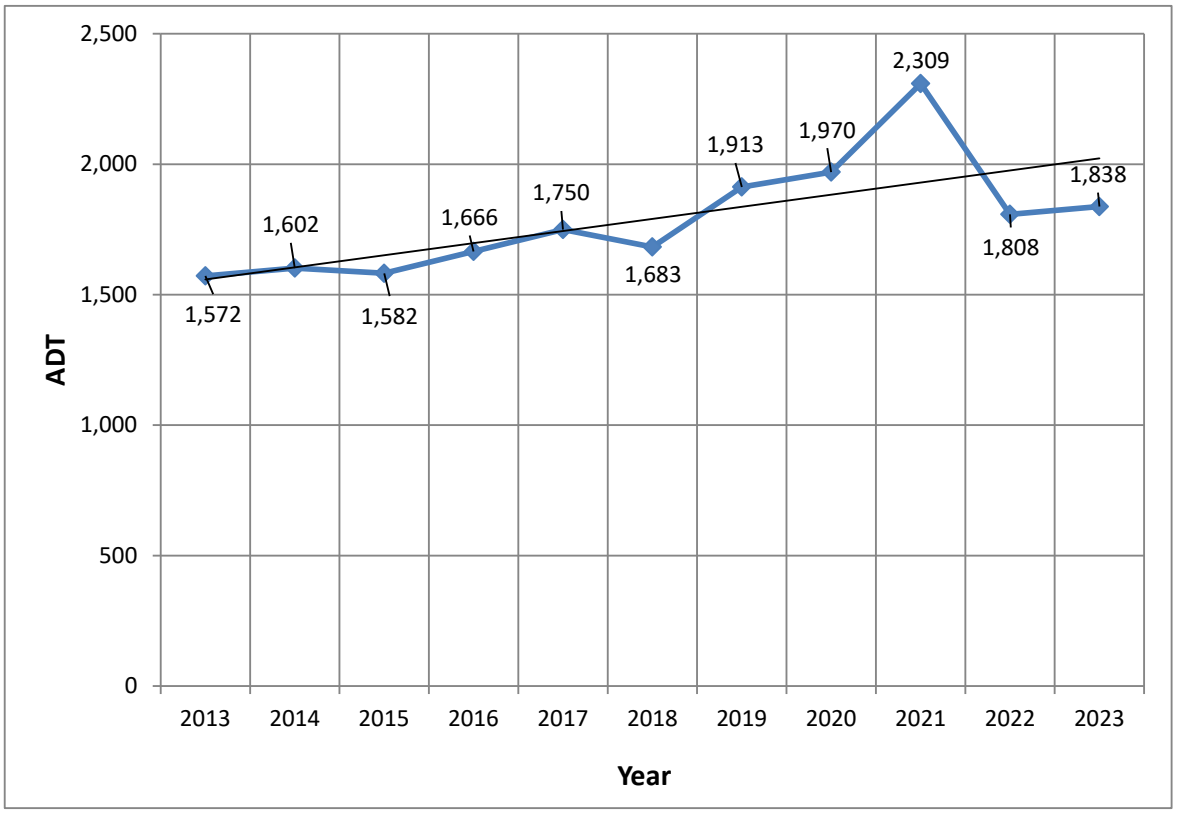
2013 - 2023 Growth Rate = 6.8%
Average Annual Growth Rate = 0.7%


TN TDOT
Traffic Count (TCDS)
Home
Locate
Locate All
Email This
Auto-Locate:
List View
All DIRs
Record 1 of 1 Goto Record go
Location ID 47000018
Type SPOT
On NHS
LRS ID 47L128901P00000
SF Group Lower FC (2025)
AF Group RMC/Local (2025)
GF Group Knox (2025)
Class Dist Grp RMC/Local (2025)
Seas Clss Grp
WIM Group
QC Group Default
Fnct'l Class Minor Collector
Located On 01289
Loc On Alias WASHINGTON PK
EAST OF MALONEYVILLE
More Detail
MPO ID
HPMS ID
On HPMS
LRS Loc Pt. 5.907
Route Type
Route
Active Yes
Category CC
Milepost
STATION DATA
Directions: 2-WAY
AADT
Year AADT DHV-30 K % D % PA BC Src
2024 3,697[3] 13 65 3,576 (97%) 121 (3%) Grown from 2023
2023 3,508 440 13 65 3,377 (96%) 131 (4%)
2022 3,484 329 9 65 3,364 (97%) 120 (3%)
2021 3,456 344 10 65 3,349 (97%) 107 (3%)
2020 3,637 361 10 65 3,506 (96%) 131 (4%)
1-5 of 40
Google
Location
Location ID: 47000018
Located On: 01289 EAST OF MALONEYVILLE
Direction: 2-WAY
Count: 3697 (2024)
View Detail in a New Search
2,397 (24)
1,016 (24)
1,937 (24)
Knox
Washington Pike
Ellistown Rd
Roberts Rd
Millertown Pike

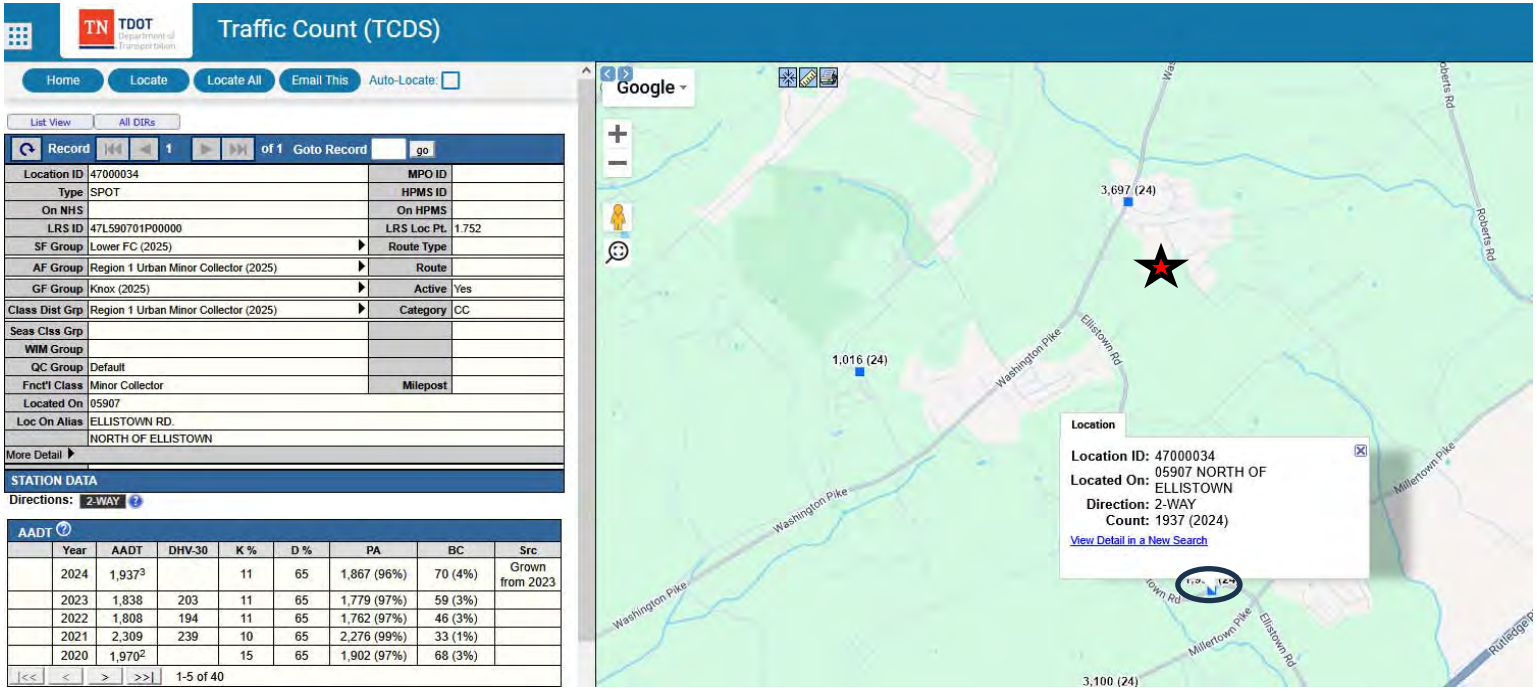
Historical Traffic Counts

Organization: TDOT
Station ID #: 47000034
Location: Ellistown Road, north of Millertown Pike

YEAR	AADT
2013	1,572
2014	1,602
2015	1,582
2016	1,666
2017	1,750
2018	1,683
2019	1,913
2020	1,970
2021	2,309
2022	1,808
2023	1,838

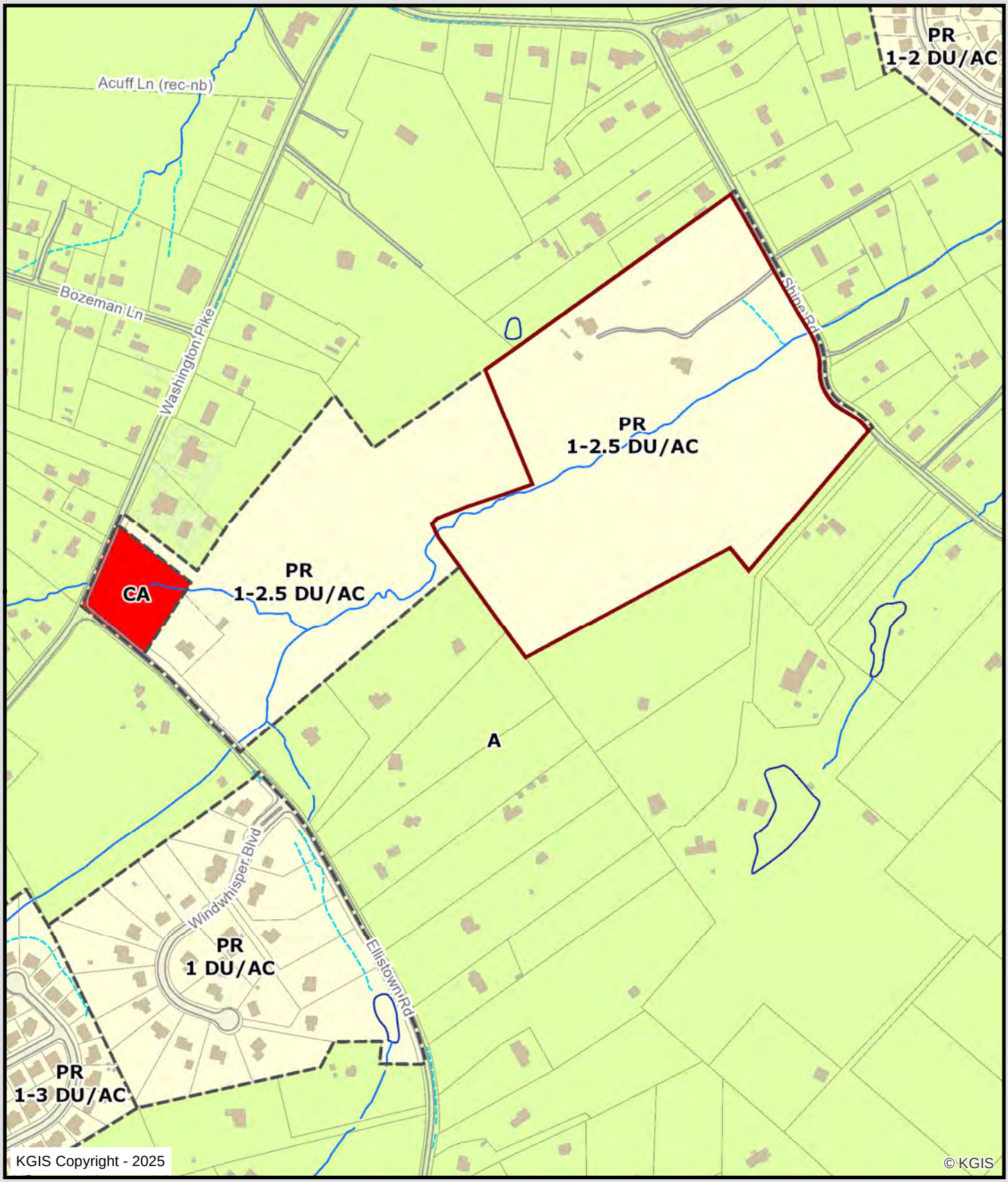


2013 - 2023 Growth Rate = 16.9%
Average Annual Growth Rate = 1.6%


TN TDOT
Traffic Count (TCDS)
Home
Locate
Locate All
Email This
Auto-Locate:
List View
All DIRs
Record 1 of 1 Goto Record go
Location ID 47000034
Type SPOT
On NHS
LRS ID 47L590701P00000
SF Group Lower FC (2025)
AF Group Region 1 Urban Minor Collector (2025)
GF Group Knox (2025)
Class Dist Grp Region 1 Urban Minor Collector (2025)
Seas Clss Grp
WIM Group
QC Group Default
Fnct'l Class Minor Collector
Located On 05907
Loc On Alias ELLISTOWN RD.
NORTH OF ELLISTOWN
More Detail
MPO ID
HPMS ID
On HPMS
LRS Loc Pt. 1.752
Route Type
Route
Active Yes
Category CC
Milepost
STATION DATA
Directions: 2-WAY
AADT
Year AADT DHV-30 K % D % PA BC Src
2024 1,937[3] 11 65 1,867 (96%) 70 (4%) Grown from 2023
2023 1,838 203 11 65 1,779 (97%) 59 (3%)
2022 1,808 194 11 65 1,762 (97%) 46 (3%)
2021 2,309 239 10 65 2,276 (99%) 33 (1%)
2020 1,970[2] 15 65 1,902 (97%) 68 (3%)
|<< < > >>| 1-5 of 40
Google
3,697 (24)
1,016 (24)
3,100 (24)
Washington Pike
Ellistown Rd
Roberts Rd
Millertown Pike
Location
Location ID: 47000034
Located On: 05907 NORTH OF ELLISTOWN
Direction: 2-WAY
Count: 1937 (2024)
View Detail in a New Search

APPENDIX B

ZONING MAP



Zoning Map

3.10.25

Knoxville - Knox County - KUB Geographic Information System

Printed: 3/10/2025 at 4:24:19 PM

0 250 500 1,000

ft

APPENDIX C

MANUAL TRAFFIC COUNT DATA

TRAFFIC COUNT DATA

Major Street: Shipe Road (SB-NB)
Minor Street: n/a
Traffic Control: n/a

12/17/2024 (Tuesday)
Overcast and Rain Showers
Conducted by: Ajax Engineering

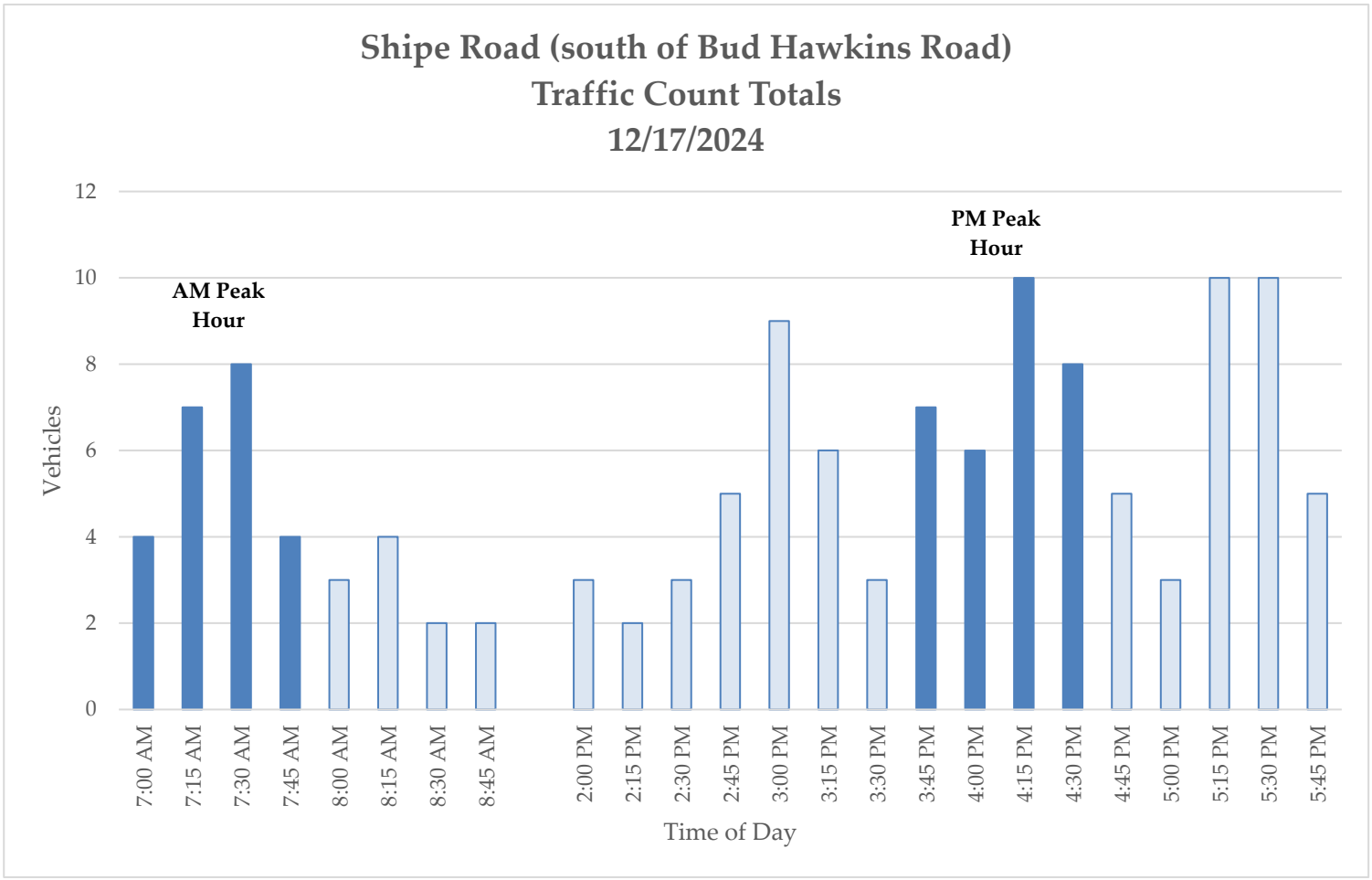
TIME BEGIN	Shipe Road SOUTHBOUND THRU	Shipe Road NORTHBOUND THRU	VEHICLE TOTAL	PEAK HOUR
7:00 AM	2	2	4	**7:00 AM - 8:00 AM**
7:15 AM	5	2	7	
7:30 AM	3	5	8	
7:45 AM	2	2	4	
8:00 AM	0	3	3	
8:15 AM	0	4	4	
8:30 AM	0	2	2	
8:45 AM	2	0	2	
TOTAL	14	20	34	
2:00 PM	1	2	3	
2:15 PM	1	1	2	
2:30 PM	2	1	3	
2:45 PM	2	3	5	
3:00 PM	5	4	9	
3:15 PM	2	4	6	
3:30 PM	2	1	3	
3:45 PM	3	4	7	**3:45 PM - 4:45 PM**
4:00 PM	3	3	6	
4:15 PM	7	3	10	
4:30 PM	5	3	8	
4:45 PM	2	3	5	
5:00 PM	1	2	3	
5:15 PM	5	5	10	
5:30 PM	4	6	10	
5:45 PM	5	0	5	
TOTAL	78	85	163	

2024 AM Peak Hour **7:00 AM - 8:00 AM**

TIME BEGIN	Shipe Road SOUTHBOUND THRU	Shipe Road NORTHBOUND THRU
7:00 AM	2	2
7:15 AM	5	2
7:30 AM	3	5
7:45 AM	2	2
TOTAL	**12**	**11**
PHF	**0.60**	**0.55**
Truck %	**25.0%**	**0.0%**

2024 PM Peak Hour **3:45 PM - 4:45 PM**

TIME BEGIN	Shipe Road SOUTHBOUND THRU	Shipe Road NORTHBOUND THRU
3:45 PM	3	4
4:00 PM	3	3
4:15 PM	7	3
4:30 PM	5	3
TOTAL	**18**	**13**
PHF	**0.64**	**0.81**
Truck %	**5.6%**	**0.0%**


Shipe Road (south of Bud Hawkins Road)
Traffic Count Totals
12/17/2024
12
10
8
6
4
2
0
Vehicles
AM Peak Hour
PM Peak Hour
7:00 AM
7:15 AM
7:30 AM
7:45 AM
8:00 AM
8:15 AM
8:30 AM
8:45 AM
2:00 PM
2:15 PM
2:30 PM
2:45 PM
3:00 PM
3:15 PM
3:30 PM
3:45 PM
4:00 PM
4:15 PM
4:30 PM
4:45 PM
5:00 PM
5:15 PM
5:30 PM
5:45 PM
Time of Day

TRAFFIC COUNT DATA

Major Street: Ellistown Road (SB-NB)
Minor Street: n/a
Traffic Control: n/a

12/17/2024 (Tuesday)
Overcast and Rain Showers
Conducted by: Ajax Engineering

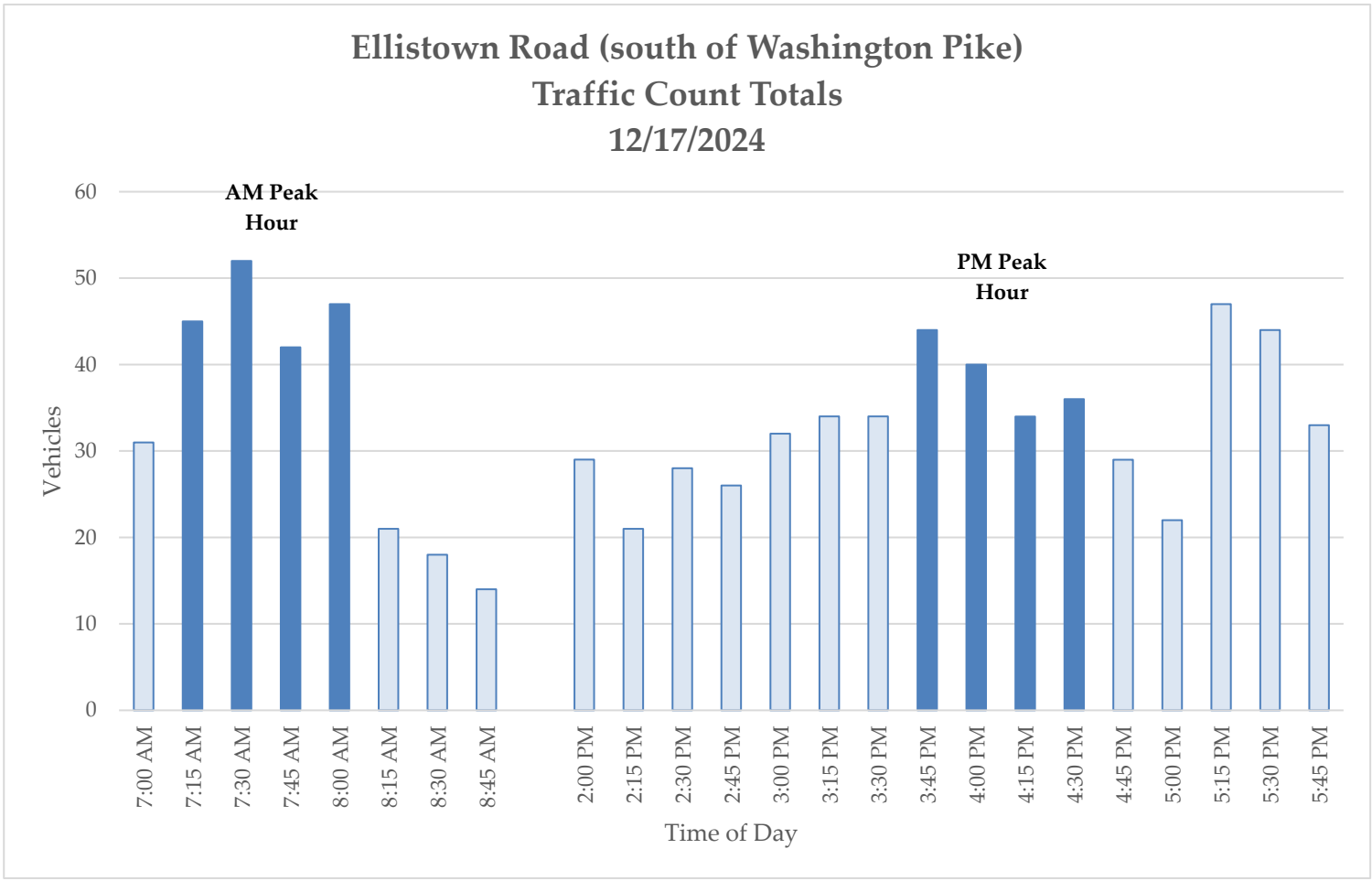
	Ellistown Road	Ellistown Road		
TIME	SOUTHBOUND	NORTHBOUND	VEHICLE	PEAK
BEGIN	THRU	THRU	TOTAL	HOUR
7:00 AM	14	17	31	
7:15 AM	27	18	45	**7:15 AM - 8:15 AM**
7:30 AM	32	20	52	
7:45 AM	21	21	42	
8:00 AM	33	14	47	
8:15 AM	12	9	21	
8:30 AM	6	12	18	
8:45 AM	8	6	14	
TOTAL	153	117	270	
2:00 PM	17	12	29	
2:15 PM	11	10	21	
2:30 PM	8	20	28	
2:45 PM	8	18	26	
3:00 PM	22	10	32	
3:15 PM	17	17	34	
3:30 PM	16	18	34	
3:45 PM	21	23	44	**3:45 PM - 4:45 PM**
4:00 PM	19	21	40	
4:15 PM	13	21	34	
4:30 PM	17	19	36	
4:45 PM	10	19	29	
5:00 PM	9	13	22	
5:15 PM	15	32	47	
5:30 PM	22	22	44	
5:45 PM	14	19	33	
TOTAL	545	528	1073	

2024 AM Peak Hour **7:15 AM - 8:15 AM**

	Ellistown Road	Ellistown Road
TIME	SOUTHBOUND	NORTHBOUND
BEGIN	THRU	THRU
7:15 AM	27	18
7:30 AM	32	20
7:45 AM	21	21
8:00 AM	33	14
TOTAL	**113**	**73**
PHF	**0.86**	**0.87**
Truck %	**1.8%**	**4.1%**

2024 PM Peak Hour **3:45 PM - 4:45 PM**

	Ellistown Road	Ellistown Road
TIME	SOUTHBOUND	NORTHBOUND
BEGIN	THRU	THRU
3:45 PM	21	23
4:00 PM	19	21
4:15 PM	13	21
4:30 PM	17	19
TOTAL	**70**	**84**
PHF	**0.83**	**0.91**
Truck %	**1.4%**	**0.0%**


Ellistown Road (south of Washington Pike)
Traffic Count Totals
12/17/2024
AM Peak Hour
PM Peak Hour
Vehicles
60
50
40
30
20
10
0
7:00 AM
7:15 AM
7:30 AM
7:45 AM
8:00 AM
8:15 AM
8:30 AM
8:45 AM
2:00 PM
2:15 PM
2:30 PM
2:45 PM
3:00 PM
3:15 PM
3:30 PM
3:45 PM
4:00 PM
4:15 PM
4:30 PM
4:45 PM
5:00 PM
5:15 PM
5:30 PM
5:45 PM
Time of Day

APPENDIX D

ITE TRIP GENERATION DATA

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)

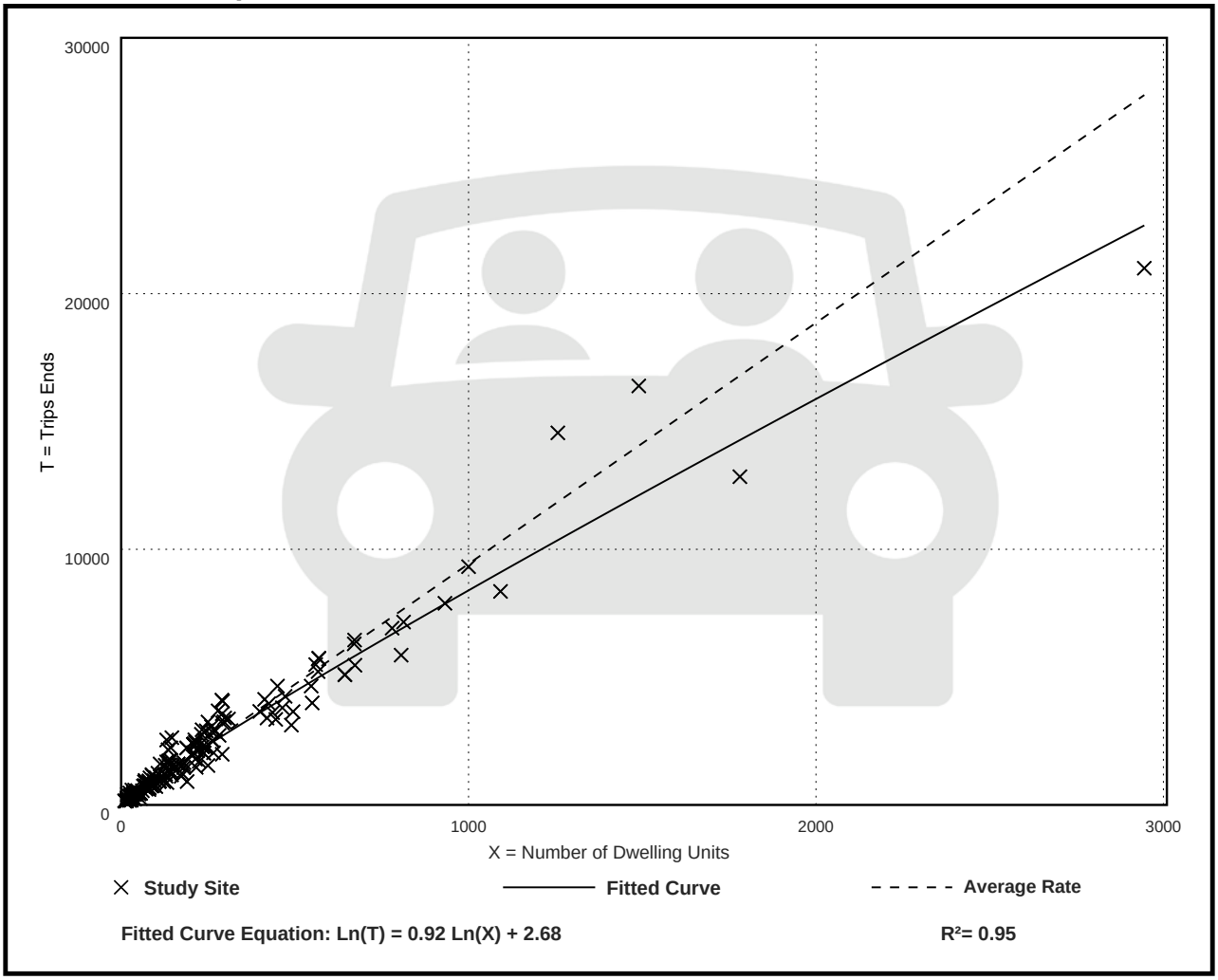
Vehicle Trip Ends vs: Dwelling Units
On a: Weekday

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



Fitted Curve Equation: Ln(T) = 0.92 Ln(X) + 2.68

R^2= 0.95

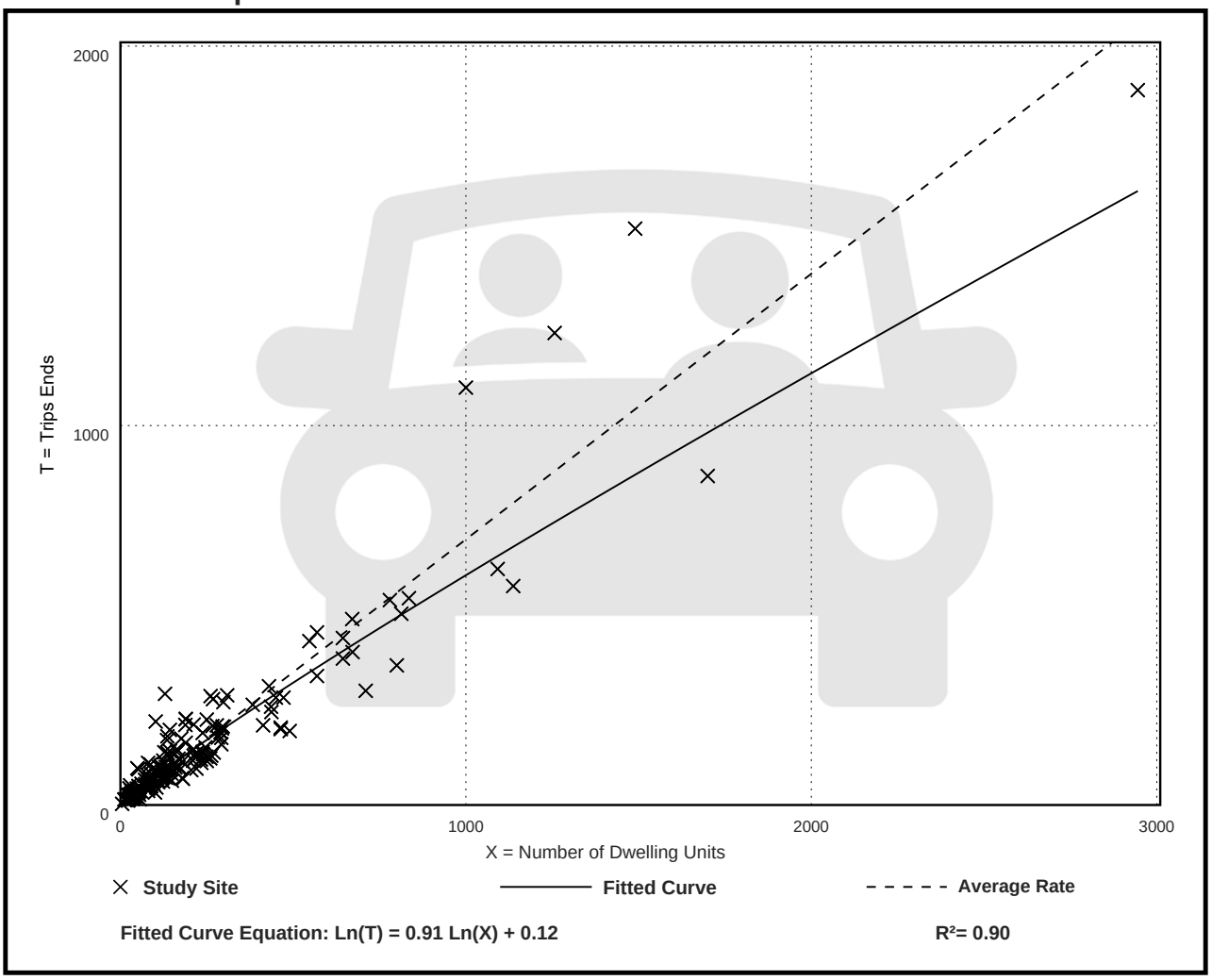
Single-Family Detached Housing
(210)

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



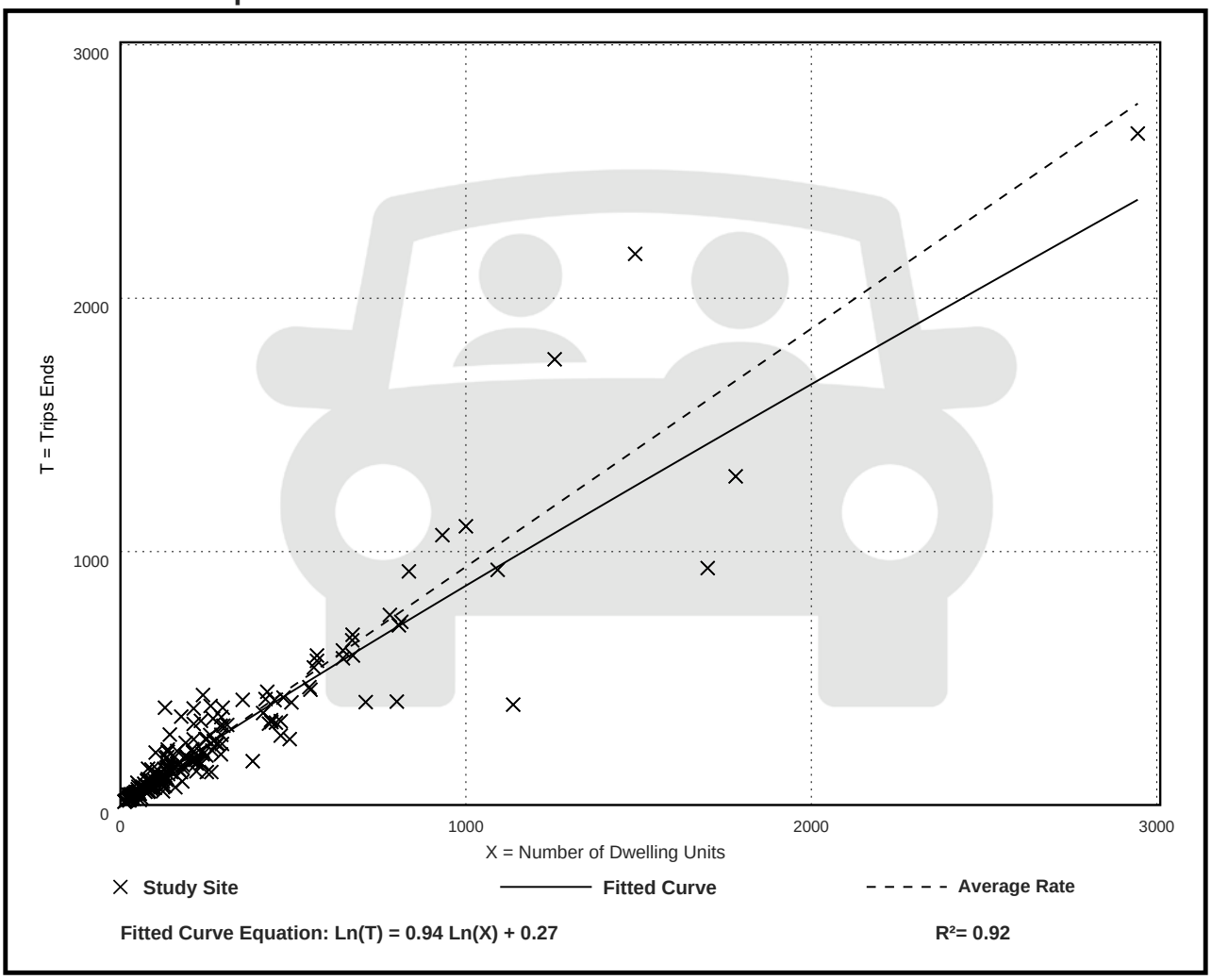
Single-Family Detached Housing
(210)

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 4923 SHIPE ROAD SUBDIVISION

86 Single-Family Detached Houses

ITE LAND USE CODE	LAND USE DESCRIPTION	# OF 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	86	878	26%	74%		63%	37%	
				17	48	65	54	32	86
Total New Volume Site Trips			**878**	**17**	**48**	**65**	**54**	**32**	**86**

ITE Trip Generation Manual, 11th Edition

Trips calculated by using Fitted Curve Equations

TRIP GENERATION FOR 4923 SHIPE ROAD SUBDIVISION

86 Single-Family Detached Houses

86 Residential Houses = X

Weekday:

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

$Ln(T) = 0.92 * 4.45 + 2.68$

$Ln(T) = 6.78$

T = 878 trips

Peak Hour of Adjacent Traffic between 7 and 9 am:

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

$T = 0.91 * 4 + 0.12$

$Ln(T) = 4.17$

T = 65 trips

Peak Hour of Adjacent Traffic between 4 and 6 pm:

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

$Ln(T) = 0.94 * 4.45 + 0.27$

$Ln(T) = 4.46$

T = 86 trips

TRIP GENERATION FOR KV CONSTRUCTION SUBDIVISION

47 Single-Family Detached Houses

ITE LAND USE CODE	LAND USE DESCRIPTION	# OF 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	47	504	26%	74%		63%	37%	
				10	27	37	31	18	49
Total New Volume Site Trips			**504**	**10**	**27**	**37**	**31**	**18**	**49**

ITE Trip Generation Manual, 11th Edition

Trips calculated by using Fitted Curve Equations

TRIP GENERATION FOR KV CONSTRUCTION SUBDIVISION

47 Single-Family Detached Houses

47 Residential Houses = X

Weekday:

Fitted Curve Equation: Ln(T) = 0.92 Ln(X) + 2.68

Ln(T) =	0.92	*	3.85	+	2.68
Ln(T) =	6.22				
T =	**504 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	*	4	+	0.12
Ln(T) =	3.62				
T =	**37 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	*	3.85	+	0.27
Ln(T) =	3.89				
T =	**49 trips**				

APPENDIX E

2022 CENSUS BUREAU DATA

United States Census Bureau OnTheMap

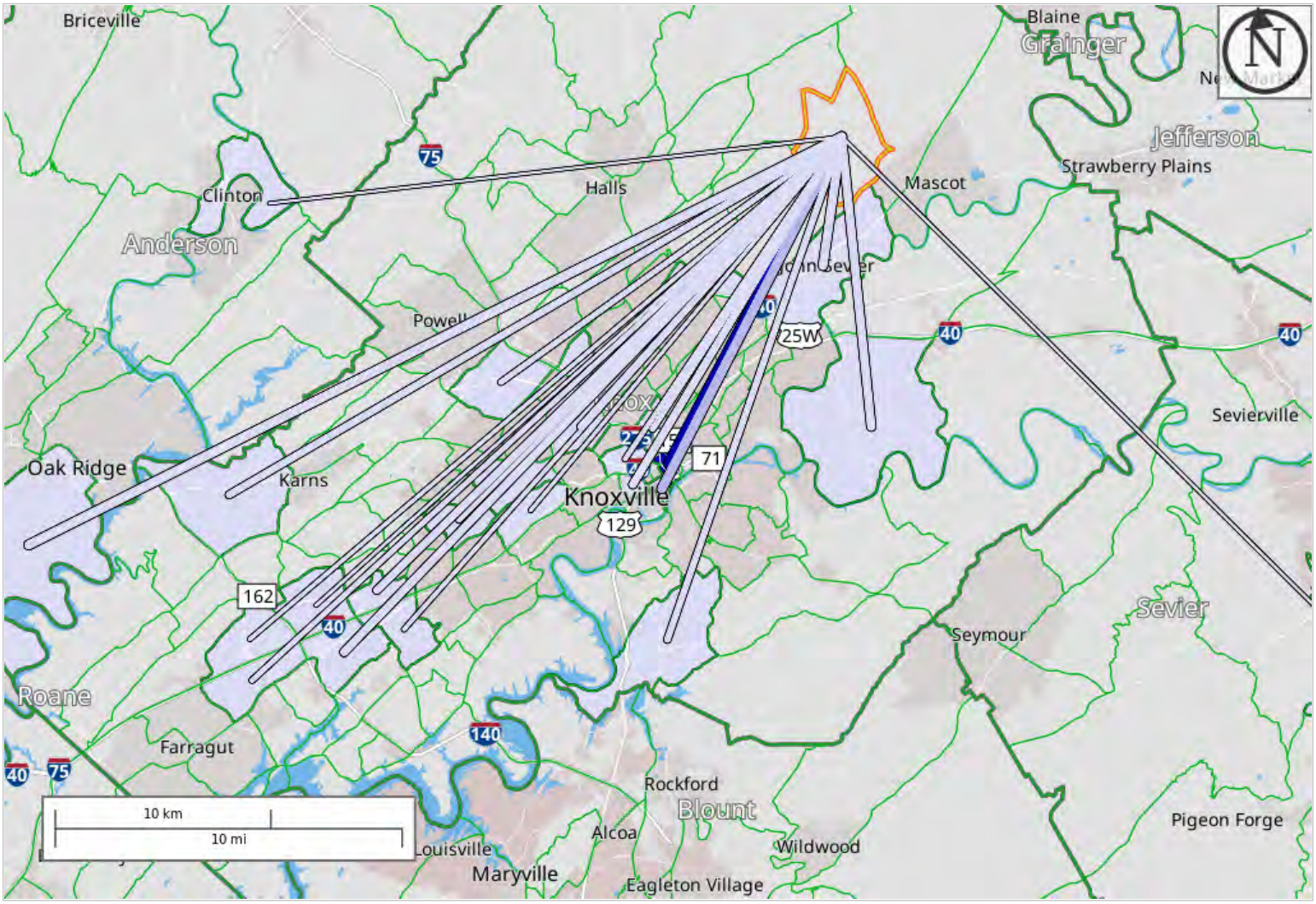
Destination Analysis

Workers: *Living in 52.04 (Knox, TN)*
Showing: *Employment locations grouped by Census Tracts*

Created by the U.S. Census Bureau's OnTheMap `https://onthemap.ces.census.gov` on 03/10/2025

Counts of All Jobs from Home Selection Area to Work Census Tracts in 2022

All Workers



Map Legend

Job Count
- 78 - 89
- 66 - 77
- 55 - 65
- 43 - 54
- 32 - 42
- 20 - 31
- 8 - 19

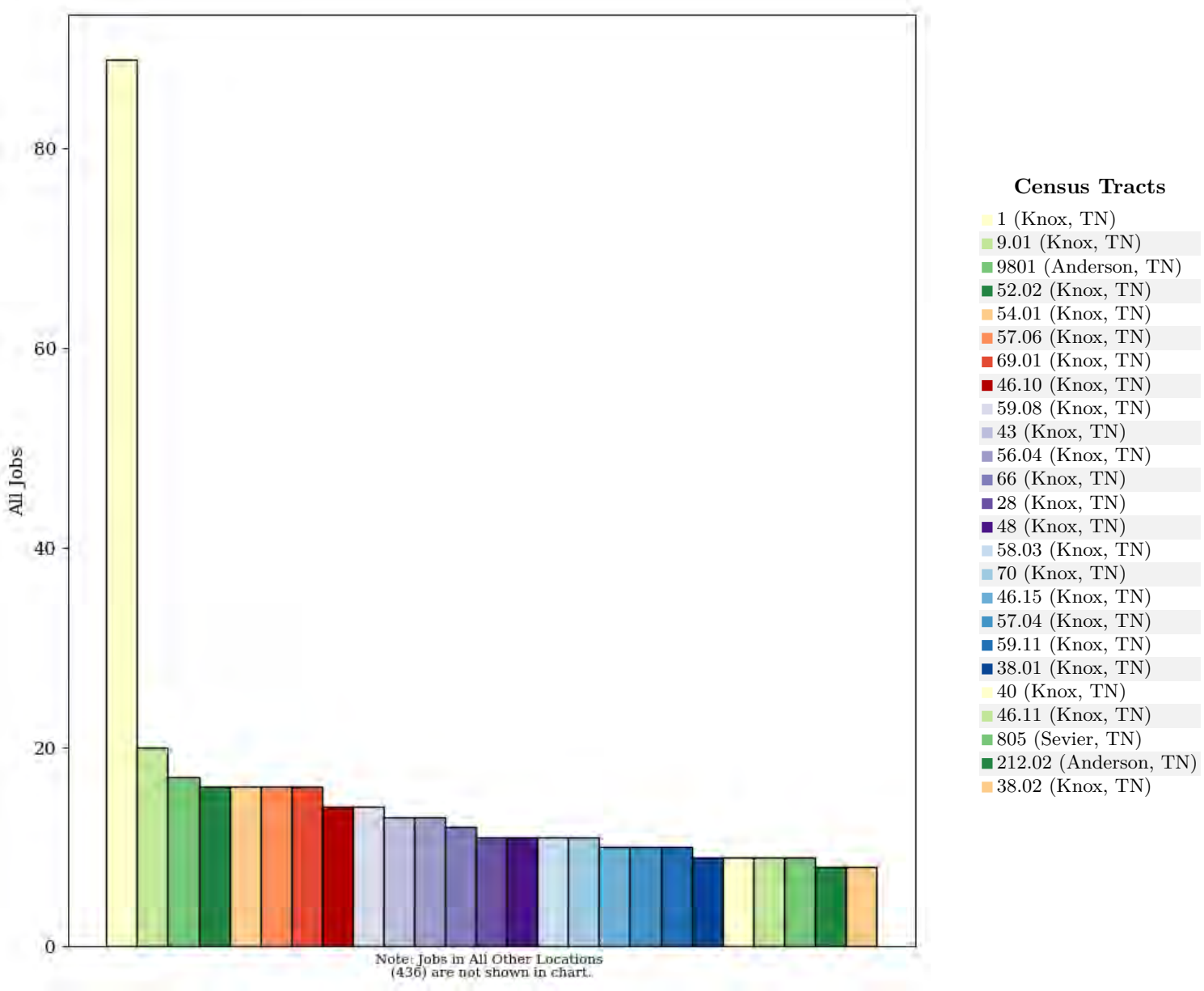
Selection Areas
Home Area

Job Count
- 78 - 89
- 66 - 77
- 55 - 65
- 43 - 54
- 32 - 42
- 20 - 31
- 8 - 19

United States Census Bureau

All Jobs from Home Selection Area to Work Census Tracts in 2022

All Workers



All Jobs from Home Selection Area to Work Census Tracts in 2022

All Workers

Census Tracts as Work Destination Area	2022 Count	2022 Share
All Census Tracts	818	100.0%
1 (Knox, TN)	89	10.9%
9.01 (Knox, TN)	20	2.4%
9801 (Anderson, TN)	17	2.1%
52.02 (Knox, TN)	16	2.0%
54.01 (Knox, TN)	16	2.0%
57.06 (Knox, TN)	16	2.0%
69.01 (Knox, TN)	16	2.0%
46.10 (Knox, TN)	14	1.7%
59.08 (Knox, TN)	14	1.7%

Census Tracts as Work Destination Area	2022 Count	2022 Share
43 (Knox, TN)	13	1.6%
56.04 (Knox, TN)	13	1.6%
66 (Knox, TN)	12	1.5%
28 (Knox, TN)	11	1.3%
48 (Knox, TN)	11	1.3%
58.03 (Knox, TN)	11	1.3%
70 (Knox, TN)	11	1.3%
46.15 (Knox, TN)	10	1.2%
57.04 (Knox, TN)	10	1.2%
59.11 (Knox, TN)	10	1.2%
38.01 (Knox, TN)	9	1.1%
40 (Knox, TN)	9	1.1%
46.11 (Knox, TN)	9	1.1%
805 (Sevier, TN)	9	1.1%
212.02 (Anderson, TN)	8	1.0%
38.02 (Knox, TN)	8	1.0%
All Other Locations	436	53.3%

Additional Information

Analysis Settings

Analysis Type	Destination
Destination Type	Census Tracts
Selection area as	Home
Year(s)	2022
Job Type	All Jobs
Selection Area	52.04 (Knox, TN) from Census Tracts
Selected Census Blocks	14
Analysis Generation Date	03/10/2025 16:20 - OnTheMap 6.25.1
Code Revision	d7e653d6dda5dbfeaebf0121d6547c7bdf6e3686
LODES Data Vintage	20241022_1605

Data Sources

Source: U.S. Census Bureau, OnTheMap Application and LEHD Origin-Destination Employment Statistics (Beginning of Quarter Employment, 2nd Quarter of 2002-2022).

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 F

CAPACITY ANALYSES – HCM WORKSHEETS (SYNCHRO 12)

Intersection	
Int Delay, s/veh	2.4

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	26	38	79	9	14	122
Future Vol, veh/h	26	38	79	9	14	122
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	-2	-	-	-2
Peak Hour Factor	92	92	87	92	92	86
Heavy Vehicles, %	0	0	4	0	0	2
Mvmt Flow	28	41	91	10	15	142

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	268	96	0	0	101	0
Stage 1	96	-	-	-	-	-
Stage 2	172	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	726	966	-	-	1505	-
Stage 1	933	-	-	-	-	-
Stage 2	863	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	718	966	-	-	1505	-
Mov Cap-2 Maneuver	718	-	-	-	-	-
Stage 1	933	-	-	-	-	-
Stage 2	853	-	-	-	-	-

Approach	WB	NB	SB
HCM Ctrl Dly, s/v	9.63	0	0.72
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	847	174	-
HCM Lane V/C Ratio	-	-	0.082	0.01	-
HCM Ctrl Dly (s/v)	-	-	9.6	7.4	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	0.3	0	-

Intersection	
Int Delay, s/veh	2.1

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	4	7	3	12	13	1
Future Vol, veh/h	4	7	3	12	13	1
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	5	-5	-
Peak Hour Factor	92	92	92	55	60	92
Heavy Vehicles, %	0	0	0	0	25	0
Mvmt Flow	4	8	3	22	22	1

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	51	22	23	0	-	0
Stage 1	22	-	-	-	-	-
Stage 2	28	-	-	-	-	-
Critical Hdwy	6.4	6.2	4.1	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	2.2	-	-	-
Pot Cap-1 Maneuver	963	1061	1606	-	-	-
Stage 1	1006	-	-	-	-	-
Stage 2	999	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	961	1061	1606	-	-	-
Mov Cap-2 Maneuver	961	-	-	-	-	-
Stage 1	1004	-	-	-	-	-
Stage 2	999	-	-	-	-	-

Approach	EB	NB	SB
HCM Ctrl Dly, s/v	8.56	0.94	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	234	-	1022	-	-
HCM Lane V/C Ratio	0.002	-	0.012	-	-
HCM Ctrl Dly (s/v)	7.2	0	8.6	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0	-	-

Intersection	
Int Delay, s/veh	2.5

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	18	25	91	30	43	76
Future Vol, veh/h	18	25	91	30	43	76
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	-2	-	-	-2
Peak Hour Factor	92	92	91	92	92	83
Heavy Vehicles, %	0	0	0	0	0	1
Mvmt Flow	20	27	100	33	47	92

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	301	116	0	0	133	0
Stage 1	116	-	-	-	-	-
Stage 2	185	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	694	941	-	-	1465	-
Stage 1	914	-	-	-	-	-
Stage 2	851	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	671	941	-	-	1465	-
Mov Cap-2 Maneuver	671	-	-	-	-	-
Stage 1	914	-	-	-	-	-
Stage 2	823	-	-	-	-	-

Approach	WB	NB	SB
HCM Ctrl Dly, s/v	9.74	0	2.55
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	806	608	-
HCM Lane V/C Ratio	-	-	0.058	0.032	-
HCM Ctrl Dly (s/v)	-	-	9.7	7.5	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	0.2	0.1	-

Intersection	
Int Delay, s/veh	1.9

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	2	5	8	14	19	4
Future Vol, veh/h	2	5	8	14	19	4
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	5	-5	-
Peak Hour Factor	92	92	92	81	64	92
Heavy Vehicles, %	0	0	0	0	6	0
Mvmt Flow	2	5	9	17	30	4

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	67	32	34	0	-	0
Stage 1	32	-	-	-	-	-
Stage 2	35	-	-	-	-	-
Critical Hdwy	6.4	6.2	4.1	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	2.2	-	-	-
Pot Cap-1 Maneuver	944	1048	1591	-	-	-
Stage 1	996	-	-	-	-	-
Stage 2	993	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	938	1048	1591	-	-	-
Mov Cap-2 Maneuver	938	-	-	-	-	-
Stage 1	990	-	-	-	-	-
Stage 2	993	-	-	-	-	-

Approach	EB	NB	SB
HCM Ctrl Dly, s/v	8.58	2.44	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	602	-	1014	-	-
HCM Lane V/C Ratio	0.005	-	0.008	-	-
HCM Ctrl Dly (s/v)	7.3	0	8.6	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0	-	-

Intersection	
Int Delay, s/veh	4.6

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	26	22	8	12	13	9
Future Vol, veh/h	26	22	8	12	13	9
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	5	-5	-
Peak Hour Factor	92	92	92	55	60	92
Heavy Vehicles, %	0	0	0	0	25	0
Mvmt Flow	28	24	9	22	22	10

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	66	27	31	0	-	0
Stage 1	27	-	-	-	-	-
Stage 2	39	-	-	-	-	-
Critical Hdwy	6.4	6.2	4.1	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	2.2	-	-	-
Pot Cap-1 Maneuver	945	1055	1594	-	-	-
Stage 1	1001	-	-	-	-	-
Stage 2	988	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	939	1055	1594	-	-	-
Mov Cap-2 Maneuver	939	-	-	-	-	-
Stage 1	996	-	-	-	-	-
Stage 2	988	-	-	-	-	-

Approach	EB	NB	SB
HCM Ctrl Dly, s/v	8.84	2.07	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	513	-	989	-	-
HCM Lane V/C Ratio	0.005	-	0.053	-	-
HCM Ctrl Dly (s/v)	7.3	0	8.8	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0.2	-	-

Intersection	
Int Delay, s/veh	3.6

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	18	14	24	14	19	30
Future Vol, veh/h	18	14	24	14	19	30
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	5	-5	-
Peak Hour Factor	92	92	92	81	64	92
Heavy Vehicles, %	0	0	0	0	6	0
Mvmt Flow	20	15	26	17	30	33

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	115	46	62	0	-	0
Stage 1	46	-	-	-	-	-
Stage 2	69	-	-	-	-	-
Critical Hdwy	6.4	6.2	4.1	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	2.2	-	-	-
Pot Cap-1 Maneuver	886	1029	1553	-	-	-
Stage 1	982	-	-	-	-	-
Stage 2	958	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	871	1029	1553	-	-	-
Mov Cap-2 Maneuver	871	-	-	-	-	-
Stage 1	965	-	-	-	-	-
Stage 2	958	-	-	-	-	-

Approach	EB	NB	SB
HCM Ctrl Dly, s/v	9.01	4.43	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1083	-	934	-	-
HCM Lane V/C Ratio	0.017	-	0.037	-	-
HCM Ctrl Dly (s/v)	7.4	0	9	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0.1	-	0.1	-	-

APPENDIX G

KNOX COUNTY TURN LANE VOLUME THRESHOLD WORKSHEETS

TABLE 4A

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

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

12

1 + 13 = 14

OPPOSING VOLUME	THROUGH VOLUME PLUS RIGHT-TURN VOLUME *					
	100 - 149	150 - 199	200 - 249	250 - 299	300 - 349	350 - 399
100 - 149 150 - 199	300 245	235 200	185 160	145 130	120 110	100 90
200 - 249 250 - 299	205 175	170	140 125	115 105	100 90	80 70
300 - 349 350 - 399	155 135		110 100	95 85	80 70	65 60
400 - 449 450 - 499	120 105		90 80	75 70	65 60	55 50
500 - 549 550 - 599	95 85		70 65	65 60	55 50	50 45
600 - 649 650 - 699	75 70	60	60 55	55 50	45 40	40 35
700 - 749 750 or More	65 60	55 50	50 45	45 40	35 35	30 30

Shipe Road at Proposed Shipe Road Entrance

2028 Projected AM NB Left Turns = 3

Left Turn Lane NOT Warranted

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

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

TABLE 4B

RIGHT-TURN LANE VOLUME THRESHOLDS

FOR TWO-LANE ROADWAYS WITH A PREVAILING SPEED OF 35 MPH OR LESS

13

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

Shipe Road at Proposed Shipe Road Entrance

2028 Projected AM SB Right Turns = 1

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

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

TABLE 4A

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

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

4 + 19 = 23

14

OPPOSING VOLUME	THROUGH VOLUME PLUS RIGHT-TURN VOLUME *					
	100 - 149	150 - 199	200 - 249	250 - 299	300 - 349	350 - 399
100 - 149	300	235	185	145	120	100
150 - 199	245	200	160	130	110	90
200 - 249	205	170	140	115	100	80
250 - 299	175		125	105	90	70
300 - 349	155		110	95	80	65
350 - 399	135		100	85	70	60
400 - 449	120		90	75	65	55
450 - 499	105		80	70	60	50
500 - 549	95		70	65	55	50
550 - 599	85		65	60	50	45
600 - 649	75		60	55	45	40
650 - 699	70	60	55	50	40	35
700 - 749	65	55	50	45	35	30
750 or More	60	50	45	40	35	30

Shipe Road at Proposed Shipe Road Entrance

2028 Projected PM NB Left Turns = 8

Left Turn Lane NOT Warranted

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

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

TABLE 4B

RIGHT-TURN LANE VOLUME THRESHOLDS

FOR TWO-LANE ROADWAYS WITH A PREVAILING SPEED OF 35 MPH OR LESS

19

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

Shipe Road at Proposed Shipe Road Entrance

2028 Projected PM SB Right Turns = 4

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

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

TABLE 4A

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

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

122

79 + 9 = 88

OPPOSING VOLUME	THROUGH VOLUME PLUS RIGHT-TURN VOLUME *					
	100 - 149	150 - 199	200 - 249	250 - 299	300 - 349	350 - 399
100 - 149 150 - 199	300 245	235 200	185 160	145 130	120 110	100 90
200 - 249 250 - 299	205 175	170	140 125	115 105	100 90	80 70
300 - 349 350 - 399	155 135		110 100	95 85	80 70	65 60
400 - 449 450 - 499	120 105		90 80	75 70	65 60	55 50
500 - 549 550 - 599	95 85		70 65	65 60	55 50	50 45
600 - 649 650 - 699	75 70	60	60 55	55 50	45 40	40 35
700 - 749 750 or More	65 60	55 50	50 45	45 40	35 35	30 30

Ellistown Road at Proposed Ellistown Road Entrance

2028 Projected AM SB Left Turns = 14

Left Turn Lane NOT Warranted

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

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

TABLE 4B

RIGHT-TURN LANE VOLUME THRESHOLDS

FOR TWO-LANE ROADWAYS WITH A PREVAILING SPEED OF 35 MPH OR LESS

79

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

Ellistown Road at Proposed Ellistown Road Entrance

2028 Projected AM NB Right Turns = 9

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

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

TABLE 4A

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

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

91 + 30 = 121

76

OPPOSING VOLUME	THROUGH VOLUME PLUS RIGHT-TURN VOLUME *					
	100 - 149	150 - 199	200 - 249	250 - 299	300 - 349	350 - 399
100 - 149	300	235	185	145	120	100
150 - 199	245	200	160	130	110	90
200 - 249	205	170	140	115	100	80
250 - 299	175		125	105	90	70
300 - 349	155		110	95	80	65
350 - 399	135		100	85	70	60
400 - 449	120		90	75	65	55
450 - 499	105		80	70	60	50
500 - 549	95		70	65	55	50
550 - 599	85		65	60	50	45
600 - 649	75		60	55	45	40
650 - 699	70	60	55	50	40	35
700 - 749	65	55	50	45	35	30
750 or More	60	50	45	40	35	30

Ellistown Road at Proposed Ellistown Road Entrance

2028 Projected PM SB Left Turns = 43

Left Turn Lane NOT Warranted

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

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

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

91

RIGHT-TURN VOLUME	THROUGH VOLUME PLUS LEFT-TURN VOLUME *					
	<100	100 - 199	200 - 249	250 - 299	300 - 349	350 - 399
Fewer Than 25						
30 25 - 49						
50 - 99						
100 - 149						
150 - 199						
200 - 249						
250 - 299						Yes
300 - 349					Yes	Yes
350 - 399				Yes	Yes	Yes
400 - 449			Yes	Yes	Yes	Yes
450 - 499			Yes	Yes	Yes	Yes
500 - 549		Yes	Yes	Yes	Yes	Yes
550 - 599		Yes	Yes	Yes	Yes	Yes
600 or More	Yes	Yes	Yes	Yes	Yes	Yes

Ellistown Road at Proposed Ellistown Road Entrance

2028 Projected PM NB Right Turns = 30

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						Yes
50 - 99					Yes	Yes
100 - 149				Yes	Yes	Yes
150 - 199			Yes	Yes	Yes	Yes
200 - 249		Yes	Yes	Yes	Yes	Yes
250 - 299	Yes	Yes	Yes	Yes	Yes	Yes
300 - 349	Yes	Yes	Yes	Yes	Yes	Yes
350 - 399	Yes	Yes	Yes	Yes	Yes	Yes
400 - 449	Yes	Yes	Yes	Yes	Yes	Yes
450 - 499	Yes	Yes	Yes	Yes	Yes	Yes
500 - 549	Yes	Yes	Yes	Yes	Yes	Yes
550 - 599	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 4A

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

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

9 + 13 = 22

12

OPPOSING VOLUME	THROUGH VOLUME PLUS RIGHT-TURN VOLUME *					
	100 - 149	150 - 199	200 - 249	250 - 299	300 - 349	350 - 399
100 - 149	300	235	185	145	120	100
150 - 199	245	200	160	130	110	90
200 - 249	205	170	140	115	100	80
250 - 299	175		125	105	90	70
300 - 349	155		110	95	80	65
350 - 399	135		100	85	70	60
400 - 449	120		90	75	65	55
450 - 499	105		80	70	60	50
500 - 549	95		70	65	55	50
550 - 599	85		65	60	50	45
600 - 649	75		60	55	45	40
650 - 699	70		55	50	40	35
700 - 749	65		50	45	35	30
750 or More	60	50	45	40	35	30

Shipe Road at Proposed Shipe Road Entrance (Without Adjacent Proposed Subdivision)

2028 Projected AM NB Left Turns = 8

Left Turn Lane NOT Warranted

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

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

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

13

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

Shipe Road at Proposed Shipe Road Entrance (Without Adjacent Proposed Subdivision)

2028 Projected AM SB Right Turns = 9

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

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

TABLE 4A

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

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

30 + 19 = 49

14

OPPOSING VOLUME	THROUGH VOLUME PLUS RIGHT-TURN VOLUME *					
	100 - 149	150 - 199	200 - 249	250 - 299	300 - 349	350 - 399
100 - 149	300	235	185	145	120	100
150 - 199	245	200	160	130	110	90
200 - 249	205	170	140	115	100	80
250 - 299	175		125	105	90	70
300 - 349	155		110	95	80	65
350 - 399	135		100	85	70	60
400 - 449	120		90	75	65	55
450 - 499	105		80	70	60	50
500 - 549	95		70	65	55	50
550 - 599	85		65	60	50	45
600 - 649	75		60	55	45	40
650 - 699	70		55	50	40	35
700 - 749	65		50	45	35	30
750 or More	60	50	45	40	35	30

Shipe Road at Proposed Shipe Road Entrance (Without Adjacent Proposed Subdivision)

2028 Projected PM NB Left Turns = 24

Left Turn Lane NOT Warranted

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

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

TABLE 4B

RIGHT-TURN LANE VOLUME THRESHOLDS

FOR TWO-LANE ROADWAYS WITH A PREVAILING SPEED OF 35 MPH OR LESS

19

30

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

Shipe Road at Proposed Shipe Road Entrance (Without Adjacent Proposed Subdivision)

2028 Projected AM SB Right Turns = 30

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

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

APPENDIX H

SIMTRAFFIC VEHICLE QUEUE WORKSHEETS

Intersection: 3: Ellistown Road & Proposed Ellistown Road Entrance

Movement	WB	SB
Directions Served	LR	LT
Maximum Queue (ft)	56	18
Average Queue (ft)	29	1
95th Queue (ft)	48	9
Link Distance (ft)	238	281
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 8: Shipe Road & Proposed Shipe Road Entrance

Movement	EB
Directions Served	LR
Maximum Queue (ft)	32
Average Queue (ft)	9
95th Queue (ft)	31
Link Distance (ft)	207
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Network Summary

Network wide Queuing Penalty: 0

Intersection: 3: Ellistown Road & Proposed Ellistown Road Entrance

Movement	WB	SB
Directions Served	LR	LT
Maximum Queue (ft)	45	40
Average Queue (ft)	25	6
95th Queue (ft)	47	28
Link Distance (ft)	238	281
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 8: Shipe Road & Proposed Shipe Road Entrance

Movement	EB
Directions Served	LR
Maximum Queue (ft)	30
Average Queue (ft)	6
95th Queue (ft)	25
Link Distance (ft)	207
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Network Summary

Network wide Queuing Penalty: 0

Intersection: 8: Shipe Road & Proposed Shipe Road Entrance

Movement	EB
Directions Served	LR
Maximum Queue (ft)	52
Average Queue (ft)	24
95th Queue (ft)	47
Link Distance (ft)	207
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Network Summary

Network wide Queuing Penalty: 0

Intersection: 8: Shipe Road & Proposed Shipe Road Entrance

Movement	EB	NB
Directions Served	LR	LT
Maximum Queue (ft)	51	15
Average Queue (ft)	21	1
95th Queue (ft)	46	9
Link Distance (ft)	207	184
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 0

APPENDIX I

LETTER TO ADDRESS REVIEW COMMENTS

AJAX ENGINEERING
CIVIL ENGINEERING / TRAFFIC ENGINEERING

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

April 15, 2025

PROJECT NAME: 4923 Shipe Road Subdivision (5-E-25-DP / 5-SA-25-C)
TO: Knoxville-Knox County Planning
SUBJECT: Response Document for Development Review Comments

Knoxville-Knox County Planning and Knox County Engineering & Public Works Staff:

The following response document addresses the comments in an email from Mike Conger, PE, dated April 14, 2025. This letter is added to the end of the revised report in the Appendix.

1) **The speed limit sign for the internal roads needs to include the standard supplemental plates that we use for residential streets.**

   Response: This request for supplemental signage with the 25 mph speed limit sign has been added to the revised report on Pages 2 and 43 and is included in the image shown on Page 43.

2) **We agree with the desirability of providing traffic calming on the longer-tangent sections of roadway. We would limit these to no more than 2 speed humps strategically placed on each of the two east/west streets.**

   Response: The discussion regarding the traffic calming speed humps has been updated on Pages 3 and 44.

3) **We agree with widening Shipe Road to a minimum width of 18 feet.**

   Response: The report has kept the widening recommendation as noted.

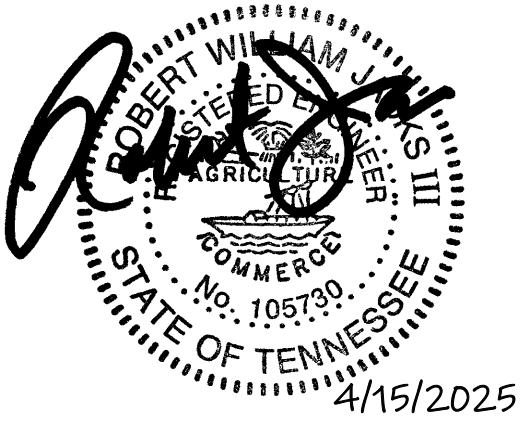
In addition to the revisions listed above, other changes in the report include the following:

- Updated Title Page
- Updated Page Footers
- Added response letter to the end of the Appendix

If you have any questions or further comments, please get in touch with me. We look forward to your approval.

Sincerely,

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



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